

Changing Cultural Dynamics in Prehistory on the Yorkshire Wolds

Volume I of II

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Abstract

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The Yorkshire Wolds encompasses a region with a rich and varied history where prehistoric funerary monuments abound. Explorations, both amateur and professional, have been carried out for over two centuries, resulting in a disjointed collection of human skeletons. What is perhaps surprising is that the human remains data has never been collated so the picture of prehistoric life on the Wolds is poorly understood. The aim of this thesis is to reconstruct the lifeways of the prehistoric people who were buried on the Yorkshire Wolds, and to assess to what degree the data is different to that from other parts of Britain or Europe. By investigating the themes of quality of life, social differentiation and movement within the context of osteology it was possible to determine a more realistic representation of the past. Using a multitude of methodologies including osteological and paleopathological diagnosis, stable isotope analysis and examinations of funerary rites to recognise and appreciate the complex relationships of people and their environment in prehistory. It has been determined that the inhabitants were subject to a variety of stressors in their earlier and later years, and that they experienced severe hardships in order to survive. The quality of life of these people decreased through time, and most specifically it was the women that lost out on the opportunity to improve their chances for survival and reproduction. The mechanisms associated with these changes may have been related to maternal health as well as the social differentiation that may have favoured males in the later period. As opposed to representing a single homogeneous collective inhabiting this region of East Yorkshire, these groups encompassed individuals with a range of backgrounds and movements. Although those buried on the Wolds have been identified as distinct or special owing to their burials, this did not buffer them from the harsh prehistoric landscape of the Yorkshire Wolds.

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Author's Declaration

This declaration states that this thesis is an original piece of research by the sole author. Any errors or omissions contained therein are the responsibility of the author.

Chapter One: Introduction

1.1 Introduction

In recent years, archaeologists have become particularly interested in discovering more about the lives of prehistoric peoples using a multidisciplinary approach of osteology and paleopathology in conjunction with the application of scientific techniques, particularly isotopic analysis that can inform on diet and migration (Evans *et al.* 2006; Jay and Richards 2006; Montgomery *et al.* 2000). In some cases, studies have focused on special and unique cases from the archaeological record including Gristhorpe Man (Melton *et al.* 2010) or the Amesbury Archer (Fitzpatrick 2002, 2003). The results of extensive analysis in these cases provide a detailed understanding of these individuals; their general diet, health and where they may have come from, which has led to a number of interpretations including those focused on social status and occupations. These are fascinating insights into human lives, but by looking at larger groups of people, it is possible to better understand how the wider community lived and how certain aspects of life may have changed through time.

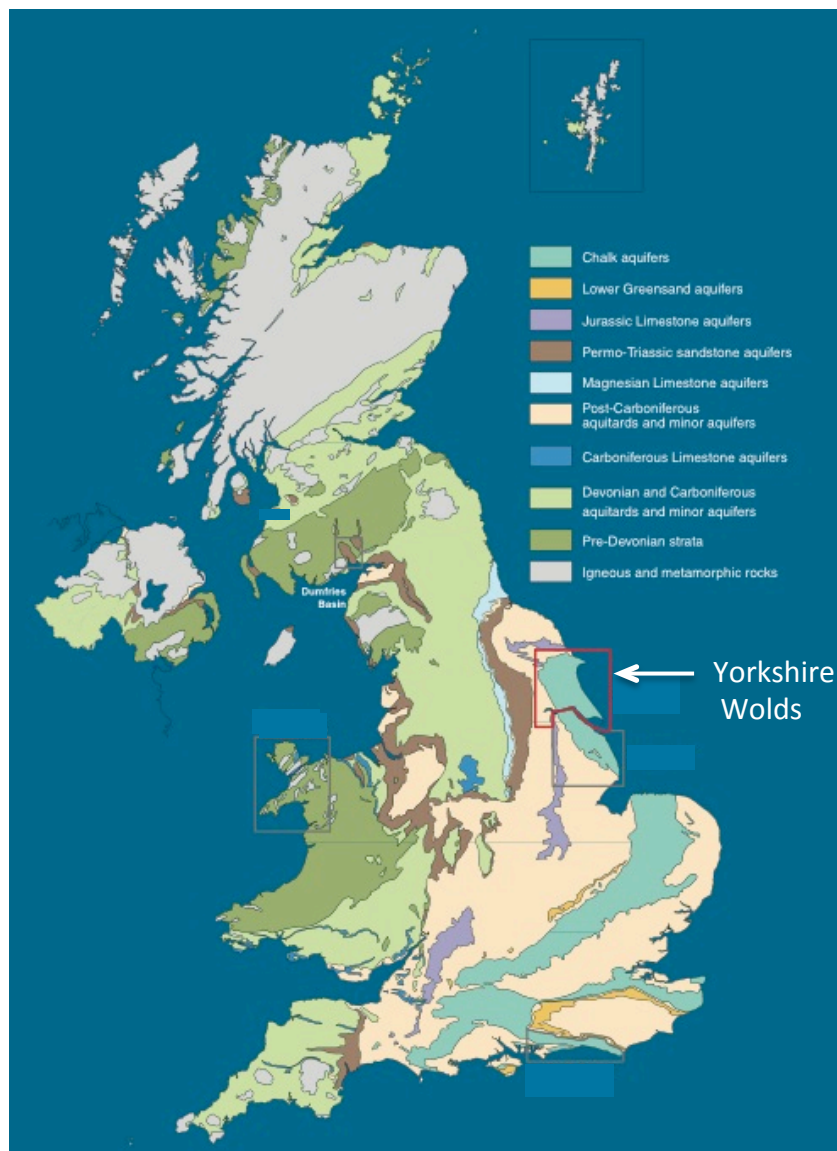
1.2 Aims, Objectives and Methods

The aim of this thesis is to reconstruct the lifeways of the prehistoric people who were buried on the Yorkshire Wolds from the Neolithic to the Iron Age, and to assess to what degree the data is different to that from other parts of Britain or Europe (Map 1.1). In order to achieve this aim the following objectives have been set:

1. To evaluate the quality of life and general health of individuals and to examine the patterns and trends both spatially and temporally.
2. To explore evidence of social status through the investigation of variations in diet and health.
3. To examine the evidence for individual or group mobility.

The Yorkshire Wolds is used in this thesis as a case study for several reasons. Firstly, a large amount of excavation has been carried out over the past several hundred years, in particular by antiquaries such as Canon Greenwell and JR Mortimer. However, what is perhaps surprising, is that the human remains data has never been collated so the picture of prehistoric human lifeways on the Wolds is site specific, if present at all. Although the Beaker People Project is endeavouring to answer questions as they relate to the Early Bronze Age, this work is still ongoing and has not been fully published. Secondly, a range of important funerary monuments are found on the Yorkshire Wolds. Many of these are unique to the area

and its landscape such as the large Neolithic round barrows along the Gypsey Race and the Iron Age square barrows located throughout the low valleys and high hills of the region. Thirdly, there are conflicting views as to whether people actually lived on the Wolds or whether they lived off the Wolds but used the area for pasture and funerary activities during much of prehistory. Overall a reassessment of the excavated finds will help to better situate East Yorkshire within the wider context of British prehistory.



Map 1.1: Location of the Yorkshire Wolds study region (after Gale and Rutter 2006).

The need for such an analysis has been highlighted recently in various framework documents. In 1996 English Heritage published a report *Frameworks for Our Past* (Olivier 1996), which put forth the necessity for regions throughout England to take a more active role in the assessment of resources using tailored methodologies that would determine a comprehensive plan. In response, in 1998 the Yorkshire Archaeological Research Framework Forum (YARFF) held a conference to discuss and make recommendations for how best to ensure the archaeological resources in Yorkshire were not only preserved but also that the

information learned be properly disseminated to the community and wider public audience (Ottaway *et al.* 2003). This meeting resulted in the volume *The Archaeology of Yorkshire* which brought together essays discussing the archaeology of prehistoric, Roman, medieval and industrial Yorkshire and made suggestions for subject areas that required further study. Ottaway and colleagues (2003) readily admit “that there are notable gaps in the assessment” and pinpoint the analysis of biological human remains as an overlooked aspect of Yorkshire archaeology that has thus far been cast aside in favour of environment, artefact and landscape studies (Ottaway *et al.* 2003: 2). The second chapter of the volume discusses the need for further work and Addyman stated, “new studies of these old collections are certainly an avenue that should be explored in any consideration of research priorities (Addyman 2003: 13).

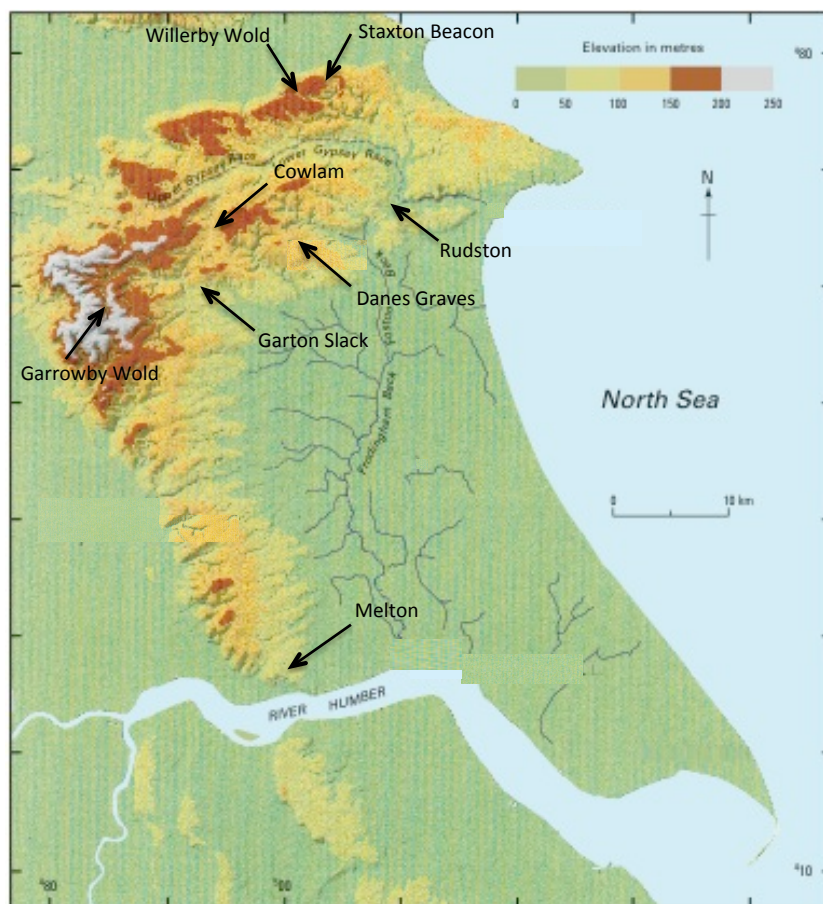
Since the publication of this volume, further work has been conducted on the Wolds. This includes a resource assessment by Roskams and Whyman (2005) in order to quantitatively assess the state of Yorkshire resources and create a database of holdings. Two years later they reported on the extent, character and accessibility of archaeological resources (Roskams and Whyman 2007: 2), however, the analysis of prehistoric human remains was not discussed. Additional work exploring the prehistoric past on the Wolds has included The Wolds Research Project situated at the University of York (n.a. 2004). Established in 2002 and still ongoing, the project aim is to investigate the complex interactions of settlement with the landscape and its natural processes from the Iron Age to present day, though there are no plans at this time to include an analysis of prehistoric human remains. Furthermore, The Beaker People Project, a five year AHRC funded project situated at the University of Sheffield, is centred on gaining an understanding of mobility, migration and diet in the British Early Bronze Age (Jay 2009). The aim is to resolve the debate regarding the arrival of non-locals and the local development of Early Bronze Age culture. By systematically sampling the surviving skeletons throughout Britain, including some sites on the Wolds, individuals are being assessed through stable isotopic analysis to understand diet and mobility. A second aim is to examine the skeletons both macroscopically and microscopically to answer questions about the trauma, health and daily lives of these individuals.

Most recently, Alex Gibson was commissioned by English Heritage to evaluate the site archives of Neolithic barrows of the Upper Great Wold Valley to gain a better understanding of the paleo-environmental sequence, obtain absolute dates for the regional monuments and to reconcile the antiquarian excavations with modern scientific methods (Gibson and Bayliss 2009). Most notably this work has led to the publication of a complete reassessment of the Duggleby Howe Neolithic round barrow which has provided new details on the osteology and bioarchaeology of the skeletons as well as a suite of radiocarbon dates to better and more

accurately situate the site in prehistory. In sum, although some exciting new research projects on human remains have commenced since the 2003 YARFF publication, there is still a lack of understanding of human lifeways through history and thus, no attempt at a synthesis.

1.2.1 *Methods*

Detailed explanations of the methods used in this thesis are provided in the relevant chapters. The research has employed a variety of different approaches in order to investigate each of the objectives. The first approach is a literature review of all sites on the Wolds which contain prehistoric human remains, examination of all published accounts, pulling out general data on funerary context and basic demographic information (where available) and an assessment of the quality of recording, analysis and interpretation. Those sources that were not readily available were obtained from commercial firms as well as the archaeologists or osteologists themselves when the site records were not published. These reports have added immensely to the body of knowledge concerning the Yorkshire Wolds and it is through this amalgamation that a more accurate representation of the history of excavations and finds has been compiled.



Map 1.2: Map of the location of prehistoric sites referred to in the text (after Gale and Rutter 2006).

Eight sites (Cowlam, Danes Graves, Garrowby Wold, Garton Slack, Melton, Rudston, Staxton Beacon and Willerby Wold) were selected for a comprehensive primary analysis of the

human remains (Map 1.2). This research involved fieldtrips to the Hull and East Riding Museum (HERM) in Hull, Yorkshire to examine remains from Cowlam; Danes Graves, Garton Slack and Garrowby Wold, all part of the Mortimer Collection. Additionally a trip to the Yorkshire Museum (YM), York enabled further analysis of remains attributed to Danes Graves. The Natural History Museum (NHM), London housed remains belonging to the Greenwell Collection and work here focused on the sites of Cowlam; Danes Graves, Rudston and Willerby Wold. Chris Fenton-Thomas of On Site Archaeology (OSA) loaned material from Melton and Terry Manby and Sewerby Hall, Beverley, Yorkshire loaned that from Staxton Beacon. Although both the Mortimer Collection and the Greenwell Collection included more sites than were examined, the site and skeleton selection were dependent on time and access constraints. This meant that it was necessary to assess as much as possible given the limitations and although the sites represented may not have been the most complete or the most sample-rich, they constituted what was available and what fit the sample criteria, as set out in Chapter Four.

Osteologically, several methods were employed to meet the objectives. Beyond the basic demographics of age, sex and stature when possible, the dentitions were examined for evidence of caries, abscesses and ante mortem tooth loss (AMTL). Additionally the entire skeleton was analysed for evidence of non-specific stress markers, including linear enamel hypoplasia (LEH) and cribra orbitalia (CO) as well as disparities between dental and skeletal age estimations in subadults. Evidence of trauma was explored through an assessment of cranial and post-cranial fractures and degenerative changes were surveyed with regards to osteoarthritis (OA) and vertebral joint disease (VJD) as they can have lasting impacts on an individual and a community's quality of life.

To determine diet composition, and add to the interpretations of the first and second objectives, individuals from both Melton and Staxton Beacon were tested using carbon and nitrogen stable isotopic analysis, funded by the University of York, with the training and sample preparation undertaken at the University of York and the final testing conducted at Bradford University.

In order to address the third objective, strontium isotopic analysis was conducted on individuals from both Melton and Staxton Beacon. As a result of a grant from the TNA and Europlanet Research Infrastructure, training and testing was undertaken with Gareth Davies at Vrije University in Amsterdam. An additional pilot study was conducted on the oxygen stable isotopes of Melton individuals, which involved training and initial sample preparation at the University of York and final testing at Bradford University.

1.3 The Case Study: the Yorkshire Wolds

This section provides detailed summaries of the prehistory of the Yorkshire Wolds as well as the wider British context in order to provide a comprehensive starting point as to the work and theories that have come about through archaeological investigation. It will cover settlement patterns and funerary monuments and evaluate the changing relationship that individuals had with each other and their surrounding landscape.

1.3.1 Introduction

The Wolds are an elevated escarpment in the East Riding of Yorkshire composed of dry homogeneous chalk with surrounding valleys of limited woodland and running water. Interest in the landscape and prehistoric monuments began early in the Victorian period with notable antiquaries Canon Greenwell and JR Mortimer whom opened over 730 prehistoric barrows. Their prolific digging spurred on their contemporaries and future archaeologists, including TCM Brewster, IM Stead, TG Manby and JS Dent who continued with vast excavations throughout the Wolds, resulting in the discovery of new sites and large samples of human remains attributed to the Neolithic, Bronze Age and Iron Age. Aerial reconnaissance surveys, post WW II, stimulated renewed excavation interests with the discoveries of crop marks throughout the Wolds, suggesting new areas and features to be explored. Stoertz (1997) published a project carried out between 1950 and 1991 by the Aerial Survey section of the Royal Commission on the Historical Monuments of England (RCHME) and brought together over 35,000 photographs of the Yorkshire Wolds. This assemblage has enabled archaeologically relevant features to be identified throughout the Wolds that were no longer visible, as a result of extensive farming activities on the ground.

1.3.2 Evidence for settlement

Competing theories abound regarding the actual significance and function of the Yorkshire Wolds. Several archaeologists, including Fenton-Thomas believe the lack of noteworthy examples of prehistoric settlements suggest the area was used primarily for rituals, elaborate burials and possibly the grazing of pastoral animals (Fenton-Thomas 2005: 24). Although he presents a thought-provoking theory, the limited amount of archaeological work focussing on *settlements* on the Wolds, means that there is little data with which to test it.

Dent (1982) acknowledges the funerary bias on the Wolds, but does not discount the belief that settlements were present. The Gypsy Race, the only water source on the Wolds, is seasonal, and this, when combined with the very limited number of confirmed settlement sites in prehistory, provides further substantiation for the theory that the Wolds may not have been able to support permanent communities (Fenton-Thomas 2005). Parker Pearson (1999: 132) commented that locations that have intermittent water sources (such as the

Gypsy Race on the Wolds), may have been important ritual areas with connections to the underworld, he felt the living, the dead and the landscape were involved in a complex relationship on the Wolds. While more recently, Neal (2009: 52) stated the lack of water on the Wolds was a misconception. Although she points out there is not a singular source, springs abound throughout the region. Her work suggests that further investigation is necessary to determine the ecological viability and therefore the carrying capacity as it relates to water on the Wolds that, ultimately, will provide a more substantiated base to develop theories regarding prehistoric settlement.

Fenton-Thomas agreed with the symbolic role of the stream, however he cites the absence of structures, and disregards the possible “flimsy nature” of prehistoric buildings, as evidence that the Wolds was not conducive to settlements (Fenton-Thomas 2005: 24). In an earlier publication, however, he acknowledges the light soils of the Wolds chalk as beneficial to low technology agricultural practices and concedes that had there been settlement on the high hills they may have been shifting and temporary in nature (Fenton-Thomas 2003: 28, 46). Unfortunately, here (Fenton-Thomas 2003: 29), and in his more recent publication (Fenton-Thomas 2005), he returns to the lack of formalised evidence for settlement, and questions whether it is reasonable or even justifiable to equate the dense concentration of burial monuments to a hypothetical parallel settlement distribution.

The presence of groups of pits scattered throughout the Wolds landscape surrounding Rudston provided evidence to Manby (1975) of extensive Neolithic occupation sites as small settlement groups. He deemed some to be the remainder of settlement features including hearths and postholes long ago destroyed by the plough. Thomas (1999: 70, 73), on the other hand, argued the pits represented evidence of a “material longing to ascribe meaning” thereby connecting people and specific events to the landscape, and not indicators of long-term occupation. Harding (2006: 117) sits somewhere in the middle. He is not convinced by ritual deposition, however due to the limited evidence to suggest longer-term storage in the pits he is equally unsure about permanent occupation. Instead he felt the pits may have been the remnants of small-scale temporary camps, suggesting occupation may have been seasonal, but nonetheless that people were living on the Wolds in some form in the Neolithic (Harding 2006: 121). Fenton-Thomas overlooked these suggested occupation areas and concluded that people did not begin to occupy the high hills until the Bronze Age, when the Wolds landscape was first divided up and enclosed (Fenton-Thomas 2005: 30).

Manby (1988) was more inclined towards supposing the prehistoric landscape would have offered inhabitants an assortment of resources to sustain permanent dwellers. The forests would have provided timber, fibres and resins, while the faunal resources including deer, bear and pigs and the marsh and marine sources of fish and wild fowl would have all enabled

sustainable access to a variety of foodstuffs. Additional local resources of flints, stones and materials for ceramic production created the opportunity for craft specialisation and trade with local and long distance networks (Manby 1988: 42). Fenton-Thomas does not consider the available resources that may have supported settlements and rather describes the Wolds as “remote windswept spots” in antiquity, “only occasionally visited for special meetings or festivals”, though evidence of these important events does not extend beyond the basic presence of funerary monuments (Fenton-Thomas 2005: 121).

Beyond the abundant resources that Manby identified, he noted that as there is evidence of timber built mortuary structures within Neolithic long barrows for the dead, it is reasonable to surmise that the populations would have been capable of building large timber structures for housing the living (Manby 1988: 44). Bevan (1997) does acknowledge the absence of settlements as problematic. He, however, cites the activity of large scale clearances of woodland on the Wolds in the Neolithic and Bronze Age, coupled with Neolithic pits with occupation debris and the funerary assemblages of animal bone and grasslands at the base of barrows, as evidence of extensive occupation and pastoral activities in prehistory (Bevan 1997; Whittle 1977:31).

Stoertz (1997: 4) points out the low lying areas of the Vale of Pickering and of York as being covered with fen and reed swamps which would have made them unsuitable for occupation in the Neolithic and would have resulted in the preferential choice of the permeable chalk uplands of the Wolds as more favourable for occupation. She further presumes that Neolithic and Bronze Age populations would have lived within unenclosed settlements so that their impression on the landscape may have been minimal, especially compared to the funerary and ceremonial monuments which have dominated aerial reconnaissance surveys and excavations (Stoertz 1997: 60). Unfortunately the physical evidence of settlement is largely non-existent in the Neolithic with the exception of a few possible isolated structures such as that at Driffield which Dent (2010: 28) suggests is the most convincing evidence of a Neolithic domestic structure as a rectangular timber form with post holes. Additionally, over one hundred years earlier Mortimer (1882: 472) described what he believed to be ancient Bronze Age dwellings at Hanging Grimston resembling a cave dwelling overlain by a later barrow. Mortimer (1882: 474) surmised the cave dwelling was once covered with a thatched roof of heather, and also believed this type of structure was present in the Kemp Howe barrow at Cowlam. Additionally, in his 1905 publication, Mortimer detailed three further pit dwellings (e.g. Figure 1.1) he identified within the Garton Slack group, one of which had evidence of a hearth and burnt animal remains.

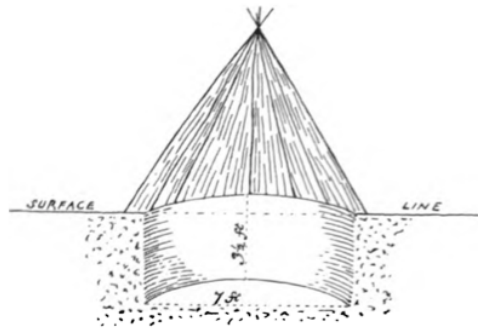


FIG. 722.—SECTION OF PIT DWELLING NEAR BARROW C 34, WITH RESTORED ROOF.

Figure 1.1: Example of Mortimer's reconstruction based on the excavation of a Bronze Age pit dwelling (Mortimer 1905: 238).

A fifth dwelling (Mortimer 1882: 477), located near Bishop Burton Wold contained evidence of stake and post holes which Mortimer felt represented the upright posts of the wattle walls of a circular house. Unfortunately none of these dwellings have been re-explored using modern archaeological methods; therefore, the settlement evidence remains tentative. While in the Iron Age settlements are more concretely attested to at the sites of Wetwang and Garton Slacks (Brewster 1981; Dent 1982), Staple Howe (Brewster 1963), West Heslerton (Powlesland *et al.* 1986), Caythorpe (Abramson 1996), Thwing (Manby 1975), Rudston (Stead 1980) and Grimthorpe (Stead 1968), the debate regarding the earlier period evidence of occupation will continue until new excavations discover more tangible proof.

1.3.3 Funerary practices

1.3.3.1 Neolithic

During the Early Neolithic period in Britain, at about 4000/3800 cal BC, there was an adoption of a new burial form; that of megalithic funerary monuments, most often termed long barrows (Figure 1.2). There is debate regarding their initial construction with Kinnes (1979) suggesting this early period of adjustment into the Neolithic phase might not have included monumental construction. Recent work by Whittle and colleagues (2008) on radiocarbon dates of first construction phases, at sites such as Windmill Hill, West Kennet, Wayland's Smithy and Knap Hill, have generated implications for their earliest constructions. Unfortunately, it is difficult to compare these with those determined for the Yorkshire Wolds, as the majority were obtained using outmoded methodologies and interpretive techniques (Hardiman *et al.* 1992; Manby 1988, Brewster 1980, Manby 1967). However, even without absolute dates, the extent of long barrow distribution on the prehistoric Yorkshire Wolds landscape (Map 1.3) does indicate a high concentration of this monumental funerary rite in a restricted region. Perhaps with a reanalysis and modern understanding of their significance, through the use of radiocarbon dates, it will be possible to gain insight into their role in Yorkshire and wider British prehistory.

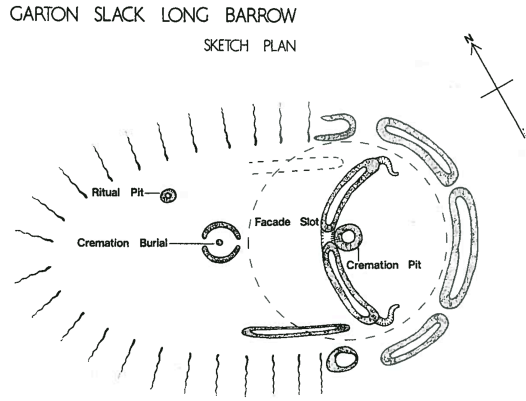
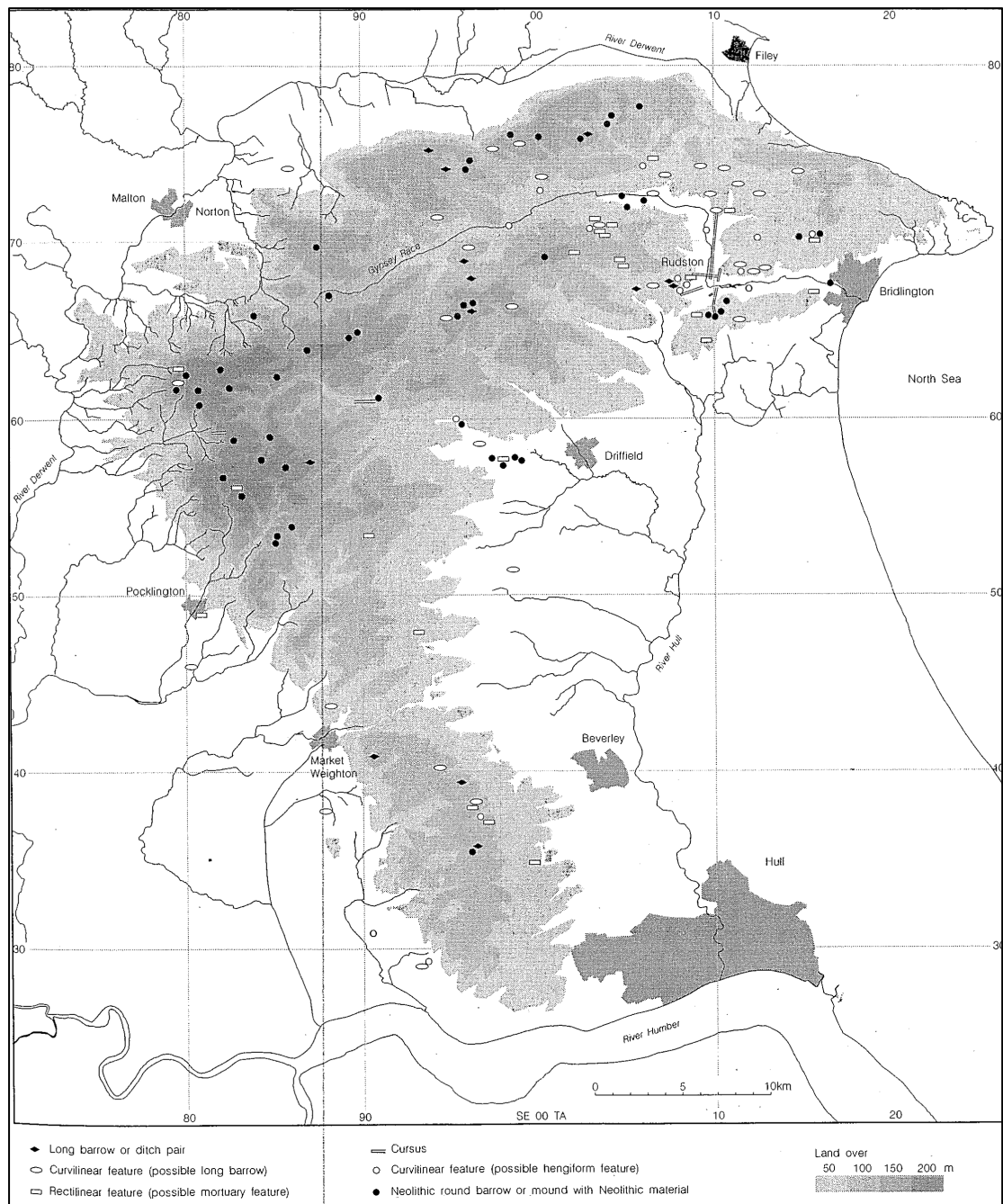


Figure 1.2: An example of a long barrow from the Yorkshire Wolds (Garton Slack; Brewster 1976: 105).



Map 1.3: Map of the distribution of Neolithic monuments on the Wolds (Stoertz 1997: 63).

The predominant burial treatment throughout the Neolithic was inhumation (in the strictest sense, the placement of human remains in the earth). However the nature, visibility and management of the remains was quite varied. The early antiquarian impressions of Greenwell and Mortimer upon the opening of long barrows, and the discovery of confused, co-mingled, damaged and disarticulated remains were acts directly attributable to rituals, feasting and cannibalism (Greenwell 1865a: 107; Mortimer 1905: xxiv). This may partially be due to the stark difference of their Victorian forms of discrete single burials, and even those attributed to the later Bronze and Iron Ages. Often these disjointed remains were the result of a range of burial practices and post depositional changes, as no clear, confirmed instances of cannibalism have thus far been attributed to the remains excavated by Greenwell or Mortimer (Brothwell 1961). Some, such as those observed at Nutgrove long barrow, contained remains that resembled ossuaries in their confused nature of deposition. Others, such as those at Burn Ground long barrow, exhibited discrete piles of remains as well as scattered disarticulated skeletons; and those in the Cotswold-Severn region appeared to contain both intact, whole individuals and co-mingled, disarticulated remains (Smith and Brickley 2006: 344, 337).

Thomas (2000: 654) believed this disorganisation was either the result of secondary deposition following excarnation or successive depositions resulting in the disruption of earlier burials, explaining how the skeletons in the deepest part of the barrow were the most co-mingled, and those closest to the entrance, the last or most recent additions, were more complete and articulated. Whittle (2003: 129), however, thinks this is far too simplistic, and in addition to Thomas' theories, includes the practices of deliberate breakage and disarticulation with reorganisation (what Thomas might refer to as "a metaphor for the changing state of a person (Thomas 2000: 659)) and the removal and circulation of specific anatomical elements throughout the living community. Beckett and Robb (2006:60) suggest Neolithic funerary practices involved multiple rites and several locations, which would account for the range of depositional locations and the variety in bone element preservation and organisation, suggesting, the most parsimonious explanation for the range of practices exhibited in the Neolithic.

Thomas (2000) does refer to the removal of certain bones, however his theory is independent from that regarding the disorganised nature of the long barrows. He places emphasis on what he terms the "general economy of human remains" which would suggest a regular activity of transporting and cherishing specific skeletal elements of remembrance (Thomas 2000: 660). He cites examples of particular bones in long barrows as being more weathered than the rest or an absence of certain bones as evidence of this economy, and yet, both may also be due to excarnation. As a corpse is laid in the open environment to

decompose, weathering of the tissues and the bones may take many forms, and will affect different bones in a range of ways, while the participants in excarnation (namely carnivores and scavengers) and the completely disarticulated nature of fully excarnated human remains may suggest alternative reasons as to why skeletons are incomplete upon their burial or reburial in long barrows. This is not to suggest that the transportation and circulation of human bones did not exist, for it certainly did. In long barrows in Orkney, such as at the stalled cairns of southern Rousay, there is evidence of individual skeletal elements being transferred from one tomb to another (Reilly 2003: 149). Reilly (2003: 150) suggests that in this region, upon death, the individual “entered a long, ritual journey during which the body was gradually separated into its constituent parts”. As there is still not enough evidence to place an economy of human remains as central to Neolithic funerary practices in multiple regions throughout Britain, these findings instead point to regional variants in the deposition of the dead.

Throughout the Wolds, a secondary burial ritual was cremation and it was found to be present in a number of long barrows including Calais Wold, Kilham and Willerby Wold. Up until the 1970s it was believed that Neolithic cremation practices were mainly isolated to northern England (Whittle 1977: 45). This, however, may be because cremated remains were not usually retained from earlier excavations as their scholarly value was not fully realised. But as methodologies and techniques of identification and analysis improved, so did reported instances of Neolithic cremations outside of northern England (Smith and Brickley 2006: 352). Specifically in the Cotswold-Severn region, multiple sites including West Kennet and Ascott-under-Wychwood have evidence of multiple cremations suggesting it was more dominant than previously believed (Smith and Brickley 2006: 351). Additional examples of cremations have been found in chambered cairns in Scotland, and Mays (2004) discussed the presence of Neolithic cremation burials at Brightlingsea in Essex and the Chestnuts long barrow in Kent.

What is unique to the Wolds with reference to cremations and inhumations in the Neolithic, is the presence of funerary chambers that were subsequently set on fire, usually within long barrows such as those at Calais Wold, Rudston, Kemp Howe and Willerby Wold (Manby 1988). The burials within these structures show some evidence of fire, but they are entirely different from the complete cremations placed within the same barrow, which Bradley (2007: 58) believes were an entirely distinctive type of funerary rite.

Manby (1963) has also discussed a number of long barrows that did not contain crematoria including that at Kilham, signifying there may have been two types of funerary customs within the long barrows and Bradley (2007: 58) notes that it appears as though there were multiple forms of funerary rituals co-existing contemporaneously throughout the Wolds. If

this is the case, there are a number of barrows from Garton Slack, Willerby Wold, Rudston and possibly even Staxton Beacon and Cowlam that may have evidence of the continued use of the funerary ritual of large numbers of individuals interred communally into the Bronze Age. Garton Slack's barrows 171 and 82 had seven and ten interments respectively, while Willerby Wold's barrow 33 also had ten. Rudston's barrow 63 had 13 individuals and barrow 68 had seven, while the Staxton Beacon barrow excavated by Manby had 13. These high numbers would suggest a continuation of communal, rather than single graves, however an additional explanation may be that some of these barrows were ossuaries, as Greenwell had interpreted Cowlam barrow 57 (Greenwell 1877: 221). Unlike the co-mingled remains seen in ossuaries elsewhere, Greenwell surmised that the individual skeletons (or heaps of bones) here were still kept discrete and isolated from one another.



Figure 1.3: An example of a Neolithic causewayed enclosure, Windmill Hill at Avebury in Wiltshire (Oswald 2011: 5).

Whittle and co-workers (2008) recently determined that causewayed enclosures took over as the dominant (though not sole) burial location in the south of England after 3700 cal BC (Fig. 1.3). The layout and architecture of these large scale complexes of banks and ditches interrupted by causeways and occasional formal entrances suggests they were the grounds for large scale gathering of multiple groups of people, though not necessarily exclusively or mainly for ritual activities (Bradley 2007). Harding (1997: 285) believes they signify the importance and necessity of identity at a higher community level, implying the mutual benefit and dependence on surrounding populations. These enclosures are present throughout southern Britain and extend throughout the Midlands and the Thames Valley. Remains found within the associated ditches were occasionally full burials, but were more often disarticulated and isolated remains, reminiscent of those from long barrows, their distribution, however, suggests a deliberate and purposeful depositional act (Bradley 2007: 74). The enclosed site of Hambledon Hill produced a large quantity of human skulls in its ditches and is believed to be the site of specialised events (Healy 2004). What is striking, despite their prominence and proliferation throughout most of England, is their almost

complete absence in all of East Yorkshire. Instead, East Yorkshire exhibits an entirely different form of burial contemporary with the southern causewayed enclosures; that of large round barrows (Fig. 1.4).

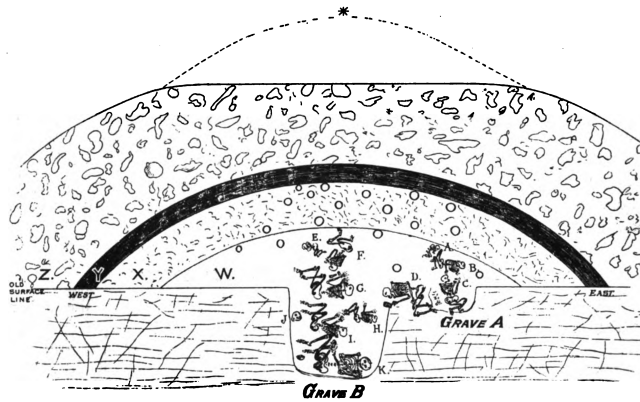


Figure 1.4: Example of a cross section of a Neolithic round barrow on the Yorkshire Wolds (Mortimer's excavation of Duggleby Howe; Mortimer 1905: 24).

Unlike the multi-use long barrows throughout Britain, these Neolithic round barrows, seen at sites including Duggleby Howe, Wold Neuton, Rudston and Birdsall Brow, generally represent single funerary events, occasionally including later, secondary intrusions (Harding 1997: 282). In contrast to the burials within the long barrows, individuals were usually interred intact and articulated; however in many of the barrows contemporary cremations were also discovered. Mortimer interpreted the exceptionally large Great Barrow of Duggleby Howe as primarily belonging to a chief or other high status individual (Mortimer 1905: 35). He believed the other ten inhumations and more than 53 cremations belonged to the chief's immediate family and servants, suggesting a shift from an ancestral and continuity-type focus of long barrows to one centred on the individual and his offspring. Harding (1997: 286) proposed this cemented the power of certain groups in the landscape as this highly orchestrated display was in direct contrast to the earlier socially collective long barrows and contemporary causewayed enclosures.

The treatment of the body within these round barrows appeared to be related to one's relative status however, the recent work by Gibson and Bayliss (2009) at Duggleby Howe has drawn attention to the range of funerary treatments that were available. Furthermore, as a result of their extensive dating program at the site, they have determined the individuals may have been buried over a number of centuries, with extended periods of burial as well as equivalent periods of disuse (Gibson and Bayliss 2009: 72). With regards to the *status* inferred by Mortimer, as a result of their osteological and bioarchaeological analysis, Gibson and Bayliss (2009: 73, incorporating the work of Cooper 2004) concluded that none of these individuals presented strontium and oxygen values consistent with the Yorkshire Wolds. When this was considered in conjunction with several instances of cranial trauma, they

theorised that social elites may have been buried elsewhere, while at Duggleby Howe it was “the vanquished or socially downtrodden” who were placed below the great mound. Overall, therefore, the local elite or ancestors “may have been far too important to have been thrown into a hole in the ground” (Gibson and Bayliss 2009: 73). These findings point to the need for a reanalysis and reinterpretation of not only the Neolithic, but all of the prehistoric evidence attributed to the antiquarians. Although their methods were far superior to the norm for their time, it is only with the application of modern methods that their assumptions may actually be tested.

Manby (1963) noted the crematoria in the long barrows were confined to the north of England and although the perceived egalitarian aspect of the long barrow was abandoned with the alteration to round barrows, the crematoria feature still continued on with Neolithic round barrows including Cowlam’s barrow 277, and Garton Slack’s barrows 80 and 81 (Manby 1963: 193, 195). In Mortimer’s excavations at Garton Slack barrow 80 and 81, he found at the natural turf line burnt wood and charcoal, which he took to suggest a continuation of the cremation ritual as well as the placement of burning embers directly on top of the corpses at the time of burial (Mortimer 1905: 236). Manby believes that the local population continued the tradition associated with the long barrow, but as a result of interactions or possibly the arrival of “single grave migrants” during the late Neolithic, new ideas and methods were adapted and added to their funerary customs (Manby 1963: 195).

It appears as though the Neolithic round barrows also alter throughout the period, so much so, that by the later part of the period, the barrows contained fewer and more discrete inhumations, such as the two found beneath Birdsall Brow (Harding 1996). It is during this later period that occasional round barrows begin to show up in the south, in isolated areas of the Midlands and East Anglia, and here they are associated with individual interments, suggesting a progressive ideological movement from the east to the south (Harding 1997). Bradley (2007: 89) noted their presence throughout much of Britain by this period as well and submitted that the round barrows were not in fact a “special feature of northern England” as commercial archaeologists have discovered several instances further south. What makes the situation on the Wolds unique is the amalgamation of multiple forms of Neolithic funerary practices within this small region of England. The relationships that individuals and groups had with their landscape high on the hills was one that allowed for individualised and collective forms of remembrance and this juxtaposition of burial features that supposedly typified different types of societies appeared to all find credence and acceptance on the Wolds. This fusion of burial methods and rites is especially unique considering contemporary populations in the south and west were continuing on with collective, disarticulated funerary treatments.

Towards the end of the Neolithic, Thomas (2000: 663) cites a general shift in the tide of the importance placed on ancestors, evidence by the shift in funerary methods towards individualised burials and what he calls “placing ancestors in the past”. Instead of identifications with communities and the wider collective, as exhibited by the earlier long barrows and more recent causewayed enclosures, personal identity was now the focus and one’s place was related to direct descent as opposed to group affiliations (Thomas 2000: 663). From the number of later Neolithic burials it is clear that large numbers of the population were being buried elsewhere or were subject to burial rites that did not result in preservation, including excarnation with secondary deposition. Smith and Brickley (2006) suggest the scattering of cremated remains into waterways as an additional explanation for the lack of remains.

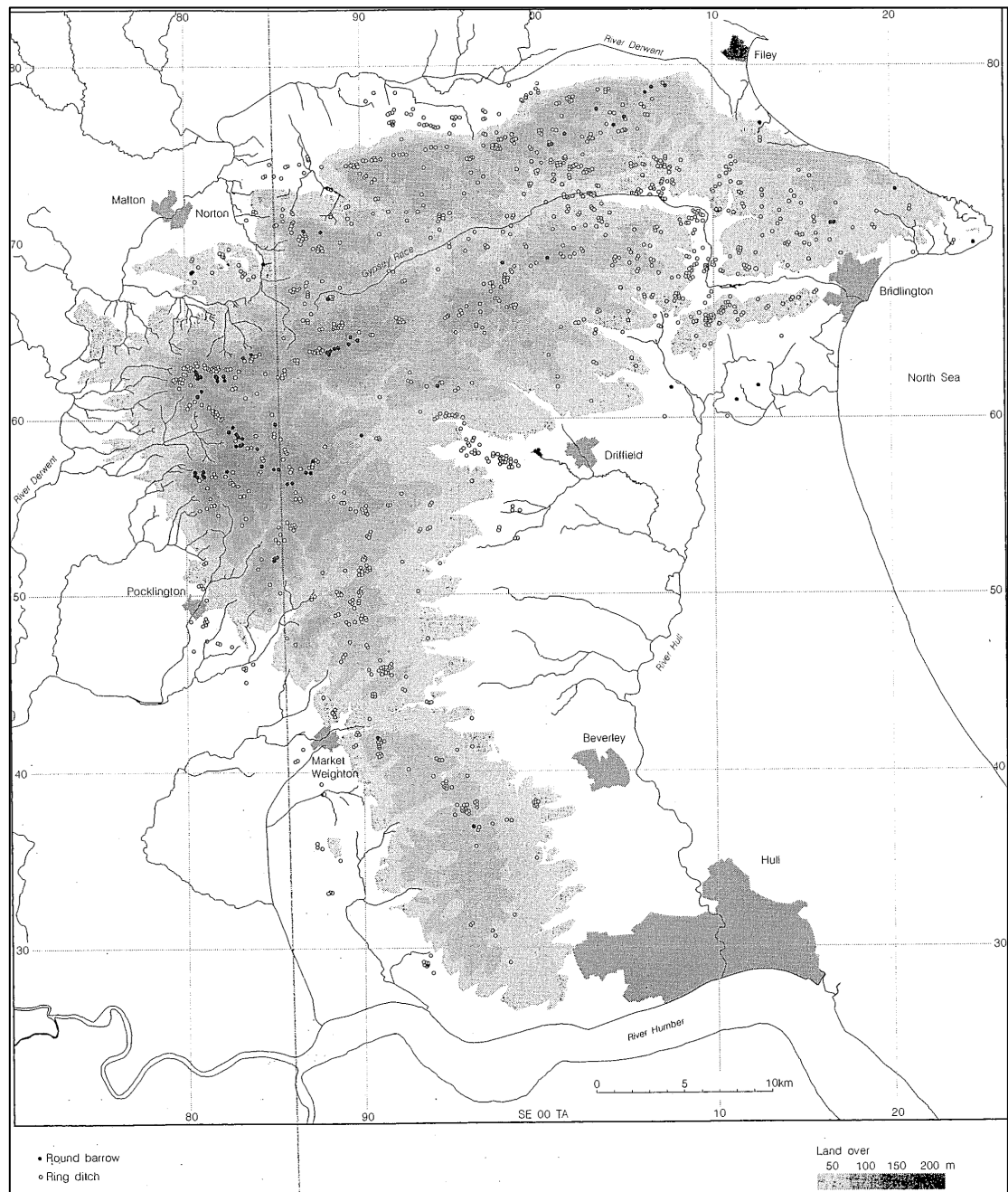
1.3.3.2 *Bronze Age*

The Bronze Age period in England is often thought of in relation to archaeology’s most interesting discoveries. The Amesbury Archer, Stonehenge and the Beaker culture have all sparked intensive excavation and analysis in order to better understand the complex funerary rituals that characterized this new era. It was once believed that the beginning of the Early Bronze Age, approximately 2300 cal BC ushered in a new funerary rite in Britain in which individuals were generally fully articulated and placed in round barrows inspired by the Beaker culture (Figure 1.5; Childe 1947: 8), however, of course this *Beaker veneer* was more variable than previously thought (Gibson 2007). Based on the evidence presented for the Neolithic, it is clear that a single-burial funerary tradition was present in the Late Neolithic, but what is important with regards to the Early Bronze Age is that during this time the small round barrows containing individual inhumations became the norm rather than the exception.



Figure 1.5: Example of an Early Bronze Age Beaker burial with typical grave goods (Jewitt 1870: 14).

Bradley (2007: 89) proposes that instead of the round barrows being a continuation of the Late Neolithic tradition, the single inhumation burials of the Early Bronze Age were a direct result of contacts with mainland Europe. Specifically, with the Bell Beaker people, who brought with them a new form of burial that involved not only single burials beneath small round mounds or in occasional flat graves, but also the important addition of a variety of personal adornments (Bradley 2007: 150). Barrett (1996: 409), not focused on the specificities of the various forms of burial, focused on the fact that the Early Bronze Age brought about a new burial methodology, one that had never before been seen in the archaeological record, that of burial on a large scale. Compared to the Neolithic period, the Early Bronze Age saw the creation of a range of burial practices including extensive cemeteries and isolated groups of barrows, suggesting more people may have had the opportunity to be commemorated in the landscape than ever before. On the Yorkshire Wolds the round barrows became the dominant burial tradition with over 1400 discovered, many by aerial reconnaissance (Map 1.4; Stoertz 1997). Many of these have been identified as Beaker burials with the characteristic body positions and accompanying grave goods located at several sites including Garton Slack (Brewster 1980: 17).



Map 1.4: Bronze Age funerary monuments on the Yorkshire Wolds (Stoertz 1997: 32).

It must also, however, be noted that this period also saw the continuation of the Late Neolithic tradition of multi-burial in round barrows (Garwood 2007: 34). While smaller than their Neolithic 'Great Barrow' counterparts, these contained at least two construction, insertion and/or elaboration phases and were evident in southern England, the Midlands and Wessex. Throughout the Yorkshire Wolds there is also a complex mix of single and multi-use round barrows suggesting, as in the Neolithic, an amalgamation of burial traditions or, conversely, an acceptance of several contemporary forms of burials that converged in the region (Manby *et al.* 2003: 60). Their chronology roughly parallels that of the single inhumation Beaker burials, as their construction and use generally ended by about 1750 BC (Garwood 2007: 34). From this evidence it is clear that the Wolds continued to be a unique

area in which multiple philosophies regarding the place and importance of the dead were accepted and displayed.

Thomas (1991: 183) characterised the funerary rituals associated with these multi-use round barrows as ostentatious and clearly derived and performed for the benefit of the wider community. The initial interments were usually single inhumations, however the later additions, typically on the periphery of the barrows, and therefore removed from the central burial, were most often cremations, which Barrett (1996: 151) interprets as a demonstration of increasing importance placed on inheritance. Bradley (2000: 157) extends Barrett's theory further and surmises that the subsequent reuse and further elaboration of the round barrows cemented the relationship between the living and the dead and offered an additional mechanism in which the individuals buried within could be remembered by the community.

Towards the end of the Early Bronze Age, c. 1500 cal BC, Brück (2000: 290) suggests a complex reordering of the social boundaries of Bronze Age England with a shift from the large-scale elaborate burials of the earlier period to a single extended family manifestation of burial. As Ellison (1981: 422) discussed in his analysis of Middle Bronze Age cemeteries, the new funerary rites were focused on single kinship groups and short periods of time. Bradley (1981) concurred with this assessment and cited the presence of small cemeteries adjacent to settlements as further evidence of a shift away from the monumentality and elaboration of the Early Bronze Age to a more private, household-centred burial tradition.

During this period, inhumations were cast aside in favour of a cremation rite, which Brück (2000: 290) interprets as an expression of the Middle Bronze Age populations' attempts to control the passage of time by taking a proactive approach to the burial rites and deciding on their own terms the final state of the dead. Bradley (2007) however, has a different interpretation and suggests that the shift to cremation was a more meaningful way to signal the social relationships of individuals to one another. As cremations themselves effectively required more expense and human energy (not only in regards to the materials involved in maintaining the pyre but also the time involved in watching over and being involved with the burial rite) than inhumations, he believes they may have identified elites or special people without the need for the elaborate burials of the past (Bradley 2007: 176). On the Wolds, though rarely found in association with settlement, the Middle Bronze Age burial rite resulted in numerous cremation deposits occurring in one mound as secondary burials to earlier period primary interments, such as those at Callis Wold and Garton Slack (Parker Pearson 1999; Dent 1983a). The Yorkshire Wolds also played host to small cemeteries with flat graves, as opposed to the mainly isolated and dispersed mound burials of the Neolithic. Small cemeteries have been found on the Wolds at Garton Slack and Painsthorpe and often remains were accompanied by food vessels and other pottery forms (Parker Pearson 2005). What is

unique about these graves is that unlike the other regions in England, the practice of inhumation continued on throughout the Middle Bronze Age period, most often in parallel with exclusively cremated burials and mixed burials of inhumations and cremations.

In the Late Bronze Age, from about 1000 cal BC, Hill (1995: 65) believes excarnation became the dominant funerary practice in Britain with skeletal elements now being placed in a range of locations associated with ritual activities including wells, boundary earthworks, caves, springs and bogs in place of inhumations. Brück (1995: 245) connects this transition with a 'de-ritualisation' of the archaeological record, as from the Middle Bronze Age to the end of the Later Bronze Age there is a continuing shift of landscape evidence from one associated with funerary monuments and rites to one focussed on settlements and field systems, and by extension economic activities. This period in Britain is also difficult as the majority of individuals became archaeologically invisible outside of southern and eastern England from approximately 1000 cal BC or possibly earlier (Brück 1995: 245). Bradley (2007: 185) maintains that cremation cemeteries continued on in this period, however the scale and number of burials decreased. What he notes however, is these cremation cemeteries appeared to include all members of society, suggesting to him that overt status distinctions may have been suppressed with regards to the burial rites (Bradley 2007: 201). In Eastern Yorkshire, on the Wolds, there is a marked continuation of formal burials, as both inhumations and cremations continue to be prevalent throughout the landscape. The sites of Garton-on-the-Wolds, Melton, Thwing, Staple Howe and Grimthorpe all contain inhumations and/or cremations attributed to the Late Bronze Age period. This suggests that on the Wolds, unlike the other regions in Britain, there was a continued and similar focus on funerary rituals and although they had shifted in emphasis from the Early to the Late Bronze Age, they still formed an important and integral part in the identities and beliefs of the populations and in their relationship with their surrounding landscape.

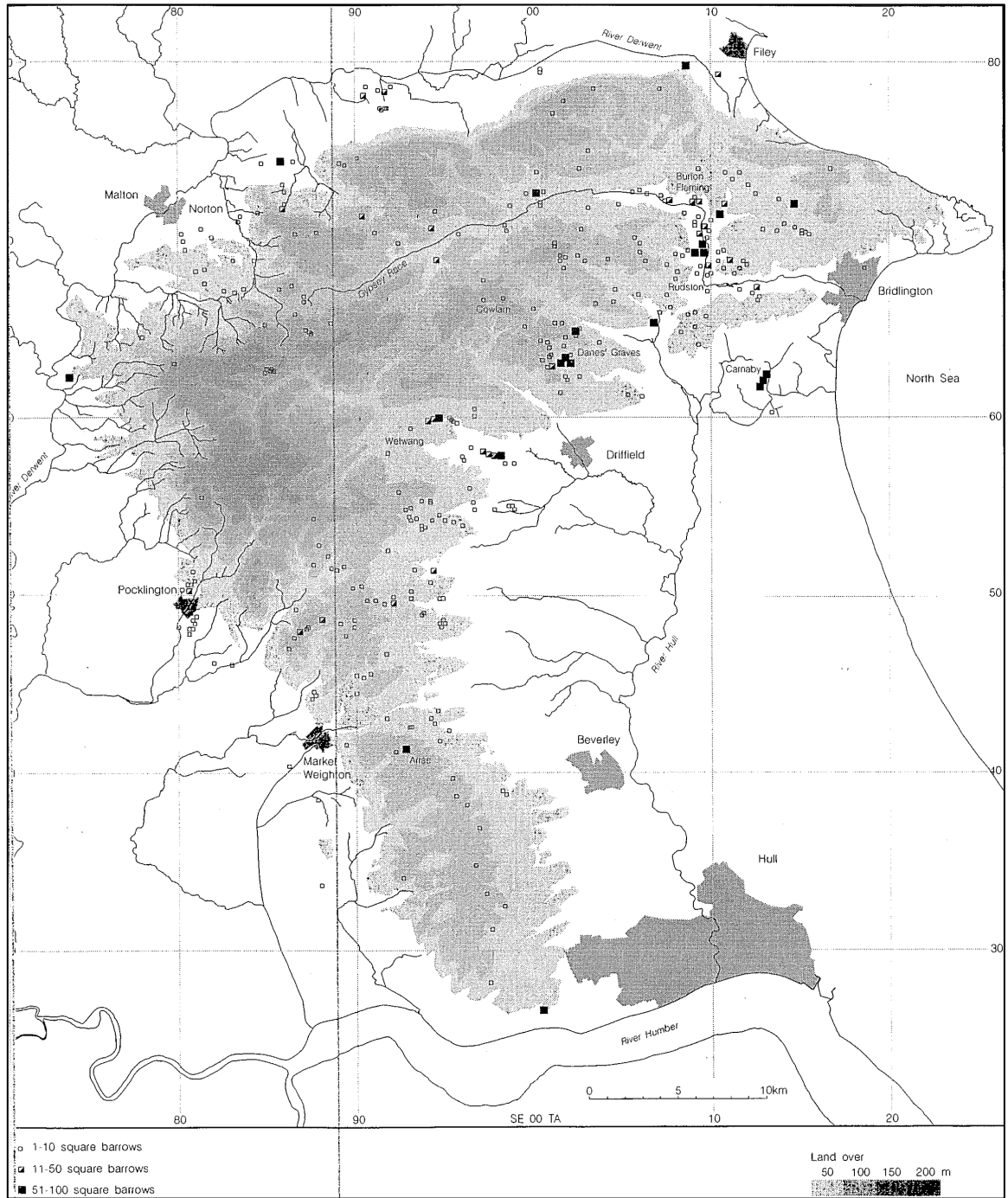
Outside of East Yorkshire, Brück (1995: 247) has proposed informal Late Bronze Age locations for human remains, the majority of which are found within settlement contexts, suggesting to her that human remains played important roles in non-funerary practices during this period. As the relics are often disarticulated and fragmentary in nature, it is difficult to equate these with the more formalised burials seen in the Early and Middle Bronze Age. Brück (1995: 250) further surmises that token deposits were also consigned to wet places, suggesting that although this practice had been present since the Neolithic, during the Late Bronze Age the scale of votive deposits increased exponentially and took the place of the archaeologically visible rites, not implying a de-emphasis on funerary ritual, but simply a re-characterising of it. Bradley (2007: 202) further supports this assertion citing C¹⁴ dates for the River Thames water burials as being consistent with the Late Bronze Age, which he also

connects back to the Neolithic and Early Bronze Age funerary practices. Brück (1995) believes a re-evaluation of older excavation reports and a renewed interest in the excavation of settlement sites may provide additional variations in the funerary methodologies of Late Bronze Age Britain.

What is integral to the understanding of this period is the re-interpretation of the dead in the landscape for one wherein human remains have a variety of functions and symbols associated with them and as such the contexts in which they are found, and consequently not found, is more varied than in previous times. Overall there is no doubt that vast number of people and often entire populations have been rendered archaeologically invisible as a result of this reordering, and only further excavations will determine if that is due to the nature of deposition or thousands of years of subsequent human activity and taphonomic processes (Brück 1995: 256).

1.3.3.3 Iron Age

The problem of archaeological invisibility, or more specifically the absence of formalised burial rites in the Late Bronze Age continued on in the Early and Middle Iron Ages for most regions in Britain (Carr and Knusel 1997: 167). Wait (1985), based on work at Danebury, theorised that only 5% of Early and Middle Iron Age individuals received any type of burial that resulted in their archaeological presence. Carr and Knusel (1997) along with Wait (1985) proposed that the remaining populations were subject to excarnation grounded upon the discovery of isolated, disarticulated or fragmentary remains within Iron Age pits, ditches, hillfort ramparts and enclosure boundaries. In 2007 Bradley stated that “until the Middle Iron Age there was no sign of a regular burial rite for the Iron Age of Britain” (262), and although the formality of this may be accurate, perhaps the regular rite was one related to excarnation and secondary burial. Hill (1995: 65) cites the presence of small deposits of human bones in settlement contexts, wells, caves, earthworks and wet places as evidence of an emerging regionalisation of funerary rituals and surmises that these social practices were used to radically distinguish one culture from another. In addition, and more recently, in her analysis of Early Iron Age funerary practices, Redfern (2008: 281) noted most individuals were represented by single bones, which were most often recovered from the interior spaces of settlement sites.



Map 1.5: Iron Age funerary monument distribution on the Yorkshire Wolds (Stoertz 1997: 35).

East Yorkshire however, presents a very different picture of funerary practices in the Early and Middle Iron Ages. Here, Early Iron Age formal burials have been identified at Melton and Staple Howe and are characterised by single, or, on occasion, double inhumations beneath low or flat mounds. Additionally, a new burial tradition developed in Britain characterised by large square ditched barrows in small groups at sites including Cowlam and Garton-Slack (Map 1.5; Fenton-Thomas 2003: 56; Brewster 1976: 109). Later in the Early Iron Age, these square barrows developed into a more prominent burial tradition on a massive scale at the type-site of Arras and additional sites including Danes Graves, Wetwang Slack, Rudston, Burton Fleming and several others (Figure 1.6). Parallels with these square enclosures could

be seen in northern France in La Tène cemeteries (Whimster 1981: 76) and Stillingfleet noted this connection earlier as a result of the excavation at Arras in 1819. He, along with several other antiquaries, uncovered the remains of approximately one hundred square barrows containing single inhumations and immediately connected their arrival to an invasion from continental Europe (Stead 1965: 2). This type-site led to the naming of the Arras Iron Age tradition in East Yorkshire and spurred on other antiquaries and modern archaeologists to uncover additional examples of the burial practice.

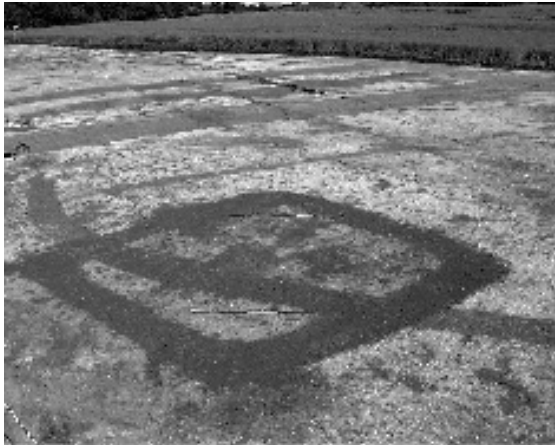


Figure 1.6: Example of an Iron Age square barrow prior to excavation (Melton barrow 2100; Fenton-Thomas 2010: 103).

Stead (1979: 93) also believed the arrival of this complex burial rite was the direct result of the movement and settlement of people from Central Europe, however Fenton-Thomas (2003: 50) entirely disagreed and suggested the presence of an Iron Age settlement in direct association with the square barrow cemetery at Wetwang Slack went a long way to refuting Stead's argument. These findings, to Fenton-Thomas (2003) implied contemporary features, which were locally derived. Stoertz (1997) believes that there is no doubt about the similarity of the square barrows at Danes Graves and Arras to those in France belonging to the La Tène culture of the fourth to first centuries BC, however she sees the change as a result of the migration of ideas only and maintains that the barrows themselves, the grave goods and those buried inside were wholly indigenous to the Wolds (Stoertz 1997: 34).

Mortimer would have completely disagreed with this assessment. He maintained that there was too much rapid change during these periods to disregard the possibility of an influx of new people and believed that the expansion of a more progressive race resulted in this shift in burial forms (Giles 2006: 302). Conversely, Greenwell would have been much more closely aligned with Stoertz as he supposes that the shift was a natural transition within the Wolds. Although he does not rule out the influence of ideas, he upholds that it was solely the exposure to the idea and not the people that were the catalyst for change (Giles 2006: 303). The parallels to the Champagne region of France however, are difficult to dismiss and the

connections extend beyond the outer representation of the burial mound (Bradley 2007: 264).

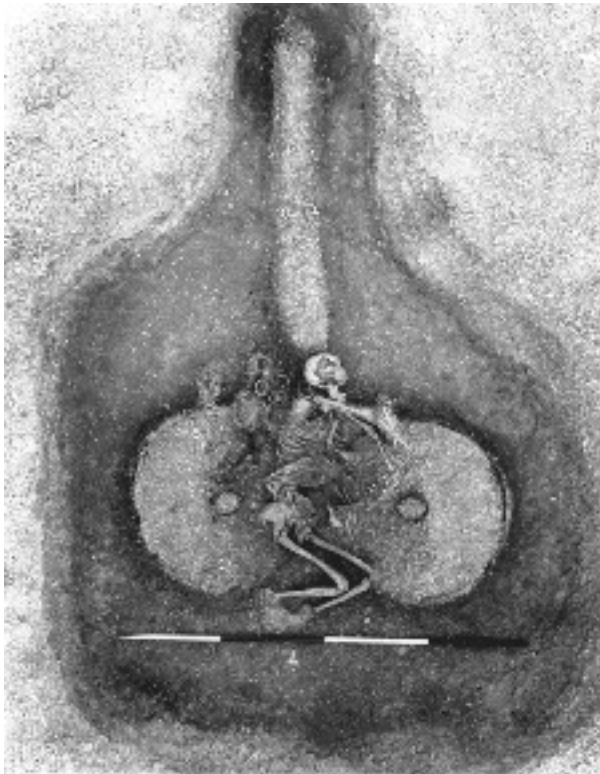


Figure 1.7: Example of an Iron Age chariot burial on the Yorkshire Wolds at Wetwang Slack (Dent 1985: Plate XX).

Within the square barrow burials of East Yorkshire two important burial traditions emerged, signifying elite or otherwise important individuals. In addition to articulated single (or on occasion double) inhumations, several individuals have been buried along with dismantled carts (or chariots) (Figure 1.7). The different terms are based on the semantics of determining the utilitarian nature of the vehicles. They were classically termed chariots to connect them with war (Mortimer 1905), however Stead (1965: 5) prefers the term cart, specifically because there is no evidence the vehicles were built to be used in combat or the theatre of war. The graves usually include all of the relevant horse trappings, the wheels and axels and British versions of European grave goods (Bradley 2007: 264). Multiple instances of chariot and cart burials have been found in Bohemia, Austria, south and central Germany and the Netherlands that date to the last phase of the Hallstatt and first phase of the La Tène (Bloemers 1986). This suggests a popular funerary rite that extended beyond geographic boundaries and ended up typifying Yorkshire in the Iron Age, one so connected that Bradley (2007) is convinced people from overseas settled the Wolds.



Figure 1.8: An example of an Iron Age warrior grave at Kirkburn, with the Kirkburn sword in the foreground (excavated by Stead; The British Museum).

A secondary unique form of burial on the Wolds within square barrows in the later part of the Early Iron Age are flexed or extended inhumations buried along with various weapons (Figure 1.8). These have been seen at Wetwang Slack, Danes Graves, Rudston, Garton Slack and Grimthorpe, which suggested to Dent (1983b: 127) that war was a genuine hazard in the Iron Age on the Wolds. Bradley (2007: 264) concurred with Dent's assessment and suggested that this shift towards a symbolism of conflict was evidence of the breaking down of an egalitarian spirit from the beginning of the period. The "warrior" graves of East Yorkshire have parallels in southern Britain and suggest a continuation of the rite further south, where complementary forms of settlement and defensive structures, such as hillforts, provide further credence to Bradley's (2007) belief in a change in societal relations. However, unlike East Yorkshire, southern England during this period is dominated by impressive hillforts, theorised as being defensive in construction and purpose (Fig 1.9; Cunliffe 1984).



Figure 1.9: Example of an Iron Age hillfort (Maiden Castle, English Heritage NMR 15852/03).

However, the defence and central place characteristic of hillforts have come under question by Hill (1995: 49) who stated that farmsteads in similar areas of Wessex as the hillforts had similar amounts and varieties of craft and resource production and argues against a need for such a central place. Additionally, he suggested the fortifications were built as a way to protect resources during a period of population expansion and not to deal with endemic warfare (Hill 1995: 52). More recently, however, in their analysis of human remains at Danebury, Stevens and colleagues (2010: 407) also discounted the notion that hillforts were primarily defensive in nature. However, they maintained that they were central places and more specifically distribution centres of food and goods as well as the location of ceremonial activities and rituals. Although in theory this concept is contradictory to that proposed by Hill (1995), he did also state an underlying flaw in Cunliffe's (1984) opinion on the notion of developed hillforts through his assertion that there was a blanket Celtic package in terms of the purpose, make-up and activities taking place at hillforts. Instead Hill (1995: 50) advocates that hillforts and farmsteads were much more similar than previously thought and furthermore that hillforts had more differences between them than compared to farmsteads. Beyond this, Hill (1995: 50) puts forth the notion that hillforts should only be seen as a coherent group in terms of the facts that they are not farmsteads. What is relevant to this discussion is that although hillforts and farmsteads varied in form and function throughout the south of England, they and their burial practices were not the norm on the Wolds. Although excavations going back to antiquarian times have produced evidence of hillforts on the Wolds (including at Grimthorpe, Thwing, Staple Howe and Devil's Hill at Heslerton (Dent 2010: 122)), they were not produced to the same scale and burial methodologies were dissimilar. Instead of isolated or occasional articulated burials buried both in settlements and in some cemeteries, on the Wolds, the Early Iron Age square barrows and flat inhumation cemeteries provide to be their own regional funerary cultural construct.

By the Middle Iron Age, approximately 400 cal BC, burial traditions were shifting once again. Throughout Britain, and on the Wolds, the funerary rites also moved away from elites and specialised rites. Larger cemeteries often close to but separate from settlements became the established funerary method, such as those found at Wetwang Slack, Burton Fleming and Rudston (Parker Pearson 1999: 132). Graves in this new system were generally densely packed next to one another with a covering mound over the top and could be individual, double or what some archaeologists believe are family crypts (Stead 1991).

Elsewhere in England, formalised burials returned and were often linked with adjacent settlements. Individual and small cemeteries of burials, occasionally found in association with swords, were found in Cornwall, Devon and Dorset from approximately 300 cal BC and onwards, and Hill (1995: 66) suggests this new practice may have been seen as an alternative

to the domestic and ritual depositional contexts prevalent in the Early Iron Age. Recent excavations in East Anglia, Wessex and the Thames Valley have led to the discovery of small inhumation cemeteries, providing further evidence for Hill's theory and suggesting that once again there was a shift in the importance placed on burial traditions in prehistory (Bradley 2007: 250). However, a more recent investigation of Middle Iron Age sites also found that single bones and articulated burials were both deposited at settlement sites and hillforts, with the majority still being buried in the interiors (Redfern 2008: 281). These cemeteries became abandoned towards the end of the second century BC, although articulated burials at settlement sites, as well as single bone depositions, continue to occur, albeit in far fewer numbers, at hillforts until the end of the period.

On the Wolds however, several sites including Reighton, Kirby Grindalyth and Melton have radiocarbon dating consistent with the end of the first century cal BC and the first century cal AD. These remains provide further evidence of the unique nature of funerary rites on the Wolds. While the remainder of Britain was once again reverting to archaeologically invisible mortuary rituals, the Wolds continued on with formal inhumation and cremation burials, suggesting a complex interaction of beliefs and practices concerning the dead within the landscape.

1.3.3.4 Determining who these individuals were

Attempting to explain whom the individuals that were buried in the Yorkshire Wolds barrows actual were is a challenging topic. Both the early barrow diggers and recent archaeologists including Manby, Stead and Fenton-Thomas agree that the barrows of the Wolds contained the elite or powerful members of society, and in some cases, close relations and their charges. This consensus has created a belief that prehistoric society had progressed beyond the stage when the family was considered the centre of the community (Greenwell 1877: 111). Greenwell believed that the barrows represented the leaders of clans, and others that claimed authority over the masses. Often this rite also extended to children, as both Greenwell and Mortimer surmised that where barrows contained subadults as the primary interment (including Rudston barrow 67) they were the descendants of the leaders and their deaths were marked with that ascribed meaning attached to them (Greenwell 1877: 111; Mortimer 1905: lxxi).

At Rudston, Greenwell found barrow 62 to be quite unique as it contained two cist burials, which he had never previously seen on the Wolds (Greenwell 1877: 242). They were placed very deep within the mound and Greenwell questioned the amount of labour and time it would have required, especially considering that the stones would not have added much by way of protection of those interred (Greenwell 1877: 242). One cist had the remains of an older adult male (believed to be the chief) and two very young children, while the other

contained the partially burnt bones of two adults and fragments of drinking cups. He concluded that in this instance, as well as others on the Wolds in which multiple people were found to be buried together (such as Mortimer's barrow 37 which contained the remains of 12 inhumations, five of which were believed to be interred at the same time due to their relative position), that the associated people were the wives, children and slaves of the man considered to be the primary burial (Greenwell 1877: 244). Fenton-Thomas also agrees with this assessment and feels the barrows are a visual reminder of the powerful elite of the previous generations (Fenton-Thomas 2005: 56). Although this theory has a lot of evidentiary support, especially when one considers the amount of time and labour involved in erecting the barrows, and it does provide a parsimonious explanation as to why there are so few in relation to the estimated population sizes, when the spatial relationship between the barrows within the barrow groups or cemeteries are considered the elite distinction becomes cloudy. Furthermore, more work needs to be done on the associated grave goods and overall spatial relationship to determine the social hierarchy that is (or is not) reflected in the burial traditions through prehistory.

An associated question related to barrow burials is what happened to the remainder of the population if indeed those on the Wolds were reserved for the upper members of society. Greenwell believes they were in fact buried on the Wolds, however, their graves were much shallower and were not accompanied with the same amount of spectacle and visual presence and therefore, they were much more likely to have been forgotten and probably suffered the effects of the plough to a much greater degree (Greenwell 1877: 112). Smith and Brickley (2006) suggested instead that differing funerary rites many have been afforded to different members of society, and therefore, alternative treatments including excarnation and cremation whereby remains are scattered throughout the landscape and into waterways would account for the supposed 'archaeological invisible' members of the population. This may explain why it has been difficult to find additional burials on the Wolds, however extensive aerial surveys have identified additional potential archaeological features indicative of burials so it may simply require more archaeological assessment to determine what happened to the rest of the population.

1.4 Thesis layout

The remainder of this thesis is set out in three parts. The first part is a review of literature which explores the major themes in scholarly research of prehistory in Britain and Europe in relation to the objectives of this research (Chapter Two), and an osteological summary of all of the published prehistoric data from the Wolds (Chapter Three), based on the desk-based assessment located in Appendix A. Part two includes an exploration of the samples and methodologies employed on the selected eight sites analysed (Chapter Four) and a

compilation of all primary datasets (Chapter Five). Finally, the third part focuses on the interpretation of the data within the context of the major prehistoric themes in Britain and Europe, referring back to the aim and objectives of the thesis (Chapter Six) and a conclusion of the major interpretations regarding the Yorkshire Wolds in prehistory (Chapter Seven).

Chapter Two: Themes in Prehistory

2.1 Introduction

For the disciplines of bioarchaeology and prehistory several different themes have come to dominate scholarly research. Earlier on in archaeological investigations, the focus was much more on parallel forms of evidence such as grave goods, settlement plans, the landscape and food refuse in order to answer questions related to the populations, sometimes, though not always in conjunction with osteological assessments. By exploring these themes within the context of osteology, archaeologists have been able to determine a more detailed representation of the past. As a result, both European and British prehistory have been studied using a multitude of methodologies including osteological and paleopathological diagnosis, stable isotope analysis and examinations of funerary rites to recognise and appreciate the complex relationships of people and their environment in prehistory. In this chapter, the themes of quality of life, social status and mobility, as set out in the objectives in Chapter One, will be examined in terms of recent studies in Britain and Europe, in order to throw light on how human skeletal remains have been examined and interpreted and the range of information that can be gleaned from their analysis.

Additionally, the importance of modern forensic work has increased knowledge and understanding of modern criminal acts and the need to identify human remains has resulted in more refined methodologies, more stringent data collection and reporting and a broader understanding of how activities and stresses effect the skeleton. Consequently, forensic methodologies have been incorporated into research involving archaeologically derived skeletal material, which has validated the belief that macroscopic osteological and paleopathological work must remain integral to individual and population studies.

2.2 Quality of Life

2.2.1 Introduction

Although in our modern world, quality of life has come to mean a variety of personal attainments and the reaching of various goalposts of personal and societal improvements, it is quite difficult to apply those determinants to people and populations in the past. Economists, demographers and social anthropologists have all played a role in attempting to define what it actually means and how to appropriately measure quality of life. The United Nations have long employed a Human Development Index (HDI), created in 1990, using rates of life expectancy, education and gross national income to determine how established a country is against a set of instituted levels (McGillivray 1991). Although this is the most

widely applied and cited form of quality of life index, others, that focus on different aspects of life including personal safety, ecological impact and perceived quality of life have also played important roles in determining our understanding of the lives of people and groups around us. The Popsicle Index was created by Catherine Austin Fitts in 2005 to determine the perceived safety of an area by using surveys to calculate the percentage of individuals that believe a child in their community can safely leave their home, walk to the nearest possible location to buy a popsicle (also known as an ice lolly in the United Kingdom) and walk back to their home. Although not an index that has been widely adopted by countries, it provides an interesting approach to understanding sensed security, which ultimately greatly effects ones' quality of life. The Happy Planet Index was introduced in 2006 by the New Economics Foundation and through a combination of life expectancy, the results of life satisfaction surveys and a country's ecological footprint, it determines the countries that use their resources in the best way possible, ecologically, and the creators believe this ultimately leads to longer, happier lives for its citizens (Marks *et al.* 2006). Finally, the Economic Intelligence Unit's Quality of Life Index created nine variables; material wellbeing, health, political stability and security, family life, community life, climate and geography, job security, political freedom and gender equality using a combination of subjective life satisfaction surveys and objective determinates to reveal a country's ability to provide a quality life for the population (n.a. 2005).

Quality of life is a complex theme in prehistory. With regards to health, prior to the 1960s the archaeological lens was focused on specific case studies of interesting or unusual elements or individuals. Conflict and interpersonal violence has also been a concentration of archaeological research since antiquarian times when the presence of weapons as grave goods, defensive structures and landscape alterations suggested prehistory was wrought with violence. With regards to the skeletons themselves, clear cases of trauma were usually identified and unusual burial methods coupled with this evidence were discussed within the veins of massacres and sacrifices. Finally, as the whole population was rarely analysed, which Whittle (2003: 25) interprets as very little attempt to integrate skeletal analysis into the wider view of population-level daily life, work was not focused on determining general well being. This may have been due to the lack of reliable diagnostics or conversely the subjective nature of well-being, but it has only been in the last thirty years or so that archaeological and osteological work has moved towards a greater and more complex understanding of people in prehistory.

In more contemporary times, social trends and modern clinical work on health has shifted towards a better understanding of quality of life. In these respects archaeology has also adapted to a more holistic approach to population studies. General health markers, episodes

of stress and exposure to traumas are now used to infer well being both at the individual and population level. Beyond this, recent work has also been undertaken to consider a range of skeletal variables in order to better place past societies within our modern understanding of a decent life. All of these methodologies aim to provide explanations for what we see in the archaeological record in order to determine the kinds of daily lives individuals and groups were experiencing. Throughout this theme, the key component is the human skeleton. Although a number of interesting and informative studies have been conducted using parallel forms of evidence to infer quality of life, it is only through osteological analysis that archaeologists can see the evidence on the bones themselves. As the strict archaeological correlates are somewhat lacking (for instance, it is quite difficult to associate settlement form or landscape alteration with a sense of a populations' well being), evidence is predominantly derived from funerary and osteological sources as their very nature provides an interpretive framework from which to explore everyday life in prehistory. However, often an examination of artefacts can provide additional, complementary information that may further add to an understanding of quality of life.

2.2.2 Health

Osteologists and archaeologists often look to clinical and other analogous literature to help frame research into the past. In regards to assessing the quality of life in prehistory the methodological translation is problematic. It is obviously not possible to determine education rates, gross national income or personal opinions on life satisfaction, and yet a driving force in osteological work is understanding the life of an individual and groups and the amount of difficulty, suffering and/or contentment they may have experienced throughout their lives. A common method that archaeologists have applied to the past is to consider isolated variables that have been accepted as non-specific indicators of health. Generally these manifest during subadulthood, as the growing and maturing individual is susceptible to environmental and cultural changes which may leave lasting markers on the skeleton. An important indicator in the determination of subadult health is the difference between skeletal and dental development, as skeletal maturation is believed to be more effected by stress than dental development (Cardoso 2007). In 1992 Bowman and co-workers evaluated that relationship by exploring the chronological age at death in comparison to both skeletal and dental age of 16 juveniles from Crypt of St. Bride's Church, London with death years between 1794 and 1841. They found that while long bone growth progressively underestimates chronological age, dental formation and eruption were similar to modern populations and therefore closer to their recorded chronological age, suggesting they were less effected by cultural and environmental factors (Bowman *et al.* 1992). As a result of the extensive Spitalfields excavation in London, in 1993 Molleson and colleagues found that the Victorian children were consistently small for their reported chronological ages when examined for skeletal

epiphyseal fusion. The difference between the dental and skeletal ages, according to the authors, was suggestive of greater environmental sensitivity to skeletal development (Molleson *et al.* 1993).

In 2011 Conceição and Cardoso explored this commonly held understanding in a modern known skeletal series from the Lisbon Identified Skeletal Collection with date of births between 1920 and 1940. They believed that skeletal maturation was a better measure of biological maturation, in comparison to stature, as the latter does not consider the negative effects during growth but rather the end result of adult height. Forty-one females and males under age 21 were analysed for state of fusion of the knee epiphysis (distal femur and proximal tibia) and their dental development in relation to the known demographic data of economic status based on the father's occupation and residential address of the subadult (Conceição and Cardoso 2011: 464). A case of delayed development was identified if there was a difference between the known chronological age and either the skeletal or dental age. Overall they found that skeletal age was more delayed in the low economic group with an average of 1.22 years of delay compared to the high economic status group, however the difference between the economic groups based on dental developmental age was much less significant with only 0.51 years delay in the low group compared to the high. Therefore the authors concluded that socioeconomic status had a greater effect on skeletal maturation than dental development and overall that chronological age is most closely estimated based on dental age (Conceição and Cardoso 2011: 468). These studies illustrate the incredible value of known age and sex skeletal collections as this determination would not have been possible in an archaeologically derived sample. This work also solidifies the commonly held belief that subadults are more susceptible to stressors, whether they be environmental or cultural in nature. Furthermore they highlight the importance of determining both skeletal and dental ages of subadults in order to more accurately identify strain in a population.

An additional method is to look at one specific variable, the presence of linear enamel hypoplasia (LEH) on the dentition as evidence of periods of sustained stress resulting in enamel disruption. Multiple lines might suggest several periods of stress that may, as examples, be related to seasonal famines or repeated pathogen exposure. In 2002 Cucina investigated the presence of LEH within the multi-period (Late Neolithic, Copper Age and Early Bronze Age) skeletal series from Trentino, Italy to determine the lifestyle and living conditions of prehistoric people (Cucina 2002: 283) (Figure 2.1).

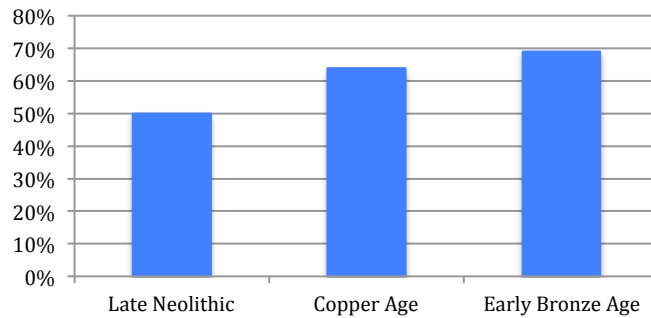


Figure 2.1: LEH at Trentino, Italy, LN n=12, CA n=29, EBA n=29 (Cucina 2002: 238).

Clearly the frequency of LEH increased with time and the author interprets this as a consequence of environmental factors with differing modes of environmental exploitation and cultural adaptations. Cucina (2002) supposed that either the Copper Age and Early Bronze Age groups faced more difficult environmental conditions than those faced in the Late Neolithic, or the Late Neolithic group faced such harsh conditions that individuals died before the possible onset of LEH. As the first option appears more parsimonious (considering the presence of adults without evidence of LEH) the author concluded the increased frequency of LEH from the Late Neolithic to the Early Bronze Age was most likely due to nutritional changes and changing cultural habits (Cucina 2002: 286).

Another form of analysis to explore overall quality of life is to consider the degenerative changes that are present in a sample as evidence of a stressful and possibly labour intensive life as diseases including osteoarthritis (OA), degenerative joint disease (DJD) and dental diseases such as abscesses and antemortem tooth loss (AMTL) can have negative consequences for the quality of life of individuals and populations. In the large National Dental Survey of Oral Health of United States adults, it was determined that 42% of adults at senior centres were edentulous and as a result Papas and colleagues (1989) investigated the nutritional effects of tooth loss further by examining the dentitions of 181 volunteers over 60 with a range of dentition presence from full teeth to complete loss. They assessed blood chemistry, a food diary, lifestyle and medical histories and determined there was a statistically significant drop in nutritional quality of diets of those with one or two full dentures compared to those with more complete dentitions. In lower income seniors this may also lead to nutritional deficiencies (Papas *et al.* 1989: 131). Furthermore they calculated that those with complete AMTL had a 20% loss in nutrition intake, suggesting the quality of life for these individuals was heavily impacted by their dental status. By extension they determined that these individuals may have had to prepare their food using alternative methods, or conversely may have been dependent on others to ensure they received adequate nutrition for survival. In 2011 Molnar and colleagues assessed the relationship between OA and age in two Neolithic populations from Gotland, Sweden. They found that

43% (14/32) of the population at Västerbjers and 19% (8/42) of the population at Ajvide had clear evidence of severe OA in the form of eburnation (Molnar *et al.* 2011: 286). The sample attributed to Västerbjers had a higher proportion of females over age 40, which the authors proposed as a partial explanation for the higher rates of both eburnation and musco-skeletal stress markers at this site. The authors noted that high incidences of OA in Neolithic groups had been associated with high levels of physical activity and strain and from their results they concluded that the population at Västerbjers had more strenuous daily movements and therefore a lower quality of life in comparison to those at Ajvide (Molnar *et al.* 2011: 288).

A complementary line of evidence that may be used to infer health involves an examination of the abilities of past populations to provide medical intervention and aid an individual's recovery. Although many of the *medicines* and additional forms of treatment, which may have included the application of pumices and bindings, were not likely to survive, some evidence has emerged that suggests individuals and groups were active participants in their healing and recovery. As Smith (1996) stated, injuries in the past, as today, may have resulted in permanent alteration to an individual's gait, speech or ability to care for themselves and others, and it is difficult to comprehend how groups would not attempt whatever was necessary to reduce pain and suffering and ultimately speed healing. Evidence of intervention has been seen in the archaeological record in the form of medical tools such as probes, retractors and a trepanning saw in an Iron Age grave at München-Obermenzing in Germany (Künzl 1995 as discussed in Roberts and Cox 2003). A Late Iron Age burial at Stanway in Essex, meanwhile, has been interpreted as a doctor's grave (Redfern 2010), with grave goods including scalpels, spring forceps, needles (Crummy *et al.* 2007) and possible medicinal tea (Wiltshire 2007). This evidence suggests prehistoric people were aware of some of the healing properties of local plants and appeared to demonstrate an understanding of the types of tools most suitable for medical intervention. Although there are debates regarding the Roman influence on Iron Age medical knowledge (Cunliffe 2007), what is relevant is the incorporation and application of that knowledge to help local group members.

Roberts and Cox (2003: 59) reported that the Neolithic period in Britain was the first with evidence that direct medical intervention, in the form of trepanation, was practiced. They reasoned that it was the now settled nature of prehistoric British society that enabled groups (or individuals) to develop curative treatments. Although trepanations were performed for a variety of reasons from real to imagined (such as to cure one from evil spirits), Roberts and Cox (2003: 59) point out that they may have also been used for ritual or violent acts, and therefore only when there is evidence of a cranial fracture and a trepanned hole should it be interpreted as medical intervention. Roberts and McKinley (2003) reported on five cases of probable trepanation, though only two males from Fussell's Lodge exhibited evidence of

healing (Ashbee 1966), while six were reported for the Bronze Age (none healed) and eight were attributed to the Iron Age, with only two healed (Roberts and Cox 2003: 105), suggesting this procedure was still in its infancy. More recently, Redfern's (2010) study of surgery and fracture treatment in Iron Age and Romano-British Dorset incorporated funerary, taphonomic and osteological signs of medical intervention. Although she determined that clear evidence of surgery was not present in the region until the Roman period, in the Iron Age the lack of secondary infections suggested to Redfern (2010: 463) that the Dorset-area communities were able to treat trauma with plants and extensive wound cleaning, while the presence of well healed fractures points to a high standard of treatment that proved to be available equally to males and females. Furthermore the range of fracture types and severity with adequate healing suggested to the author that medical practitioners had experience with a wide variety of injuries, while in an earlier publication, Redfern (2008) also concluded that the well healed calluses of fractures suggested adequate nutrition which further enabled a faster and more successful recovery.

These studies incorporate a range of forms of evidence and provide for the possibility that prehistoric quality of life was as dependent on access to nutrition, and the amount of physically laborious activities as it was on community involvement in the care of others.

2.2.3 *Interpersonal Conflict*

Archaeological evidence relating to or implying the presence of interpersonal aggression in prehistory comes in many forms. Although overall evidence of weapons, defensive structures and weapon injuries can be used to imply periods of social instability, time period specific evidence provides for a more detailed opportunity to explore the quality of life of individuals as it relates to their experience with trauma. Neolithic LBK ditched enclosures and palisades in Europe were first interpreted as evidence of fortifications (seen in the excavations of Köln-Lindenthal by Buttler and Haberey between 1929 and 1934, as discussed in Whittle 1996). More recently however, the defensive and warfare interpretations of these structures fell by the wayside, with authors such as Whittle (1996) putting forth the notion that these sites represent formal communal spaces and Kaufmann (1997 as cited in Golitko and Keeley 2007) stating the sites were more suited to ritual activities or cattle kraals. Scarre (2005: 411) however, took this separation from violence one step further and stated that almost none of the ditched enclosures could be suitable defensive works for several reasons including the shallow depth of the ditches and that the enclosures themselves provided apparent safety for too small an area. Golitko and Keeley (2007) found many faults with these theories and beyond pointing out that the size of an enclosed settlement does not preclude it from offering a safe haven and that even if an enclosed structure was inherently used for ritual activities (based often on the presence of ritual depositions of animals and human bones), those

individuals used for the ceremonies may not have been local or willing participants. The authors point out that certain features at these sites, including the shape of the ditches and the complex gating systems that had no normative purpose could only have had military functions (Golitzko and Keeley 2007: 388). When these archaeological features were compared to the osteological evidence of violence, Golitzko and Keeley (2007) noted that the presence of embedded projectile points in conjunction with no evidence of healing of wounds provides further evidence to support the defensive need for enclosed sites. In 1999 Gronenborn determined that the archaeological evidence of hunted game in the LBK Neolithic declined through time and yet the presence of projectile points did not. Furthermore Gronenborn (1999: 163) found that the frequency of projectile points correlated geographically with burial trauma and additionally with site fortifications. Based on this archaeological evidence it would appear as though the threat of interpersonal violence was real during the Neolithic and Bronze Ages and when human remains were also examined at these sites, they provided further validation. Golitzko and Keeley (2007: 332) found that conflict was highly prevalent, especially at the later period western sites of central Europe and the evidence showed that conflict was not only occurring between LBK groups, but also between LBK populations and nearby hunter-gatherer groups as well.

In 2008 Haak and colleagues looked at the Mittelelbe-Saale group of the Corded Ware Culture at Eulau, Saxony-Anhalt, Germany dating to the Bronze Age between 2700 and 2000 cal BC. Four closely grouped multi-interment burials were uncovered and it was found there were multiple examples of interpersonal violence. Skull fractures on one child and one female, a projectile point injury in the vertebra of another female and forearm defensive wounds on the two adult males suggested the entire group succumbed to violent deaths. Golitzko and Keeley (2007: 338) determined that the site of Schletz-Asparn II exhibited the most direct evidence for violent conflict in the form of osteological evidence, however the site did not have extensive ditches or complex gates, which suggested to the authors that the defensive measures that they may have had in place simply failed. Windl (1999: 43 as reported in Golitzko and Keeley 2007) discussed this earlier by noting the absence of young adult females within the burial environment, which suggested they might have been taken by the aggressors. Additional sites in Europe abound including at Talheim in the Middle Rhine Valley (Bentley *et al.* 2008), the location of a pit containing what is believed to be the entire local population of 34 people, all victims of blunt force trauma at the hands of individuals carrying LBK axes and adzes. While in the south-east Iberian peninsula, Jiménez-Brobeil and co-worker's 2009 study of the relationship between traumatic cranial injuries and violence from the Neolithic to the Bronze Age determined a much more complex picture of well-being in prehistory (Figure 2.2).

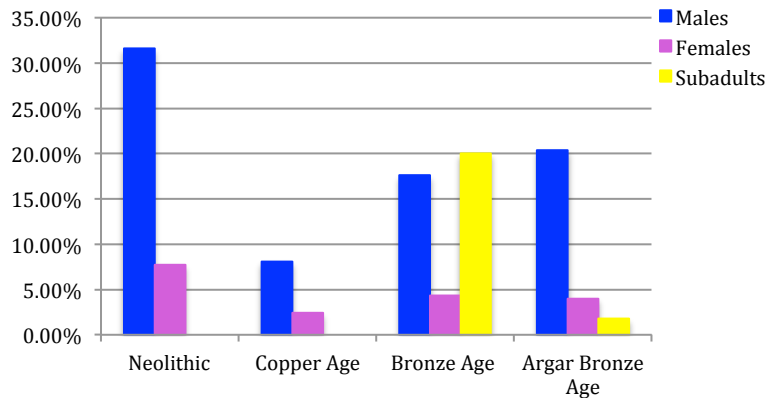


Figure 2.2: Cranial injuries through time in the southeast Iberian Peninsula (Jimenez-Brobeil *et al.* 2009: 469).

Overall the authors supposed the Neolithic findings suggested violence that, in part, may have been related to cannibalism at some sites (Jiménez-Brobeil *et al.* 2009: 466), though it is unclear from the publication what evidence was used to arrive at that conclusion. Conversely, the Copper Age showed the lowest frequencies of cranial injuries suggesting fewer interpersonal conflicts. The Argar (a specific population within the Iberian Bronze Age) were different in that Jiménez-Brobeil and colleagues (2009) suggest instances of cranial trauma were related to well defined sex-linked activities as opposed to solely being a direct result of violent encounters. For the Bronze Age however, the authors believe the significant increase in cranial trauma may be related to the adoption of a more complex social organisation resulting in an increase in non-lethal, but nonetheless present interpersonal violence ((Jiménez-Brobeil *et al.* 2009: 473), however, although it appears that subadults were highly susceptible to cranial injuries (as seen in Figure 2.2), this percentage only represents one of five subadults examined and should not be taken to imply a massive increase of fractures in subadults during the Bronze Age.

Hillforts have often been cited as evidence of the presence of warfare during the Iron Age based largely on the basic defensive nature and structure as well as the evidence of the destruction and burning of the forts themselves such as at Danebury, which has been used to further the belief that these sites were under regular attack. However Bowden and McOmish (1987) dispute this assertion as the evidence often cited for an attack is secondary. They (and others such as Ainsworth and co-workers 2008) also question whether the supposed defensive structures would have in fact been functional. Instead Hill (1995) considered the ritual deposits often found in conjunction with destruction and asserts that the demolition was just as likely to have its origin within the interiors of the fort. Although the connection to the ritualised discoveries is unclear, Bowden and McOmish (1987: 78-79) propose that it was the defenders themselves that were responsible for the destruction. Additionally, however, Hill (1995) further questions the fact that the implications of warfare are often not

considered when ideas concerning warfare in the Iron Age are theorised. The need to organise large numbers of people and weapons has been largely overlooked and instead it is their simple presence in the landscape that is drawn upon.

Redfern (2008) though not her main goal, in her analysis of human remains at both Maiden Castle and Gussage All Saints, determined that individuals who were provided with a funerary rite that included excarnation and secondary burial and also had evidence of sharp force trauma were all males. When this information was combined with Karl's (2005) findings that martial training in the Iron Age began during childhood and Redfern's (2008) additional results that the majority of individuals examined in Late Iron Age Dorset who died before the age of 35 had a history of trauma, it suggested that interpersonal violence was a fact of life for some of the individuals buried within Iron Age hillforts. Therefore, although Hill (1995) cites the purpose of hillforts as being far beyond defensive needs, the archaeological and osteological evidence does support the theory that conflict was present and an impetus for the need to build such fortifications. These studies suggest that the presence of architectural structures can be a starting point in discussions concerning interpersonal aggression, however the need to include and consider the osteological evidence in conjunction with archaeologically derived material is necessary to determine the realities of violence, trauma, and by extension, well being, in prehistory.

2.2.4 Overall wellbeing

An alternative method used to determine the quality of life of prehistoric peoples is to consider a range of variables (much like the modern indexes) and determine the overall impression of well being of a population. By analysing populations with this method it is possible to pick out minor or subtle population variations, as some groups or individuals may express stress in different ways, and as many of these variables may have several possible aetiologies, this method instead looks at the overall observed incidence. Further refinement or detailed discussion on each variable would bring attention to population-specific trends as well as probable catalysts for skeletal alteration. As this section is focused on the general quality of life of groups, the emphasis is on what the indicators tell us at the population level.

In 1993 Power analysed 391 skeletons dating to between the Neolithic and Early Medieval period in Ireland to uncover the comparable levels of physiological stress experienced by the different groups using a combination of cribra orbitalia (CO), periostitis, dental caries, LEH and stature (Figure 2.3; Power 1993: 10).

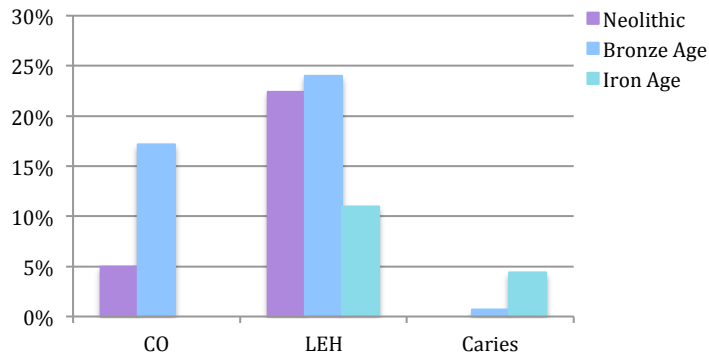


Figure 2.3: Physiological stress as represented by caries, LEH and CO in Ireland (Power 1993: 10-13).

The author suggested that the Neolithic and Bronze Age rates for caries and LEH may be indicative of physiological instability due to pathogens or diet, while those rates for the Iron Age may suggest a population that has become better adjusted to their environments (Power 1993: 11), however as the Iron Age and Early Medieval data was combined for LEH it is difficult to assess the true incidence in Iron Age Ireland. In comparing rates of CO, the author concluded that there was a certain level of stress in the Neolithic and Bronze Age that was not present in the Iron Age (Power 1993: 12). Overall the Irish Neolithic was seen as healthy, possibly as a result of a nutritious diet and low population density with evidence of seasonal stress as exhibited by the LEH rates (Power 1993: 15). The Bronze Age was considered less healthy than the preceding age in regards to the rates of LEH and CO and Power believes this may be due to the exposure to animal husbandry and additional pathogens. Although the sample size was small for the Iron Age for CO, when combined with the other variables, the Iron Age is overall seen as having a better adjusted economy with some episodes of physiological stress (Power 1993: 16). This study has highlighted the value in considering several health related variables and has brought attention to the minor variances in population quality of life.

In 2002 Steckel and Rose published their findings of the Western Hemisphere Project and the health index they created to understand average levels of health across populations in the past (Steckel and Rose 2002a). They amassed a sample of 12,520 individuals from North, Central and South America attributed to the past several thousand years from 65 composite sites and analysed the skeletons for seven different indicators of health that have become generally accepted in the academic community (Steckel *et al.* 2002b: 61). They chose three related to health in childhood (stature at death, LEH and skeletal signs of anemia), two as measures of declining health in adults (dental decay and DJD) and two that could be applied to any age group (skeletal infections and trauma). All of the indicators were weighed equally to form an individual and a population health index (Steckel *et al.* 2002b: 69). They chose to place more emphasis on the childhood aspects (by having more indicators in that category),

which they based on the premise that positive and negative childhood health has a lasting effect on later life health (Steckel *et al.* 2002b: 70). Although this index is one of the first to be applied exclusively to skeletons to understand quality of life in relation to health in the past, there are several aspects of the index and the methodology that may be problematic. Primarily, there is the concern, echoed by Roberts (2006: 346) about weighing each indicator equally. As it is obviously not possible to take into account the environmental and social contexts that influenced the presence or absence of any one of the attributes, by lumping them all together, subtle site or time-specific catalysts will be missed. Additionally, several assumptions made in the creation and implementation of the index, including not recognising multiple or healed trauma and assuming dental diseases were completely absent in childhood, results in self imposed limitations on the application and understanding of the index and suggests that the methodology needs further refinement for cross cultural and temporal comparisons. Despite these drawbacks, the value of this index stems from the fact that several different markers related to quality of life were combined in an effort to understand an individual and their populations' life cycle.

In 2005 Papatheasiou focused on identifying the impact of the transition to agriculture on the quality of life of the largest archaeologically derived Neolithic population from Greece, at Alepotrypa Cave. She also chose to focus on multiple indicators including stature, CO, OA, cranial injuries, dental disease (including AMTL and abscesses) and LEH (Papatheasiou 2005: 380). As the majority of remains were derived from an ossuary context, using a minimum number of individuals (MNI) she determined there were 161 people (80 subadults and 81 adults with an age range from foetal to fifty years) with most being represented by only one or two skeletal elements (Figure 2.4).

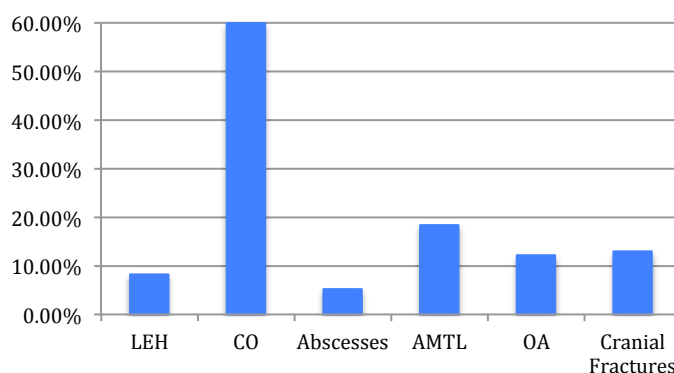


Figure 2.4: Multiple indicators of quality of life at Neolithic Alepotrypa Cave, Greece (Papatheasiou 2005: 380).

Stature was considered within the range for Neolithic populations, and 13% (9/69 people of all ages and both sexes) had small, circular and well-healed cranial depression fractures suggesting a certain amount of non-lethal interpersonal aggression within the population.

Overall the author concluded a large percentage of the population was subject to nutritional or disease related stress, intermittent episodes of conflict and a slight decline in general health status with the transition to agriculture in Greece (Papathenasiou 2005: 388).

2.2.5 Summary

Overall it is clear that the determination of quality of life is integral to osteological assessments of population. While many researchers may be subtle in their identification of these aims, by examining skeletal and dental age estimation, LEH, CO, degenerative changes, dental diseases and trauma, archaeologists are measuring the physical well-being of individuals and groups. The majority of these variables are non-specific or multi-causal in nature, which requires further discussion and interpretation to examine, but the sheer presence of these indicators implies an alteration to the skeleton that was either the by-product of or directly resulted in a decreased quality of life.

2.3 Social Status

2.3.1 Introduction

In today's world the effects of social inequality can and do have wide ranging consequences on the lives of individuals and groups. Women, minorities, and the lower classes of society often have very different experiences depending on the type of power and authority that is present in their lives. In the living society it is possible to evaluate the power structures and forms of stratification by simply examining the dynamics and inter-relationships between different members of society. In the past, however, it becomes more difficult to interpret the remaining archaeological evidence to come to an understanding about prehistoric power structures. Although earlier archaeologists and anthropologists including Childe (1951) and Leach (1973) had a difficult time in reconciling how to see and understand social organisation in prehistory, others, including Jacobsen and Cullen accepted we might never fully understand the past, but valid inferences about social organisation using mortuary archaeology could still be uncovered (Jacobsen and Cullen 1981: 79-80).

2.3.2 Archaeological funerary viewpoints on status

In 1971 Binford set the tone for the analysis of differentiation by writing that the study of rank amongst burials is dependent on the assumption that as an individual (or group's) status increases in life, so too will the monumentality and elaboration of their death (Binford 1971: 21). In part influenced by Binford, Tainter (1973) suggested the theory that the amount of energy expended in the creation of mortuary rituals and treatments for a select few could be indicative of social stratification. He believed, when groupings of burial forms cluster into distinct levels in which different amounts of energy were involved in their creation, they would signify distinct grades of ranking within the society (Tainter 1980: 310).

He analysed the burial forms of the Middle Woodland (200-300 BC to AD 700-900) mortuary population from the Illinois Valley and found there to be six distinct strata within the society based on how much time and effort was involved in the creation of the final resting places of the group members (Tainter 1980: 311). Although Binford and Tainter have provided thought provoking theories on the visibility of rank in the past, much of their inference is based on focusing on one aspect of the archaeological context while ignoring any regional or group specific cultural attributes that may have had a more prominent influence on burial rites.

In 1973 Renfrew published a study exploring the Neolithic tombs on two Scottish islands. Although an initial assessment of the varied forms and sizes of mounds within the context of energy expenditure might suggest a complex social make-up, when Renfrew considered the theoretically established low population numbers, the variety of mounds could not represent a range of social strata (Renfrew 1973: 137). Price (1995) believes there is clear evidence for the beginnings of social differentiation in the earthen long barrows of Scandinavia. Their relative obscurity, with most of them only known in western Denmark, and the fact that generally only one grave (or very few) have been found within the barrows suggests to him that these were elite burials and that only a limited portion of the population was entitled to the rites that involved large amounts of human labour to construct (Price 1995: 138).

Recently, Parker Pearson and colleagues (2009) used the theory of energy expenditure to reinforce their belief that the cremation cemetery associated with Stonehenge was a burial ground of elites. They cited the presence of the large stones of Stonehenge as evidence of a form of hereditary power that was able to control a large workforce (Parker Pearson *et al.* 2009). Although the actual graves themselves were minimal in the energy required for their creation (when compared to contemporary barrows), the ritualised landscape at Stonehenge was seen as integral to their ultimate final resting place and therefore the evidence of their status. As the cremations did not yield extensive information on the individuals, the authors proposed, based on the continuation of a burial rite and the C¹⁴ dates derived from several cremations, that Stonehenge was used by a single dynasty over seven centuries (Parker Pearson *et al.* 2009: 26).

These two studies highlight the theoretical application of energy expenditure, however there are any number of ways to pay tribute to rank, and although energy expenditure may apply in some societies, to suggest that the presence of large funerary monuments automatically implies a ranked society is problematic. As seen in Chapter One, the changing relationship that prehistoric individuals had between the living, the dead and the landscape can have far more important consequences on the mode and method of burial and commemoration and monument size itself may have very little correspondence with the social position of the

individual (or individuals) inside. Furthermore, Wason (2004: 78) states, “a magnitude of variation among burials may not give a dependable picture of the magnitude of status hierarchy”, though he does acknowledge burial methods as a starting point to understanding status in the past.

Renfrew (1982) considered whether it was justified to use the burials and their contexts of individuals to define societies at all, however as they are an integral aspect of the cultural constructs of a group they must be evaluated as one dimension and expression of a theoretical power structure. Within the study of social status there are two main structural methodologies, those concerned with unranked and ranked societies, and those focused on ascribed versus achieved power within ranked populations. Unranked societies can be classified as those without institutionalised rules regarding status, suggesting to Wason (2004: 37) that differences within the population, with regards to access to adequate nutrition and labour expectations would predominantly be based on sex. Therefore there would (or should) be differences in the osteology and burial methods for men and women. In ranked societies, status is more formalised and goes beyond simple sex differences. Here, rules regarding access and expectations may be related to the power structure of society, namely that developed from an ascribed or hereditary base or one derived from achievements. Those based on hereditary status may display mortuary evidence such as elite child burials (suggesting conferred status from birth) and osteological and burial rite differences within each sex. Stratification due to achievement may also have extensive displays in the archaeological record with evidence of warrior classes in burial assemblages and osteological differences among adults but not amongst subadults, as status would not be obtainable until adulthood (Danforth 1999: 7).

2.3.3 Status in the Archaeological Record

Evidence of social differentiation in prehistory is often seen as problematic due to the range of interpretations that can often be elucidated from evidence. Presence of enclosures and field boundaries, such as those in the Bronze Age have been interpreted as evidence of a purposeful restriction of access or conversely as a form of control that certain individuals or groups were able to exercise over a wider population. Parkinson and Duffy (2007) theorised that Neolithic and Early Bronze Age enclosures indicated a level of social organisation not previously seen. This institutionalisation of social differentiation in material culture is suggested to have come about as a result of increased sedentism, territorialism and food production (Parkinson and Duffy 2007). Beginning with the concept suggested by Renfrew and colleagues (1974), that monumental construction in prehistory could only have been commenced and completed if formalised inequality was present, Parkinson and Duffy (2007) disputed this assertion as a generalised view of monumental architecture and pointed to the

range of social and political expressions of power in egalitarian societies, some of which built substantial features. Instead, they suggest that the social differentiation became more solidified in this period as a result of the act and ability to bring together large groups of people. It was the actual coming together and participation that identified certain people or groups with political or social influence (Parkinson and Duffy 2007: 127).

In contrast, Harding (1997) pointed to the shift from collective burial and causewayed enclosures to single burials as a distinct social shift in perceptions of social inequality. Although the Early Neolithic enclosures displayed interrupted ditches, interpreted as constructed by several distinct groups that came together, the double ditched bank circuits and multiple entrances of the Later Neolithic henge monuments instead projected a demarcation of regulated access to features on the landscape (Harding 1997: 286). Furthermore, Harding postulated that the architect may have envisioned a clear distinction in the landscape between those with inner access and those without. Meanwhile those monuments, such as the North Yorkshire henges at North Thornborough and Hutton Moor were interpreted as evidence of the further manipulation of the landscape and material culture by what he surmised to be the powerful elite (Harding 1997: 288). Both this study and that by Parkinson and Duffy (2007) however, stressed that there was no blanket form of social order in the Neolithic and Early Bronze Age and rather it was the regional power base, in its varied forms, that dictated the architectural expressions of their influence.

Additionally, grave goods, especially when they encompass extensive objects, both in terms of their exoticness and sheer quantities, have been theorised to convey the power and authority that these individuals had in life and therefore that which translated to their death and life beyond. However, relying on these subjective forms of evidence does necessitate the acceptance that enclosures may have been used to control animals as much if not more so than humans (Hill 1995), while the grave goods themselves may instead be symbols of the ways in which the living remained connected with the dead, or conversely the purposeful choices the living made on behalf of the dead. Shennan (1975) has found evidence of ascribed status within the Nitra culture (a part of the LBK) at the Early Bronze Age site of Branč in Slovakia based on an assessment of the differences in mortality of rich and poor females and males. She found rich females were the least likely to die in infancy and furthermore that there was no difference in the mortality patterns between poor females and males. Therefore Shennan concluded that wealth and not sex was the deciding factor in survival and the presence of a proportionate number of rich (and poor) infant and child burials suggested the power structure in this population was based on ascribed status (Shennan 1975: 285). However, the reliance on specific types of grave goods to equate or signify not only the presence of a social hierarchy but also the underlying mechanisms for survival is difficult

when one considers the possible range of explanations for the presence of artefacts in burial contexts. Although Shennan (1975) presents an interesting interpretation of the Nitra culture and highlights anomalies within LBK cultures, to imply that wealth is of utmost importance with regards to mortality suggests that wealth, in prehistoric times was a shield from infections, communicable diseases and accidents, and there is no evidence that this was the case.

To extrapolate and consider a wider picture than that provided by grave goods on their own, Gilman (1981) cited the development of metallurgy and class differentiation as intertwined entities. Metal production required elaborate mechanisms of organisation and exchange and Gilman (1981: 1) theorised that it was a permanent elite that necessitated the production and continued evolution of the goods. Through the presence of these individuals, wider trade networks and exchanges for more exotic items became possible which brought new goods into communities, and, by extension, strengthened the elites' place in societies. Gilman (1981) cites the presence of Beakers in Bronze Age graves as well as swords in Later Iron Age burials as evidence of the existence of the continued presence of an upper class. Harding (1981) questions Gilman's basic assumption concerning the importance of the grave goods so often cited as evidence of status. If metallurgy was integral to the existence and permanency of a social hierarchy, why was this tangible form of class not more readily apparent in the late Neolithic? Instead Harding (1981: 12) doubts the validity of relying on our modern cultural constructs of prehistoric status and points instead to the suggestion that it is the varied nature of wealth distribution that may be more indicative of differentiation, but to what extent it is then possible to derive any form of conclusion regarding status is questionable.

In 2006 Dürrwächter and co-workers explored the relationship between perceived status differences and the stable isotope analysis of diet for three groups from Southern Germany during the Neolithic. The Middle Neolithic cemetery at Trebur was in use between ca. 4900 and 4600 cal BC by both the Hinkelstein (HST) and Grossgartach (GG) cultures. The HST grave goods were characterised by extensive wild and domestic animal remains while the GG's were predominantly those associated with agriculture. Furthermore, variations in artefacts were also observed within the groups suggesting differential goods and by extension status based on sex (Dürrwächter *et al.* 2006: 40). The third group is that of the LBK at the Early Neolithic site at Herxheim, which was assumed to be in use for less than 100 years and may have functioned as a cemetery for the secondary burials of a wider network of sites. Twenty individuals from each culture were tested for carbon and nitrogen values and the authors found no significant differences in the mean nitrogen ratios between the two groups at Trebur and the LBK individuals from Herxheim were statistically indistinguishable (Dürrwächter *et al.* 2006: 43-4). Furthermore at Trebur, a variation was found in nitrogen

values based on sex among the HST, irrespective of the perceived wealth or age of the individual (Dürrwächter *et al.* 2006: 45). The higher mean nitrogen average by 1 % suggested to the authors that males consumed more animal products (or by-products) than females, however the difference was quite small. Overall Dürrwächter and co-workers believed there is not enough evidence to conclusively state a relationship between apparent status based on grave goods and stable isotope analysis (Dürrwächter *et al.* 2006: 45). This study highlights the importance of looking beyond the grave goods for evidence of status, as the perceived cultural constructs associated with artefact deposition in burials may have no correlation to the daily lives and society of prehistoric groups.

In 2011 McClure and colleagues published a report examining the skeletal remains buried in the ossuary at Cova de la Pastora in Alicante, Spain dating to between the Late Neolithic (ca. 3800-3000 cal BC) and the Bronze Age (ca. 2200-1500 cal BC). It was previously believed this site was the Mediterranean type-site of the emergence of social hierarchies, as it was originally believed to solely date to the Neolithic (McClure *et al.* 2011: 420). As a result of C¹⁴ and AMS dating of ten mandibles the site was found to span over 2300 years and represented an opportunity to discover if the perceived inequalities between these individuals were visible on the human skeletons, and if those inequalities altered over time. Using nitrogen values of those same ten dated individuals, the authors found that there was differential access to animal protein between the Chalcolithic (ca. 3000-2500 cal BC) and the Bronze Age with a range of 7.5% to 10.6% and a mean of $9.2 \pm 0.96\%$ (McClure *et al.* 2011: 423). Furthermore in an osteological assessment of 59 individuals from all levels of the cave, they found 13 cases of CO (22%) spanning all ages suggesting a general lack of iron in everyone's diet. This is however, at odds with the high levels of protein in their diets suggesting additional health concerns which may be attributed to malnourishment during weaning, the presence of infectious disease, the consumption of more dairy products than actual animal meat or the presence of scurvy. Unfortunately, as the ossuary contained comingled remains and the original excavators only excavated craniums, it was not possible to examine associated post-cranial remains for confirmation of these theories.

Overall they concluded that if the individuals buried in the caves were a representative sample from Alicante there was little change over time in terms of quality of life and as it was not possible to associate specific grave goods with individuals or specify sex or age, the only evidence of inequality was in the burial environment itself. Although burial in caves was dominant during the Late Neolithic and Chalcolithic in Valencia, it was not common during the Bell Beaker Transition (ca. 2500-2200 cal BC) or the Bronze Age, suggesting the importance of the practice and the individuals may have altered through time (McClure *et al.* 2011: 427). Unfortunately, however, as AMS and C¹⁴ dating were only carried out on ten

individuals contained within the previously excavated comingled cave it is difficult to understand how the 59 individuals 'from all levels of the cave' necessarily corresponded with all three time periods, and this study should have highlighted the context of burial as a starting point in an analysis of status with an aim of including multiple strands of inquiry.

Although connected to a later period, Robb and co-workers (2001) assessed the relationship between funerary wealth and skeletal health in an Iron Age and Early Historic site in Campania, Italy. Ninety-four sexed adults, dating to between the later fifth and early third centuries BC, buried in three distinct areas of the site, were examined for stature, LEH, CO, trauma as healed fractures and Schmorl's nodes and were compared to their mode of burial, ranging from simple pits with no grave goods to elaborate complex tombs with over forty artefacts (Robb *et al.* 2001: 215-6). They concluded that there was no direct correspondence between mode of burial and biological status which may suggest either the indicators employed were not sensitive enough to detect differences or all levels of society were susceptible to health risks. However, as with Shennan's (1975) study, Robb and co-workers (2001) also seem to have overlooked the possibility that the importance or significance of the grave goods themselves were misinterpreted, and may not have had any connection to the dead, but may in fact have had meaning for the living.

Burial methods have been considered within the context of social differentiation since antiquarian times as the visual distinction that can clearly be seen between inhumations and cremations provides for the opportunity to make conclusions regarding the state of individuals and groups within a society. Rowlands (1980) believed that they were distinct types of burials in so much as to suggest they were inscribed for specific individuals or groups within the site. As there are a multitude of sites in Britain attributed to the Early Bronze Age that employ both forms of burial, many have assumed this to imply social differentiation (Bradley 1984, Mount 1995). McKinley (1997c) took the inhumation burial to imply more care and attention to the elites, while those of the lower class were simply burned. The cremation ritual however, required much more time and extensive resources to maintain. The physical changes to the dead, being either visibly seen or felt with other senses would have left much more of an impression on those involved and therefore by extension the ritual would have much more meaning than simple inhumation.

Derevenski (2002) theorised that in the Upper Thames Valley, since more men than women had been found within the barrows they held a higher status because they were inhumed, while women were cremated and therefore of a clear lower strata of society. In 2009 Brück sought to examine this theory by examining burials at 62 random sites from Scotland, Northern England, the Midlands, Southern England and Wales. She analysed 221 burials that

could be possibly or accurately sexed which translated to 87 inhumations and 134 cremations (Figure 2.5).

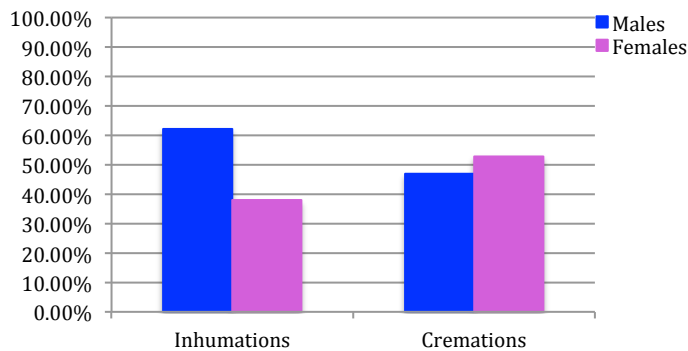


Figure 2.5: Burial methods by sex throughout Britain (Brück 2009: 7).

Although it may appear that females were more likely to be cremated, Brück (2009) believes there was more of a general trend as opposed to one ascribed to a specific sex. Furthermore, the belief that cremations were dominant for the lower classes because they were inexpensive must be called into question as a great deal of materials and an extensive amount of labour was required to build and maintain the pyre (Brück 2009: 9). However, when the results are examined more closely it appears as though the differences based on sex are negligible and may in fact be due more to sampling than an actual sex-specific burial trend. Additionally, as the sexing was stated as either being possibly or accurately sexed (though not for each assessed), it provides for the possibility that it may not have been possible to confidently assign sexes to all individuals. Overall this study illustrates the importance of modern osteological reassessment of previously excavated human remains in order to determine the actual significance of differing burial methods in prehistory.

Hillforts have come to be interpreted in a variety of ways including expressions of endemic warfare and central places that allowed for a communal arena within which to store and trade resources (Cunliffe 1984). Additionally, these monuments have been seen as the first solid form of evidence of chiefdoms in Britain (Geselowitz and Gibson 1988: 26) and therefore evidence of Iron Age elites and social differentiation. Hill (1995), however has argued that there is no evidence of social hierarchies within the fortifications. Although Cunliffe (1984) cited the presence and increased amounts of prestige goods, weaponry, harness fittings, personal adornments and differing sizes of round houses to denote evidence of elites at Danebury, Hill (1995: 49) in his evaluation of these aspects at other Iron Age hillforts and farmsteads, determined Danebury did not have higher concentrations or proportions and therefore stated there was little difference in the status of individuals at the various sites.

Additionally, the presence of grain storage pits within hillforts has been used to infer a surplus in production and therefore the beginning of social differentiation and by extension restricted access and control over resources. These pits have been identified at sites throughout England including Danebury, Grimthorpe, Maiden Castle, and Thwing and although their presence does suggest the ability of a population to store food, the connection to control may be tentative. Stead (1968: 158) at Iron Age Grimthorpe proposed that the configuration of three groups of granaries suggests they belonged to three families who resided within the fort, however outright control and therefore by extension a heightened social status because of this is difficult to conclude. Maiden Castle also had evidence of extensive storage capabilities. However in 1991 Sharples reinvestigated the site and when the presence of pits was combined with the evidence of extensive and ongoing construction and remodelling throughout the lifespan of the fort, the storage was alternatively explained as a location to store food that would feed the construction force and not one used for long term storage for a select high status group.

The continued debate regarding the use and reasons for hillforts in relation to status has necessitated investigations beyond the archaeology itself in order to provide further lines of evidence. Stable isotope analysis of individuals buried in pit burials at Danebury (Stevens *et al.* 2010) can be seen as both supporting and contradicting the theory of elites at hillforts. Cunliffe (1984: 562) envisioned the hillfort as a location where elites lived and controlled resources, which is based on the supposition that there was a blanket Celtic way of life, idealised in historical literary sources, typifying prehistoric Celts (Giddens 1984). Hill (1995), however, argues hillforts such as Danebury were the centres of communal rituals and activities whereby they allowed for the coming together of populations from the local farmsteads and villages for events in the Early Iron Age, while in the Middle Iron Age those hillforts, such as that at Maiden Castle, were seen as sites that allowed communities to congregate and permanently settle (Sharples 1991; Hill 1995: 55). Similarly, van der Veen and Jones (2007) agreed that storage pits were likely to be used for communal celebrations. However, they stressed that the pits were not simply used to store surplus but also to enable certain elites to gain and wield power. They stated that in the Early Iron Age, when social disparities were at a minimum, the feasts were a mechanism used to bring people together, but as social differences began to permeate Iron Age society the act of hosting a feast embodied social status, which allowed them to gain power and control over those they were feeding (van der Veen and Jones 2007: 427).

When all of these theories are examined through a bioarchaeological lens, as Stevens and colleagues (2010) did at Danebury, they discovered the carbon and nitrogen values of individuals buried in the burial pits were remarkably homogeneous. Although they identified

five distinct burial types, some of which, they theorised, required more investment in time and resources, there was very little variation. Additionally, age and sex were not found to have significant associations with diet (Stevens *et al.* 2010: 421). These results may be used to support the various theories based on the archaeological evidence. As strontium and oxygen have not yet been assessed it is not possible, at this time, to determine if these individuals were residents of the hillfort, trophies of war or slaves (Stevens *et al.* 2010: 423), or according to Cunliffe (1995) ritual sacrifices. As those examined did not receive the *normal* Iron Age burial rites, which rendered the majority of the prehistoric population archaeologically invisible, it does provide for the very real possibility they were not the average individual that frequented or lived at the hillforts. However, when these findings are examined in the context of the interpretation of the archaeological evidence, they may suggest a single, socially cohesive group (whether high or low status, that is unclear), though the isotopic evidence points to a significant amount of animal protein consumed on a regular basis, with little or no input from marine or fresh water sources (Stevens *et al.* 2010: 419-420). Alternatively, they may also represent the *guests* at the feasts, with *hosts* being provided with a different burial rite. Within the context of the archaeozoological and archaeobotanical evidence at Danebury, which included carbonised assemblages of annual seed crops as well as a wide variety of animal remains with butchery marks and dairy fats recovered from some pots suggesting that secondary animal products were common (Stevens *et al.* 2010: 410) it still does not sway the bioarchaeological data one way or the other. When the carbon and nitrogen values of fauna were also assessed, they were determined to be more heterogeneous than that of the humans. Stevens and co-workers (2010: 425) surmised this may be related to bone collagen turnover rates or that the humans were consuming a greater variety of food (and therefore averaging out their isotopic signals) than the animals. These results would support the theory of hillforts as communal arenas, however, the protein signal may also be masking differential food access and by extension a social hierarchy as it is not possible to distinguish between primary and secondary protein sources. Overall the role and importance of hillforts is quite complex and the discussion of social differentiation even more so. What is clear however, is that a multidisciplinary approach, though not necessarily providing conclusive answers, enables a more thorough understanding of population dynamics and suggests that the connection between archaeological features, funerary rites and burials in connection to developing social hierarchies was complex and heavily influenced by local regional frameworks.

2.3.4 Summary

Social status, as a research trajectory into prehistory, requires the amalgamation of a number of strands of inquiry to uncover the realistic portrayal of the interrelationships between individuals, groups and the wider population. Although certain forms of evidence, including

grave goods and structures point to a diversified society with entrenched differentiation, the reasons behind their placement and make-up are more complex than our current methodologies allow for. Therefore it is prudent to consider alternative lines of inquiry to provide for a more comprehensive understanding of prehistory.

2.4 Movement

2.4.1 Introduction

Of intense interest since the time of the antiquarians has been the question of who prehistoric people were. Early on, assessments about *foreigners* in Britain were based on the presence of unique or unusual grave goods to imply an invading force; as in 1901 when Abercromby used the presence of a drinking cup in a mortuary assemblage to illustrate the existence of invaders from the continent (Childe 1947: 3). The *round headed* (brachycephalic) and *long headed* (dolichocephalic) races have long been characterised as non-local and local and the early medical observers connected these cranial morphologies to specific groups that must have arrived by boat from the continent to either share their knowledge of metallurgy or subject the citizens to their rule (Greenwell 1865b; Wright and Mortimer in Mortimer 1911b).

During Victorian times it was assumed that cranial shape was tied directly to race and specific cultures, with Thurman reporting that long heads were placed in long barrows and round heads buried in round barrows (Mortimer 1877: 332). Therefore when a range of cranial morphologies were present in the same burial environment the default interpretation was a mixed population of races living peacefully together (Mortimer 1877: 333). Similarly, when a certain shape was not encountered, such as dolichocephalic individuals being absent from some Bronze Age round barrows, it was explained by an invading group that took over the area and effectively replaced the native population (Mortimer 1905; Greenwell 1877). The apparent abrupt beginning or abandonment of distinct mortuary rites has also been used to infer the arrival of new populations. As noted in Chapter One, it was believed by the antiquarians that it was the Beaker people who altered Early Bronze Age burial methods, while the La Tène people (or their ideas) brought about new ways for Iron Age individuals to reflect their status in life in their burials. Discussions of mobility thus becomes more complex, as additional methodologies, including stable isotope analysis become necessary to help to identify those possible non-locals, those that may have done the travelling in their earlier years and whether these people were welcomed and treated like members of the community in life and in death.

2.4.2 Presence of artefacts as correlates for human mobility

An additional debate concerns the actual physical movement of people and whether the new grave goods, funerary rites or architecture *suddenly* present in the prehistoric landscape were the product of a movement of individuals or groups, or simply the transfer of ideas. While a certain number of individuals were likely to have been mobile, the central crux of the debate explores whether these cultural changes were the result of elites or even priests (Childe 1947) imposing their way of life on a new people, or if individuals were incorporated into a group whose ideas were progressively amalgamated into society. More recently, prevailing understanding of cultural transmission paints a picture of small groups moving about the landscapes of Britain and Europe creating a web of networks that later developed into exchange networks and later still, formalised trade. Cunliffe (2007) cites the presence of *British-made* swords during the Iron Age as evidence of the migration of initial ideas of weaponry and metallurgy from Britain. However the alteration and creation of a distinct regional form points to an initial or temporary presence of non-locals who provided the impetus of new ideas, though it was the local people that embraced the practice to fit their needs.

Grupe and co-workers (1997) conducted one of the earliest strontium studies that focused on the mobility of people on the European continent. The authors and previous scholars have assumed, based on the extensive distribution of Bell Beaker pottery, prestige items such as those made of Cu and a morphologically distinct cranial shape, that Beaker people were highly mobile, specialised people that split into several regional groupings. However, the somewhat random and patchy distribution of artefacts across Europe suggests a more complex organisation and the authors therefore examined the skeletons themselves for a better understanding of changes in residency (Grupe *et al.* 1997: 518). They examined 69 skeletons from 11 sites attributed to the southern Bavarian Neolithic to establish whether people ventured into other areas of Europe or remained stationary during their lives. The range of the enamel values implied to the authors that there was evidence of residential mobility as they suggest incidences of migration between 18.8% and 24.6% (Figure 2.6; Grupe *et al.* 1997: 522).

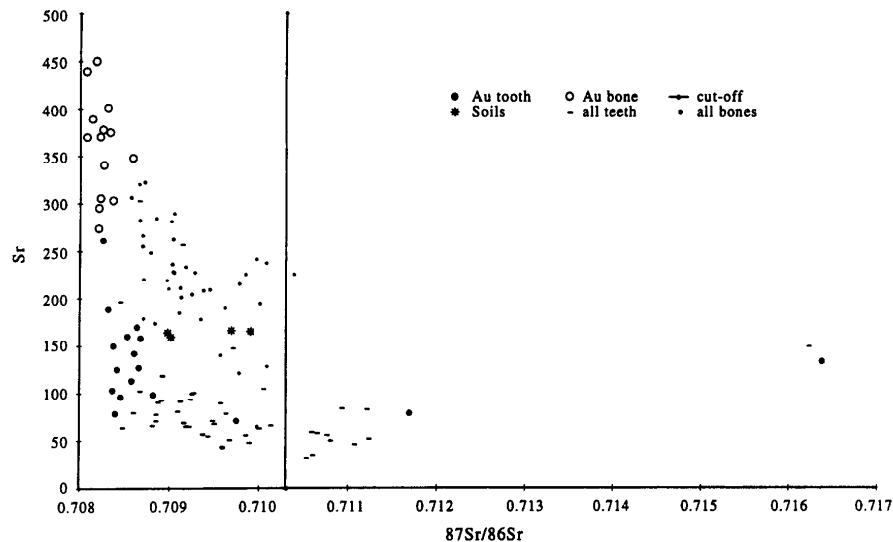


Figure 2.6: Strontium ratios of all Bell Beaker burials in southern Bavaria with those at Augsburg highlighted as an example (Grupe *et al.* 1997: 523).

When the eleven sites were looked at in more detail, they found that the earlier sites exhibited a higher influx of migrants, between 33% and 50%, while the later, larger cemetery sites appeared more sedentary with only 14.3% to 33% non-local residents. At several of the sites, the representative samples were five or fewer individuals, therefore the proposed immigration rates at these sites of up to 50% appears arbitrary. Overall these findings do support the assumption of Neolithic Bell Beaker mobility based on the archaeological evidence, however, Grupe and co-workers (1997) suggest movement was less formalised and more probably resembled small familial groups moving about the landscape.

The excavations at Amesbury in 2002 revealed an Early Bronze Age male burial that was unexpected because the site was attributed to the later Romano-British period (Fitzpatrick 2003: 148). The individual was found in a round barrow which contained a timber mortuary structure and it is believed he lived most of his life with a mobility disability. Based on his extensive grave goods which included items connected to hunters, metal workers, warriors and people with status, popular media labelled him the King of Stonehenge (Harris 2009 in *The Daily Mail*), and as the different artefacts pointed to regions outside of Wiltshire, it was suggested that he represented a migrating European elite (Fitzpatrick 2003: 151). Stable isotopic analysis of oxygen signals within the dentition were examined to aid in the interpretation and it was determined that as a child the male lived in a colder climate than that represented for modern Britain (Fitzpatrick 2003: 151), which the author suggested pointed to a central European region near the Alps. Although work is still ongoing and more bioarchaeological data is required, this individual provided further validation that individuals (and possibly small groups) were traversing wide landscapes during the Early Bronze Age.

Evans and colleagues (2006a) explored the burial context and oxygen and strontium values of individuals from the 4th century cemetery of Lankhills in Hampshire to determine if differential burial practices denoted distinctive people in the same community. A group were set apart from the normal burial rites afforded to Romano-British individuals at this cemetery in that their graves contained numerous types and quantities of artefacts and personal adornments while hobnails were absent (Evans *et al.* 2006a: 267). The group of nine individuals were mixed in sexes and ages and, based on some of the objects discovered with them, are suggested to be from an area of Hungary east of the Danube and, so that the authors supposed the group may have travelled with the Roman army into the area (Evans *et al.* 2006a: 268). Strontium and oxygen isotopes were analysed to add to or dispute the archaeological evidence and it was determined the group showed a wide variety of values which pointed to a non-southern British origin, though the authors also concluded the sample was not likely to represent a single cohesive population (Figure 2.7).

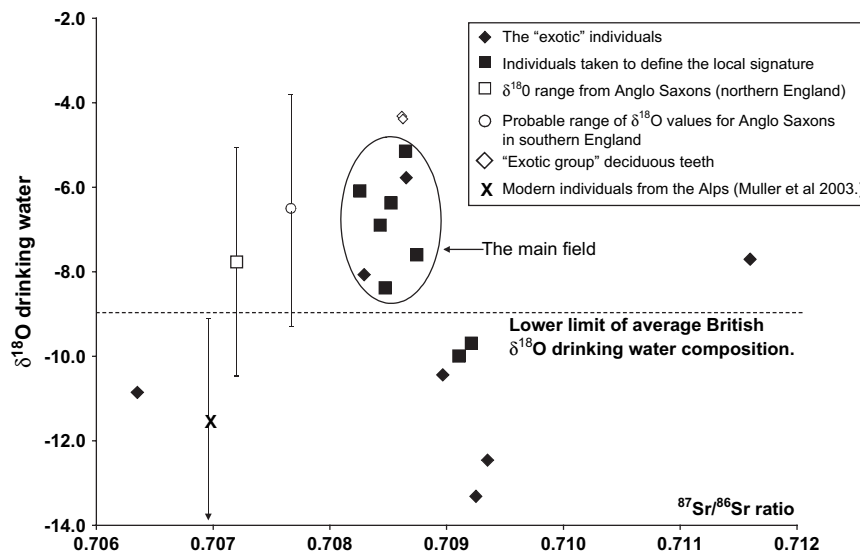


Figure 2.7: Strontium and oxygen results of a distinct burial group at Lankhills cemetery, Hampshire (Evans *et al.* 2006a: 270).

They concluded that their original assumptions regarding the burial rites may have been too simplified and this study draws attention to the need to look beyond the grave goods and funerary customs to distinguish locals and non-locals. Although the presence of a distinct rite might suggest a distinct group, the stable isotope values provided a more realistic assessment of who these individuals were in relation to each other and the wider cemetery.

2.4.3 Distinct burials as correlates of migration

In 2000 Montgomery, Budd and Evans considered the reliability of using strontium to reveal the mobility of four skeletons (one adult female and three juveniles) from what is believed to be a Neolithic henge monument, radiocarbon dated by the skeletons to 5500 – 5100 BP (4538

- 3695 cal BC (KW)) at Cranborne Chase in Monkton-up-Wimbourne in Dorset. All individuals were recovered from a single burial context, the construction of which, along with the articulated and undisturbed nature of the bones was interpreted as a single event during the initial construction of the monument (Montgomery *et al.* 2000: 374). Montgomery and co-workers (2000: 380-1) found the adult female's enamel (0.71007) to be quite different then the local signal (0.707) and they concluded she had spent her formative years elsewhere, possibly 80 km northwest in the Mendip Orefield, or conversely 350 km north in the north Pennines.

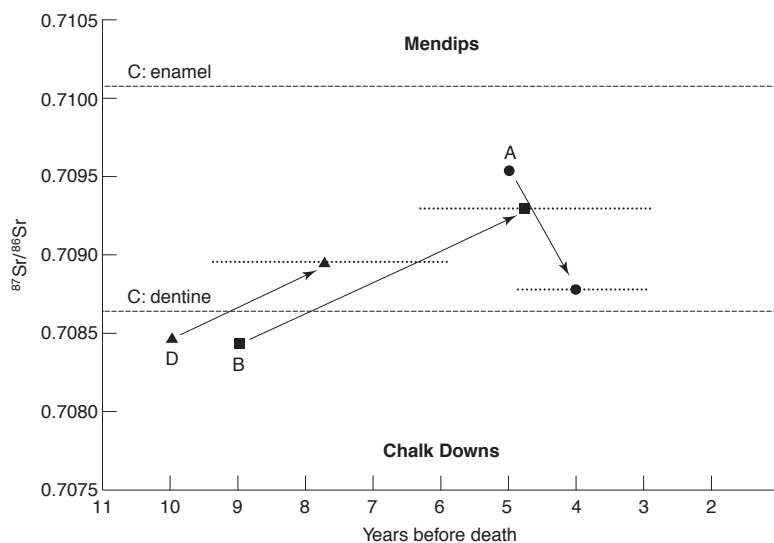


Figure 2.8: Strontium values for the Neolithic juveniles at Cranborne Chase (Montgomery *et al.* 2000: 379).

Two of the juveniles (B and D in Figure 2.8) showed patterns of living at or near the chalk in very early childhood (with deciduous results as 0.70844 and 0.70849) and then moving away from the area in later childhood (with permanent teeth exhibiting values of 0.70928 and 0.708797 respectively) most likely to a similarly high strontium concentration area as the adult female (Montgomery *et al.* 2000). The other juvenile (A in Figure 2.8) appears to actually be an anomaly as their teeth reflect an opposite trend with living away from the chalk in early life (0.70955) and moving into the area in later childhood (0.70878). What this study has illustrated is that Neolithic people were moving, possibly in groups to medium distance locations. Furthermore, as the Mendip Orefield was favoured during the Mesolithic, the authors concluded that there might have therefore been considerable continuity in terms of subsistence practices from the Mesolithic to the Neolithic period (Montgomery *et al.* 2000: 382).

In 2006(b) Evans, Chenery and Fitzpatrick studied nine Bronze Age burials in Wiltshire to see if strontium and oxygen isotopes would produce evidence of a mobile population. The authors examined two classic Beaker-style single male burials and an unusual multi-person

burial from the same period, in the same region, in order to assess whether the archaeological evidence of migration could be corroborated by the skeletal material. They cited the distinct Beaker type of burial with Beaker-style pottery and metal objects present throughout Britain in the Early Bronze Age circumstantially pointing towards a mobile population (Evans *et al.* 2006b: 310). Based on the oxygen values of the Amesbury Archer, who was buried with an assortment of Beaker-related artefacts, Evans and co-workers (2006b) surmised the individuals under review may exhibit similar stable isotope values pointing to a European migration (Figure 2.9; Fitzpatrick 2003). By extension then, they aimed to assess whether the Beaker rites had arrived in the area through an influx of people or through social contact and diffusion.

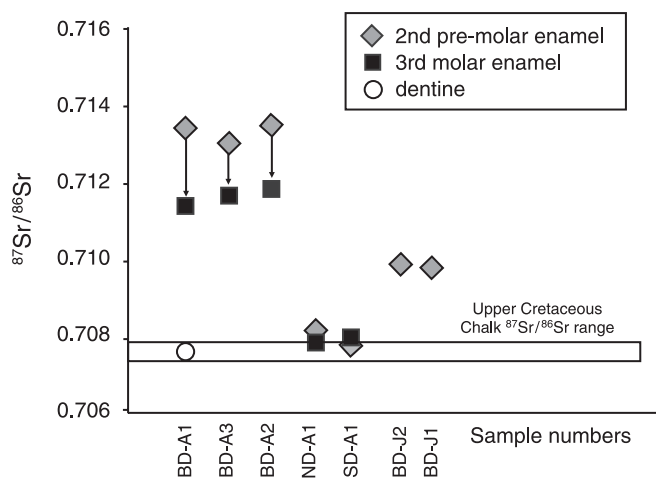


Figure 2.9: Strontium results for individuals buried near Stonehenge (Evans *et al.* 2006b: 314).

For the singly buried individuals (ND-A1 and SD-A1 in Figure 2.9) no significant differences were seen between their premolars and their third molars suggesting they were born, grew up and died in the local area. The three adults at Boscombe (BD-A1 to A3 in Figure 2.9), however, displayed significant differences between their premolars and their third molars which led the authors to interpret that all three adults followed the same migration path to end up at Boscombe, but probably at different times (Evans *et al.* 2006b). In addition, the two juveniles at Boscombe (BD-J1 and J2 in Figure 2.9) exhibited lower premolar ratios suggesting they were raised elsewhere than the adults. The oxygen levels were similar for four of the adult males, while a fifth presented as an unexplained outlier. These findings point to the individual, group and population level variability of mobility that existed in the Early Bronze Age and suggest that the presence of a Beaker *vener* (Gibson 2007) does not imply the presence of non-locals and instead points to a cultural adoption and adaptation of continental rites.

Finally in 2010 Chenery and colleagues studied individuals found in a late second century BC mass grave pit at London Road in Gloucester with a control population of individuals from a nearby cemetery of discrete burials. They examined strontium and oxygen to see if those results would support an osteological conclusion of victims of a catastrophic event, such as a serious epidemic, and whether the victims were a separate group or part of the general local population (Figure 2.10).

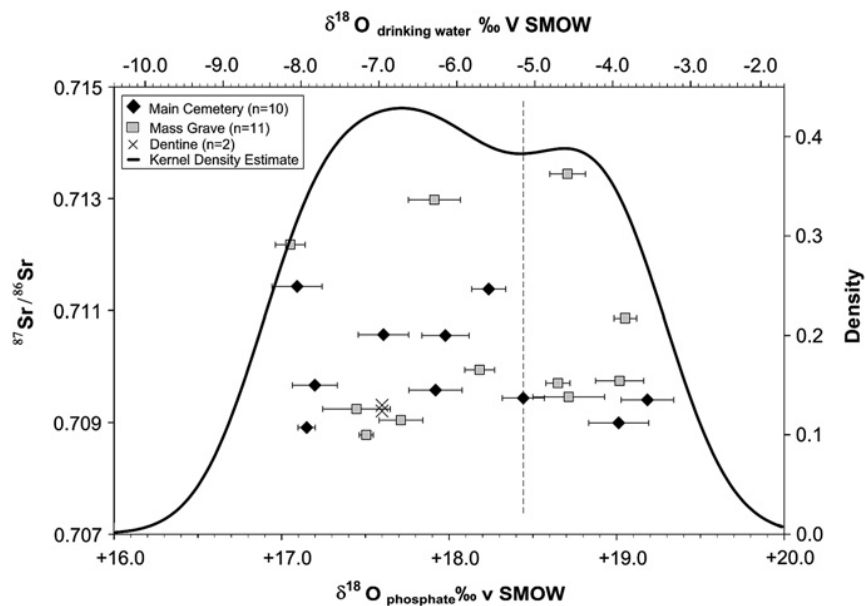


Figure 2.10: Strontium and oxygen results for the mass grave and main cemetery at London Road (Chenery *et al.* 2010: 157).

Overall no significant differences were seen when the mass and discrete burials were compared with oxygen values. The overall strontium enamel range was between 0.7088 and 0.7134, which entirely conforms to the established local signature. Therefore it appears those in the mass grave were in fact a representative sample of the local population and most likely did all fall victim to a catastrophic event necessitating their quick burial (Chenery 2010: 157). The authors do suggest that up to seven individuals may have had childhoods outside of Britain, possibly the Mediterranean coast, however as the local signatures are so wide it is not possible to be more conclusive. If, however these seven individuals do turn out to be non-local, Roman Gloucester experiences considerable diversity with up to 28% of individuals spending their childhood elsewhere (Chenery 2010: 159).

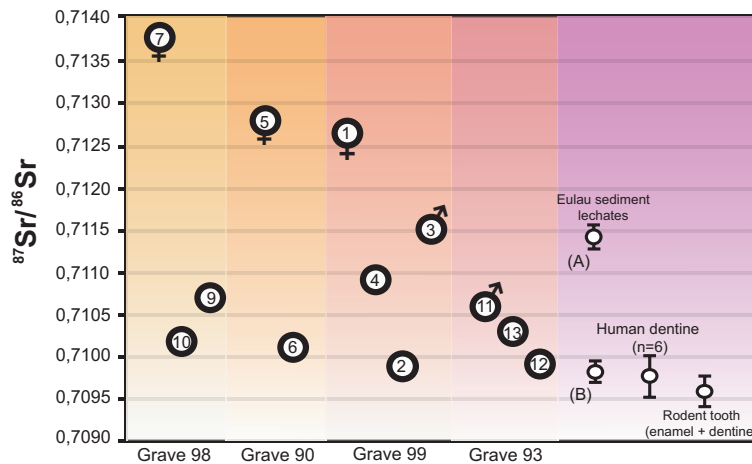


Figure 2.11: Strontium results from Eulau (Haak *et al.* 2008: 18228).

In 2008 Haak and colleagues looked at the Mittelbe-Saale group of the Corded Ware Culture at Eulau, Saxony-Anhalt, Germany dating to between 2700 and 2000 cal BC, discussed in Section 2.2.3. The children and the two males were determined to be local, although the range was broad (Figure 2.11). The females all had ratios above 0.7125. The authors therefore concluded, based on the strontium signatures and the exotic (though few) grave goods placed with the women, that they did not spend their childhood at Eulau and by extension, that the population, with this representative sample, practiced female exogamy and patrilocality (Haak *et al.* 2008: 18230).

2.4.4 Summary

The movement of individuals and groups in prehistory has provoked intense debates regarding the arrival and assimilation of people, the amalgamation of cultural and funerary practices as well as the discarding of previous ways of life in favour of new and innovative technologies and productions. The analysis of these societal alterations have pointed to a period with mobile groups throughout the landscape coming into contact with a range of local inhabitants and it is through the combination of bioarchaeological assessment with archaeological features that the extent of this movement can be understood and interpreted.

2.5 Conclusion

This chapter has explored three of the key themes when studying prehistoric populations: quality of life, social status and movement. The main methods have been evaluated and it has been demonstrated that many important aspects of past lives can be revealed, particularly when a range of methods are used together. The following chapter will provide data correlated from all Wolds sites as a desktop survey, which will demonstrate the state of play of knowledge in terms of quality of life, social status and movement.

Chapter Three: Osteological Summary of the Yorkshire Wolds

3.1 Introduction

This chapter is based on the extensive gazetteer of Yorkshire Wolds prehistoric sites as detailed in Appendix A. The information gathered is based on a wide-spread desk-top assessment of all available published excavation reports and assessment and also includes reports that were not published, which were obtained directly from the excavators themselves. This is an important aspect of the thesis as it illustrates the extensive work that has been conducted on the Wolds since antiquarian times. Unfortunately, due to the dispersed and incomplete nature of the fieldwork and resulting collections, there has not previously been an attempt to collate all of the available osteological information in order to arrive at an understanding regarding the prehistoric Yorkshire Wolds inhabitants. The discussion set out below, therefore provides extensive details regarding what has been gleaned thus far with respect to osteology and paleopathology and sets the stage for the results obtained in this thesis.

The osteological details were taken directly from the original publications and do not include any assessments carried out for this thesis. If it was not specifically stated that all individuals were examined, only those mentioned were counted as being assessed. Osteologically only 38.39% (580 of 1511) of inhumed individuals were analysed, while 32.16% (486 of 1511) were investigated using 20th Century osteological methodologies. The summary is limited, as depending on the era in which the samples were observed, certain paleopathological methods and terminologies had not yet been established (such as identifying and understanding what the presence of LEH might mean for childhood health). This makes it more difficult to assess the true incidence of various osteological manifestations of daily life, however it sets a baseline of information regarding life on the prehistoric Yorkshire Wolds.

3.2 Antiquaries and Archaeologists

Perhaps some of the best known early barrow diggers on the Wolds include Canon William Greenwell and John Robert Mortimer, while in recent times archaeologists Thomas Cape Mason Brewster, Terrance George Manby, Ian Mathieson Stead and John Strickland Dent continued their legacy of barrow exploration in order to uncover the prehistoric Yorkshire Wolds dwellers and understand the daily lives of England's earliest inhabitants. Others, such as the Victorian doctors Dr. George Rolleston, Dr. John Thurman and Dr. William Wright and later osteoarchaeologists including Sheelagh Stead, Jean Dawes and Malin Holst were more involved in the later, post-excavation analysis of the human remains themselves.

Greenwell (1820 – 1918) was a minor Canon of Durham Cathedral, a Rector, prolific author, and graduate of Durham University. In 1847 Greenwell opened his first barrow (near Chollerford, in Northumberland), which took place during a “raging blizzard with 6 inches [15.24 centimetres] of snow on the ground” and only candlelight available to inspect the burials (Marsden 1983: 61). Despite this rather challenging beginning, Greenwell continued with his digging and, starting in 1864, spent over 40 years excavating 379 mounds in the East Riding of Yorkshire, much of which was on the Yorkshire Wolds, numbering each barrow consecutively as it was opened (Greenwell 1877: 3). He summed up his findings in his seminal work *British Barrows* in 1877. Although he provided an extensive discussion and interpretation of the barrows and their contents, the absence of maps, site and barrow drawings makes deciphering his excavations difficult. Kinnes has since commented on the issues and possible problems associated with using Greenwell’s sites in parallel research as he believed Greenwell’s sense of direction and dimension were prone to error (Kinnes 1977: 52).

Greenwell gave the reporting of the osteological remains over to Rolleston, MD, FRS Linacre Professor of Anatomy and Physiology at Oxford, as his reputation “made it self-evident how greatly [his analysis] adds to the value of this book” (Greenwell 1877: vii). Rolleston was given sixty pages to discuss some of the remains that Greenwell sent him. He was methodical and fully explained the techniques he uses to determine sex, age and stature of the individuals he was able to examine.

Mortimer (1825-1911) was an East Yorkshire corn merchant who spent much of his leisure time and his own money to excavate 356 Neolithic, Bronze Age and Iron Age barrows that were scattered throughout his neighbourhood at Fimber on the Yorkshire Wolds (Giles 2006: 280), numbering each barrow as it was opened (Mortimer 1905: lxxviii). As he often had to obtain permission from the various landowners, this meant revisiting sites over several years before he excavated all of the prehistoric mounds. He became known for his ability to distinguish artefacts and taught others, including the local farmers, how to identify those that were found scattered in the landscape. In his seminal work *Forty Years Researches in British and Saxon Burial Mounds of East Yorkshire* (1905) he detailed every individual barrow excavation and the finds associated with each. He spent a great deal of time and energy focusing on the grave goods, including dozens of pages on the classification of the different types of pottery and the possible meanings and uses in the context of the different types of burial, including inhumations and cremation deposits. Unlike Greenwell, Mortimer was methodical and attempted to be as clear as possible in his discussions of barrow location, excavation techniques and stratigraphy in his many publications (i.e. Mortimer 1898, 1905, 1909, 1910, 1911a, 1911b).

Mortimer employed Wright of Birmingham University to analyse some of the skulls he excavated. They worked together on and off throughout Mortimer's digging career and their relationship ended with Wright penning Mortimer's obituary after his untimely death (Giles 2006: 296). Unfortunately, even though Wright cited Rolleston (suggesting he was aware of Rolleston's considerable expertise in reporting on the osteology of human remains) in his discussion, on the shapes and possible meaning of the skulls, he did not provide any information regarding the methods used to determine sex or age (Mortimer 1905: lxxix).

Thurman was a trusted colleague of Mortimer and Greenwell and often provided assessments of specific crania sent to him from Danes Graves, in addition to the occasions in which he excavated the area with the Yorkshire Archaeological Club (YAC). Although his day job was as the Superintendent of the Wiltshire County Lunatic Asylum, he enjoyed the diversion the prehistoric bones provided and examined individuals from the Yorkshire Wolds, Wiltshire and Gloucestershire. His additional contribution to prehistoric archaeology was the creation of the term "Beaker Folk" which he attributed to those Bronze Age skeletons found in association with a specific form of pottery (named Beakers).

Brewster spent much of his career exploring the prehistoric landscape of Eastern Yorkshire. His most notable excavations included the monumental undertaking at Garton and Wetwang Slack, however he also explored Cowlam, Riggs and Staple Howe. Stead began his career surveying the Arras and La Tène cultures and their archaeological remains in East Yorkshire and the Champagne region of France. During this time he also began what would become a 20-year career at the British Museum (BM) in the Department of Prehistoric and Romano-British Antiquities while also continuing to excavate on the Wolds at several sites including Burton Fleming, Cowlam and Rudston, and focussed most of his work on Iron Age material culture. His seminal work *Iron Age Cemeteries in East Yorkshire* (1991) provided an extensive discussion of Iron Age human remains and landscapes. Manby has been excavating throughout Britain for over 40 years but particularly focused his work on the Wolds where he has explored, excavated and re-excavated a number of sites including Thwing, Willerby Wold, Kilham and Staxton Beacon. His influential work, *The Archaeology of Yorkshire: An Assessment at the Beginning of the 21st Century* (2003) provided an extensive overview of the prehistoric landscape in Yorkshire.

Osteology forms an integral element in both the excavation and post excavation processes. The early antiquaries (when not making the determinations themselves) relied on medical doctors (such as Rolleston, Wright and Thurnam) to inform them of their discoveries. Post 1950s there was a push in the archaeological community to defer to trained osteoarchaeologists and paleopathologists. Sheelagh Stead, Dawes and Holst are three that have lent their expertise in post excavation for sites on the Wolds. Stead, working often in conjunction with her husband, analysed the human remains associated with a number of sites

on the Wolds including Rudston, Burton Fleming and Kirkburn. In a recent review of two of her husband’s books, the authors praised Sheelagh Stead for her “customarily thorough analysis of human bones” (Megaw and Megaw 2007: 424). Dawes (MA in Archaeology) provided an assessment of skeletons excavated at Cowlam, Wetwang and Garton Slacks, while Holst (MSc in Osteoarchaeology), an osteoarchaeologist and company director for York Osteoarchaeology, has been a consultant for a number of commercial archaeology units and on the Wolds and has analysed skeletons at Kirby Grindalyth and Reighton.

3.3 The prehistoric Wolds population

In total an estimated 1511 inhumations were excavated or unearthed on the Yorkshire Wolds from 67 sites, which resulted in the discovery of 554 unsexed adults, 313 males, 233 females and 411 subadults (Figure 3.1). Despite these high numbers, only 15 attributed to the Neolithic (out of 54), 95 assigned to the Bronze Age (out of 909) and 470 of 537 Iron Age skeletons were osteologically examined. These differences may be related to the actual number of individuals that could be identified as discrete inhumations, selective excavation (whereby the majority of individuals may have been left in the barrow after discovery), or, as in the case in Victorian times, as only certain skeletons (or specifically skulls) were *chosen* to be examined further.

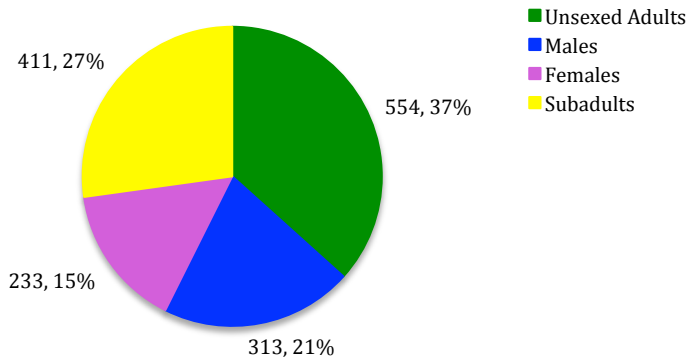


Figure 3.1: Demographic profile of the prehistoric Yorkshire Wolds.

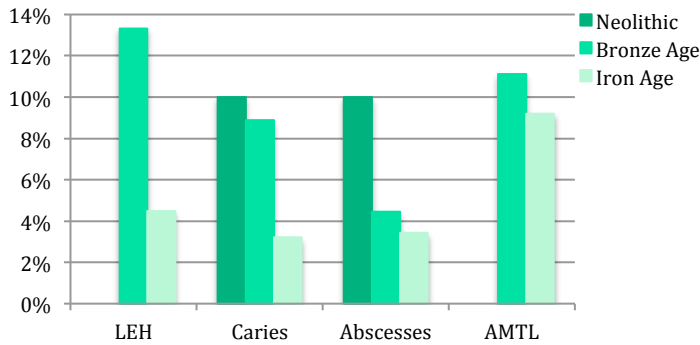


Figure 3.2: Prehistoric dental pathologies on the Yorkshire Wolds.

When the Yorkshire Wolds samples were divided by time period and assessed for quality of life, it was found that none of the individuals attributed to the Neolithic were reported as presenting with LEH or AMTL (Figure 3.2), however this is likely due to the small sample size attributed to the period. If LEH is examined through time on the Wolds, of those incidences reported, it appears as though the rate of hypoplasia decreased from the Bronze Age to the Iron Age which suggests an improvement in childhood health, a reduction in the presence of the stressors that would have contributed to the manifestation of LEH, or that children were dying as a result of those stressors before their enamel growth could be disrupted. With respect to caries, there appears to be a trend of decreasing cases of individuals with caries through time. However as the Neolithic rate is only represented by one individual, this is a largely arbitrary conclusion without further investigation, abscess rates reflect the same theoretical pattern. Finally AMTL also decreases from the Bronze Age to the Iron Age, and as skeletons attributed to the later period were more likely to have been osteologically assessed (due to sampling and excavation methodologies and not specifically the time period itself), this pattern may hold weight. Additionally, as AMTL is a visually obvious dental alteration, it was also picked up by the antiquaries and therefore may provide further validation as a realistic baseline. Overall, these four variables all appear to show decreasing rates through time, which suggests, on the surface, that lives, both in childhood and adulthood were improving.

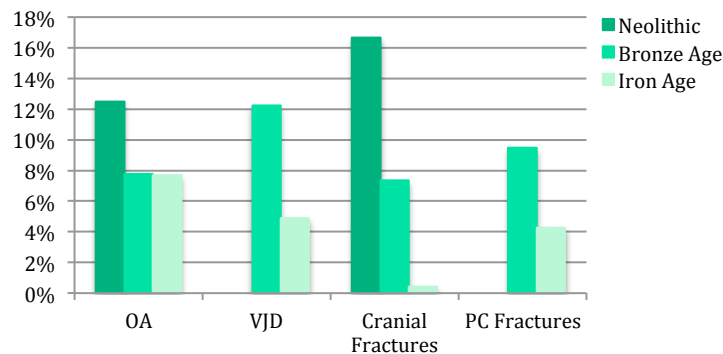


Figure 3.3: Prehistoric degenerative and traumatic alterations on the Yorkshire Wolds.

When adulthood, with respect to degenerative changes, was considered (Figure 3.3), the pattern persists, though it is more subtle in the expression of OA in comparison to VJD. It should be noted, however, that the Neolithic rate is only based on the presence of OA in one individual out of eight adults and should not necessarily be interpreted as representative. As sex and age categories were largely unavailable or unreliable it limits the extrapolations from this data, however, these findings indicate that life may have been getting progressively less demanding into the Iron Age with regards to heavy strenuous or repetitive activities, especially those affecting the spine.

Trauma was also considered in terms of both cranial and post-cranial fractures, as they may seriously affect quality of life, and once again the reported cases are suggesting that as time progressed there were fewer incidents (whether purposeful or accidental) of skeletal damage. As a poorly healed fracture often leaves a strong impression, these were likely to be observed by the early barrow diggers, which may explain the higher rates in the Bronze Age, however those fractures that healed well, without complications may have gone unnoticed. It is therefore difficult to determine the realistic frequency of trauma based on early excavation reports. The rate of cranial fractures in the Neolithic is based on two individuals of thirteen and may not be representative. Overall, however, based on these reported findings it would appear that both adulthood and daily life became less hazardous and intensive from the Bronze Age to the Iron Age.

3.3.1 Neolithic

During the Neolithic period, the dominant burial rite was one of disarticulation and secondary burial within barrows. Depending on the individual barrow, this may result in the comingling of remains or discrete piles of individuals or specific types of bones. Ten sites on the Wolds are attributed to this period, and although 54 individuals, as inhumations, were attributed to this time, the majority of the population were either too comingled to assess, were cremated and placed in the barrows or were buried in some other manner that we have yet to fully comprehend. These 56 skeletons represent a very small percentage of the population (Figure 3.4), and as Mortimer and Greenwell excavated the majority, only 15 were assessed post-excavation. More recently Gibson and Bayliss (2009) reanalysed the surviving Duggleby Howe remains and therefore, with the exception of stature estimations, these modern results are considered in place of those detailed in Mortimer (1905).

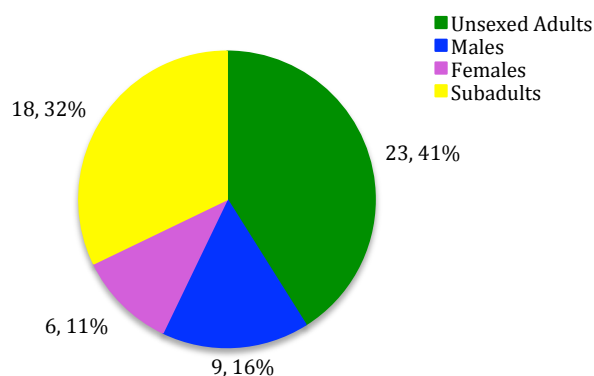


Figure 3.4: Demographic profile of the Neolithic Yorkshire Wolds.

Although not described in detail, at Duggleby Howe, seven males were sufficiently preserved for Garson (1893: 9) to determine living stature estimations. He determined the average height was 162.8 cm (5ft. 3.4in.), while the minimum was 154.6 cm (5ft. 0.7in.) and the tallest 187.4 cm (6ft. 1.5in.), which suggested a range in heights that might be explained by a mixed

group of people or the presence of individuals who experienced high and low quality childhoods which had lasting effects on their ability to reach their full adult height potential.

Due to the limited number of cranial and post-cranial elements that currently represent the Duggleby Howe material, full skeletal analyses were not possible. However, based on those available, Gibson and Bayliss (2009) were able to provide an assessment of those present at HERM. Three subadults were identified, and one was sufficiently preserved to identify CO, suggesting this individual may have experienced non-specific stress during their short life. Of the four males that could be sexed, an old adult exhibited a gross caries, while another had OA on his right mandibular condyle. More interestingly, a middle adult male presented an abscess as well as a possible perimortem cranial fracture to his left parietal. A single female was identified and she appeared to have fallen victim to a number of violent assaults resulting in a healed broken nose, blunt force trauma to both of her parietals and a possible blade wound to her frontal bone. Finally, a young adult who could not be sexed exhibited bowed femurs, which may have been indicative of infantile rickets (Gibson and Bayliss 2009: 54-5). Additionally, there were a number of isolated individuals from other sites that exhibited further pathologies. A male from Rudston had a sagittal synostosis, while another had a severe abscess (Greenwell 1877: 613, 615). One male at Garton Slack presented with caries (Brewster 1980: 743), while another male, at Birdsall Brow had a skull cleft (Mortimer 1905: 332), though it is unclear if this was congenital in nature or another term for a skull fracture.

If this sample of 15 individuals were considered on their own as a group, it may be possible to conclude the group had mixed experiences with stress in childhood, moderate dental pathologies. Certain individuals might have experienced violence or severe accidents during their lifetime, but this group is not complete, and if available, more attention should be placed on examining any surviving Neolithic skeletons from the Yorkshire Wolds to refine our impression of their lives.

3.3.2 Bronze Age

Thirty-eight sites have been attributed to the Bronze Age and have resulted in a total population of 909 inhumations, which is a large increase in the discoveries of human remains when compared to the Neolithic and may largely be attributed to the differing funerary customs in the periods (Figure 3.5). Unlike those attributed to the Neolithic, portions of the inhumations assigned to the Bronze Age were sufficiently preserved to determine stature estimations (Figure 3.6). It appears as though heights were quite variable, with females being separated by as much as 13 centimetres and males by 33 centimetres. This could suggest a mixed population of several different groups, or conversely may represent childhood buffering and neglect experienced by different individuals in the period.

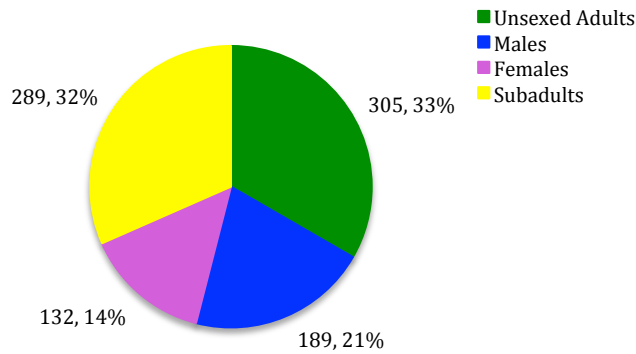


Figure 3.5: Demographic profile of the Bronze Age Yorkshire Wolds.

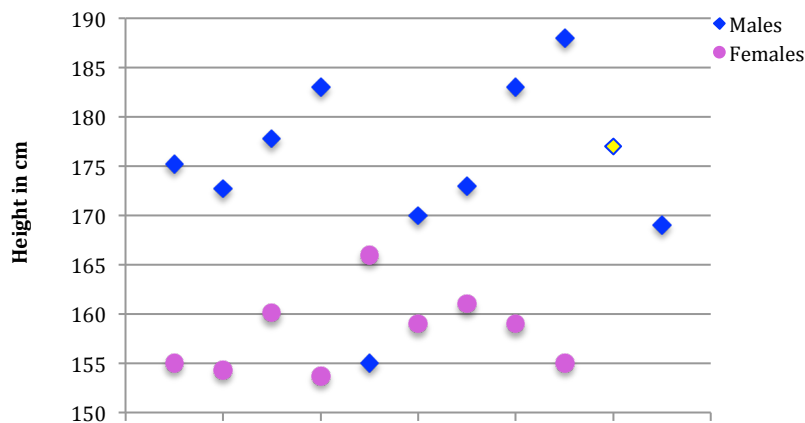


Figure 3.6: Bronze Age stature estimates on the Yorkshire Wolds.

The yellow-filled data point represents a pooled male average from Brewster's (1980) Garton and Wetwang Slacks, it is unknown how many individuals this includes.

Only 95 of the 909 (10.45%) inhumations were analysed and 74 of those (77.89%; 8.14% of the total) were assessed using modern osteological methods. As such it was possible to determine some aspects of health in this period. Based on the rate of LEH (Figure 3.7), it appears as though the majority of individuals did not exhibit evidence of stress, or, conversely that there may have been alternative manifestations of stress, such as skeletal developmental delays that were not described, or, a likely explanation given the high percentage of subadults attributed to this period, that stress, whether pathologically, culturally or environmentally-induced was too acute to allow for skeletal and dental alterations. With respect to dental pathologies, adults were most likely to experience AMTL, however the incidences of caries and abscesses were high enough to suggest that a portion of the sample was experiencing a reduced quality of life as a result. Sex and age-specific information was not always available and as all of these cases were simply reported, as opposed to being analysed and assessed at the individual, tooth and tooth space level, the full extent of these pathologies is unknown.

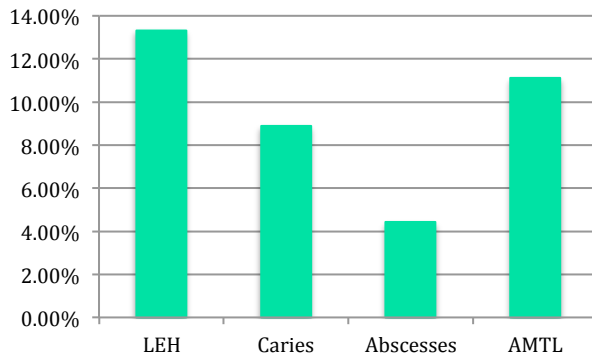


Figure 3.7: Bronze Age dental pathologies.

Bronze Age adults appeared to also have been relatively free from OA which raises the possibility that daily life was not overly burdensome, or conversely, that the labour and activities that may have manifested themselves as degeneration of the joints may have been restricted to a small group of individuals (Figure 3.8). Vertebral joint disease was experienced by a greater proportion of adults, suggesting that certain activities may have made it more likely to stress the spine. However, as sex and age specific information was not always forthcoming it is just as likely that the individuals affected were in the older age categories and were therefore experiencing the normal skeletal ageing process. When trauma was also examined, it was found that post-cranial fractures were slightly more likely, which could suggest some were due to accidents as opposed to interpersonal aggression. As there were six incidents of cranial trauma, it does provide for the possibility that violence may have played a role in their lives as well. Overall, the Bronze Age population under review did appear to experience hazards in their every day life, some of which may have led to death.

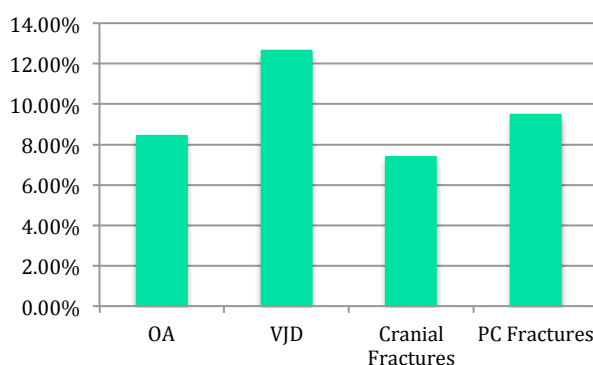


Figure 3.8: Bronze Age degenerative and traumatic alterations.

There were a few additional pathologies worth mentioning. Among the adult females, one from Staxton Beacon presented with possible platymeria (excessive antero-posterior flattening of the femur) and platycnemia (of the tibia) which can indicate poor nutrition (Stead 1959: 140), while another from Wetwang Slack had a shortened left leg relative to the right, which may have resulted in a limp (Dent 1979: 37) and finally a third, at Rudston

exhibited osteomalacia, also known as adult rickets (a vitamin D deficiency) (Greenwell 1877: 700). One male at Wetwang Slack had evidence of an infected foot wound in the fifth metatarsal (Dent 1979), while a male from Calais Wold exhibited an arm injury that resulted in the fusion of the arm, wrist and hand bones (Brothwell 1961). At Garton Slack a male had an abnormal osseous growth on a fibula (Mortimer 1905: 234), while another male's left acetabulum and femoral head were grossly malformed (Brewster 1980: 725). In the more recent assessment of Bronze Age individuals from West Heslerton, one adult male stood out as a result of the multitude of pathologies that were present in his skeleton. It is likely that either his hearing or his speech was impaired as both of auditory meatus' were narrowed. Additionally, he exhibited a healed Parry fracture in his left ulna and an unhealed fracture to his left mandibular condyle which was likely due to a severe blow to his chin and almost certainly contributed to his death (Haughton and Powlesland 1999: 53). Finally, though subadults were rarely commented on, one from Garton Slack was aged through their dentition as between six and eight, however their skeletal age was assessed at less than two (Brewster 1980: 731), suggesting this child was severely stressed during their short life.

When the LEH rate of 13.33%, the females with non-specific poor nutrition and osteomalacia and the subadult with delayed skeletal development were considered in conjunction, the Bronze Age on the Wolds presents as a period with increased stress during developmental years and the presence of adult nutritional deficiencies suggests during childhood and adulthood, for some, this stress was likely to be due to inadequate or limited diets. Dental diseases were evident in the Bronze Age, with almost twice as many individuals exhibiting caries than abscesses, however it was AMTL that affected more adults than any other pathology, and as both caries and abscesses are contributing factors to the premature loss of the dentition, these pathologies are likely to blame for the majority of tooth loss that was identified. As rates were not elaborated on beyond their mere presence (or absence with respect to AMTL), it is not possible to discuss the pathological incidence of dental diseases at the tooth or tooth space level.

With respect to degenerative changes, more than ten per cent of the adult population had evidence of joint (or spine) degeneration suggesting that for a portion of the population, adult life included heavy and/or repetitive physical tasks. When fractures were considered, rates were relatively low, however when the additional forms of trauma were also studied, more than ten per cent of the population was experiencing a temporary or permanent alteration to their quality of life. Both the arm injury and the malformed pelvis and leg would have resulted in a marked change in lifestyle for these individuals, to the point where the hand may have fallen into disuse and the alteration to the hip joint may have led to a decrease in lower limb mobility, both of which may have meant that they depended on the help of others to navigate their landscapes. Furthermore the extensive injuries exhibited in the male from

West Heselton points to at least two separate violent incidents, which Haughton and Powlesland (1999: 54) theorise may have been related to his sensory impairment.

3.3.3 Iron Age

The Iron Age population on the Wolds is scattered throughout 19 sites resulting in a total inhumation population of 537 individuals (Figure 3.9). Of the 537 skeletons, 470 (87.52%) were analysed which is the highest percentage of all of the time periods. Modern osteological assessment accounted for 405 of the inhumations (86.17%; 75.41% of the total population). Due to more complete skeletons, as a result of Iron Age burial rites and excavation methodologies, stature estimates were available for a number of individuals (Figure 3.10), however some of the sites that were analysed by modern osteologists were too large to publish every height estimate and as a result, average male and female heights were provided instead.

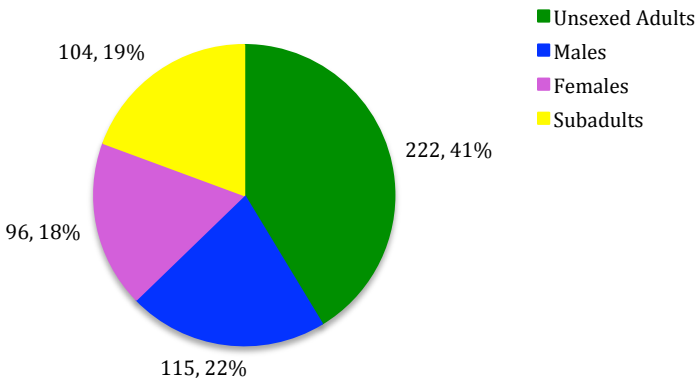


Figure 3.9: Demographic profile of the Iron Age Yorkshire Wolds.

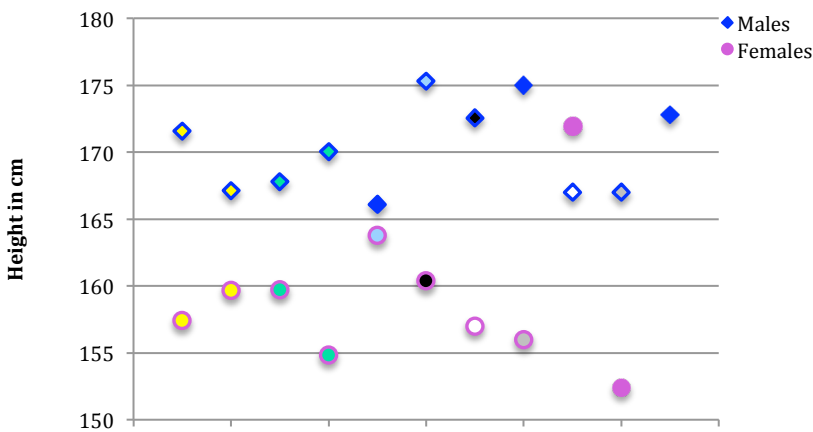


Figure 3.10: Iron Age stature estimates on the Yorkshire Wolds.

Those data points with yellow fill represent Rudston (from two sites), green denotes Burton Fleming (also two sites), light blue for Garton Station, black for Kirkburn, white for Garton and Wetwang Slack, excavated by Brewster (1981) and grey for Dent’s excavations at the same two sites.

Examining the stature estimates, it is clear that the range of heights has become more restricted than those determined for the Bronze Age though as many of these points are averages this may be misleading (as standard deviations were not always provided). Additionally, the female range increased to a spread of 18 centimetres, while the average remained stable and among males the range decreased to just nine centimetres and their average decreased by four centimetres, suggesting that female childhood health during their growth periods may have remained somewhat stable, while among males, some may have experienced more stressful formative years than their Bronze Age counterparts. When the presence of LEH was considered in this context (Figure 3.11), the rate actually decreased from the preceding period, suggesting that on the surface, childhood development, with regards to enamel growth, was not as affected as in the Bronze Age. As sex was not provided in most cases, it is not possible to determine if it was indeed the males that had evidence of both LEH and a reduced stature or if this manifestation was independent from the potential of achieving full adult height.

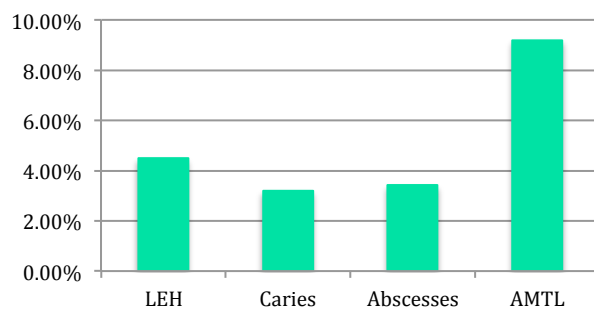


Figure 3.11: Iron Age dental pathologies.

Although caries and abscesses were both present in the population in low rates, the incidence of AMTL was twice that, suggesting a portion of adults were coping with the loss of at least one and often several more, such as a female from Reighton who had lost all but two teeth. This individual, and several others like her would have probably been dependent on those around her or would have had to process her food into an alternative form to ensure they received adequate nutrition (Holst 2004: 4). Dental pathologies were likely to have led to some of the AMTL, but overall, the majority of the population appeared to experience relatively sufficient oral health. When quality of life in adulthood was examined with respect to degenerative changes, it was found that although OA remained at a somewhat constant state, the incidence of VJD had reduced by half (Figure 3.12). Although this may be reflective of excavation or sampling strategies, or conversely the higher percentage of skeletons examined in a modern setting in comparison to the Bronze Age, it may also reflect a reduced amount of strenuous or heavy labour. This may point to a more diversified economy that requires a range of activities as opposed to a collective repetitive occupation, however, when the still high rate of OA is also considered, it suggests, as it did in the Bronze Age, that work

amongst the populations is becoming more diversified, with certain members of the group still taking part in the more arduous tasks. Without a better understanding of the ages and sex categories affected however, it is impossible to take this theory further. Finally trauma was also considered and it was determined that incidences of cranial fractures had reduced from the preceding period. As the post-cranial fracture rate had also reduced, this provides for the possibility that accidents were occurring less frequently, and also that interpersonal violence was less detrimental to the health of the Iron Age Wolds inhabitants than those attributed to the Bronze Age. This is a low rate and suggests that the Iron Age on the Wolds may not have been one surrounded by warfare and violence, as believed by the reported findings of weapons and interpersonal violence (Dent 1983), which is said to characterise the new social hierarchies and increased social differentiation of the Iron Age (Hill 1995).

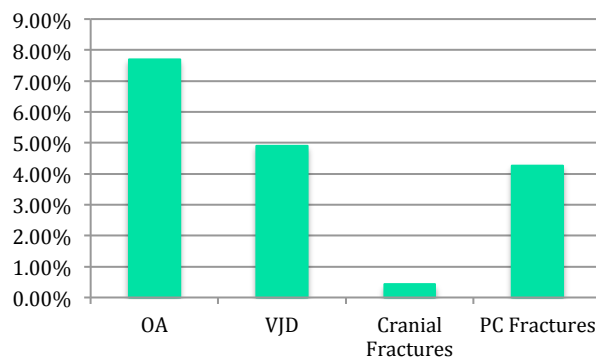


Figure 3.12: Iron Age degenerative and traumatic alterations.

There were also several additional pathologies worth commenting upon that were attributed to the Iron Age. Three subadults at Kirby Grindalbyth were determined to have evidence of scurvy and two of those exhibited severe malnutrition, evidenced by a marked difference in their dental eruption and skeletal ages (Caffell and Holst 2006: 3). Beyond this, in the populations of Garton and Wetwang Slack there were very high instances of newborn and very young infant mortality suggesting a prevalent disease that struck these subadults, or one that was possibly passed on by their mothers (Brewster 1980). Two females at Kirkburn were also found to have died during or as a result of childbirth, their babies also being found in situ (Stead 1991: 136). Additionally there was one reported case of probable polio at Burton Fleming, one benign cranial tumour at Rudston (Stead 1991: 137), one case of spina bifida occulta, one case of Paget's disease and two possible cases of spinal tuberculosis (or Pott's disease) all at Garton and Wetwang Slack (Brewster 1980). Finally, with respect to trauma, one male from Garton Station exhibited an extensive soft tissue wound to his lower leg which resulted in an inflamed and infected tibia, while another male at Grimthorpe, besides his extensive dental and degenerative pathologies, had broken at least seven different bones during different stages in his life, suggesting his quality of life was greatly diminished.

When the instances of scurvy and malnutrition are considered in conjunction with the high infant mortality, it appears as though young subadults in the Iron Age were suffering from a number of stressors in their early lives, which may have been brought about by the health state of their mothers. When the LEH rate as well as the reduced statures of adult men were also considered it provided further validation to the belief that childhood in the Iron Age was wrought with difficulties, meaning that a large proportion of very young subadults did not live beyond infancy and adults may not have been able to reach their full height potential. It also appears that trauma was present, but not necessarily prevalent throughout the period. Although there were isolated cases of extensive or severe injuries, the majority of individuals were found to be free from these forms of pain and suffering. As there were a number of cases of isolated diseases, once this and all other available information was examined, the Iron Age appeared to be a period of stress and difficulty for certain members of the population in a number of ways. However, as a greater proportion were free from skeletal alterations, it implies that either some individuals were susceptible in some ways or conversely, that others were somehow buffered, either during their childhoods, or possibly as a result of the occupations and lifestyles they had as adults.

3.4 Conclusions

This chapter has provided a systematic overview of the prehistoric human remains excavated on the Yorkshire Wolds from the Victorian period to the present. It has determined that there were 67 sites with human remains. The number of individuals ranged from one to over 200 at certain sites, and the various burial methods, including cremation, disarticulation and inhumation have resulted in a representative population of at least 1900 people, though approximately only 1511 received the funerary treatment of inhumation. Therefore, only a portion of individuals were provided with a burial rite that allowed for their archaeological presence to be accounted for.

There are a multitude of research questions that could be explored beyond the basic information, and this skeletal assemblage deserves to be examined. Unfortunately there are questions regarding the number of individuals actually exhumed (as the early antiquaries could often not see the value of subadult skeletons), and the completeness of those skeletons is debatable. It is probable that the number of people attributed to each site and consequently each time period, and the total population that is available for analysis, is far less than that reported on initial barrow opening, and is also likely to be less than that reported here.

The osteological findings reported in this chapter open up several avenues of research in order to better understand the populations that inhabited the Wolds. In both the Bronze and Iron Ages the changing dynamics associated with stature, childhood nutrition and degenerative changes suggest that underlying mechanisms that created or altered daily life

were not consistent through both periods. Furthermore the high proportion of young subadults within the Iron Age points to a worsening of either maternal or infant health.

The following chapters describe the methodologies and results associated with eight sites on the Wolds that had not previously been subjected to extensive analysis. The results presented here will be incorporated in order, to provide a clearer and more modern evaluation of the lives of those that lived on the Yorkshire Wolds.

Chapter Four: Materials and Methodology

4.1 Introduction

This chapter examines the complex combination of issues involved with finding and ultimately deciding on suitable materials for analysis. Additionally, a detailed summary is provided of the range of methodologies employed in order to understand the prehistoric Yorkshire Wolds population and to fulfill the stated objectives. Overall, this chapter aims to provide an explanation of the approaches that have been employed based on the available materials and their current state of preservation. As archaeologists are most often faced with less than complete skeletons, and those that are in varying states of preservation, it is necessary to tailor methodologies to best fit with the remains in order to arrive at the most complete understanding of the past. Whenever possible, established methodologies have been employed to determine the variables under review. However, when the skeletal state necessitates the use of less than ideal approaches, the full limitations and concerns have been considered in the production of the final results, and are detailed in the associated subsections.

4.2 Materials

4.2.1 Site Selection

Of the 67 sites with human remains, those chosen have not been extensively studied or published to avoid repetition of data. The sites of Wetwang Slack, Towthorpe, Burton Fleming and the modern excavations at Rudston and Garton Slack have therefore been excluded due to their excellent analyses and forthcoming or current publications. They will, however, be discussed within the context of the Yorkshire Wolds as well as the correlations and contrasts with those sites currently under study.

Biased excavation methods and excavations have had a large impact on the remains available for analysis. Antiquaries such as Mortimer and Greenwell focused on the presence of barrows to guide their digging. This methodology resulted in missed inhumations if a burial mound was not readily visible on the surface due to the intensification of agriculture, including the destruction of barrows to use the soil for farming purposes (Mortimer 1905). Today crop marks recognised through aerial surveys are often relied upon to identify new areas of potential prehistoric value (Stoertz 1997).

Differing excavation techniques by these early barrow diggers also resulted in demographically biased samples. As craniometrics was the established method of the day, subadults, whose skulls had not yet fully ossified, were recorded as being present but were

rarely excavated. Furthermore, certain skeletal elements, such as the small bones of the hands and feet, or occasionally entire skeletons, save for the skull, were often not removed from the mound, which led to the vast majority of skeletons excavated by antiquaries being only partially complete. One reason for this may be the inability of the Victorian antiquaries to see the value in certain skeletal elements. This was pointed out by Garson (1905: 36) as a major drawback in the work of Mortimer, and therefore there was a disinterest in excavating and keeping them associated with the skulls (Brothwell 1960: 311). This had an impact not only on the quantity and quality of basic demographic information, and resulted in the loss of pathologically diagnostic elements. Of course, modern excavations also have built in biases. For instance, work by commercial firms can result in minimal sampling or up to 50% of the area being excavated depending on project aims, resources and the level of archaeological threat (Pers. Comm. Ed Blinkhorn). Those conducted by academics, based around research questions, may mean entire areas are sifted through screens or are ignored entirely if time and funding is limited (Grauer 2008: 66).

Finally the last caveat in the selection of sites was the accessibility of the collections. Some have been dispersed and are difficult to track down, while others belonged to institutions with very limited windows for research. Due to time and budgetary constraints an extensive analysis of all sites was not possible. As the Hull and East Riding Museum (HERM) and the Natural History Museum (NHM), London were open to this project's research initiatives, the majority of sites were selected from their antiquarian collections. As the Mortimer and Greenwell collections were those that contained human remains from the Yorkshire Wolds, and they had not been extensively analysed in recent times, four sites were chosen from HERM (Cowlam, Danes Graves, Garton Slack and Garrowby Wold) and four from NHM (Cowlam, Danes Graves, Rudston and Willerby Wold), out of their entire selection of sites as discussed throughout Chapter 3. Although both Mortimer and Greenwell each excavated at over 20 sites on the Wolds, the skeletal presence and preservation levels precluded a majority of the sites from being examined. Two further individuals excavated by Mortimer at Danes Graves were sent to the Yorkshire Museum (YM) and were also analysed for this project. Additionally, in an exploration of archaeological work carried out post-1950, it was found those sites excavated by TCM Brewster and IM Stead had been osteologically analysed, while TG Manby's Staxton Beacon, excavated in 1958-9 held promise as an unpublished and osteologically unanalysed site. Finally, commercial excavations were explored throughout the Wolds. Although many such investigations had been conducted, once the requirement of skeletons from prehistory were taken into account, only one site, Melton, excavated by On Site Archaeology (OSA) in 2004-5, was deemed suitable for analysis.

4.2.2 Sample Selection

There were a number of requirements and limitations involved with individual skeletal selection. The first condition was burial mode. As individuals on the Yorkshire Wolds were inhumed, cremated, disarticulated and excarnated, it was necessary to limit the analysis to those who were inhumed discretely. Unfortunately the analysis of cremations is beyond the scope of this project and due to antiquarian retrieval methods, cremations were seldom excavated and disarticulated or comingled group burials were not fully removed and where they were it has not been possible to determine if they were accurately sorted or labelled, and therefore they had to be excluded from this analysis. Beyond this, based on an initial assessment of the state of the remains in the Mortimer Collection, and grounded in the presumption that the Greenwell Collection would be similar, it was determined that at least 50% of the skull needed to be present (which had to include a minimum of three morphological features used for sex estimation) along with either the mandible or maxilla. As the antiquaries rarely excavated postcranial elements, their presence was a bonus as opposed to a requirement. Therefore, even if a site originally had a high number of skeletons, after these exclusions and limitations were taken into consideration, the previous population often drastically decreased in samples deemed suitable for analysis.

The skeletal population for this project is not a random sample, as all remains that fit these criteria were analysed. However, it should also not be seen as a biased sample as most of the reasons for exclusion were based on taphonomic changes and excavation methods, which were not connected to individual people. With regards to the burial methods as exclusions, it has been generally agreed that those buried on the Wolds were special people in some respect (Fenton-Thomas 2005, Parker Pearson 1999, Stoertz 1997), and yet as there were different contemporary burial practices it provides for the possibility that different people (based on a range of possible criteria) may have been subjected to (or were the beneficiaries of) different rites.

The burial customs on the Wolds during the Neolithic proved to have a detrimental effect on the available skeletal population. The discovery of comingled, disarticulated and excarnated remains created difficult conditions in which to excavate individuals, especially for the earlier antiquaries. As they were responsible for the initial discoveries at many of the long barrows, the resultant Neolithic skeletal sample was minimal. Due to the adoption of burial customs during the Bronze Age, most specifically the differentiation into more individualised burials that were visually significant on the landscape, group graves with discrete inhumations and a higher percentage of inhumations than cremations, the Bronze Age has the highest number of individuals. During the Iron Age the complete transition to individual burials below low or flat graves have meant fewer have been identified in the landscape, but as they were also predominantly buried in large inhumation cemeteries, they represent a lesser but still

comparable number of individuals for this project. Three sites are situated within the northern Wolds. The site of Staxton Beacon is the northern-most site and is represented by six individuals dating to the Bronze Age. The second site, Willerby Wold, is composed of four individuals, also dating to the Bronze Age. Finally, Rudston is composed of two individuals attributed to the Neolithic and 10 dating to the Bronze Age. One site was identified and analysed from the central Wolds; Danes Graves, and includes 23 individuals dating to the Early Iron Age period. Two sites were chosen from the western Wolds; Garrowby Wold, composed of six individuals from the Bronze Age, and Cowlam which includes eight individuals from the Bronze Age and three from the Iron Age. Garton Slack is situated within the central Wolds and includes one from the Neolithic and 22 individuals from the Bronze Age. Finally, the southern-most site of Melton, located in the southern Wolds includes 18 individuals from the Iron Age.

4.3 Methods

The decision to include and excluded certain methods was based on several limitations. The first limitation was the presence and preservation of remains. Due to the fact that isolated skulls represented the majority of inhumed individuals at sites, it was not possible to assess the entire skeleton for evidence of multiple pathologies. Additionally, as many of the skulls were reconstructed during Victorian times, or conversely, were altered as a result of their preservation methods post-excavation, craniometrics and associated discussions regarding the metrics of facial features, often connected to racial determinations, were left out entirely.

As a result of collection and museum impositions it was not possible to use any destructive methods on the remains housed at HERM, the NHM or the YM, which limited those assessments to macroscopic analysis. Additionally, the collections housed at these three museums were not available for loan to the University of York, and as such a regulated number of visitations could be arranged with each institution. As a result, it was not possible to analyse all of the remains available, save for those at the YM, and it was decided that the focus should be on those individuals with the highest number and best-preserved elements. Conversely, the collections of Staxton Beacon and Melton were available for chemical analysis and the approaches used for these two sites are detailed below under bioarchaeological methods. As both of these collections were loaned to the University of York, a complete and detailed assessment was conducted on all of the remains conforming to the project requirements, attributed to the sites. All data was recorded on forms adapted from the Arizona State Museum Human Skeletal Remains Checklist, which itself was adapted from Buikstra and Ubelaker (1994) *Standards for Data Collection from Human Skeletal Remains*.

4.3.1 Osteological Methods

4.3.1.1 Sex Estimation

Occasionally, and most often occurring in the early decades of archaeology, sex was determined by the associated grave goods found with the burial (Rolleston describes the problems and yet the commonplaceness of this method throughout his paper in Greenwell's *British Barrows* 1877: 565). There are obviously a multitude of issues associated with this practice including the discussion of sex versus gender, but also the subjective labels (such as the presence of weapons indicating men) that were often relied upon for sex determinations. Grave goods may be placed in graves for a number of reasons, as the burials on the Wolds would attest. These reasons may include beliefs in the afterlife and goods that may be needed, the superstitions with using items belonging to or attributed to the dead, as well as simple gifts given by mourners; a practice that is still commonplace today. Mortimer found over 160 food vessels (which he considered to be domestic), accompanied with inhumations of men, women and children (Mortimer 1905: lxii) suggesting further that grave goods should not be relied upon to determine sex. As a result of this none of the sex estimations associated with the individuals under analysis were considered (even those established under modern techniques) and each was approached without prior knowledge of an assigned sex.

A second concern that needs to be kept in mind is natural human variation. In regards to humans displaying secondary sexual characteristics there is very little sexual dimorphism compared to other members of the primate lineage (exemplified by gorillas) and as such there can often be very subtle differences between the sexes. As can readily be apparent in today's population there are small males and large females and thus bone size and robusticity should not be relied upon to determine sex (Mays 2010b). We must consider the variation that can be seen among and between groups as a result of such factors as diet, geography, climate, occupation and genetics that influence the human form, and since we do not have modern analogous populations to study we cannot be sure of the amount of variation that was present in populations of the past (Roberts and Manchester 2010: 32).

Sub-adults (under 18) are often impossible to sex. As the secondary sexual characteristics develop throughout puberty and only halt in the early twenties (or later for males) there are no clear morphological differences that can distinguish the two before that transition has occurred (Keen 1950:75). In fact, males, before puberty, resemble females to such a degree it becomes a redundant exercise and therefore was not attempted for this study.

Sexing methods are largely based on a morphological assessment of the skull and pelvis. With regards to the pelvis, Phenice (1969) connected the morphology of the ventral arc, the subpubic concavity and the ischiopubic ramus as diagnostic indicators of biological sex and these are still relied upon today to determine sex (Roberts and Manchester 2010). Beyond

these, the shape of the greater sciatic notch and the preauricular sulcus were also considered when estimating sex, based on the sexually dimorphic elements as discussed by Walker in Buikstra and Ubelaker (1994). All five of these indicators were independently scored, according to Buikstra and Ubelaker (1994) and the most sex-specific features were used to determine estimated sex. White and Folkens (2000: 368) pointed out that using Phenice's (1969) method, it was possible to achieve between 96% and 100% accuracy in analysis.

With regards to the skull, areas to consider include the shape and angle of the mandible and mental eminence, the prominence of the supraorbital ridges and glabella, the angle and general size of the mastoid process and the presence and degree of the external occipital protuberance. In 1920, Hrdlička discussed these points and suggested they were special features that could readily differentiate the sexes (Hrdlicka 1920 in Keen 1950: 67). The scoring system used was based on the sexually dimorphic cranial features, as listed above and detailed by Walker in Buikstra and Ubelaker (1994). This combination of variables allows for between 80-90% accuracy in sex estimation based solely on the cranial characters. All five of the morphological variables were independently scored, and, as with the pelvis, if there was a discord within the variables, the most likely sex was determined. The possible estimates were female, probable female, unknown (which were then excluded from further analysis), probable male and male. When there was a disagreement between the pelvic and the skull scores, the most common estimate was taken, however when there was no clear determination, a conservative estimate of probable or even unknown was recorded. As the majority of individuals derived from the Mortimer and Greenwell Collections did not include innominates, the skull was most often relied upon for sex estimation. Since the pelvis is considered a more accurate representation of biological sex, this limitation was taken into consideration and all sex determinations were conservatively estimated.

4.3.1.2 *Aging the Skeleton*

In discussions on aging methods, Rolleston stated "there was very little difficulty in determining with a high degree of probability the age of skulls below thirty, especially with the bones of the trunk and limbs available for inspection" (in Greenwell 1877: 566). There are clear differences in accuracy when it comes to aging skeletons. In an inverse correlation to sexing, the younger the skeleton (less than 30) the more accurate the aging method. In recent discussions of age markers for older adults, the major issue of contention is how reliable the methods are (White and Folkens 2005), as this form of analysis focuses on degenerative changes. On the one hand, some argue that they are inadequate as the inter/intra observer error rates are too high and the methods are too subjective (Baccino *et al* 1999). From this perspective the methods that have thus far been developed are insufficient to identify those over 40 with any degree of accuracy beyond a ten and

sometimes twenty-year range. On the other side some believe they can be quite reliable if the methods are employed correctly (White and Folkens 2005: 344).

4.3.1.2.1 Subadult Age Estimation

For this project two forms of age estimation were employed to assess chronological age at death in subadults, defined as those under age eighteen. Dental development sequences, based on the work of Ubelaker (1978) were used to infer age estimation ranges. This method is based on the combination of dental formation (of both crowns and roots) and eruption (the degree of growth above the alveolar bone) to determine age scales based on the collection of teeth (White and Folkens 2000: 342). Although this work is based on earlier investigations by Schour and Massler (1941) which was created through an assessment of terminally ill children, and Ubelaker's (1978) work was developed for work involving Native Americans (though only for the permanent dentitions (White and Folkens 2000: 342)), the method was chosen due to its ease of use and the fact that it has become a recognised standard in archaeological work around the world (Hillson 1996; Buikstra and Ubelaker 1994). As the reference populations are not in parallel with those under study, conservative estimates were employed, though as Hillson (1996) points out, archaeologically derived subadult remains (and presumably those dating to prehistory), were not healthy individuals and they were unlikely to have received care equivalent to the modern middle-class children that other dental eruption methodologies were based on (such as Moorrees, Fanning and Hunt (MFH) (1963) as detailed in Fanning and Brown (1971)) and therefore Ubelaker (1978) was deemed the most suitable methodology for this work.

A second method for subadult age estimation was that of epiphyseal and bone fusion sequences as listed in Scheuer and Black (2000). Each bone (or section of bone) was described and the range of fusion stages detailed, which when combined suggests a skeletal developmental age range. The reference sample for this method was based on 20th century populations derived from the longitudinal Brush Inquiry/Foundation Growth Study conducted at Western Reserve University in Ohio, USA (Nelson *et al* 2000) on a group of mid to upper socioeconomic status children from 1926 to 1942. Obviously this population is not a parallel to that currently under study, however, as with the dental eruption sequence, this method has been employed by archaeologists around the world and attempts were made to remain conservative in the determined age ranges. As it was not possible to sex subadults, the entire range for males and females were considered when determining the skeletal age.

Subadults were placed within four age ranges, as suggested by Buikstra and Ubelaker (1994). These include fetal (before birth), infant (aged 0 to 3), child (aged 3 to 12) and adolescent (aged 12 to 18). These age-specific labels were strictly based on the determination of biological age, and therefore do not equate socially structured age determinations or maturity levels (Chamberlain 2006: 17). When speaking generally about those under

eighteen, the term subadult, a developmental and osteologically-constructed category, has been applied. As both dental eruption and epiphyseal fusion were used in conjunction, differences were often noted between the dental-derived estimate and that determined through skeletal development. As dental eruption is considered to be less susceptible to stress, whether that be environmentally, culturally or pathologically derived, it was decided to be the more accurate representation of chronological age. When the age ranges were found to be different by at least 1.5 years, it was theorised that there was some amount of skeletal developmental delay, and therefore non-specific stress present in the life of the subadult.

4.3.1.2.2 Adult Age Estimation

The most reliable method today is the Suchey-Brooks 1990 public symphysis technique, which is based on the earlier work by Todd in 1921 and Katz and Suchey in 1986. Their method, composed of six phases, provided casts of the changes that could be seen from 15 to 87 years of age. Due to the morphology of the pelvis the pubic symphysis often does not survive intact and occasionally becomes too fragmentary to use. Meindl and Lovejoy in 1985 developed an aging method based on the changes associated with the auricular surface of the innominate. This method had eight phases of degenerative changes from age 20 to over 60, which could be studied with photographs, casts and detailed descriptions. In cases of preservation, this method is almost always possible as long as there are fragments of the pelvis, as the auricular surface can usually be easily distinguished. As both of these were the ideal methodologies to employ they were used when the skeletal presence and preservation allowed for them. Unfortunately in over 75% of cases, innominates were not available for analysis and as such an alternative method had to be employed.

Towards the later decades of the twentieth century there was a push to create more reliable methods to age skeletons that were less than perfectly preserved. In 1981, Brothwell researched British Neolithic to Medieval populations and arrived at a method of aging using dental attrition. His method had four stages for individuals aged 17 to over 45 based on wear patterns. He looked at molar wear and using his illustrated diagrams it was possible to assess the degrees of wear on all three of the molars separately to arrive at an age range (Brothwell 1981). The obvious issue with this method is the effects of diet, food processing, bruxism and using the mouth for non-mastication activities that may wear down the teeth prematurely. Brothwell (1981) was very aware of this issue and stressed that attrition should be used for a sample from a single population or group. He believed, especially in prehistoric groups, there would not be huge variations in diet and thus generally it is possible to use wear to assess age (Brothwell 1981). Although many authors (Lovejoy *et al.* 1985) have highlighted the benefits of combining attritional age estimation with seriation, it was not possible to employ this method for this project due to time constraints at each museum as well as the spread of sites over both museums. Therefore it was unfeasible to establish a scale of attrition based on

development (White and Folkens 2000: 344). As Brothwell's (1981) reference population was a parallel to that currently under study, it was decided, based on the presence of skeletal elements, that attrition would be the main adult age estimation methodology, however large age ranges were applied. The age scales suggested by Buikstra and Ubelaker (1994) were relied upon and included young adult aged from 18 to 35, middle adult aged from 35 to 50 and old adult aged over fifty years.

4.3.1.2.3 Stature

Stature has long been used to not only identify the normal height distribution of an archaeologically derived population, but also to determine the relative health and nutrition in childhood, as retarded growth is a reliable indicator at the population level (Mays 2010: 132). The most dependable method is the anatomical technique first developed by Fully (1956), which was based on work carried out after World War Two in order to identify French citizens killed at the Mauthausen concentration camp in Austria. He measured the heights of the cranium, vertebral bodies, the lengths of the femur and tibia as well as that of the articulated talus and calcaneus of 120 males in order to determine skeletal height. These measurements were compared to the documented heights and Fully (1956) developed correction factors to establish living stature estimates (Mays 2010: 130). Unfortunately as it is not usually the case that all of the required elements were appropriately preserved in the archaeological record, this method was not the ideal choice for the samples currently under study.

The mathematical stature estimation method created by Trotter and Gleser (1952, 1958) was applied to the skeletons from the Wolds. They used an initial sample of over 5,000 male Korean war dead with documented living heights along with 240 known females from the Robert A. Terry Collection in order to determine the most representational skeletal elements that may be selected to determine living stature. The paired or individual bones were ranked according to accuracy and corrective formulae were created for males and females of different ancestry including Asians, Blacks, Mexicans and Whites (Trotter and Gleser 1952, 1958). Mays (2010) stated the white male and female calculations could be readily applied to prehistoric Europeans and as their equations are the most commonly employed when skeletal preservation is less than ideal, this method was put to use in this project. Due to the range in preservation as well as skeletal element presence it was not possible to determine the stature of every individual in the sample, but every individual that had a skeletal element for which Trotter and Gleser (1952, 1958) created a formula, was measured. The stature estimates were also used in conjunction with other forms of evidence to determine the presence of stress (which therefore may have led to growth stunting) within and between the populations.

4.3.1.3 Non-specific Indicators of Stress

The presence of linear enamel hypoplasia (LEH) and cribra orbitalia (CO) were examined for general childhood well-being as they represent stressful incidents that have resulted in “permanent chronological [and skeletal] records” from early life (Lewis and Roberts 1997: 581). Although an ideal goal would be to determine the exact nature of the stress involved during development, often it is not possible to pinpoint such specificities and alternatively, the presence of these skeletal indicators suggest that something of environmental, cultural or pathological construct was present for a long enough duration that it left its mark on the skeleton. If a subadult died without the presence of these markers it may suggest their cause of death was not related to stress, or alternatively, it may suggest that the individual was not able to survive long enough for their skeleton to be affected (Wood *et al.* 1992) suggesting the stress was too severe to recover from.

4.3.1.3.1 Linear Enamel Hypoplasia

Enamel hypoplasias, characterised as acute non-specific physiological stress markers, occur in childhood during enamel formation. LEH specifically is identified as transverse depressions of enamel arrest on the labial and buccal surfaces of the anterior teeth (Goodman and Armelagos 1985). As the anterior dentition has been determined to be the most vulnerable portion of the dental arch to hypoplasia formation (Hillson 1996: 167), it was decided to focus on the first premolars, the canines and both incisors in each section of the dental arcade.

All four quadrants of the dentition were visually inspected and due to the variability in preservation and presence, especially within the context of the antiquary-derived samples which resulted in the reconstruction of the mandible and maxilla and the teeth themselves, using a range of materials including glues, pastes, resins and wires, it was not possible to consider each tooth independently and instead the entire anterior dentition was scored (see Table 4.1 for a summary of the method).

Score	Description
0	Not observed (no anterior teeth present)
1	Absent
2	Single hypoplasia on one or more teeth
3	Two or more hypoplasias on one or more teeth

Table 4.1 LEH scoring of combined anterior teeth.

As LEH remains on teeth throughout adulthood, and by its nature, were laid down in childhood, comparing the presence on the teeth in several different age groups was not beneficial for this sample as the time periods to which they were attributed consisted of multiple generations and the remains were likely to be spread throughout. Instead sex estimates were examined in relation to both presence and severity to determine possible correlations between sex and the presence of non-specific stress in childhood.

4.3.1.4 *Cribra Orbitalia*

There has been much research over the past several decades looking into the aetiology of cribra orbitalia, partially spurred on by the high incidence of CO and porotic hyperostosis among the Maya (Wright and White 1996) as well as the transition to agriculture throughout the old and new worlds (Roberts and Manchester 2010). Hooton (1940), believed the presence of CO was directly related to diet (and therefore iron deficiency) as a result of his investigations of subadults at Chichen Itza, a Post Classic Maya site. Stuart-Macadam (1992), conversely, attributes the presence of anaemia (and by extension CO) to parasites and suggests this may have been a positive adaptive response to environmental stress. Holland and O'Brien disagreed with Stuart-Macadam and instead state the presence of anaemia "is a sign that something is seriously wrong" (Holland and O'Brien 1997: 185).

More recently Walker and colleagues (2009) concluded that CO could not be connected to iron deficiency anaemia specifically but rather was likely due to other forms of acquired anaemias as a result of marrow hypertrophy. Furthermore they also felt that the paleopathological expressions of scurvy and rickets, namely subperiosteal inflammation, could easily be mistaken for CO at the macroscopic level and therefore determined more work was needed on the complex aetiology of CO. Overall they stated the "synergistic effects of nutritionally-inadequate diets, poor sanitation, infectious disease and cultural practices" could all contribute to the high rates of CO in the archaeological record (Walker *et al.* 2009: 114). Due to the possible connections and disagreements regarding its link to iron deficiency anaemia, other forms of anaemia, parasites and the possible confusion with other nutritionally-deficient diseases, it was decided to not attempt to correlate CO with a specific cause, especially when the associated post-cranial elements were usually unavailable for analysis. Instead, as most in the literature agree that CO indicates an alteration to the quality of life of individuals, and therefore by extension a less than healthy person, its presence suggested an individual in stress.

Orbits were observed (when available) and scored based on an adaptation of Stuart-Macadam (1991), (see Table 4.2 for a summary of the method). Both age ranges and sex were studied in relation to CO to determine if the stress affected one group more than another. As bone remodels it is also possible to determine if the stress was specific to subadults or could afflict any age group. Additionally, age was also a consideration in itself, as it has been established that the more severe form of anemia, expressed as a score of four or above in subadults, actually suggests a more moderate form of the stress when demonstrated in adults (Wright and White 1996: 157) and therefore any evidence of severe CO in adults was cautiously interpreted.

Score	Description
0	Not observed
1	Absent
2	Scattered fine foramina
3	Small and large isolated foramina
4	Trabecular structures of linked foramina
5	Trabecular outgrowth from the outer orbital table surface

Table 4.2 Scoring for CO (based on Stuart Macadam 1991).

4.3.1.5 Dental Diseases

A complex combination of mastication, food processing techniques, food quality, dental hygiene and using the dentition for non-consumption purposes led to the development and severity of dental diseases and alterations. Although modern populations are aware of the importance of dental hygiene and many have access to dentists to alleviate dental problems, Roberts and Manchester (2010) suggest that it is likely that oral hygiene and dentistry were not significant enough in archaeological populations to affect or influence the presence, severity and results of dental diseases, and rather it was particular diets that led to their manifestation in the past. Dental caries, abscesses and antemortem tooth loss (AMTL) were focused on for this project as all were present in prehistory and all affect the individual in varying degrees from a minimal nuisance to possible death.

4.3.1.5.1 Caries

Caries are typified by the decalcification and destruction of enamel, cement, dentine or root as a result of extensive acid production due to bacteria formation as a result of the continued presence of dental plaque surrounding the lesion area (Hillson 1996). In the early stages of development, initiated by microbial action that demineralises tooth surfaces, opaque or brown spots on the enamel or cement exposed as a result of periodontal disease were a product of the fermentation of sugars found in the diet (Roberts and Manchester 2010: 65). In the later stage, this leads to extensive cavities and can result in complete crown or root destruction. Due to the range of taphonomic processes and post-excavation alterations affecting the dentition, it was decided to not record the initial stage of caries (specifically the presence of spots) so as to not artificially increase the prevalence rates (Roberts and Manchester 2010: 66).

All teeth were examined and the initiation site of the caries was recorded as occlusal surface sites, approximal sites (smooth crown surfaces along the buccal and lingual margins and between interproximal surfaces but not the cervical margin) or the root site (including the cement-enamel junction (CEJ)), after Hillson (1996). The severity of occlusal and approximal caries were recorded based on the scoring method presented in Table 4.3, after the work of Lukacs (1989: 267). Root site caries were scored the same way as Table 4.3 for levels 0 and 1, with 2 representing a shallow crater on one side of the root and 3 denoting broad shallow craters extending on two or more sides of the root. Higher levels of severity are not possible to record, as they would result in the loss of the tooth without leaving any indication on the

surrounding alveolar bone. Additionally, when the initiating site is unknown, due to the extent of the caries, they were classified as gross caries and not placed within one of the site categories (Hillson 2001: 273).

Score	Description
0	Not observed
1	Absent
2	Pit/Fissure
3	Less than half the crown
4	More than half the crown
5	Complete crown destruction

Table 4.3 Scoring for caries (based on Lukacs 1989: 267).

In a determination of rates it was found that a raw percentage of teeth affected would not produce comparable results and therefore the teeth were first separated into anterior, premolar and molar teeth, as well, mandibular and maxillary teeth were detailed separately and the presence of caries was recorded within these subsets. Due to the range of aetiologies for AMTL it was determined that a missing tooth would not necessarily correlate with a carious lesion, therefore, they were recorded as absent and not considered in the percentage of teeth affected. This conservative assessment was used to determine the minimum number of teeth affected, which would not extrapolate conclusions beyond the available data. Individuals were also separated into wide age groups of subadults and young adults against middle and old adults. As Hillson (2001: 272) noted, the difficulty of using attrition as an ageing method and considering the prevalence of caries when attrition has been connected to both increasing age and presence of caries is a concern. However, by creating only two age groups it is hoped some of this circular argument is avoided, and more importantly that caries presence is considered for the range of sites (and not just the occlusal surface), which ideally will decrease the possibility of a strict correlation between caries, attrition and age.

4.3.1.5.2 Abscesses

Dental caries can predispose a tooth to the development of an abscess as a result of the exposure of the pulp cavity, however attrition, periodontal disease and trauma, all which allow for the invasion of bacteria, may also lead to the development of a localised collection of pus near the tooth root apices within a cavity (Roberts and Manchester 2010: 70; White and Folkens 2000: 403). Within archaeologically derived populations, the presence of an abscess can only be noted once the bacteria and dead cells (the pus) builds enough pressure in the cavity to develop a sinus on the surface of the alveolar bone to allow it to escape (Roberts and Manchester 2010: 70).

In the analysis for abscesses, three aspects were considered. First was the state of healing, recorded as active or healed at the time of death, based on the presence of rounded edges of the margin. The location of a sinus was examined and observed as either internal or external. Finally the size of the abscess was considered as moderate (less than five millimetres) or

severe (more than five millimetres). The presence or absence of the tooth itself was also noted. The variables of age groups and sex were considered in association with the presence of abscesses to determine any possible correlations, as the aetiology is not specific to one particular group.

4.3.1.5.3 Antemortem Tooth Loss

The loss of a tooth (or multiple teeth) prior to death can be the result of a number of factors including a complication of caries, abscesses, using teeth for non-masticatory purposes, purposeful removal for cultural or pathological reasons, accidental or traumatic loss or as a result of the loss of associated alveolar bone due to periodontal disease (Hillson 2001: 268).

In the dental assessment a number of factors were considered regarding AMTL, primarily the number of teeth considered lost antemortem within the dentition. The second determination is the stage of healing, from a recent loss with a minor amount of healing (stage one), initial remodelling of bone (stage two) or complete root cavity infilling and closure (stage three). Finally, adjacent dental pathologies (namely caries or abscesses) are also recorded if they are considered related to the tooth loss. AMTL prevalence was based on the number of teeth missing from available mandibular and maxillar bone. If the bone, or part of bone was unavailable it was not considered in the total number of teeth (or tooth roots) present in order to remain conservative in the estimation of AMTL. Age groups, as defined in the age estimation section, were examined, as well as sex in order to determine correlations that may exist beyond the established parallel of increasing age and AMTL.

4.3.1.6 *Degenerative Changes*

During the normal ageing process in humans, the weight of the body coupled with activity, diet, trauma and pathologies leads to a degeneration (gradual or acute depending on the causal factors) of the joints of the skeleton and eventually may result in decreased or limited mobility. Many degenerative changes, such as those of the pubic symphysis and articular surface, have been used as reliable ageing methods, as they tend to change at recognised intervals. Others, such as the joints of the hips, wrists and knees are largely based on the amount of physical stress and therefore can present a range of variability that is, to a certain extent, removed from age. There are a variety of diseases to examine to explain the patterns of activity and degeneration in past populations and for this project osteoarthritis (OA) and vertebral joint disease (VJD) were chosen to exemplify alterations to the body, and provide a basis for discussion regarding daily life and degenerative changes in prehistory.

4.3.1.6.1 Osteoarthritis

Osteoarthritis (or degenerative joint disease) is characterised by both bone destruction and formation in synovial joints (Roberts and Manchester 2010: 136). Destruction, or erosion, is first seen in the articular cartilage of the joint and then also in the joint itself as porosity and

eburnation. Bone formation or proliferation, is typified by the creation of osteophytes to attempt to compensate for the loss of joint stability as a result of cartilage alteration and the fusion of the adjacent bones to one another with the complete destruction of the articular cartilage (White and Folkens 2000: 398).

Skeletons were examined and joints were scored based on the criteria set out by Jurmain (1990) (see Table 4.4 for a summary of the scoring method). Additionally, differentiation of cause was based on the location of the OA with a localised alteration to one or more adjacent elements suggesting the deterioration is the result of trauma, the regionalisation of the OA signifying activity-induced changes and systemic degeneration implying progressive OA synonymous with the normal ageing process. In the case of systemic degeneration, the age estimate was also considered to further determine the reality of the normal prehistoric ageing processes.

Score	Description
0	No evidence
1	Moderate with porosity and minimal osteophytes
2	Severe osteophytes leading to an altered joint contour and eburnation
3	Fusion of joint

Table 4.4 Scoring of OA (adapted from Jurmain 1990).

4.3.1.6.2 Vertebral Joint Disease

Vertebral joint disease, or spinal joint disease, is a subsection within degenerative joint disease, and is the direct result of spinal stress brought on by the human evolution of bipedalism and an upright posture (Roberts and Manchester 2010: 139). As a result of daily life and associated movement, the intervertebral discs of the spine begin to rupture and the bone compensates through bone growth of marginal osteophytes around the vertebral bodies to add stability to the joint surface, while the disc pressure on the bodies creates indentations known as Schmorl's nodes. Additionally, the apophyseal joints and the synovial joints are also affected by joint degeneration and can exhibit porosity, osteophyte formation, eburnation and fusion (Roberts and Manchester 2010: 140). All available vertebral bodies were examined for the presence of Schmorl's nodes, marginal osteophytes, porosity, eburnation and fusion according to the scoring method presented in Table 4.5. As the presence of the entire spine was limited, it was not often possible to interpret the presence of VJD relative to the individual vertebrae of the spine within a skeleton, however the affected section (cervical, thoracic, lumbar) was noted and compared across individuals and sites.

Score	Description
0	No evidence
1	Mild marginal osteophytes and porosity
2	Moderate marginal osteophytes altering joint contours, Schmorl's nodes, eburnation
3	Joint fusion

Table 4.5 Scoring of VJD.

4.3.1.7 Trauma

In archaeological discussions, trauma has often been synonymous with conflict and violence, however, in reality, trauma encapsulates a wide range of skeletal changes brought about by the interaction of individuals with their environment, the landscape and people around them. Beyond the interpersonal violence, trauma, in the form of cranial and post-cranial fractures, may be due to simple accidents, activity or work related mishaps or as a secondary result of pathologies. The reason for the inclusion of trauma in this project is to determine the overall well being and general risk of everyday life in prehistory on the Wolds.

4.3.1.7.1 Fractures

Strictly speaking, a fracture is the partial or complete break of a bone, however the range of types and causes of fractures, and the resulting alterations during healing may have many manifestations and produce lasting changes to quality of life. There are three stages of healing associated with fractures, the first is cellular in nature and begins within two days of the injury and involves the closure of the fracture and the formation of a primary callus of immature, woven bone. This stage can take anywhere from three to nine weeks depending on the bone involved, the severity of the fracture and the ability to immobilise the injury for a significant period of time (Roberts and Manchester 2010: 91). The second, metabolic stage sees the conversion of the woven callus to one of mature, lamellar bone, which provides additional strength and reinforces the initial callus. The final stage, mechanical in nature, can take up to several years to complete and is focused on the realignment and remodelling of the bone along the fracture lines, which ultimately results in the complete restoration of bone structure and loss of the fracture line (Roberts and Manchester 2010: 92).



Figure 4.1 Common cranial fracture types (Lovell 1997: 149).

From left to right: simple linear fracture due to blunt trauma; comminuted depressed fracture due to blunt trauma and comminuted penetrating fracture from a high velocity projectile.

Fractures were differentiated by cranial and post-cranial injuries. Cranial injuries were identified as blunt or sharp force and their breakage pattern, when possible to assess, was listed as linear, depression, or puncture/penetration, (see Figure 4.1, after Lovell (1997)). Post-cranially, fractures were identified as caused by either direct or indirect trauma, (see Figure 4.2 for visual representations of the types of fractures within each cause, after Lovell 1997).

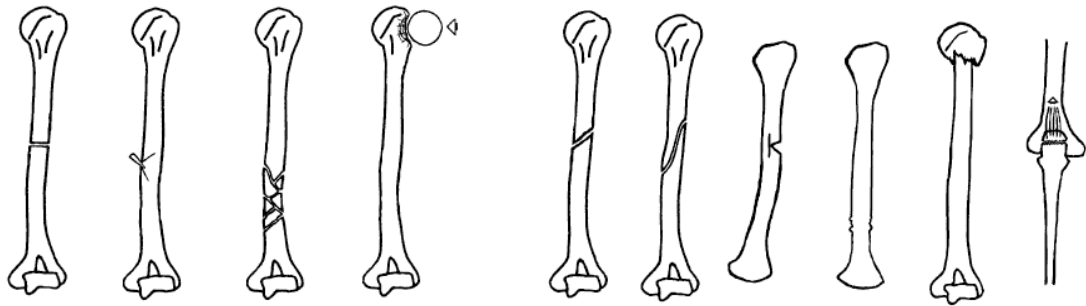


Figure 4.2 Types of fractures caused by direct and indirect trauma (Lovell 1997: 142-3).

Direct trauma from left to right including transverse, penetrating, comminuted and crush and types of fractures caused by indirect trauma including oblique, spiral, greenstick due to angular force, greenstick due to compression, impaction and avulsion.

The surrounding bone was also examined for associated and secondary alteration including localised OA, evidence of infection, mal-alignment resulting in reduced use or mobility, rotational deformity or limb shortening. Both types of fractures were assessed for the stage of healing, and the summary of the scoring method is listed in Table 4.6. Although it would have been beneficial to use radiographs to assess the amount of apposition and mal-alignment, due to the constraints of keeping museum specimens at the museum and not having access to a radiography machine at those sites, it was not possible to comment on the accurate state of fractures in these respects. The findings were examined against age and sex to determine possible correlates with activities, accidents and interpersonal violence. Patterns of fractures on multiple individuals were also explored to shed possible additional light on causal factors.

Score	Description
0	No healing, suggesting fracture occurred at or very near time of death
1	Deposition of woven bone
2	Deposition of lamellar bone
3	Fully healed with faint impression of fracture line

Table 4.6 Scoring methods for fractures.

4.3.1.8 Summary of Osteological Methods

In closing, a range of osteological variables were examined and identified on the prehistoric Wolds skeletons. In all instances the most appropriate methodologies relating to the preservation and population composition of the project were employed and as a result a number of key paleopathological subsets were considered. Beyond sex and age estimation, evidence of non-specific stress, dental diseases, degenerative changes and trauma were recorded to fulfil the project objectives. By focusing on these variables the quality of life and social status of the individuals and groups from the Bronze and Iron Ages were determined. Beyond the macroscopic analysis, two populations, those at Staxton Beacon and Melton, were the subject of additional bioarchaeological methodologies to ascertain further information on the quality of life, social status and mobility of these individuals.

4.3.2 *Bioarchaeological Methods*

4.3.2.1 *Introduction*

Bioarchaeological methods are at the current forefront of archaeological research and are the result of the adoption of scientific techniques from the subdisciplines of chemistry, biology, physics and geology in order to better understand the lives of individuals and groups using direct evidence derived from teeth and bones. Due to the need for sample destruction in order to analyse stable isotopes, many museum institutions have strict non-destruction clauses for osteological analysis in order to preserve human remains for future generations of researchers. As such it was only possible to sample from the Bronze Age site of Staxton Beacon and the Iron Age site of Melton.

The stable isotopes of strontium, oxygen, carbon and nitrogen were selected for this project in order to better determine the mobility and diets of these two groups. All four of these isotopes have been used extensively in the archaeological literature and have provided independent forms of evidence from which to extrapolate information regarding the migration of people and ideas as well as the basic terrestrial versus marine composition of diet and its possible variation within a population. Integral to bioarchaeological work, however is the interpretation of results and therefore the stable isotopic evidence will be combined with other forms of evidence, when available, in order to answer the three objectives of this project.

4.3.2.2 *Strontium*

As different rocks are characterised by different ratios of strontium they weather differently into the rivers and surrounding ground water. The resulting ratios are incorporated into plants through a combination of the soils and water that feed them, and by extension into the animals and humans that eat them (Bentley *et al.* 2004; Hedman *et al.* 2009). Strontium is similar to calcium, however it has no metabolic function so the body processes it as though it were calcium. Therefore the body accumulates most of it in bones where it can substitute for calcium in the hydroxyapatite as it models and remodels and in the dentition until it mineralises (Burton and Wright 1995). The $^{87}\text{Sr}/\text{Sr}^{86}$ content seen in teeth is therefore a reflection of all the foods in the diet at the time of formation and mineralisation (Bentley *et al.* 2004). Additionally, as strontium does not fractionate (due to its relatively large atomic mass (Bentley 2006)) as it moves through trophic levels (for example from the bedrock to soil to herbivore to carnivore) the end ratios seen in teeth should be a representative sample of the geologic region in which the individual grew up (Sealy *et al.* 1991:400).

4.3.2.2.1 *History of the methodology*

In 1956 Turekian and Kulp established that there were distinct regional differences in strontium content in almost all types of rock. Strontium was employed by geologists to assess

the age of rocks and the structure of the earth to determine its origins (see Faure and Powell 1972, as reported in Ericson 1985). As early as the 1950s archaeologists began looking at the connection between strontium and diet and surmised that bones and teeth could reveal evidence of specific trophic level exploitation (Odum 1957 as reported in Elias 1980).

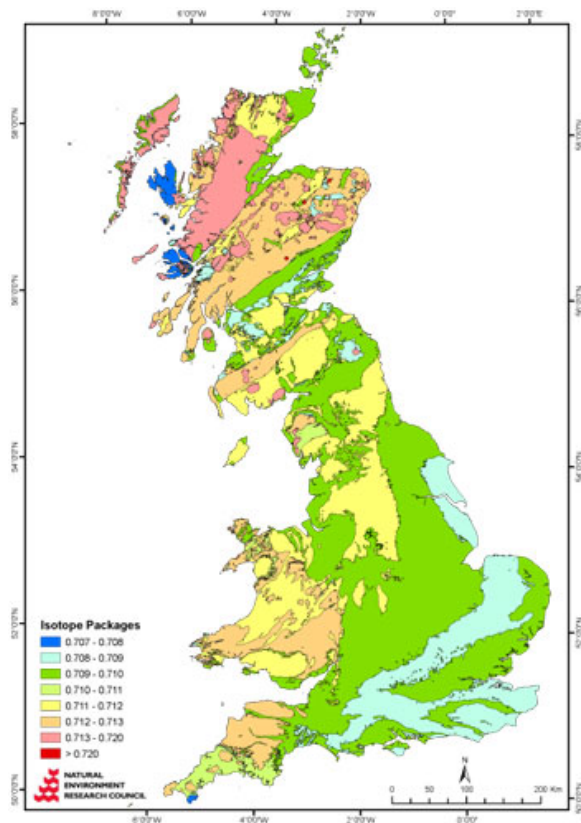
Ericson conducted the first influential strontium isotope migration work in 1985. His aim was to present a new methodological approach to study specific behavioural patterns related to human subsistence and migration. The pilot sample was composed of tooth enamel (from the second molars) and bone (metatarsals) from three individuals of the prehistoric Californian population of Chumach Indians in two cemetery groups (Ericson 1985). He chose these two samples in order to ascertain pre and post marital residence. Ericson (1985) brought attention to a variety of important considerations including using dental enamel as opposed to dentine as it preserves the biogenic record and is less affected by diagenesis. In addition, he highlighted possible problems with the methodology including the need to establish the extent of strontium geographic variability within the population, pinpointing the realistic local strontium isotopic signature by sampling a large number of human bones and soil and rock to determine baselines and understand the effects of diagenesis on samples and therefore results (Ericson 1985: 507-8). His results suggest that pre and post marital residence and subsistence remained relatively stable with limited, seasonal movement between coastal and inland locations. Overall he believed that strontium analysis could provide answers in characterising catchment areas and determining marital residence patterns. This seminal work highlighted what could be gained by strontium analysis and identified key issues related to prospective results that are still being debated today.

4.3.2.2.2 The Local Signal

In order to properly assess strontium results it is necessary to understand the signal that is naturally found within the tested region. The ratios produced from samples can then be compared to geological ratios and those signatures that have been identified as the local range to ascertain whether individuals were mobile in the past, during their formative years compared to their present location. In 2002 Montgomery first suggested a two-component model that used the ratios of the local geological strontium compared to those derived from rainwater. The method assumes that populations are obtaining their food sources from only one type of bedrock (growing and grazing) plus an input from the biosphere. The strontium ratios related to the biosphere, namely those ratios found in rainwater that play an integral part in the complex combination of strontium isotopes that end up in skeletons, must also be considered. Evans and colleagues (2010) have researched and produced a map of the strontium biosphere variation in Britain and the range provided from the bulk strontium value and the biosphere range will establish minimums and maximums in terms of the local range of predicted values (Map 4.1). This method proves useful in geologically homogenous

regions, such as the Yorkshire Wolds (Montgomery 2002; Montgomery *et al.* 2007) and as such is employed in this study.

Montgomery and colleagues (2005) determined the local Yorkshire Wolds strontium signal based on the strontium values obtained for both sand (0.708245 to 0.708379) and chalk (0.707408 to 0.707414). However, based on their work at other local sites (Montgomery *et al.* 2005), they determined that the local enamel $^{87}\text{Sr}/\text{Sr}^{86}$ ratios did not often cluster around those determined for the soils. They discovered that the signals fell between those soils and that derived from modern seawater (0.7092). Montgomery and co-workers (2005: 130) therefore concluded that this meteoric water value needed to be considered, as bioavailable strontium was likely to be influenced. As a result this methodology was applied to this thesis and the strontium values termed local were assigned to the range between 0.707 and 0.7092.



Map 4.1: Strontium biosphere values in Britain, with the Yorkshire Wolds exhibiting values between 0.708 and 0.709 (Evans *et al* 2010).

4.3.2.2.3 Materials

In the early years of strontium analysis there was an understanding that teeth could be used to characterise movement in the early years of life. Enamel is formed in a series of successive layers, the deepest of which, known as core enamel, is considered the least affected by diagenesis within the burial environment as once it has fully matured, becomes non-porous with large dense crystals that cannot be easily permeated (Hillson 1996; Ambrose and Krigbaum 2003). Therefore choosing certain teeth will provide a snapshot of the strontium levels, and by extension geographic location, during a specific time in childhood when the

enamel was mineralising. Although there is a certain amount of variation related to sex and race, dental enamel provides strontium ingestion evidence during key years between formation and mineralisation with the first molar representing birth to age three, the second molar represents the third and a half years through to the seventh and the third molar, the last childhood signature, between ages nine and fourteen (Hillson 1996: 125). Due to these age ranges it was decided to use a combination of two molars (M1 and M3), however when one was not available, second molars were also used, in order to create comparable results with other studies as well as obtaining results for distinct ages.

The basic premise of investigating strontium isotope ratios is to measure the relative abundance of ^{87}Sr isotopes against ^{86}Sr isotopes in a given sample (Hedman *et al.* 2009). The ratio varies as a function of the relative abundance and radioactive decay of ^{87}Rb and/to ^{87}Sr (the half-life of which is 49 billion years), and the age of the rocks (Latkoczy *et al.* 1998; Bentley 2006).

4.3.2.2.4 Methods

Sample preparation occurred in two stages, at two labs. At the Department of Archaeology bioarchaeology lab at the University of York, the teeth being used for analysis were mechanically cleaned using a Dremel Model 800M hand held mini drill with a diamond tipped burr to remove soil, calculus, staining and the outer most layer of enamel to reveal the inner core enamel. The drillbit was cleaned by successive placement into ethanol, Milli-Q water, 0.15 NHCl, and Milli-Q water repeated after surface cleaning and prior to enamel removal and dried using compressed air. For strontium analysis, 1 to 5 mg of inner core enamel was removed from each tooth and placed in a pre-weighed plastic epindorf tube and reweighed.

The remainder of sample preparation and analysis took place at the Faculty of Earth and Life Sciences Clean Lab at Vrije University (VU) in Amsterdam. Upon arrival at VU the powdered samples were leached using the lab's SOPs. Each sample tube received 0.500 mL of 1M HAC and was manually agitated to remove CO_2 that may be present. Samples were then centrifuged for 2.5 minutes at 1200 RPM. The acid was then pipetted out and 0.250 mL of Milli-Q water was added, manually agitated and centrifuged at 1200 RPM for 2.5 minutes and repeated once more. When the remaining Milli-Q water was pipetted out, 0.250 mL of 3M HNO_3 was added to each tube and left for thirty minutes, manually agitating the tubes every fifteen minutes to remove any lingering CO_2 .

The resin used to separate the strontium isotopes within the columns was cleaned with Milli-Q and centrifuged for two minutes at 1200 RPM. The resin was then injected into pre-cleaned columns. Successive additions of 0.750 mL of 3M HNO_3 and 0.750 mL of Milli-Q water were placed in the columns three times and then the resin was conditioned with 0.375 mL of 3M HNO_3 . One drop of 0.5% H_3PO_4 was placed within the sample collection beakers and when

they were placed under the columns 0.450 mL of the samples were loaded into the columns and were collected into the beakers using 0.750 mL of Milli-Q water. One extra beaker (per twelve samples) was reserved for the standard and a spike of 0.1 g of Spike 20100208 was added to the beaker in place of the sample. The beakers were then placed, opened, under a flow hood on a hot plate over night to dry out.

While the samples were drying filaments were made using a Unitek Weldmatic by welding single ribbons of rhenium to the filament holder legs. The associated plates and shields were then manually cleaned using corrosive powder and a tooth brush to remove any old rhenium and persistent particles and they, along with the filaments, were all boiled in demi water for twenty-five minutes and then placed in boiling Milli-Q water for twenty-five minutes and finally placed in an oven at 120° C for one hour to dry. The filaments, once dry, were outgassed using an outgassing machine for approximately thirty minutes to remove any additional impurities from the water and air.

Once the samples, filaments, plates and shields were dry, the samples were loaded onto the filaments. Using a spaghetti tube, 2 to 4 μl of HNO_3 was placed in the beaker with the sample and set aside. At the same time the filament legs were inserted into a filament heater and using another spaghetti tube, 2 μl of TACl_5 was added to the middle of the rhenium one drop at a time until two or three drops had partially evaporated using a current of 1.30A. Using a new spaghetti tube, 200 ng from the sample was added onto the partially evaporated TACl_5 at a current of 1.30A one drop at a time until fully loaded. When loaded, the current was increased to 1.60A until the liquid turned black. The current was then slowly increased again to 2.25A and then progressively increased to a maximum of 2.4A until the sample turned red, at which point the sample was ready for analysis. The filaments were then placed on the turret and the plates and shields were fastened into place. The turret was then positioned in the TIMS machine with twelve samples and one standard (NSB 987) and analysed. TIMS works by thermally ionizing isotopes by passing a current through the rhenium under a vacuum. The ions that are thus created are then accelerated and focused into beams. Once these beams are passed through a magnetic field the ion beams are dispersed based on their separate mass to charge ratios. These separate beams are finally directed and collected into Faraday cups where they are converted into voltages. The individual beams within each cup are then compared to one another to determine isotopic ratios.

4.3.2.3 Oxygen

Oxygen has three stable isotopes (^{18}O , ^{17}O , ^{16}O), however ^{18}O and ^{16}O are most commonly involved in stable isotopic analysis of archaeologically-derived human remains as they create greater mass differences (Schoeninger 2010: 454). Although the water cycle of evaporation and condensation creates predictable global patterns of $\delta^{18}\text{O}$ in water and animals

(Schoeninger 2010: 454), oxygen isotope abundance ratios are affected by climatic and water sources including those variables related to latitude, distance from the coast and altitude (Katzenberg and Saunders 2008: 430). These all affect the regional expression of oxygen isotopes in precipitation and ground water and ultimately in plants, animals and humans who inhabit or exploit the region. Unlike strontium, oxygen fractionates within the body, but unlike carbon and nitrogen (which also fractionate), oxygen fractionation is consistent both between and among mammalian species (Budd *et al.* 2004: 128). As a result the predictive nature of the ratio, it is possible to determine the presence of locals and non-locals within a given territory.

4.3.2.3.1 History of the methodology

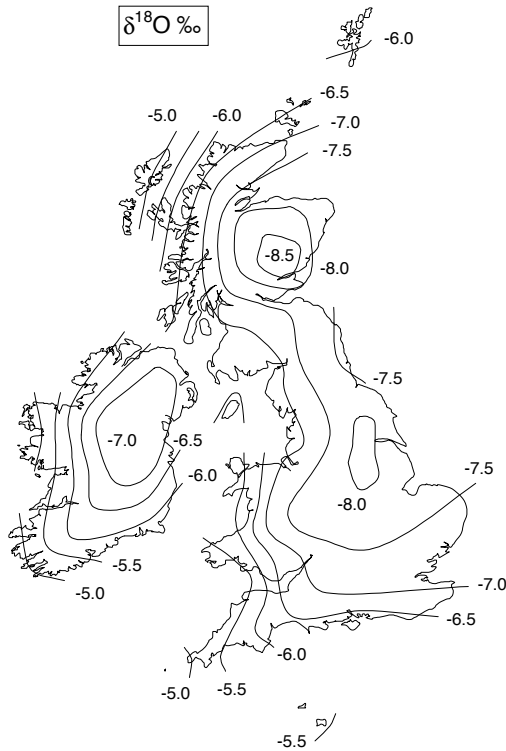
Oxygen was first explored by geochemists attempting to understand its variation and its potential for studies on past climate. In the 1950s and 1960s this research resulted in a major improvement in the understanding of the earth's biosphere and geosphere (Katzenberg and Saunders 2008: 414). Some of the earliest archaeologically-related work involved examining the seasonal occupation of midden sites (Shackleton 1973) and the collection of molluscs by prehistoric people using seasonal growth increments, such as that by Killingley (1981). In 1984 Longinelli determined that the oxygen isotopes found within skeletal tissue is the direct result and ratio of that consumed through drinking water. Due to this important discovery, archaeologists began to apply oxygen stable isotope analysis directly to humans. The ratio of oxygen stable isotopes has most often been employed to identify the potential geographic origins of prehistoric people including discrete populations (Evans *et al.* 2006) as well as the presence of first generation immigrants within cemeteries (Budd *et al.* 2004).

4.3.2.3.2 Materials

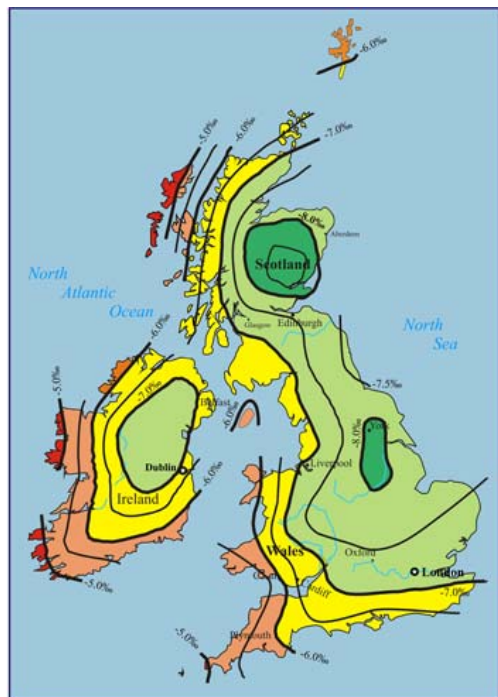
Much like strontium, oxygen within dental enamel is formed during tooth mineralisation as a result of the intake of water resources, and provides a time capsule of the hydro-location of individuals in early childhood. As oxygen analysis formed a pilot study within this project, it was decided to test one tooth type, the first molar, in order to have readily comparable results within a small sample size of oxygen-isotope residential locations from early childhood between the estimated ages of birth to age three.

Recent work has been conducted on the oxygen isotopic ratios of rainfall, surface water and ground water in Great Britain (Darling *et al.* 1999, 2003; Darling and Talbot 2003) meaning researchers have a solid base from which to extrapolate and compare information with that which is archaeologically derived. By consulting these maps (Map 4.2 and 4.3) it is possible to determine the probable regional origins of those termed non-locals based on their oxygen isotope ratios. Additionally, in 2006, on behalf of the British Geological Survey, Gale and Rutter published their report exploring the chalk aquifer of the Yorkshire Wolds. Based on 49 $\delta^{18}\text{O}$ values derived from 49 boreholes and springs across the region they determined the

Yorkshire Wolds oxygen values clustered between -8.4‰ to -7.0‰ (Gale and Rutter 2006: 34). Therefore, as this was the largest reported range, the local oxygen signal was determined to fall between these values.



Map 4.2: Oxygen values derived from rainfall for the British Isles, with the Yorkshire Wolds signal hovering around -7.5 (Darling *et al.* 2003).



Oxygen Isotope Values for UK Spring and Well Waters
 ■ δ¹⁸O -4 to -5 ■ δ¹⁸O -6 to -7 ■ δ¹⁸O -8 to -9
 ■ δ¹⁸O -5 to -6 ■ δ¹⁸O -7 to -8

Map 4.3: Oxygen values for Britain based on ground water, with the Yorkshire Wolds ranging between -7 to -8 (Darling *et al.* 2003).

4.3.2.3.3 Methods

Initial sample preparation was carried out at the Department of Archaeology Bioarchaeology lab at the University of York. The teeth being used for analysis were mechanically cleaned using a Dremel Model 800M hand held mini drill with a diamond tipped burr to remove soil, calculus, staining and the outer most layer of enamel to reveal the inner core enamel. The drillbit was cleaned by successive placement into ethanol, Milli-Q water, 0.15 NHCl, and Milli-Q water repeated after surface cleaning and prior to enamel removal and dried using compressed air.

For oxygen, a minimum of 0.5 mg was collected and placed in 2 mL micro-centrifuge tubes where 1.8 mL of 1.7% NaOCl was added. The tubes were manually agitated for one minute before allowing them to stand for twenty-five minutes, after which they were centrifuged for five minutes at 1250 RPM. The acid was then pipetted out and 1.8 mL of Milli-Q water was added and the samples were centrifuged for five minutes at 1250 RPM and the process was repeated three times before the final removal of the remaining water and the addition of 1.8 mL of 0.1M Acetic acid. The sample was manually agitated for one minute, left alone for five and then centrifuged at 1250 RPM for five minutes. The acid was then removed with a pipette and the sample was rinsed three times with distilled water. As much of the water as possible was then removed and the tubes were placed in a -80°C freezer overnight before being transferred to the freeze dryer for twenty-four hours. The sample, now in freeze-dried form, was sent to Bradford University for analysis.

4.3.2.4 Carbon and Nitrogen

The old maxim 'you are what you eat' could not be more correct than when describing the stable isotopes of carbon and nitrogen found within human collagen. Carbon, derived from atmospheric CO_2 is photosynthesized into the food chain through plants, while nitrogen, taken up from the soil, and in some cases the atmosphere, is absorbed by those at the base of the food chain. Both elements form essential amino acids in collagen, which can then be measured to determine the basic composition of protein based diets, namely those obtaining their nutrition from terrestrial or marine based sources. Carbon remains relatively stable as it is ingested and as it travels up the food chain, while nitrogen becomes enriched as it moves up the trophic levels of the food chain (Linderholm and Kjellström 2011: 926). The $^{12}\text{C}/^{13}\text{C}$ ratio seen in bones represents the protein sources in the diet (with a major component being the ingestion of C^3 versus C^4 plants. However as there is no evidence of C^4 plants in Britain before the Roman period, this aspect of carbon isotopes will not be covered further (Jay and Richards 2007: 172)) and the $^{15}\text{N}/^{14}\text{N}$ ratios represent an exploitation of a certain trophic level of food resources (White and Folkens 2000: 488). Overall these two stable isotopic measurements can reveal the local and possibly longer-distance food selection strategies and

therefore the dominant protein, and ultimately, provide information on the natural environment that was at a population's disposal.

4.3.2.4.1 History of Methodology

During the late 1970s several studies employed the stable isotopic analysis of carbon to research questions, and the first to be directly applicable to archaeology was a study to determine the importance of maize in the diets of early North Americans (Vogel and van der Merwe 1977: 238). Pollard (2008: 363) states their study "single-handedly established isotopic human paleodietary studies as legitimate and fruitful". At the same time, in 1978, DeNiro and Epstein demonstrated an experimental correlation between $\delta^{13}\text{C}$ values of the exoskeletons of animals and the $\beta^{13}\text{C}$ ratios from their diets and a few years later in 1983 Schoeninger and DeNiro determined that nitrogen values also varied between dietary sources and observed a division between marine and terrestrial isotopic signatures. Further to this work, Ambrose and Norr (1993) found that the carbon and nitrogen in amino acids that combined to form human collagen was at least partially derived from the dietary protein. These findings spurred on stable isotopic work using human bone in Europe in order to answer a range of research questions including those focused on the importance and significance of marine resources in early prehistory (Richards *et al.* 2003), the arrival and potential exploitation of C^4 plants (Gil *et al.* 2011) and the possible connection between differential diet (or access) and status (Jay and Richards 2006).

In 1999 van Klinken drew attention to serious concerns regarding human bone collagen quality in connection to carbon and nitrogen analysis and established quality parameters to not only ensure adequate collagen content and intactness for viable results but also collagen quality to ensure accuracy and cross-comparisons of results. He suggested a cut-off point in collagen yields of between 0.5% and 1% in order to maintain a quality result as he surmised that a yield of less than 0.5% would make it difficult to remove contamination and guarantee representative findings. Connected to contamination issues is the choice of bone type. Jørkov and colleagues (2007) found in their analysis of bone collagen extraction methods, that trabecular bone is more easily contaminated than compact bone and suggested a methodology including ultrafiltration in order to limit the possible degradation effects to the isotope values. Although this will ultimately result in lower collagen yields, overall it minimises the possible presence of contaminants and instils an additional measure of confidence in the findings.

Finally, a third quality check to ensure accurate results in carbon and nitrogen isotopic studies is to consider the C:N ratio of the sample. In 1985 DeNiro suggested an acceptable range of between 2.9 and 3.6, as that is the range of modern animals and humans, however van Klinken (1999) argued that range was too wide to measure quality and instead pointed to the tighter range of 3.1 to 3.5, as this is the range employed by Oxford Radiocarbon

Accelerator Unit to determine a sample's acceptability. All three of these points were considered and applied in the analysis of the Yorkshire Wolds material in order to safeguard the results.

4.3.2.4.2 Materials

The analysis of carbon and nitrogen isotopes involves the destructive sampling of bone in order to obtain either bone apatite or bone collagen. Bone apatite is often used to provide a more detailed representation of diet, as it is believed to characterise a mixture of dietary protein, carbohydrates and fats; while collagen predominantly produces a signal based on dietary protein (Tykot 2004: 434). However, as bone apatite is not only more susceptible to contamination (even despite additional protocols such as ultrafiltration) and as the survival is often in question (Jørkov *et al.* 2007), bone collagen was determined to be the best and most reliable source of paleodietary stable isotopic results.

The two main types of bone commonly used for analysis are compact (such as long bones) and trabecular (such as ribs) bones. Carbon and nitrogen ratios derived from long bones, as their collagen turn-over rate is slow, generally represent diet over the last ten to fifteen years of an individual's life (Fischer *et al.* 2007). Values obtained from ribs, with a faster bone turnover rate, provide evidence of an individual's diet in the last five years of life (Pollard 2008: 367). Based on skeletal element preservation as well as the decision to include ultrafiltration within the methodology, it was decided to predominantly analysis carbon and nitrogen found in the trabecular bone of ribs, while, when unavailable, long bone sections were also sampled.

4.3.2.4.3 Methods

Sample preparation was carried out at the University of York, where the bone was cleaned manually with a scalpel to remove the outer surface of the bone and any additional dirt and contaminants. In some instances the bone sample was much larger than required and a water drill was used to cut the bone to a smaller size. All sectioned pieces were then washed under running water to remove any additional dust from the outer surface. They were left to dry overnight and then crushed using a percussion mortar. Between each sample preparation the mortar and pestle were cleaned by successive placement into ethanol, Milli-Q water, 0.15 NHCl, and Milli-Q water. Approximately .500 mg was required for combined carbon and nitrogen analysis, and the crushed samples were then placed in pre-weighed and pre-labelled tubes and reweighed.

To demineralise the samples 8 mL of cold 0.6M HCl was added to each tube and the caps were left loosely on for one hour. The tubes were then placed on a horizontal shaker in a cold room for several days until the sample became soft. Every two to four days the tubes were centrifuged at 3000 rpm for ten minutes at 4°C and the acid was replaced. When the samples

were ready they were centrifuged for ten minutes at 3000 rpm and the acid was pipetted out. The tubes were then rinsed three times with Milli-Q water using the same method as above to remove the acid. The remaining sample was gelatinised by adding 8 mL of HCl pH3 to the tubes that were then placed in an oven set to 75°C for 48 hours. The tubes were then positioned in a centrifuge at 3000 rpm for ten minutes at 4°C.

Ultrafilters were prepared by filling them with 2 mL of 0.1M NaOH and centrifuging them at 5000 rpm for eight minutes at 4°C. The 0.1M NaOH was then removed with a pipette and replaced with 2 mL of deionized water, centrifuged for eight minutes at 5000 rpm at 4°C and repeated three times. When the ultrafilters were ready, using a pipette, 4 mL of the sample liquid was placed in the filter and centrifuged at 5000 rpm at 4°C beginning at seven minutes and decreasing in increments of two minutes until most of the sample had passed through the filter. The filtrate was then removed and reserved in labelled test tubes and the process was repeated until the entire sample had passed through the filter leaving behind the collagen. The collagen liquid was then extracted from the filter and placed in a pre-weighed and labelled tube. Then, using .500 mL of the passed filtrate, the sides of the filter were washed and the remaining collagen was placed with the rest of the retained collagen sample.

The retained collagen samples were then placed at a sharp angle in the -40°C freezer overnight until completely frozen and then transferred to the freeze dryer for several days until the samples were lyophilized. The tubes were then reweighed to determine the collagen yield and the samples were prepared for analysis. The collagen was weighed out into three D1000 tin capsules with ideal weights of between 0.8 to 1.2 mg of collagen in each and placed in labelled tubes.

The tubes containing the tin capsules were then sent to Bradford University for analysis. Between 0.3 and 1.2 mg of the sample was weighed into tin cups for analysis in either a Roboprep Combustion Device coupled to a Europa 20-20 Mass Spectrometer or a Flash EA 1112 coupled to a Thermo Delta Plus Mass Spectrometer in the Mass Spectrometer Laboratory at The University of Bradford (Robson 2010).

The samples were measured relative to the vPDB standard (for $\delta^{13}\text{C}$) and the AIR standard (for $\delta^{15}\text{N}$) according to internationally accepted operating procedures using a number of laboratory and international standards that were analysed concurrently with each sample group to ensure instrument integrity (Richards and Hedges 1999).

4.3.2.5 *Limitations*

With respect to the bioarchaeological techniques employed for this project there were two limitations that might have an as yet unknown impact on the results. Primarily is the unfortunately absence of local animal values that would have aided in determining the local

strontium signal and the base lines for both the carbon and nitrogen values. At the site level, the Bronze Age Staxton Beacon barrow that was investigated did not produce any animal remains and as such it was not possible to obtain these values. At Melton, although animal remains were present they were unavailable at time of testing to be assessed on their own. Although this is not ideal, the signal determined for strontium on the Wolds is expected to be quite reliable (Pers. Comm. Jane Evans January 20, 2010). Additionally, in place of animal values for carbon and nitrogen rates, the extensive work conducted by Jay (2005) at Iron Age Wetwang Slack has been employed here as a representational range in order to provide some context for the results at Melton. This shortcoming is fully accepted and as a result extensive discussions regarding the relationship between trophic levels of various animals and humans were not attempted.

4.3.2.6 Summary of Bioarchaeological Methods

Lambert (1997: 214) wrote “the chemical legacy of an extinct people is present not only in surviving creations of their hands (their artefacts), but also their bodily remains and even in the genetic material they pass on to their descendants”. The application of bioarchaeological methodologies in conjunction with osteological as well as archaeological variables provides for the opportunity to delve deeper into the human past and gain a more detailed understanding of individuals and populations. The value of stable isotopic work provides that additional dimension of understanding that may be missed or misunderstood using traditional archaeological and osteological applications. The analysis of strontium, oxygen, carbon and nitrogen isotopic ratios from individuals on the Yorkshire Wolds was indispensable for the determination of this project’s objectives and provided an important body of comparative work from which to extrapolate information on quality of life, social status and mobility.

4.4 Summary

This chapter has focused on the materials and methodology under review and point to the multidisciplinary nature of the project. By combining multiple lines of evidence it is possible to arrive at a more complex understanding of prehistory on the Wolds. The following chapter details the results for each site and time period as a whole to provide a suite of results used for a discussion of the thesis themes, which is explored in Chapter Six.

Chapter Five: Results

5.1 Introduction

This chapter focuses on the results of the osteological and bioarchaeological analysis of the eight sites under examination from the Yorkshire Wolds. The layout begins with a general demographic and preservation overview of the entire sample, which is then followed by a site-by-site analysis with a summary at the end of each time period. Within this chapter the results are presented in chart form, however all data referred to is available in Appendix 2 in table form.

5.2 The Complete Study Sample

5.2.1 Introduction

The complete sample for this project was derived from eight sites, attributed to three periods, spread out throughout the Yorkshire Wolds and includes one hundred and three individuals. As illustrated in Figures 5.1 and 5.2, the sex profile is skewed towards males, while the age profile is biased towards young adults and this relationship was found to be statistically significant ($p = <0.001$, $\chi^2 = 102.521$, $df = 12$).

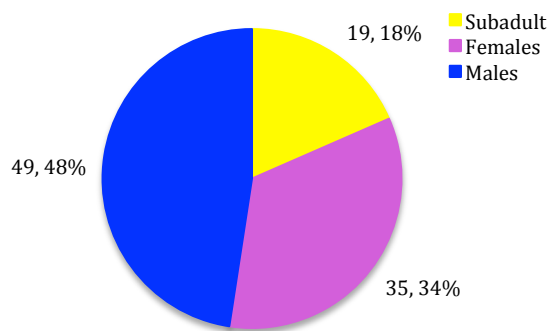


Figure 5.1 Yorkshire Wolds sample profile.

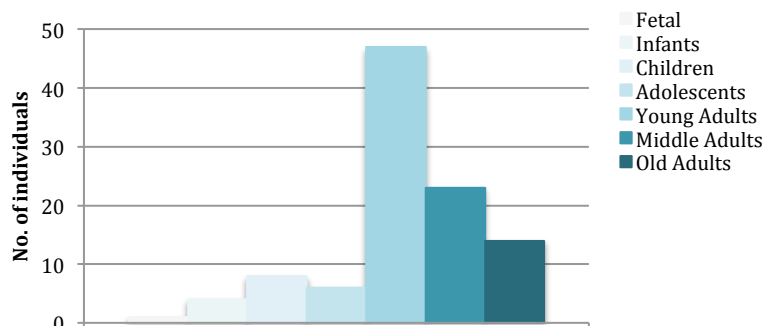


Figure 5.2 Yorkshire Wolds sample profile by age.

The overall adult sample is biased towards males in every age category (Figure 5.3), but when the sample is separated by time period this bias changes and is discussed further within each time period section. The relationship between both sex and age against time period for the overall sample were also found to be statistically significant (sex: $p= 0.002$, $\chi^2=12.349$, $df=2$; age: $p= 0.032$, $\chi^2= 13.81$, $df= 6$), however due to the small sample size of three individuals attributed to the Neolithic, this period was not included in statistical assessments.

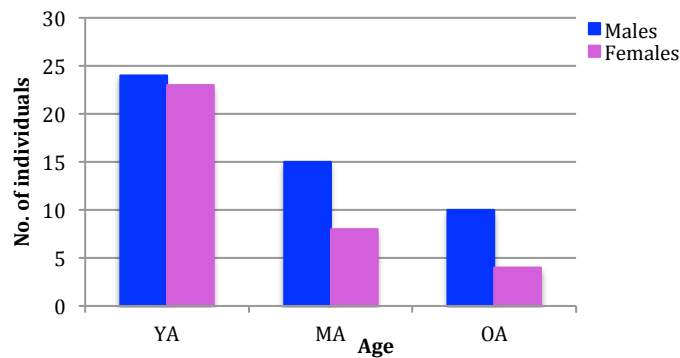


Figure 5.3 Yorkshire Wolds adult profile.

5.2.2 Preservation

The preservation of the sample was quite varied and was heavily influenced by the original excavation methodologies as well as the time since being unearthed. Therefore those discovered by Mortimer and Greenwell were less complete than those uncovered by Manby and On Site Archaeology (Figure 5.4).

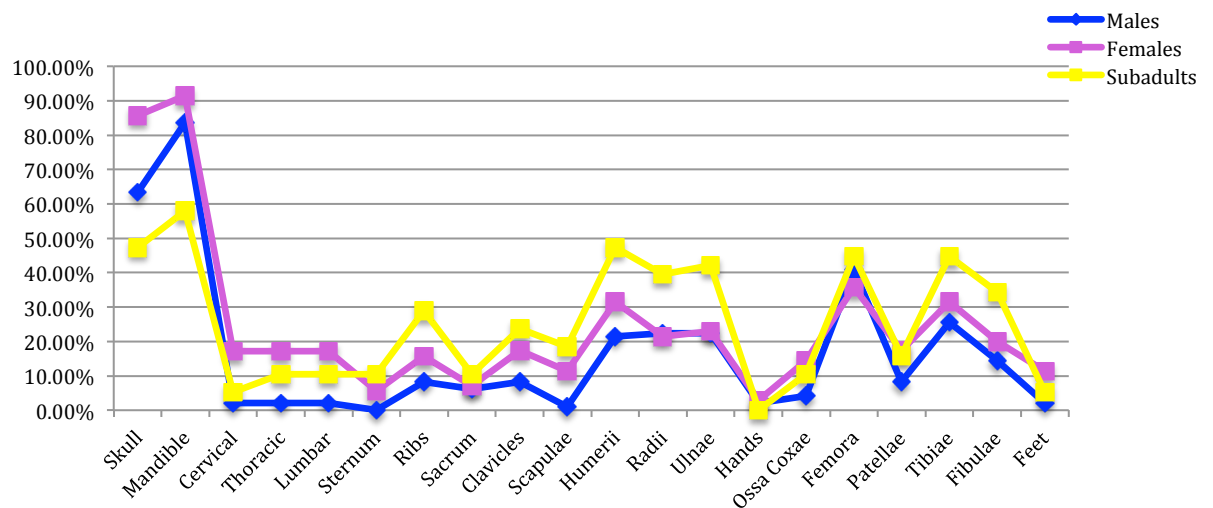


Figure 5.4: Overall skeletal element completeness.

Completeness: Presence of at least 75% of the element, paired elements were combined in order to arrive at a percentage for individuals and each sub-sample.

The preservation level was converted for statistical testing purposes into three scores. A score of one indicated the minimally required skeletal elements (as discussed in Chapter Four), a score of two denoted at least one post-cranial limb bone in addition to the required

cranial elements and a score of three indicated that at least 75% of the entire skeleton was present. When the overall preservation records were examined they were found to be statistically significant in relation to period, site, single or multiple burial, age, and sex, see Table 5.1 for a summary of the statistical findings.

Variable	P Value	Value	Degrees of Freedom
Period	<0.001	15.542	2
Site	<0.001	81.997	14
S/M Burial	0.002	12.269	2
Age	0.009	26.603	12
Sex	0.03	10.685	4

Table 5.1: Overall statistical summary of skeletal preservation.

When the sample was divided graphically by period (Figure 5.5), it was found that the skeletons from the Iron Age were more complete than their Bronze Age counterparts and this may, in part, be explained by excavation methodology at Melton, which was carried out by On Site Archaeology and additionally accounted for almost half of the total Iron Age skeletons (n=18, 40.9%). However, this may also have been influenced by the burial methods for each time period. Although the Bronze Age rite included complete and individual burials, it was not until the Iron Age when it became the norm on the Wolds. This was confirmed with the highly statistical significance of time period as well as that of age and sex.

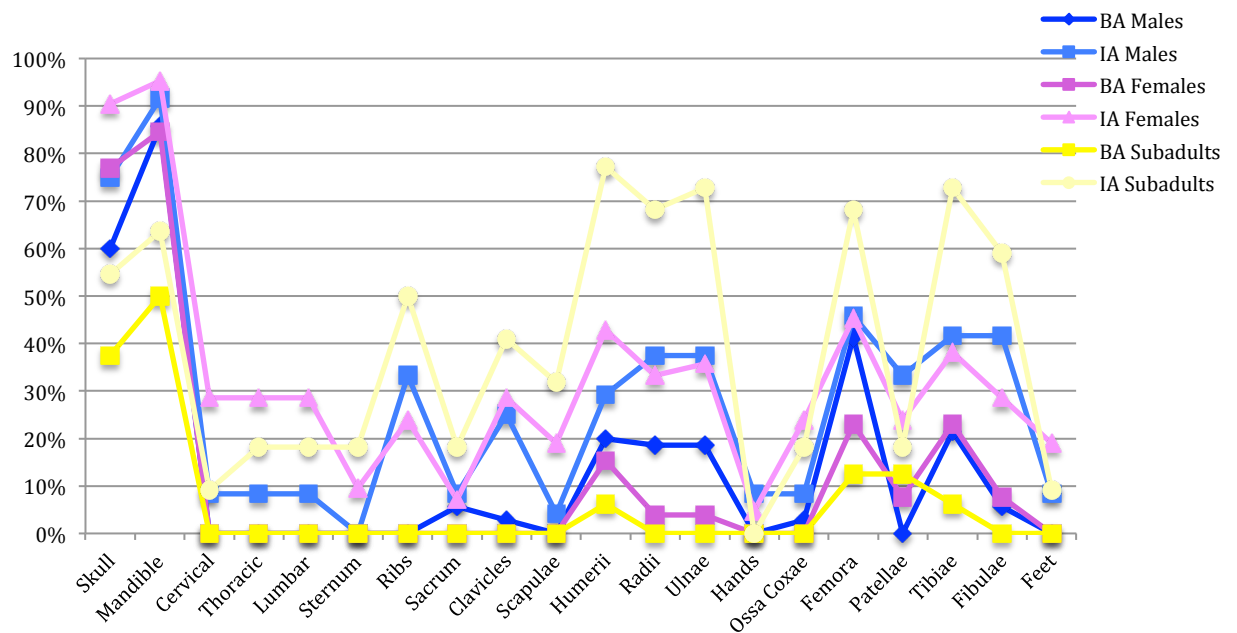


Figure 5.5: Overall skeletal element completeness by time period.

As only three skeletons represent the Neolithic they were not included in Figure 5.5. When the total sample was divided by sex, it was found that preservation was statistically significant for both sexes in relation to sites, while period and sex was only statistically significant for males (Table 5.2).

Variable	P Value	Value	Degrees of Freedom
Female and Site	0.002	31.16	12
Male and Site	<0.001	43.173	14
Male and Period	0.015	8.38	2

Table 5.2: Overall statistical summary divided by sex and preservation.

Dental preservation was explored separately from skeletal preservation and it was found that for the adults, the total number of teeth observed was 1797 out of an expected total of 2680 resulting in 67.05% of expected teeth. When the sample was divided by sex, it was found that males had only slightly more teeth present than females. When the sample was further divided into age ranges within the sexes it was found that the females presented the expected decrease in tooth presence in relation to age, while males displayed the reverse. When this relationship was investigated statistically, it was found that there was a strong relationship for females with regards to age and dental preservation ($p= 0.010$, $\chi^2= 16.871$, $df=6$), however no such association was found for males. When the samples were also divided by period it was found the males increased their dentition presence for young and middle adults but decreased for old adults. Females also had an increased total in the Iron Age, however there were no old adult females in the Iron Age (Figures 5.6 and 5.7).

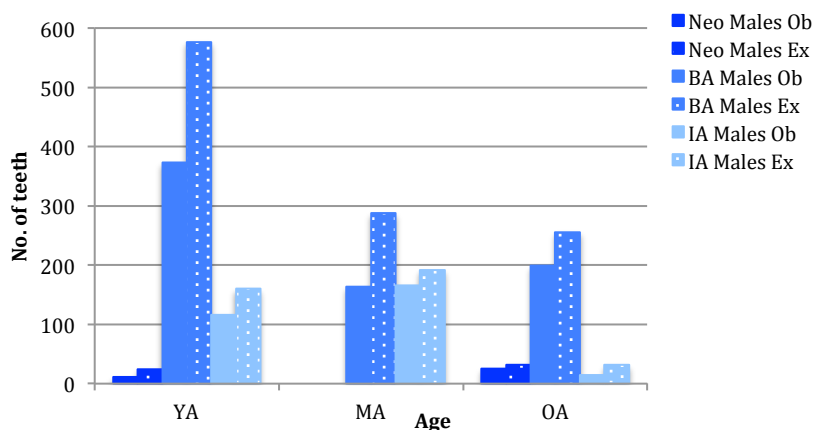


Figure 5.6: Time period dental presence for males.

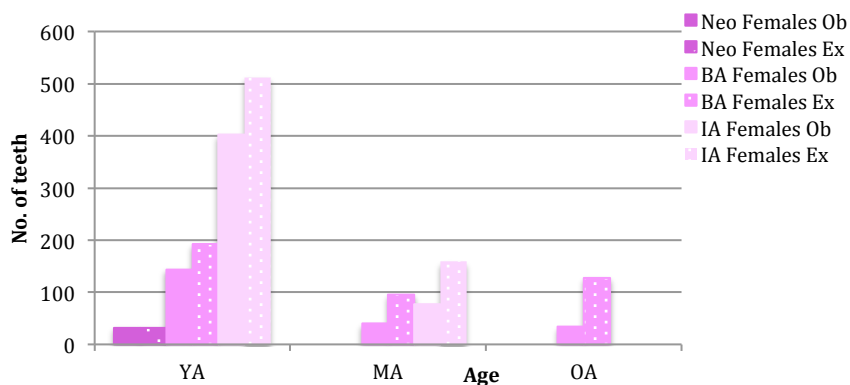


Figure 5.7: Time period dental presence for females.

When the average number of teeth was examined it was found that overall males had a slightly higher average than females (22.12 versus 20.59) and once the sample was subdivided into age groups and sex, and separated by period, both young and middle adult groups had an increased average dentition presence in the Iron Age (Figure 5.8). The exceptions, however, were the sole young adult female from the Neolithic who presented with a complete dentition and the single old adult male with 28 teeth.

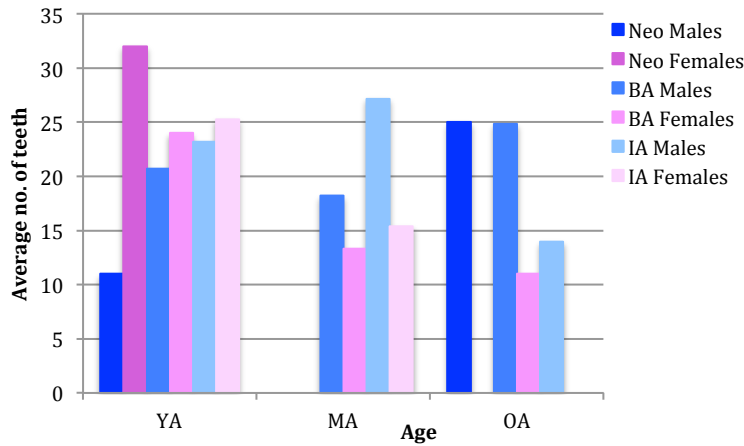


Figure 5.8: Average dentition presence by time period on the Yorkshire Wolds.

In order to test for statistical significance with regards to dentition presence it was decided to use a scoring system based on a range of teeth that were present from zero to thirty-two within four pre-determined groups. The lowest number of teeth was one and the highest was thirty-two (Figure 5.9). Subadults were not considered within this preservation assessment due to the range of dental eruptions for all of the subadults who were aged from foetal to adolescent.

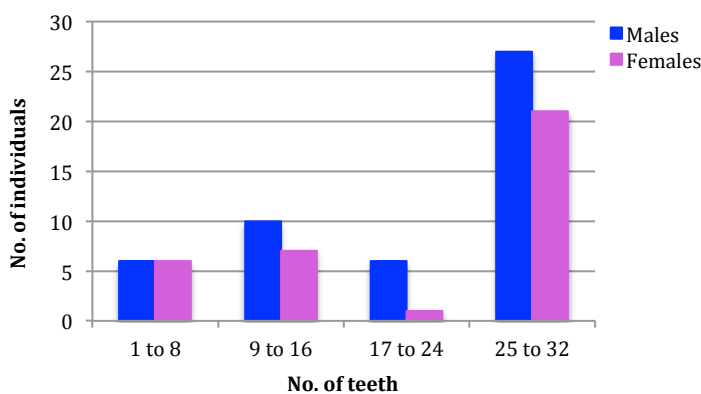


Figure 5.9: Overall dentition presence by sex.

Dental presence, much like skeletal presence, was found to be statistically significant with respect to period, sex and age, however due to the small sample size, the Neolithic was excluded from statistical assessments. Period will be discussed in more detail; however when the entire sample was divided by sex it was found only females and age had a statistically significant relationship with respect to dental presence (Table 5.3).

Variable	P Value	Value	Degrees of Freedom
Period	0.040	10.015	4
Sex	0.004	22.766	8
Age	<0.001	84.501	24
Females and Age	0.010	16.871	6

Table 5.3: Overall statistical summary of dental presence divided by sex.

5.3 The Total Neolithic Population

5.3.1 Introduction

Due to prehistoric funerary rites, sampling strategies and curatorial methods, the remains attributed to the Neolithic on the Wolds were very sparse. Although the barrow of Duggleby Howe at Towthorpe represented 16 inhumations, these were currently under review by other researchers and as such they were deemed unsuitable. For this project the Neolithic is represented by three individuals; two at Rudston excavated by Greenwell and one at Garton Slack excavated by Mortimer (Figure 5.10).

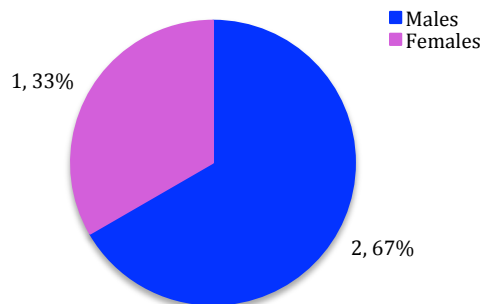


Figure 5.10: Demographic profile of the Neolithic.

Although both antiquaries alluded to several more skeletons, they could not be located at the time in their respective collections. The population includes two young adults and one old adult male. Both males were classed as probable, as innominates were unavailable, however the majority of morphological features suggested male and as such they were deemed male for this project. The single young adult female was deemed a female as her cranial features all pointed towards this finding. All three individuals were also aged using attrition and therefore large age categories were employed.

5.3.2 Preservation

The preservation level of these Neolithic adults was quite limited with respect to the skeleton (Figure 5.11); however when the dentition was examined it was found that there was more of a variety in observable teeth (Figure 5.12).

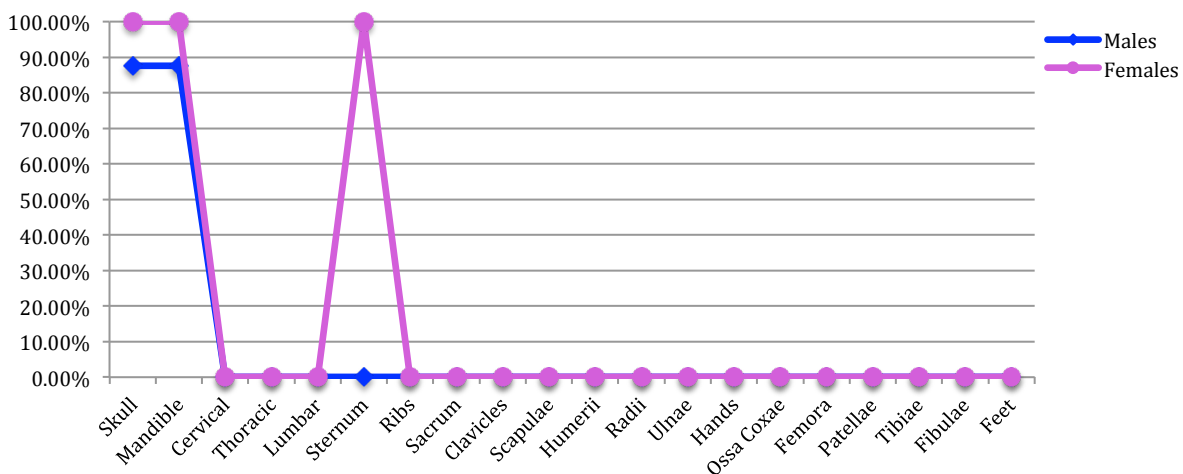


Figure 5.11: Neolithic skeletal element preservation.

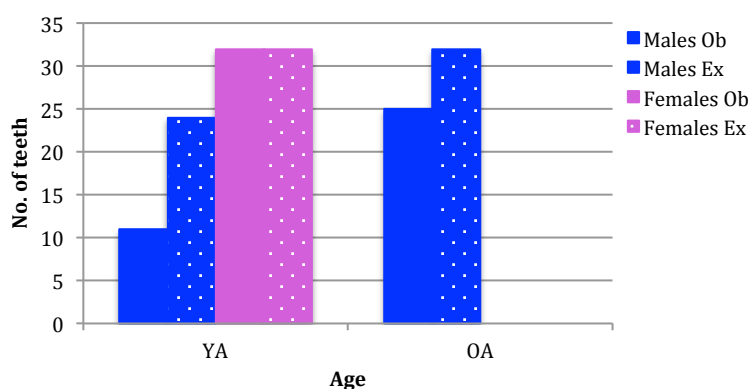


Figure 5.12: Dentition presence in the Neolithic.

The two males presented with an average number of 23.5 observable teeth, while the sole female had all 32. Dentition presence was also scored to determine the range of preservations (Figure 5.13), and it was noted that only the young adult male exhibited a lower score. When the dentition was divided by section it was determined that in every category the young adult male had the least number of observable teeth (Figure 5.14).

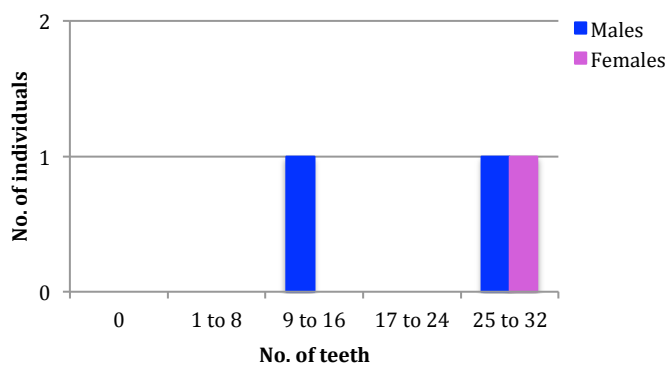


Figure 5.13: Neolithic count of dentition presence.

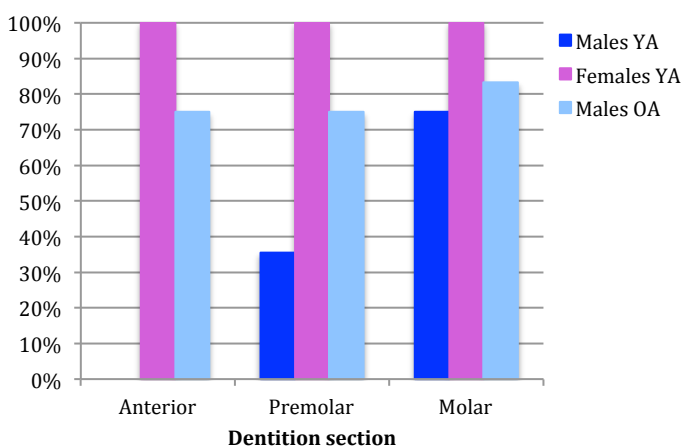


Figure 5.14: Dentition section presence in the Neolithic.

5.3.3 Non-Specific Stress Indicators

When the Neolithic population was examined for linear enamel hypoplasia (LEH) it was determined that the young adult male did not have any observable anterior dentition, while both the young adult female and the old adult male had the more severe expression (with a score of three). This suggested that both of these individuals experienced multiple periods of stress in their developing years.

The sample was also investigated for the presence of cribra orbitalia (CO) and although all three had the requisite orbits, only the old adult male exhibited a moderate form of this stress manifestation, suggesting a recent period of instability prior to death.

5.3.4 Dental Diseases

It was determined that two individuals (66.7% of the sample) had evidence of caries, while the young adult male was free from this disease (Figure 5.15).

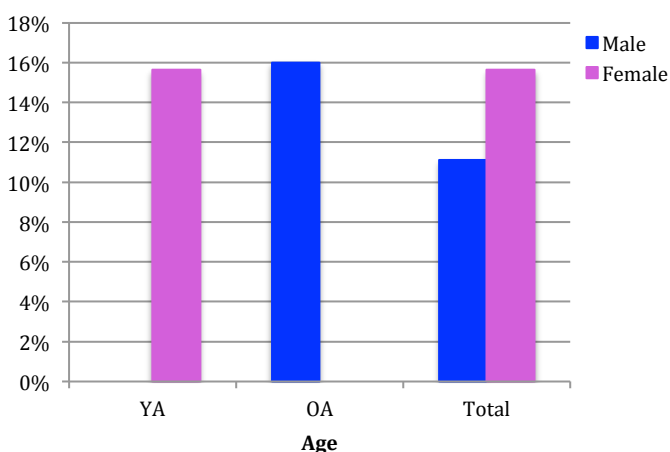


Figure 5.15: Proportion of carious teeth in the Neolithic.

When rates for each sex were examined, it was found the female had a slightly lower ratio compared to the old adult male, however, overall the population rate was 13.24%, suggesting caries were a cause for concern for this limited population. Caries type was also analysed

(Figure 5.16) and it was determined that the vast majority were located on the occlusal surface. However, as only two individuals exhibited caries it was not possible to identify any sex or age patterns.

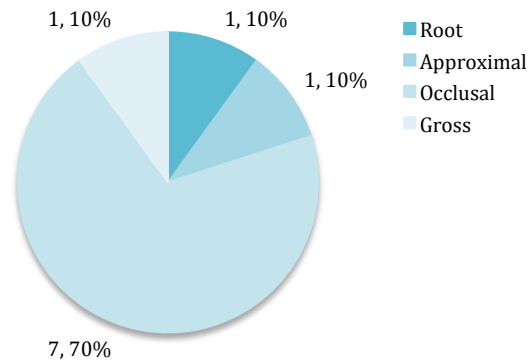


Figure 5.16: Proportion of caries by type in the Neolithic.

Interestingly, when caries location was assessed it was found that the old adult male had all four on his maxillary dentition. Conversely, the five caries identified in the young adult female were exclusively found on the mandibular dentition.

Abscesses were also explored in the Neolithic skeletons and it was determined that only the old adult male exhibited three abscesses, all on the left molars of his dentition, and none resulted in tooth loss (Table 5.4).

Sex/ Age	Total Male Observed Tooth Places	Observed Tooth Places	# Abscesses	% Total Male Abscesses	% Abscesses	Dental Location	Healing	Sinus	Severity
M OA	56	32	3	5.35%	9.38%	Maxilla (2)	Active	External	Severe
						Mandible (1)	Healed	Internal	Moderate

Table 5.4: Abscess details and prevalence in the Neolithic.

Finally, the sample was assessed for ante mortem tooth loss (AMTL), however there was no evidence of tooth loss earlier in life for any of the Neolithic individuals.

Overall with respect to dental diseases two thirds of the population had caries, one third (the old adult male) exhibited abscesses and all were free from AMTL (Figure 5.17). It would appear that dental disease presence increased with advanced age, however this sample is too small to extrapolate further.

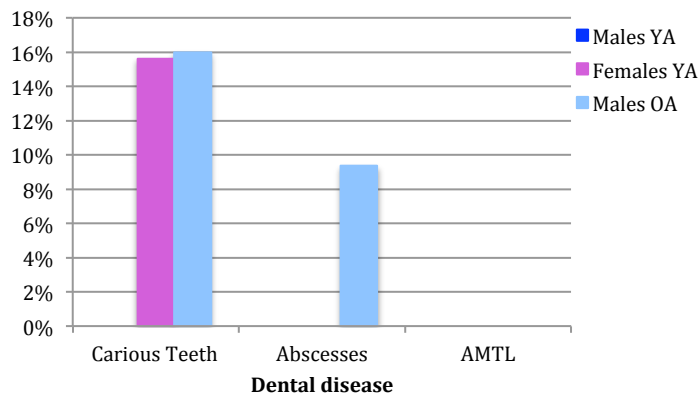


Figure 5.17: Proportion of observed teeth and tooth spaces with disease in the Neolithic.

5.3.5 Degenerative Diseases

Due to the limited post-cranial preservation, and after an examination of the tempo-mandibular joint (TMJ), it was determined that there was no evidence of osteoarthritis (OA). Furthermore none of the individuals presented with observable vertebrae and therefore the presence of vertebral joint disease (VJD) is unknown.

5.3.6 Trauma

When the Neolithic population was analysed for cranial trauma, it was found that the old adult male exhibited a single fracture (Table 5.5).

Sex/Age	Location	Location Side	Type	Sub Type	Healing Stage
M OA	Temporal/Parietal	Right	BFT	Crushing	1

Table 5.5: Cranial fracture details in the Neolithic.

The sample was similarly examined for post-cranial fractures. However, the near total absence of post-cranial elements, save for a single sacrum belonging to the young adult female, precluded any evidence of this form of trauma.

5.3.7 Summary of the Neolithic Population

Overall, this limited Neolithic sample included two males and one female and was slightly biased towards the younger adult category. It was determined that 100% of those with anterior dentitions exhibited the more severe form of LEH, while only one third had CO. Caries and abscesses were present in this group, however, the old adult male was the only individual to experience both diseases. Degeneration was not observable for this group, however, with respect to trauma, the old adult male exhibited a single cranial fracture. Post-cranial elements were conversely not sufficiently preserved to comment on skeletal trauma.

5.4 The Bronze Age

5.4.1 Staxton Beacon

The population of Staxton Beacon includes a total of six individuals and the demographic profile and breakdown is illustrated in Figures 5.18 and 5.19.

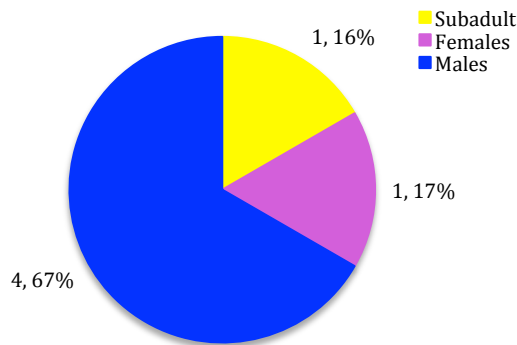


Figure 5.18: Demographic profile of Staxton Beacon.

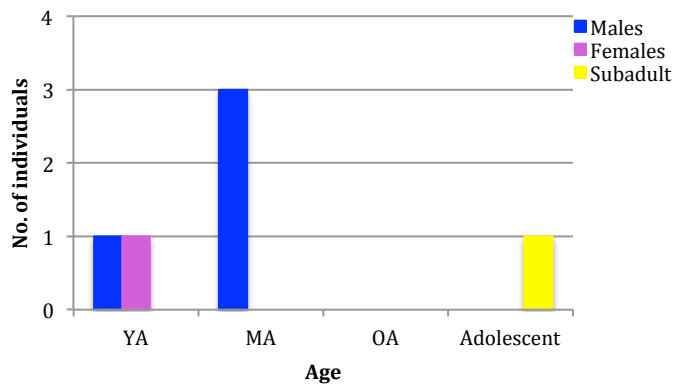


Figure 5.19: Staxton Beacon profile by age and sex.

As can be seen in the figures above, Staxton Beacon has a strong bias towards males, however the age distribution only has a very slight bias towards the middle adult range. When the adolescent is also considered however, there is an even split between the young and the middle age categories. The adolescent was aged using dental and skeletal elements and the estimation ranges overlapped with one another suggesting that childhood stress, if it was experienced by this individual, was not severe enough to affect their skeletal growth and development. All five of the adults were aged using dental attrition. Unfortunately, although two individuals had fragmented pieces of innominates, the areas required for age and sex estimation were not sufficiently preserved for analysis. All of the adults were also sexed using a combination of morphological features of the skull. Three of the four males were estimated to be probable and the young adult female was also deemed probable female. However, all five individuals displayed a bias towards their stated sex, and therefore for this project they were termed male and female respectively.

5.4.1.1 Preservation

In an initial examination of skeletal element preservation it was found that very few elements could be termed complete, requiring at least 75% of the element (Figure 5.20). Due to the lack of complete bones it was deemed necessary to also include those elements considered partially complete (at least 25% of the element) in order to show there was enough of each skeleton available for analysis and therefore that each was justifiable in being included in the project.

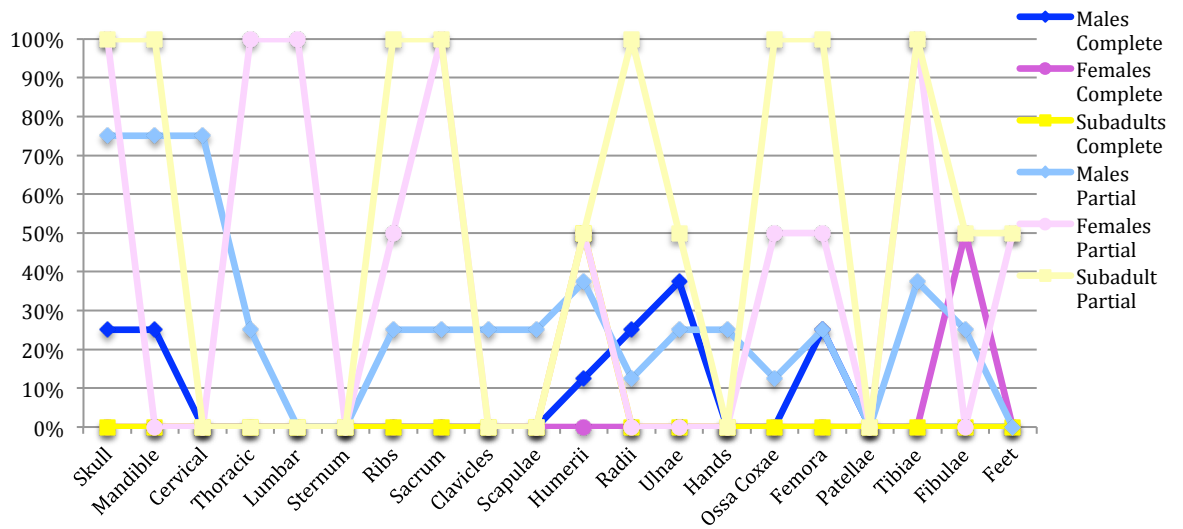


Figure 5.20: Staxton Beacon skeletal element preservation.

As can be seen from the chart above, the majority of skeletal elements that were available for analysis were only partially complete and the adolescent had the widest selection of skeletal elements.

Dental preservation was also examined and it was determined the sole female had significantly fewer teeth available for analysis in comparison to both her male age counterparts and the entire male population (Figures 5.21 and 5.22).

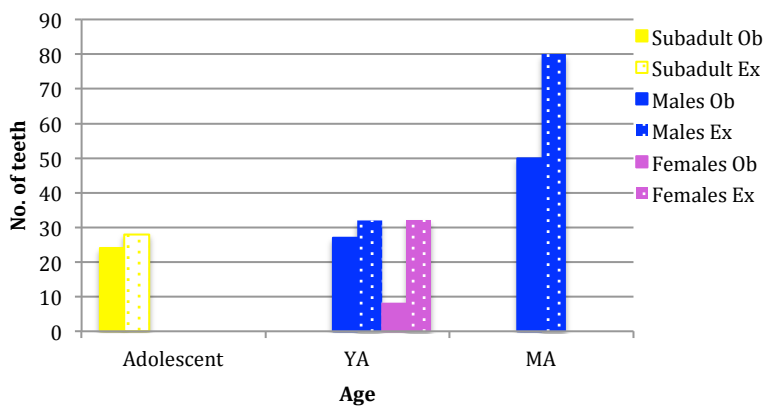


Figure 5.21: Dental preservation at Staxton Beacon.

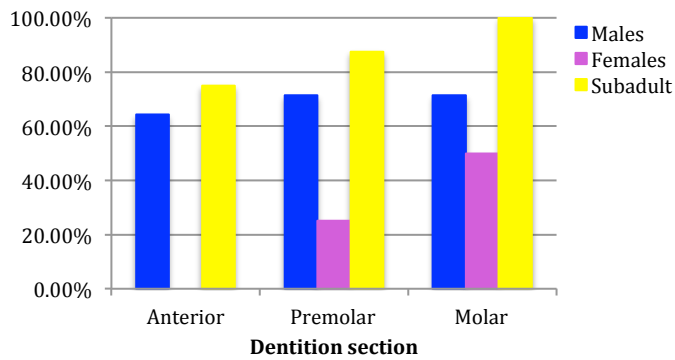


Figure 5.22: Staxton Beacon dentition presence.

With respect to the males, the young adults presented a higher percentage of observable teeth in comparison to the middle adults, which is to be expected. When the average male and female dentition was determined it was found the sole female had nine available teeth, while males as a whole had 19.25 teeth per individual, which is a large discrepancy. Finally dentitions were also scored based on presence (Figure 5.23).

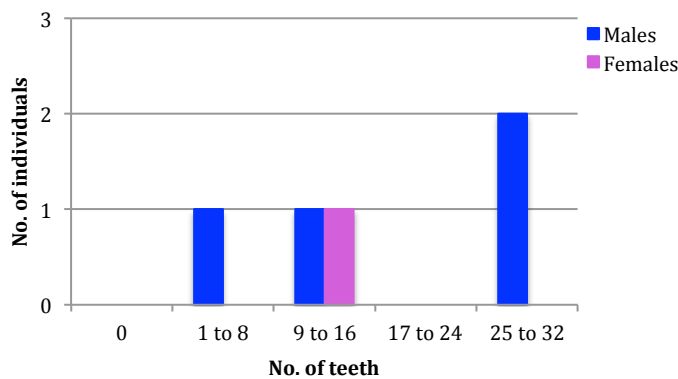


Figure 5.23: Staxton Beacon count of dentition presence.

Due to the fact that all of the available long bones were incomplete it was not possible to determine any stature estimations for the population.

5.4.1.2 Non-Specific Stress

In an analysis of the Staxton Beacon population for LEH, it was found that one individual (a middle adult male) did not have any observable anterior teeth dentition, 16.67% of the population (Figure 5.24).

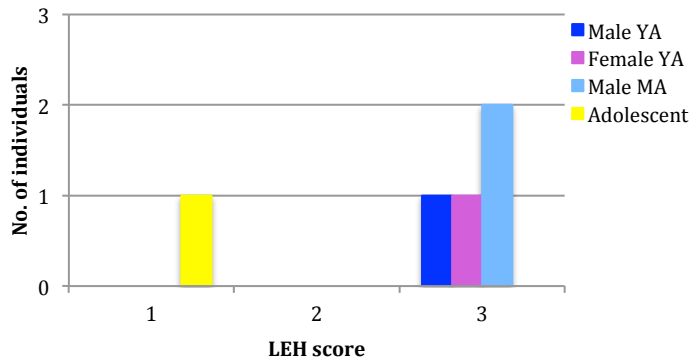


Figure 5.24: LEH severity at Staxton Beacon.

Scoring: One indicates anterior teeth presence but the absence of LEH, while two and three are increasing levels of LEH severity.

Eighty per cent of the population with anterior teeth had evidence of LEH. Based on an analysis of severity, all of those with LEH had the more severe form suggesting they experienced more than one episode of significant stress during their formative years.

When the sample was examined for CO it was found that one individual (a male middle adult) did not have orbit preservation sufficient enough for examination (16.67% of the population). Of the remaining population, none of the individuals had any evidence of CO.

5.4.1.3 Dental Diseases

In an analysis of the population for dental diseases it was determined that three individuals, half of the population, did not have any dental caries (Figure 5.25). Based on this assessment, only males experienced caries at Staxton Beacon. Males were also analysed for carious teeth and those results are presented below in Table 5.6.

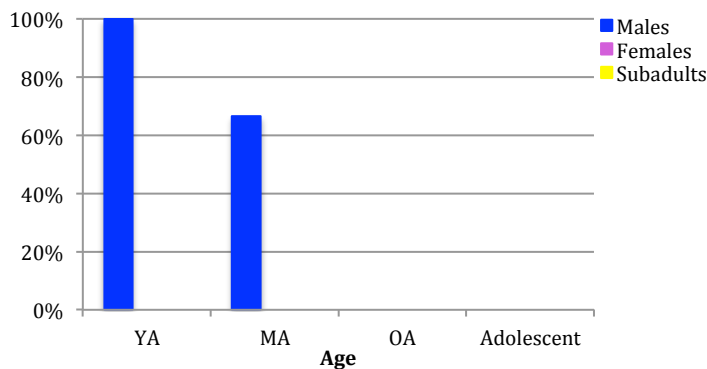


Figure 5.25: Caries prevalence at Staxton Beacon.

Age	Males		
	# Teeth Observed	# Carious Teeth	% Carious
YA	27	5	18.52%
MA	50	18	36%
Total	77	23	29.87%

Table 5.6: Proportion of carious teeth at Staxton Beacon.

The chart above illustrates the range of caries rates between the age categories, with the middle adults exhibiting twice the rate of carious teeth compared to their young adult counterparts. Caries were also examined within the context of caries types as well as severity (Figures 5.26 and 5.27).

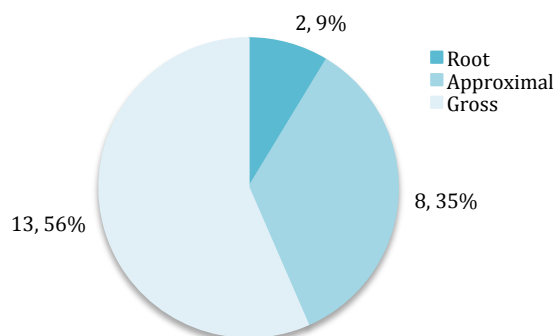


Figure 5.26: Proportion of caries by type at Staxton Beacon.

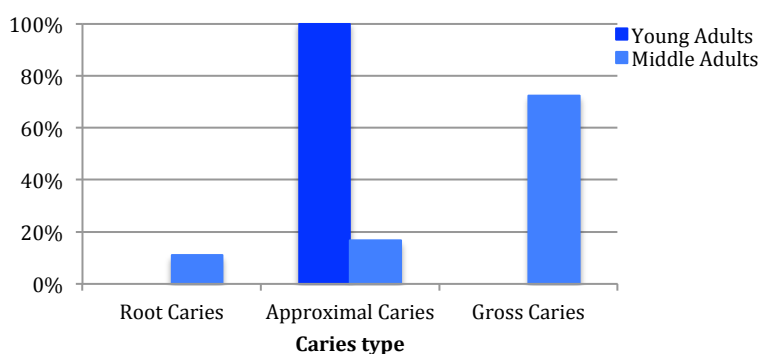


Figure 5.27: Staxton Beacon caries by type.

Just as with caries type, all of the young adult male caries were located in one area, the mandibular dentition, while the middle adults exhibited caries in both locations. The presence of abscesses was also examined among the Staxton Beacon population and it was found that four individuals were free from this dental disease, 66.67% of the population (Table 5.7).

Sex/ Age	Observed Tooth Places	# Abscesses	% Abscesses	Dental Location	Dental Section	Tooth Loss	Healing	Sinus	Severity
M YA	32	1	3.13%	Maxillary	Anterior	Yes	Healed	Internal	Moderate
M MA	32	1	3.13%	Mandibular	Molar	No	Active	External	Moderate

Table 5.7: Abscess prevalence at Staxton Beacon.

AMTL was also investigated for this population and it was determined that four individuals did not have any tooth loss. The results of the two individuals that did present AMTL are detailed below in Table 5.8. The older individual, aged as middle adult had an AMTL that was ten times that of the young adult male. When the age and observable number of tooth places were observed, the relationship between both males and rates of AMTL is clear.

Sex/Age	Total Observed Tooth Places	Total YA or MA Observed Tooth Places	Individual Observed Tooth Places	# AMTL	% Population AMTL	% YA or MA Male AMTL	% Individual AMTL
M YA	144	32	32	1	0.69%	3.13%	3.13%
M MA	144	76	16	5	3.47%	6.58%	31.25%
Total	144	108 Males		6	4.17%	5.56% Males	

Table 5.8: AMTL prevalence at Staxton Beacon.

In a summary of dental diseases at Staxton Beacon, it was found that 50% of the population (n=3) did not suffer from any dental diseases (Figures 5.28 and 5.29).

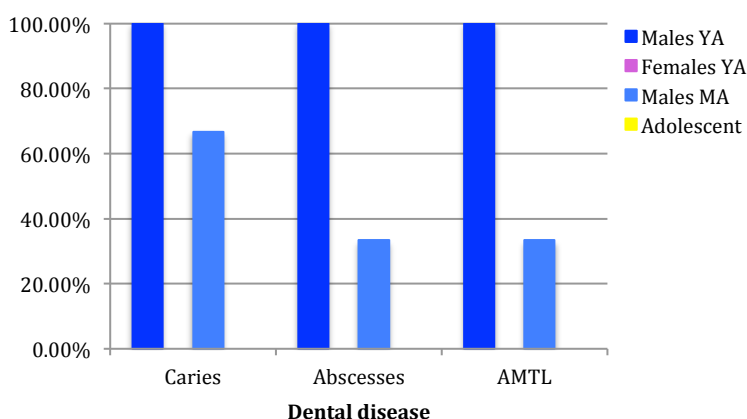


Figure 5.28: Staxton Beacon proportion of individuals with dental disease.

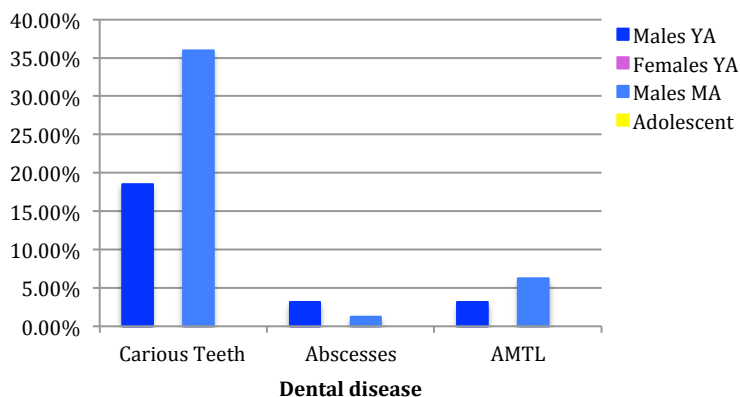


Figure 5.29: Staxton Beacon proportion of observed teeth and tooth spaces with disease.

Overall, the population of Staxton Beacon was minimal in its presentation of dental diseases with only the males exhibiting evidence of caries, abscesses and AMTL.

5.4.1.4 Degenerative Disease

The population at Staxton Beacon was examined for evidence of OA and it was found that three adults (and the subadult) did not display any evidence of degeneration (66.67% of the total population). As only two males exhibited degenerative changes, their results are summarised in Table 5.9.

Sex/Age	Joint Location	Left / Right/Both	Severity	Distribution
M MA	TMJ	Right	1	Regional
	Wrist	Left	2	
M MA	Wrist	Left	2	Regional

Table 5.9: Staxton Beacon OA prevalence.

Both individuals had damage to their wrists, suggesting they may have participated in a common activity, while the degeneration to the TMJ suggests an isolated activity or mastication method that was not repeated by others in the population.

VJD was also examined in this group and one individual did not have any preserved vertebrae available for analysis (16.67% of the population). Four adults had vertebrae and three males have evidence of the disease (Table 5.10).

Sex/Age	Vertebral Location	# Affected	Severity
M YA	Thoracic	1	2
		4	1
M MA	Cervical	1	1
M MA	Cervical	3	1

Table 5.10: Staxton Beacon VJD prevalence.

As can be seen above, the young and two middle adult males were affected by VJD and with the exception of a single thoracic vertebrae, all expressions were mild in form.

5.4.1.5 Trauma

The population of Staxton Beacon was also assessed for evidence of cranial fractures and it was determined that only one individual, 16.67% of the population, had evidence of trauma (Table 5.11). Additionally, in an examination of post-cranial trauma, only one individual (not the same individual) had evidence of a healed post-cranial fracture (Table 5.12).

Sex/Age	Location	Location Side	Type	Sub Type	Healing Stage
Adolescent	Parietal	Right	BFT	Linear	0

Table 5.11: Prevalence of cranial trauma at Staxton Beacon.

Sex/Age	Bone	Side	Healing	Associated Pathologies
M MA	Ulna	Right	3	Misalignment

Table 5.12: Prevalence of post-cranial fractures at Staxton Beacon.

As the sample at Staxton Beacon is small it is not possible to extrapolate trauma patterns. However as one third of individuals had evidence of fractures, it suggests accidents and/or interpersonal aggression were present in the lives of this group.

5.4.1.6 Bioarchaeology

Permission was granted by Sewerby Hall for sampling of the Staxton Beacon skeletons and four of them were sampled for carbon and nitrogen analysis (Figure 5.30).

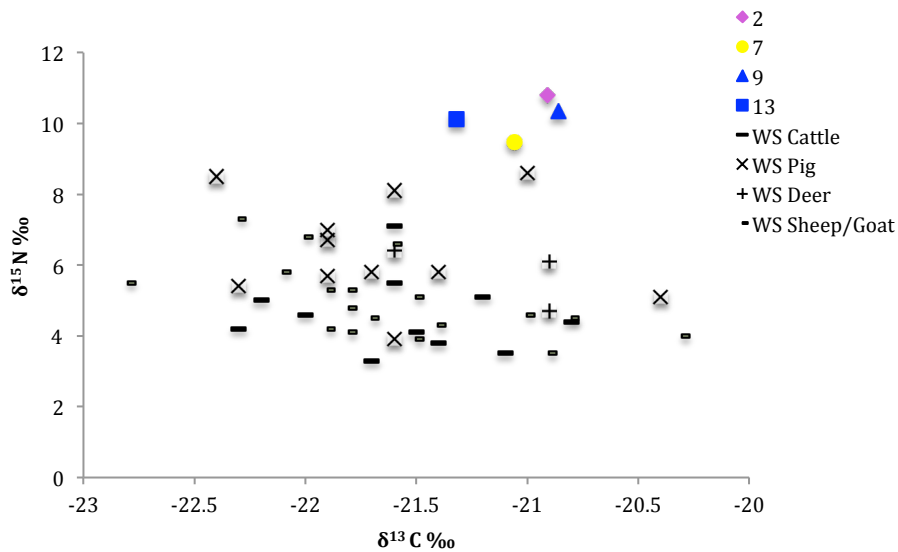


Figure 5.30: Staxton Beacon carbon and nitrogen results.

WS represents animal values derived from Iron Age Wetwang Slack as a proxy of the Yorkshire Wolds animal signal (Jay 2005).

Five individuals were originally tested, however, the rib of one did not contain any collagen. All four individuals tested were divergent from one another with the subadult presenting the lowest nitrogen value and the female the highest. With respect to carbon, both males had the highest and lowest values, however none of these signals were divergent enough to create a statistically significant relationship. Although animal remains were not available at the site, nor for any other accessible Yorkshire Wolds Bronze Age site, the values obtained by Jay (2005) at Iron Age Wetwang Slack were plotted to illustrate the divergence that was present between trophic phases. As these were not directly associated it is not appropriate to comment on their relationship beyond stating that the human values were generally more enriched with respect to nitrogen and slightly more enriched with regards to carbon. Six individuals from the sample were also tested for strontium isotopic values (Figure 5.31).

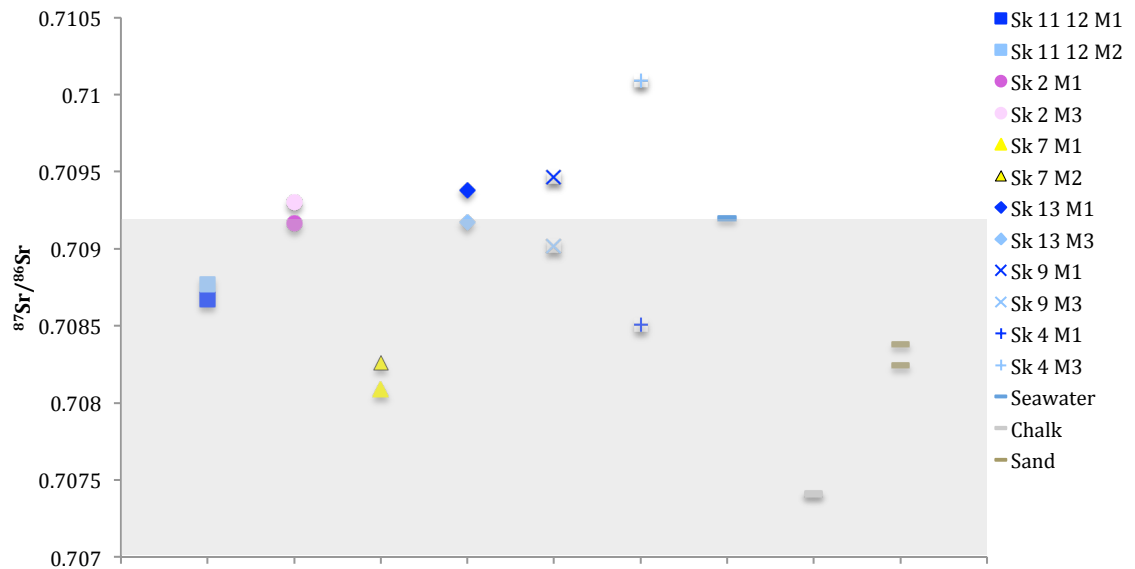


Figure 5.31: Staxton Beacon strontium results.

The shaded region represents the range of values derived from Montgomery and colleagues (2006) that denote the local Yorkshire Wolds signal.

Following Montgomery and colleagues (2006) the local Yorkshire Wolds signal was taken from sand, chalk and seawater values. Four individuals had one strontium value that was consistent with part of a childhood spent away from a homogeneous chalk environment. For skeletons 13 and 9 it was their earlier childhoods (using their first molars which represent approximately ages one to three), while skeletons 2 and 4 spent their later childhoods (using their third molars which correspond approximately to ages seven through thirteen) in an area dissimilar to the Yorkshire Wolds region. Each of their other respective signals were consistent with a chalk environment. Two individuals (skeletons 11/12 and 7) had values consistent with spending their childhood on the Wolds or in a similarly homogeneous chalk region. As all individuals were found buried on the Wolds, it is possible to hypothesise that individuals 2, 13, 9 and 4 were moving throughout at least two different landscapes during their childhoods.

5.4.1.7 Radiocarbon

Three sets of remains from Staxton Beacon were analysed at the Oxford Radiocarbon Accelerator Unit in order to obtain absolute dates for the Bronze Age barrow. At the time of submission one sample had not yet been run. Two dates, however, were obtained for Sk 4 and a single date was determined for Sk 7 (Figures 5.32 and 5.33). It was determined that these individuals were correctly attributed to the Bronze Age and this was specified even further to the later part of the Early Bronze Age. Due to the overlap of the samples it suggests these individuals were both likely to have been buried in the Early Bronze Age.

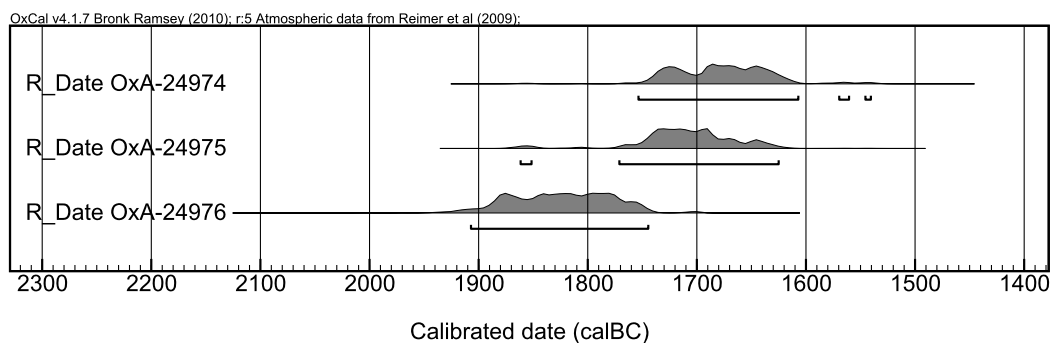


Figure 5.32: Representation of radiocarbon dates determined for Staxton Beacon.

Samples OxA-24974 and OxA-24975 are both derived from Skeleton 4, while OxA-24976 represents Skeleton 7.

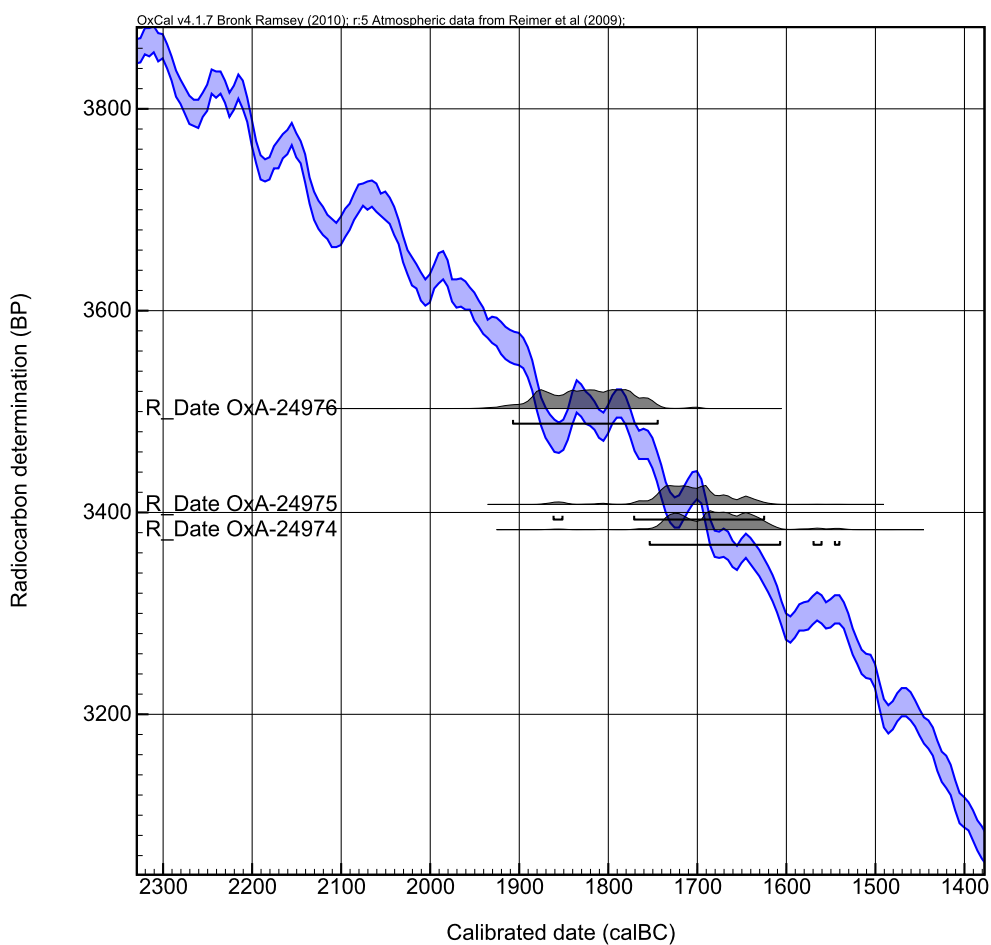


Figure 5.33: Calibration curve for radiocarbon dates obtained from Staxton Beacon.

These findings corroborate the stratigraphic and artefactual assessments by Manby (1998) that all pointed to an Early Bronze Age date for the barrow. Currently a final date is expected which was taken from the first burial phase of the barrow in order to determine its possible initial use.

5.4.1.8 Site Summary

The site of Staxton Beacon includes six individuals which were found to be biased towards males, however the age demographics suggest an even split between the young (including an

adolescent) and the middle to old adults. Non-specific childhood stress, in the form of LEH was seen in 66.67% of the population, while none presented any evidence of CO. Dental diseases only affected the males of the population with 75% of them exhibiting caries, and 33.33% having evidence for abscesses and AMTL. OA was also only seen in males, with 50% with degenerative changes, while 75% had evidence of VJD. Trauma was rare in this group with the adolescent exhibiting a cranial fracture and one male presenting a healed post-cranial fracture. Finally, with regards to bioarchaeological findings, the carbon and nitrogen values for four of the individuals suggest a slight range in diets, with the youngest skeleton revealing the lowest nitrogen value, while the highest and lowest carbon values were seen in both males examined. With respect to strontium, there is clearly a certain amount of mobility within this group with some individuals spending significant periods of their childhood in an area consistent with the Wolds, while others spent time both in and away from the area while they were growing up, and all returned to the Wolds at some point before or at death to be buried at Staxton Beacon.

5.4.2 Rudston

The population of Rudston includes ten individuals and the sex and age profiles are presented in Figures 5.34 and 5.35.

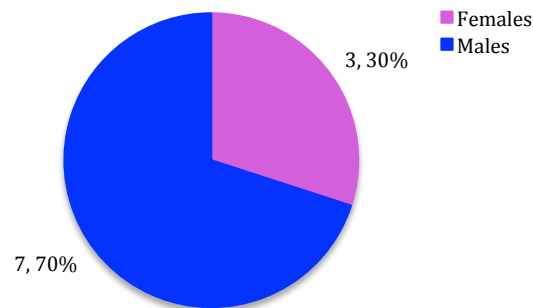


Figure 5.34: Demographic profile of Rudston.

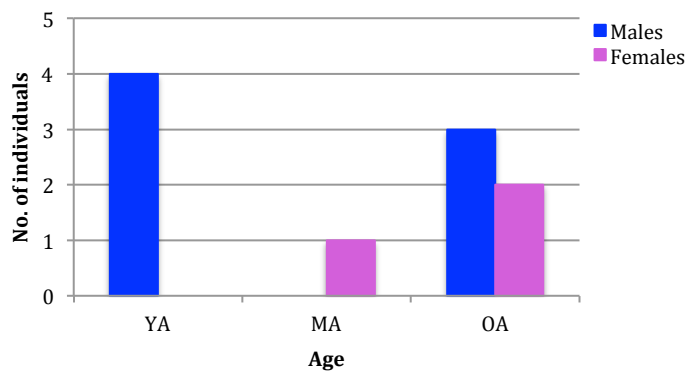


Figure 5.35: Rudston adult profile.

There is a strong bias towards males, but, based on age, the population is evenly split between young and middle adults, and old adults. Two of the seven males were determined to be probable males and two of the three females were also established as probable. All of the individuals were sexed using the skull's secondary sexual characteristics. And, as will be seen, there was a complete lack of preserved innominates within this population. All of the individuals were also aged using dental attrition, due to element presence.

5.4.2.1 Preservation

In an assessment of skeletal element preservation, it was found that the majority of bones were not available for analysis (Figure 5.36).

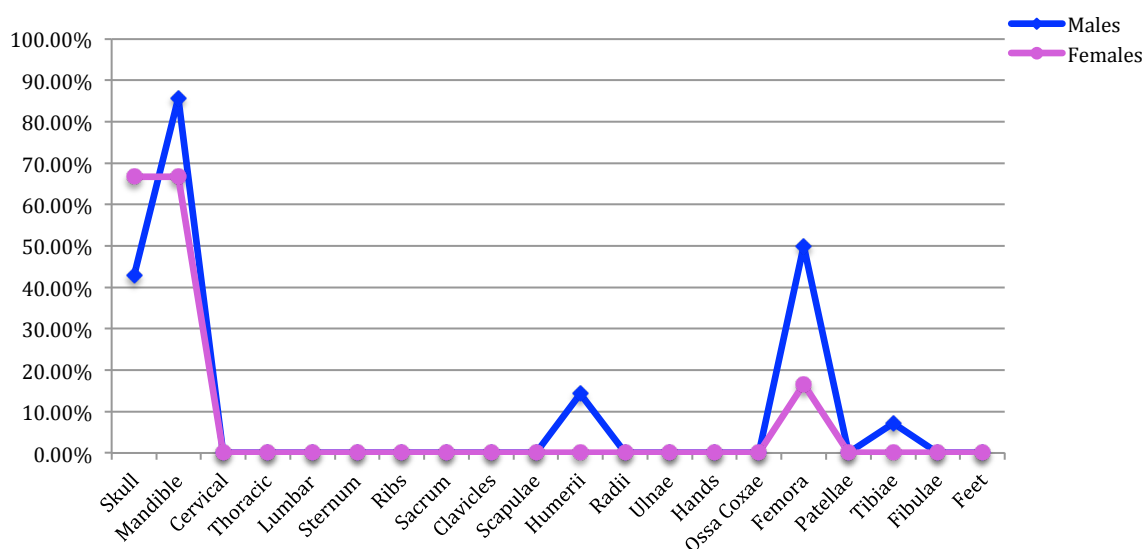


Figure 5.36: Rudston skeletal element preservation.

Additionally, the sample was investigated for dental preservation. The details are summarised in Figures 5.37 and 5.38 for both total teeth observed and a breakdown by dentition section.

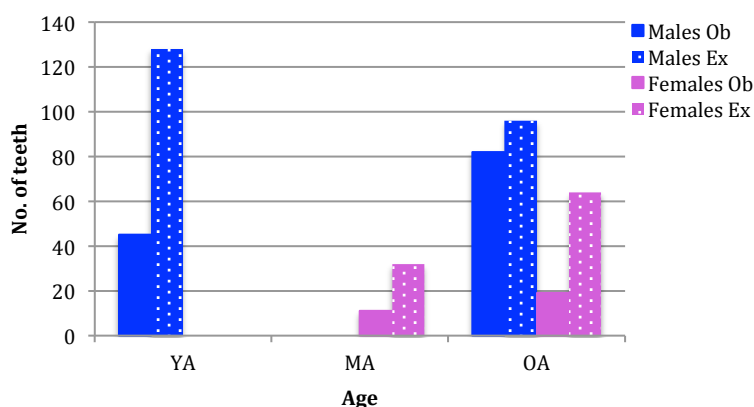


Figure 5.37: Dentition presence at Rudston.

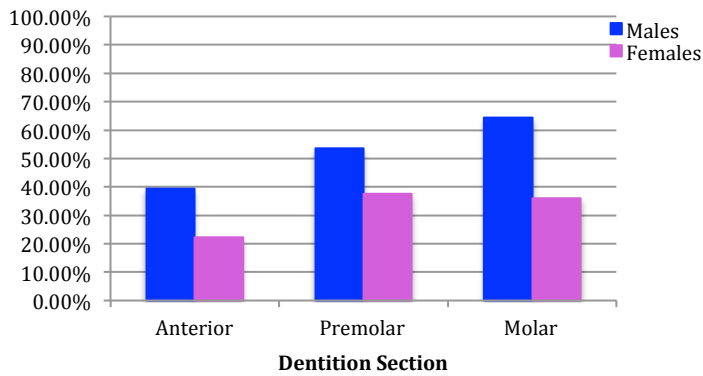


Figure 5.38: Dentition section presence at Rudston.

Males had a higher majority of teeth available for analysis and when the dentition was broken down into sections, it was determined that the males had on average, twice as many teeth preserved as females. Among the males, the old adults had the highest average number of teeth with 27.33, while among the females the middle adults had a high of 11. When the age groups were combined the males presented with an average of 18.14 teeth and the females exhibited 10 on average. Figure 5.39 provides a summary by dentition score of tooth presence for the whole population.

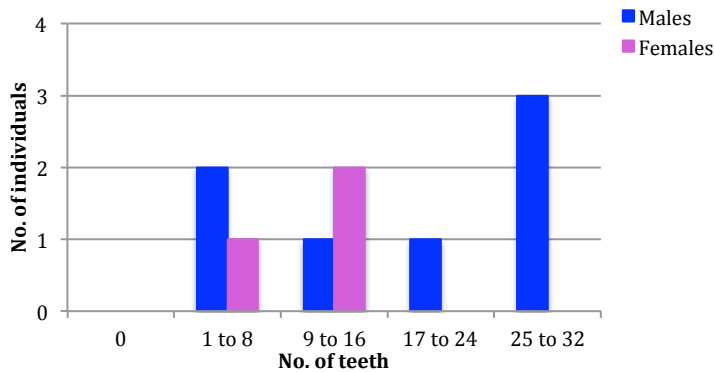


Figure 5.39: Rudston count of dentition presence.

Based on average available dentition it was determined that young adults of both sexes had similar numbers of surviving teeth, while the old adult males had three times as many teeth present, on average, as their female age counterparts. It was possible to determine stature estimates for four individuals, three males and one female (Table 5.13, Figure 5.40). The males presented a range of values with a spread of 9 cm based on median measurements.

Skeleton	Sex/Age	Element	Height (cm)	Height (in)
1952	M YA	Left Femur	166.13 ± 3.27	65.405 ± 1.287
1958	M OA	Left Femur	176.602 ± 3.27	69.528 ± 1.287
1964	M OA	Right Femur	175.88 ± 3.27	69.247 ± 1.287
1953	F OA	Left Femur	165.497 ± 3.72	65.156 ± 1.464

Table 5.13: Stature estimation at Rudston.

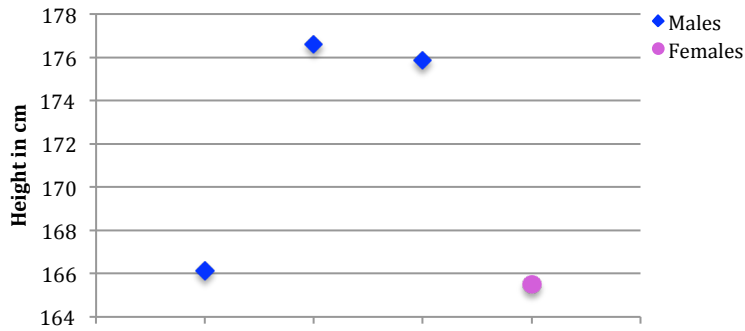


Figure 5.40: Stature estimations at Rudston.

5.4.2.2 Non-Specific Stress

In an examination of LEH presence in the Rudston sample, three individuals (30% of the population) either did not have preserved anterior dentition or they were obscured as a result of conservation efforts post excavation (Figure 5.41).

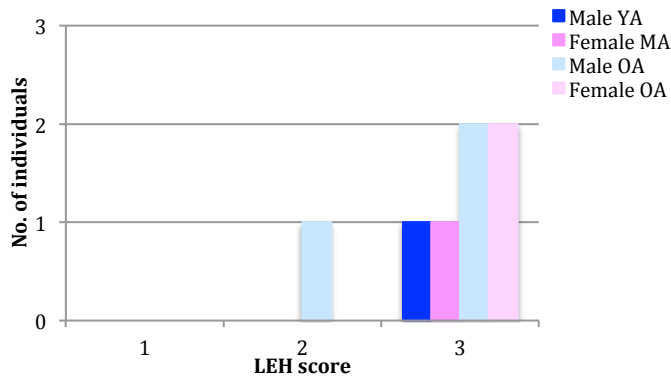


Figure 5.41: LEH severity at Rudston.

A majority of individuals had evidence of LEH (100% of those with anterior teeth), and all but one suffered from at least two distinct episodes of severe stress in their formative years.

When CO was examined, it was found that three individuals (30% of the population) did not have any surviving orbital regions suitable for analysis. Of the remaining seven individuals, only one, an old adult female had evidence of CO, and was found to have a moderate expression (scored as three out of five).

5.4.2.3 Dental Diseases

Caries were first assessed within the population at Rudston and six individuals were free from this dental disease (Figures 5.42 and 5.43).

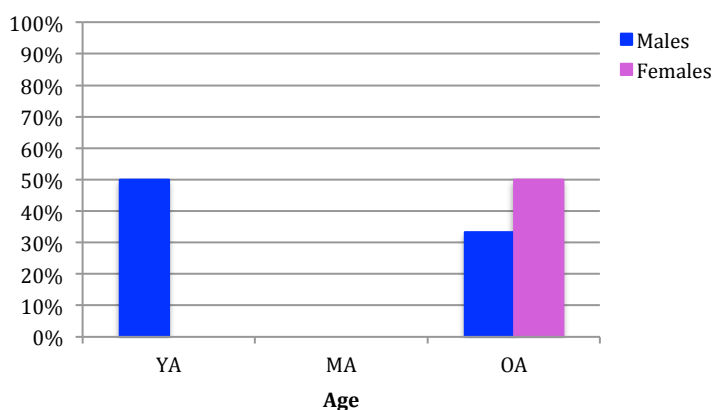


Figure 5.42: Caries prevalence at Rudston.

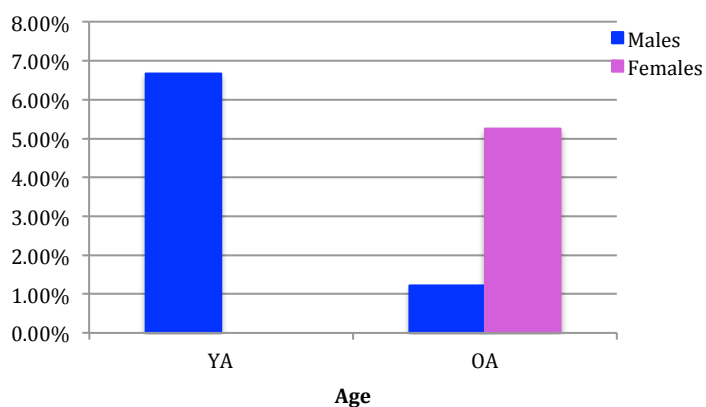


Figure 5.43: Proportion of carious teeth at Rudston.

Slightly more males had evidence of caries, while, once the number of carious teeth was considered it was found that the old adult females had a higher percentage of carious teeth compared to their male age counterparts. Caries type was also examined (Figure 5.44).

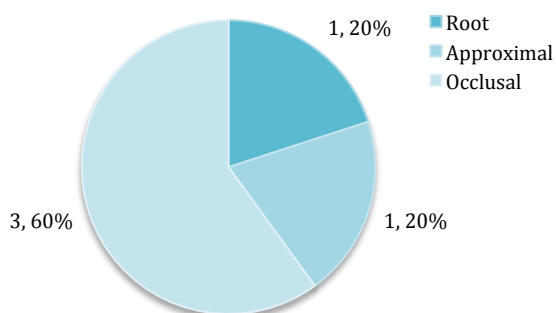


Figure 5.44: Proportion of caries by type at Rudston.

It appears as though each type of caries was unique to the age and sex of the individual. Finally, dentition location was assessed and the mandibular dentition was only slightly more often affected with regards to the number of caries presented.

Abscesses were also investigated and it was found that six individuals (60% of the population) did not have any evidence of this dental disease (Figure 5.45 and 5.46).

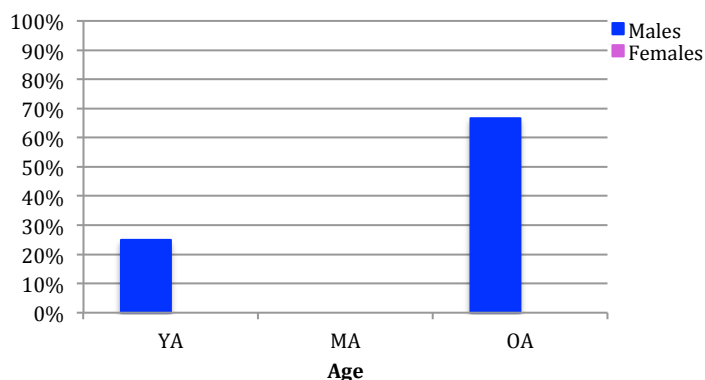


Figure 5.45: Abscess prevalence at Rudston.

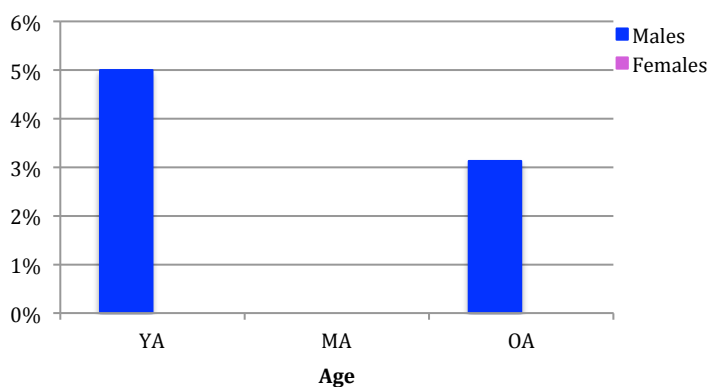


Figure 5.46: Proportion of tooth spaces and abscesses at Rudston.

Although two old adult males have evidence of abscesses, the young adult individual had a higher percentage of abscesses to their observed tooth places, suggesting they experienced more numerous and more painful dental diseases than their older aged counterparts. When dentition section and tooth loss were examined, it was determined that the young adult abscesses were severe enough to cause tooth loss in 75% of affected tooth areas, while the old adult males did not experience any tooth loss.

Additionally, it appears as though dentition location itself was not a factor in the presence of abscesses as they were almost spread evenly between the maxilla and the mandible for both age groups. When dentition section was inspected, it was found the anterior teeth were only affected in the young adult with an additional molar exhibiting an abscess, while the old adults all had abscesses exclusively on their molar teeth. Finally, abscesses were also analysed with respect to stage of healing, sinus location and severity. Healing stage was spread out evenly between the dentition sections as well as the age categories. With respect to sinus location the majority were located externally, while abscess severity was also almost evenly split, irrespective of dental section and age.

AMTL was the last aspect of dental disease that was explored and within the population of Rudston it was found that four people (40%) were free from tooth loss (Figure 5.47).

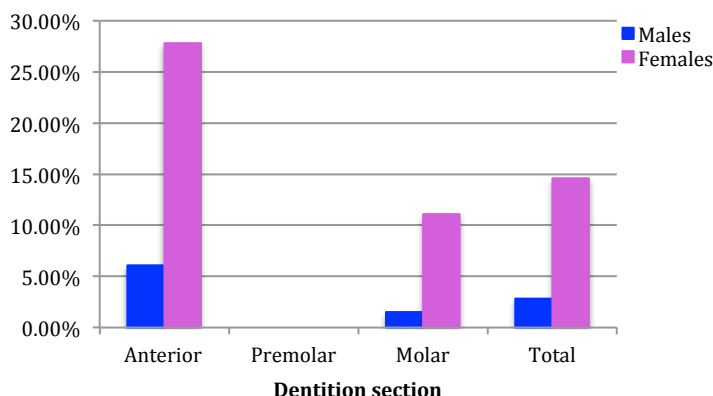


Figure 5.47: Proportion of tooth spaces and AMTL at Rudston.

Less than half of the males and all of the females had evidence of AMTL. When this was broken down into dentition section, it was found that the anterior teeth were most often affected, while only 25% of the AMTL was derived from the molar area. AMTL was also explored with respect to individual tooth type and side, the left of which was more often affected for both the young and middle adult groups. With respect to the old adults, each sex had AMTL exclusively on one side, however they were opposite from one another. AMTL was also investigated within the context of dentition location (maxillary versus mandibular), stage of healing and the number of teeth lost as a result of associated pathologies (Figure 5.48).

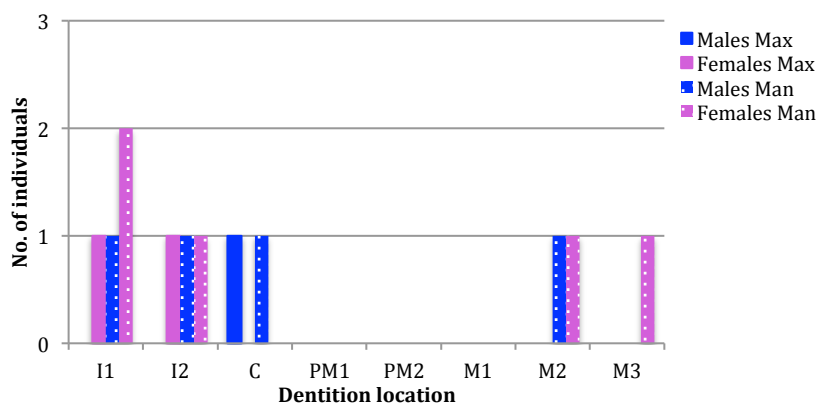


Figure 5.48: AMTL at Rudston by dentition location.

The majority of AMTL was observed on the mandibular dentition for both sexes, and the majority of tooth loss occurred earlier in life, as 75% of the total AMTL had a healing score of three, indicating almost complete resorption of the root cavities. Finally, only the males had clear evidence of associated pathologies causing the AMTL, and all three teeth were connected to the one young adult male who experienced four abscesses.

In a dental summary of Rudston, it was determined that only one individual (10% of the group), a young adult male, did not experience a single dental disease (Figure 5.49 and 5.50).

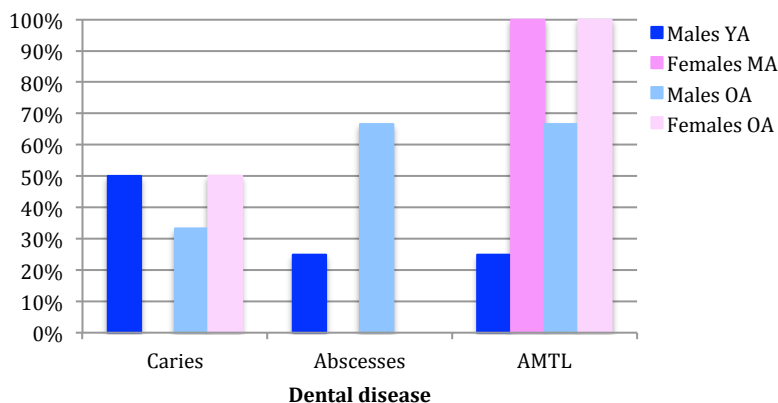


Figure 5.49: Rudston proportion of individuals with dental disease.

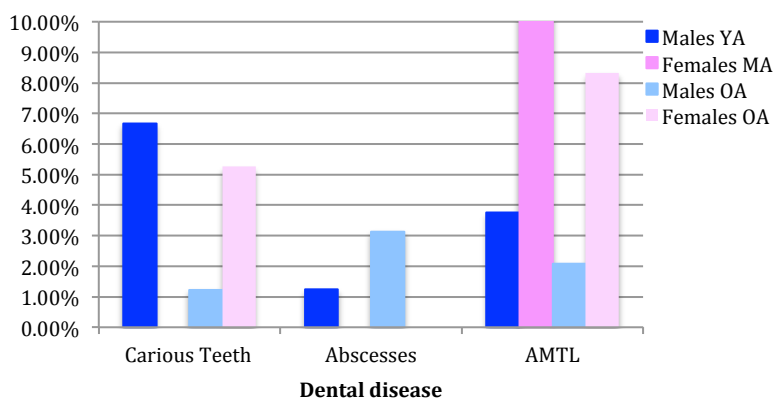


Figure 5.50: Rudston proportion of observed teeth and tooth spaces with disease.

Clearly, both caries and AMTL were experienced by both sexes, but abscesses were only evident in males. Total caries rates were also similar between both sexes, while AMTL were drastically increased for females in comparison to males. This may be partially explained by the age groups available as the females had higher age categories relative to the males.

5.4.2.4 Degenerative Disease

The entire population of Rudston was examined for OA and seven people (70%) were found to be free from degenerative changes (Figure 5.51).

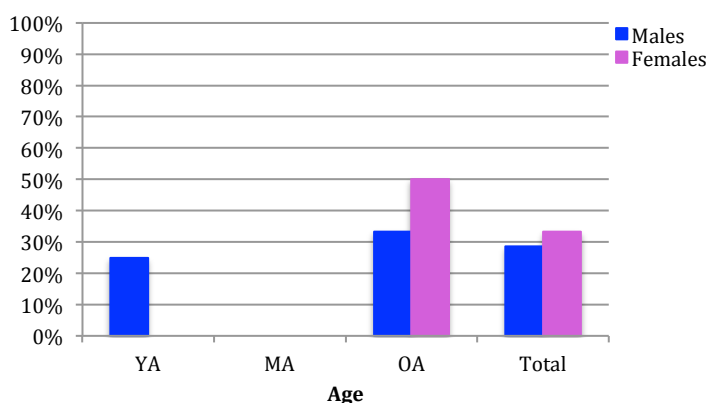


Figure 5.51: Rudston OA prevalence.

Both age groups of males had evidence of OA, while only a single old adult female presented with degenerative changes. OA was also examined with respect to joint location, side and severity (Figure 5.52).

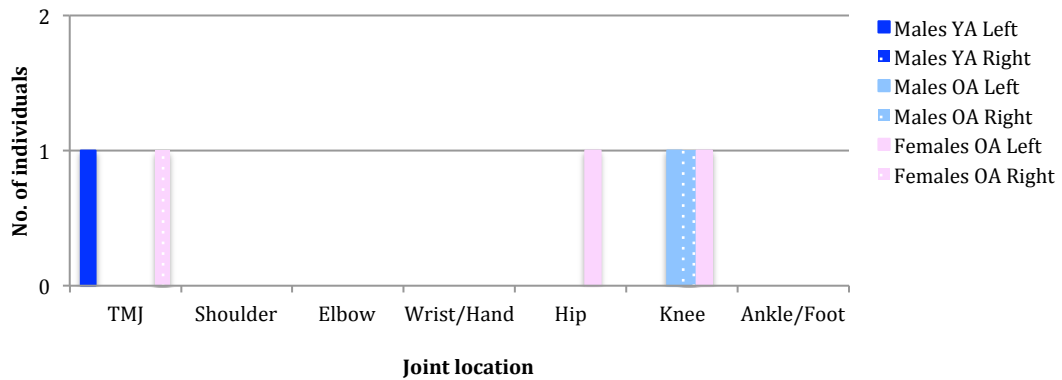


Figure 5.52: Rudston prevalence of OA by side.

With respect to side, there was only a slight bias towards the right, with 66.67% of joints affected compared to 33.33% for the left. In terms of severity, there was no evidence of severe OA resulting in joint fusion, and although the males conform to the pattern of increased severity with age, the single old adult female only conforms if the lack of OA in the middle adults is also considered, suggesting that OA was present and more prominent in males. When OA distribution was considered however, only the old adult female had a significant spread of degenerative changes to be termed systemic, which corroborates with her age. When VJD was analysed at Rudston, it was found that seven individuals (70%) did not have any observable vertebrae, and of the three individuals that did, none had any evidence of the degenerative disease.

5.4.2.5 Trauma

When the craniums were inspected for evidence of fractures, seven were determined to be free from this trauma, while all three of the females within this population were inflicted with at least one cranial fracture (Table 5.14).

Sex/Age	Location	Location Side	Type	Sub Type	Healing Stage
F MA	Occipital	Right	BFT	Depression	0
		Left	2 SFT	Punctures	0
F OA	Parietal	Right	SFT	Puncture	0
F OA	Occipital	Right	SFT	Puncture	2

Table 5.14: Rudston prevalence of cranial trauma.

The occipital was the most common bone affected and punctures were the dominant form of trauma experienced by these females. The majority did not show any evidence of healing, suggesting they occurred at or close to the time of death. Although the entire sample was

examined for evidence of post-cranial fractures, it was found that none of the individuals had any evidence of this trauma. The limited number of post-cranial elements available for analysis may partially explain this.

5.4.2.6 Site Summary

The population of Rudston included ten individuals, who were heavily biased towards males. With regards to age, however, the group was evenly separated between the young and middle adults and the old adults. Dental diseases were quite common in this group with both sexes experiencing caries, however all sex and age groups had evidence of AMTL while only males were inflicted with abscesses. With respect to degenerative changes, the males were predominantly affected, while trauma in the form of cranial fractures was only evident on the females in the group.

5.4.3 Willerby Wold

The population of Willerby Wold includes four males and their age profile is presented below in Figure 5.53.



Figure 5.53: Demographic profile of Willerby Wold.

The sample is relatively evenly spread across the age groups, while there is obviously a sex bias towards males. All four males were sexed using the skull, and all four were determined to be males, based on their prominent secondary sexual characteristics. Additionally, they were all aged using attrition.

5.4.3.1 Preservation

Skeletal element preservation was examined for this group and the results are presented below in Figure 5.54.

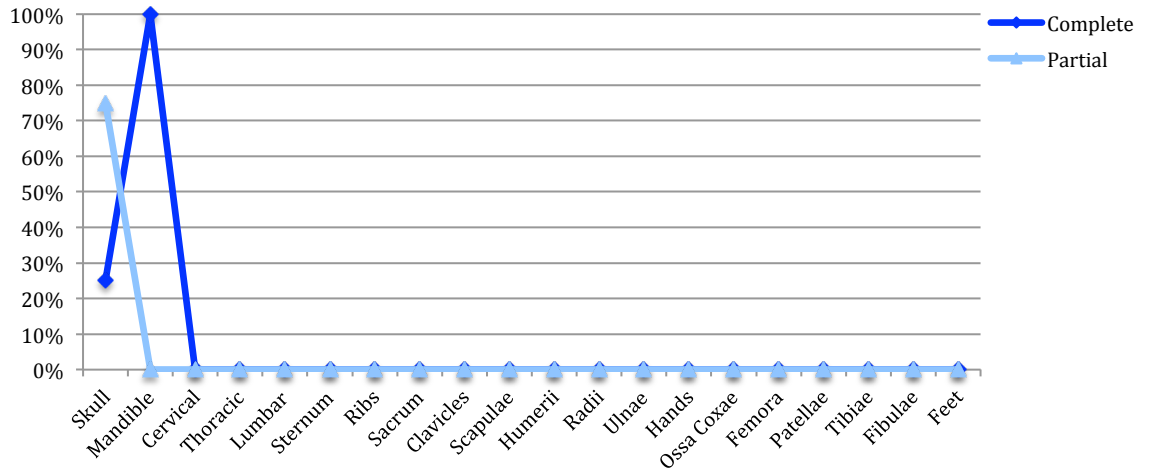


Figure 5.54: Willerby Wold skeletal element preservation.

This population is only represented by skulls and mandibles, and although the mandibles are all complete, the skulls range in preservation from the required minimum of 50% to only one individual having more than 75% of their skull available for analysis. Dental presence was also examined and there was a progressive decrease in dentition presence, which directly correlates with age (Figure 5.55).

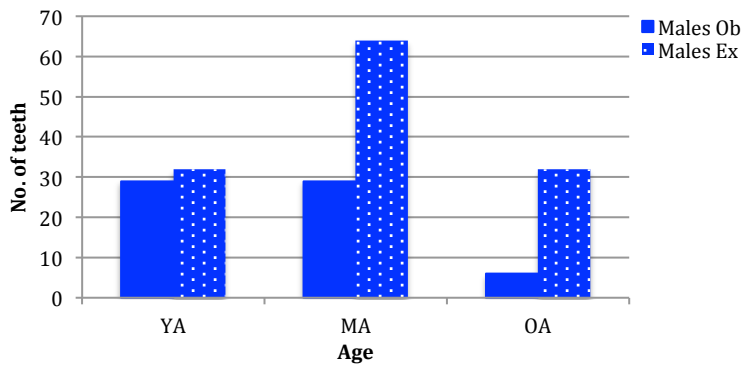


Figure 5.55: Dental presence at Willerby Wold.

Once the ages were combined and examined based on dentition section (Figure 5.56), it was found there was a fairly equal distribution of available dentition, though due to the minimal numbers of overall dentition available for the middle and old adults, the entire percentage of available teeth was approximately half of what was expected.

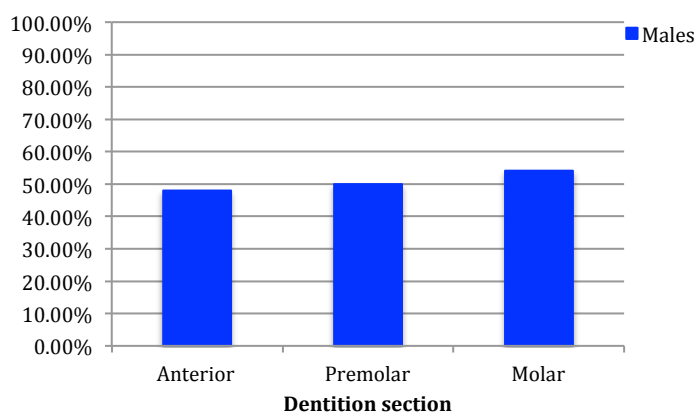


Figure 5.56: Dentition section presence at Willerby Wold.

These findings coincide with the established average dentition presence for the entire sample, which was determined to be 16, which is only 50% of the expected dentition. Finally, dentition presence was also scored (Figure 5.57).

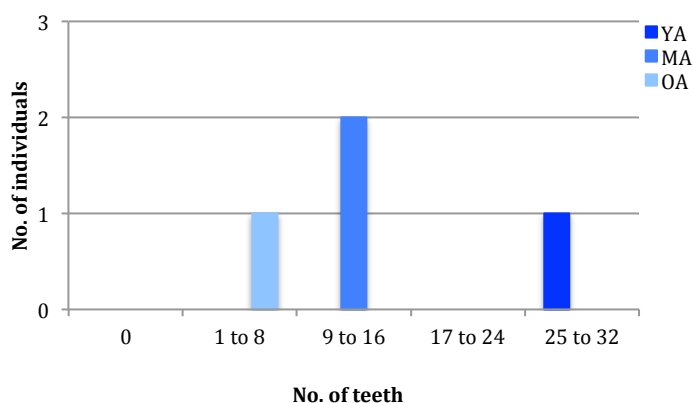


Figure 5.57: Dentition section presence at Willerby Wold.

There is a clear disparity between the available dentitions with the middle and old adults having far fewer available teeth for analysis in comparison to the young adult. Due to the complete lack of post-cranial element preservation, it was not possible to determine any stature estimations for this population.

5.4.3.2 Non-Specific Stress

When this group was examined for LEH, it was found that all individuals had the required anterior dentition for analysis (Figure 5.58).

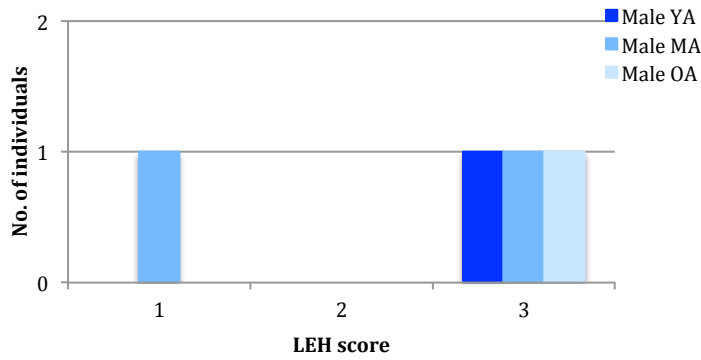


Figure 5.58: LEH severity at Willerby Wold.

Three quarters of the population had evidence of LEH, and they all presented with the more severe form, suggesting they experienced multiple periods of significant stress during their childhood years. In an analysis of CO, it was determined that two individuals (50% of the group) did not have orbits that were available for assessment, and the two individuals that did (the young adult and one middle adult) did not present any evidence of CO.

5.4.3.3 Dental Disease

Caries were first examined for this group, and it was found only a middle adult male presented with a single caries (Table 5.15).

Age	Total Observed Teeth	Observed Teeth	Cariou Teeth	% Population Cariou	% Individual Cariou	Caries Type	Severity	Dentition Location	Dentition Section
MA	65	16	1	1.54%	6.25%	Root	2	Mandibular	Molar

Table 5.15: Caries prevalence at Willerby Wold.

Additionally, when the population was examined for abscesses one individual (the old adult), 25% of the population, had evidence of a single abscess (Table 5.16).

Age	Observed Tooth Places	# Abscesses	% Abscesses	Dental Location	Dental Section	Tooth Loss	Healing	Sinus	Severity
OA	80	1	1.25%	Mandibular	Premolar	Yes	Healed	External	Moderate

Table 5.16: Abscess prevalence at Willerby Wold.

Finally, AMTL was also examined and it was found that only the old adult exhibited any tooth loss (25% of the population) and this loss was directly attributed to the abscess (Tables 5.17 and 5.18).

Age	Total Observed Tooth Places	Individual Observed Tooth Places	# AMTL	% Population AMTL	% Individual AMTL
OA	80	16	1	1.25%	6.25%

Table 5.17: AMTL prevalence at Willerby Wold.

Age	Dentition Location	Dentition Section	# AMTL	Left	% Left	Right	% Right
OA	Mandibular	Premolar	1	0	0%	1	100%

Table 5.18: AMTL detail at Willerby Wold.

In a summary of dental diseases experienced by the population at Willerby Wold, it was found one individual had a single caries and one individual that had both a single abscess and a single AMTL (Figures 5.59 and 5.60).

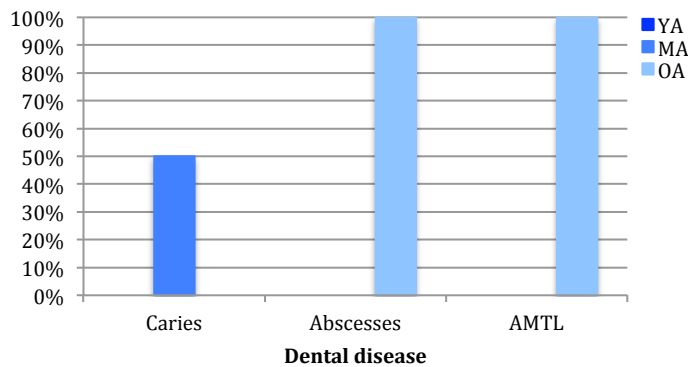


Figure 5.59: Willerby Wold proportion of individuals with dental disease.

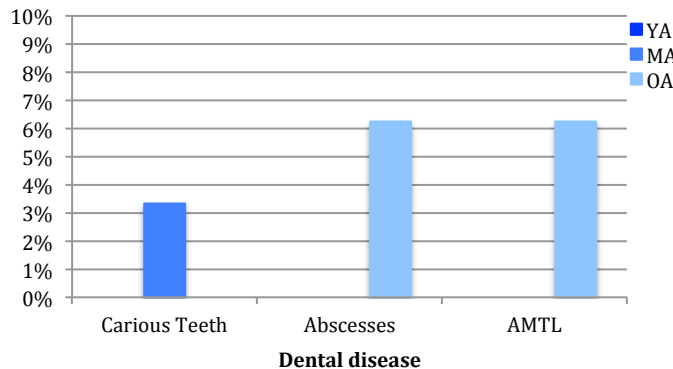


Figure 5.60: Willerby Wold proportion of observed teeth and tooth spaces with disease.

As can be seen, dental diseases were not a significant issue for this sample.

5.4.3.4 Degenerative Disease

As a result of the complete lack of post-cranial elements, and after assessing the TMJ of all individuals, it was determined that none of the individuals had any evidence of OA or VJD. The lack of degenerative changes may be due to the age of the skeletons, or more probably as a direct result of a lack of skeletal element preservation.

5.4.3.5 Trauma

In an analysis of cranial fractures, it was determined two individuals (50% of the population) had evidence of trauma (Table 5.19).

Age	Location	Location Side	Type	Sub Type	Healing Stage
MA	Frontal	Right	SFT	Puncture	1
MA	Frontal	Left	SFT	Linear	0
	Parietal	Right	SFT	Slice	1

Table 5.19: Prevalence of cranial trauma at Willerby Wold.

Two individuals were inflicted with three separate cranial fractures that were either not healing or in the early stages of healing at the time of death. Due to the complete lack of post-cranial elements it was not possible to determine if any of the individuals suffered from this form of fracture.

5.4.3.6 Site Summary

The site of Willerby Wolds includes four adult males with a relatively even distribution across the age categories. LEH was a prominent non-specific stressor with 75% having experienced multiple periods of stress in their formative years. Dental diseases were only experienced by two individuals and only three total teeth were involved. It would appear that this population did not experience degenerative diseases, however this may be due to the lack of post-cranial elements available for analysis. Trauma in the form of cranial fractures was experienced by 50% of the population and very little healing of each of the injuries took place before death. Finally, and once again due to preservation, it was not possible to assess to presence of post-cranial fractures.

5.4.4 Garton Slack

This site is composed of 22 individuals, and the demographic profile is illustrated below in Figures 5.61 and 5.62.

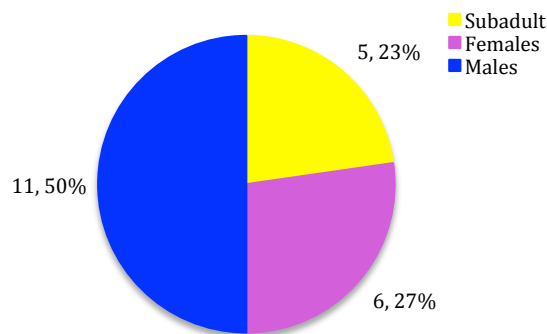


Figure 5.61: Demographic profile of Garton Slack.

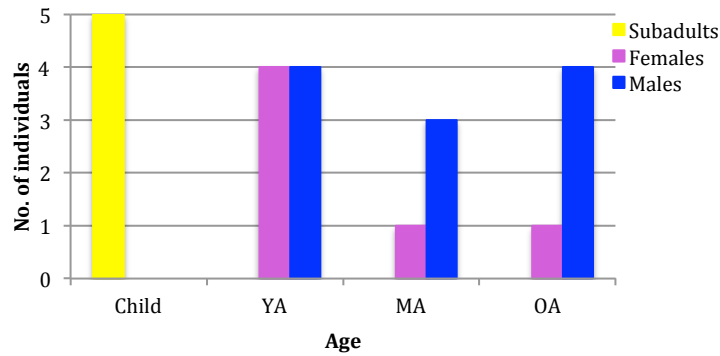


Figure 5.62: Garton Slack profile by age.

Garton Slack has a strong male bias, with age almost evenly distributed for males, but strongly biased towards young adults for females. This relationship was found to be very statistically significant ($p= 0.001$, $x^2= 23.883$, $df= 6$). Due to the limited number of post-cranial elements attributed to the subadults, it was not possible to reliably estimate their age based on epiphyseal fusion or presence. Therefore dental development was wholly relied upon which meant it was not possible to comment on a possible disparity between skeletal and dental development for this population. Two individuals (one young adult male and one old adult female) were estimated to be a probable male and probable female, as more of their secondary sexual characteristics of their skulls suggested male and female respectively, and for the purposes of this project, they were placed within their respective sex groups. Additionally, with the exception of one pelvis, all of the adults were sexed using the morphological features discussed in Chapter Four. For the young adult male that did have surviving innominates, it was determined his greater sciatic notch corroborated the sex estimation derived from the skull. All adults were also aged using dental attrition. The young adult male with innominates was also age estimated using the auricular surface and the ranges were found to overlap (dental attrition 25 to 30, auricular surface 25 to 29).

5.4.4.1 Preservation

Skeletal element preservation was examined for the sample from Garton Slack and the results are presented below in Figure 5.63.

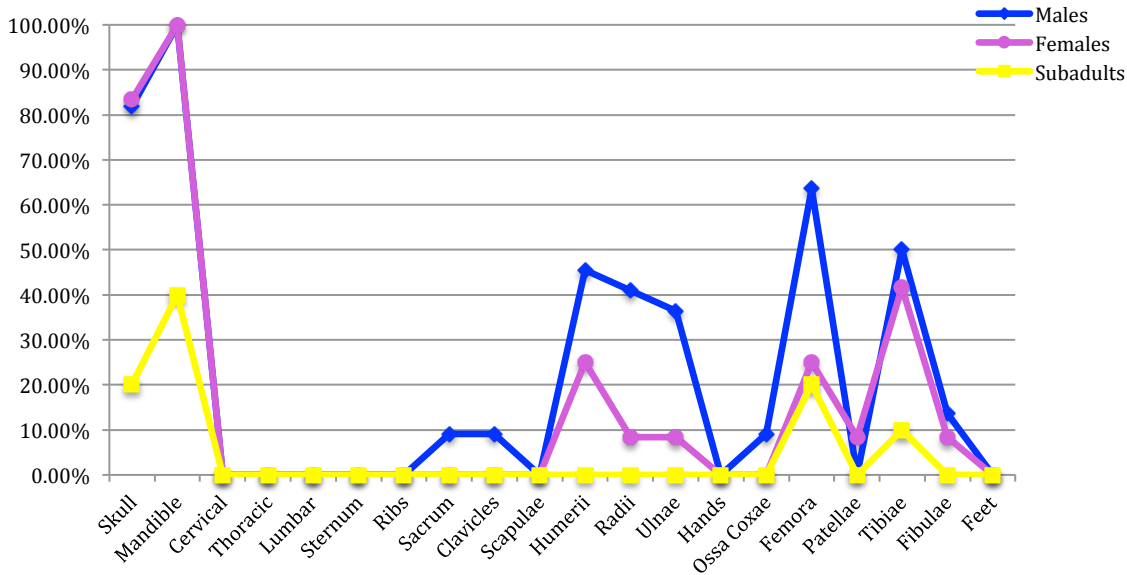


Figure 5.63: Garton Slack skeletal element preservation.

Males had a greater percentage of complete skeletal elements, but both males and females had a similar range in the types of elements represented. Subadults were much more limited in their complete elements.

Dental preservation was also examined with respect to tooth presence by age and sex as well as tooth section (Figures 5.64 and 5.65).

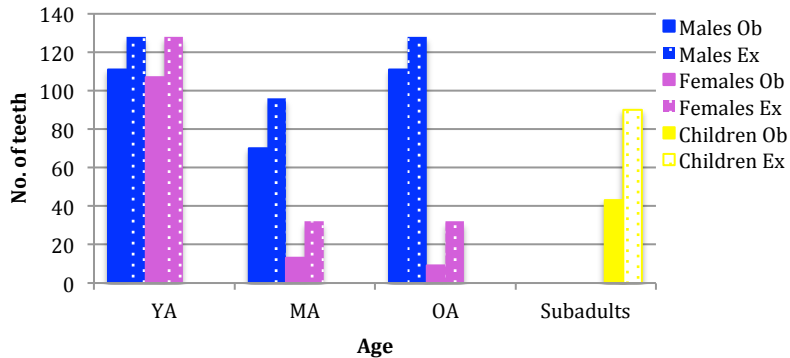


Figure 5.64: Dental preservation at Garton Slack.

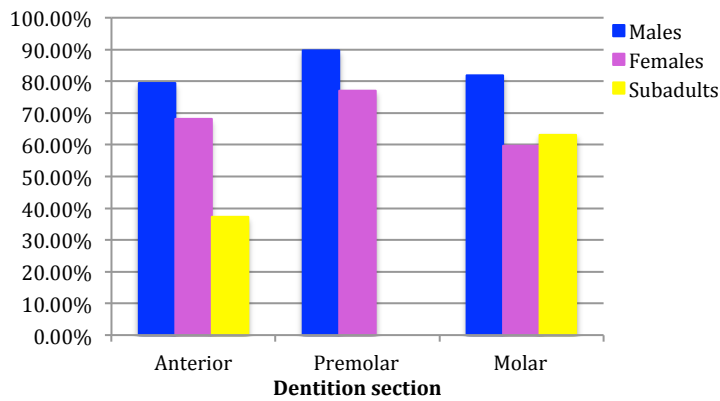


Figure 5.65: Dentition section presence at Garton Slack.

The young adults of both sexes had very similar dentition available for analysis. However with regards to middle adults, and even more so with the old adults, the females had a drastic decrease in dentition presence compared to the males. When this relationship was broken down by dentition section, premolars were the most complete section for both sexes, followed by the anterior dentition and then the molars. With respect to sex, however, males had consistently higher percentages of expected teeth across all tooth sections. Finally, dentitions were also scored based on presence (Figure 5.66).

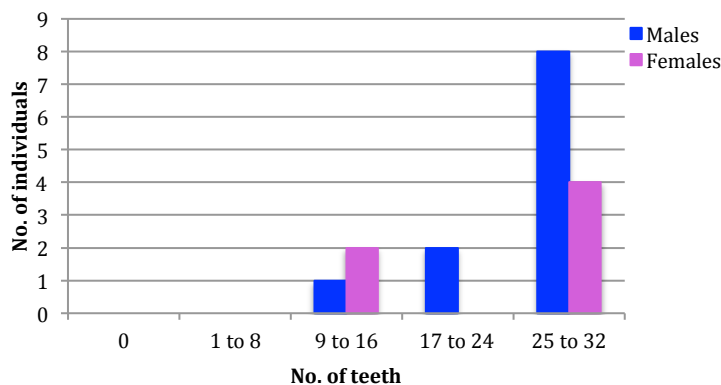


Figure 5.66: Garton Slack count of dentition presence.

Based on the calculated average dentition presence, young adult and old adult males have very similar rates, while middle adults have the lowest for their sex. For females however, the young adults have the highest rate and dentition presence decreased with increasing age. When dentition scores were examined, it is clear that the majority of individuals (70.59%) have dentition counts in the highest bracket, suggesting, overall, a favourable amount of dentition available for analysis.

As a result of the preservation levels for this population, it was possible to determine stature estimates for seven males and two females (Table 5.20 and Figure 5.67).

Skeleton	Sex/Age	Element	Height (cm)	Height (in)
B75Bu2Sku23	F YA	Right Tibia	163.9 ± 3.66	64.527 ± 1.44
B79Bu5	F OA	Left Femur	167.72 ± 3.72	66.031 ± 1.464
B75Bu3Sku24	M YA	Left Femur + Tibia	170.54 ± 2.99	67.142 ± 1.17
B82GFSku39	M YA	Right Femur	166.13 ± 3.27	65.405 ± 1.287
B82GHSku41	M OA	Left Femur + Tibia	176.26 ± 2.99	69.393 ± 1.17
B82BJSku40	M MA	Right Tibia	174.884 ± 3.37	68.851 ± 1.326
B107BASku21	M YA	Left Femur	171.128 ± 3.27	67.373 ± 1.287
B152B2Sku97	M OA	Right Tibia	178.916 ± 3.37	70.439 ± 1.326
B152B5Sku20	M OA	Right Humerus	171.782 ± 4.05	67.630 ± 1.594

Table 5.20: Stature estimation at Garton Slack.

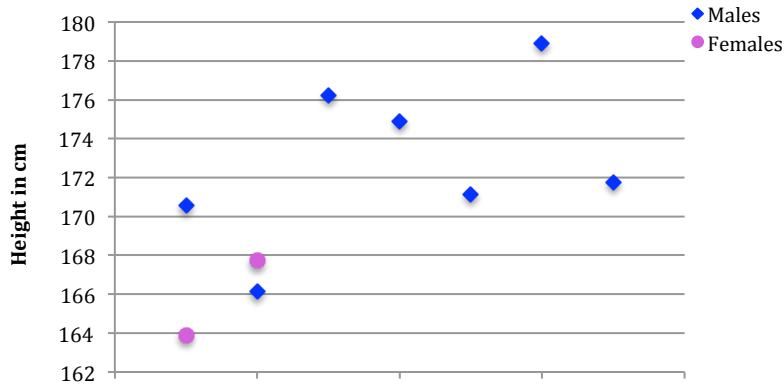


Figure 5.67: Garton Slack stature estimation by sex.

The males have a wide range of heights from a low of 166.13 cm (5ft. 4.5in.) to a high of 178.916 cm (5ft. 8.7in.), with an average of 172.806 cm (5ft. 6.7in.). The two females are significantly shorter at 163.9 cm (5ft. 3.8in.) and 167.72 cm (5ft. 5in.) and an average of 165.81 cm (5ft. 4.4in.), with only one male falling between their measurements.

5.4.4.2 Non-specific Stress

The presence of LEH was examined at Garton Slack and seven individuals did not have any anterior teeth or their labial surfaces were obscured as a result of reconstruction efforts post excavation (Figure 5.68).

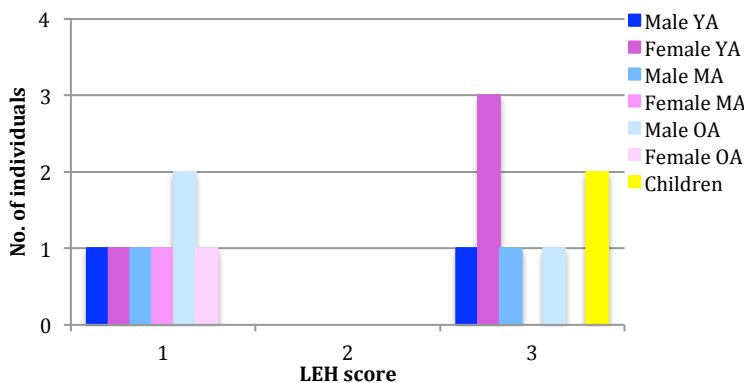


Figure 5.68: LEH severity at Garton Slack.

Males in every age group had evidence of LEH compared to only young adult females. When those without anterior dentition were removed from the analysis however, 50% of females and only 42.86% of males had evidence of LEH, though each sex had three individuals with

LEH. When severity was examined it was determined that all of those with LEH had experienced at least two separate instances of severe stress during their childhood years. As the only two subadults with observable anterior dentition presented with LEH, this suggests they were likely to have been under stress when they died and had already experienced several periods of stress in their short lives.

The presence of CO was also analysed for this population and only one individual (a child) did not have any surviving orbits suitable for inspection (Figure 5.69).

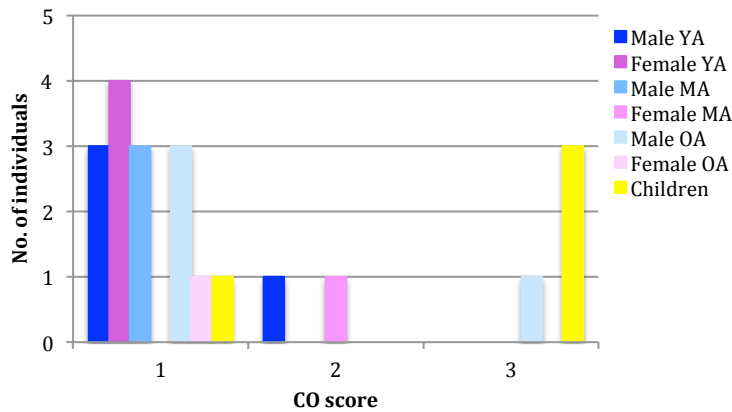


Figure 5.69: CO severity at Garton Slack.

The population of Garton Slack was affected with CO in both sexes and in every represented age category. Overall 27.27% of the population had evidence of CO, with 17.65% of adults and when the subadult without available orbits is removed from the sample, 75% of them also had evidence.

5.4.4.3 Dental Diseases

Caries were examined in the population at Garton Slack and eight individuals (36.36%) were free from this dental disease. A summary of caries presence by both sex and age and an investigation of observed and carious teeth are in Figures 5.70 and 5.71.

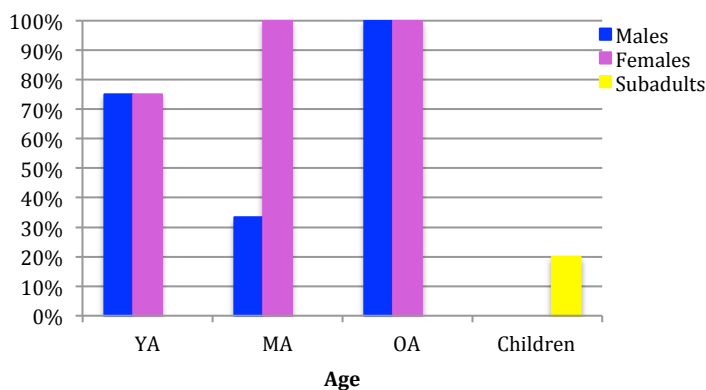


Figure 5.70: Caries prevalence at Garton Slack.

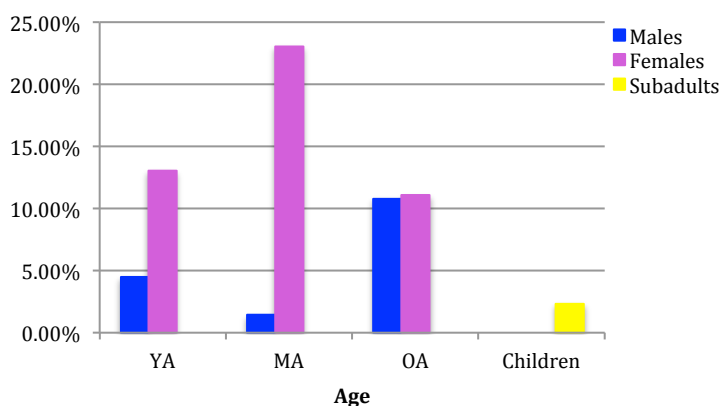


Figure 5.71: Proportion of carious teeth at Garton Slack.

Based on the charts above it is clear that for young and old adults both males and females had the same percentage of individuals with caries (75% and 100% respectively), while middle adult males had a much lower percentage compared to their female age counterparts, and subadults had the lowest percentage at 20%. When raw numbers were examined however, more males ($n=8$) than females ($n=6$) had caries present on their dentition. When the relationship between age and caries presence was examined statistically, a slightly strong relationship was found ($p= 0.052$, $\chi^2= 7.739$, $df= 3$). When carious teeth were analysed, overall and for each age category, females presented much higher percentages, with only the old adult males approaching the percentage seen in their female age counterparts. The raw number of carious teeth was the same, but, as there was a higher percentage of preserved teeth in males, the rate was drastically decreased. Dentition location was also investigated and the majority of caries were observed on the maxillary dentition for females. However for males there was almost an even split between the maxillary and mandibular dentition. Caries type was also explored (Figure 5.72 and 5.73).

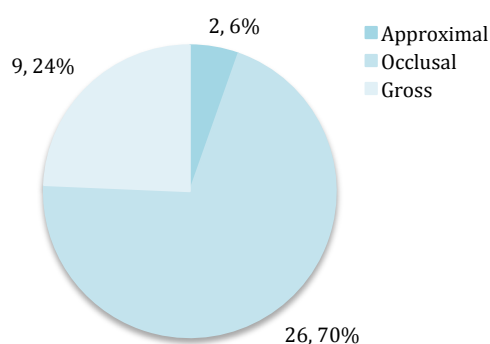


Figure 5.72: Proportion of caries by type at Garton Slack.

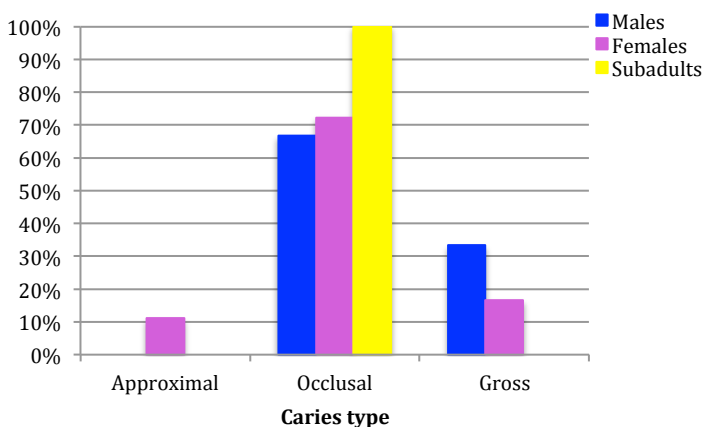


Figure 5.73: Garton Slack caries by type.

The majority of caries were occlusal in nature, though for the age groups among the females, the middle adults had a higher proportion of gross caries in comparison to any other type. With respect to severity, for males, 83.33% of all caries were scored as a three or higher, while for the females only slightly more were classed as three (55.56%) in comparison to a score of two (44.44%).

Abscesses were also examined in this population and 12 individuals (54.55%) did not have any evidence of this dental disease (Figures 5.74 and 5.75).

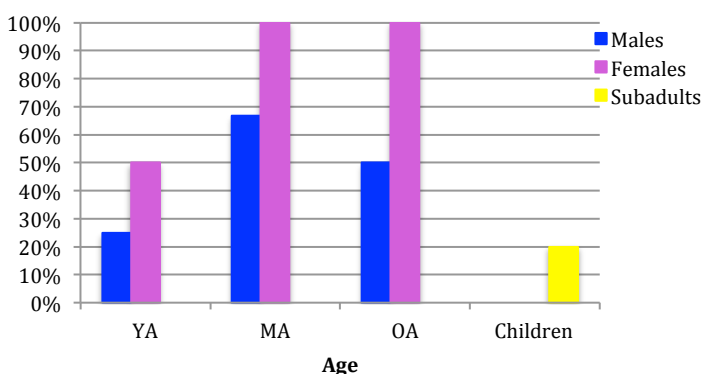


Figure 5.74: Abscess prevalence at Garton Slack.

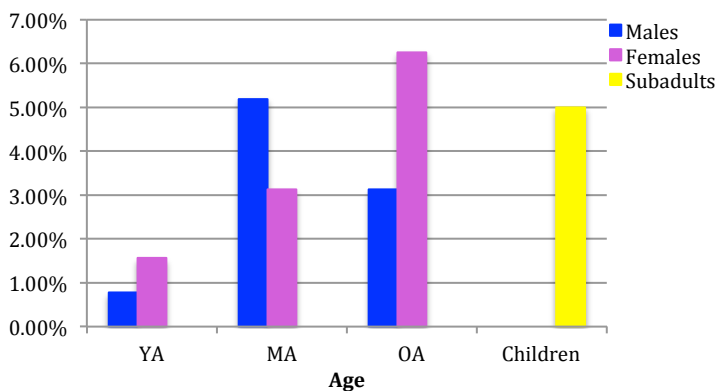


Figure 5.75: Proportion of tooth spaces and abscesses at Garton Slack.

Every age group and both sexes had evidence of abscesses, and in total, 45.45% of the population had at least one abscess, including one subadult. With respect to the total sex rates, males and females was quite similar, but when age categories were examined it was found that the young and old adult females had twice the rate of their male aged counterparts, while middle adult males had just under twice the rate of middle adult females. The single abscess observed on the subadult was active at their time of death, had an external sinus and was considered of moderate size. The majority of males were still suffering with their abscesses at their time of death, had external sinuses and exhibited more severe and extensive abscesses. Conversely, all of the females had healed abscesses, the majority also had external sinuses and the severity was deemed to be moderate in 75% of cases. Finally, tooth loss as a result of abscesses was explored with respect to dentition location and both males and females lost the same number of teeth. However as the three mandibular teeth lost in the middle adult category are derived from one individual, more females actually lost teeth as a result of abscesses. This may be due to the advanced state of their abscesses, and as the males' were mostly still active, they may have subsequently lost those teeth as the disease progressed.

Finally, AMTL was investigated among the Garton Slack population and 11 adults (64.7% of the adult population) did not experience any tooth loss (Figure 5.76).

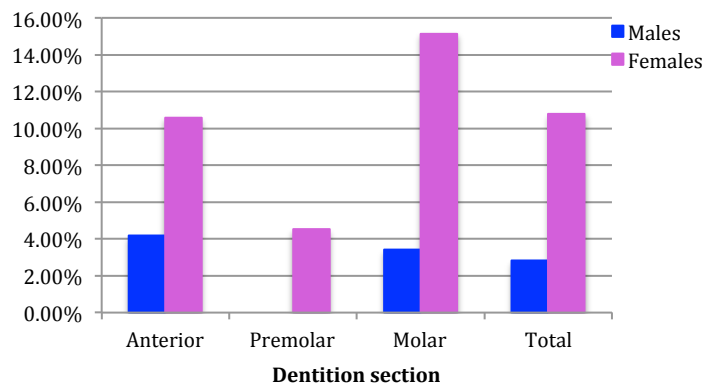


Figure 5.76: Proportion of tooth spaces and AMTL at Garton Slack.

AMTL was present in both sexes and through all age groups. With respect to dentition section, males had a much lower rate of AMTL in both the anterior and molar region, and the premolars were free from AMTL. Among the females all three sections of the dentition were affected with the highest percentage among the molars. AMTL by side was also investigated for both sexes (Figure 5.77).

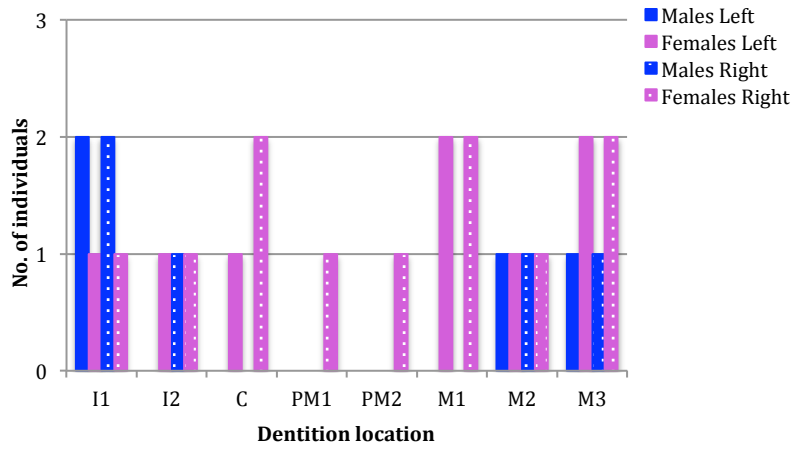


Figure 5.77: AMTL by side at Garton Slack.

Among young and middle adult males there is a bias towards the right, while for old adult males that bias is entirely with the left side of the dentition. For females the young adult only had a single tooth lost, while for the middle and old adults there was almost an even distribution for left and right. Dentition location was also examined and the findings of the combined age categories by sex are detailed in Figure 5.78.

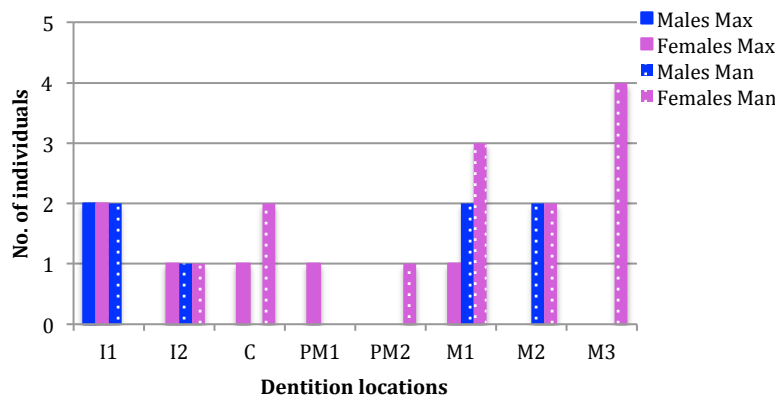


Figure 5.78: AMTL at Garton Slack by dentition location.

There is a bias towards the mandibular dentition with the males showing a stronger preference. With regards to healing stage, for both the males and females, the majority of AMTL occurred some time before death as the tooth root spaces were beginning to close. Additionally, only with the females was there evidence of complete healing, suggesting some of these teeth were lost quite a while before death. Finally, AMTL was examined for associated pathologies to determine the possible causes of the tooth loss and almost half of the male AMTL was directly related to associated pathologies (in all cases, abscesses, as described in the previous section), while among the females, there were only two clear cases of pathological association, and both of these were also as a result of abscesses.

In a summary of dental pathologies, it was determined that only four subadults (18.18% of the population) did not display any evidence of disease. A summary by both age and sex of

disease presence is provided in Figure 5.79, while an investigation of observed teeth and teeth places with respect to dental disease is detailed in Figure 5.80.

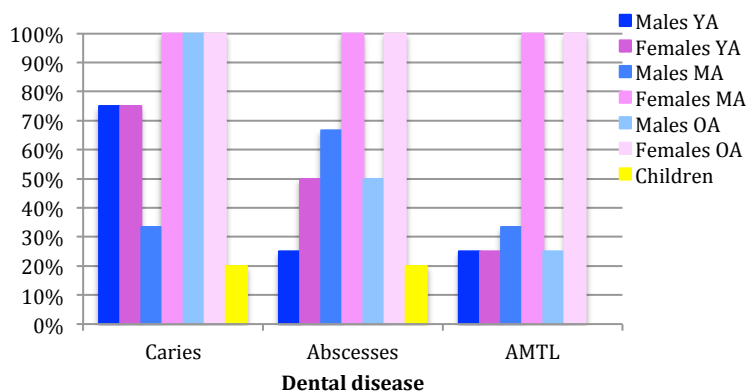


Figure 5.79: Garton Slack proportion of individuals with dental disease.

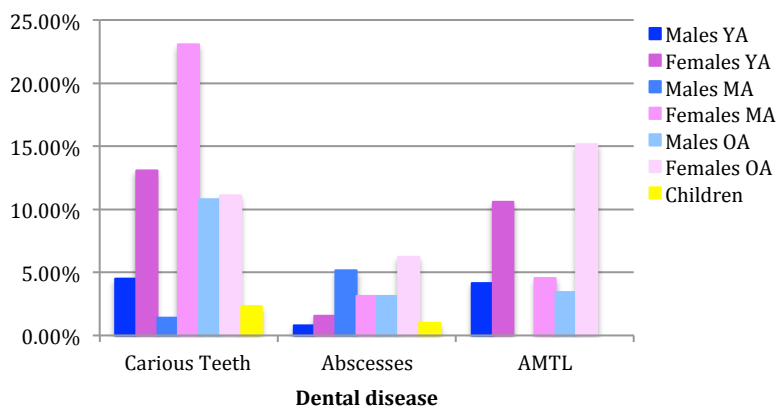


Figure 5.80: Proportion of observed teeth and tooth spaces with disease at Garton Slack.

All three types of dental diseases were experienced by all age and both sex groups (with the exception of AMTL in subadults). Additionally, when carious teeth and rates of abscesses and AMTL were considered, females exhibited much higher rates of both caries and AMTL while abscesses were present on almost the same rate of teeth for both sexes. The single subadult that had evidence of dental disease had a single caries and an abscess on their deciduous dentition.

5.4.4.4 Degenerative Disease

In an assessment of the adult population at Garton Slack, it was found that 12 individuals (63.16% of the group) had no evidence of degenerative changes (Figure 5.81).

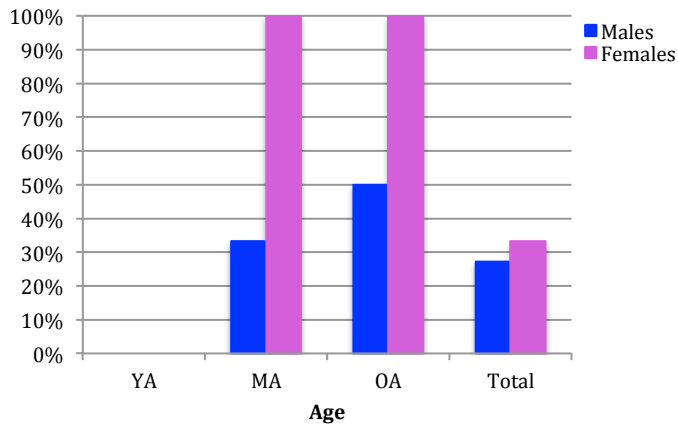


Figure 5.81: OA prevalence at Garton Slack.

Only the middle and older adults of the population had evidence of OA. The sample was investigated further with regards to joint location and side and with the exception of two single instances of OA at the TMJ (present in the old adult male and the middle adult female), sides of joints affected are evenly split between left and right (Figure 5.82).

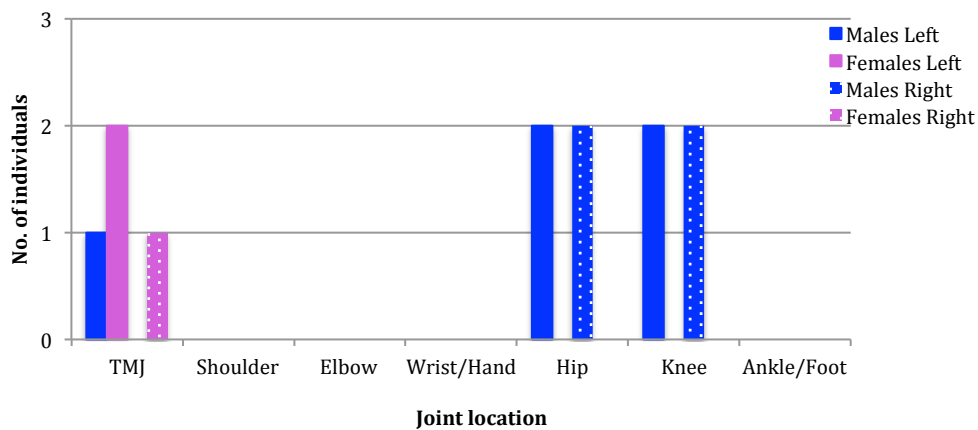


Figure 5.82: Garton Slack OA by joint and side.

The ages were combined and the relationship between joint location and sex was explored. With the exception of the instance of OA on the TMJ of a male, it appears as though joint location was biased towards a certain sex with the hip and knees exclusively degenerating in males, while the TMJ was predominantly affected in females. Due to these small sample sizes, however, it was not possible to determine statistical significance. Finally, severity and OA distribution were investigated and it is clear that none of the adults had evidence of the most severe form of OA, which was joint fusion. All three males affected showed moderate severity, while the middle adult female displayed mild severity, and with increased age was heightened severity, as the old adult female had moderate OA. With respect to OA distribution, all individuals, with the exception of the middle adult female, demonstrated a regional spread of OA. The middle adult female, with the joints of the hips, knees and TMJ showing evidence of degeneration, was classed as systemic.

In an inspection of the adult population at Garton Slack for VJD, it was determined that 13 individuals (76.47% of the adult group), did not have any vertebrae preserved for analysis. Although four individuals did have a few partial vertebrae, none demonstrated any evidence of degeneration.

5.4.4.5 Trauma

Crania were inspected for evidence of fractures at Garton Slack and 16 individuals were found to be free from this form of trauma, 72.72% of the population (Figure 5.83).

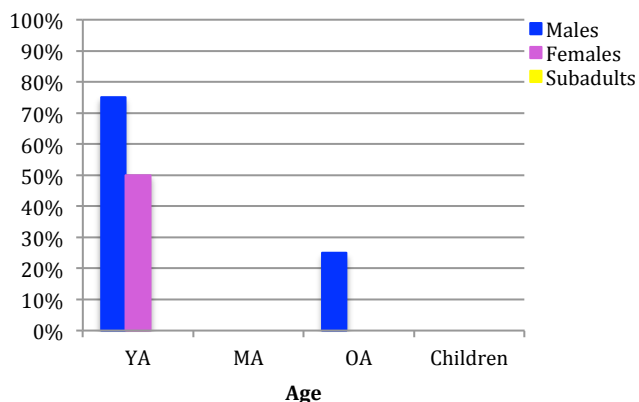


Figure 5.83: Cranial trauma prevalence at Garton Slack.

Cranial fractures were confined to the young adults in the population as well as an isolated old adult male. Fracture location and type were investigated and the results are below in Figure 5.84 and 5.85.

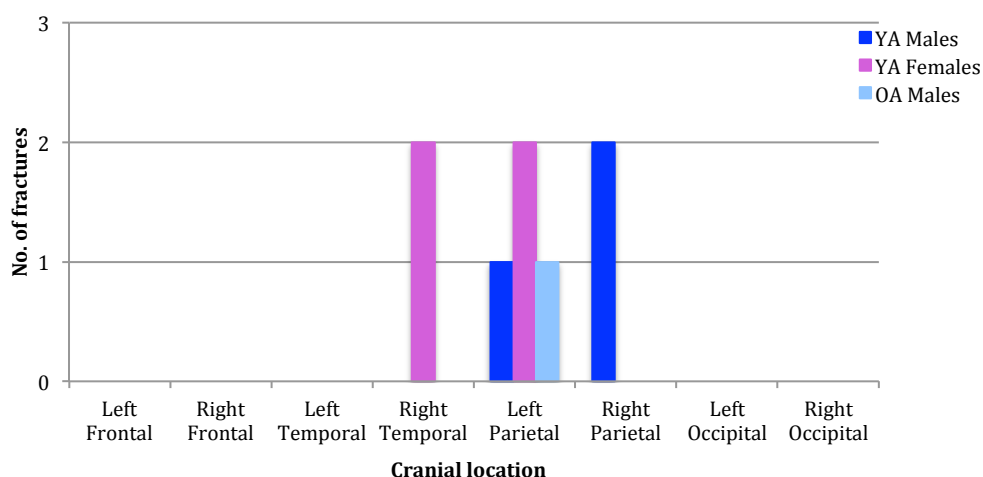


Figure 5.84: Garton Slack cranial fractures by location.

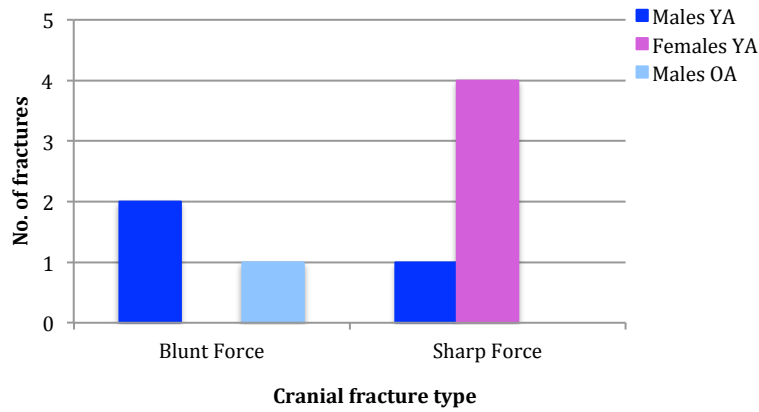


Figure 5.85: Garton Slack cranial fractures by type.

These findings suggest that all individuals with cranial fractures had their wounds in the centre of their skulls with four exhibiting fractures on the right side, and four on the left. This pattern was not found to be sex specific. With respect to fracture type, all of the females received sharp force trauma, while the males predominantly displayed blunt force trauma. Fracture sub type and healing were also investigated (Figures 5.86 and 5.87).

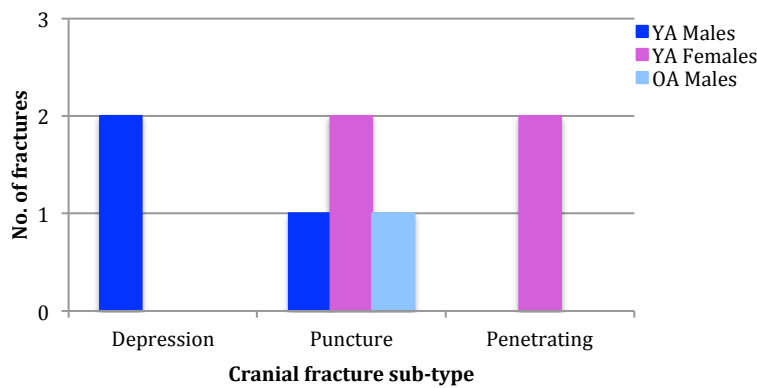


Figure 5.86: Garton Slack cranial fractures by sub type.

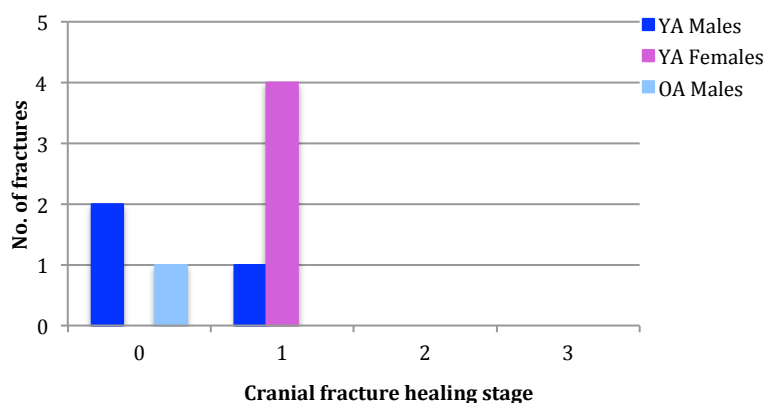


Figure 5.87: Garton Slack cranial fractures by healing stage.

There was a range of fracture sub types with no obvious relationship between sex or age and fracture received. With respect to healing, it is clear from the figure above that all individuals

received their fractures at or relatively close to death, as there was either no, or very little evidence of healing.

When the population of Garton Slack was investigated for post-cranial trauma, it was found that 19 individuals (86.36% of the population) did not have any evidence of fractures. The three individuals that did are summarised below in Table 5.21.

Sex/Age	Bone	Side	Healing	Associated Pathologies
M OA	Femur	Right	3	Shortened Length
M OA	Humerus	Right	2	None
F YA	Humerus	Right	3	Twisted

Table 5.21: Prevalence of post-cranial fractures at Garton Slack.

All individuals with injuries, suffered fractures to their right bones, however this sample size is too small to determine statistical relationships between sex, age and fracture location.

5.4.4.6 Site Summary

The site of Garton Slack includes 22 people and is heavily biased towards males, though the age ranges are relatively evenly distributed. LEH was common at this site with 36.36% of the population exhibiting at least one hypoplasia, while CO was present in 27.27% of individuals. Dental diseases were very common in this population with both sexes and all age ranges exhibiting caries and AMTL, with abscesses present in males and a single subadult. OA was evident in a third of adult males and females, while VJD was non-existent, partially due to the lack of available vertebrae for analysis. Finally, cranial trauma was quite prominent with 45.45% of the population exhibiting fractures, while three individuals had evidence of post-cranial trauma to the right side of their bodies.

5.4.5 Cowlam

The Bronze Age sample from Cowlam is composed of eight individuals and Figures 5.88 and 5.89 provide graphical summaries of the age and sex distribution.

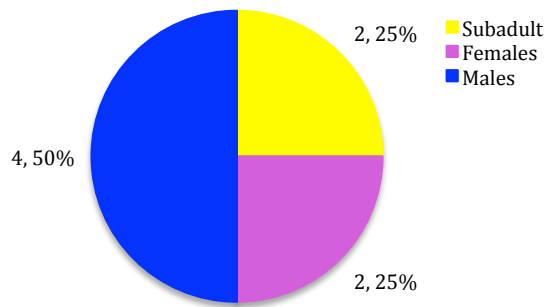


Figure 5.88: Demographic profile of Cowlam.

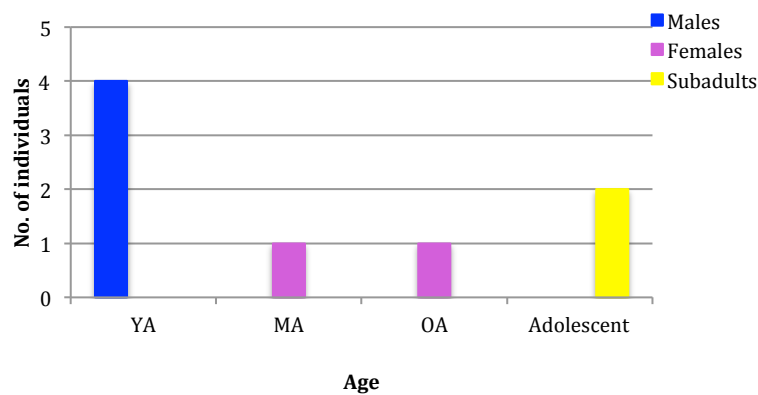


Figure 5.89: Cowlam profile by age.

Of the four males, two were classed as probable and of the two females, one was termed probable. For the purposes of this project the groups were combined to result in four males and two females. There appears to be both an age and sex bias within the Cowlam sample, however due to the low numbers it was not possible to determine the statistical significance.

Both adolescent subadults were aged using dental and skeletal estimations and it was found that the age ranges from each method overlapped sufficiently to negate any belief that their skeletal growth was seriously affected by stress. All of the adults were aged using dental attrition as a result of a lack of any additional skeletal elements. With regards to sex estimation, as the skull and mandibles were sufficiently complete to assess secondary sexual characteristics, and the innominates were not available for examination, the morphological features of the cranium and mandible were used to determine sex. As stated in Chapter 5, if there was ambiguity or fewer than three morphological features available, the individual was excluded from the study.

5.4.5.1 Preservation

As alluded to, the preservation of skeletal elements from Cowlam was quite limited. The majority of individuals were only represented by skulls and a few isolated elements (Figure 5.90).

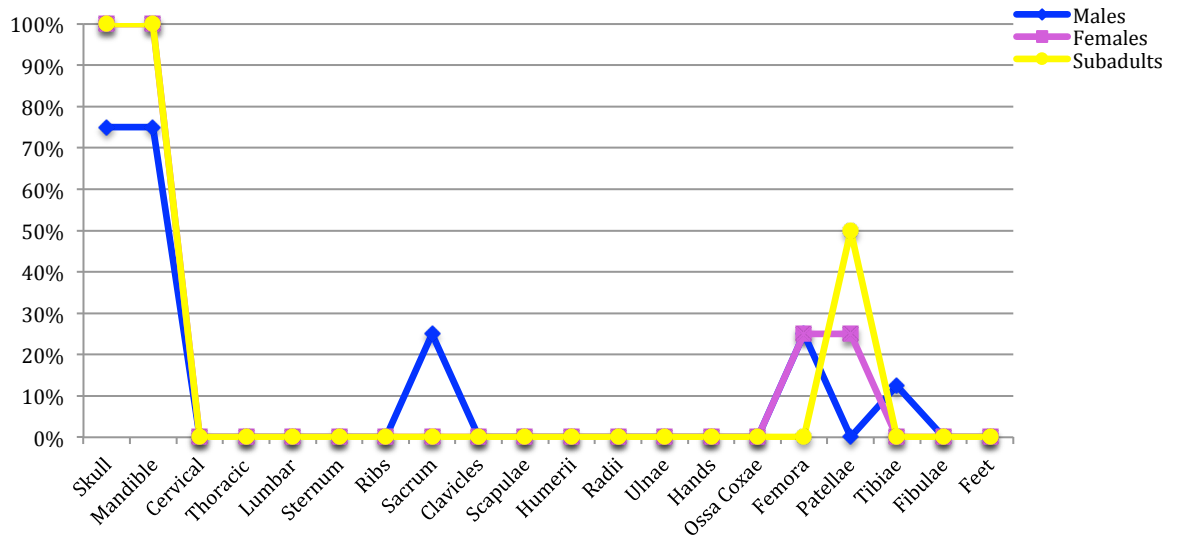


Figure 5.90: Cowlam skeletal element preservation.

Dental preservation was also examined separately to determine whether any patterns existed among the sex and age groups for the adults. Teeth were first assessed with regards to the percentage of expected teeth that were present (Figure 5.91).

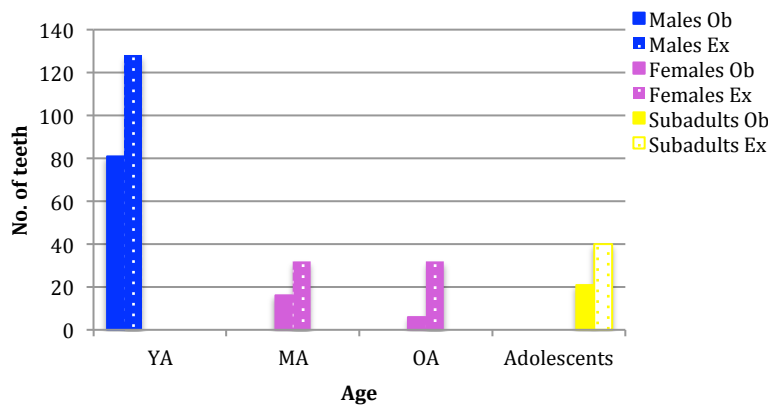


Figure 5.91: Dentition presence at Cowlam.

The males have a higher percentage of teeth present, however they are also younger than the two females of the sample, and the old adult female had the least number of teeth present, which was to be expected. When the dentitions were separated by section (Figure 5.92), it was found that the percentage of presence was quite similar across the sections.

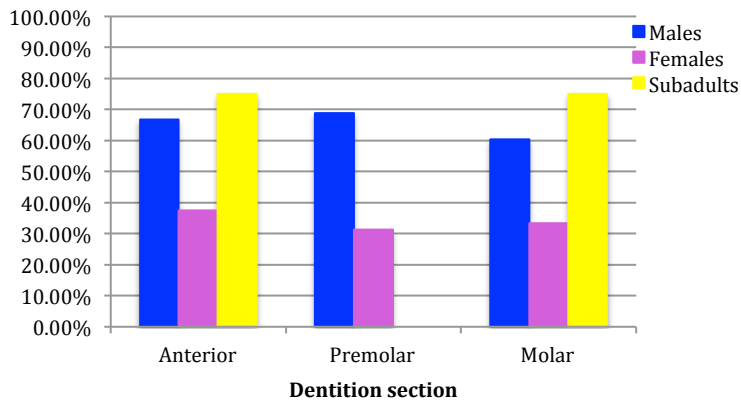


Figure 5.92: Dentition section presence at Cowlam.

Dentition presence was also examined within the context of average dentition and it was found the males had 20.25 teeth, while the females had 11, suggesting the males had on average twice as many teeth as the females and this relationship was also examined through dentition score (Figure 5.93).

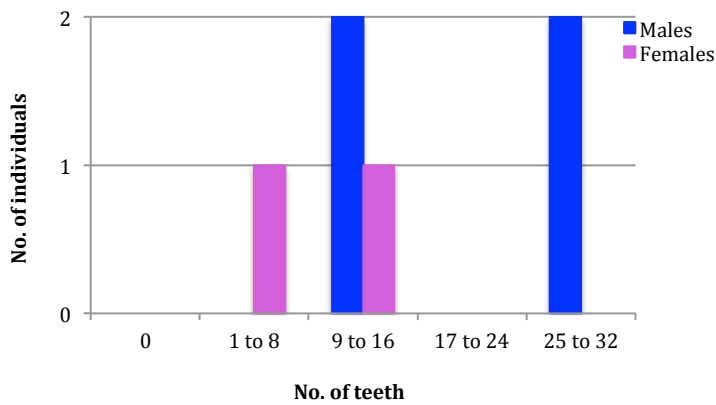


Figure 5.93: Cowlam count of dentition presence.

When the sample was examined for available skeletal elements to determine stature, it was found that two young adult males had the necessary long bones to arrive at stature estimates (Table 5.22).

Skeleton	Sex/Age	Element	Height (cm)	Height (in)
1939	MYA	R Femur	159.942 ± 3.27	62.969 ± 1.287
1941	MYA	R Femur	164.464 ± 3.27	64.749 ± 1.287

Table 5.22: Stature estimation at Cowlam.

5.4.5.2 Non-specific Stress

When the Cowlam sample was examined for LEH it was found that one young adult male did not have anterior dentition that could be properly examined (due to a loss of 75%, n= 9 teeth) and an obscuring of the remaining three due to reconstruction techniques. Of the remaining seven individuals, six (85.71%) displayed evidence of LEH. Those with anterior dentitions available for analysis were examined based on the presence of LEH and the severity score (Figure 5.94).

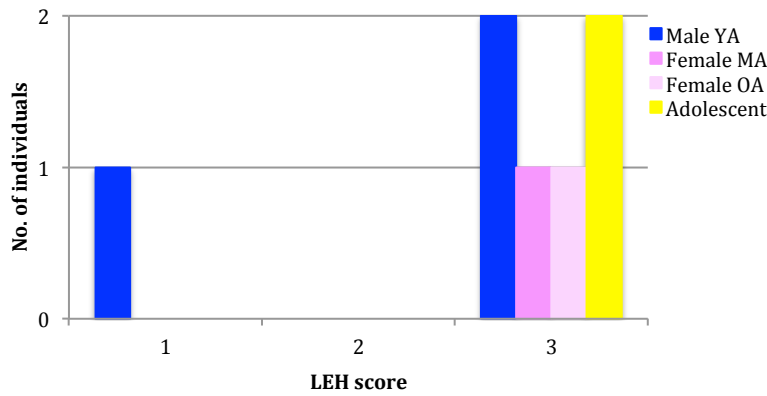


Figure 5.94: LEH severity at Cowlam.

All of the individuals with LEH exhibited the more severe form with more than one LEH per tooth, suggesting several episodes of stress in childhood.

The presence of CO was also examined at Cowlam and it was found that all individuals had orbits preserved for analysis. Only one young adult male had evidence of CO, and when severity was examined it was found this individual had the second highest severity score (4), suggesting an ongoing and severe stress episode.

5.4.5.3 Dental Diseases

The sample was examined for the presence of caries and it was found that two individuals did not have any caries (25%). Figure 5.95 provides a summary of the presence and absence of caries by both sex and age. As all of the females, most of the males, and half of the subadults exhibited at least one caries each, it would suggest a high prevalence rate. The number of carious teeth was also examined within the context of both sex and age (Figure 5.96).

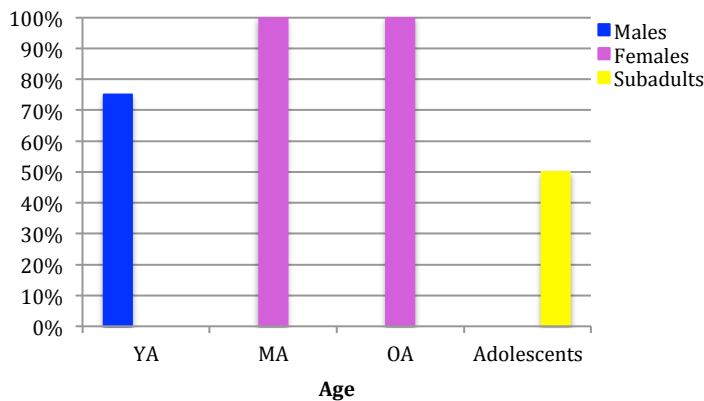


Figure 5.95: Caries prevalence at Cowlam.

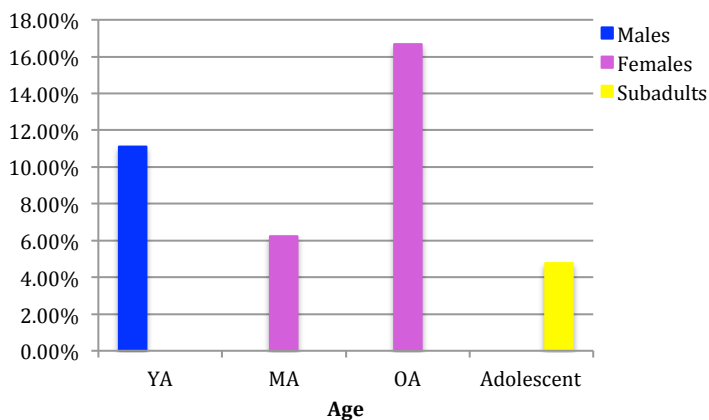


Figure 5.96: Proportion of carious teeth at Cowlam.

Males exhibited a slightly higher caries rate overall, however, due to the low number of teeth overall for the sole old adult female, she has the higher percentage of carious teeth. Caries type was also explored (Figures 5.97 and 5.98).

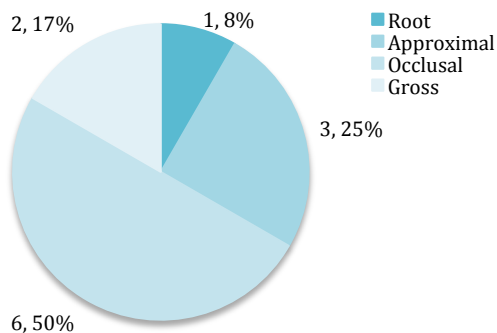


Figure 5.97: Proportion of caries by type at Cowlam.

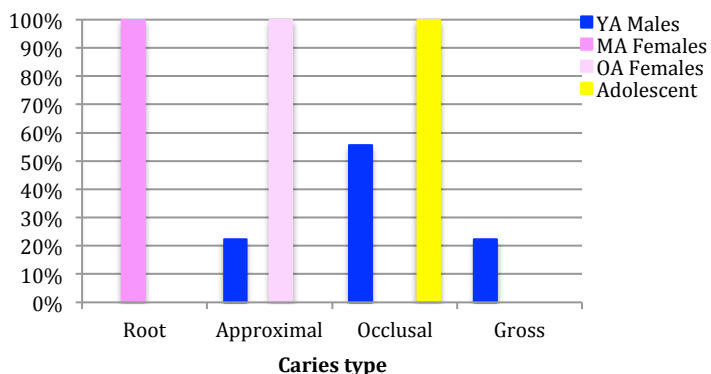


Figure 5.98: Cowlam caries by type.

The males presented a range of types of caries, while the middle adult and old adult females as well as the adolescent each presented one type of caries (from one caries each). Finally, caries were also explored within the context of dental location and it was found that only the males exhibited caries on both the maxillary and mandibular dentition, while the females and subadults were confined to the mandibular dentition.

Abscesses were also examined within this population and it was found that only one individual had a single abscess (12.5% of the total population Table 5.23), and this resulted in a personal abscess rate of 3.13% and a population abscess rate of 0.55%.

Sex/ Age	Total Observed Tooth Places	Observed Tooth Places	# Abscesses	Dental Location	Dental Section	Tooth Loss	Healing	Sinus	Severity
M YA	183	32	1	Mandible	Molar	No	Active	Internal	Severe

Table 5.23: Abscess prevalence at Cowlam.

Finally, AMTL was also examined for this population and it was found that only one individual (not the individual with the abscess), exhibited the loss of four teeth much earlier in life as they had all fully healed (with a healing score of 3), and no associated pathologies were found to be the causal factor. Due to the completeness of healing, however, it is not possible to be positive about associated pathologies (Table 5.24 and Table 5.25).

Sex/ Age	Total Observed Tooth Places	Total Female Observed Tooth Places	Individual Observed Tooth Places	# AMTL	% Population AMTL	% Female AMTL	% Individual AMTL	Dentition Location
F OA	136	32	16	4	2.94%	12.50%	25%	Mandible

Table 5.24: AMTL prevalence at Cowlam.

Female Old Adult					
Dentition Section	# AMTL	Left	% Left	Right	% Right
Premolar	1	1	100%	0	0%
Molar	3	1	33.33%	2	66.67%

Table 5.25: AMTL details at Cowlam.

In a summary of the dental diseases exhibited by the population at Cowlam, it was determined that two individuals out of eight (25%) did not display any evidence of dental disease (Figure 5.99).

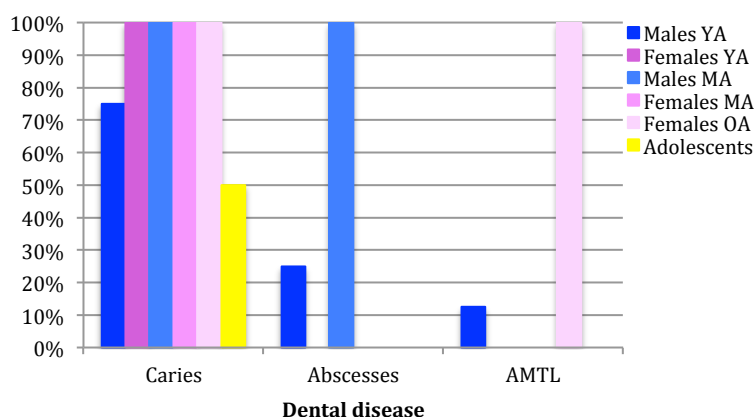


Figure 5.99: Cowlam proportion of individuals with dental disease.

Caries were the most prevalent form of dental disease within this population and single individuals within each age and sex category were the only ones affected by abscesses and

AMTL. Dental diseases were also summarised by affected tooth or tooth spaces (Figure 5.100).

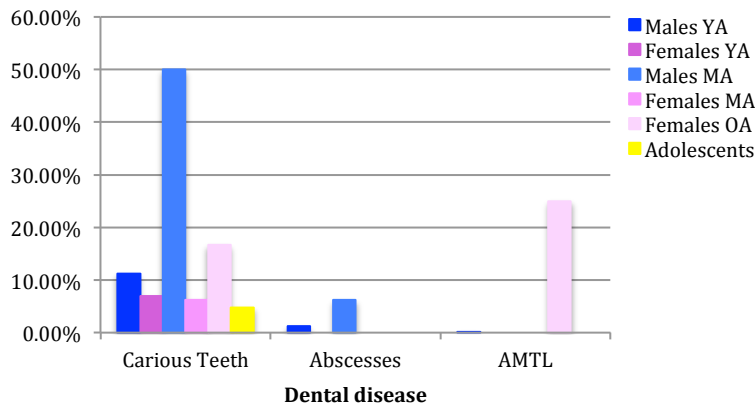


Figure 5.100: Cowlam proportion of observed teeth and tooth spaces with disease.

Overall, the Cowlam sample presents high percentages of caries and carious teeth and a limited number of abscesses and AMTL.

5.4.5.4 Degenerative Diseases

In an assessment of the Cowlam adult sample, it was found that seven individuals (87.5%) did not display any evidence of degenerative changes. This may, in part, be explained by the limited number of post-cranial elements available for inspection as well as the younger age categories that form the majority of the sample. Given this information, it was found that the sole individual with OA was an old adult female (Table 5.26).

Sex/ Age	Joint Location	Left / Right/Both	Severity	Distribution
F OA	TMJ	Left	1	Regional

Table 5.26: OA prevalence at Cowlam.

Additionally, VJD was explored to determine an additional measure of degeneration, however six individuals (75%) did not have any surviving vertebrae, and of the remaining two that did, they did not display any vertebral degeneration. This may be due to the younger age cohort or the limited samples available for analysis.

5.4.5.5 Trauma

The Cowlam sample was also assessed for the presence of both cranial and post-cranial fractures and it was determined that none of the eight individuals displayed any trauma. As each individual had the majority of their skull and mandible, a lack of skeletal evidence was not an issue with cranial fractures. However the very limited number of post-cranial bones makes it impossible to determine whether any of the individuals actually experienced this type of trauma.

5.4.5.6 Site Summary

Overall, this sample of eight individuals from Cowlam was biased towards the young age ranges as well as males. They exhibited high levels of LEH (85.71%), and a single instance of CO (12.5% of the population). Dental diseases were mainly centred on caries, while there were only single individuals with abscesses and another with AMTL. Only one individual exhibited OA, while none had evidence of VJD. Finally, none of the individuals had any evidence of cranial or post-cranial trauma in the form of fractures.

5.4.6 Garrowby Wold

The available population of Garrowby Wold is composed of six individuals and Figures 5.101 and 5.102 present both the sex and age make-up of the group.

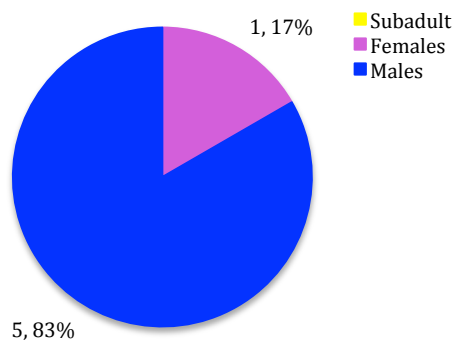


Figure 5.101: Demographic profile of Garrowby Wold.

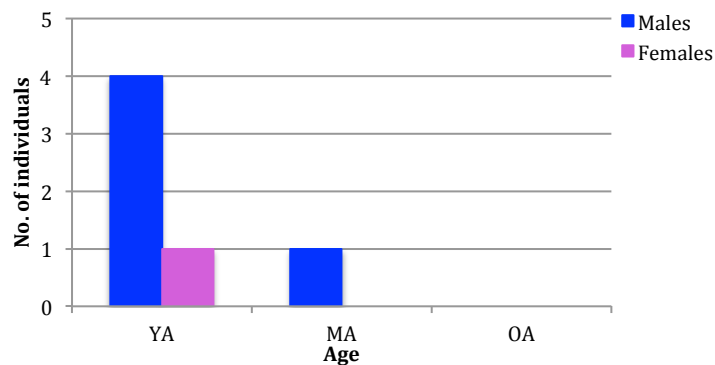


Figure 5.102: Garrowby Wold profile by age.

The Garrowby Wold sample is very heavily biased towards males and also towards young adults. As the population size is very small it is not possible to comment statistically on this bias. All of the individuals were aged using dental attrition, as none had surviving innominates available for analysis. Only one individual, a female, was determined to be a probable female based on morphological features of the cranium. These features were more heavily biased towards a female, and as such the skeleton was considered female in this project.

5.4.6.1 Preservation

In an investigation into the preservation of skeletal elements for this sample it was found that the vast majority were represented by a skull and mandible, while three also had a one or two additional post-cranial bones (Figure 5.103).

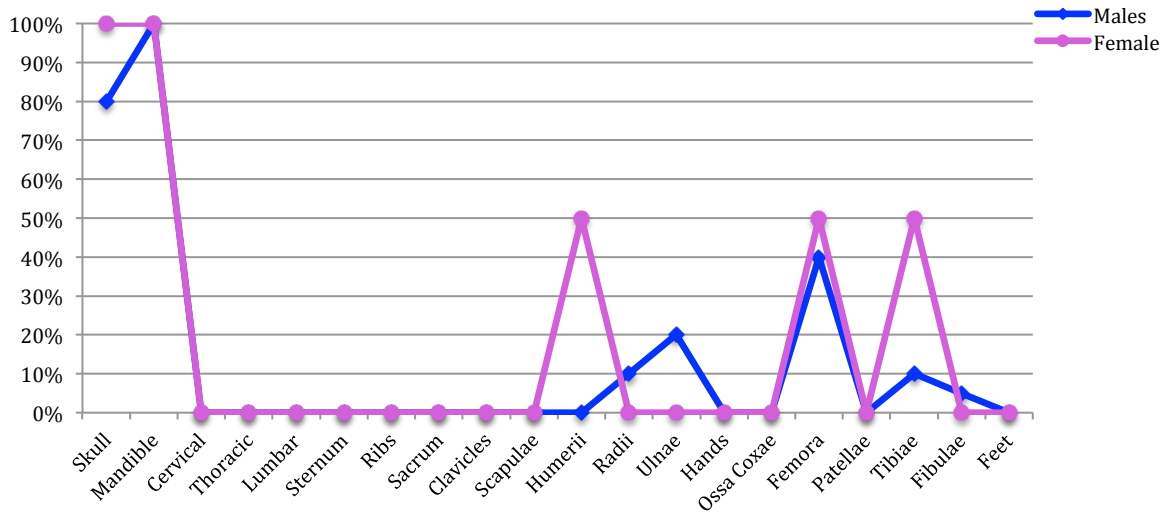


Figure 5.103: Garrowby Wold skeletal element preservation.

The vast majority of skeletal elements were not preserved for analysis. Dental preservation was also examined (Figure 5.104) and it was found the single female had a much higher percentage of preserved teeth compared to both her male aged counterparts and also the entire male sample. Dentition section preservation was also examined in Figure 5.105.

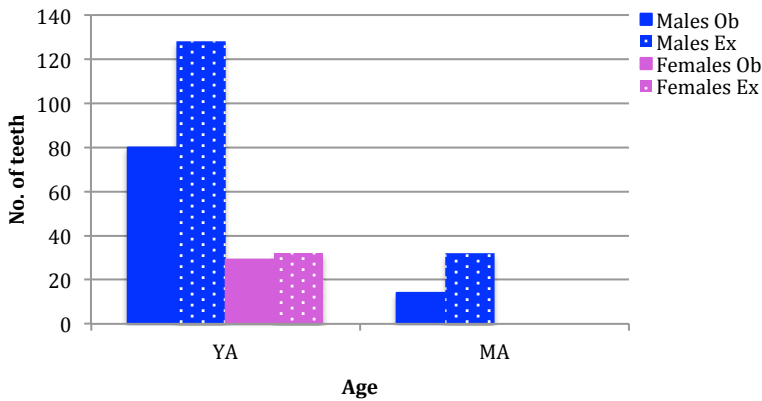


Figure 5.104: Dental presence at Garrowby Wold.

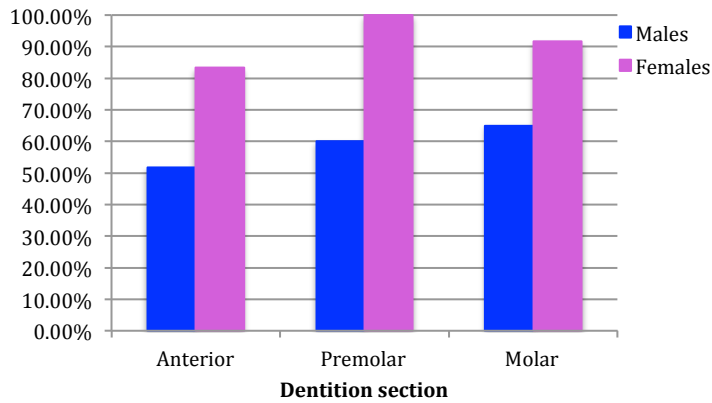


Figure 5.105: Dentition section preservation at Garrowby Wold.

There are very similar percentages of teeth present by dentition section, and in all cases the sole female has more teeth present than the five males. The average number of dentition was also examined for the males (as the sole female dentition presence was known), and found to be 18.8 teeth, which is eleven teeth below that of the female. Additionally the males and female were recorded based on the range of dentition scores (Figure 5.106).

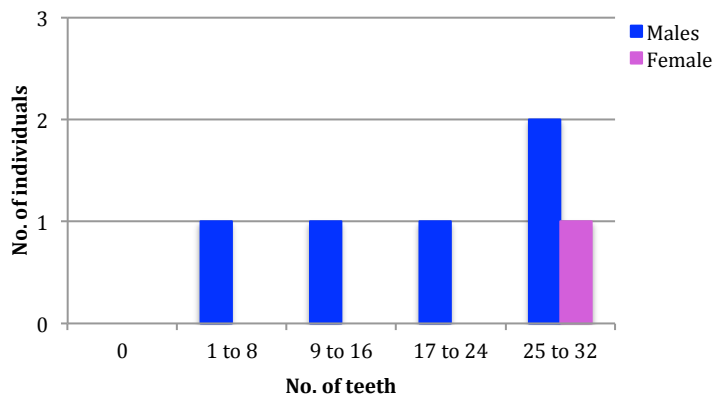


Figure 5.106: Garrowby Wold count of dentition presence.

Although the middle age male had the second lowest number of teeth present (and therefore scored in the 9 to 16 category), the sample is not large enough to determine the possible statistical significance of age (or for that matter sex) and dentition presence.

Despite the limited number of post-cranial elements available for analysis, two individuals had complete long bones and therefore stature could be estimated (Table 5.27).

Skeleton	Sex/Age	Element	Height (cm)	Height (in)
B120B1Sku87	M YA	L Femur	166.13 ± 3.27	65.405 ± 1.287
B198Sku84	M YA	L Femur + L Tibia	175.09 ± 2.99	68.933 ± 1.177

Table 5.27: Stature estimation at Garrowby Wold.

5.4.6.2 Non-Specific Stress

The presence of LEH was examined for this population and it was found that one individual did not have anterior teeth available for analysis (16.67%). When this young adult male was removed from the analysis, it was found that 80% of the sample exhibited LEH (Figure 5.107).

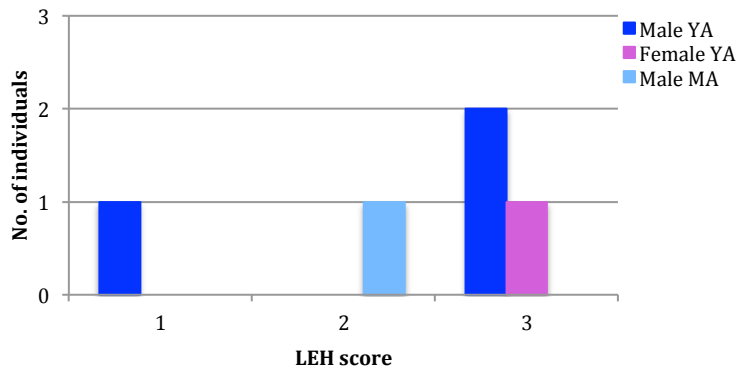


Figure 5.107: LEH severity at Garrowby Wold.

Only one individual had the moderate form of LEH, while the female as well as two of the male young adults had more than two LEH lines per tooth, suggesting repeated periods of stress in their childhood. The presence of CO was also examined and it was found that all individuals in the sample had preserved orbits suitable for analysis (Figure 5.108).

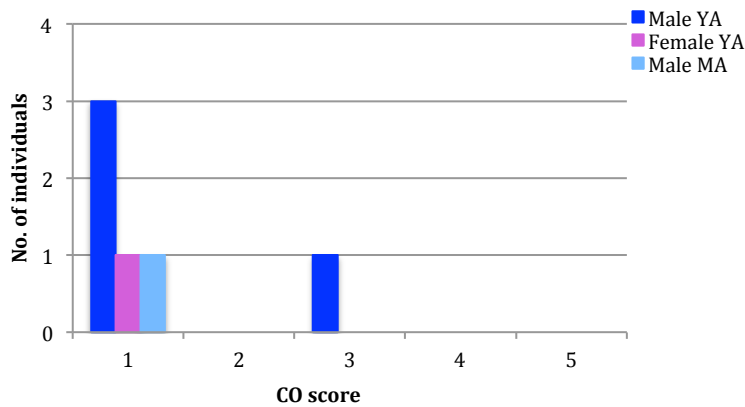


Figure 5.108: CO severity at Garrowby Wold.

Only one individual, a young adult male, had CO and also had the more severe form of LEH suggesting that during their childhood and young adulthood they experienced several periods of intense stress.

5.4.6.3 Dental Diseases

In an analysis of dental diseases it was found that a single individual (a young adult male) did not display any caries (16.67%) (Figure 5.109). Caries were further examined by exploring the percentage of carious teeth (Figure 5.110).

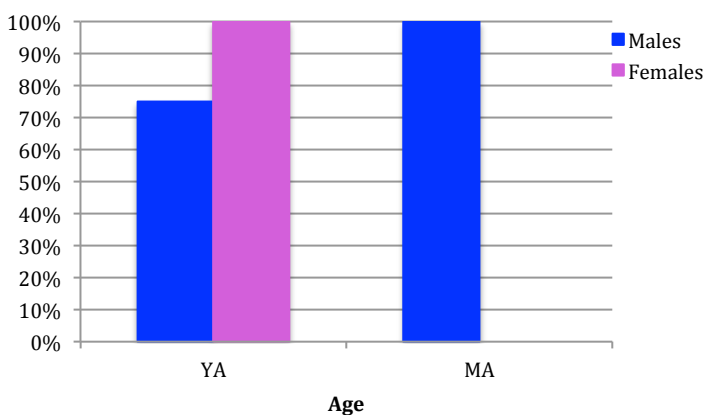


Figure 5.109: Caries prevalence at Garrowby Wold.

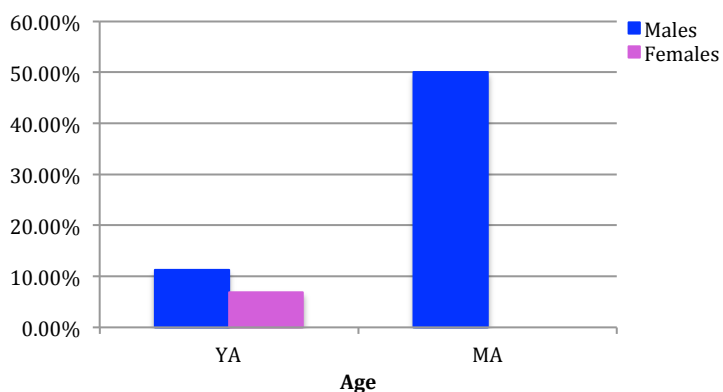


Figure 5.110: Proportion of carious teeth at Garrowby Wold.

Males as a whole had almost three times as many carious teeth as the sole female. Caries type was also examined (Figure 5.111) in order to attempt to uncover any significant relationships between age and/or sex and type.

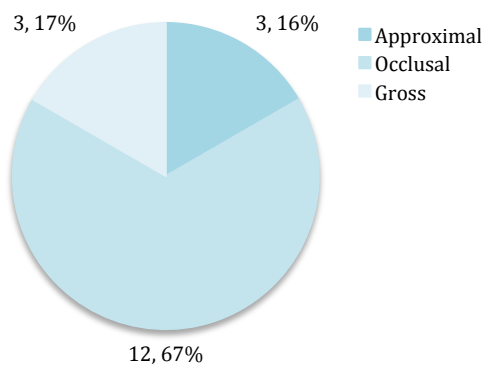


Figure 5.111: Proportion of caries by type at Garrowby Wold.

The young adults all exhibited occlusal caries, while the middle adult males presented a range of types. Caries severity was also examined within the context of caries type and the findings suggest a range of severity for both the caries type and by age and sex. Finally, caries were

also considered with respect to dental location, and the vast majority of caries presented on the mandibular dentition, irrespective of age or sex.

The individuals from Garrowby Wold were also examined for the presence of abscesses and it was found that four individuals (66.67%) did not exhibit any among their dentition. Only males displayed abscesses, and as there were only two individuals, their findings are reported as a summary in Table 5.28.

Sex/ Age	Observed Tooth Places	# Abscesses	% Abscesses	Dental Location	Dental Section	Tooth Loss	Healing	Sinus	Severity
M YA	32	2	6.25%	Maxilla	Premolar	Yes	Healed	External	Severe
				Mandible	Molar	No	Healed	Internal	Moderate
M MA	16	1	6.25%	Mandible	Premolar	No	Healed	External	Moderate

Table 5.28: Abscess details at Garrowby Wold.

As both males presented with healed abscesses, it suggests they were both able to overcome this form of dental disease.

With respect to AMTL, it was found that only one individual, a middle adult male, had AMTL (16.67%) and lost two teeth ante-mortem, one of which was found to be due to the abscess discussed above (Table 5.29 and Table 5.30).

Sex/ Age	Total Observed Tooth Places	Total Male Observed Tooth Places	Individual Observed Tooth Places	# AMTL	% Population AMTL	% Male AMTL	% Individual AMTL	Dentition Location
M YA	176	144	32	2	1.14%	1.39%	6.25%	1 Max, 1 Man

Table 5.29: AMTL prevalence at Garrowby Wold.

YA Male							
Dentition Section	# AMTL	Left	% Left	Right	% Right	Healing Stage	Associated Pathologies
Premolar	1	1	100%	0	0%	2	Abscess
Molar	1	0	0%	1	100%	3	None

Table 5.30: AMTL details at Garrowby Wold.

As one of this individual's teeth was lost as a result of an abscess, it is likely that this also explains for the molar lost earlier in life. However, due to the advanced stage of healing this cannot be confirmed.

In a summary of the dental diseases at Garrowby Wold, it was found that only one individual, a young adult male, did not display any dental diseases (16.67% of the total population) (Figure 5.112).

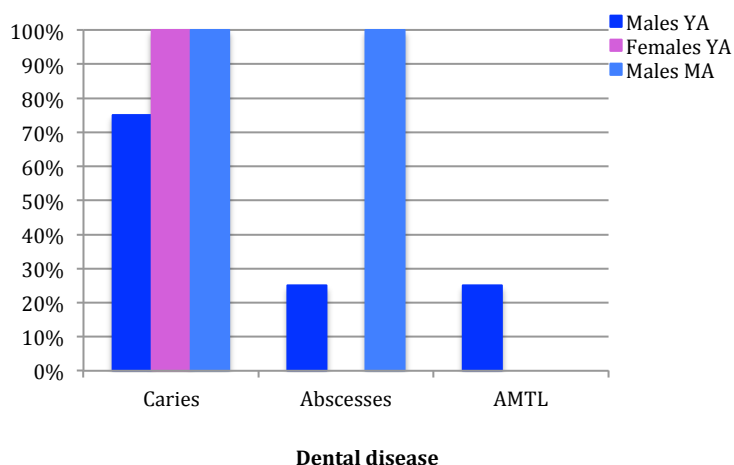


Figure 5.112: Garrowby Wold proportion of individuals with dental disease.

Caries were the most prevalent dental disease. However 40% of males also had abscesses and one male had AMTL. The total population was examined based on the number of teeth present (for caries) as well as total number of observed tooth places (for both abscesses and AMTL) (Figure 5.113).

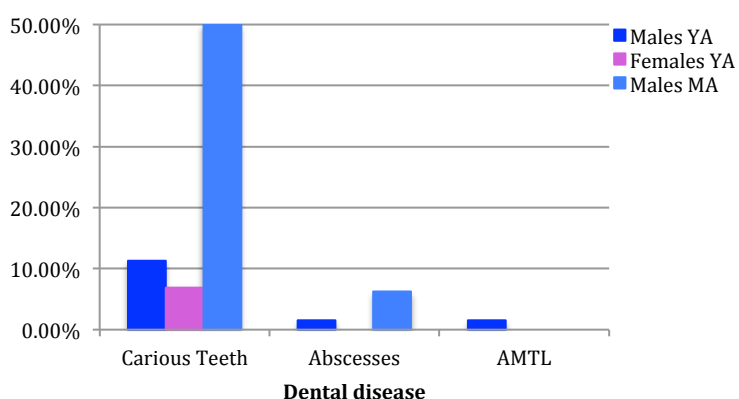


Figure 5.113: Garrowby Wold proportion of observed teeth and tooth spaces with disease.

Males exhibited a wider range of dental diseases at Garrowby Wold, while the sole female was limited to two caries.

5.4.6.4 Degenerative Diseases

The population at Garrowby Wold was studied for the presence of OA and it was found that three individuals (one female and two males) did not present any evidence of degeneration (50% of the total population). The limited evidence of OA may be explained by both the insufficient number of post-cranial elements available for analysis as well as the lower age range of the population (Table 5.31).

Sex/Age	Joint Location	Left / Right/Both	Severity	Distribution
M YA	TMJ	Both	1	Regional
M YA	Hip (Femurs)	Both	2	Regional
M YA	TMJ	Right	1	Regional
	Knee (Femur)	Left	1	

Table 5.31: OA prevalence at Garrowby Wold.

Three joints were affected, but due to the small sample size (as well as the lack of femurs for the other individuals in the sample) it is not possible to assess the statistical significance of this.

Vertebral joint disease was also examined for this group, and it was found that four individuals (one female and three males, 66.67% of the population) did not have any preserved vertebrae available for examination. Two individuals had four cervical vertebrae between them and all had evidence of VJD. The first young adult male had one vertebra, which had a severity of one, while the second had three cervical vertebrae present and they were all scored as a severity of two.

5.4.6.5 Trauma

The presence of cranial fractures was analysed for the population at Garrowby Wold and four individuals (all young adult males) were found to be free from this form of trauma (66.67% of the population). The young adult female and the middle adult male both exhibited cranial fractures (Table 5.32).

Sex/Age	Location	Location Side	Type	Sub Type	Healing Stage
M MA	Frontal	Right	SFT	Puncture	0
F YA	Temporal	Right	SFT	Puncture	0

Table 5.32: Prevalence of cranial fractures at Garrowby Wold.

Although the actual bone affected was different, the side of the skull as well as the type, sub type and healing stage of the cranial fracture were identical.

In an assessment of the presence of post-cranial fractures it was found that none of the individuals had any evidence of post-cranial trauma. In part, this is likely due to the lack of post-cranial elements available for analysis.

5.4.6.6 Site Summary

In an assessment of the Garrowby Wold population it was found the six adults, including one female and five males, had a bias towards the younger age category of young adults, had a high incidence of LEH, and only one instance of CO. Caries were the most frequent form of dental disease, while two individuals had abscesses and only one male had AMTL. OA was present in three males, while the only two individuals with vertebrae present exhibited VJD.

Finally trauma was present in this population in the form of almost identical cranial fractures in two individuals. However, post-cranial elements being limited, there was no evidence of fractures in this group.

5.5 The Total Bronze Age Population

5.5.1 Introduction

The entire Bronze Age sample for this project consists of 56 individuals from six sites that were spread out among the northern, central and western regions of the Yorkshire Wolds. The demographic profile is illustrated in Figure 5.114, while the age distribution is displayed in Figure 5.115.

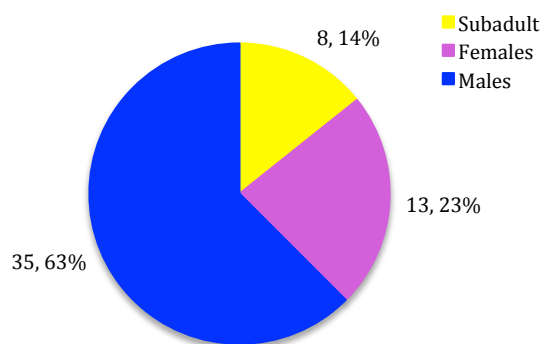


Figure 5.114: Demographic profile of the Bronze Age.

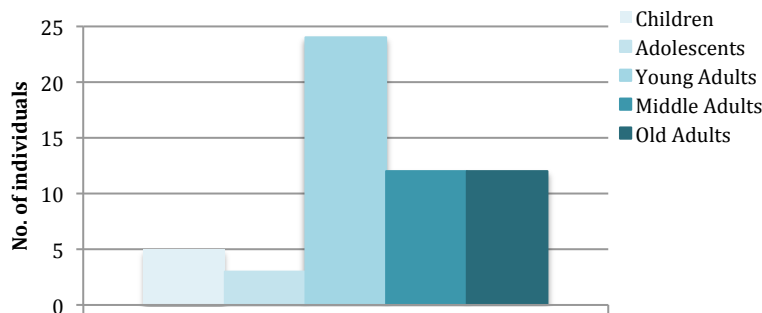


Figure 5.115: Bronze Age demographic profile by age.

The Bronze Age sample is biased towards males as well as young adults and this relationship was found to be statistically significant ($p = <0.001$, $\chi^2 = 56.369$, $df = 8$). Figure 6.116 represents the sex and age distribution of the entire Bronze Age sample, and the bias is here more clearly represented, not only with respect to the distribution of the males across the three age categories but also in terms of the decreased numbers of females within each category in comparison to the males. In each instance there were fewer than 50% of the number of males.

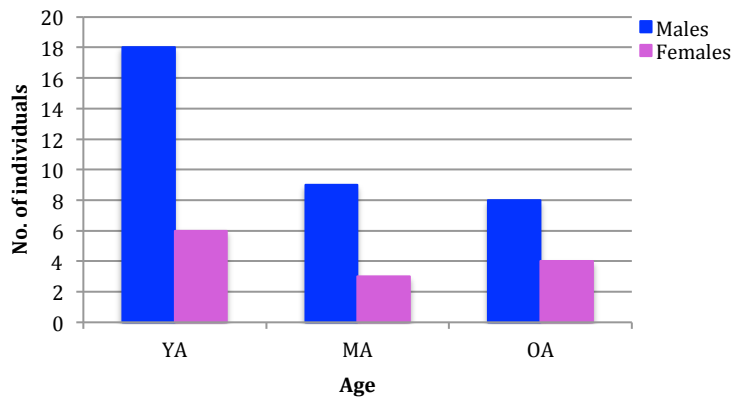


Figure 5.116: Bronze Age adult profile.

Ten of the males were classed as probable males and six females were termed probable females, however, due to the small sample sizes overall, it was decided to add those deemed a probable sex into their most likely sex categories in order to enable statistical tests of significance. Additionally, when sites were considered in relation to sex they were not found to be statistically significant, however the connection between site and age was found to be significant ($p= 0.045$, $\chi^2= 31.829$, $df= 20$).

With respect to the subadults within this sample, the five children and three adolescents were all aged using both dental and skeletal age estimates and in each case both methods were found to overlap in their estimation. All of the adults from this period, with the exception of one young adult male from Garton Slack, were aged based on dental attrition. This was due to the fact that only the individual above had innominates preserved for analysis. The young adult male was, however, still aged using attrition, though his pelvis was used as additional evidence and it was found that the auricular surface corroborated the age estimation determined by dental attrition. In connection to this, all of the adults were also sexed using cranial markers, and due to the level of preservation, the young adult male from Garton Slack was only additionally sexed by the morphology of the greater sciatic notch (which supported that derived from the skull).

5.5.2 Preservation

With regards to preservation of individual skeletal elements, as discussed above, the Bronze Age sample was quite limited. Skulls and mandibles represented the vast majority of individuals, with only a few having an additional post-cranial element (Figure 5.117). It was found that subadults had the least complete skeletons followed by females while males were considered the most complete of the three, though their overall element presence was still minimal.

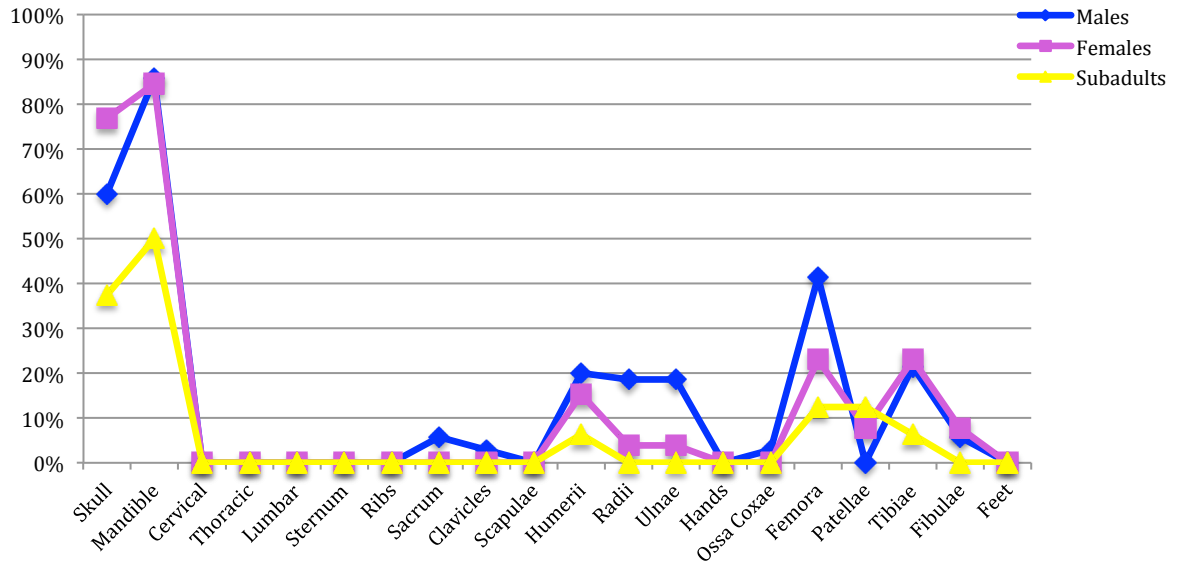


Figure 5.117: Bronze Age skeletal element preservation.

The relationship between skeletal preservation and age was found to be statistically significant ($p= 0.039$, $\chi^2= 16.243$, $df=8$), but no such relationship was found to exist between preservation and sex. With regards to dental preservation, Bronze Age males had a higher percentage of tooth presence among middle and old adults, while females exhibited higher numbers among young adults (Figure 5.118).

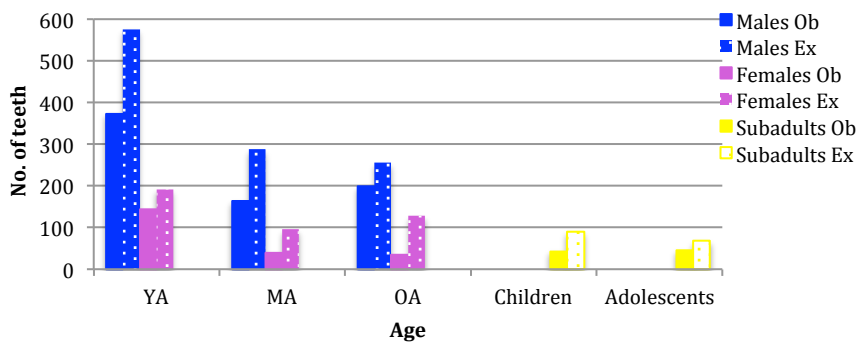


Figure 5.118: Dentition presence in the Bronze Age.

When the dentition was broken down into sections (Figure 5.119), it was found that old adult males had the highest percentages of all three sections of the dentition, while middle adult males had the lowest, with the exception of the anterior which was lowest among the young adult males. For females, the breakdown by dental section confirmed the overall dental presence percentage with the young adult females exhibiting the highest and the old adult females having the lowest percentage of teeth present.

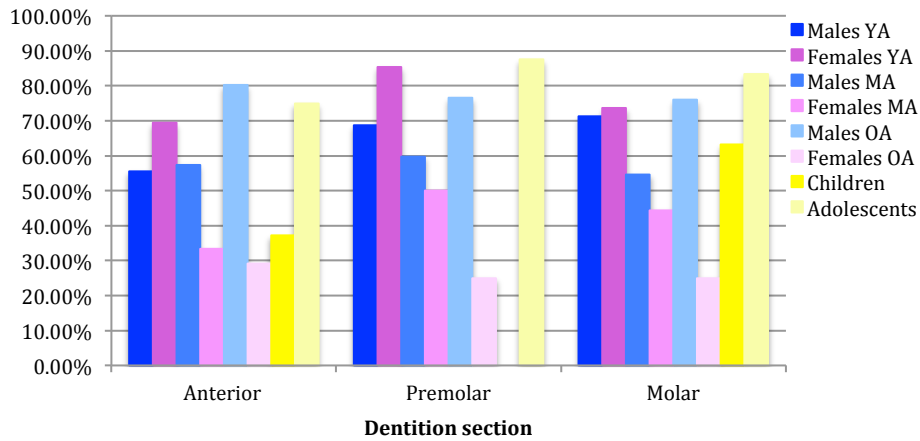


Figure 5.119: Dentition section presence in the Bronze Age.

When Bronze Age males and females were considered on their own with respect to dental preservation, it was found that there was no significant relationship with males, but there was for females with regards to age and dental preservation ($p= 0.010$, $x^2= 13.289$, $df= 4$).

The average dentition present was an additional measure of completeness and it was found that the females exhibited the expected differences from young to old adults, while for males, the old adult males had the highest averages with the middle adults exhibiting the lowest average number of teeth present. When dental preservation was broken down further into scores (Figure 5.120) for statistical purposes, it was found that the relationship between dental preservation and age was statistically significant ($p= 0.035$, $x^2= 22.217$, $df= 12$).

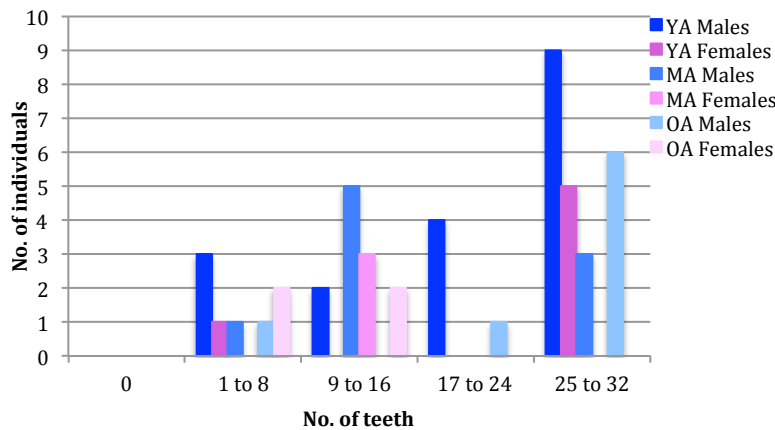


Figure 5.120: Bronze Age count of dentition presence.

Stature was possible and estimated for eighteen individuals from four sites (Garton Slack, Garrowby Wold, Rudston and Cowlam), and as illustrated in Figure 5.121, the fourteen male individuals were spread from a low of 159.942 cm (5ft. 3in.) to a high of 178.916 cm (5ft. 10.4in.) and an average of 167.286 cm (5ft. 6.1in.). The four females were more tightly grouped between 152.406 cm (5ft.) and 167.72 cm (5ft. 6in.) with an average of 162.38 cm (5ft. 3.3in.).

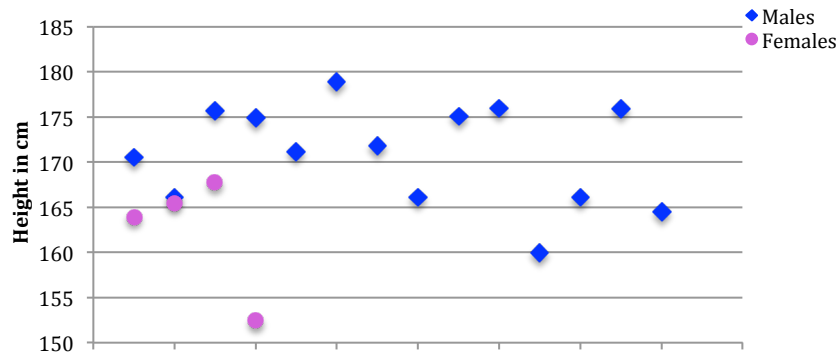


Figure 5.121: Bronze Age stature estimation.

5.5.3 Non-Specific Stress Indicators

LEH was found to be quite prominent in the Bronze Age, however this was also dependent on anterior teeth preservation. Unfortunately 23.2% of the total Bronze Age sample (n=13) either did not have any anterior teeth available for inspection, or those that were available were obscured by attempts at reconstruction post excavation (Figure 5.122). When the individuals without anterior dentitions were removed from the total sample, a highly statistically significant relationship was found for age and sex with respect to LEH ($p < 0.001$, $\chi^2 = 43.125$, $df = 8$).

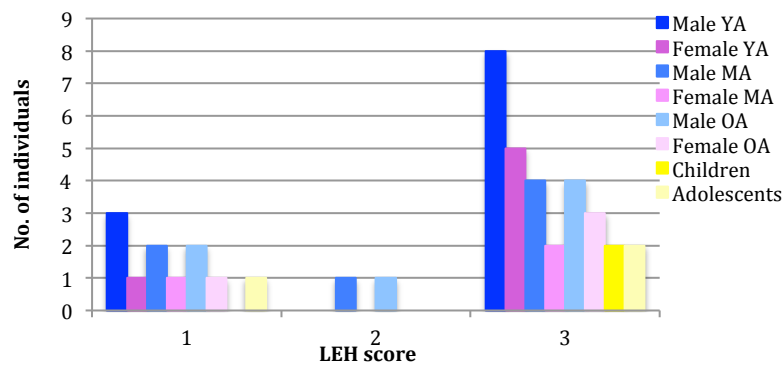


Figure 5.122: LEH severity in the Bronze Age.

A score of one represents an absence, a score of two represents a single hypoplasia and a score of three represents multiple hypoplasias.

The relationship between LEH severity and both sex and age was found to not be statistically significant. Additionally, the presence and also the severity of LEH were examined with respect to sites but no statistically significant relationships were discovered.

The presence of CO was examined for all individuals within the Bronze Age sample and 12.5% (n=7) skeletons were discovered to not have orbits preserved to a satisfactory degree for an adequate examination (Figure 5.123). There are clear differences between the presence of CO and age and sex and when analysed statistically it was found to be a highly significant relationship ($p < 0.001$, $\chi^2 = 49.045$, $df = 8$). When this relationship was explored in more detail a nearly significant relationship was found with specific respect to the presence

of CO and age (but not sex), ($p= 0.056$, $x^2= 20.649$, $df= 12$). Most likely the statistical significance of these findings is related to the absence, as opposed to the presence, of CO.

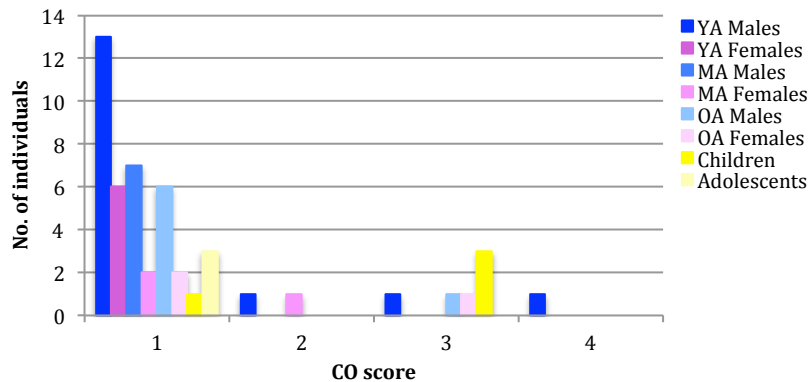


Figure 5.123: CO severity in the Bronze Age.

As the majority of individuals were found to be free from CO no statistically significant relationship was found between CO severity and age or sex. Additionally, the presence and also the severity of CO were examined with respect to sites, though no statistically significant relationships were found to exist. Finally the presence and severity of both LEH and CO were statistically tested with respect to sex and also age, but no significant associations were found between any of the variables.

5.5.4 Dental Diseases

Caries were observed in 33 individuals from the Bronze Age (58.93%), spread over all six sites (Figure 5.124). There is a close association between males and females for the percentage of individuals with caries and a highly statistical relationship was found between sex and age for those with caries ($p<0.001$, $x^2= 33.432$, $df= 8$). As the subadults with caries represent 25% of the total subadult sample, it would suggest an important correlation, however there is no statistical significance associated with the individuals with caries and age for the Bronze Age period. The sample was further subdivided to examine the actual number of observed teeth in conjunction with those exhibiting caries for both sexes and all age groups (Figure 5.125 and Table 5.33). There were slightly higher incidences of carious teeth for young and old adult females, while middle adult males have a higher percentage compared to middle adult females. This relationship between age and caries was found to be statistically significant ($p=0.056$, $x^2= 12.301$, $df= 6$).

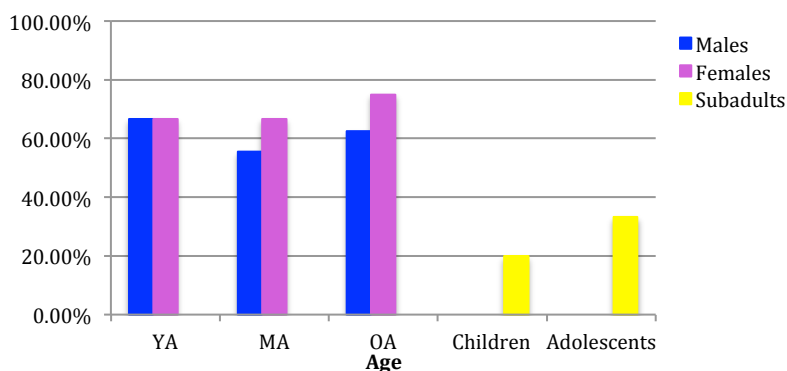


Figure 5.124: Bronze Age caries prevalence.

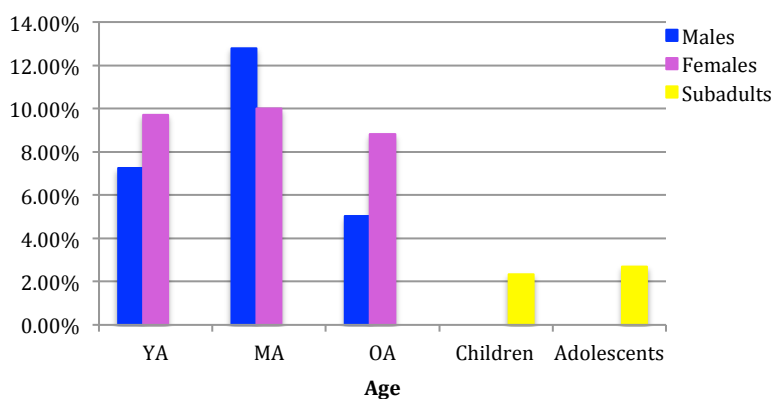


Figure 5.125: Proportion of carious teeth in the Bronze Age.

Sex/Age	Teeth observed	Cariou teeth	% Cariou
Males	736	58	7.88%
Females	218	21	9.63%
Subadults	88	2	2.27%

Table 5.33: Proportion of carious teeth by group in the Bronze Age.

The sample was subdivided again according to caries type and examined against age and sex to uncover patterns related to type (Figures 5.126 and 5.127). Both subadults that exhibited caries (one child and one adolescent, each with one caries) had them on their occlusal surfaces and both were scored with a severity of two.

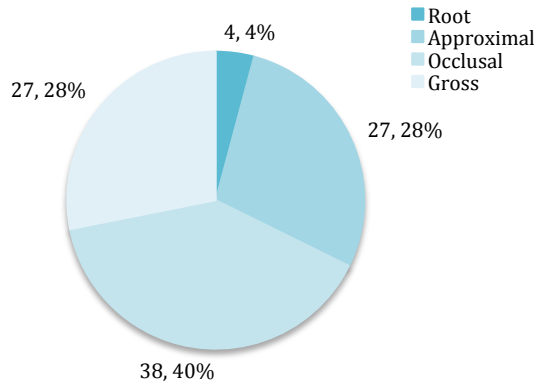


Figure 5.126: Proportion of caries by type in the Bronze Age.

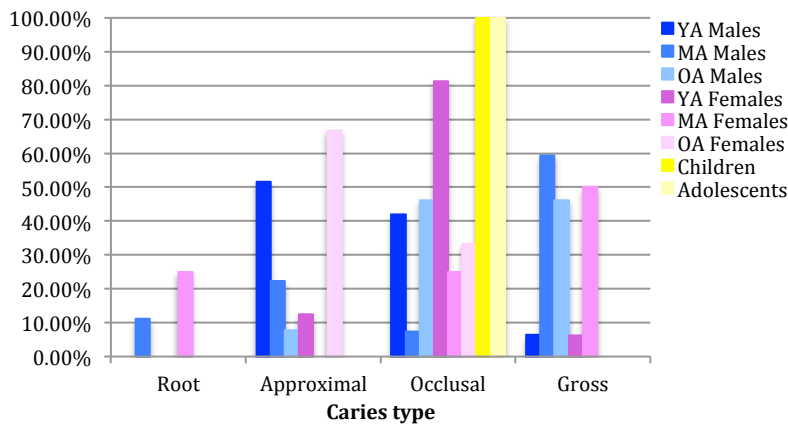


Figure 5.127: Bronze Age caries by age and type.

The results are so varied with respect to both age and sex and caries type that there is not a significant relationship, and statistically this was found to be the case. In order to determine if caries severity played a role in the relationship between caries and sex and age, the sample was subdivided into type and severity. In examining the results for statistical significance it was found that among the middle age adults there was a strong statistical relationship between caries type and severity ($p= 0.030$, $x^2= 7.00$, $df= 2$), however there were no other statistically significant associations between the sub variables. Finally, caries were examined with respect to maxillary and mandibular location within the dentition (Figure 5.128).

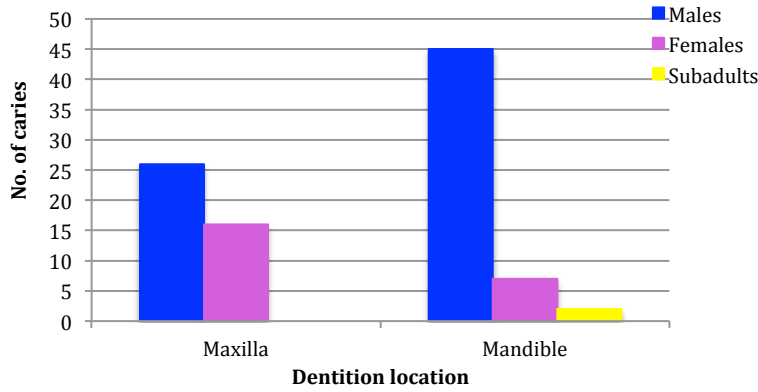


Figure 5.128: Bronze Age caries by location.

Caries location along with age and sex were statistically evaluated but were not found to be significant. When location, however, was compared to caries type, the number of caries per individual, as well as caries severity it was found that all three sub variables were statistically significant (however, caries type was only slightly significant) (Table 5.34).

Variable	P Value	Value	Degrees of Freedom
Caries Type	0.058	12.184	6
Number of caries	0.025	14.435	6
Severity	0.038	6.562	2

Table 5.34: Bronze Age statistical summary of caries location.

When abscesses were explored within the Bronze Age sample it was found that 37 individuals (66.07%) were free from this dental disease, while 19 individuals (33.93%), displayed at least one abscess each (Figure 5.129).

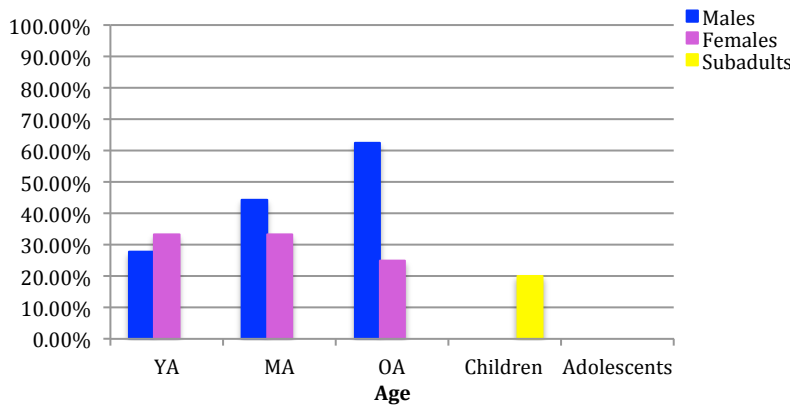


Figure 5.129: Abscess prevalence in the Bronze Age.

When this data was explored statistically, a highly significant relationship was found between the age and sex of those with abscesses ($p = 0.004$, $\chi^2 = 19.301$, $df = 6$). This relationship was even more evident when the number of observed tooth places was compared with the number of abscesses for both males and females in three age categories (Figure 5.130).

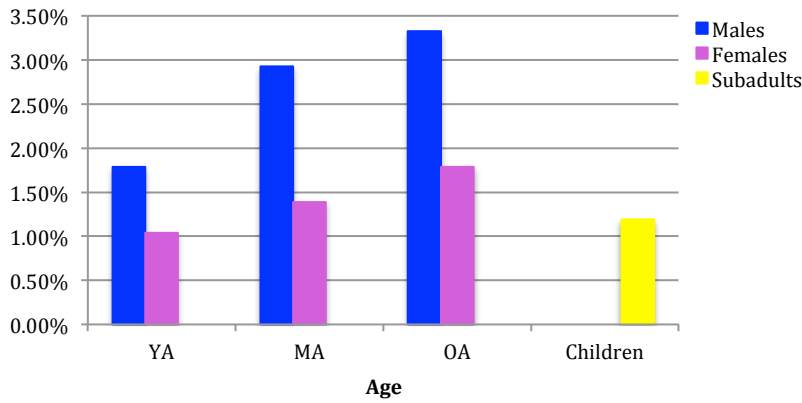


Figure 5.130: Proportion of tooth spaces and abscesses in the Bronze Age.

Although overall males exhibited slightly more abscesses, the statistical relationship was more specifically seen in rates for middle and old adult males in comparison to the equivalent female age categories. Abscesses were also considered within the context of dental section as well as dentition location and tooth loss (Figures 5.131 and 5.132). The single child had their abscess located on the maxillary dentition, but the tooth was not lost.

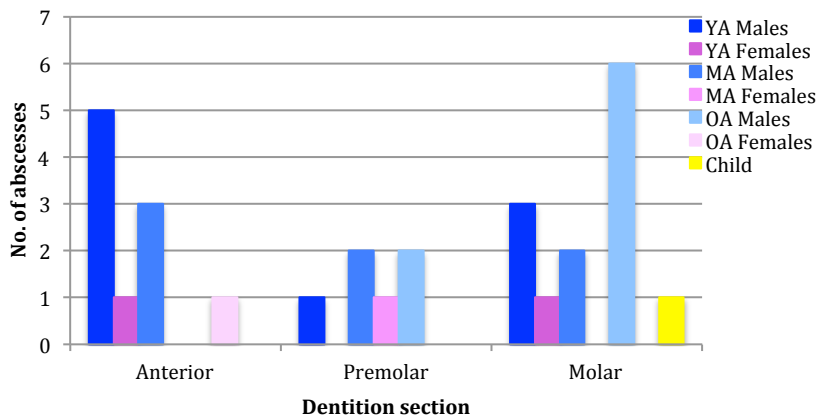


Figure 5.131: Bronze Age abscesses by dentition section.

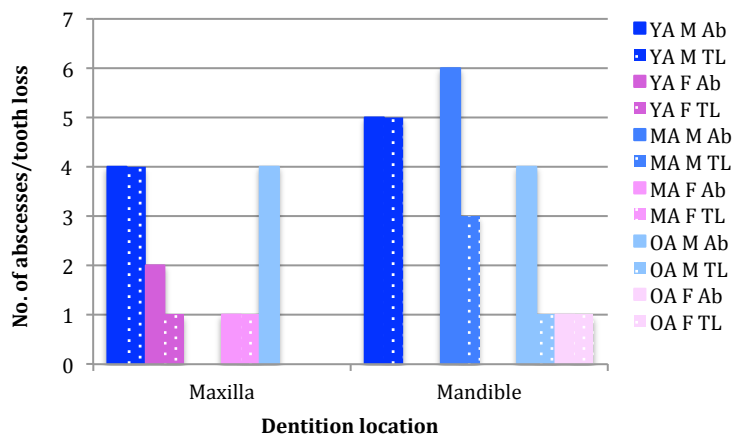


Figure 5.132: Bronze Age abscesses and tooth loss.

When this data was examined statistically, no close association was determined between the location of abscesses, the number of abscesses, tooth loss and both sex and/or age. The final

aspect of the dentition that was examined was AMTL. Within the entire Bronze Age adult sample it was determined that 30 individuals (62.5%) did not exhibit any tooth loss (Figure 5.133).

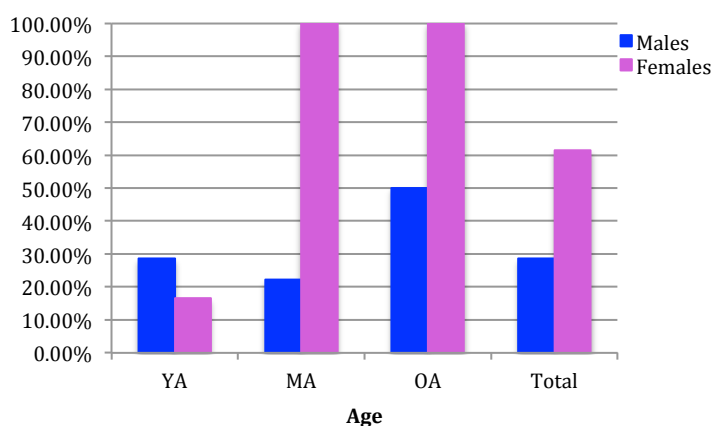


Figure 5.133: AMTL prevalence in the Bronze Age.

Exploring the relationship between AMTL and both age and sex, it was found that both exhibited a strong statistical relationship. When the females were examined on their own it was also found that there was a strong association between age and AMTL, but no such relationship existed for males (Table 5.35).

Variable	P Value	Value	Degrees of Freedom
Age	0.017	12.05	4
Sex	0.031	6.933	2
Females and Age	0.031	6.964	2

Table 5.35: Statistical summary of Bronze Age AMTL.

AMTL was further explored by examining the number of observed tooth spaces in relation to the number of teeth lost antemortem (Figure 5.134).

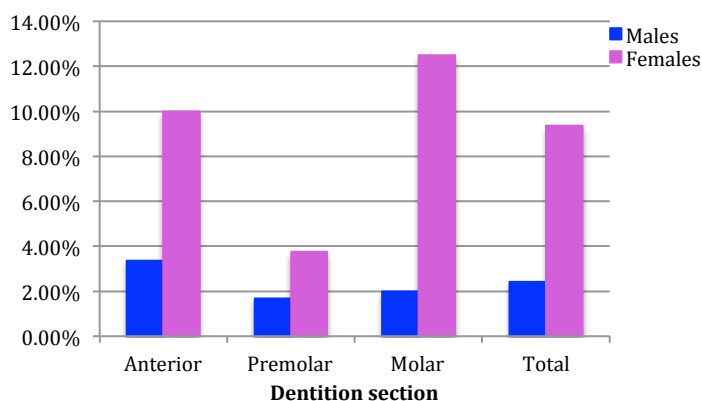


Figure 5.134: Proportion of tooth spaces and AMTL in the Bronze Age.

The findings determined that females had lost more than three times the percentage of teeth compared to males (9.38% versus 2.43%). For males, they lost the highest percentage of teeth from the anterior section, while females were closely matched in teeth lost from the anterior and molar sections. Both the middle adult males and females had the highest

percentage of tooth loss within their sex (3.9% and 26.39% respectively), while the young adults had the lowest. Although the statistical relationship between dentition section, AMTL, age and sex were explored, only the association between the number of AMTL and dentition section with AMTL within the context of females was found to be significant ($p= 0.030$, $\chi^2= 14.00$, $df= 6$).

The Bronze Age adult sample with AMTL was further divided by individual tooth type and side and explored within the context of both age and sex (Figures 5.135 and 5.136).

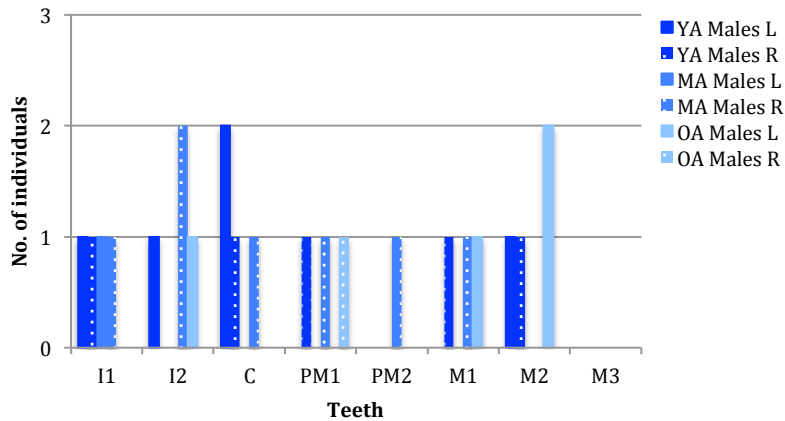


Figure 5.135: Bronze Age AMTL in males by side.

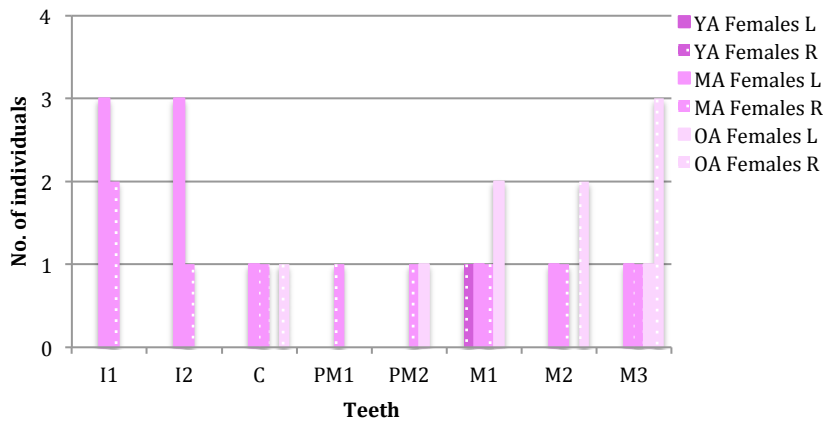


Figure 5.136: Bronze Age AMTL in females by side.

No relationships between side with AMTL along with age or sex were found to be statistically significant. AMTL was also explored in terms of dental location and was assessed within the context of both age and sex (Figures 5.137 and 5.138).

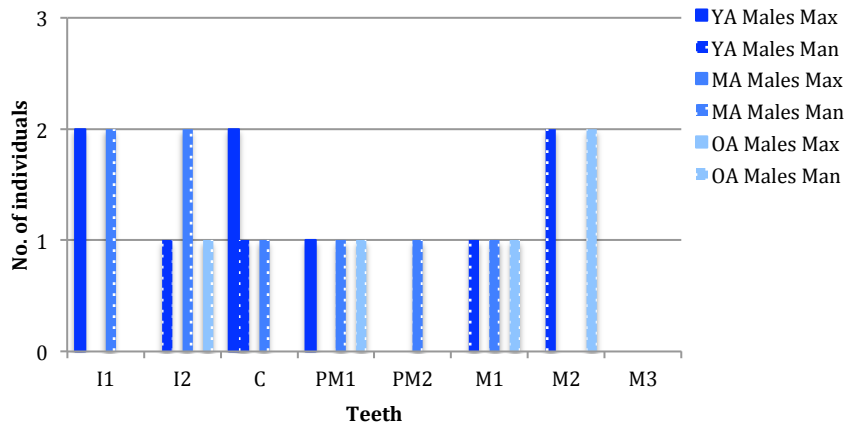


Figure 5.137: Bronze Age AMTL in males by dentition.

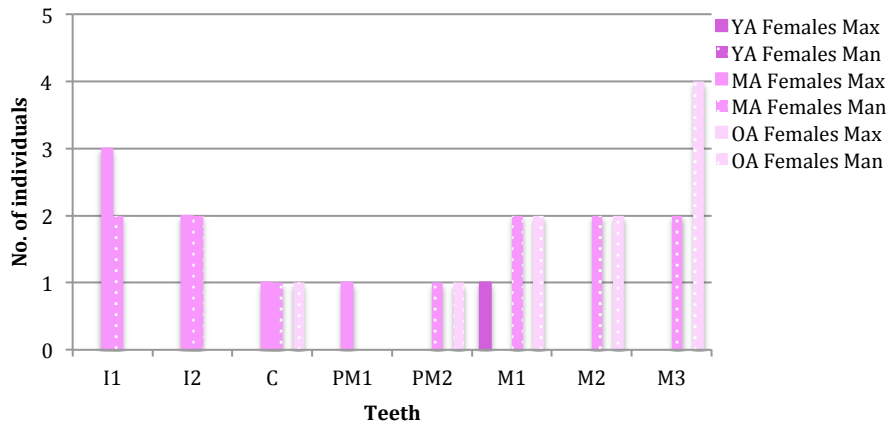


Figure 5.138: Bronze Age AMTL in females by dentition.

When the statistical relationship between dentition location and AMTL was explored with reference to age it was found there was a strong statistical relationship. When the sample was broken down by sex it was found both males and females also had a strong association between dentition location and age (Table 5.36). The stage of healing was also explored with respect to sex (Figure 5.139).

Variable	P Value	Value	Degrees of Freedom
Age	0.006	14.620	4
Males and Age	0.040	10.00	4
Females and Age	0.007	14.00	4

Table 5.36: Bronze Age statistical summary of AMTL and dentition location.

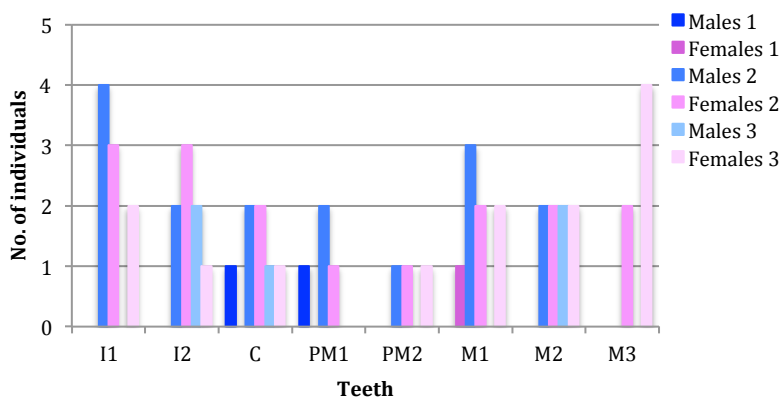


Figure 5.139: Bronze Age AMTL by healing stage.

When stage of AMTL healing was explored for statistical significance, it was found that the only strong relationship was within the female subcategory of healing and age ($p= 0.044$, $\chi^2= 9.8$, $df= 4$), no such relationship was found for males or between the sexes.

Finally, AMTL was examined in conjunction with associated pathologies to determine a possible relationship (Figures 5.140 and 5.141 and Table 5.37). Where it was unclear if the AMTL was caused by an associated pathology it was cautiously interpreted as not being related.

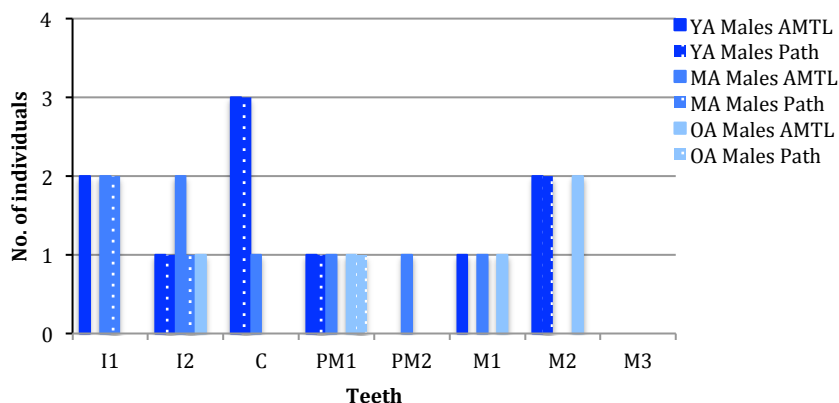


Figure 5.140: Bronze Age male AMTL caused by associated pathologies.

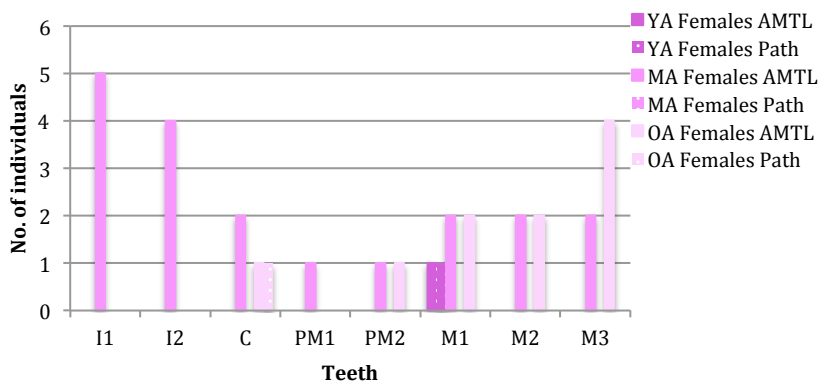


Figure 5.141: Bronze Age female AMTL caused by associated pathologies.

Tooth	Males			Females		
	AMTL	Path	% Path	AMTL	Path	% Path
I1	4	2	50%	5	0	0%
I2	4	2	50%	4	0	0%
C	4	3	75%	3	1	33.30%
PM1	3	2	66.67%	1	0	0%
PM2	1	0	0%	2	0	0%
M1	3	0	0%	5	1	20%
M2	4	2	50%	4	0	0%
M3	0	0	0%	6	0	0%
Total	23	11	47.83%	30	2	6.67%

Table 5.37: Bronze Age AMTL and associated pathologies.

Overall thirteen individuals (six males, one female and six subadults) were found to be completely free of any dental diseases, which accounts for 23.21% of the entire Bronze Age population (Figure 5.142).

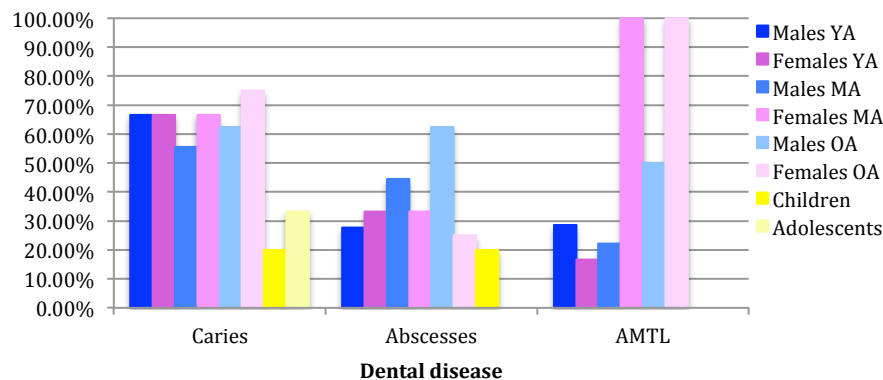


Figure 5.142: Proportion of Bronze Age individuals with dental disease.

When the relationship between individuals with caries, abscesses and AMTL were statistically explored a significant relationship was found between abscesses and AMTL, and when this association was explored within the context of each sex, a statistical relationship was found for males with respect to abscesses and AMTL (Table 5.38). No such relationship was found among females.

Variable	P Value	Value	Degrees of Freedom
Abscesses and AMTL	0.001 (F= 0.002)	10.315	1
Males Abscesses and AMTL	0.002 (F= 0.006)	9.333	1

Table 5.38: Bronze Age statistical summary of dental disease presence.

The sample was also explored within the context of dental diseases with regards to number of teeth (for caries) and observed tooth spaces (for abscesses and AMTL) affected (Figure 5.143). Overall, although with the exception of the high rates of AMTL seen among the middle and old adult females, dental disease proportions were low, though every segment of the population appears to have experienced the various manifestations.

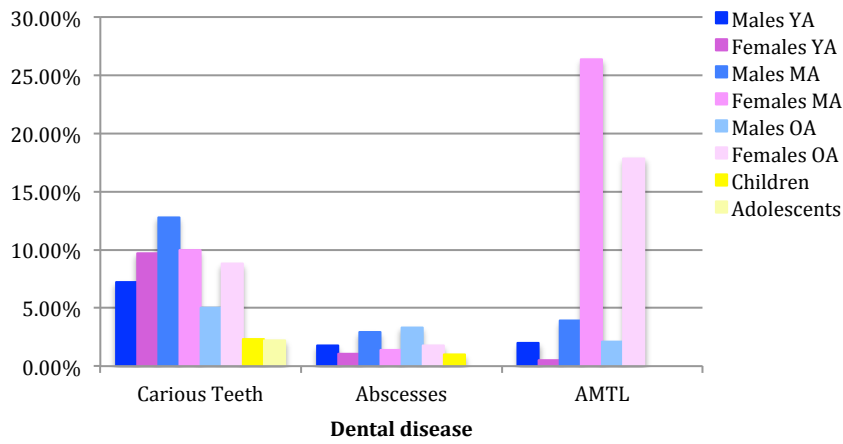


Figure 5.143: Proportion of observed teeth and tooth spaces with disease in the Bronze Age.

5.5.5 Degenerative Diseases

In an assessment of adults in the Bronze Age affected by osteoarthritis (OA), it was found that 34 individuals (25 males and 9 females) did not exhibit degenerative changes (70.83%) (Figure 5.144).

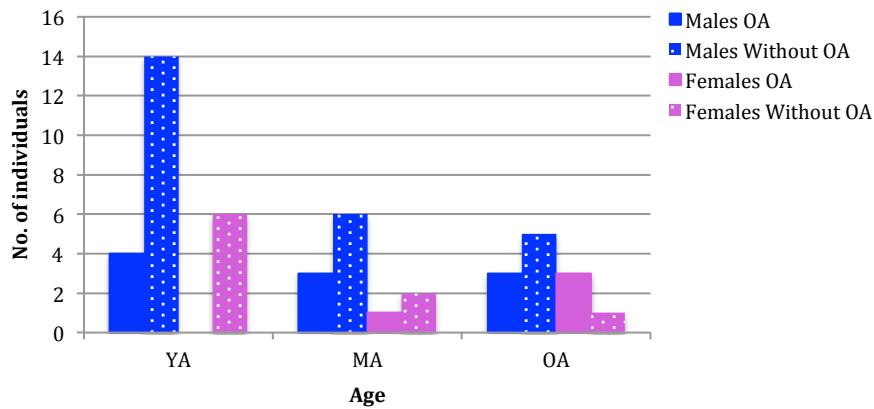


Figure 5.144: Bronze Age OA presence.

Those adults with OA were further examined within the context of the distribution of joints and the association between left and right incidence was explored through both sex and age (Figure 5.145).

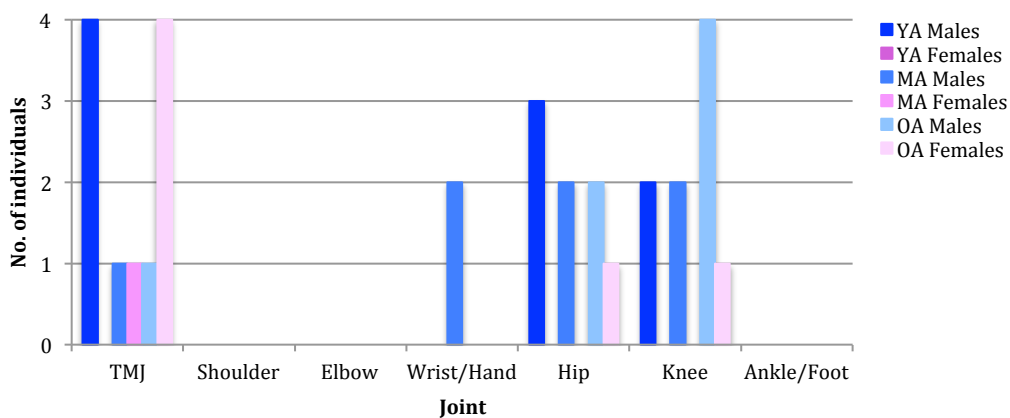


Figure 5.145: Bronze Age distribution of OA.

The distribution of OA was analysed by side in order to determine whether the degeneration observed was bilateral or predominantly expressed on a particular side (Figure 5.146), however no statistically significant relationship was uncovered.

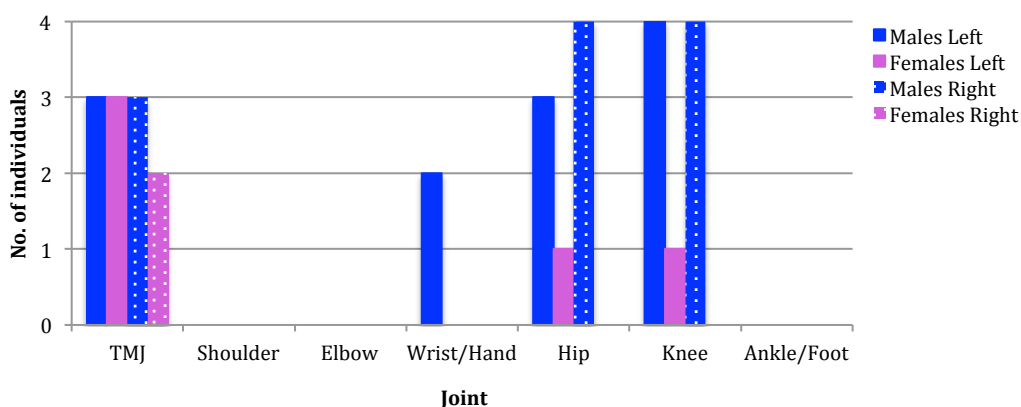


Figure 5.146: Bronze Age OA side distribution.

The presence of OA was further examined within the context of degenerative severity (Figure 5.147). It was determined males had a more severe expression of OA, however it was not statistically significant.

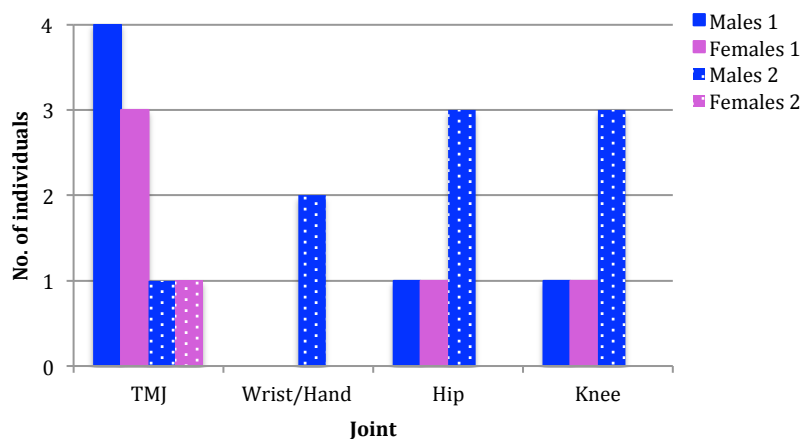


Figure 5.147: Bronze Age OA severity distribution.

Finally, OA was assessed within the context of total skeletal distribution to uncover the possible connections between OA and age and additionally determine the possible traumatic association with degenerative changes (Figure 5.148). It was found that the majority of individuals had regional expressions, however, if they had continued to age it is likely their OA would have become systemic.

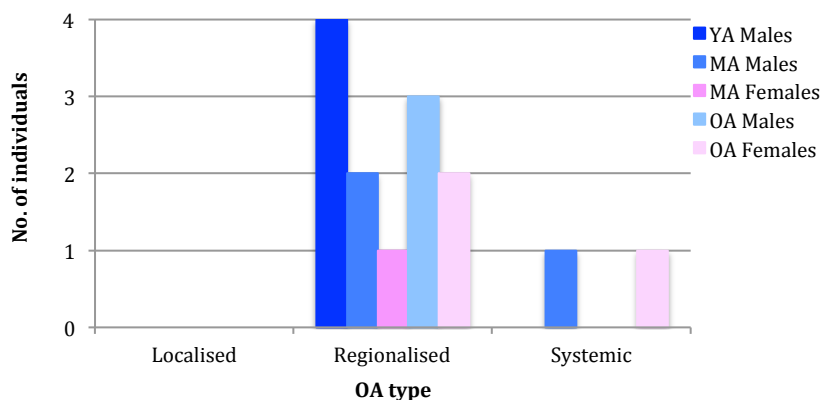


Figure 5.148: Bronze Age OA type.

Another method used to examine degenerative changes was to analyse the state and possible degeneration of vertebral bodies, which characterises vertebral joint disease (VJD). In an assessment of the Bronze Age adult population it was found that 35 individuals (62.5%) did not have any surviving vertebrae to evaluate (Figure 5.149).

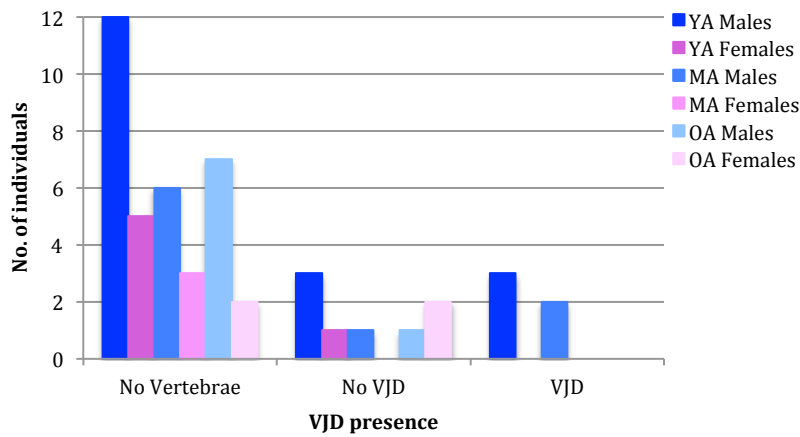


Figure 5.149: Bronze Age VJD prevalence.

Females that had vertebrae available for analysis (n= 3) did not exhibit any of the degenerative changes synonymous with VJD. Additionally, though it was expected that older adults would have increased amounts of vertebral degenerative changes, due to the lack of available skeletal elements, this could not be properly assessed.

In order to examine the relationship between age and VJD for males in more detail the vertebral location affected and its severity were explored within the context of age (Figure 5.150).

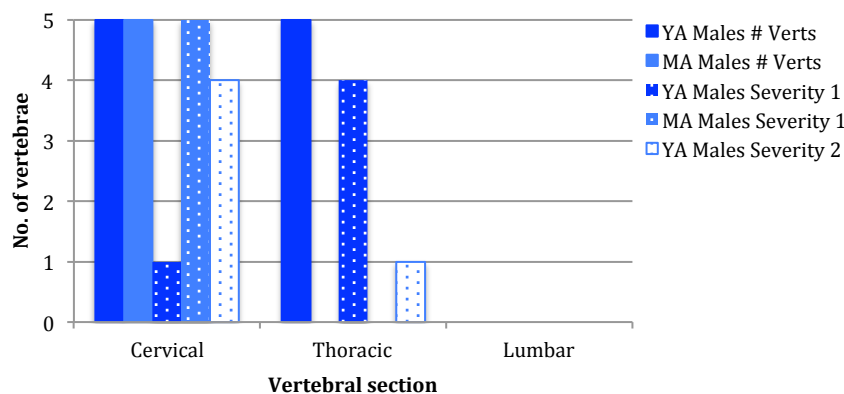


Figure 5.150: Bronze Age VJD severity.

It was determined that young adult males were more likely to exhibit mild VJD in their thoracic region with a more severe alteration in their cervical vertebrae. Among middle adult males the cervical region was the only area that presented with degeneration. No statistically significant relationships were found.

5.5.6 Trauma

Trauma was evaluated in this project through the presence of cranial and postcranial fractures. It was found that 42 individuals (75%) did not suffer from any cranial fractures (Figure 5.151).

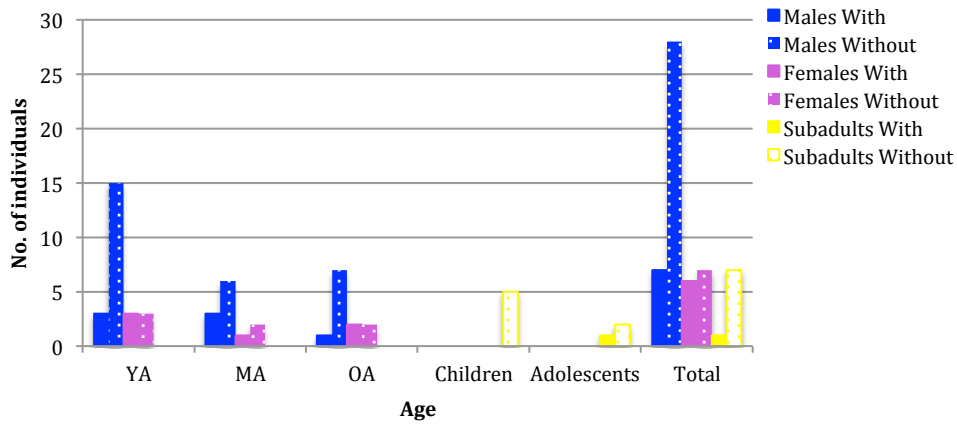


Figure 5.151: Bronze Age cranial fracture prevalence.

The relationship between cranial fractures with both sex and age were further explored by examining the location of the fractures in order to determine any possible relationships between side and sex. Three individuals (one middle adult male, one young adult female and one middle adult female) exhibited more than one fracture each (with both females displaying two additional fractures) and as such each individual fracture (as opposed to each individual) was detailed (Figure 5.152).

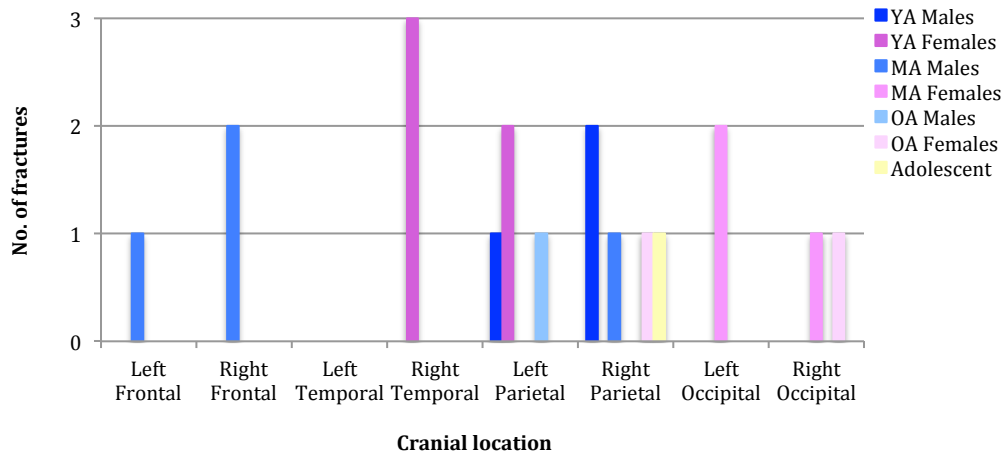


Figure 5.152: Bronze Age cranial fractures by location.

Cranial fractures were also examined within the context of type, either blunt or sharp force trauma (Figure 5.153), however, despite the greater chance of a female receiving sharp force trauma, this was not statistically significant.

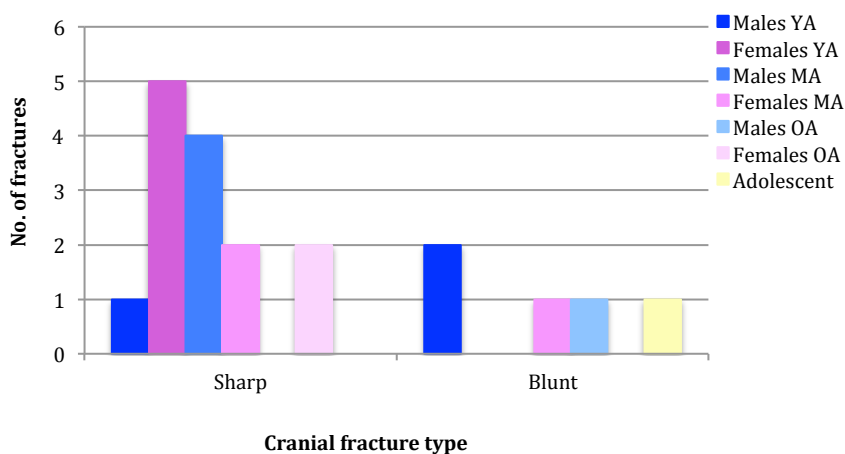


Figure 5.153: Bronze Age cranial fractures by type.

Cranial fractures were assessed further within regards to the sub types of fractures (Figure 5.154), and it was found that although females were more likely to receive puncture or penetrating fractures over other types and compared to males, no statistical relationship was found.

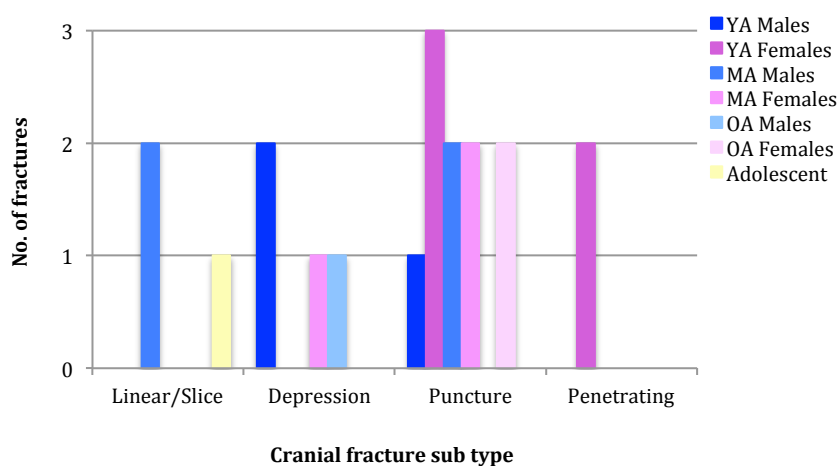


Figure 5.154: Bronze Age cranial fractures by sub type.

Finally, cranial fractures were considered within the context of stage of healing (Figure 5.155) and with the exception of a single fracture in an old adult female, all had been inflicted or received at or close to the time of death.

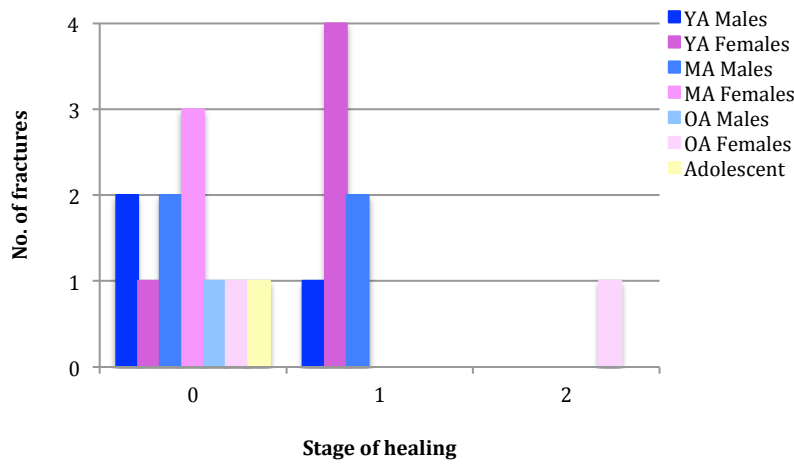


Figure 5.155: Bronze Age cranial fractures and stage of healing.

The entire Bronze Age sample was also assessed for post-cranial fractures and it was found that only four individuals were inflicted with this trauma, which did not include any of the subadults (Figure 5.156).

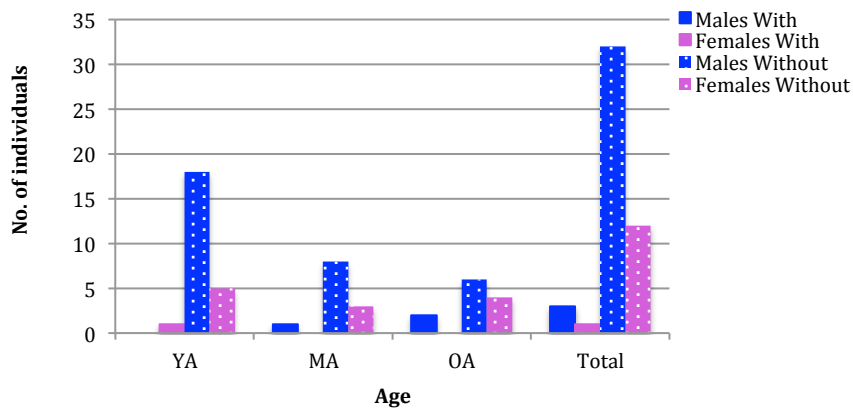


Figure 5.156: Bronze Age post-cranial fractures.

Those individuals with post-cranial fractures were examined for location, side, severity and associated osteological changes (Table 5.39). Although all fractures were located on the right side, due to the small number of post-cranial fractures it was not possible to produce any statistically significant results within the context of the total Bronze Age, by sex or by age.

Sex	Age	Bone	Side	Healing Stage	Associated Osteological Changes
Female	YA	Humerus	Right	3	Misalignment
Male	MA	Ulna	Right	3	Misalignment
Male	OA	Femur	Right	3	Shortened length
Male	OA	Humerus	Right	2	None

Table 5.39: Bronze Age summary of post-cranial fractures.

5.5.7 Summary of the Bronze Age Population

The Bronze Age population included 56 individuals and is heavily biased towards males and younger age categories. Non-specific stress in the form of LEH was experienced by 57.14% of the total population, while CO was only evident in 16.07%. Dental diseases were experienced by both sexes with both males and females most likely to have caries compared to abscesses

and AMTL. Males and females were also almost evenly matched with respect to OA, almost one third of each had degenerative changes. VJD however was only seen in males with 50% of those with vertebrae exhibiting this form of skeletal degeneration. Trauma in the form of cranial fractures was seen in 25% of the total population and it affected males, females and subadults. Finally, 7.14% of the population also had evidence of post-cranial fractures, which included about 10% of males and a little less of females.

5.6 The Iron Age

5.6.1 Cowlam

The site of Cowlam is a multi-phase site, and the population attributed to the Iron Age includes three young adult females (Fig 5.157).

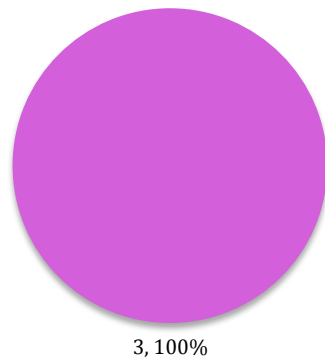


Figure 5.157: Demographic profile of Cowlam.

One female was determined to be a probable female, however the morphological features of her skull suggested female and as such she was placed in the female sex category for the purposes of this project. All of the individuals were both aged and sexed using the skull, as with the exception of those elements shown below, no sexual or age-diagnostic elements were available for analysis.

5.6.1.1 Preservation

Skeletal element preservation was examined and is detailed below in Figure 5.158.

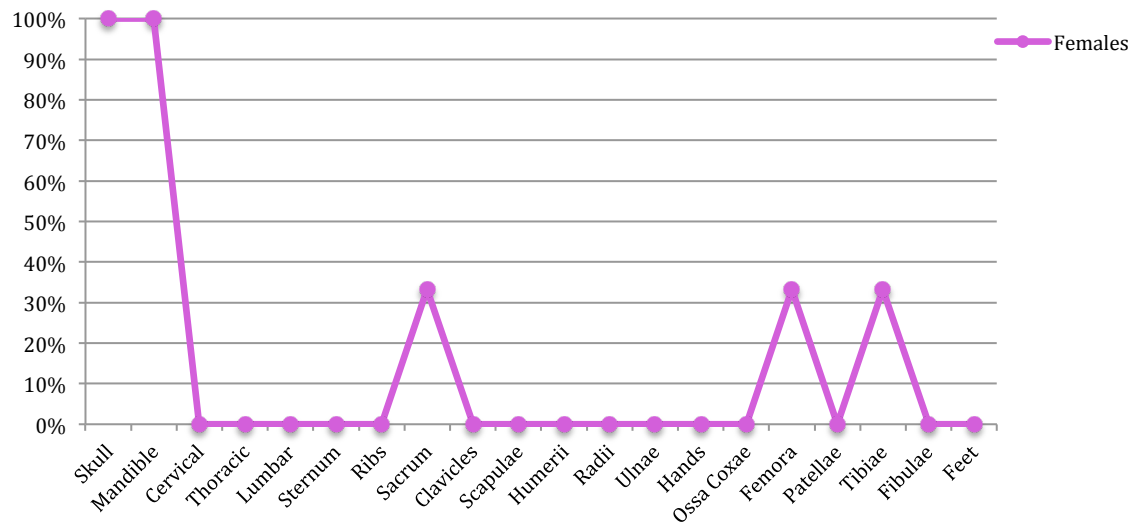


Figure 5.158: Cowlam skeletal element preservation.

With the exception of a single sacrum and a pair of femora and tibiae, no other post-cranial elements were available for analysis. Dental preservation was also examined (Table 5.40 and Table 5.41). The average dentition count for the three young adult females was 29.33 and all three individuals scored in the top preservation bracket of 25 to 32 teeth.

Age	Females		
	# Teeth Observed	# Teeth Expected	% Present
YA	88	96	91.67%

Table 5.40: Dentition preservation at Cowlam.

Dentition Section	Females		
	# Teeth Observed	# Teeth Expected	% Present
Anterior	34	36	94.44%
Premolar	22	24	91.66%
Molar	32	36	88.89%

Table 5.41: Dentition section preservation at Cowlam.

The vast majority of teeth were available for analysis. When the dentition was broken down into sections, only the molars exhibited less than 90% of the expected teeth.

Due to the preservation of a single set of femora and tibia, it was possible to determine a single stature estimation of one of the young adult females (Table 5.42).

Skeleton	Sex/Age	Element	Height (cm)	Height (in)
1936	F YA	R Femur + Tibia	152.168 ± 3.55	59.908 ± 1.397

Table 5.42: Stature estimation at Cowlam.

5.6.1.2 Non-Specific Stress

In Iron Age Cowlam it was determined that all three females had the necessary anterior dentition to investigate LEH. All three females were found to exhibit the more severe form of

LEH (scored as a three), suggesting they had each experienced at least two intense episodes of stress during their formative years. When CO was investigated it was established that all orbits were available and observable and one female was found to have a moderate case, while the other two did not present any evidence.

5.6.1.3 Dental Diseases

In an examination for the presence of caries it was found that one individual did not have any evidence of caries, while one female had a single caries and the third female presented with two (Table 5.43).

Age	Total Observed Teeth	Observed Teeth	Cariou Teeth	% Population Cariou	% Individual Cariou	Caries Type	Severity	Dentition Location	Dentition Section
YA	88	30	1	3.41%	3.33%	OS	4	Maxilla	Molar
YA	88	32	2		6.25%	OS	2	Max/Man	Molar

Table 5.43: Caries prevalence at Cowlam.

All three caries were located on the occlusal surfaces of molars, however the severity was quite different for each individual. Abscesses were examined at Cowlam, however there was no evidence on any of the dentition. Finally, AMTL was investigated and it was determined that only one individual had lost a single tooth earlier in life (Tables 5.43 and 5.44).

Age	Total Observed Tooth Places	Individual Observed Tooth Places	# AMTL	% Population AMTL	% Individual AMTL
YA	96	32	1	1.04%	3.13%

Table 5.44: AMTL prevalence at Cowlam.

Age	Dentition Location	Dentition Section	# AMTL	Left	% Left	Right	% Right
YA	Maxillary	Anterior	1	0	0%	1	100%

Table 5.45: AMTL details at Cowlam.

The single tooth that was lost earlier in life was scored three for healing, suggesting the tooth had been lost some time before death as the root space had entirely closed up.

To summarise the dental diseases at Iron Age Cowlam, it was found that one individual was free from all diseases, one displayed a single moderately severe caries and had lost a single anterior tooth much earlier in life, and the third young adult female had suffered from two moderate caries.

5.6.1.4 Degenerative Diseases

In an investigation of OA at Cowlam it was found that all three young adult females were free from OA and all were missing their entire vertebral column, therefore it was not possible to assess for the presence of VJD.

5.6.1.5 Trauma

Trauma, in the form of cranial and post-cranial fractures, were analysed at Cowlam and it was found that all three of the young adult females were free from these forms of traumatic injury. Although the lack of cranial fractures is clear, the absence of a significant portion of post-cranial elements makes it difficult to comment on the trauma experienced by these three young females during their lives.

5.6.1.6 Site Summary

The Iron Age site of Cowlam includes a small population of three young adult females. Non-specific stress was present in all three individuals in the form of LEH. CO was identified in one of the females, though all three sets of orbits had been preserved for analysis. With respect to dental diseases there were only three carious teeth in the group, no instances of abscesses and a single AMTL. Finally, partially due to age and partially due to skeletal element preservation, there was no evidence of degenerative changes on these three females and trauma in the form of cranial and post-cranial fractures was entirely lacking

5.6.2 Danes Graves

This site included a total sample of 23 individuals. The demographic profile by both sex and age is detailed in Figures 5.159 and 5.160.

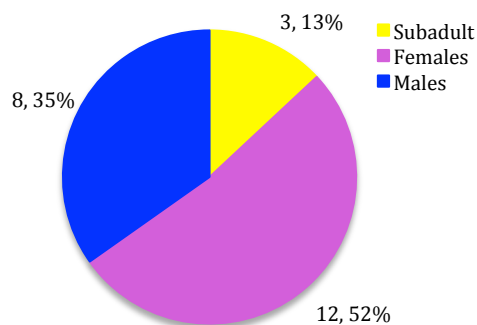


Figure 5.159: Demographic profile of Danes Graves.

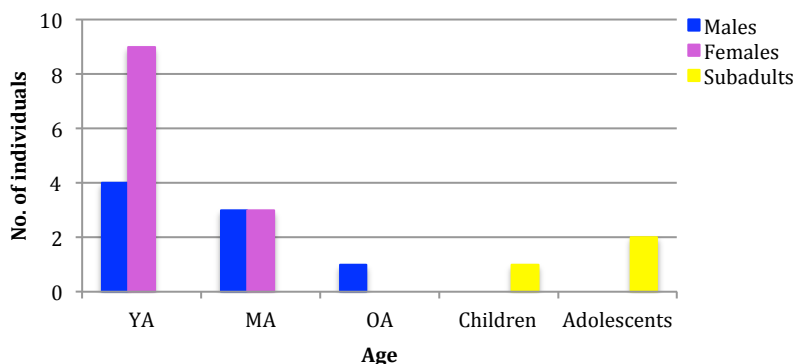


Figure 5.160: Danes Graves age profile.

The sample is slightly biased towards females and with respect to age strongly biased towards the younger age categories. Six females and two males were deemed probable sexes due to the insufficient number of morphological features available for analysis. All had at least three landmarks that were observable, however in all cases two out of three were biased towards the estimated sex and as such they were treated as females and males respectively. Unfortunately there were no innominates available for analysis and as such all sex and age estimation was derived from the skull with secondary sexual characteristics used for sex assessment and dental attrition for age estimation. Three subadults were part of this population; one adolescent did not have any post-cranial elements to examine to determine skeletal development and as such it was not possible to comment on skeletal age in relation to dental age. The second adolescent had a number of partial long bones and, based on their state of fusion and development, it was determined the skeletal and dental age estimations were sufficiently close (each age range was within one year of the other) to determine that skeletal developmental delay had not occurred. Finally, the child (Sk B7) had a number of post-cranial bones and was developmentally aged to between two and three and a half years. However, the dentition suggested a range between three and a half to five years. It was determined, due to the much younger age minimum derived from the skeleton that this child was skeletally delayed.

5.6.2.1 Preservation

Skeletal element preservation was examined at Danes Graves with regards to elements considered complete (Figure 5.161).

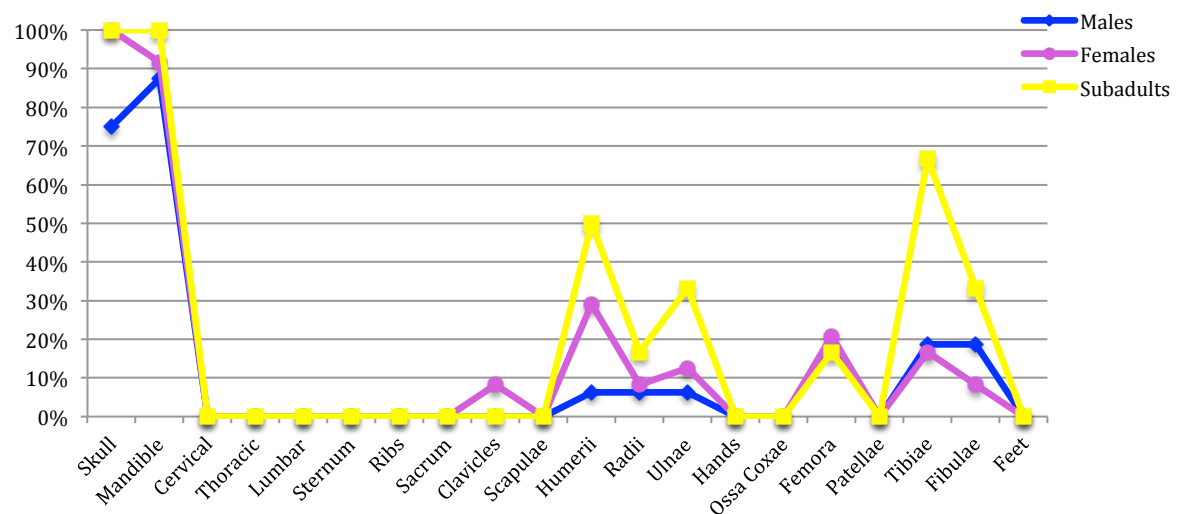


Figure 5.161: Danes Graves skeletal element preservation.

It is clear that the three subadults had a greater quantity of complete elements in comparison to the adults. With respect to males and females, with the exception of the skull and the

humeri, they were both closely matched in their skeletal element preservation. Dental preservation was also assessed for overall tooth presence (Figure 5.162 and 5.163).

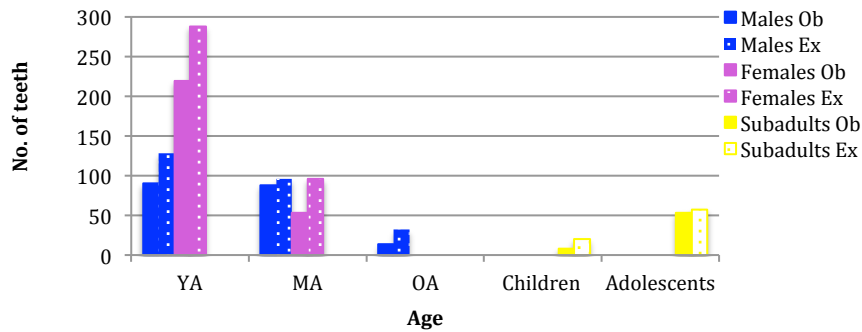


Figure 5.162: Dentition preservation at Danes Graves.

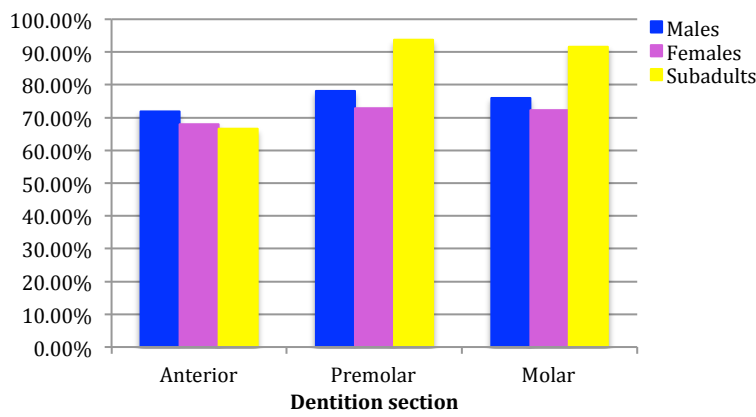


Figure 5.163: Dentition section presence at Danes Graves.

It was determined that young adult males and females had a similar number of available dentitions, however middle adult males had almost twice the observable teeth as their age category female partners. When dentition section was examined it was found that each was relatively evenly represented across the section for both males and females, with the female anterior dentition being the least representative and the male premolars the best. Male average dentition was determined to be 24 teeth, while female average was slightly lower at 22.67 teeth. Finally, the dentition was scored for presence (Figure 5.164).

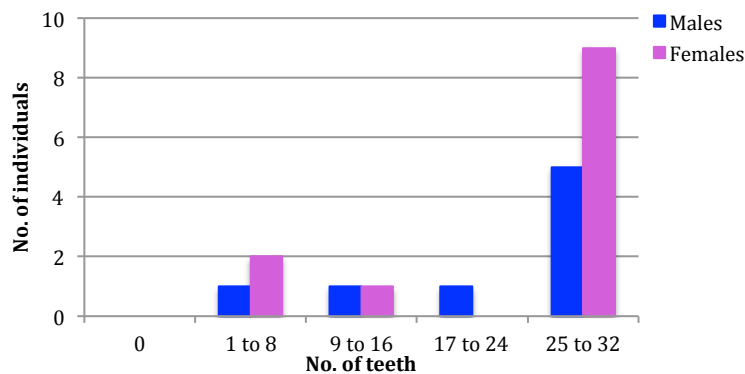


Figure 5.164: Danes Graves count of dentition presence.

It was found that 45% of the adults (n=20) scored in the highest range of available teeth, while 15% (n=3) scored in the lowest category that was represented.

As a result of a range of skeletal elements being preserved it was possible to estimate stature for five individuals (Table 5.46 and Figure 5.165).

Skeleton	Sex/Age	Element	Height (cm)	Height (in)
M35SkuI25 1898	M YA	Left Femur	150.66 ± 3.27	59.314 ± 1.287
B3SkuI3 1909	F YA	Right Radius	177.696 ± 4.24	69.959 ± 1.669
M16SkuI8 1898	F YA	Right Ulna	176.039 ± 4.30	69.306 ± 1.692
M/B5SkuI30 1899	F YA	Right Femur	157.099 ± 3.72	61.85 ± 1.464
M5SkuI30 1909	F YA	Right Humerus	171.202 ± 4.45	67.402 ± 1.751

Table 5.46: Stature estimation at Danes Graves.

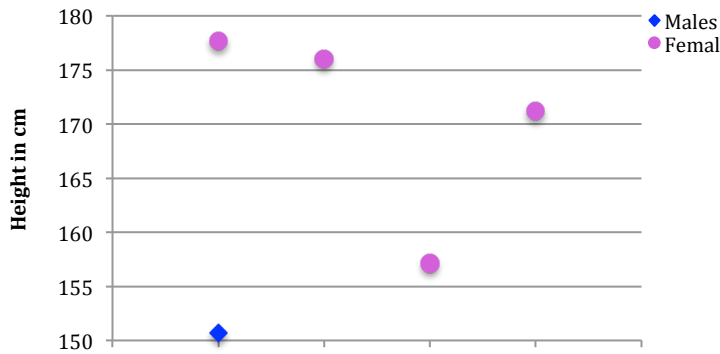


Figure 5.165: Stature estimations in centimetres for individuals at Danes Graves.

The females displayed a range of heights from a low of 157.099 cm (5ft. 1.5in.) to a high of 177.696 cm (5ft. 8.3in.) and an average of 170.51 cm (5ft. 6in.). Meanwhile the single male presented with the lowest height estimate, providing for the possibility that this individual may not have been able to achieve their full adult height potential.

5.6.2.2 Non-Specific Stress

In an analysis of LEH at Danes Graves, it was determined that six individuals (26.09% of the population) did not have the requisite anterior dentition or they were obscured as a result of post excavation reconstruction efforts (Figure 5.166).

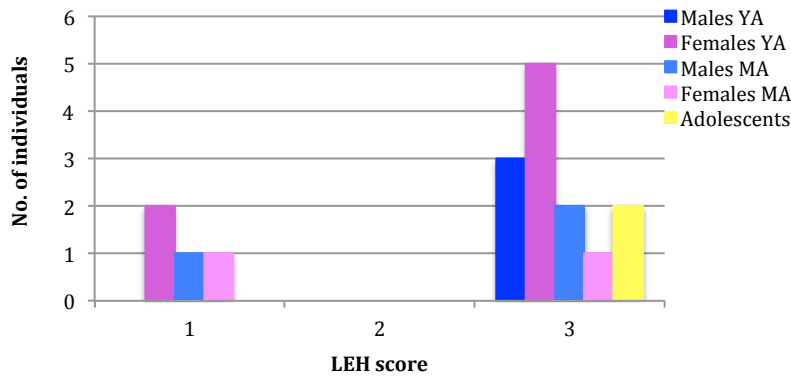


Figure 5.166: LEH severity at Danes Graves.

It was determined that 76.47% of the population not only exhibited LEH, but also experienced at least two separate incidences of severe stress during their formative years. When the presence of CO was examined, it was found that orbits were available and observable for all individuals in the population (Figure 5.167).

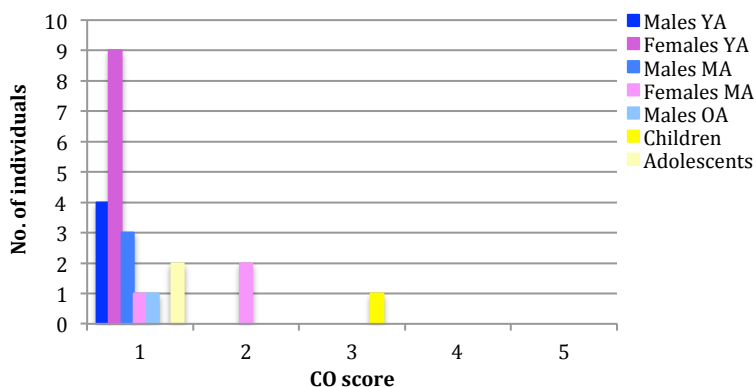


Figure 5.167: CO severity at Danes Graves.

Only three individuals (13.64%) exhibited evidence of CO, and all presented with the mild to moderate form of stress. In conjunction with the LEH findings, only one middle adult female exhibited both LEH and CO.

5.6.2.3 Dental Diseases

When the population of Danes Graves was analysed for caries, it was determined that 11 individuals (47.83% of the population) did not present any evidence of the disease (Figure 5.168 and Figure 5.169).

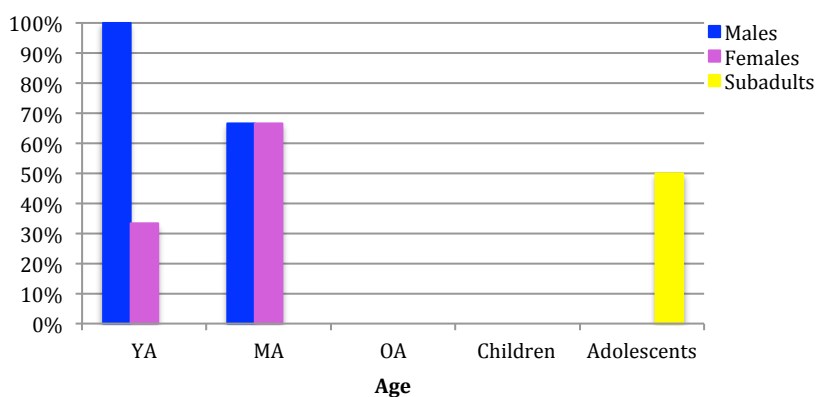


Figure 5.168: Caries prevalence at Danes Graves.

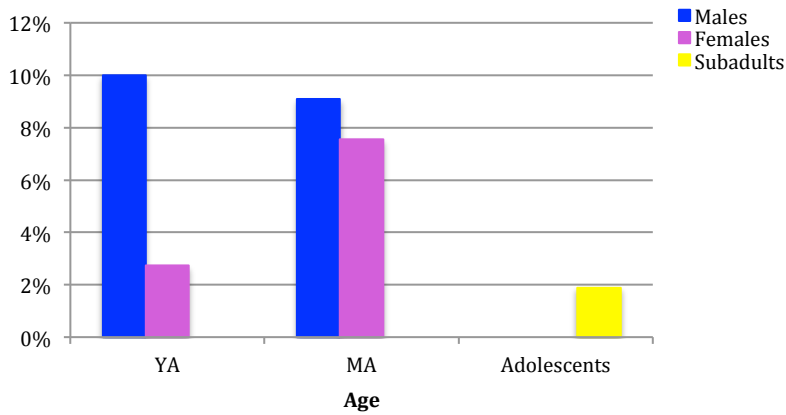


Figure 5.169: Proportion of carious teeth at Danes Graves.

With the exception of the single child and male old adult, all age and both sex categories had evidence of caries. Males had almost twice as many individuals with caries compared to the females, while only one subadult had evidence of a carious lesion. When carious tooth rates were considered, young adult males had a rate almost five times that of their female age counterparts, and for the total male and female populations, the females had half the overall rate of carious teeth compared to males. Caries were also examined with respect to dentition location and were found to be almost evenly matched across both dentitions for both sexes and all age groups with the exception of the middle adult females, both of whom exhibited caries solely on the mandibular dentition. Caries type was also assessed (Figure 5.170).

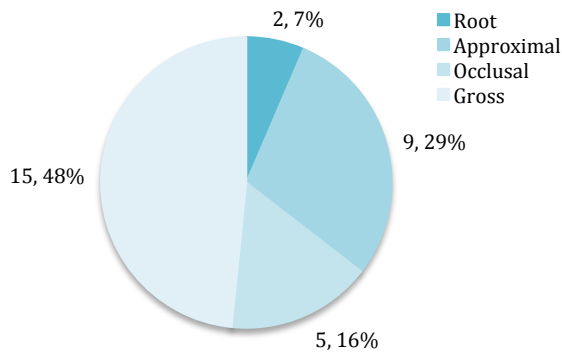


Figure 5.170: Proportion of caries by type at Danes Graves.

Gross caries were the most likely expression of the disease, followed by approximal caries. As gross caries are so named because the carious lesion has expanded beyond a clear single type, it is difficult to comment on prevalence of caries type, as the original lesion may have been any one of the three other types noted above. In an examination of severity, it was determined that 60% of caries (n=18) were mild in nature, and none were found to have destroyed the entire dental crown.

Abscesses were also assessed at Danes Graves and 15 individuals (65.22% of the population) did not have any evidence of this disease (Figure 5.170 and Figure 5.172).

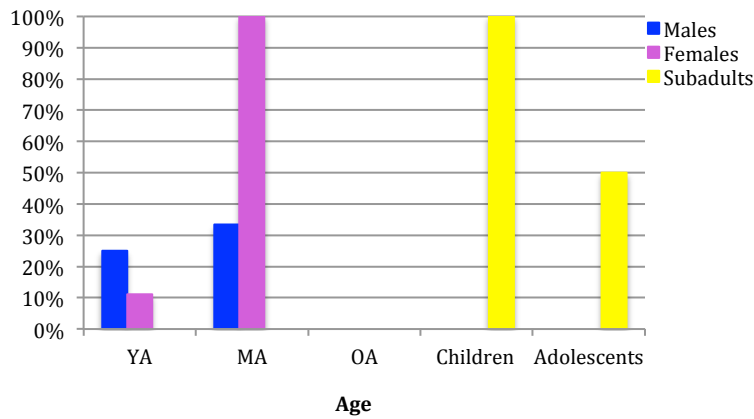


Figure 5.171: Abscess prevalence at Danes Graves.

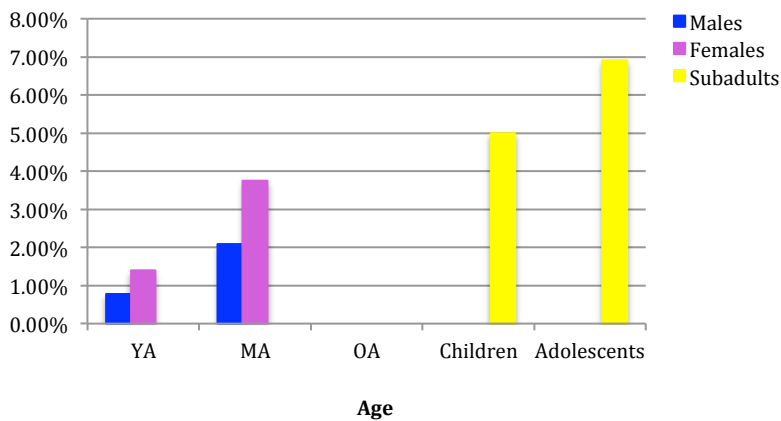


Figure 5.172: Proportion of tooth spaces and abscesses at Danes Graves.

Males, females and subadults all had evidence of abscesses, with subadults having the highest percentage of individuals affected, while females had the highest raw number of people with the disease. When abscess rates were considered, subadults had the highest percentage. However, as females had a higher amount of observable tooth places (directly due to their higher proportion in the population), their overall abscess rate in relation to observed tooth places was much lower. Based on age among the adults, the middle adult category for both sexes exhibited the highest abscess percentage for the population.

Abscesses were also examined with respect to dentition section and they were almost evenly spread throughout all sections, with the anterior dentition having just one additional abscess in comparison to the molars, and only two more than those found among the premolars. It was determined that males had more healed abscesses with internal drains and a moderate severity. Females, in contrast, exhibited more active lesions at their time of death, with external sinus drains, but also slightly more moderate expressions. Finally, abscesses seen in subadults were exclusively active with external sinuses, though the majority were also moderate in severity. This suggests that males were able to overcome their abscesses, while it is unclear if the disease (or related issues) were connected to the deaths of the females and subadults with active lesions.

Finally, AMTL was examined and 13 of the adults (and all of the subadults) did not experience any tooth loss during their lifetime (69.56% of the total population) (Figure 5.173).

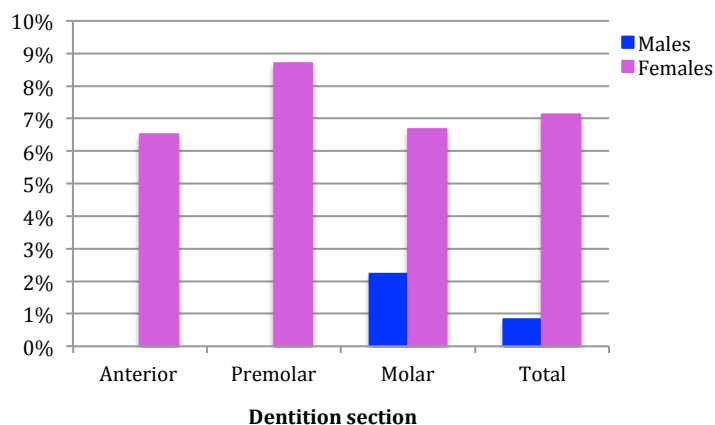


Figure 5.173: Proportion of tooth spaces and AMTL at Danes Graves.

Females at Danes Graves were much more likely than males to have AMTL, and it was determined that with increased age came increased numbers of individuals with AMTL for both sexes. When percentage of AMTL was examined females had a much higher percentage of lost teeth, when dentition section was considered in all three sections the rate for females was at least three times that for males. AMTL was also explored by individual tooth type and side as well as dentition location (Figures 5.174 and 5.175).

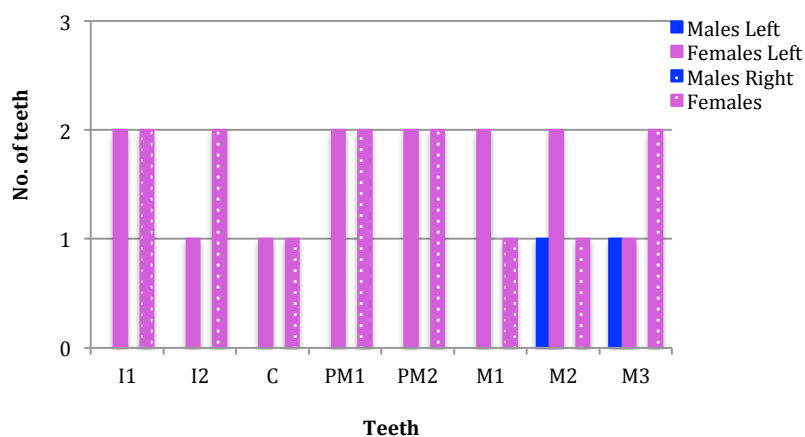


Figure 5.174: Danes Graves AMTL by side.

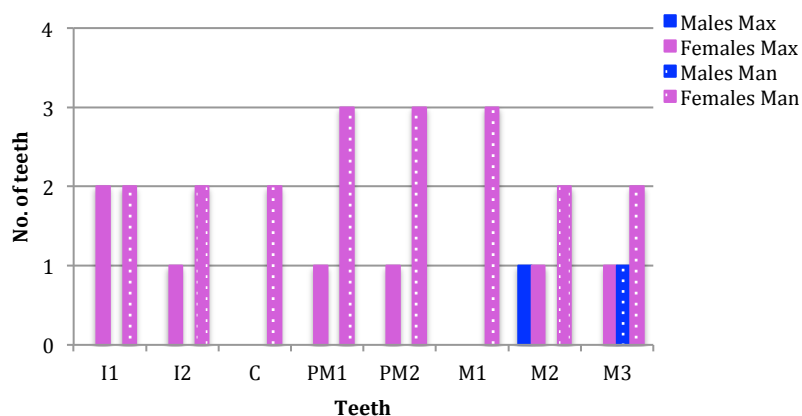


Figure 5.175: Danes Graves AMTL by dentition location.

Based on the charts above, AMTL in males was exclusively found on the left side of the dentition, while it was evenly split between the maxillary and mandibular locations. Conversely, in females, AMTL was evenly split between the left and right sides however there was a strong bias towards the mandibular dentition. With respect to healing stage, the male tooth loss had all occurred some time before death, as the root surfaces had begun to close up. For the females although a majority were scored the same as the males, almost 40% of the teeth were lost a long time prior to death, as their root spaces had entirely filled in. Associated pathologies were conclusively determined for half of the male AMTL, while for the females only 23.08% of teeth lost could be directly attributed to a pathology, which, in all cases, was an abscess. Some of the tooth loss in females could not be attributed to a pathology due to the advanced healing stage.

In a summary of the dental diseases at Danes Graves it was determined that 21.74% of the population (n=5), which included one subadult, three females and one male, had dentitions clear of the dental diseases that were assessed (Figure 5.176 and 5.177).

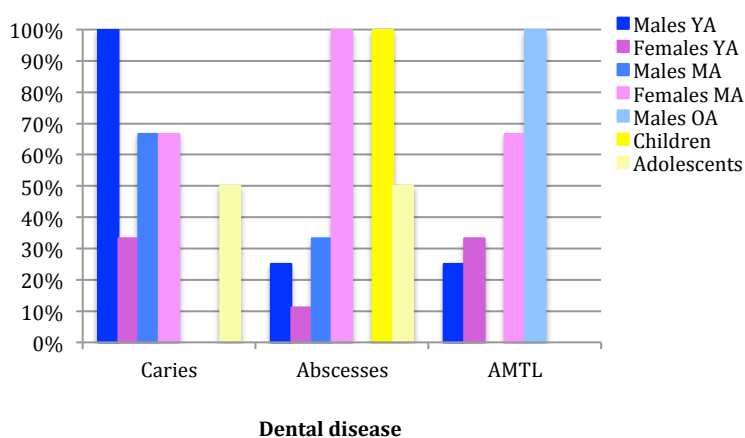


Figure 5.176: Danes Graves proportion of individuals with dental disease.

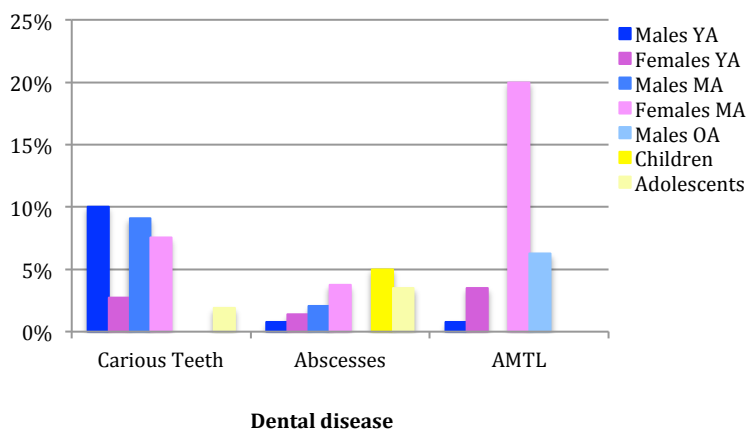


Figure 5.177: Danes Graves proportion of observed teeth and tooth spaces with disease.

A higher number of males presented with caries, while relatively few exhibited abscesses and AMTL. For females, the population exhibited almost even numbers of individuals with all three dental diseases, while subadults were much more likely to have an abscess than caries. Males had the highest rate of caries and low rates of abscesses and AMTL, while females had half the carious tooth rate compared to males and similar abscess rates, but much higher rates of AMTL, while subadults had an abscess rate that was three times that of their caries rate.

5.6.2.4 Degenerative Diseases

In an investigation into degenerative changes experienced by the population of Danes Graves, it was found that 17 individuals (85% of the adult population) had no evidence of these alterations and therefore only three young adult females presented with OA (Table 5.47).

Sex/Age	Joint Location	Left / Right/Both	Severity	Distribution
F YA	Shoulder/Scapula	Right	1	Regional
F YA	Knee, Femurs	Both	1	Regional
	Knee, Tibia	Left	1	Regional
F YA	Hip, Femur	Right	1	Regional

Table 5.47: OA prevalence at Danes Graves.

When these were examined in more detail, it was found that the lower joints were the most likely to be affected, while overall the severity of these alterations was quite low.

VJD was also assessed in this population and 80% of adults (n=16) did not have any surviving vertebrae available for analysis. Two of the four individuals with vertebrae however, did have evidence of degenerative changes (Table 5.48).

Sex/Age	Vertebral Location	# Affected	Severity
F YA	Cervical	3	3
F MA	Cervical	3	3

Table 5.48: VJD prevalence at Danes Graves.

Although the sample is too small to assess statistically, it is worth noting that both females exhibited severe vertebral fusion of three of their cervical vertebrae.

5.6.2.5 Trauma

When the population of Danes Graves was assessed for cranial fractures, it was discovered that 30.43% of the population (n=7), had evidence of this trauma (Figures 5.178 to 5.180).

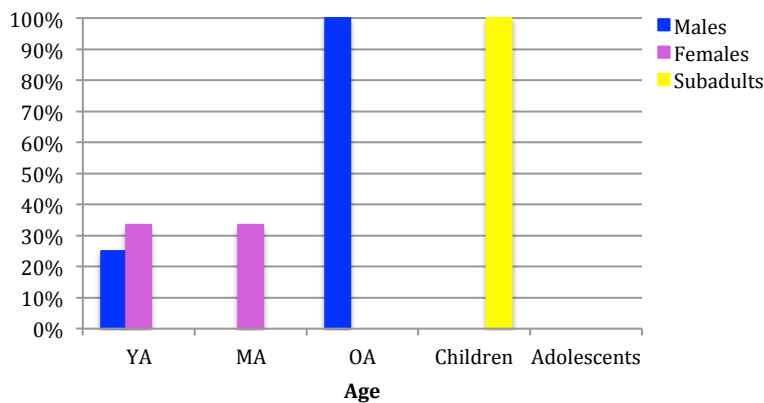


Figure 5.178: Cranial fracture prevalence at Danes Graves.

Based on percentages, children had the highest proportion of individuals with cranial fractures, while females had the highest raw number of individuals inflicted with this trauma. Overall however, with the exception of middle adult males, all age categories and both sexes of adults experienced trauma in their lives.

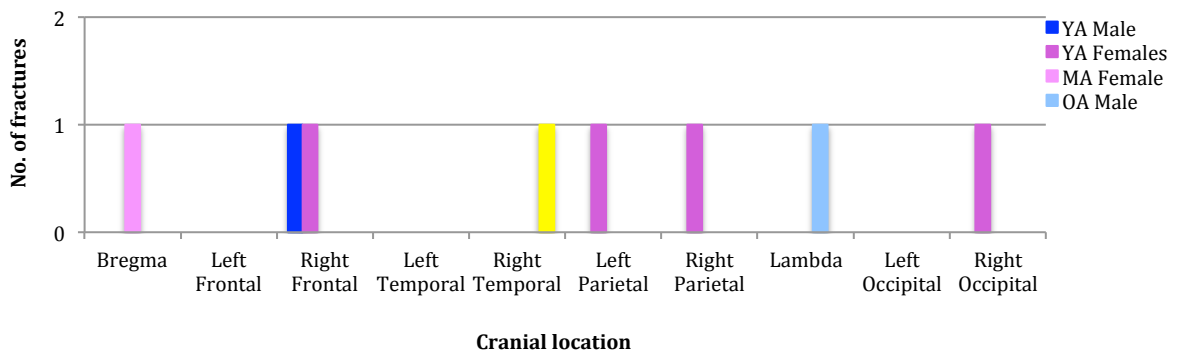


Figure 5.179: Danes Graves cranial fractures by location.

When fracture location was examined, no pattern of distribution could be discerned and there was no apparent bias with regards to sex, age or fracture location.

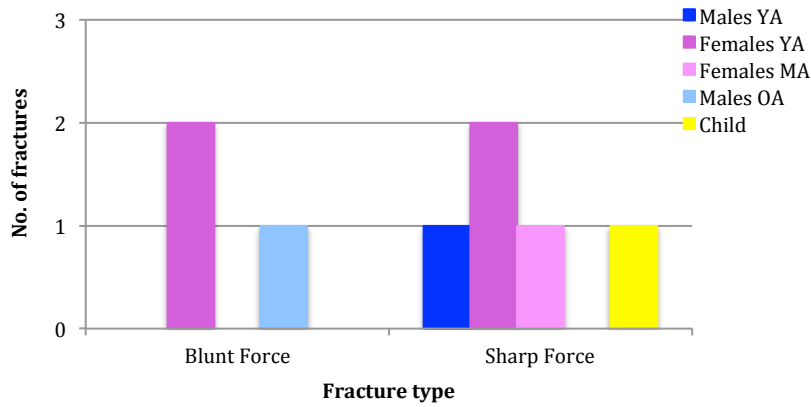


Figure 5.180: Danes Graves cranial fractures by type.

Fracture type also did not appear to be connected to sex or age, as with the exception of the young adult females who were evenly split, all other groups only had a single fracture. When the age groups were brought together for the adults, they were still almost evenly split, with only one additional instance of sharp force trauma among the females (Figure 5.181 and Figure 5.182).

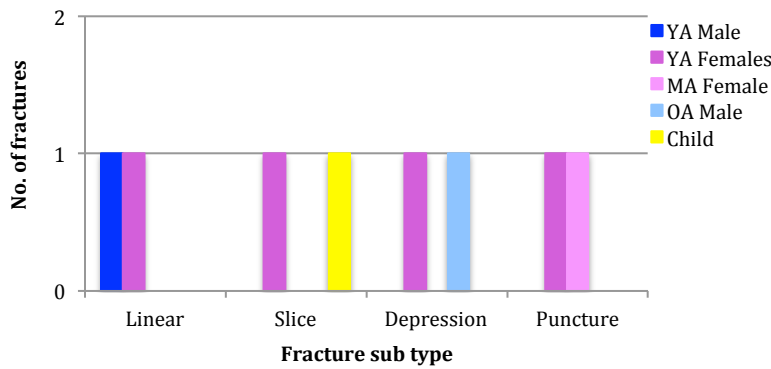


Figure 5.181: Danes Graves cranial fractures by sub type.

It is clear there is very little association between fracture sub type and age or sex. Although only females exhibited puncture wounds, the sample is too small to determine any statistical significance with this association.

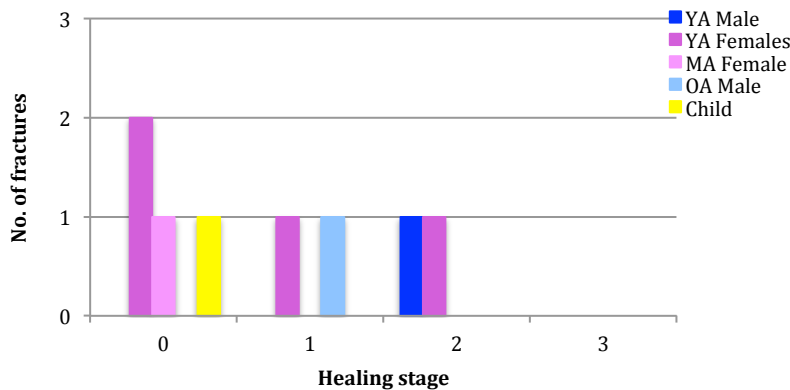


Figure 5.182: Danes Graves cranial fractures by healing stage.

Based on fracture healing stage, males were more likely to survive (at least initially) as a result of the trauma they received. The single subadult and three of the wounds exhibited on the females proved to either be fatal or were received very close to the time of death, as there was no evidence of healing.

Post-cranial fractures were also assessed in this group and only one individual (4.34% of the population) had evidence of this form of trauma (Table 5.49).

Sex/Age	Bone	Side	Healing	Associated Pathologies
F YA	Humerus	Right	3	Misalignment

Table 5.49: Post-cranial fracture prevalence at Danes Graves.

With respect to healing, although the fracture had healed, it had most likely not been set properly, or was in use prior to it fully healing. This suggests the use of the arm may have been diminished in some way.

5.6.2.6 Site Summary

The population of Danes Graves includes 23 individuals with a strong bias towards females and the younger age categories. Non-specific stress was present and reoccurring in the childhoods of a majority of the individuals in the form of LEH (76.47% of the population), while CO was mild in its manifestation and only affected two individuals (13.64% of the sample). Dental diseases were prevalent with two thirds of subadults exhibiting caries and abscesses. Males were most likely to have caries, while AMTL was common among females. Degenerative changes were only seen in females and with respect to OA it was mild in form. VJD however, though only seen in two of the four individuals with vertebrae was severe in its expression as the two females had evidence of fused cervical vertebrae. Finally, trauma was a common occurrence among the population with 30% displaying cranial fractures and 50% of those not surviving long enough for them to heal. Post-cranial fractures were rare, with only one individual exhibiting this trauma, however this was heavily influenced by the lack of preserved post-cranial elements.

5.6.3 Melton

The site of Melton included 18 individuals and the demographic profile by both sex and age is detailed below in Figures 5.183 to 5.185.

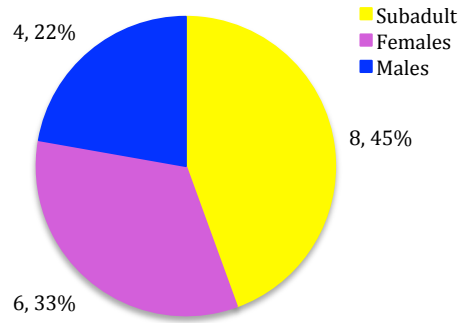


Figure 5.183: Demographic profile of Melton.

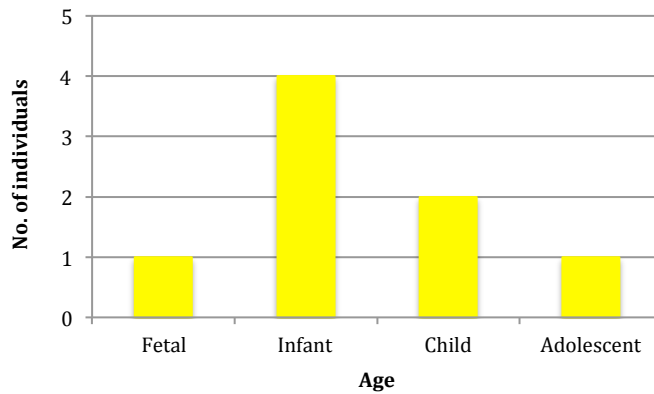


Figure 5.184: Melton subadult age distribution.

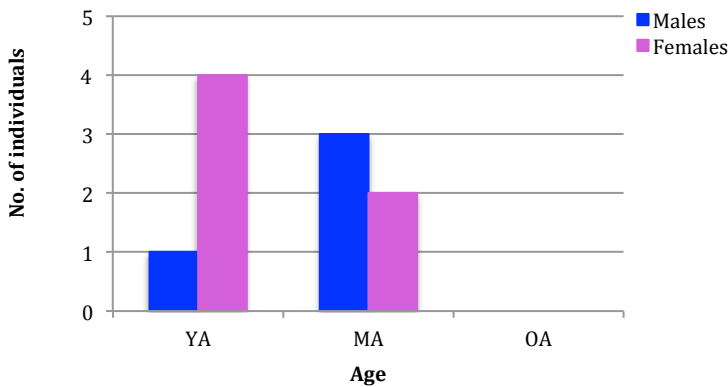


Figure 5.185: Melton adult age distribution.

The site had a bias towards females as well as subadults. When the adults are considered separately there is a clear bias towards females and a complete lack of older adult individuals. Three females and three males were determined to be probable sex as these were the individuals without associated innominates available for analysis. However, as they all had at least four morphological features, 75% of which suggested one sex over the other, for the purposes of this project they were placed in the female and male sex groups respectively. Dental attrition was relied upon to determine age estimation for adults. In four cases, the pubic symphysis was available and in eight cases the auricular surface was available. In all of these cases dental attrition was scored first and age estimation derived from the pelvis were

found to coincide with those estimations. The subadults, with the exception of a single infant, had age determined as a result of both dental development and skeletal development and it was found that two infants had differing age estimations to such a degree that it was concluded their skeletal maturation had been arrested as a result of stress (Table 5.50).

Skeleton	Age Category	Dental Age	Skeletal Age
Sk1183	Infant	2 to 4 years	1 to 1.5 years
Sk1818	Infant	2 to 5 years	Birth to 2 years

Table 5.50: Subadult age estimation disparities at Melton.

5.6.3.1 Preservation

The population of Melton was assessed for skeletal element preservation and the results are presented in Figure 5.186.

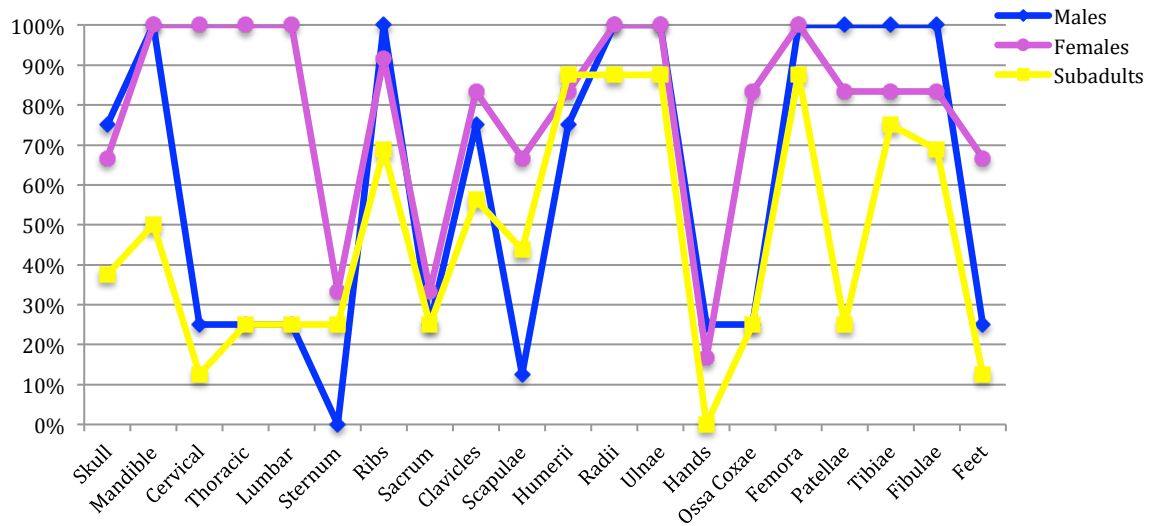


Figure 5.186: Melton skeletal element preservation.

Skeletal element preservation was quite good at Melton with a range of observable elements for each group. This can be almost directly attributed to the excavation methodology of On Site Archaeology. Dental preservation was also assessed (Figure 5.187 and Figure 5.188).

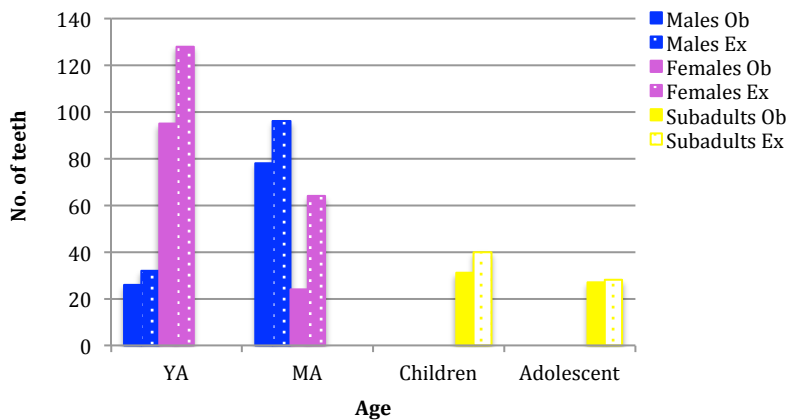


Figure 5.187: Dentition preservation at Melton.

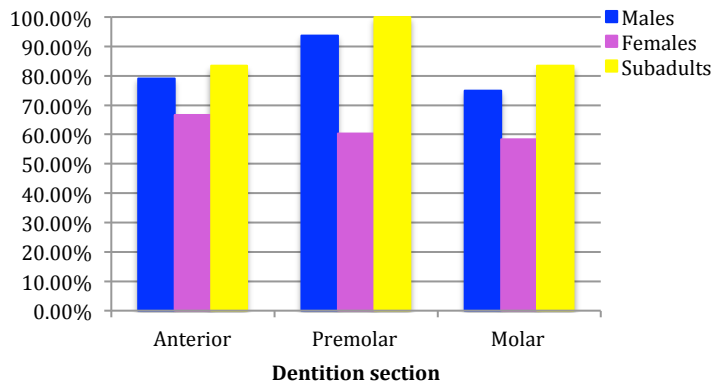


Figure 5.188: Dentition section preservation at Melton.

Males had much higher rates of dentition presence in both groups and overall in comparison to females who were closely matched with respect to young adults, but drastically reduced in middle adults. When dentition section was considered, premolars were the most complete section among males, while the anterior dentition had the highest preservation levels for females. In both instances the molars were the least preserved part of the dentition. The average number of teeth for males and females was calculated and males presented with 26 teeth, while females had a much lower average with 19.83 teeth. Finally, the dentition was scored based on presence (Figure 5.189).

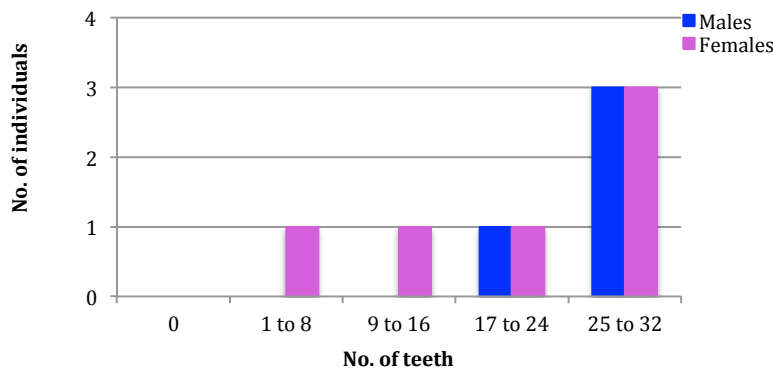


Figure 5.189: Melton count of dentition presence.

Although the majority of both males and females scored in the highest dentition count category, females were also spread through all ranges (with the exception of zero), while males only had a single individual that had not scored in the top bracket. As a result of the completeness of a number of skeletal elements it was possible to estimate stature for seven individuals (Table 5.51 and Figure 5.190).

Skeleton	Sex/Age	Element	Height (cm)	Height (in)
Sk1032	F YA	Left Femur + Tibia	155.8515 ± 3.55	61.358 ± 1.397
Sk1489	F MA	Right Tibia	158.39 ± 3.66	62.358 ± 1.440
Sk1823	F YA	Left Fibula	155.421 ± 3.57	61.189 ± 1.409
Sk3890	F YA	Left Femur + Tibia	160.23 ± 3.55	63.082 ± 1.397
Sk4297	F YA	Left Femur + Tibia	158.84 ± 3.55	62.535 ± 1.397
Sk2722	M MA	Left Humerus	181.33 ± 4.05	71.389 ± 1.594
Sk4075	M MA	Left Radius	165.194 ± 4.32	65.037 ± 1.7

Table 5.51: Stature estimation at Melton.

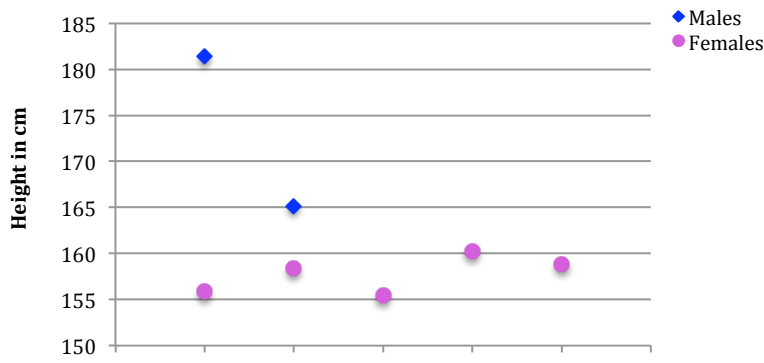


Figure 5.190: Melton stature estimation by sex.

As can be seen in the chart above, the females were all clustered between 155.421 cm (5ft. 1.2in.) and 160.23 cm (5ft. 3.1in.) with an average of 157.75 cm (5ft. 2.1in.). The two males conversely have a much wider range from a low of 165.194 cm (5ft. 5in.) to 181.33 cm (5ft. 11.4in.) and an average of 173.26 cm (5ft. 8.2in.).

5.6.3.2 *Non-Specific Stress*

The population at Melton was examined for the presence of LEH and four individuals (22.22% of the population) did not have any anterior teeth to assess (Figure 5.191).

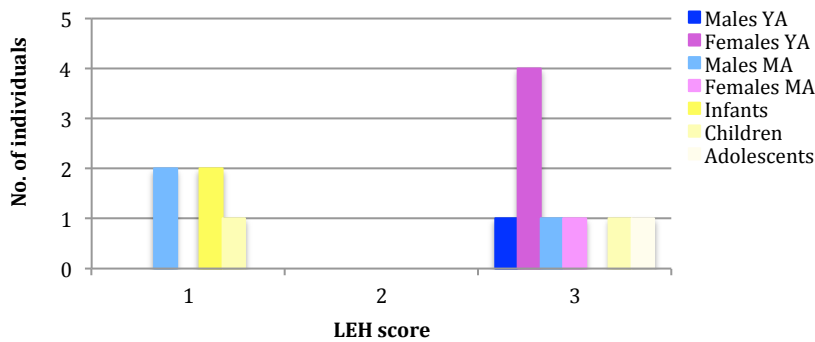


Figure 5.191: LEH severity at Melton.

All individuals attributed to the adolescent and young adult categories had evidence of LEH, while among the children and middle adults of both sexes, only a third to half of the individuals had evidence of this dental enamel defect. Overall, 50% of the population with anterior dentition (n=9) experienced episodes of stress in their younger years, and based on the severity score, all of those afflicted had multiple severe stressful periods in their childhoods, which negatively impacted the growth of their enamel.

The presence of CO was also examined at Melton and six people (33.33% of the population) did not have any observable orbits for inspection (Figure 5.192).

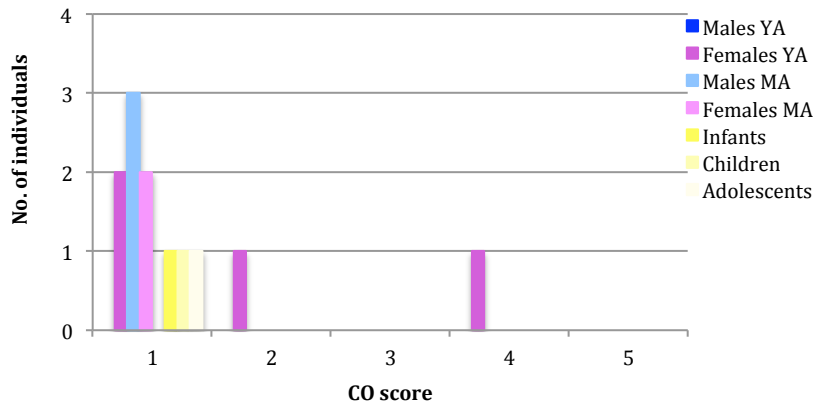


Figure 5.192: CO severity at Melton.

Only two young adult females (16.67% of the population with orbits) had evidence of CO, and although one had a moderately severe form, these findings suggest the population, as a whole did not generally manifest this expression of stress.

5.6.3.3 Dental Diseases

When the population of Melton was assessed for caries it was determined, of those individuals with dentitions present (n=13), five individuals (38.46%) were free from carious lesions (Figure 5.193).

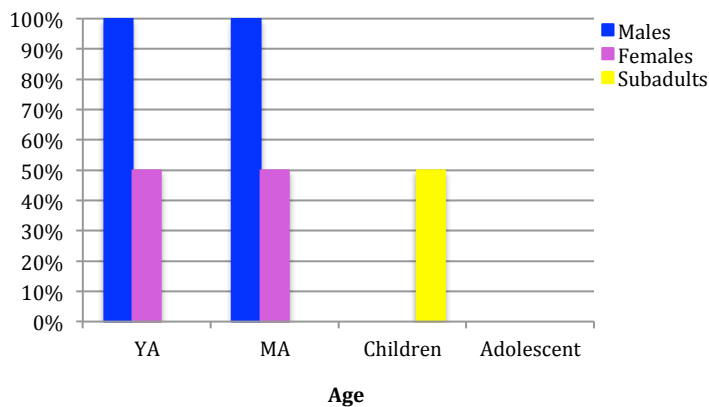


Figure 5.193: Caries prevalence at Melton.

It was determined that all males, half of all females and a third of subadults had at least one caries. With the exception of the single adolescent, all age ranges were also affected (Figure 5.194).

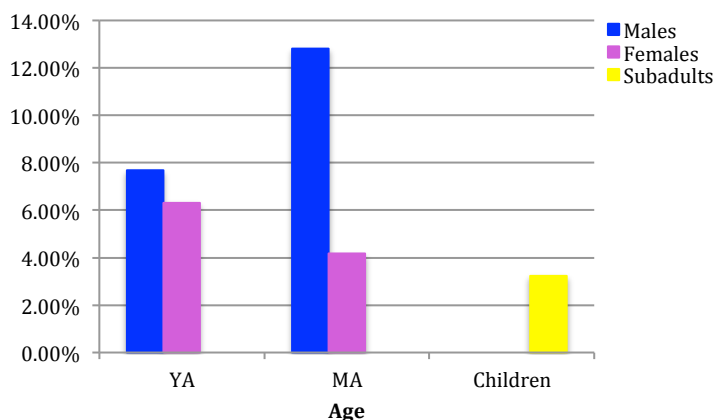


Figure 5.194: Proportion of carious teeth at Melton.

Males, and especially middle adult males, had the highest rate of carious teeth, while among the females it was the young adults that exhibited the highest rate. Though this was still only half the rate observed in males. The single carious lesion seen in the sole child presented the lowest rate of carious teeth for the whole group. Based on dentition location, in all instances, caries were biased towards the mandibular dentition. Caries were also examined with respect to type and severity (Figure 5.195).

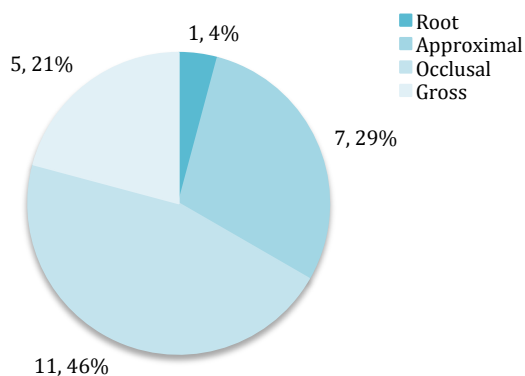


Figure 5.195: Proportion of caries by type at Melton.

Caries were variable in their manifestation and although 45.83% of caries were located on the occlusal surface, all types were represented at Melton. When severity was considered, the majority were moderate in nature and received a score of three (50%, n=12). No discernable relationship was found with respect to age or sex and caries type or severity.

Abscesses were also assessed at Melton and of the 13 individuals with adequate dentition for inspection, and it was found that two middle adult males (15.38% of the group) were the only ones with this form of dental disease (Table 5.52).

Sex/ Age	Observed Tooth Places	# Abscesses	% Abscesses	Dental Location	Dental Section	Tooth Loss	Healing	Sinus	Severity
M MA	32	3	9.37%	2 Maxilla	Molar	1	Healed	External	Severe
				1 Mandible	Molar	No	Active	Internal	Moderate
M MA	32	4	12.50%	2 Maxilla	Molar	3	Active, Healed	External, Internal	Moderate, Severe
				2 Mandible	Molar	1	Active	External	Severe

Table 5.52: Abscess prevalence at Melton.

The table above (5.52) illustrates a high rate of abscesses for both of these individuals, and for males as a whole that rate was 7.03% of observed tooth places. Abscesses were in both stages of healing, exhibited sinuses on both the internal and external surface and were moderate and severe in their expressions.

Finally, AMTL was also considered for the adults at Melton and half of the population did not have any evidence, among males, only those of middle age, while conversely among females, both age categories experienced tooth loss. When the rate of AMTL was considered with respect to observable tooth places (Figure 5.196), it was found that females had a rate of tooth loss that was about 5% higher than that observed in males. However when the raw number of teeth lost ante mortem was observed it was noted that females lost more than twice the number of teeth as males. When individual dentition sections were considered it was found that among males the anterior dentition was rarely involved and the premolars never were. In contrast, females experienced tooth loss in all sections, and similar to males, experienced the highest rate of tooth loss among the molar section. Dentition location and side were also examined with respect to AMTL (Figures 5.197 and 5.198).

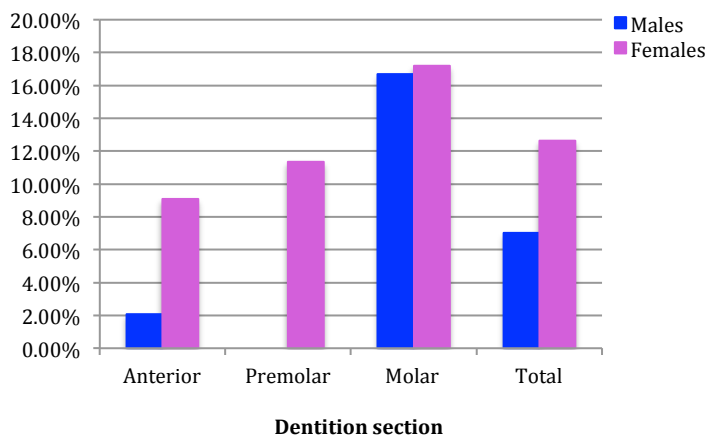


Figure 5.196: Proportion of tooth spaces and AMTL at Melton.

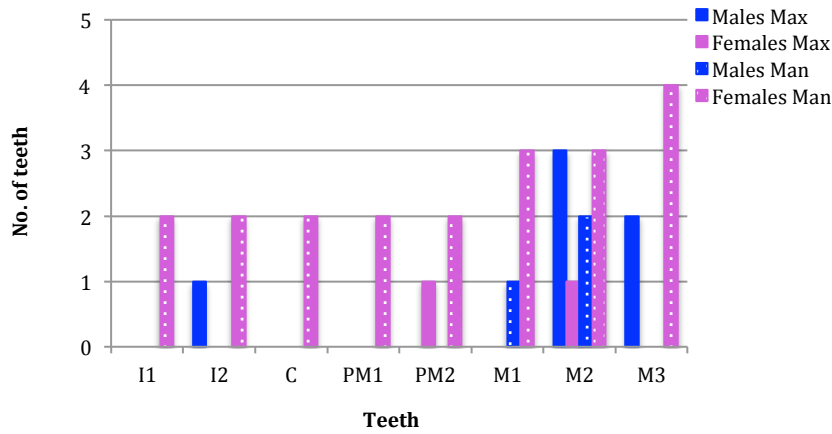


Figure 5.197: AMTL at Melton by dentition location.

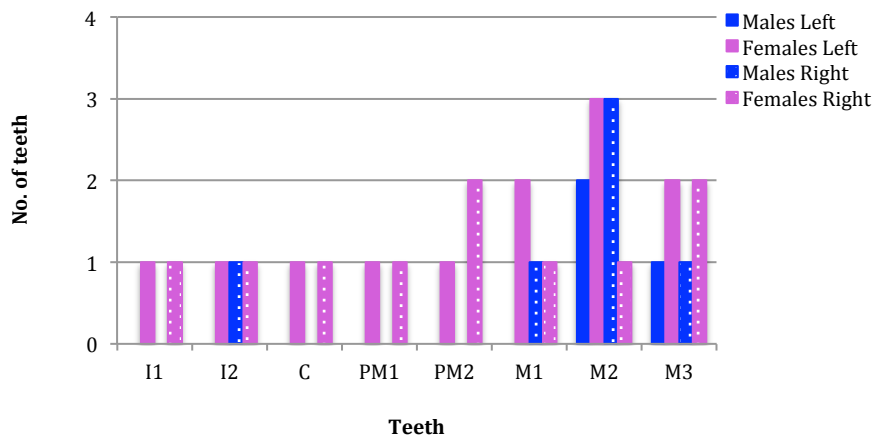


Figure 5.198: AMTL at Melton by side.

Males lost slightly more teeth within their maxillary dentition compared to their mandible, and with respect to side, two thirds of the lost teeth were located among the right teeth. For females, their tooth loss was predominantly on the mandibular dentition and among the young adults was biased towards the left side, but evenly split between left and right sides among the middle adults. AMTL healing and associated pathologies were also examined and in a little over half of all cases, AMTL in males occurred a short time before death as their root spaces had begun to fill, while the rest were lost very close to death as they did not display evidence of healing. For females, the majority of their teeth had been lost much earlier in life, as their root spaces had entirely closed. With respect to associated pathologies, among the males six teeth could be directly attributed to pathologies (namely abscesses as discussed above). Females did not have any evidence of clear pathological involvement, though this may be due to the advanced stage of healing which may have hidden the initial causes of tooth loss.

In a summary of dental disease presence at Melton, five individuals (including three subadults) with observable teeth were found to be free from all described diseases (35.71% of the group) (Figure 5.199 and Figure 5.200).

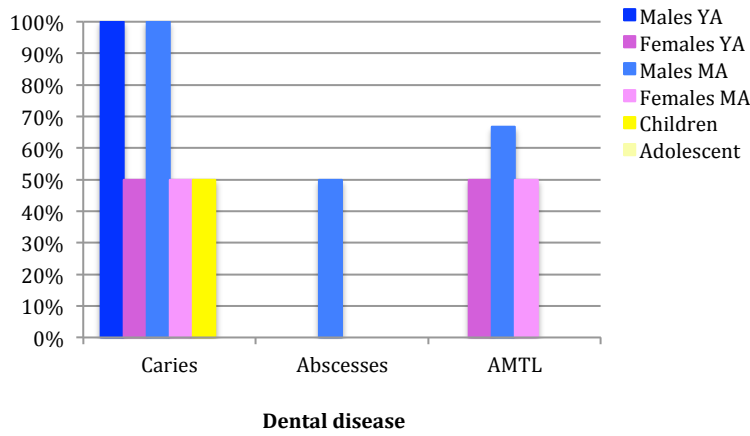


Figure 5.199: Melton proportion of individuals with dental disease.

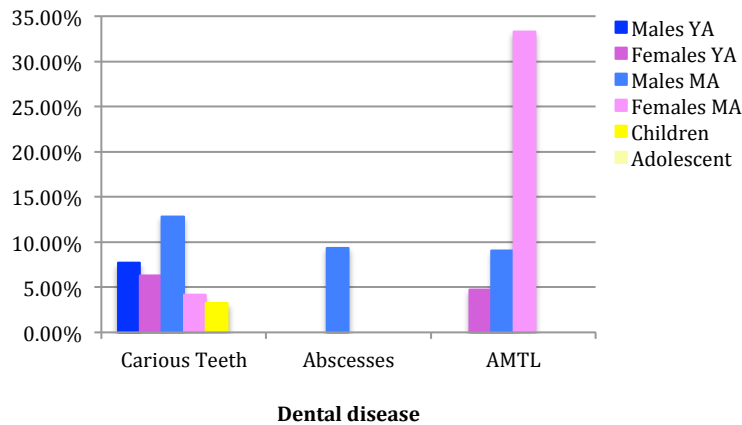


Figure 5.200: Melton proportion of observed teeth and tooth spaces with disease.

Melton males were much more likely to have caries than abscesses or AMTL, while females were equally likely to have caries and AMTL. Subadults were relatively free from dental diseases with only one caries being reported in a single child. With respect to dental disease rates, males exhibited twice the rate of caries compared to females, but females had almost twice the rate of AMTL in comparison to males, and exhibited the loss of more than twice the number of teeth.

5.6.3.4 Degenerative Diseases

In an analysis of adults at Melton, it was determined that a third of individuals (n=5) did not have any evidence of OA (Figure 5.201).

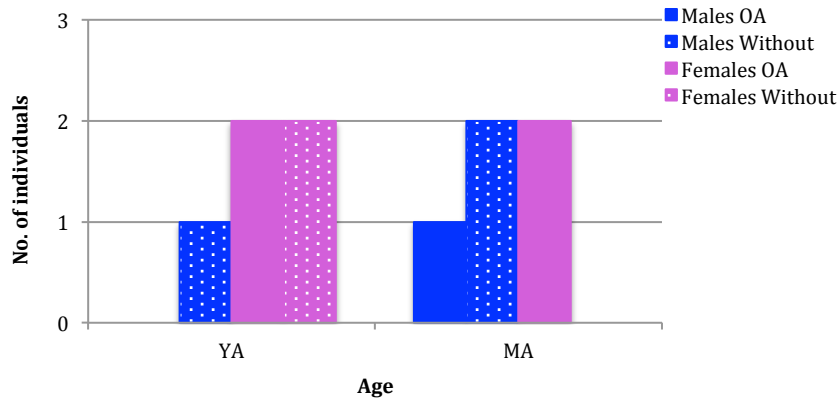


Figure 5.201: Prevalence of OA at Melton.

Only one male, a middle adult, had evidence of degenerative changes, while 66.67% of females, including half of the young adults displayed degenerative alterations to their skeleton (Figure 5.202).

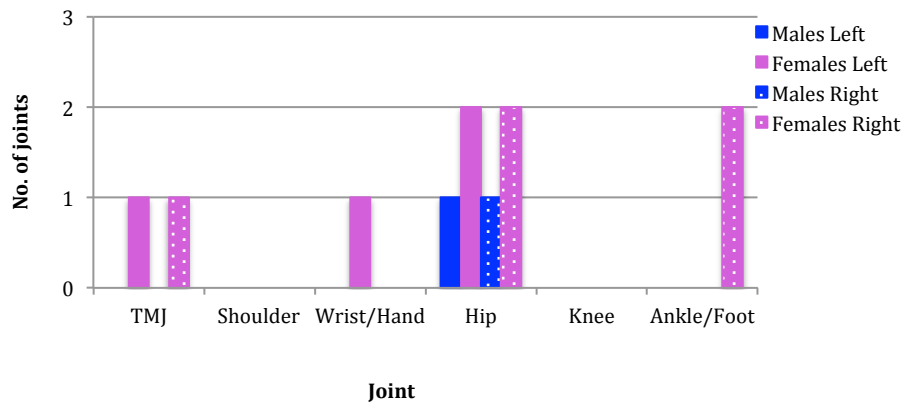


Figure 5.202: Melton OA side distribution.

Overall the severity of OA was mild to moderate for those afflicted, however, among the females they had a greater proportion of joint involvement compared to the male. With respect to joint location, the hip was the most often affected with the male and two females exhibiting degenerative changes. When distribution was examined it was determined that the male and two females displayed regional changes, suggesting they may have been activity induced. However without the rest of the post-cranial skeleton to assess, this conclusion is only tentative. Two females conversely, had a range of affected joints and as such their OA was considered systemic in nature.

When VJD was assessed at Melton it was found that all adults had vertebrae available for analysis (Figure 5.203).

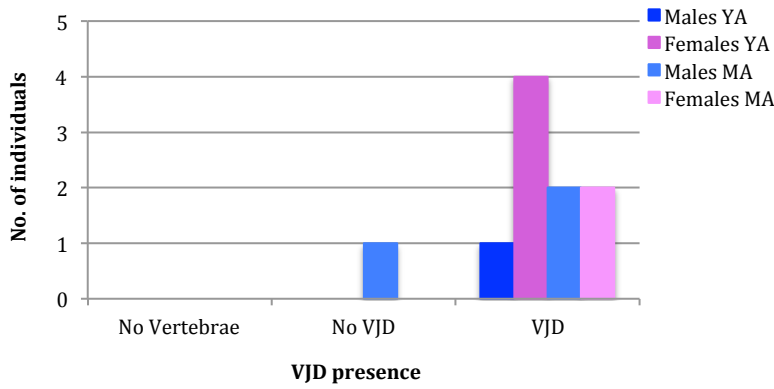


Figure 5.203: Melton prevalence of VJD.

It was found 90% of the adult population had evidence of VJD on their available vertebrae. Females had a higher proportion with all individuals exhibiting the degenerative changes, while three quarters of males also had evidence. The number and location of vertebrae affected as well as their severity were examined by both sex and age (Figure 5.204).

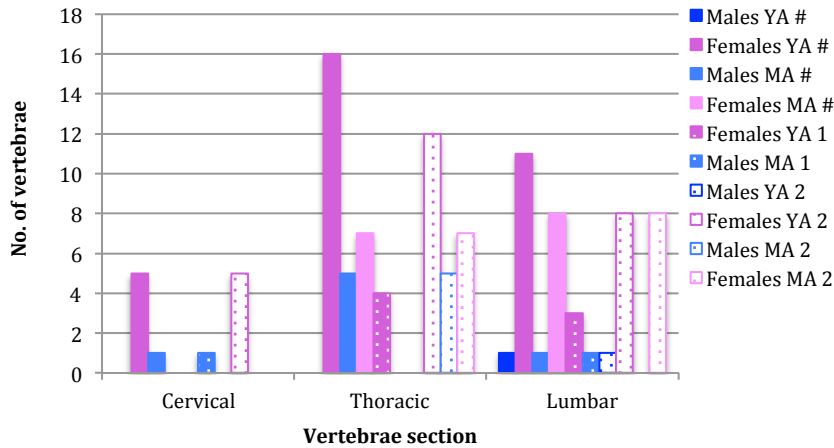


Figure 5.204: Melton VJD vertebrae affected and severity.

Young adult males had the lowest number of vertebrae affected, while young adult females had the highest. Both young and middle adult females had the highest number of vertebrae with a severity score of two. Overall, none of the individuals exhibited the most severe form with vertebrae fusion. However considering the young age of the females it is likely that had they lived into middle or old adulthood, their vertebrae would have continued to degenerate.

5.6.3.5 Trauma

When cranial fractures were examined at Melton, it was found that only one individual, an infant, had evidence of this form of trauma (Table 5.53).

Sex/Age	Location	Location Side	Type	Sub Type	Healing Stage
Infant	Parietal	Right	BFT	Depression	0

Table 5.53: Cranial fracture prevalence at Melton.

The infant suffered a severe blow to their parietal that was likely to have been a contributing factor to their early death. When post-cranial trauma was evaluated, it was determined that three females (16.67% of the population) had evidence of fractures (Table 5.54).

Sex/Age	Bone	Side	Healing	Associated Pathologies
F YA	Femur	Right	3	Rotational deformity of head and shortened length
	Rib	Right	3	None
F YA	Femur	Left	3	Shortened Length
F MA	Scapula	Right	0	Non-union of coracoid process

Table 5.54: Post-cranial fracture prevalence at Melton.

Three of the fractures were almost fully healed, and both femurs had evidence of bone alteration, most likely as a result of the fractures not being set properly or the use of the limb prior to it being fully healed. With respect to the scapular fracture, it is probable that the fracture was not set properly and the two bone portions did not have a chance to reunite.

5.6.3.6 Bioarchaeology

As a result of the permission granted by On Site Archaeology and a grant provided by The Department of Archaeology, University of York, 16 individuals were tested for their carbon and nitrogen values (Figure 5.205).

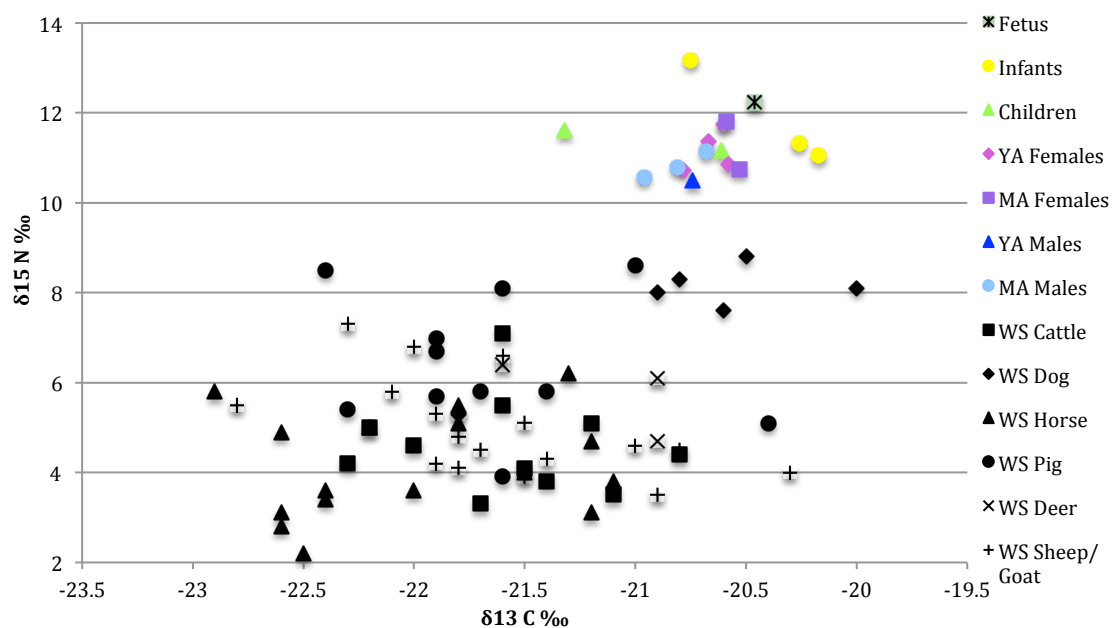


Figure 5.205: Melton carbon and nitrogen results.

Although animal remains were not examined for this project, the extensive work conducted by Jay (2005) at Iron Age Wetwang Slack has been incorporated with the carbon and nitrogen results from Melton. The animals all appeared to have less enriched nitrogen values, and the majority also had less enriched carbon values, all pointing to their lower trophic value in comparison to the humans. Overall the males had slightly decreased values of nitrogen in comparison to the females, however there was some overlap. With respect to carbon, the

subadults exhibited a greater range of values in contrast to the adults. However, overall, the entire group was quite tightly clustered, suggesting they were likely to have all ingested similarly composed diets.

Twelve individuals were also assessed for strontium values as a result of a grant from the Europlanet Research Infrastructure Network (Figure 5.206).

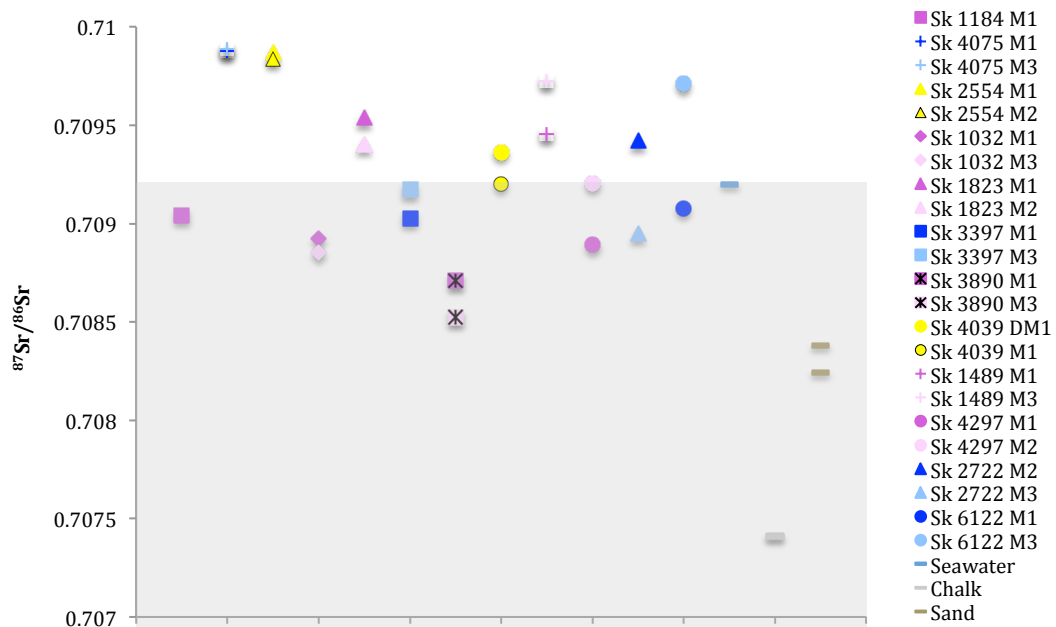


Figure 5.206: Melton strontium results.

The shaded area represents the local Yorkshire Wolds signal as determined by Montgomery and colleagues (2005).

Following the local Yorkshire Wolds signal, derived from sand, chalk and sea water values, Montgomery and colleagues (2005) suggested values outside of the range between 0.707 and 0.7092 were the result of strontium contributions from an area unlike the homogenous chalk environment located in this region. Based on these values, several of the individuals (Skeletons 4075, 2554, 1823 and 1489) spent two significant periods of their childhoods away from the Wolds (or similar homogeneous chalk regions). Four individuals (Skeletons 1184, 1032, 3397, 3890) spent their childhoods in a region consistent with the Wolds, and the remainder had mixed childhoods partially spent on and partially spent away from regions similar to the Wolds. All were, however, buried on the Wolds suggesting they either returned to the area at some point before their deaths or they were brought back to the Wolds to be buried in this region.

Finally, four males were analysed in a pilot study for oxygen isotope values as a result of a grant provided by the Department of Archaeology, University of York and Figure 5.207 provides a plot of strontium and oxygen results for these four individuals.

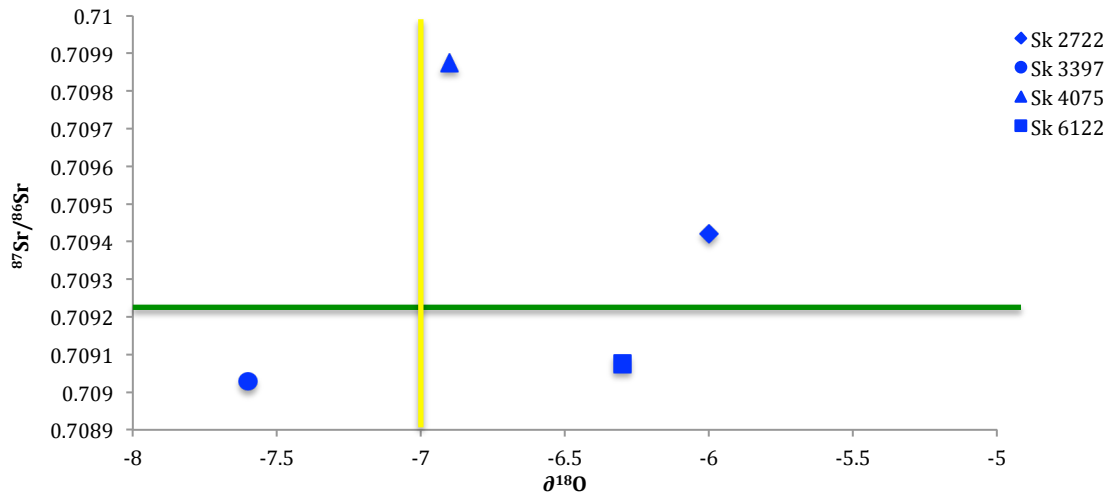


Figure 5.207: Strontium and oxygen values for four males at Melton.

The green line represents the most radiogenic strontium signal attributed to the Yorkshire Wolds (Montgomery et al 2005) and the yellow represents the most oxygen-enriched values determined for the same region (Gale and Rutter 2006). Therefore the small area where these two values intersect represent the signals assumed to be consistent with the homogeneous chalk environment of the Yorkshire Wolds.

When the strontium and oxygen values were combined, it was determined that one individual (Sk 3397) had both signals consistent with a homogeneous chalk region and the Yorkshire Wolds with regards to oxygen values. However, the remaining three individuals were likely to have spent time away from this type of region during the ages of four and seven. The use of multiple stable isotopes has enabled a further refinement of the understanding regarding the mobility of these four individuals on the Yorkshire Wolds.

5.6.3.7 Site Summary

The site of Melton included 18 individuals and was biased towards females and the younger age categories. Non-specific stress was experienced during the childhood years of 50% of the population and exhibited in the form of LEH, while CO was only present in two young adult females. Dental diseases were prevalent at Melton with males exhibiting all three types, though females had evidence of caries and AMTL only. Subadults also had evidence of dental disease in the form of a single carious tooth. Degenerative changes predominantly affected females with two showing systemic distribution, with all instances expressed as mild and moderate forms. Trauma in the appearance of cranial fractures were only evident on a single infant that likely contributed to their cause of death and post-cranial fractures were only seen in three females, with a majority showing advanced stages of healing. Bioarchaeology was also employed and it was found that the individuals assessed presented a range of carbon and nitrogen values with the adults clustering closer together and the subadults exhibiting a wider range of carbon values. When the population was tested for their strontium values it was found that the population was mixed and included individuals that spent all of their childhoods (based on the dentitions analysed) in a region similar to the Wolds, those that

spent it away from a homogeneous chalk region and those that moved back and forth from regions consistent with the Wolds.

5.7 The Total Iron Age Population

The total Iron Age sample included 44 individuals spread over three regions and three sites: Cowlam, from the western Wolds region; Danes Graves from the capital Wolds region; and Melton from the southern Wolds (Figures 5.208 to 5.211).

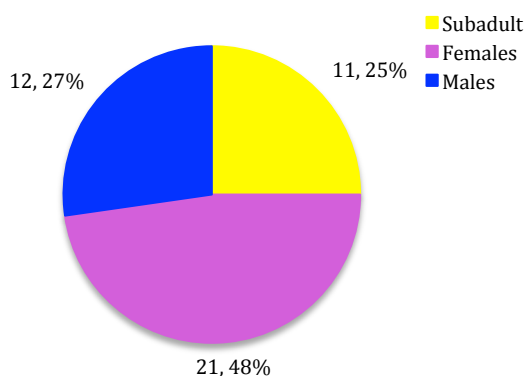


Figure 5.208: Demographic profile of the Iron Age.

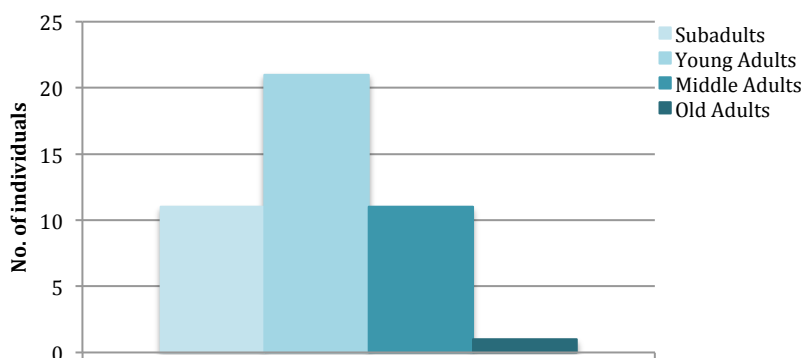


Figure 5.209: Iron Age demographic profile by age.

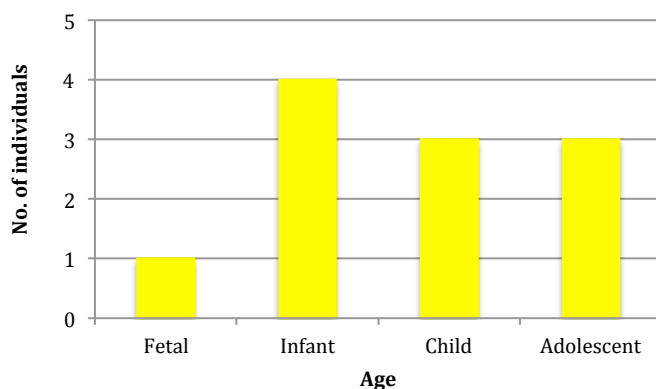


Figure 5.210: Iron Age subadult age distribution.

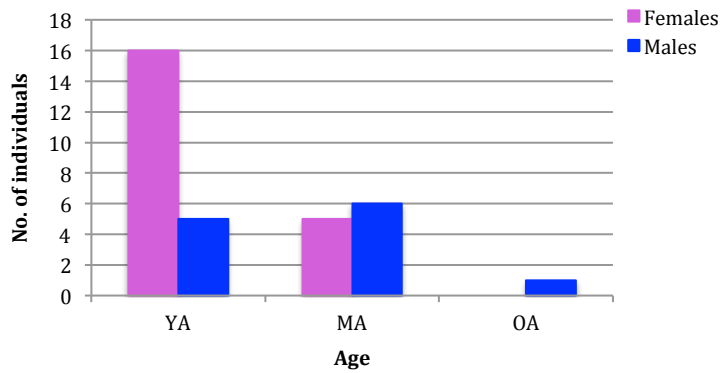


Figure 5.211: Iron Age adult age distribution.

The Iron Age sample had a bias towards females and younger age categories with 72.72% (n=31) of individuals aged as young adult or subadult. Within the population nine females and four males were considered probable in their sex estimation. This was largely due to the lack of innominates in these individuals and only three or four of the morphological markers on the skull being available for analysis. In all cases however, there was a definite bias towards one sex and as such, for the purposes of this project they were placed within their respective sexes. If there had been fewer than three landmarks available, or if the sex estimation had been ambiguous, the individuals would have been left out of the study. Only seven individuals (one male and six females) had preserved, but fragmentary innominates, and although all adults in this project were primarily sexed using the cranial features as described in Chapter Four, for each of these skeletons the features on the pelvic bones, being primarily the greater sciatic notch, the ventral arc and the ischial-pubic ramus, corresponded to the sex estimation derived from the skull.

All adults were also aged using dental attrition, although two females and two males had pubic symphysis and auricular surfaces available and three females and one male had fragmentary auricular surfaces, and in all cases the age estimations derived from the dentition for these individuals matched those determined from the pelvis. The subadults were aged using a combination of dental development and, when available, skeletal development. In total, only one infant did not have any dentition for analysis and in all subadults (one foetus, four infants, three children and three adolescents) there were at least fragmentary post-cranial elements available to assess. Overall, only three subadults; two infants from Melton and one child from Danes Graves were found to have skeletal ages that were at least 1.5 years lower than the ages derived from their dentition, these results were detailed within each site.

5.7.1 Preservation

Skeletal preservation was examined for the whole population and the results are presented below in Figure 5.212.

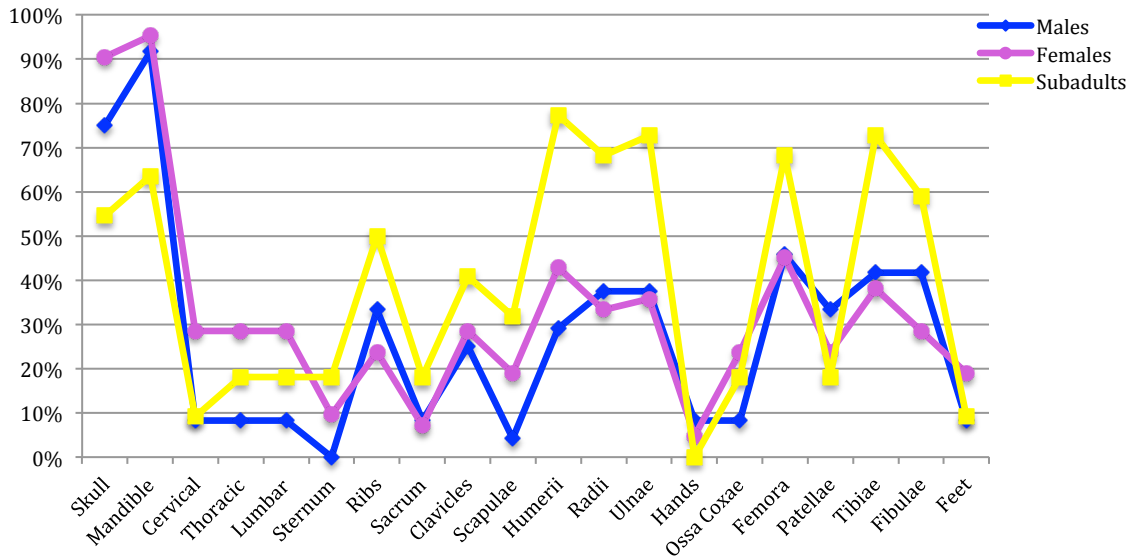


Figure 5.212: Iron Age skeletal element preservation.

Skeletal element completeness was good with a range of elements available for each group. This is predominantly due to the excavation carried out by On Site Archaeology at Melton. The commercial and modern nature of the excavation allowed for the thorough excavation and recovery of the human remains. This theory proved to be correct as a statistical examination with regards to skeletal preservation and sites was highly significant ($p = <0.001$, $\chi^2 = 36.409$, $df = 4$).

Dental preservation was also examined and the results are presented in Figure 5.213, while a breakdown by dentition section is provided in Figure 5.214.

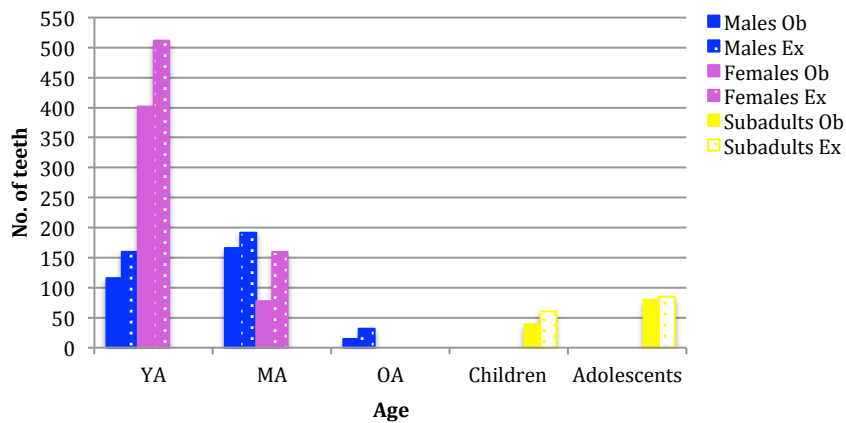


Figure 5.213: Dentition presence in the Iron Age.

Males and females were closely matched with regards to the percentage of dentitions preserved for both sexes. However when age was considered it was found that middle adult males had almost twice the percentage of observable teeth as females (86.46% versus 48.13%), while young adults were relatively equal. When the relationship between tooth presence and both age and sex was investigated it was found, as expected, there was a strong

association, which was almost entirely related to the differences seen with the middle adults ($p= 0.001, \chi^2= 50.720, df= 24$).

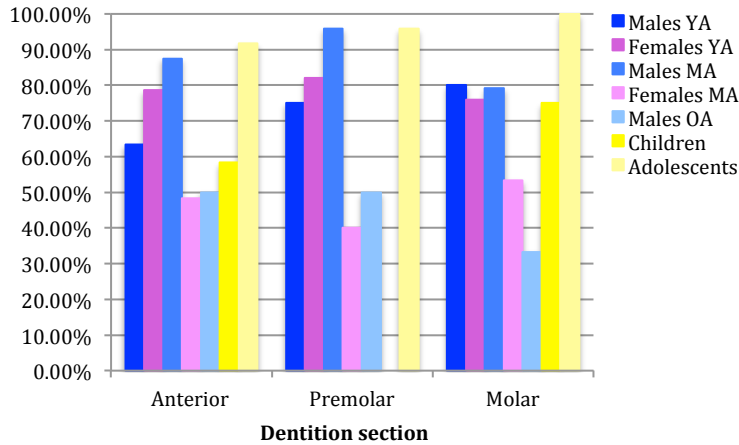


Figure 5.214: Dentition section presence in the Iron Age.

Among adults, young adult males had the highest percentage of molar teeth present, while middle adults had premolars and old adults were even between anterior and premolar sections. Young adult females, in contrast had the highest percentage of premolars, while middle adults had more molar teeth than any other section. Dentition presence was also investigated by dentition scores for both males and females (Figure 5.215).

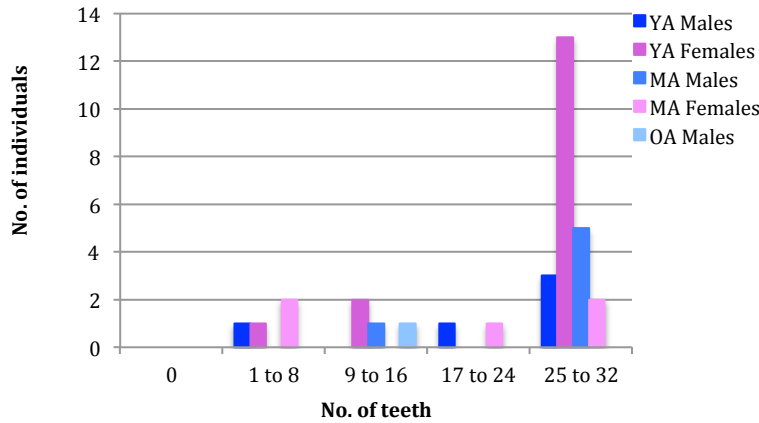


Figure 5.215: Iron Age count of dentition presence.

Overall and between the young adults, the average number of teeth was closely matched. When the middle adults were investigated there was a clear difference (by almost twelve teeth) of dentition presence averages between males and females. When dentition score was examined however, both males and females were found to spread across all brackets, with the exception of zero teeth presence.

As a result of the preservation of a number of post-cranial elements it was possible to estimate stature for 13 individuals (ten females and three males) (Figure 5.216).

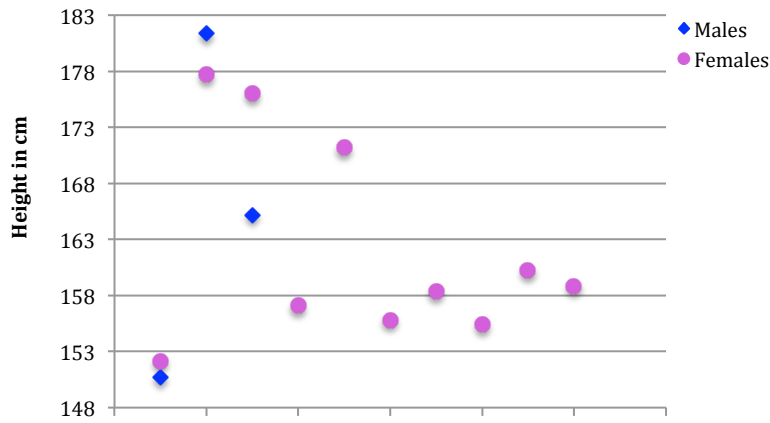


Figure 5.216: Stature estimation in the Iron Age.

The females presented with a range of heights from a low of 152.168 cm (5ft.) to a high of 177.696 cm (5ft. 10in.) and an average of 162.29 cm (5ft. 3.9in.), while the three males had a greater range of measurements with a low of 150.66 cm (4ft. 11.3in.) to a high of 181.33 cm (5ft. 11.3in.) and an average of 165.728 cm (5ft. 5.3in.).

5.7.2 Non-Specific Stress

In an assessment of the Iron Age population for evidence of LEH, it was determined that ten individuals (22.73% of the population) did not have the necessary anterior dentition available for analysis. Three of these individuals were infants or younger and as such had not yet developed dentitions outside of the dental crypt (Figure 5.217).

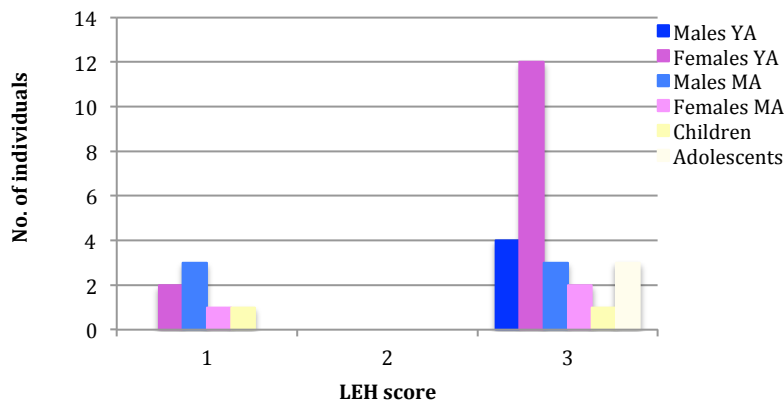


Figure 5.217: LEH severity in the Iron Age.

All of the adolescents and a majority of the young adults from both groups had evidence of LEH, while less than half of the children and middle adults were affected. This relationship between age and LEH was found to be statistically significant ($p= 0.028$, $\chi^2= 10.880$, $df=4$). When severity was examined, it was determined that all of those affected experienced at least two separate and serious episodes of stress during their developmental years.

When CO was examined for the Iron Age population it was found that six individuals (including the foetus, three infants, one child and a young adult male, 13.64% of the population), did not have any surviving orbits available for examination (Figure 5.218).

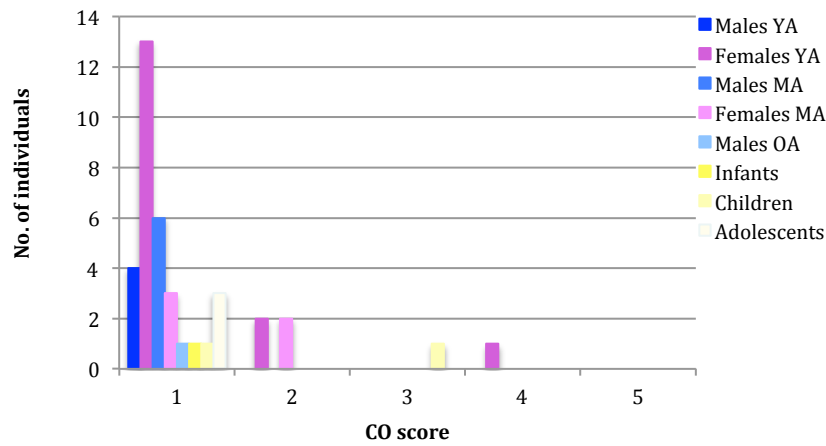


Figure 5.218: CO severity in the Iron Age.

It was determined 13.64% of the population had evidence of CO, and this included one child and five females. When severity was examined, it was determined that the majority of expressions were mild to moderate in severity, with only one young adult female exhibiting moderately severe CO (with a score of 4). Although CO was examined with respect to sex, age and severity, no statistical relationships were found to exist.

5.7.3 Dental Diseases

When caries were examined among the Iron Age individuals, it was found that 52.25% of the population did not have evidence of caries. This includes the five subadults (one foetus and four infants) without adequately observable dentitions (Figure 5.219 and Figure 5.220).

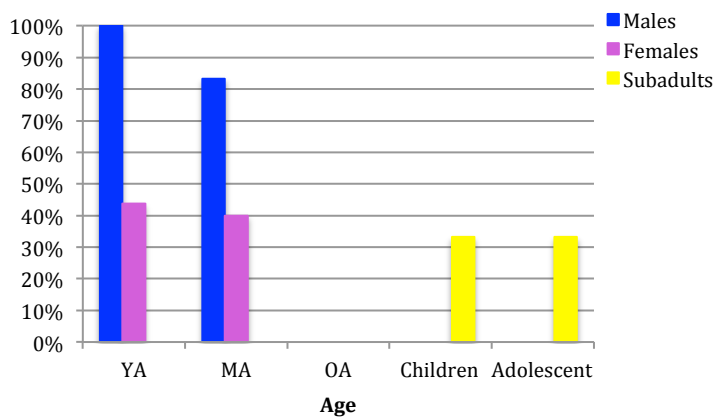


Figure 5.219: Caries prevalence in the Iron Age.

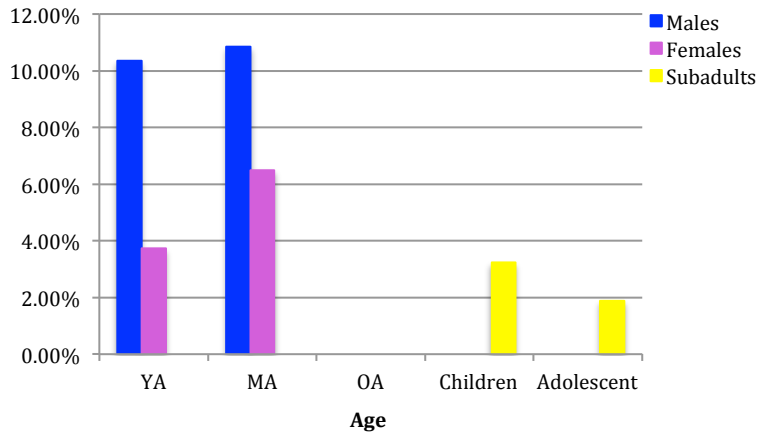


Figure 5.220: Proportion of carious teeth in the Iron Age.

Individuals with carious teeth were in greatest proportion among the males, while the females had half the rate and the subadults still fewer. When age was considered, all young adult males had evidence of caries, while within their similar aged female counterparts, less than half had evidence, however based on raw numbers, more young adult females were affected. Among the middle adults, the males also had twice the rate compared to females. Among subadults, only one child and one adolescent had evidence of caries. When rate of carious teeth was examined, this pattern continued with males having a rate of over ten per cent, while females were just above four per cent. Subadults had the lowest rate with only 2.38% of teeth displaying evidence of caries. Caries were also investigated with respect to type (Figure 5.221 and 5.222).

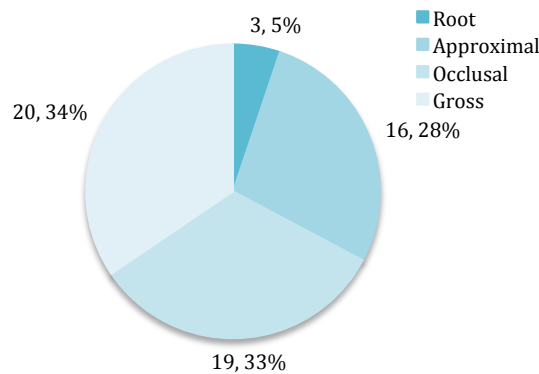


Figure 5.221: Proportion of caries by type in the Iron Age.

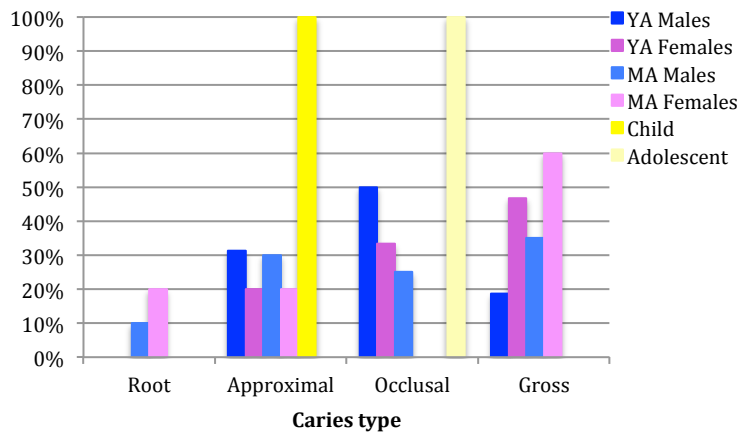


Figure 5.222: Iron Age caries by type.

It was determined that very few caries were derived from the root areas. For males, the highest concentration was found among the occlusal surface caries, while for females half of all caries were gross caries, suggesting their severity had progressed beyond the original lesion site. Among the subadults, as there were only two caries, they were evenly split between approximal and occlusal surfaces. Severity was also examined with respect to caries type and finally, caries were also investigated based on dentition location (Figure 5.223).

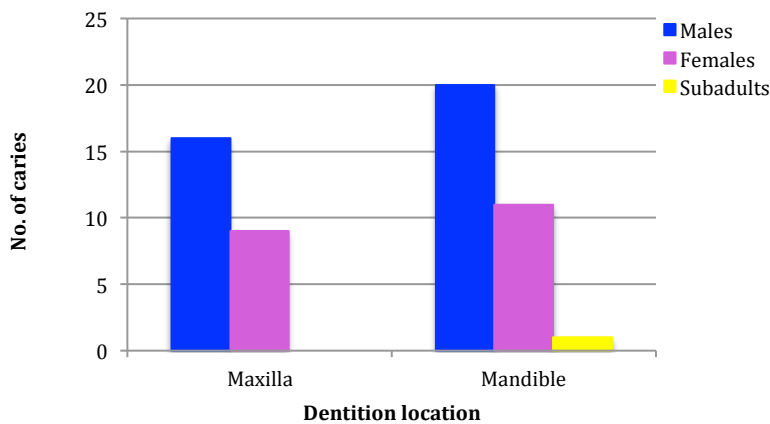


Figure 5.223: Iron Age caries by dentition location.

Based on the severity, it was determined that among the males, the majority of caries ($n=22$, 61.11%) were mild in form, while among the females, 75% ($n=15$) were moderate to severe in nature. Both caries exhibited on the subadult dentitions were moderately mild. Based on dentition location, adults were relatively evenly split between the maxillary and mandibular dentitions, while subadults only had caries present on the mandibular teeth. However for both the young adult males and middle adult females, there was a bias towards the mandibular dentition.

Abscesses were also examined for the entire Iron Age population and 29 individuals with dentition (excluding the foetus and three infants) were found to be free from abscesses (75% of the total population), (Figure 5.224).

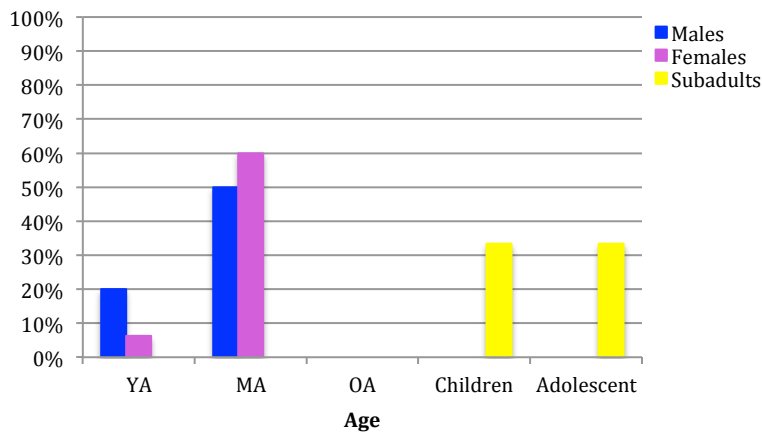


Figure 5.224: Abscess prevalence in the Iron Age.

A third of all males and almost 20% of females had evidence of abscesses, however based on raw numbers four males and four females were affected. Among the subadults, one third of those with dentitions had abscesses. Observed tooth places were also examined to determine the true abscess presence rate (Figure 5.225).

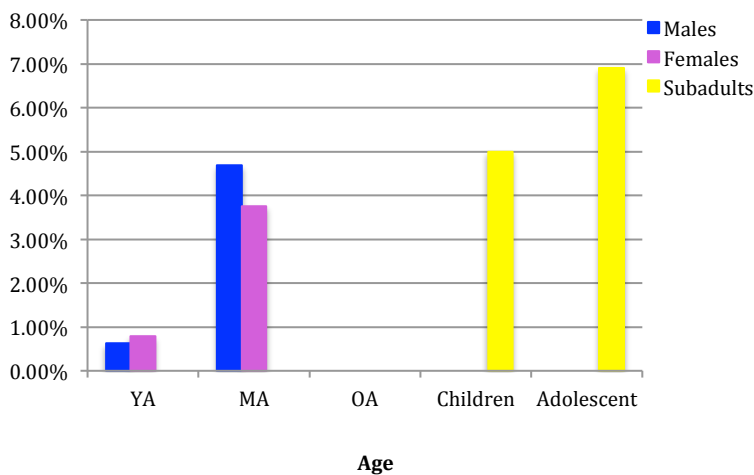


Figure 5.225: Proportion of tooth spaces and abscesses in the Iron Age.

It was found that males had twice the rate of abscesses compared to females, though subadults, with their lower number of observable tooth places, had the highest rate at 6.12%. Dentition location and tooth loss were also examined with respect to abscesses (Figure 5.226) and it was found males experienced the highest number of teeth lost as a direct result of abscesses, while among the females, only the middle adults had evidence of the loss of two teeth. Abscesses were also investigated with respect to dentition section as well as healing stage, sinus location and severity (Figure 5.227).

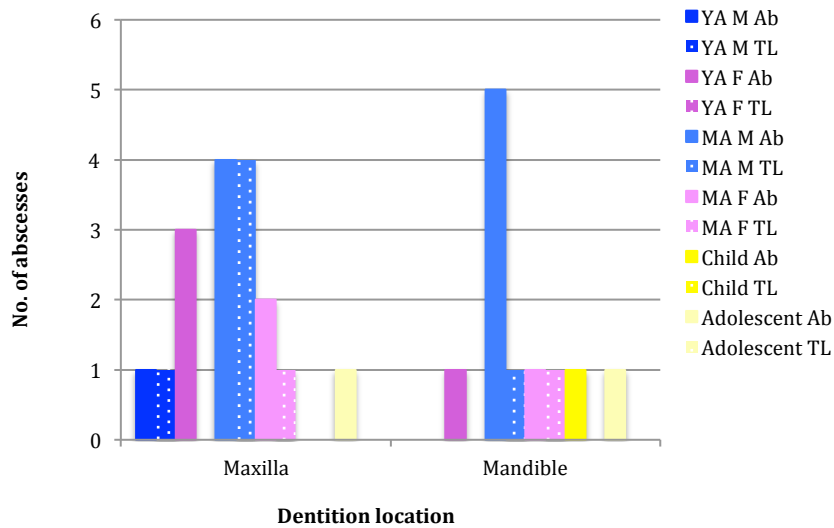


Figure 5.226: Iron Age abscesses and tooth loss.

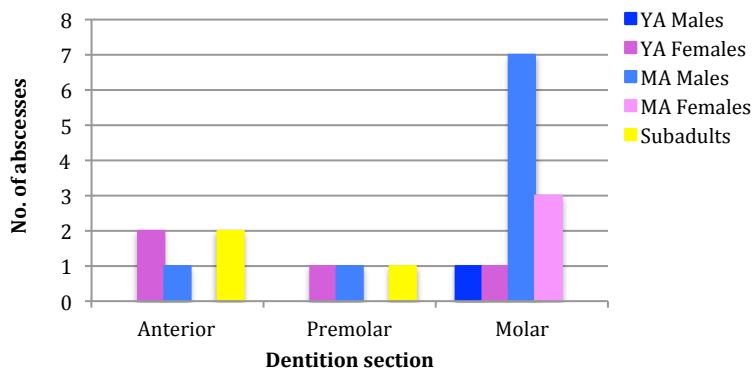


Figure 5.227: Iron Age abscesses by dentition section.

Molars were the most likely location for abscesses for both males and females. However, among subadults, the anterior dentition was only slightly more often affected than the premolars, and none were evident on the molar section. Among the anterior and premolar dentitions of the males, abscesses were healed, and moderate, while among the affected molars, the majority were still active at the time of death and were severe in nature. Throughout the whole dentition however, the majority of abscesses had sinuses located on the external surface of the alveolar bone. Among the females, the majority of abscesses were active at the time of death, had external sinus locations and were almost evenly split with regards to severity. Finally, among the subadults, all of their abscesses were active, and their sinuses were external, though two were considered moderate and one was found to be severe in expression.

AMTL was also investigated among the Iron Age adults and it was found that 20 individuals (60.6% of the adult population) did not experience any tooth loss during their lives (Figure 5.228).

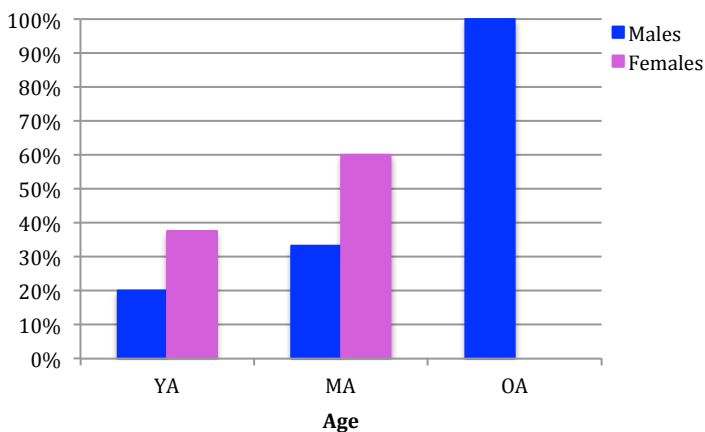


Figure 5.228:AMTL prevalence in the Iron Age.

Females were more likely to have AMTL compared to males, and when this was inspected with respect to age it was found that increased age coincided with an increased chance of having AMTL. Young adult females had almost twice the rate of AMTL while, based on the molar teeth alone, middle adult females had three times the rate of their male aged counterparts (Figure 5.228). In all dentition sections females had a higher rate of tooth loss, but within the molar area, when ages were combined, male and female rates were quite close (Figure 5.229). AMTL was also investigated with respect to side (Figures 5.230 and 5.231) and dentition location (maxillary versus mandibular) (Figures 5.232 and 5.233).

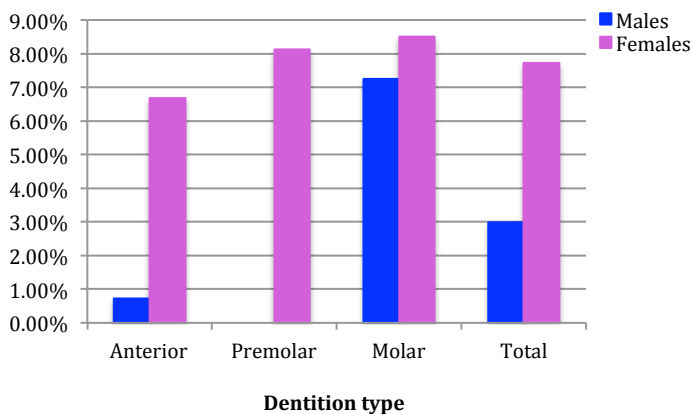


Figure 5.229: Proportion of tooth spaces and AMTL in the Iron Age.

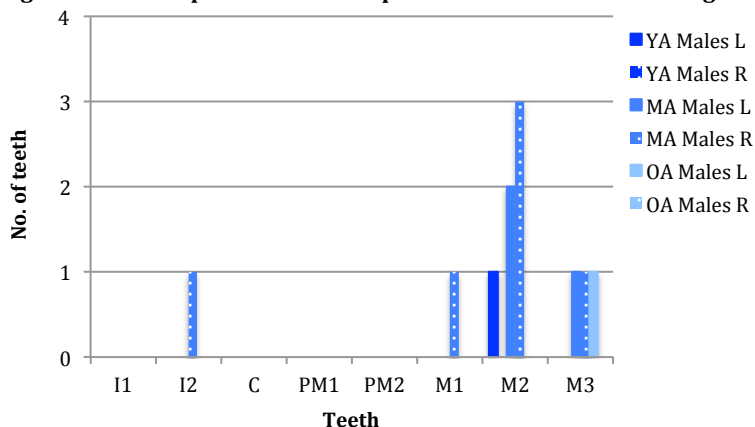


Figure 5.230: Iron Age AMTL in males by side.

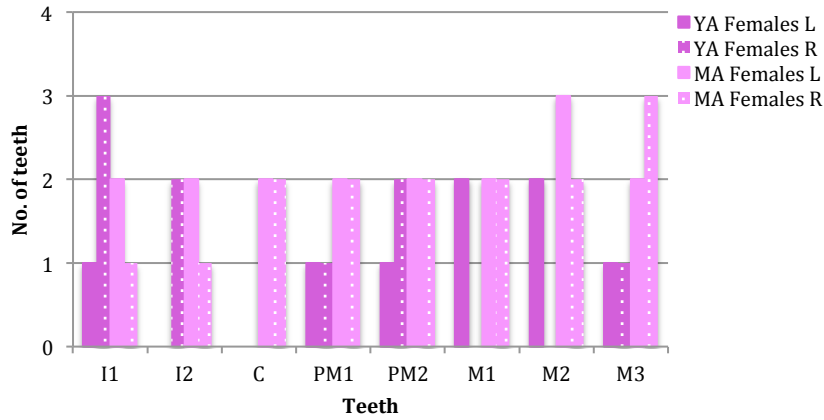


Figure 5.231: Iron Age AMTL in females by side.

Females had a much more varied and extensive range of tooth loss compared to males. When side was examined, among the males the young and old adults had a left bias, while among the middle adults there was a slight right bias. For females in both age groups, AMTL was almost evenly split between left and right. When the sexes were combined, both males and females exhibited almost even numbers of teeth lost from the left and right sides of their dentitions.

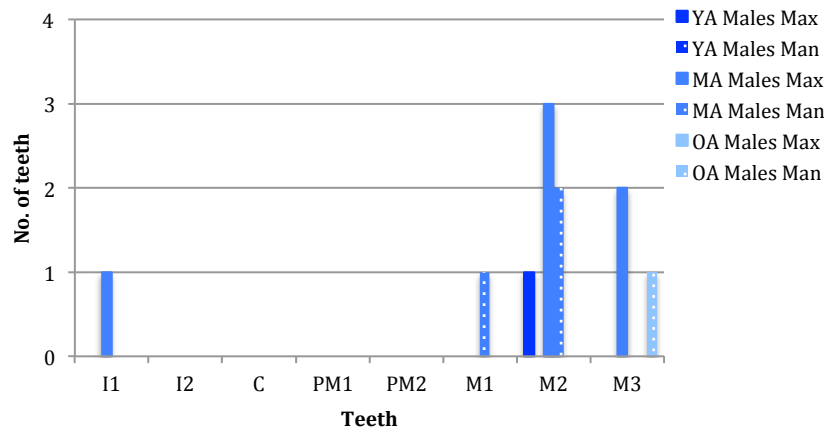


Figure 5.232: Iron Age AMTL in males by dentition location.

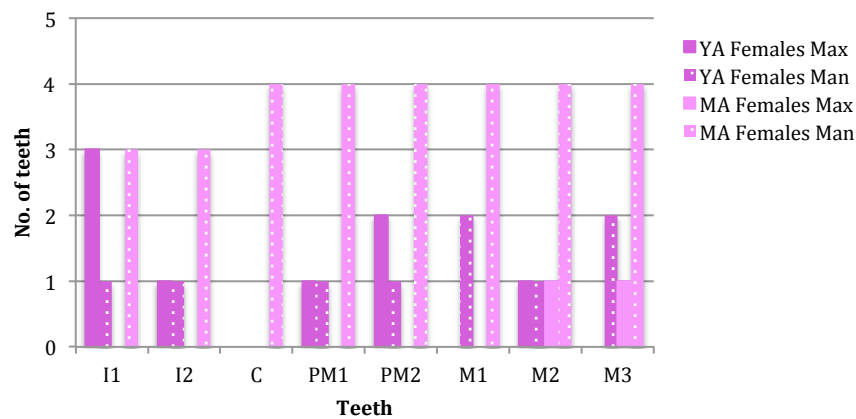


Figure 5.233: Iron Age AMTL in females by dentition location.

When dentition location was examined for males with AMTL, it was found that both young adult males and old adult males had each lost one tooth and they were from the maxilla and mandible respectively, while for the middle adult males, there were slightly more maxillary teeth lost than mandibular. Among the females, the young adults lost slightly more maxillary teeth, while mandibular teeth were the most likely to be lost among the middle adults. Based on this trend, it might suggest that with increasing age, the mandibular dentition was more likely to be susceptible to loss, however the lack of female old adults and the singular example of a male old adult makes this theory difficult to examine in more detail. When the age groups were combined, the males lost slightly more maxillary teeth and the females lost a higher proportion of mandibular teeth. Stage of healing was also inspected with respect to both males and females (Figure 5.234).

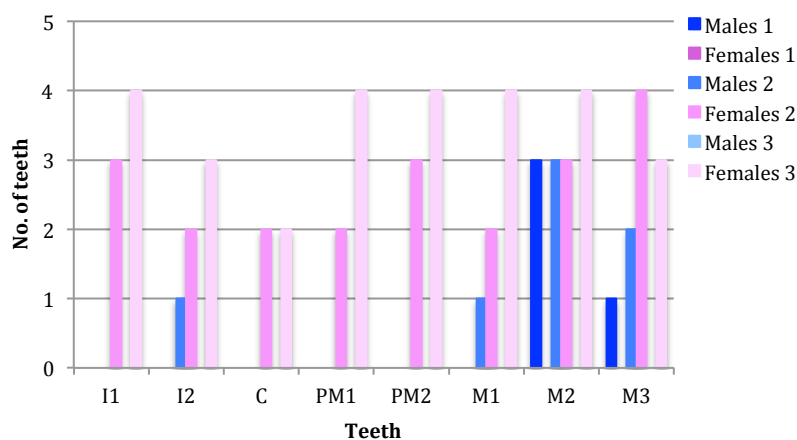


Figure 5.234: Iron Age AMTL by healing stage.

Young adult males and old adult males each had moderate healing in their tooth loss, while for the middle adult males, the teeth were split between being lost close to death and slightly earlier in life, allowing some healing of the root spaces to take place. Conversely, for the young adult females, a majority of teeth had been lost some time before death. However for the middle adult females a majority of teeth had been lost much earlier in life, allowing the tooth root spaces to almost or completely close up. When the age groups were combined AMTL in males was mostly at stage two, while among females, their tooth loss healing was slightly more likely to be at a stage three. Finally, AMTL was investigated with respect to associated pathologies, in order to help determine the possible causes of the tooth loss (Figures 5.235 and 5.236).

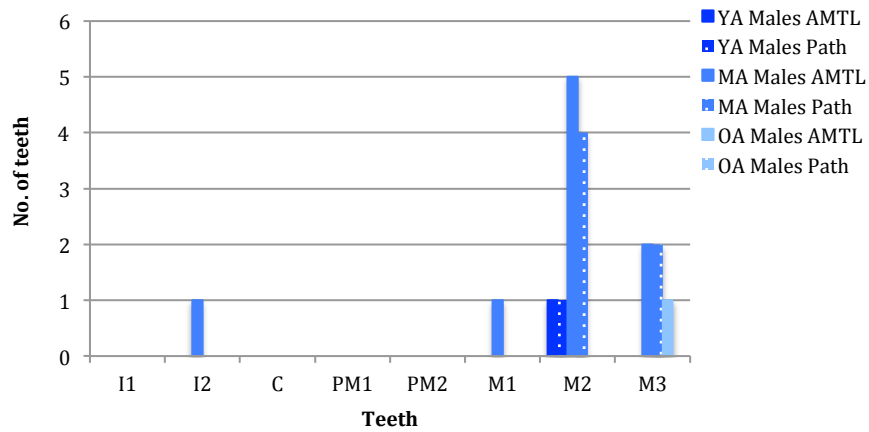


Figure 5.235: Iron Age AMTL and associated pathologies in males.

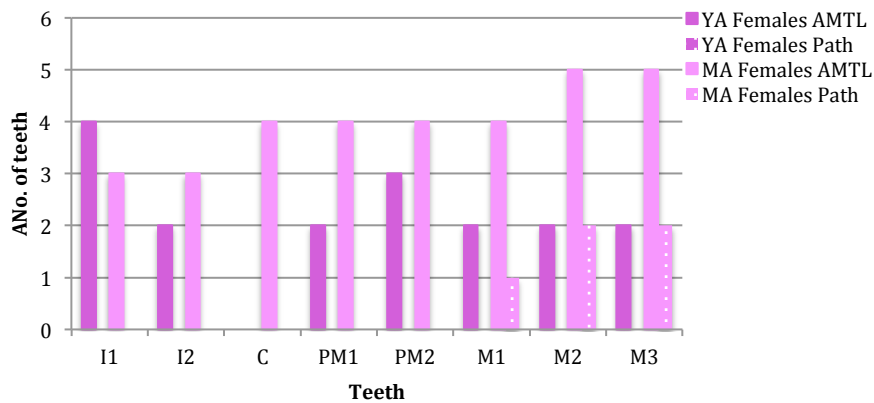


Figure 5.236: Iron Age AMTL and associated pathologies in females.

When AMTL and associated pathologies were examined, it was found that among males a majority of tooth loss could be directly attributed to pathologies, but among females, for the young adults, no clear pathological cause could be found and for the middle adults only 15.63% (n= 5) could be connected. When the age groups were combined, over 60% of AMTL in males was clearly due to pathologies, while for females that proportion dropped to 10%. The pathology at play was most likely abscesses for a majority of the teeth. The lack of clear association with pathologies with regards to the female dentition may be due in large part to the advanced state of healing. As the alveolar bone resorbs, it fills in missing bone, specifically locations where once active abscesses may have been located.

In a summary of the dental diseases present in the Iron Age, 11 individuals (with observable teeth) were found to be free from all described pathologies (29.73% of the group) (Figure 5.237).

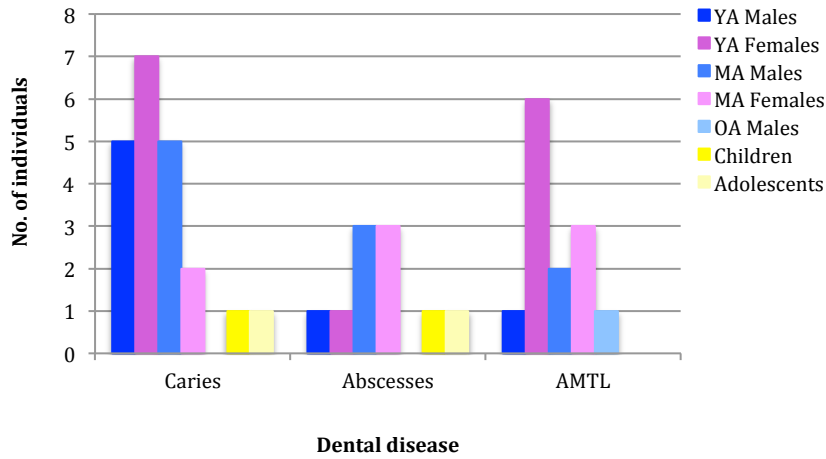


Figure 5.237: Iron Age proportion of individuals with dental disease.

Males of all ages were experiencing dental diseases, with caries being their most likely expression. For females both ages were also affected, however caries and AMTL had the same proportion of individuals affected, and among subadults there was an even number of individuals inflicted with caries and abscesses (Figure 5.238)

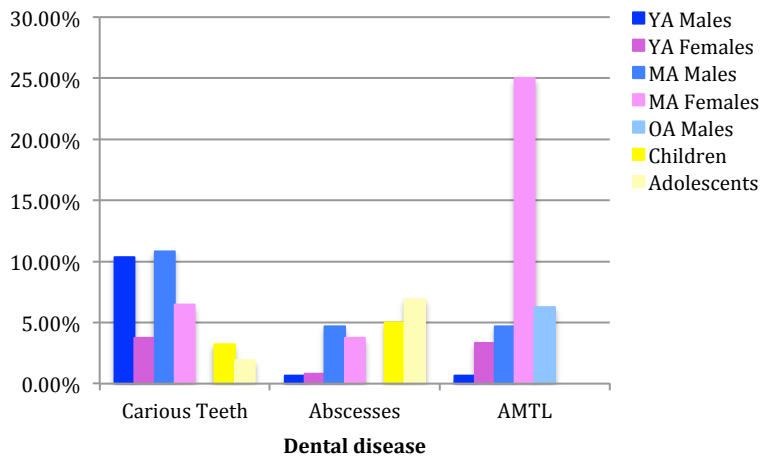


Figure 5.238: Iron Age proportion of observed teeth and tooth spaces with disease.

It was found that males had the highest rate of caries while females had the highest rate of AMTL. However the proportion of carious teeth was quite close, and subadults had three times the rate of abscesses compared to caries.

5.7.4 Degenerative Diseases

In an assessment of the Iron Age adult population, it was found that 25 individuals (75.76% of adults) did not exhibit any degenerative alterations to their skeletons (Figure 5.239).

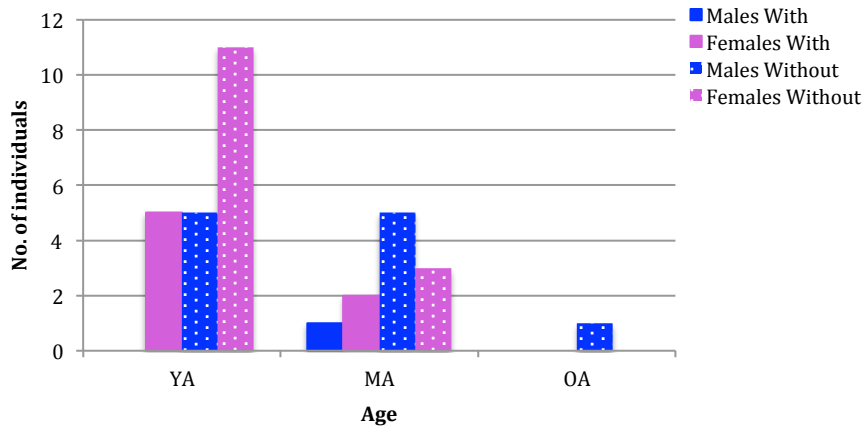


Figure 5.239: Iron Age OA presence.

Females were much more likely to exhibit degenerative changes compared to males. When ages were considered it was found that a third of young adult females had evidence of OA, while among young adult males OA was absent. Both middle adult males and females had OA, however females were much more likely to experience these alterations than males, and interestingly, the sole old adult, a male, did not have any evidence of skeletal alteration. Joint and side were also investigated by both sex and age (Figure 5.240).

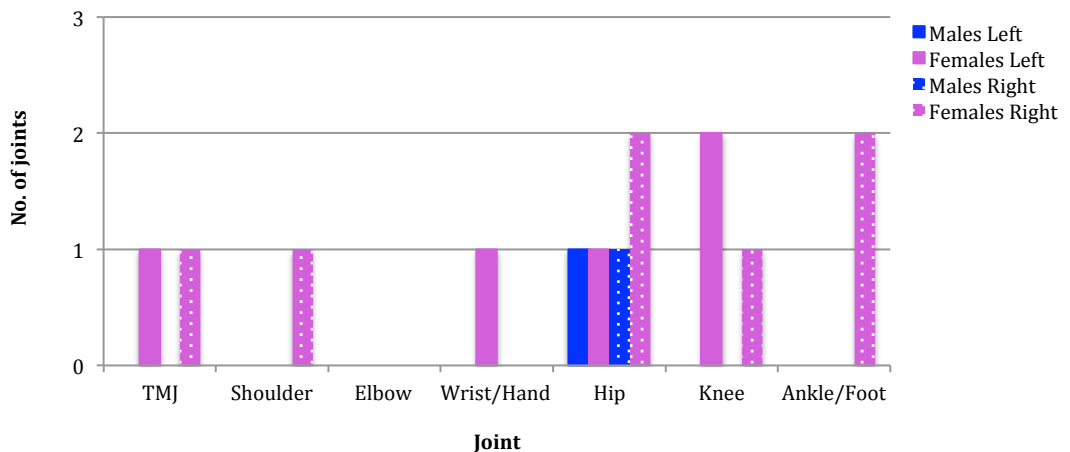


Figure 5.240: Iron Age OA distribution by side.

Not only were females more likely to have joint alterations, but they also presented a wider range of joint involvement. With regards to side affected however, although the middle adult male was evenly divided, young adult females had a bias towards the right (66.67%) and middle adult females towards the left (66.67%). When the age groups were combined the distribution was almost even for both males and females. The severity of each individual joint affected was also examined (Figure 5.241).

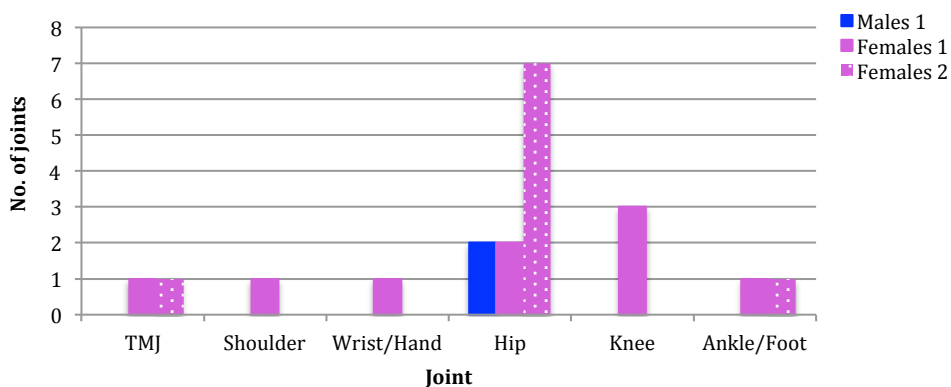


Figure 5.241: Iron Age OA distribution by severity.

The middle adult male exhibited a mild form of OA in both of his hips, however females were equally spread between mild and moderate OA, with more young adult female joints being classed as moderate than among middle adult females. Finally, OA was also examined with respect to distribution (Figure 5.242).

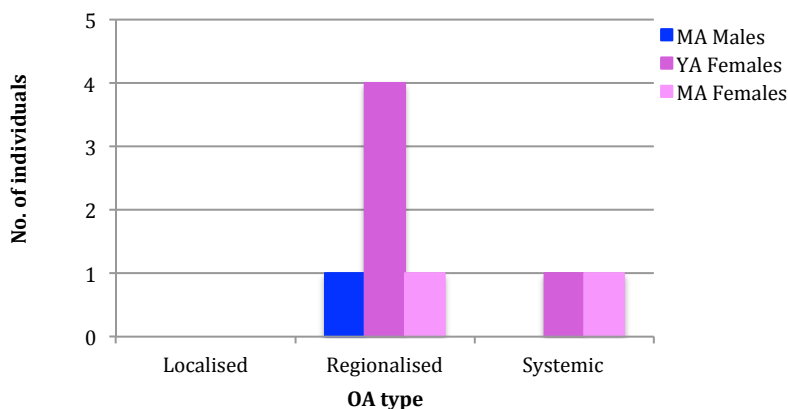


Figure 5.242: Iron Age OA type.

The distribution of OA as seen among the majority of individuals (both sexes) would suggest the likelihood that these changes were due to persistent, repetitive, heavy or hard activities. Only two individuals, one young adult and one middle adult female exhibited multi-joint involvement suggesting typical changes associated with increased age. However, given the ages of young and middle adult, it suggests that these two individuals were subjected to increasingly difficult adult lives, had additional pathological issues which exacerbated their skeletal degeneration, or were genetically predisposed to OA.

VJD was also investigated for the Iron Age population and it was discovered that 19 adults (57.58% of the group) did not have any preserved vertebrae available for examination (Figure 5.243).

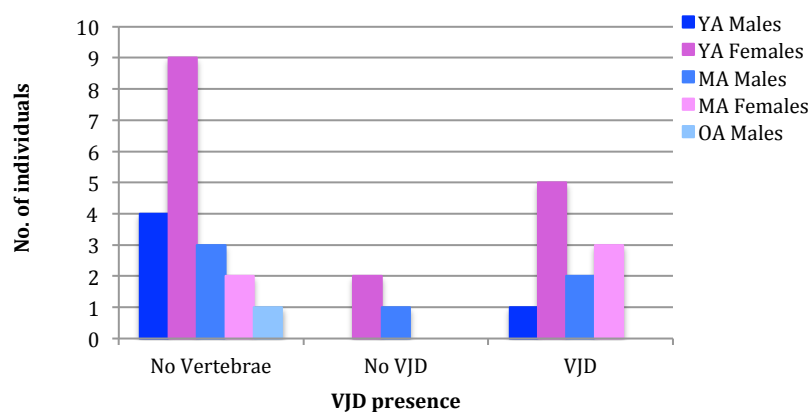


Figure 5.243: Iron Age VJD prevalence.

Overall males and females exhibited almost equal proportions of individuals with VJD. When this was explored with respect to age it was found more young adult males had evidence of VJD than their female aged counterparts, however the opposite was the case with the middle adults. The sole old adult male did not have any preserved vertebrae to examine. The number of vertebrae affected and their severity were analysed with respect to vertebral section for each sex (Figures 5.244 and 5.245).

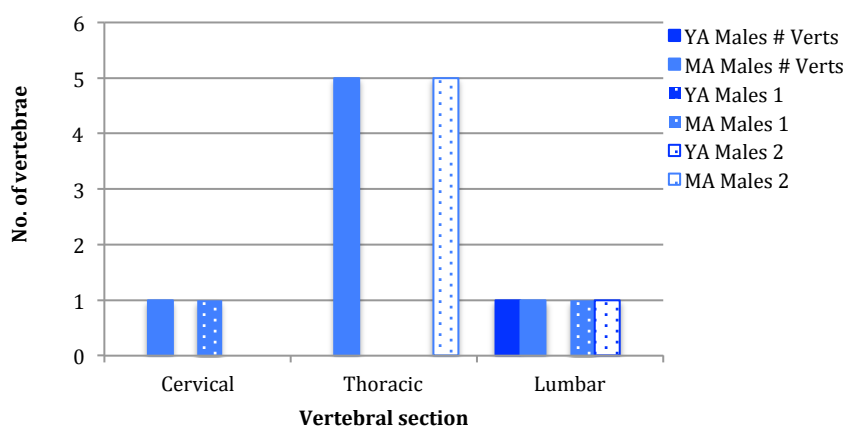


Figure 5.244: Iron Age VJD vertebrae affected and severity.

The Iron Age males had vertebral involvement in all three sections, but the thoracic section exhibited the worst severity observed for males (with a score of two). There was no evidence of the most severe form of VJD with joint fusion.

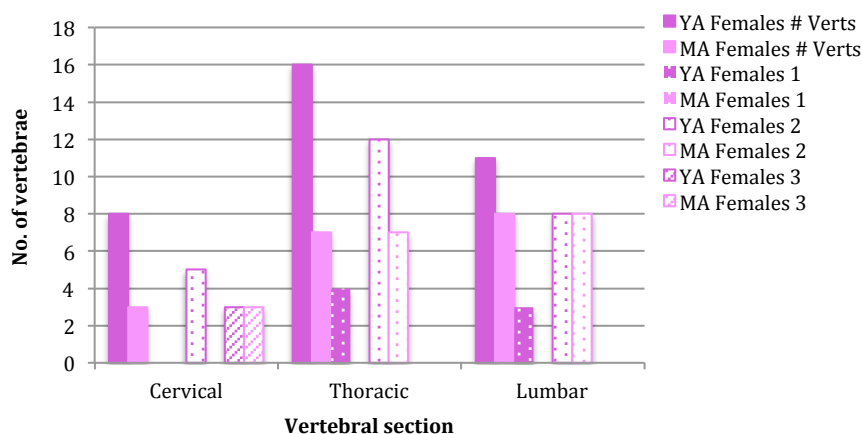


Figure 5.245: Iron Age VJD vertebrae affected and severity.

For Iron Age females it was observed that they also had VJD in all vertebral sections, the number of vertebrae involved was greater than that for males and the severity was also worse with two females (one young and one middle age) exhibiting the most severe form with the fusion of three cervical vertebrae each. It is important to note that these two individuals are not the same females as detailed above with systemic OA.

5.7.5 Trauma

In an assessment of cranial fractures in the Iron Age, it was determined that 36 individuals (81.82% of the population) were free from this form of trauma (Figure 5.246).

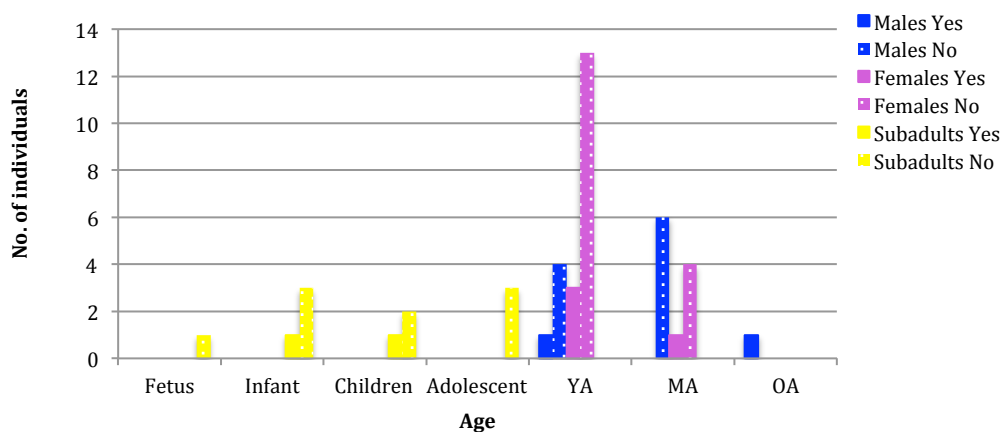


Figure 5.246: Iron Age prevalence of cranial fractures.

Subadults, females and males in the Iron Age exhibited cranial fractures with all three groups experiencing similar proportions of individuals inflicted. Fracture location was examined and all locations on the skull, with the exception of the left temporal and left occipital were the sites of fractures among the Iron Age population (Figure 5.247).

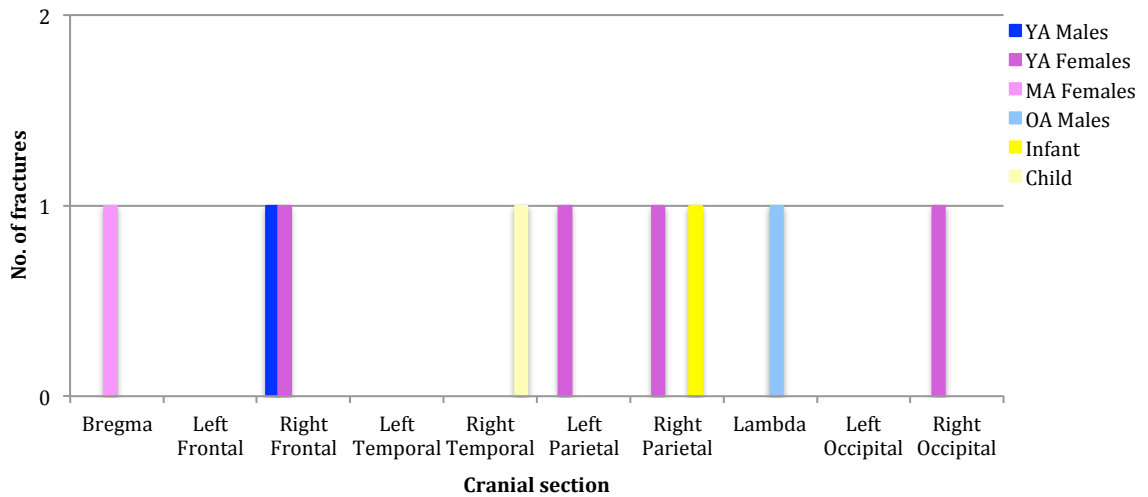


Figure 5.247: Iron Age cranial fractures by location.

Fracture type was also explored and they were evenly spread between the sexes and subadults, with all exhibiting evidence of both types (Figure 5.248). When fracture subtype was examined (Figure 5.249), it was found that the observed injuries were still evenly distributed with no evidence of a bias for subtype by sex or age.

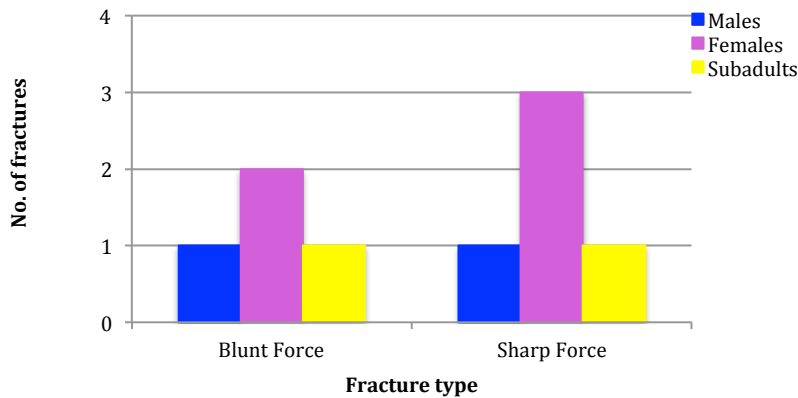


Figure 5.248: Iron Age cranial fractures by type.

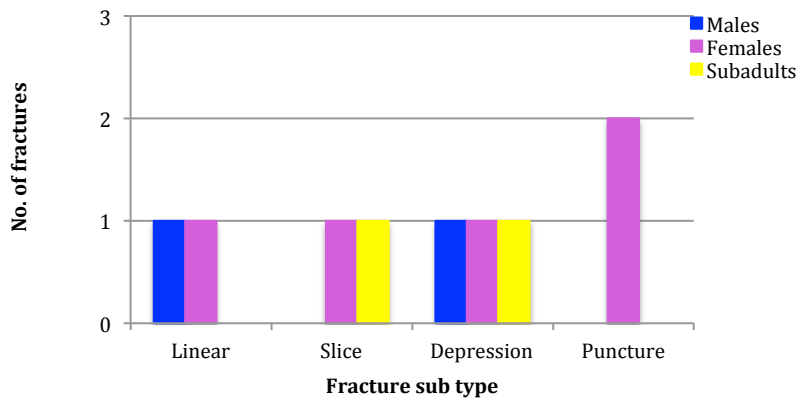


Figure 5.249: Iron Age cranial fractures by sub type.

Finally, healing stage was examined and it was found that a majority of females and both subadults received their fractures at or close to their time of death, suggesting these may have hastened the end of their lives (Figure 5.250).

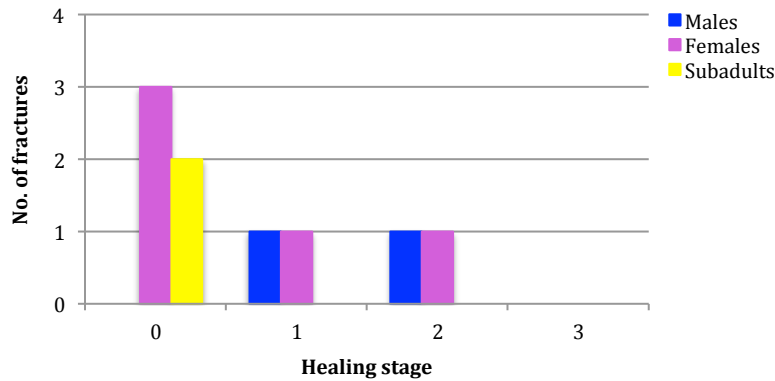


Figure 5.250: Iron Age cranial fractures by healing stage.

Four fractures were also found to be in some stage of healing, suggesting these individuals had lived for a certain amount of time after receiving their injuries, though it is not possible to determine if, ultimately, these fractures led to their cause of death.

Finally, post-cranial fractures were examined for the entire Iron Age population and 39 individuals (88.64% of the population) were found to be free from this form of trauma (Figure 5.251).

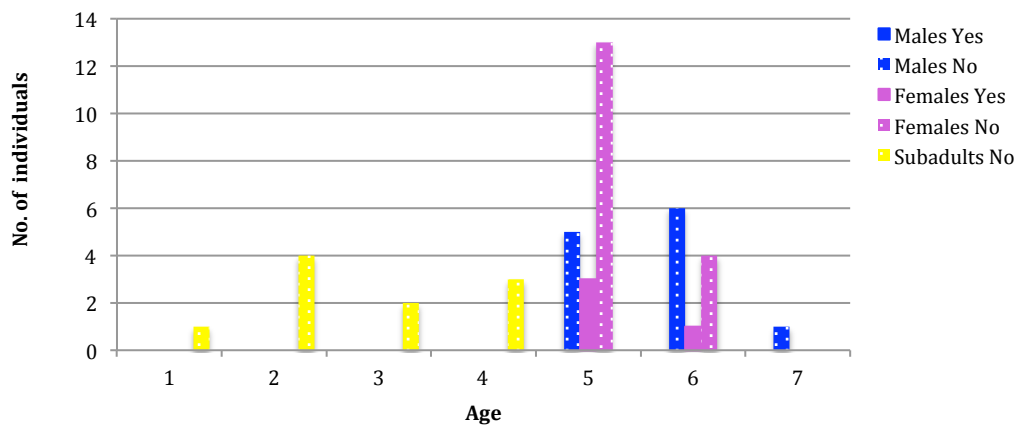


Figure 5.251: Iron Age post-cranial fracture prevalence.

Fractures were absent among males and subadults and exhibited in 20% of females (Table 5.55). The lack of evidence for this form of trauma may be in part attributed to the incomplete nature of the post-cranial skeleton.

Sex/Age	Bone	Side	Healing	Associated Pathologies
F YA	Humerus	Right	3	Misalignment
F YA	Femur	Right	3	Rotational deformity of head and shortened length
	Rib	Right	3	None
F YA	Femur	Left	3	Shortened Length
F MA	Scapula	Right	0	Non-union of coracoid process

Table 5.55: Iron Age post-cranial fracture details.

The majority of those inflicted were females and the femur appears to be the bone most often affected by fracture. With the exception of the subadult, and the middle adult, the fractures have all fully healed, and although they have not all healed perfectly, the fact that they were scored as a stage three suggests that adequate time was provided to enable healing. As there was no evidence of infection or OA as a result of the fractures, the associated pathologies were instead mechanical in nature, which would have affected the daily lives of these individuals but were not likely to have affected their lifespan.

5.7.6 Iron Age Summary

The population attributed to the Iron Age includes 44 individuals with a bias towards females and the younger age categories. Non-specific stress was observed in the form of LEH in 56.82% of the population, while CO was only seen in 13.64%. Dental diseases were exhibited in males, females and subadults, with males predominantly exhibiting caries, females displaying the same proportion of abscesses and AMTL and equal numbers of subadults with caries and abscesses. With respect to degenerative changes, OA was present in a third of females and only one male, and joint alteration was seen across the spectrum of joints in females. Finally trauma, in the form of cranial fractures, was present in 18.18% of the population, which included females, males and subadults, while post-cranial fractures were only seen in 9.09% of the population, and were confined to females.

5.8 Summary

The results presented in this chapter provide an overview of the types of lives experienced by these prehistoric individuals. An in depth analysis with respect to the quality of life, social differentiation and mobility is set in Chapter Six. It combines additional investigations conducted on the Yorkshire Wolds and places these results in the wider prehistoric context of Britain in order to better situate the regional character of the Bronze and Iron Ages.

Chapter Six: Discussion

6.1 Introduction

In this chapter the results reported in Chapter Five will be considered within the context of quality of life, social stratification and migration in prehistory. These themes will be explored at the individual, site and time period population level in order to uncover the life experiences in child and adulthood and determine if and how they altered from the Bronze to the Iron Age.

As there have not been a great deal of multi-period publications presented with respect to osteological findings in Britain it has been difficult to find and contrast comparable data. *Health and Disease in Britain* by Roberts and Cox (2003), however, has proved to be an invaluable resource. The authors have pooled a large proportion of the unpublished site data, which amounted to 38% of all reports consulted, and osteological reports from a number of sites across Britain and this has been relied upon to determine much of the prehistoric picture of life outside of Yorkshire. Roberts and Cox (2003: 28) pooled information from 45 Bronze Age sites resulting in a sample of 291 skeletons, while those from the Iron Age include 591 people from 21 sites. Unfortunately, as site reports were often lacking in some paleopathological details, with respect to the variables discussed, rates were often based on a reduced sample. The number of sites included is detailed within each respective subsection. Due to the often insufficient details regarding methodology, Roberts and Cox (2003) did not consider age in any of their assessments beyond the division between subadults and adults.

Additionally, the work of Brothwell (1961, 1972) has enabled a further level of understanding regarding the prehistoric skeletal remains of individuals in Yorkshire and the wider English context. Unfortunately, as Brothwell (1961) did not generally include details on the specific sites examined, his findings are simply referred to as representing Yorkshire or outer Yorkshire. As a result of his extensive excavations at the Iron Age Yorkshire Wolds cemetery sites of Burton Fleming, Bell Slack, Kirkburn and Rudston, and Sheelagh Stead's thorough osteological analysis (in Stead 1991), there is a comprehensive body of information pertaining to the formal cemeteries on the Wolds. Unfortunately, however, due to the differing sample sizes from each site it was decided to pool the osteological results and as such, unless otherwise noted, rates with respect to variables represent the total sample. Within osteology and paleopathology classic studies have been published that continue to be relied upon for their extensive and rigorous analysis of human remains. Within the context of this thesis, the work by Merbs (1983) exploring activity-related degenerative changes in a

Canadian Inuit population was also consulted with respect to osteoarthritis and vertebral joint disease seen in the Yorkshire Wolds populations. Further publications were consulted when available, however these findings and the corpus of publications available that provide a detailed assessment of skeletal demographics and health in prehistory throughout Britain has proven to be largely insufficient in the face of such a great deal of prehistoric archaeological work that has been carried out since antiquarian times.

Although the Neolithic period was also examined, due to the limited number of individuals attributed to this period that could be conclusively identified ($n=3$), it was deemed prudent to not include them in the discussions below. Until more work, such as that by Gibson and Bayliss (2009), is conducted on the skeletal collections identified as Neolithic in origin, which are needed to resolve the disparity between the antiquarian archaeological record and that which is currently available in museum catalogues, it is not advised to enter into debates regarding the wider regional patterns of quality of life, social differentiation and mobility in the Neolithic period.

6.2 Quality of Life

By uncovering the presence and extent of childhood stress, it reveals some of the hardships that individuals had to sustain in order to reach maturity. During adulthood the deterioration visible on the skeleton provides an indication of the impact of daily life on the body, while fractures, whether accidental or violently induced, alter and negatively affect individuals and those around them.

6.2.1 *Childhood on the Wolds*

Although modern and clinical discussions of stress during childhood centre, in part, upon the effects of emotional neglect and cases of failure to thrive, these modern Western cultural constructs cannot, and largely should not, be applied to prehistoric populations. The domestication and adoption of agriculture may have ushered in new and sustainable food sources, but, it also brought a reduction in the variety of diets, and as a consequence, an increase in vitamin and nutrient deficiencies as a result of their ties to the land (Cohen and Armelagos 1984; Roberts and Cox 2003). The need to watch over and constantly tend to crops led to a need for nearby permanent settlement, which increased the presence and pervasiveness of pathological processes. Kiple (2000: 1705) furthered this assessment and commented that the adoption of agriculture and a settled way of life led to “a backwards tumble as far as human health was concerned”. These problems, coupled with alterations in social interactions and changes to the environment, may have led to periods of famine and reduced immune systems. Those most likely to be affected were the youngest and most vulnerable to stress, subadults (Roberts and Manchester 2010). Though it is impossible to identify emotional trauma and neglect in a skeleton, the evidence of severe physical and

developmental stress due to nutrition, pathological processes or cultural practices, leave their marks on the skeleton.

Study	Site	LEH	CO
Current Project	Pooled	74.42%	18.37%
	Garton Slack	53.33%	28.57%
	Rudston	100%	14.29%
	Cowlam	85.71%	12.50%
	Willerby Wold	75%	0%
	Garrowby Wold	80%	16.67%
	Staxton Beacon	80%	0%
Brothwell 1961	Pooled Yorkshire	50%	N/A
Roberts and Cox 2003	Pooled	12.3%	10%

Table 6.1 Childhood health in the Bronze Age by the number of individuals affected.

LEH: linear enamel hypoplasia; CO: cribra orbitalia.

The overall rates of LEH within Bronze Age sites on the Wolds were determined to be much higher than the average reported by Roberts and Cox (2003) from a pool of 10 sites in Britain, and all are also higher than the rate reported by Brothwell (1961) (Table 6.1). When these findings were analysed statistically, a strong relationship was found between LEH and sites for Bronze Age subadults ($p=0.034$, $x^2=10.400$, $df=4$). As only two of five Bronze Age sites had subadults, and all of those with anterior dentition had LEH, this association suggests that at those sites with subadults, there was a high probability of them exhibiting LEH. Furthermore, by extension, it supposes that Bronze Age subadults on the Wolds were likely to have manifested stress in the growth disruption of their enamel.

CO was, on the other hand, lower than the average reported by Roberts and Cox (2003) from six pooled sites at both Staxton Beacon and Willerby Wold where the prevalence rates were zero, while the population at Garton Slack exhibited the highest rate of individuals affected. These rates at the site level were not found to be statistically significant. When the presence of stress in childhood was considered with respect to both variables, Rudston had the highest amount of childhood stress with every member that had available anterior dentition and/or orbits experiencing at least two episodes of stress in their formative years. At the other end of the scale, the Garton Slack population experienced a moderate amount of stress with 45.45% of the sample not displaying any enamel disruptions or CO. These findings suggested that the catalysts of developmental stress were prevalent across the entire region. However, as there were not even proportions of individuals affected, it provides for the possibility that somehow certain members of these groups may have been genetically or culturally buffered.

Study	Site	LEH	CO
Current Project	Pooled	73.53%	17.95%
	Cowlam	100%	33.33%
	Danes Graves	76.47%	13.64%
	Melton	64.29%	16.67%
Roberts and Cox 2003	Pooled	16.7%	8.65%
Hooper 1984	Danebury	N/A	30.9%
Keepax 1990	Gussage All Saints	50%	27.27%
Stead 1991	Pooled	1.98%	N/A

Table 6.2 Childhood health in the Iron Age by individuals affected.

Iron Age childhoods were also plagued with stressful episodes, which were severe enough to inhibit enamel growth in a majority of individuals with available anterior dentition. In comparison to the rate of pooled Iron Age individuals outside of Yorkshire as determined by Roberts and Cox (2003: 100) from eight sites, the proportion on the Wolds suggests that in this region childhoods were more susceptible to prolonged and repeated stress in contrast to the rest of Britain (Table 6.2). Interestingly, it was determined that age and presence of LEH in the Iron Age was statistically significant ($p=0.028$, $\chi^2=10.880$, $df=4$). When age categories were examined it was found that the young adults (aged between 18 and 35) with anterior dentition were the most likely to exhibit LEH with 88.8% (16 of 18) compared to middle adults (aged 35 to 50) at 55.56% (5 of 9). However, the underlying causation of this association is unclear as the young adults are from both Danes Graves and Melton and it is virtually impossible that they belong to the same generation.

At the site level all three sites exhibited drastically higher frequencies compared to Britain as a whole, while Gussage All Saints presents the closest rates. Although there were differences between the sites, it calls into question the available food supply and pathogen loading on the Wolds, which may account for the regional variation. With respect to CO, the overall rate for the Iron Age on the Wolds was significantly higher than that reported for the rest of Britain by Roberts and Cox (2003) from six sites, and at the site level both Danes Graves and Melton had less than half the rate seen at Cowlam. However, as the site of Cowlam is only represented by three females, it provides for the likelihood that sampling and not actual levels of stress was responsible for this difference.

When subadults were examined children fared worse than their adolescent counterparts in the Bronze Age for LEH, while when CO was considered, none was found on the orbits of adolescents, but among children a majority of those with orbits displayed bony changes (Table 6.3). This relationship between CO and subadult age was found to be statistically significant ($p=0.011$, $\chi^2=16.625$, $df=6$). Overall for subadults LEH was seen in 80% and CO in 42.86%, while in adults those rates decreased to 73.68% with LEH and 11.11% with CO. Childhood stress was clearly present on the Bronze Age Wolds and a majority of individuals

experienced at least two significant periods of stress in their developing years. As the subadults presented higher average rates of LEH and CO in comparison to adults, it might be tempting to suggest that certain generations experienced a more stressful childhood compared to others, however, as we do not have specific C¹⁴ dates, and in fact cannot currently be more conclusive than the Bronze Age period in general, it is not possible to determine if this was an entire Wolds region phenomenon. Furthermore, as we do not know if the subadults themselves were from the same generation at or between sites (and most likely they were not), it is not possible to take this theory further within the context of this project.

Period	Age	LEH	CO
Bronze Age	Child	100%	75%
	Adolescent	75%	0%
	Subadults	80%	42.86%
Iron Age	Infants and Children	25%	0%
	Adolescents	100%	25%
	Subadults	57.14%	16.67%

Table 6.3 Childhood stress for subadults in the Bronze and Iron Ages on the Yorkshire Wolds.

It was found that a quarter of infants and children attributed to the Iron Age exhibited LEH in comparison to all adolescents, while with respect to CO infants and children did not exhibit any evidence and a quarter of adolescents had CO in their orbits. A moderate statistical association was found between LEH and CO for Iron Age subadults, suggesting an inverse correlation between both variables ($p=0.057$, $\chi^2=9.167$, $df=4$). This was a reversal compared to the results determined for Bronze Age Wolds sites, suggesting that the older age category of subadults was more susceptible to stress in contrast to those from the Bronze Age where it was the younger group. Alternatively, in the Iron Age this may also suggest that very young subadults were not able to live long enough to develop these dental and osteological indicators implying that the adolescents with stress markers were actually the stronger immuned or more nutritionally and pathologically buffered subadults in society (Wood *et al.* 1992). As it is not possible to sex subadults without incurring the large expense involved in aDNA work, or until a reliable cost effective and ideally non-destructive methodology is developed that allows for it, it is unknown if one sex was more or less favoured which could have accounted for the difference in stress expression that we see among the Iron Age subadults. This theory will, however, be examined with respect to those subadults that became adults in Section 6.3.1.1.

In comparison to the rates reported for the Bronze Age Wolds population, with 73.68% of individuals experiencing at least one form of stress, it appears as though there was change with regards to the stress experienced or manifested in subadults on the Wolds. Overall 61.36% of Iron Age skeletons exhibited at least one form of stress, which does suggest a

decrease. However, the rate remained much higher in contrast to those reported elsewhere (Roberts and Cox 2003). In Ireland, Powers (1993) stated a decreased prevalence of both CO and LEH from the Bronze to the Iron Ages which represented a shift from physiological instability to a period in which stress still remained but was diminished as a result of a better adjusted economy. Cucina (2002), in contrast, determined that the increase in evidence of LEH from the Late Neolithic to the Early Bronze Age (from 50% to 70% of skeletons) could be attributed to changes in environmental exploitation and nutritional alterations. On the Wolds, the overall decrease in percentage of people exhibiting non-specific stress suggests an adaptation to the local environment and available nutrition. However, overall the actual CO and LEH rates reported for this region remained quite high compared to elsewhere in Britain which further supports the theory that the Yorkshire Wolds population was still not able to significantly improve the lives of their youngest members as time went on.

6.2.2 Adulthood on the Wolds

The stress and strain of adulthood can have many contributing factors including an intensive or hard occupation, insufficient or poor quality diet or the presence of environmental hazards.

6.2.2.1 Osteoarthritis

The presence of joint deterioration among adults at Wolds sites provides a glimpse into the physical demands placed on the population in order to survive and subsist, (Table 6.4). Overall the Bronze Age population had a higher incidence of arthritic changes than that reported in Roberts and Cox (2003) from 12 sites for Bronze Age Britain. At the site level, highest rate was found at Garrowby Wold with half of all adults demonstrating an increased level of workload and activity compared to other sites, however this was not found to be statistically significant owing to the small sample size at Garrowby Wold (n=6).

Study	Site	OA
Current Project	Pooled	29.20%
	Garton Slack	29.41%
	Rudston	30%
	Cowlam	16.67%
	Willerby Wold	0%
	Garrowby Wold	50%
	Staxton Beacon	40%
Roberts and Cox 2003	Pooled	12.4%

Table 6.4 Osteoarthritis in the Bronze Age by people affected.

At the site and individual level there were several people that most likely had their quality of life altered as a result of osteoarthritis (OA). At Garton Slack there were two males (B82GHSku41 an old adult, and B107BF a middle adult) that experienced moderately severe arthritis in both of their knees with the middle adult also displaying this joint degeneration in

his hips. Two further males, both young adults at Garrowby Wold (B120B1Sku87 and B198Sku84) also presented OA with one hip joint mildly and two hip joints moderately severely respectively. Finally, at Rudston one old adult female (Sk 1953) presented mild OA on one hip and one knee joint and an old adult male (Sk 1958) presented moderately severe OA in both knee joints. As these were spread out across sites with all age categories affected, and as OA in these joint regions have been connected with general stress responses (among Middle Woodland Illinois Valley populations (Tainter 1980)), and the result of weight bearing (Roberts and Manchester 2010: 138), it suggests these individuals may have been subjected to more strenuous manual labour and activities compared to the rest of their group and the Wolds Bronze Age population in general.

Furthermore, the two young adult males from Garrowby Wold may be examples of individuals who developed OA as a result of repetitive activities that might be connected with an occupation entered into early in life (Roberts and Manchester 2010: 144). As there was no associated evidence of trauma as a catalyst and due to their young age, which makes it less likely these changes were a natural degenerative progression, it is probable that behaviours they rhythmically engaged in were the instigation of their joint alteration. When hip and knee joint element proportions were examined for OA it was determined that 28% of male hip joint elements (the acetabulum and proximal femur) had evidence of OA, while the female rate was 20% and the overall Bronze Age proportion was 26.67% of all hip joint elements. Unfortunately, Roberts and Cox (2003) lamented that due to the range of analysis and reporting methodologies, it was not possible to determine the presence of OA at the joint element level for their pooled British Bronze Age sample and as such it is unknown if, compared to wider Bronze Age British populations, this is a high or expected proportion. Among male knee joints (the distal femur and proximal tibia) 29.4% of joint elements had OA, among females that rate was 9.09% and overall 24.4% of knee elements had OA, suggesting that, in the Bronze Age a quarter of all available hip and knee joint elements had evidence of OA, and therefore that 12.5% of adults experienced reduced qualities of life as a result of the additional strain and stress placed on their lower limb joints.

Two further male middle adults from Staxton Beacon (Sk 4 and Sk 11/12) are worth discussing as they both presented moderately severe OA in their left wrists. Unfortunately the articulating carpal bones were unavailable for analysis but Sk 4 had evidence on both the distal radius and ulna, while Sk 11/12 only had the distal ulna available and it was altered. The same sex, age category and side affected suggests a commonality, and this pattern was previously reported in connection to ulnar flexion as a result of cutting skins with the left hand among Sadlermuit woman while holding the skin in their right hand (Merbs 1983). Of course, the sexes and cultures are different, it is the analogous nature of the activity which

suggests a possible occupational or at least repetitive action that may be responsible for these joint alterations. Within the Staxton Beacon sample the wrist joint elements affected accounted for 100% of wrist joints available, while for all Bronze Age males (with these two individuals being the only ones affected with OA in this region) they accounted for 16.67% of all wrist joint elements and 15% of all Bronze Age wrist joint elements. Due to the limited number of joint elements affected throughout the Wolds population, it is likely that these patterns are directly due to activity as opposed to the normal “wear and tear” experienced by individuals as they age.

Finally, OA to the tempo-mandibular joint (TMJ) is worth highlighting as nine individuals (18.75% of adults) had at least one mandibular condyle with joint degeneration. Sides were tallied and 15% of left and 12.8% of right condyles had OA, which translated to 13.92% of all condyles. These rates prove to be quite interesting as TMJ, especially on the left side, has been linked to masticatory pressure due to activities such as softening skins as seen in Sadlermuit women (Merbs 1983), and additionally Roberts and Cox (2003) suggest that TMJ OA was quite high among both prehistoric and living populations which was likely to be related to the types and quality of foods being consumed. In their assessment of pooled Bronze Age sites outside of Yorkshire, Roberts and Cox (2003: 81) reported a rate of 10.2% of individuals affected from four sites although side was not recorded sufficiently for them to discuss. As less than 20% of Wolds Bronze Age adults had mandibular condyle degeneration (which translated to between 16.67% and 33.33% of adults at each site), an occupational or at least repetitive activity was likely to be a contributing factor to the presence of OA at the TMJ.

Study	Site	OA
Current Project	Pooled	24.24%
	Cowlam	0%
	Danes Graves	15%
	Melton	50%
Roberts and Cox 2003	Pooled	8.8%
Hooper 1984	Danebury	4.7%
Keepax 1990	Gussage All Saints	8.3%
Stead 1991	Pooled	6.3%

Table 6.5 Osteoarthritis in the Iron Age by people affected.

Osteoarthritis is strongly influenced by the age distribution within a group as an increase in age leads to an increased likelihood of developing OA (Larsen 1998: 179). However, in a population such as that on the Wolds in the Iron Age, with a very strong bias towards the young adult age category, the evidence of arthritic changes would suggest additional mechanisms at play (Table 6.5). Skeletal degeneration was observed in a quarter of Iron Age adults, which was much higher than the rate proposed by Stead (1991) in the pooled Yorkshire Wolds cemetery sample. Additionally, it was also higher than that reported by

Roberts and Cox (2003) of three pooled Iron Age sites outside of Yorkshire as well as those reported for Danebury and Gussage All Saints. At the site level, the low rate at Danes Graves was surprising, in comparison to the proportion of 50% exhibited at Melton. Within the Iron Age Wolds population, there were three individuals with OA in the hip joint at Melton including one middle adult male (Sk 3397) with both joints affected and one female middle adult with one joint altered (Sk 1489), both of whom presented mild forms. A young adult female (Sk 1823) also presented moderately severe OA in one hip joint. At Danes Graves, only one individual, a young adult female (Sk M4), presented with mild OA of one hip joint. When proportion of joint elements affected was established it was found that 25% of male hip joint elements (acetabulum and proximal femur) were altered, while 20.83% of female joints and 21.87% of total hip joint elements exhibited evidence of degeneration. In contrast, Stead (1991) reported a low rate of only 2.7% from the pooled Iron Age cemetery sites on the Wolds, while in the south, at Danebury, a rate of 1.56% was established by Hooper (1984). Finally, in two separate publications McKinley related a rate of 28.57% at Cockey Down (1997a) and 33.3% at Wilby Way in Wellingborough (1997b). As these findings create a spread of prevalence from 1.56% to 33.3%, it suggests skeletal degeneration was very site specific and further explains the range of values on the Wolds. The younger age range of those in the study region in the Iron Age provides for the likelihood that OA was closely linked to activity in this period.

With the exception of the female proportion of joint elements affected, which was negligibly higher than that reported for the Bronze Age (20%), both the male and overall rates decreased from that determined for the Bronze Age on the Wolds. In contrast with the earlier period however, only one individual, a young adult female from Danes Graves (Sk M16Skul8), had evidence of mild OA on both knee joints, which resulted in an affected knee joint element proportion of 12.5% for females and 9.09% overall. This was a slight increase among females (from 9.09% in the Bronze Age) though overall it was a major decrease from that reported in the earlier period of a quarter of knee joint elements. It was, however, much higher than that reported by Stead (1991) at 0.79% and twice as high as that determined at Gussage All Saints at 4.17% (Keepax 1990). As both hip and knee OA were connected to strenuous weight bearing, it suggests the need for this type of activity had decreased among people in the Iron Age, or alternatively that adult joints in the later period were better equipped to handle these arduous activities. However, as more joints were still being affected in this project's Iron Age population it suggests here that individuals were either more predisposed to skeletal degeneration or were still involved in similar activities.

Additionally, three Iron Age individuals presented with interesting joint alterations not seen previously on the Wolds in the Bronze Age. Among the later population, no one exhibited

wrist bone degeneration, which was observed on two males from Staxton Beacon. However, as Stead (1991) reported a single instance of an unsexed adult with this alteration, it suggests the actual activity involved was still present in the later period. One young adult female from Danes Graves had evidence of mild joint alteration to the glenoid fossa of her right scapula. When viewed bilaterally this form of OA was the result of repetitive and strenuous extension of the arms and has been connected to regular hide and skin scraping among the Sadlermuit women (Merbs 1983). As the left scapula was unavailable for analysis, this is but one mechanical explanation for joint alteration, and as it was seen in a young adult it is likely it was activity-induced. This resulted in a female shoulder joint element proportion (glenoid fossa of the scapula and the proximal humerus) of 4.55% of Iron Age females and 3.55% of all shoulder joints. In contrast McKinley (1997a) reported a rate of 14.29% of OA of shoulder joints at Cockey Down in Salisbury, while Gussage All Saints had a rate of 2.08% (Keepax 1990), suggesting that Iron Age incidence was within the reported ranges and as only one person on the Wolds in the Iron Age was affected, it was ultimately an individualised incidence of this OA expression.

Two females from Melton exhibited OA changes to their metatarsals, previously unseen on the Wolds in the project sample. A middle adult female (Sk 1489) had mild changes to three left and two right, while a young adult female (Sk 1823) presented moderately severe OA in the single right metatarsal that was available for analysis. As both individuals were females and none of the other females (or males) from the Iron Age population with metatarsals exhibited these joint alterations it is assumed they are the result of particular actions. It was determined that these changes can come about through the extension of the metatarsophalangeal joint as a result of repetitive and or prolonged kneeling during activities, which had previously been seen among individuals in the Late Integration period on the south coast of Ecuador (Ubelaker 1978; 1979 as cited in Kennedy 1989: 100). With respect to metatarsals affected by OA, 10.9% of female elements were degenerated which led to an overall average of 7.06% of metatarsals with OA on the Wolds in the Iron Age. When compared to the rates of "foot bones" affected, Danebury had a proportion of 3.125% (Hooper 1984) and at Gussage All Saints 2.08% of non-specific foot bones presented with OA (Keepax 1990), which suggests the rate reported for the Wolds was at least twice that outside of Yorkshire. This implies that individuals on the Wolds that may have been involved in kneeling related activities, and were performing these actions for a longer period of time and on a more regular basis compared to elsewhere. However skeletal preservation, both on and off the Wolds, may have skewed these results as Roberts and Cox (2003: 95) point out that it is highly likely OA results for the Iron Age in Britain were underreported.

Finally the incidence of TMJ was compared on the Wolds between the populations of the Bronze and Iron Ages and in the later period it was found that only two individuals at Melton (Sk 1032 and Sk 1823) and overall had single mandibular condyles affected with a right presenting mild OA while a left was moderately severely altered respectively. Overall only 6.06% of the adult population had TMJ OA, which is greatly decreased from 18.75% of adults seen in the Bronze Age. At the joint element affected level in the Iron Age 3.45% of total mandibular condyles had evidence of OA, which was a large decrease compared to the rate of 13.92% of Bronze Age condyles. These results suggest a decrease in the intensity of masticatory loading whether due to the improved quality with respect to coarseness of nutrition or a reduced emphasis on the use of the dentition for non-ingestion purposes.

6.2.2.2 Vertebral Joint Disease

The evidence of spinal degeneration, though an expected change with advanced age, is also an evolutionary by-product of our shift to bipedalism (Roberts and Manchester 2010), however, the additional stress and strain we place on our bodies through weight bearing and active lifestyles can increase the chance of vertebral joint disease (VJD) for all age categories (Table 6.6). Although Roberts and Cox (2003) reported a rate of 10.7% of VJD in their pooled British sample from 22 sites, on the Wolds, in the Bronze Age, 38.46% of adults with vertebrae had VJD. At the site level, Rudston, Garton Slack and Cowlam presented no evidence for vertebral degeneration despite there being nine individuals with vertebrae. In contrast, Staxton Beacon and Garrowby Wold both presented very high rates of VJD, suggesting these two populations were leading harder and more intensive lifestyles compared to those at other sites. This was also found to be statistically significant ($p=0.027$, $\chi^2=20.235$, $df=10$), suggesting that degeneration of the vertebrae was connected to individual sites and therefore that either there may have been a difference in lifestyle or alternatively that individuals at Staxton Beacon and Garrowby Wold were more susceptible to VJD.

Study	Site	VJD
Current Project	Pooled	38.46%
	Garton Slack	0%
	Rudston	0%
	Cowlam	0%
	Willerby Wold *	0%
	Garrowby Wold	100%
	Staxton Beacon	75%
Roberts and Cox 2003	Pooled	10.70%

Table 6.6 Vertebral joint disease in the Bronze Age.

Those sites marked with an asterix represent a complete lack of vertebrae for analysis.

When those individuals highlighted above with respect to OA at the hip and knee joints were examined for corroborating evidence in the spine for the results of weight bearing, only one

individual (B198Sku84) from Garrowby Wold had any vertebrae available for assessment. As there were only three cervical vertebrae available (C3, 5 and 6), it only provides a limited correlation as the effect of weight bearing is most often presented at C5, T8 and L4 (Roberts and Manchester 2010: 139). Nonetheless, all three cervicals presented with extensive new bone formation on the articular facets and osteophytes that encircled the vertebral bodies. This evidence, though narrow, further confirmed the routine, possibly occupationally induced stress that was experienced by this young individual.

Among the adult Iron Age population on the Wolds 42.42% of individuals from two sites had vertebrae available for analysis, which was an increase from the 31.25% of individuals in the Bronze Age attributed to five sites. When Iron Age adults with vertebrae were inspected it was determined that 78.57% (11 of 14) had VJD which was twice the rate reported for the Bronze Age (38.46%; 5 of 13). As the relationship between VJD and time period amongst adults was found to be statistically significant ($p=0.038$, $\chi^2=6.543$, $df=2$), it suggests there was a reduced quality of life with respect to spinal degeneration from the Bronze to the Iron Age. Elsewhere on the Wolds, Boylston and Roberts (in Abramson 1996) determined a rate of 14.3% at Caythorpe, and Stead (1991) a combined frequency of 44% at his Iron Age cemetery sites. As a highly significant association was found between site and presence of VJD for Iron Age adults ($p<0.001$, $\chi^2=22.563$, $df=4$), just as in the Bronze Age, it supposes this alteration was site specific, which accounts for the range of prevalence at different sites in the region (Table 6.7). Off the Wolds, the rates reported from Danebury, Gussage All Saints and Cockey Down are equally varied, which further supports a site-specific phenomenon in which activities and lifestyle took their toll on Iron Age adults. Interestingly Hooper (1984) noted that VJD was quite widespread throughout the adult Danebury population, though the expression was usually mild. It was concluded, therefore, that these changes were associated with the normal ageing process and these rates pointed to a population that was not involved in extensive and intensive agricultural labour (Hooper 1984: 427).

At the site level, Danes Graves exhibited spinal degeneration in half of adults with vertebrae, while Melton had vertebral alterations in 90% of available spinal elements. This matches the pattern with respect to OA at both sites and suggests that adults at Melton were involved in more labour intensive work in comparison to those at Danes Graves. As a strong statistical relationship was determined at Melton between OA and VJD ($p=0.009$, Fisher's $\chi^2=0.029$, $\chi^2=6.923$, $df=1$), this further supports the theory that adults at the site were differentiated by their labour activities, or alternatively, those at Melton were more susceptible to skeletal degeneration. In association with the Bronze Age sites however, both Melton and Garrowby Wold appear to have had similar lifestyles that took their toll on the backs of a majority of the adults, while amongst both Danes Graves and Staxton Beacon, populations were closely

matched in terms of the assertion that certain individuals in the samples were involved in more repetitive and possibly specialised activities compared to others. As the samples at Garrowby Wold and Staxton Beacon were too small for statistical assessment this cannot be confirmed.

Study	Site	VJD
Current Project	Pooled	78.57%
	Cowlam*	0%
	Danes Graves	50%
	Melton	90%
Stead 1991	Pooled	44%
Boylston and Roberts 1996	Caythorpe	14.3%
Hooper 1984	Danebury	37.5%
Keepax 1990	Gussage All Saints	4.2%
McKinley 1997a	Cockey Down	57.1%

Table 6.7 Vertebral joint disease in the Iron Age.

Those sites marked with an asterix represent a complete lack of vertebrae for analysis.

When the individuals with OA of the hip and knee were examined for VJD, unfortunately it was found that both females from Danes Graves did not have any preserved spinal elements, while at Melton all three adults had vertebrae available, but only the two females exhibited moderately severe VJD, while the male spine was clear of degeneration. As there were strong statistical associations for both sex and VJD as well as sex and OA at Melton (Table 6.8) these findings were expected. This suggests that weight bearing and/or strenuous labour was taking its toll in Iron Age females as reflected in multiple areas of the skeleton.

Variable	Probability	Value	Degrees of Freedom
Sex and VJD	0.001	15.0	2
Sex and OA	0.022	7.615	2

Table 6.8: Statistical summary of degenerative changes at Melton.

As a large increase in the rate of VJD was noted between the Bronze and Iron Age populations (notwithstanding the limited sites), and considering the rates reported elsewhere for some sites also increased outside of Yorkshire through the periods, this suggests that the quality of life of Iron Age inhabitants, and particularly those living in the Wolds, was diminished as a result of spinal degeneration, and it appears as though this was related to more labour intensive activities being performed on a regular basis. However, as opposed to an all-inclusive increase, it appears that populations at certain sites were more negatively affected than others pointing to different lifestyles.

6.2.2.3 Abscesses

Abscesses have a complicated aetiology and can be brought about as a result of a number of influences including caries, severe attrition and periodontal disease (Roberts and Manchester 2010: 68). They were included in the quality of life indicators of adults because as Roberts

and Cox (2003: 70) point out, the pain of abscesses can be severe even before the sinus develops and as sinuses were present in all cases reported here, it can be assumed that dental pain was a factor in the lives of all of those with abscesses. Roberts and Cox's (2003: 82) reported prevalence of pooled British Bronze Age adult skeletons from 19 sites with abscesses was only a third of that determined in this project, suggesting those on the Wolds were much more likely to experience the pain and associated secondary issues connected to infection (Table 6.9). Brothwell (1961) reported on his findings at Bronze Age Yorkshire sites and determined a similar rate of individuals affected as that reported by Roberts and Cox (2003). However, as the rate of tooth spaces affected was quite similar across all sites and pooled samples it suggests that more people at certain sites (such as Garton Slack and Staxton Beacon) exhibited abscesses, as overall a comparable number of tooth spaces were affected. As the rate of sockets affected was not reported for all sites (only eight compared to the 19 reports that detailed basic presence) it cannot be confirmed, but seems likely that individuals off of the Wolds may have had more abscesses per person compared to those on the Wolds. However, the range of provenances on the Wolds negated any evidence of statistical associations at the site level.

Study	Site	% Population	% Tooth Spaces
Current Project	Pooled	33.93%	2.13%
	Garton Slack	52.94%	2.55%
	Rudston	30%	3.13%
	Cowlam	16.67%	0.73%
	Willerby Wold	25%	1.25%
	Garrowby Wold	33.33%	1.70%
	Staxton Beacon	40%	1.72%
Brothwell 1961	Pooled Yorkshire	12.5%	2%
Roberts and Cox 2003	Pooled	11.70%	1%

Table 6.9 Adult abscesses in the Bronze Age.

In the Iron Age, on the Wolds, slightly less than a quarter of adults experienced the pain of abscesses, which resulted in 1.89% of tooth sockets being affected by this pathology. In comparison to Stead's (1991) rates, the Wolds population was more likely to experience abscesses, but three times as many tooth sockets were affected in the project sample. In comparison to rates reported elsewhere (Table 7.10), those for the Wolds were slightly elevated with respect to people affected but within the middle range with regards to tooth sockets. At the site level, the population at Danes Graves had the highest rate suggesting almost a third of adults were experiencing dental pain. A strong statistical relationship was determined for Iron Age females with respect to abscesses and age ($p=0.008$, Fisher's=0.028, $\chi^2=7.138$, $df=1$) which reflected the rate exhibited in young adult females (6.25%) compared to middle adult females (60%), suggesting increased age contributed to the presence of abscesses in females. At Danes Graves this relationship was corroborated further statistically

($p=0.005$, Fisher's=0.018, $\chi^2=8.00$, $df=1$) as only 11.11% of young adult females had abscesses while 100% of middle adult females presented this disease. This was quite different in comparison to the Bronze Age overall in which young and middle adult females had the same prevalence (33.33%). However, whilst more individuals had abscesses at Danes Graves, adults at Melton had a higher proportion of abscesses and therefore, more realistically, were experiencing a lower quality of life as a result of abscesses and their accompanying pain. At Melton, instead of age, abscesses were found to be statistically significant with respect to sex as 50% of males and zero females exhibited this dental disease ($p=0.019$, $\chi^2=7.857$, $df=2$). As the aetiology of abscesses is multifaceted, it suggests the influence of different mechanisms were at play at each of the sites.

Study	Site	% Population	% Tooth Spaces
Current Project	Pooled	24.24%	1.89%
	Cowlam	0%	0%
	Danes Graves	30%	1.65%
	Melton	20%	2.98%
Stead 1991	Pooled	N/A	0.6%
Roberts and Cox 2003	Pooled	16.67% (5 sites)	4.29% (3 sites)
Keepax 1990	Gussage All Saints	16.67%	6.5%
Morant and Goodman 1943	Maiden Castle	5.56%	N/A
McKinley 1997a	Cockey Down	14.29%	N/A

Table 6.10 Adult abscesses in the Iron Age.

When these findings were compared to those determined for the Bronze Age, both the proportion of adults and tooth sockets affected decreased through time, suggesting that oral hygiene improved from the Bronze to the Iron Age; that the contributing factors associated with abscess aetiology (caries, severe attrition and periodontal disease) decreased; or most likely a combination resulted in less pain and ultimately a better quality of life with respect to abscesses in the Iron Age.

6.2.2.4 *Ante Mortem Tooth Loss*

Finally AMTL was also considered as although there are a number of aetiologies behind the loss of teeth in life all still negatively affect the individual in terms of the pain involved during the process of loss and healing. The range of proportion of individuals with AMTL on the Wolds is from a low of 16.67% (at both Cowlam and Garrowby Wold) to a high of 60% of adults at Rudston. When compared to the rate of 12.02% for Britain determined by Roberts and Cox (2003: 82), it suggests that more people on the Wolds were experiencing tooth loss during their lives than throughout the rest of Britain (Table 6.11). However, when tooth sockets affected (out of all those observable) were considered, with a reported rate of 13.2% for Bronze Age Britain (Roberts and Cox 2003: 82), none of the Wolds sites came close to that

average, suggesting that although more people on average had tooth loss, individuals lost less than half the number of teeth as those in other regions of Britain as a whole.

Study	Site	% Population	% Tooth Spaces
Current Project	Pooled	37.50%	4.18%
	Garton Slack	35.29%	5.50%
	Rudston	60%	5.36%
	Cowlam	16.67%	2.94%
	Willerby Wold	25%	1.25%
	Garrowby Wold	16.67%	1.14%
	Staxton Beacon	33.33%	4.17%
Brothwell 1961	Pooled Yorkshire	N/A	4%
Roberts and Cox 2003	Pooled	12.02% (18 sites)	13.20% (7 sites)

Table 6.11: Ante mortem tooth loss in the Bronze Age.

Statistically there were several interesting relationships for AMTL in the Bronze Age. Overall sex and AMTL as well as age and AMTL were found to have a highly significant association during this period which, when explored in more detail, meant that there was a strong relationship for Bronze Age females for age and AMTL, while for males AMTL and abscesses were found to be connected (Table 6.12). Therefore, it would appear that age was a contributing factor for females and among males, abscesses were the likely catalyst for tooth loss during life.

Variable	Probability	Value	Degrees of Freedom
Sex and AMTL	0.031	6.933	2
Abscesses and AMTL	0.001, Fisher's 0.002	10.315	1
Age and AMTL (BA females)	0.031	6.964	2
Abscesses and AMTL (BA males)	0.002, Fisher's 0.006	9.333	1

Table 6.12: Statistical summary of Bronze Age AMTL.

With respect to AMTL within the context of quality of life, although the majority of people lost less than three teeth (of those that lost any), one individual from Garton Slack stands out as she, a middle adult female (Sk B82GISku38), lost 15 teeth earlier in life. Just as Papas and colleagues (1989) determined a severe decrease in nutrition in edentulous individuals, this loss implies that her ability to eat properly was compromised. However, as all tooth roots exhibited extensive healing at the time of her death, it suggests she was able to alter her food sufficiently to consume it, or she had help from her family or the wider community, which enabled her nutritional survival. With the exception of one tooth of which the loss could be directly tied to a dental pathology (an abscess), due to the advanced state of healing it was not possible to determine conclusively if the remainder were lost as a result of pathology, accidents or cultural modification. However, as three of her remaining 13 teeth had evidence of moderate caries, it is probable that this pathology also contributed to her premature tooth loss.

On the Wolds in the Iron Age 39.39% of adults experienced tooth loss during their lives, while 5.98% of tooth sockets were affected (Table 6.13), although Stead (1991) reported half the rate of sockets affected in his pooled sample, at the site level for this project the variability between sites is still in line with those findings. Statistically the association determined for Bronze Age males between abscesses and AMTL continued in this later period to a lesser degree ($p=0.030$, Fisher's=0.067, $\chi^2=4.688$, $df=1$), but the female association of age and AMTL is no longer present. Most likely this is the result of a complete lack of old adult females attributed to the Iron Age. Off the Wolds however, there was an increase in both the number of people affected and, especially in the case of Gussage All Saints, a large increase in the percentage of tooth sockets affected. Robert and Cox's (2003: 102) rates remained somewhat stable, (despite or because of the decreased number of pooled sites), which are quite similar to the project sample results, suggesting that the mechanisms leading to tooth loss (whether pathological, accidental or cultural in nature) remained prevalent. At the site level both Cowlam and Danes Graves were almost equal in which third of adults underwent loss, however, among individuals at Melton, half experienced the loss of teeth during their lives. When the proportion of teeth spaces affected was considered, this pattern was altered as fewer teeth overall were being lost on the Wolds.

Study	Site	% Population	% Tooth Spaces
Current Project	Pooled	39.39%	5.98%
	Cowlam	33.33%	1.04%
	Danes Graves	35%	4.63%
	Melton	50%	10.26%
Stead 1991	Pooled	25.39%	2.1%
Roberts and Cox 2003	Pooled	12.82% (5 sites)	10.63% (3 sites)
Keepax 1990	Gussage All Saints	18.75%	24.3%
Morant and Goodman 1943	Maiden Castle	44.4%	N/A

Table 6.13 Ante mortem tooth loss in the Iron Age.

The loss of teeth during life could have had a direct impact on the quality of life of Iron Age people and two individuals are worth highlighting for that very reason. Skeleton 1184 from Melton, a middle adult female, lost 16 teeth early in life and presented with a completely edentulous mandible, while her maxilla was not available for analysis, leaving open the possibility that even more teeth may have been lost. Unfortunately due to the advanced stage of healing it was not possible to determine the contributing processes that led to the loss. At Danes Graves another middle adult female (Sk 2081) lost 14 teeth during life and as six were lost early enough to result in complete root absorption and eight were still in the process of closing, it suggests at least two (if not more) separate incidents of loss. Three teeth were lost as a result of abscesses suggesting that pathological processes may have affected several more but the remainder were too healed to provide any additional information. However, as age and abscesses were found to be statistically significant with respect to Danes Graves

females ($p=0.005$, Fisher's=0.018, $\chi^2=8.00$, $df=1$) it presents the likelihood that abscesses and AMTL were intertwined for the females. As both of these individuals exhibited clear healing after the loss of a significant portion of their dentition, it implies, just as was seen among the Bronze Age sample, that they were either each able to adapt their diet to their own needs or were helped by their immediate and or local community to ensure they were able to survive.

6.2.2.5 Stature

Stature is a complicated aspect of osteological analysis, not only because of the range of factors during growth and development that can influence whether an individual reaches their full adult height, but also with respect to the elements that are required, that must be perfectly preserved, in order to determine an accurate estimation of living height. Roberts and Cox (2003) reported an increase in stature among the prehistoric Britons for both males and females from the Neolithic to the Bronze Age. However, when the Iron Age was also examined it was found that male average height decreased while females remained stable (Table 6.14; Figure 6.1). Though Brothwell (1961: 316) mixed both Yorkshire and outer Yorkshire samples and ultimately combined values derived from Iron and Roman period skeletons, he also came to this same conclusion for males. Unfortunately, he felt there were not enough adequately preserved female skeletons to determine their heights through the time periods in Britain. Overall Brothwell's (1961) stature estimates were much higher than those reported by Roberts and Cox (2003) and as neither specified the populations examined, it is assumed this difference is due to different samples.

Study	Time Period	Male Range	Male Average	Female Range	Female Average
Duggleby Howe, Garson in Mortimer 1905	Neolithic	155-192	162.8	N/A	N/A
Brothwell 1961	Neolithic Britain	N/A	169.93	N/A	N/A
Roberts and Cox 2003	Neolithic Britain	162-177	165	151-161	157
Current Project	Bronze Age	159.94-178.92	170.91	152.41-167.72	162.38
Brothwell 1961	BA Yorkshire	N/A	175.26	N/A	N/A
	BA Britain	N/A	178	N/A	N/A
Brewster 1980	BA Garton and Wetwang Slack	N/A	177	N/A	N/A
Roberts and Cox 2003	BA Britain	167-177	172	154-161	161
Current Project	Iron Age	150.66-181.33	165.78	152.17 - 177.7	162.29
Stead 1991	IA Combined	N/A	171	N/A	158
Brewster 1980	IA Garton/Wetwang Slack	N/A	167	N/A	157
Dent 1982	IA Wetwang Slack	N/A	167	N/A	156

Brothwell 1961	IA + Roman Yorkshire	N/A	172.2	N/A	N/A
Roberts and Cox 2003	IA Britain	164-174	168	154-164	162
Hooper 1984	IA Danebury	156.9-178.7	166.5	140.5-160.2	153.3
Keepax 1990	IA Gussage All Saints	164-169	166.33	155-162	157.5

Table 6.14 British stature from the Neolithic to the Iron Age, in centimetres.

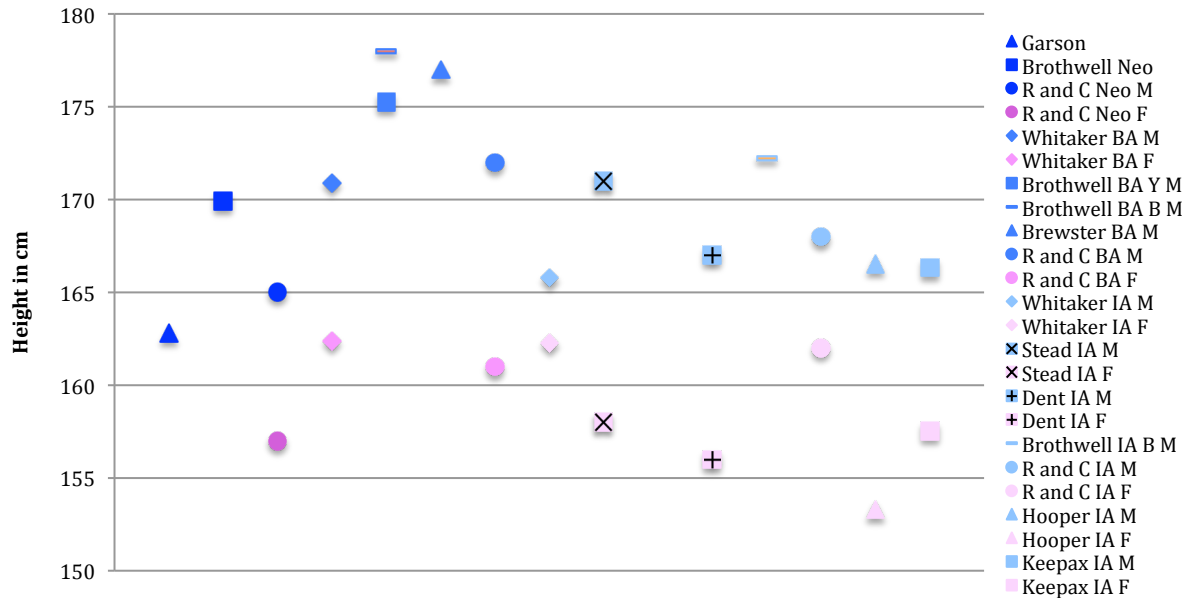


Figure 6.1: Graphic representation of stature averages as detailed in Table 6.14, in centimetres.

On the Wolds stature estimates were quite limited and as such it was deemed necessary to rely on Garson (1893: 10) and his analysis of Duggleby Howe males (that Mortimer (1893) had previously excavated) for a Neolithic range, which was shorter than that provided by both Roberts and Cox (2003) and Brothwell (1961). For sites attributed to the Bronze Age Dawes (in Brewster 1980) reported an average male stature of 177 cm for the combined skeletons at Garton and Wetwang Slacks, though she did not provide an estimate for females. This project determined Bronze Age estimations that suggested average male heights had also increased on the Wolds from the Neolithic to the Bronze Age. Compared to measurements reported by Roberts and Cox (2003) however, there was a larger variation in Bronze Age heights on the Wolds, which Brothwell (1961) proposed as being due to the incoming populations from the continent who settled on the Wolds during this period.

For the Iron Age Wolds there were several different stature estimates available as a result of the extensive excavations by Stead (1991), Brewster (1980) and Dent (1982) as well as those determined in this project. Dawes, in Brewster (1980) reported a male average of 167 cm and a female average height of 157 cm for the combined Garton and Wetwang Slack populations, while Dent (1982) detailed similar findings as a result of his work at Wetwang Slack, and as these were ultimately all from the same site area, parallels were expected. Finally Stead

(1991) provided a combined average for his Iron Age cemetery sites of 171 cm for males and 158 cm for females. In comparison to the rates provided by Roberts and Cox (2003), on the Wolds, Iron Age males had also decreased in average stature, however that decrease was even more prominent with up to ten centimetre differences at Garton and Wetwang Slack. Brothwell (1961: 316) surmised that this change may have been due to a combination of factors including the interbreeding of the taller continental peoples with the shorter, local Bronze Age Wolds inhabitants which produced smaller individuals, as well as the variations in available food supply from one period to the next, and finally the limited sample available for assessment, which is always an osteological concern.

For areas outside of Yorkshire, Roberts and Cox (2003: 103), who reported on reduced evidence for childhood stress with respect to CO but an increase in LEH in the Iron Age, suggested that males might have been subject to additional stresses related to increased intensity in agriculture and the adoption of multiple industries. As the male populations on the Wolds had been experiencing reduced levels of childhood stress from the earlier to the later period, this aspect of their theory appears irrelevant to the sample area. Instead, it is possible that, as discussed in Chapter One, a second wave of continental people into Yorkshire (descendants of the La Tène people), intermixed with the local Wolds population, so that what these stature ranges represent is a comingling of several groups of people.

Among Iron Age females for this project, the average stature remained stable from the preceding period, although as there were no other published Bronze Age stature estimates from the Wolds, this is the only information available. As Roberts and Cox (2003) reported only a one centimetre increase in female heights for populations outside of Yorkshire, which is virtually identical to that on the Wolds, it suggests that from the Bronze to the Iron Ages British females were able to maintain their stature. However, alternatively, it may also suggest that despite the passage of time, they were not able to improve their access to high quality nutrition or overcome environmental and cultural factors enough to increase their height as a group. The range of female heights widened from the earlier Bronze Age period (152.41 cm – 167.72 cm) to the later Iron Age period (152.17 cm – 177.7 cm) on the Wolds, with more individuals getting taller compared to the Bronze Age. Additionally as the minimum height remained the same (152 cm), it suggests that some females were in fact experiencing a better quality of life in childhood which enabled them to achieve increased stature in their later subadult years. An interesting discovery was made when the Iron Age females with heights above the maximum height in the Bronze Age (167.72 cm) were examined for LEH. It was determined that two of the three skeletons had experienced multiple periods of stress resulting in enamel growth disruption, and yet were able to

overcome those stalls in development with at least one phase of catch-up growth, to theoretically reach their full height potential.

Iron Age males on the Wolds also exhibited a wider range of heights compared to their Bronze Age counterparts, however, unlike the females, this was at both the minimum and maximum ends. Both the tallest and the shortest males exhibited LEH suggesting that the factors affecting males' ability to reach full heights went beyond early childhood growth disruptions. As these males were from Melton (the tallest) and Danes Graves (the shortest) respectively, it provides for the possibility that the living conditions at each site had a large contributing factor on the lives of the population. Additionally, however, as stature is also tied to genetics it allows for the possibility that the populations at each site were distinct groups. This theory is further supported by the results as discussed above, which indicated that the quality of life of childhood at Danes Graves was different, and indeed worse, than that experienced at Melton.

Subadults in both the Bronze and Iron Ages were examined for developmental disparities between ages determined on the basis of dental and skeletal growth, as a difference of at least 1.5 years might theoretically suggest a skeletal developmental disruption as a result of environmental, cultural, nutritional, pathological, (or a combination there of) stress. Within the earlier period, two adolescents and two children did not experience any stress that led to a clear growth delay in their skeletons. The additional three children and adolescent unfortunately did not have any surviving diagnostic post-cranial elements to provide an age estimation and as such could not be assessed for skeletal growth disruption.

During the later period, although the majority of subadults including one foetus, two infants, two children and two adolescents were developmentally on track, one adolescent did not have any post cranial bones to assess and two infants and one child had clear skeletal growth delays. Both infants, from Melton (Sk 1183 and Sk 1818), exhibited dental ages of between two and four years, however, their skeletal ages were between one and one and a half and birth and two years respectively, suggesting very serious skeletal delays, which may in fact have ultimately contributed to their cause of death. The single child at Danes Graves (Sk B7) was also delayed as their teeth suggested an age of 3.5 to 5 years while their skeletal age was determined to be between 2 and 3.5 years. As the two infants were younger their growth deficits were likely to be the result of inhibited growth in utero. For the child, although foetal health may have had an initial impact, their infant and early childhood years were clearly stressful, and as it is not possible to determine when skeletal growth disruptions began for this child (as additionally the anterior dentition was unavailable for LEH analysis, though their orbits presented with moderate CO) it is assumed that during their short life they probably experienced stress on a regular basis. Therefore, although additional information on

the other subadults in the sample is certainly lacking, based on that available, Iron Age young subadults were more likely to experience stress that manifested as a halt in skeletal development in comparison to both their earlier period age-counterparts and the older Iron Age subadults, as their stress was presented as both LEH and CO. This theory is further corroborated by the results of LEH and CO amongst subadults in the Iron Age. As infants and children were dying before stress could alter their dentitions (and for that matter before they had fully developed), it further suggests that although adolescents were clearly exhibiting stress, their skeletal development had either experienced a catch-up period before their deaths or that the stressful element in their lives had lessened or disappeared prior to their deaths if they were never initially osteologically delayed.

6.2.2.6 Adulthood Summary

Overall, among the Bronze Age population, less than a third experienced OA, a little more than a third of adults with vertebrae had VJD, a third had evidence of abscesses and a little more than a third lost teeth during their lives suggesting that once they reached adulthood a greater proportion of individuals were able to improve their quality of life from that which they experienced in childhood. When the proportion of individuals without any evidence of these markers of adulthood stress was explored, it was found that adults from both Cowlam and Staxton Beacon had the greatest chance of less stressful lives (specifically with regards to the variables under review) with 66.67% and 60% of people, respectively, not exhibiting any OA, VJD, abscesses or AMTL. Rudston had the lowest quality of life among adults with only 30% of individuals managing to protect themselves from these skeletal and dental alterations suggesting that adulthood was wrought with difficulties to a proportion not seen at other sites. Overall 44.7% of Bronze Age Wolds dwelling adults were able to lead a quality life (based on these indicators), which is a marked improvement from only 16.07% of childhoods that were definitely free from both LEH and CO.

In contrast, among the Iron Age sample, a quarter of individuals had OA, almost 80% (of those with vertebrae) had VJD, a quarter had abscesses and almost 40% lost teeth during their lifetime. This suggests that upon reaching adulthood, based on the individual variables, this population was able to improve their lives, though not to the extent that they had been able to in the Bronze Age. When all four adult indicators were pooled, Danes Graves exhibited the highest level of well being with 40% of the population being free from all indicators, while Melton fared the worst with only 10% (one individual) experiencing a stress free life based on these variables. Overall, only 30.3% of adults presented with a high quality of life, which was a marked decrease from 44.7% of the Bronze Age population. Although this was an increase from the proportion of individuals with stress free childhoods (13.63%, based on the presence of both anterior teeth and orbits and the absence of both LEH and CO), overall

there were fewer individuals leading high quality subadult and adult lives in the Iron Age compared to the previous period. This suggests that while the Wolds inhabitants been unable to adapt and improve people's lives from one period to the next, the well being of the population had actually decreased.

Interestingly, when period was examined statistically, both skeletal and dental preservation were related (Table 6.15). Furthermore, within each period, site and skeletal preservation were highly significant. As these findings were linked to the excavation methodologies, the Iron Age sites, and especially Melton, were considered more complete. As the Iron Age exhibited a decreased quality of life, with generally more available elements, that assessment would not be likely to improve with the addition of further postcranial bones. In contrast, however, as the presence of postcranial elements was reduced in skeletons attributed to the Bronze Age, the discovery and/or analysis of additional elements would not improve their image of quality of life but may in fact reduce it. Unfortunately this is not likely to ever be tested and therefore it is necessary to rely on the available data, which points to a reduced quality of life in the Iron Age in comparison to the preceding period.

Variable	Probability	Value	Degrees of Freedom
Period and skeletal preservation	<0.001	15.542	2
Period and dental preservation	0.040	10.015	4
BA site and skeletal preservation	0.011	23.030	10
IA site and skeletal preservation	<0.001	36.409	4

Table 6.15: Statistical summary with respect to preservation.

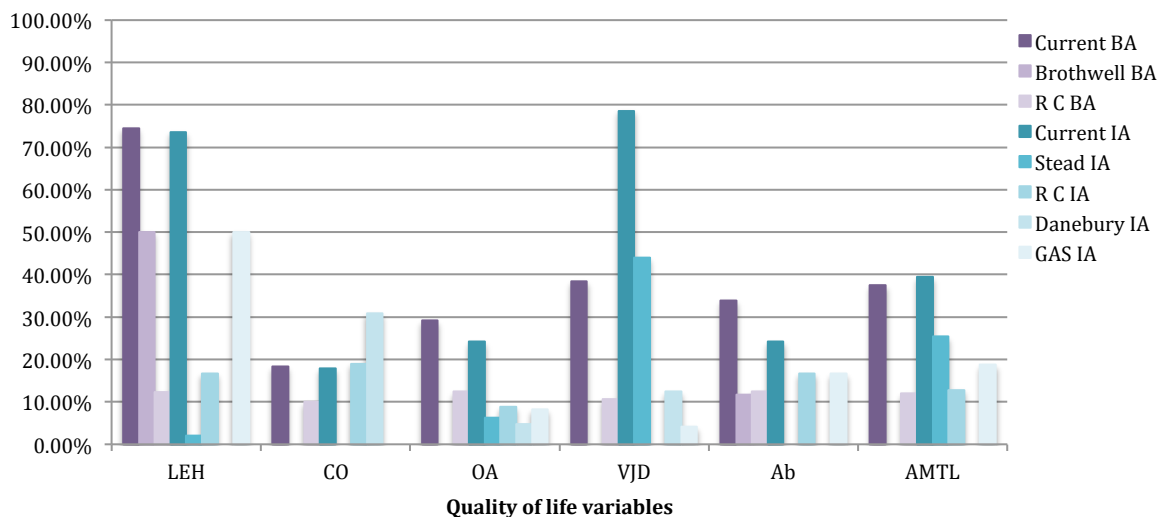


Figure 6.2: Summary of quality of life variables of sites discussed in the text.

Although the results reported in Roberts and Cox (2003) were not combined with regards to childhood and adulthood variables, with the exception of VJD, all individual indicators and overall for both life periods showed a marked decrease in incidence from the Bronze to the Iron Ages. This suggested that, outside Yorkshire, the lives of prehistoric British inhabitants were actually improving, which is a complete contrast to that exhibited on the Wolds (Figure

6.2). This further supports the theory that on the Yorkshire Wolds life was different though not necessarily better, compared to that experienced elsewhere in Britain.

6.2.3 *Everyday Stress*

In addition to variables that were derived from and inscribed on the bones and teeth during specific life periods, individuals can be susceptible to trauma at any point in their lives. By considering this additional dimension of well being it is possible to explore the human relationships between individuals and also, with their landscapes and uncover the possible threats that may have existed in people's lives.

6.2.3.1 *Cranial Trauma*

Cranial fractures were explored on the Yorkshire Wolds as an additional measure of well-being, as they could be experienced by all members of the population. Whether accidental or violent in their cause, traumatic injury that is severe enough to alter the skeletal system has a direct corollary with a reduced quality of life, whether temporary or permanent. Cranial fractures, due to their clear skeletal alteration if the skull was preserved, were more likely to be reported by both Mortimer (1905) and Greenwell (1877) and it was found in a desk based assessment of their excavations of Bronze Age barrows that one individual had "a hole punched through their frontal bone" at Wharram Percy (Mortimer 1905: 48); at Langton Wold a skeleton had an "extensive weapon fracture to the skull" which displayed some evidence of healing (Mortimer 1905: 349) while at Painsthorpe an adult exhibited a severe cranial fracture with some healing, which Brothwell (1961: 318) determined to be due to one or more blows to the forehead. Although evidence is limited, it suggests that individuals were involved in traumatic, and most likely violent incidents in their everyday life (Table 6.16).

Study	Site	% Cranial
Current Project	Pooled	25%
	Garton Slack	27.27%
	Rudston	30%
	Cowlam	0%
	Willerby Wold	50%
	Garrowby Wold	33.33%
	Staxton Beacon	16.67%
Roberts and Cox 2003	Pooled	8%

Table 6.16: Cranial fracture prevalence in the Bronze Age.

Kilgore and co-workers (1997), Roberts and Manchester (2010), Filer (1997) and Knight (1991) all discuss the importance of location when considering the inherent cause of cranial fractures, most often whether violently inflicted or accidental in nature. Although not an exact science, Roberts and Manchester (2010) and Filer (1997) point to the frontal and left parietal as suggestive of a frontal assault and/or hand to hand combat with a right handed

attacker, while Kilgore and colleagues (1997) propose that an absence of cranio-facial trauma would negate the belief that interpersonal violence was prevalent in a society.

In the Bronze Age sample 75% of individuals were free from cranial fractures. Of those that presented skull trauma, 36.84% of injuries were located on the frontal or left parietal bones, which may suggest some of these injuries may have been the result of interpersonal aggression. Conversely, 63.16% of fractures were found on the right side of the skull or the occipital, which could suggest some of those injuries were at the hands of right handed attackers, though the victims in these cases would have been fleeing the blows. Interestingly, 21% of total fractures were located on the occipital, and Manchester (1983) proposes that if these injuries were violent in aetiology, the victim may have been fleeing or lying face down already, which is more suggestive of murder than combat in itself.

At the site level, all of the fractures discovered at Rudston (four on three people) were located on the right parietal or the occipital, while two thirds at Willerby were indicative of forward facing hand to hand combat. At both Garton Slack and Garrowby Wold the fractures were evenly split between what may be interpreted as active, engaged injuries to the front of the skull and passive, almost defenceless, wounds to the back and right of the cranium. It was determined that Bronze Age sites and cranial fracture location had a statistically significant association ($p=0.016$, $\chi^2=30.333$, $df=16$), which may suggest there were different mechanisms at play at each site and not an overall catalyst, such as interpersonal violence. The injuries sustained by individuals at Rudston may be indicative of victims, while those buried at Willerby Wold presented fractures that were more consistent with an active engagement (though, ultimately they were also victims). At Rudston the characterisation of those with cranial fractures as victims presents an interesting observation, as sex and cranial fracture presence was found to be highly statistically significant ($p=0.002$, Fisher's $p=0.008$, $\chi^2=10.00$, $df=1$), as only females, and for that matter all females ($n=3$), exhibited this form of trauma. Although based on modern culturally constructed stereotypes, it appears to be more likely that these females were the victims as opposed to the aggressors. As their fractures were also all located on either the occipital, or the right parietal in one case, this further supports the victim conclusion. Additionally, the populations at both Garton Slack and Garrowby Wold demonstrated both types of injuries, suggesting a mixture of roles in interpersonal violence. Interestingly, unlike any other Bronze Age site assessed, at Garton Slack a strong statistical association was discovered between age and presence of cranial fractures ($p=0.037$, $\chi^2=8.514$, $df=3$). Although 35.3% of adults exhibited fractures, 62.5% of them were young adults, suggesting that this mixed-sex age group were the most likely to receive this form of injury. In comparison, none of the middle adults ($n=4$) and only one of the old adults ($n=5$) exhibited similar injuries.

Outside Yorkshire, Roberts and Cox (2003:88) reported a lower rate of trauma overall (8%). At the site level they determined that two people at Millockston had injuries to their frontal bone (8.7% of the population), while at Barnack the prominent location was the parietal bone, which was damaged in 11.8% of individuals. Brothwell (1961) reported on cranial fractures for Britain (without specifying sites) and found an even split between those located on the frontal and those on the parietal for the combined Neolithic and Bronze Ages, suggesting he had also noted a combination of behaviours that led those to receive injuries. It appears, with this limited data, that fracture location was quite variable and often site specific. As there is no clear evidence of combat, these injuries were all likely to have been the result of small scale and interpersonal matters.

Cranial fractures were also assessed with respect to fracture type (blunt (BFT) or sharp force trauma (SFT)). Lovell (1997: 149-50) characterised BFT as low velocity in nature and the result of the impact of the skull with a large object or surface. Conversely, SFT or penetrating fractures, have a small impact area and tend to be of higher velocity, which is needed to breach the skull. Although not stated explicitly, it appears those injuries recorded by Mortimer were a mixture of BFT and SFT. In the present study, there was also a mixture of fracture types, but significant relationships were found at the site level. At both Rudston and Garton Slack there was a strong association between sex and cranial fracture type (Table 6.17), with females predominantly exhibiting SFT. At Rudston all three females had SFT, while 75% of males (n=4) had BFT. Interestingly, at Willerby Wold, a sample that only included males, the two with fractures had SFT, while at Garrowby Wold one male and one female each had SFT. As the sole adolescent at Staxton Beacon exhibited BFT it is possible that this was an accidental injury unrelated to sex or interpersonal aggression. Unfortunately, due to the range of site reports Roberts and Cox (2003) consulted, they did not detail cranial fracture types in their pooled Bronze Age, sample and it is therefore not known if sex and cranial fractures were interrelated at sites outside Yorkshire.

Variable	Probability	Value	Degrees of Freedom
Sex and cranial fractures (Rudston)	0.007	10.00	2
Sex and cranial fractures (Garton Slack)	0.050	6.00	2

Table 6.17: Statistical summary with respect to Bronze Age cranial fracture presence.

In the Iron Age sample under review, it was determined that 81.8% of individuals were free from cranial fractures, which is a slight increase from the preceding period. The frontal and/or left parietal was affected in 44.4% of cases, while the right side and/or occipital was altered in 55.56% of injuries. This is a slight shift from the Bronze Age and points towards more forward facing interactions than fleeing. However, as the percentage located on the occipital (22.22%) remained stable, it suggests that this form of interpersonal aggression was still present. During Greenwell's excavation of Cowlam, he reported on a single individual with a healed cranial fracture (which is not currently part of the collection), though the injury

itself and the location affected were not specified. At Danes Graves Mortimer identified a middle adult female with a healed cut to her frontal bone and a further unsexed middle adult with a distinct cut to the left parietal, neither of these individuals are present in Mortimer's collection (Mortimer 1899: 127; Mortimer 1911: 45). Both of the individuals Mortimer observed at Danes Graves exhibited fractures that suggest forward facing interaction, further corroborating the time period shift in injury location. However the difference is small and still does not point to large-scale conflict but rather an increase in relational antagonism.

At the site level, the population of Cowlam did not exhibit any cranial fractures and Melton only had a single instance of an infant with this injury. At Danes Graves however, 30% of the population exhibited fractures, which included all age groups and sexes with the exception of middle adult males. These findings suggest a mixture of causative factors and, due to the spectrum of people affected, no statistical associations could be determined with respect to age, sex or fracture location. With regards to fracture type in the Iron Age 44.44% of injuries were BFT, while SFT accounted for 55.56%. Unlike the Bronze Age however, there were no significant relationships between sex and type, as with the exception of one additional female with SFT there was an even split between BFT and SFT for males, females and subadults.

Brewster (1980: 746), in his excavation of Iron Age Garton Slack, also discovered an unsexed old adult with what may have been a healed puncture wound to the skull, though once again the location was not provided. Additionally, at Iron Age Wetwang Slack, Dent (1983) identified a young adult male with a sliced occipital which was consistent with a sword injury and another young adult male with a partially healed depression fracture to his frontal bone, while at Acklam Wold, detailed in that same publication, Dent assessed an individual with multiple severe sword blows to the occipital bone which resulted in death. Elsewhere on the Wolds, Stead (1991) reported on a single young adult female from Rudston with a cut to her frontal bone that had begun to heal at her time of death. These additional cranial fractures do support the supposition that the Iron Age on the Wolds was a period of increased interpersonal aggression as several instances of weapon-causing injuries were identified. However, this was not an abrupt change from the preceding period, but instead a very gradual and only slight shift towards more conflict-related injuries.

Study	Site	% Cranial
Current Project	Pooled	18.18%
	Cowlam	0%
	Danes Graves	30.43%
	Melton	5.56%
Roberts and Cox 2003	Pooled	6.52%
Hooper 1984	Danebury	6.25%
Morant and Goodman 1943	Maiden Castle	18.18%
Keepax 1990	Gussage All Saints, Dorset	20%

Table 6.18: Cranial fracture prevalence in the Iron Age.

In the Iron Age outside Yorkshire, Roberts and Cox (2003: 99-100) reported a proportion of 6.52% of individuals with cranial fractures, which was one third the rate determined for the Wolds at 18.18% (Table 6.18). Hooper (1984) reported a cranial fracture rate of 6.25% of individuals at Danebury, while Keepax (1990) identified a single adult male at Gussage All Saints (20% of the sample) with evidence of a cranial injury to the left parietal. Finally, at Maiden Castle, Morant and Goodman (1943: 346-8) determined that 18.18% of adults attributed to the Iron Age exhibited cranial fractures. Although the site context with regards to conflict will be discussed in Section 6.2.3.3, these rates for outer Yorkshire are both below and similar to those determined for this project. This suggests that the Yorkshire Wolds inhabitants were just as susceptible to injuries as individuals at other sites, though the mechanisms, including accidental versus purposeful harm, may have been different.

6.2.3.2 *Post-cranial Trauma*

Post-cranial fractures were also assessed as a broken limb or axial bone would lead to a reduced quality of life not only in terms of the pain involved in receiving them and dealing with the healing process, but also the possible resulting reduced mobility that may lead to an inability to perform tasks and participate in occupational and cultural activities (Table 6.19). Roberts and Manchester (2010: 108) report that beyond the skull, evidence of fractures to scapulae, ribs, forearms and hands all point towards the causal factor of interpersonal violence. Alternatively, Kilgore and colleagues (1997) are adamant that postcranial fractures are the least diagnostic when attempting to infer violence and aggression in a population. Overall, the range of possible aetiologies for postcranial fractures (with the exception of those in which the weapon itself or causal agent is still embedded in the wound, as seen at later Iron Age sites such as Burton Fleming (Stead 1991)), requires that caution be taken when suggesting interpersonal conflict as the driving force for injuries.

In the desk based assessment of Mortimer and Greenwell's Bronze Age excavations, it was determined that due to the range of preservation of post-cranial skeletal elements, both within and between sites, the early antiquarians may have missed a number of fractures.

However if there was evidence of healing, they made a note of their belief that they discovered traumatic injury. Greenwell commented on two injuries including a healed fracture of the left radius of a male reported at Folkton (Greenwell 1890: 15), and an individual at Ganton who had both femurs fractured and healed (to what extent is not known) before death (Greenwell 1877: 176). Unfortunately, as Greenwell made special notes of these individuals and their interesting pathologies, it followed that these elements (and not necessarily the entire skeleton) were removed from the barrows and were ultimately not reunited with the collection, as they were not available for analysis.

Among the Bronze Age population examined, 7.14%, or four individuals, exhibited post-cranial fractures (Table 6.19). This included two humeri, which represented 10.53% of available humeri, one ulna and 7.14% of all ulna and one femur, which translated into 2.7% of all femora. Based on the locations alone, it is clear that none of the elements (including the ulna, as it displayed a healed fracture to the olecranon process) exhibit the classic signs of active combat or defensive injuries. In addition, none presented evidence of cause in the form of embedded weapons, and as such it is likely that some, if not all, were accidental in nature. Unfortunately, as hand bones were largely absent and ribs were limited to fragments, the typical fractures here were not possible to assess. At the site level, Rudston, Garrowby Wold, and Cowlam were found to be free from this trauma, while Staxton Beacon had evidence of a single individual and Garton Slack had three, suggesting at these sites accidents or violence involving the skeleton was still at a minimum. As no statistical significance was found at or between sites, it suggests post-cranial fractures were random as opposed to connected to a specific site, sex, age, skeletal element or activity.

Study	Site	% Post-cranial
Current Project	Pooled	7.14%
	Garton Slack	13.64%
	Rudston	0%
	Cowlam	0%
	Willerby Wold*	0%
	Garrowby Wold	0%
	Staxton Beacon	16.67%
Roberts and Cox 2003	Pooled	5.50%

Table 6.19: Post-cranial fractures in the Bronze Age.

The site represented with an asterix did not present with any observable post-cranial elements.

Due to the range in reporting methodologies, Roberts and Cox (2003: 88-9) detailed individual fractures as opposed to site rates, but when all fractures (16 total) were contrasted against the reported number of individuals a rate of 5.5% was determined. However, this is likely to be a low estimate, as the authors themselves were not able to analyse the skeletons

but provided a desk based assessment of the available site and skeletal reports. As a result, the rate determined for the Wolds is considered to be comparable to that outside Yorkshire.

When evidence of post-cranial fractures was assessed for the Iron Age on the Wolds in the project sample, it was found that 9.09% of individuals, which translated to four females, experienced injuries to their appendicular and axial skeletons (Table 6.20). The female population at Melton was quite susceptible to this form of trauma as 50% (n=6) exhibited fractures. This was determined to be highly significant with respect to sex and post-cranial fracture presence for females ($p=0.027$, $\chi^2=7.2$, $df=2$). Specifically with regards to the individual fractures from Melton, one, belonging to a middle adult female (Sk 1184), presented an ununited coracoid process fracture to her right scapula, which Lovell (1997: 160) proposed could be the result of a purposeful action of downward force displacement to the shoulder. Additionally, a young adult female (Sk 1032) had a healed rib fracture, which could be the result of a fall, a direct blow or even constant coughing (Lovell 1997: 159). As neither of these injuries represents definitive instances of violence, and as none of the post-cranial fractures observed could be tied to weapons of any kind, there is no real basis to suggest that these populations were subject to extensive interpersonal conflict. Dent (1983: 126) also commented on the possible accidental nature of some of the reported fractures including a fractured nose and rib of a young adult male and a middle adult female, also with a broken nose, both from Wetwang Slack. This evidence further suggests that a number of the reported cases of trauma, even those classically considered aggressive in nature, were in fact innocently derived.

Study	Site	% Post-cranial
Current Project	Pooled	9.09%
	Cowlam	0%
	Danes Graves	8.70%
	Melton	13.04%
Hooper 1984	Danebury	8.93%
Morant and Goodman 1943	Maiden Castle	1.39%
Keepax 1990	Gussage All Saints	50%

Table 6.20: Post-cranial fracture prevalence in the Iron Age.

At Iron Age Rudston, Stead (1991: 136) discovered five males with healed clavicle fractures, which are often attributed to a fall directly onto the shoulder or an outstretched hand (Lovell 1997: 160). One healed fractured humeri in another male was also noted, which led to atrophy. However, as the location and initial pathology were not discussed in detail, it is unknown if the contributing action was direct or indirect trauma. Additionally two males at Burton Fleming were found interred with the weapons that may have ultimately caused their deaths. The first had a spearhead imbedded in his pelvis, while the second had one located in his vertebrae (Stead 1991: 137). Additional individuals were discovered at Stead's Garton

Station and Burton Fleming sites with what initially appeared to be weapon wounds, though it was later determined that these, unlike those detailed above, were the result of a post mortem funerary ritual (Stead 1991: 136). All of these cases resulted in a post-cranial fracture rate amongst Stead's (1991) pooled adult sample of 3.25%, which is lower than that determined for this project. However, as all of those reported as injured by Stead were males, and those discussed here were females, it further suggests different contributing factors. Furthermore, this theory is supported by the fact that there was no similarity with respect to skeletal element involvement and as weapons were discovered in association with two of Stead's injures it is much more likely that some were the result of conflict.

Outside Yorkshire, Keepax (1990: 167) reported a post-cranial fracture rate of 50% (n=10) at Gussage All Saints with injuries to a rib, three humeri and a tibia. One fractured humerus may have been the result of a blow to the elbow while the arm was extended, however none of the other injuries could be connected to interpersonal interaction. Alternatively, at Danebury, Hooper (1984: 428) identified three individuals with post-cranial fractures resulting in an adult population rate of 8.93%. One elderly male stood out as his skeleton exhibited multiple healed fractures to several ribs, his right clavicle and his spine. Hooper (1984) concluded this individual experienced a great deal of violence and the fractured clavicle resulted in a permanent impairment, which severely restricted the movement of his right arm. The descriptions of these injuries all point to a different aetiology with respect to the causes of the fractures in comparison to those exhibited on the Wolds, and overall do further the suggestion that those on the Wolds were more likely to be accidental than violent in nature.

One particular Iron Age subadult stands out, as this child from Danes Graves (Sk B7) exhibited a life ending cranial fracture to their right parietal. As, stereotypically, this location is connected with a frontal attack it suggests that this child experienced severe interpersonal aggression at the hands of another. As their axial skeleton was completely lacking and only a few long bones were present, it was not possible to determine with any certainty if additional injuries had been inflicted. However, when additional osteological information was considered, including moderate CO in both orbits, delayed skeletal development which pointed to an age up to three years younger than their dentition, as well as the presence of a severe and active abscess, it appears as though this child was not well cared for. Although a label of child abuse is purely conjecture without additional fractures (Roberts and Manchester 2010: 119) at the very least this subadult experienced neglect by those caring for them in their short life. This appeared to be an isolated circumstance, but as it was attributed to the Iron Age, a time when interpersonal aggression was seen as the contributing factor in many cases of injuries, it further supports the theory that the Iron Age on the Wolds was a period of reduced quality of life for all individuals in the population.

6.2.3.3 *Conflict in the Iron Age*

At the Iron Age hillfort site of Danebury, Hooper (1984) determined that at least 17.85% of the population (n=56) was subjected to serious injuries that were directly caused by weapons. Of the ten male skeletons that exhibited these traumatic injuries, 80% had direct blows to the head which were caused by swords or other weapons, and which directly led to a majority of deaths (Hooper 1984: 428). This was to be expected for a site with a need for defensive measures, however at the neighbouring hillfort of Maiden Castle, a rate of 1.4% was much lower than expected. Based on these findings, and the knowledge that their pooled Bronze Age site reports did not detail any clear weapon related trauma, Roberts and Cox (2003: 99) proposed that the development of metal technologies that boomed during the Iron Age led to an increase in aggression and therefore, ultimately, to a decrease in the well being of Iron Age people.

On the Wolds the evidence for either demand (presence of metal works or smelting hearths) or use of weapons was limited compared to other areas in Britain. This was particularly evident by the almost total lack of weapons discovered at early La Tène grave and settlement sites (Stead 1965: 5; Dent 2010: 43). Dent (1983) proposed that, based on the weapon wounds observed at the later site of Wetwang Slack in particular, such as the young adult female observed with an iron spearhead touching her spine, and other sites such as Danes Graves, violence on the Wolds was increasing towards the end of the period when those large cemeteries were in use. Unlike the earlier La Tène burials found at Arras, Cowlam and Eastburn, in which few weapons were identified, at Wetwang-Slack the presence of weapons and chalk figurines depicting human figures with swords suggested to Dent (1983) that war was a genuine hazard on the Wolds. This was further supported by the later discoveries at Stead's extensive Iron Age cemeteries, including the unique presence of a coat of chainmail at burial K5 at Kirkburn (Stead 1991: 54-56), and it was therefore theorised that the military and defensive structures that were so prominent in the south, were not the only arenas of interpersonal aggression.

The Wolds only had a few possible examples of hillforts, such as that at Grimthorpe, and possibly those at Paddock Hill Thwing, Nafferton Wold and Caythorpe (Stead 1965: 71; Dent 2010: 32). On the one hand this may suggest a lack of structures that survived, as the Wolds region was already a defensible area, or alternatively it may point to a region of people that did not feel the need to protect themselves from those outside. However, as the population presented with multiple instances of cranial and post cranial trauma, some of which identified by Stead (1991) and Dent (1983) could be readily tied to purposeful weapon use, it further supposes that conflict was more prevalent on the Wolds than the archaeological evidence would suggest. In a comparison of sites outside Yorkshire with a similar lack of clear

defensive architecture, at the site of Gussage All Saints in Dorset only one individual presented with injuries to both on his parietals, his left humerus and the left clavicle (Keepax 1990: 167). These injuries were interpreted as consistent with face to face combat and Keepax (1990: 168) concluded it was very likely this young adult male “died by violent means”. Beyond this, only one additional male presented with a rib fracture suggesting that 20% of people at Gussage All Saints were susceptible to traumatic injury. Whimster (1981) also cited three additional single instances of individuals with weapon wounds at non-defensive settlements. At Berwick St. John an old male presented with a healed fracture to his occipital, at Egginton in Bedfordshire At the Manor Farm a partially healed sword wound to the right tibia had become infected prior to death and at St. Merryn in Cornwall an unsexed skeleton was discovered with extensive cranio-facial sword injuries (Whimster 1981: 219, 227, 283). Clearly the fortified settlement of the Iron Age was not the predetermining factor for interpersonal violence. Although it is possible that populations outside of Yorkshire provided individuals for large scale warfare that occurred at or near the large hillforts in the south of England, as Collis (2005) suggests with central places, it appears more likely, with the limited evidence of defensive wounds reported on the radius, ulna and hands, that these acts of violence were random in nature as opposed to the result of formalised warfare.

To further support the belief that on the Wolds conflict was on a much smaller and less organised gradation, when sex of the individuals with fractures (both cranial and post cranial) was examined it was determined that more females were being injured compared to the clear majority of males outside of Yorkshire with 15,4% of males, 15.4% of subadults and 69.2% of females experiencing these injuries. Although Lovejoy and Heiple (1981) suggest that populations in which fractures are exhibited equally among the proportion of males and females, trauma is more likely to be accidental in nature, the clear bias towards females for this project suggests additional, unknown contributing factors that affected the well being of Iron Age females. In contrast, when all cranial and post-cranial fractures were combined for Bronze Age, males and females were equally affected with eleven injuries each. This suggests that there were different circumstances in the earlier period, but these period-based differences with regards to sex and fracture presence were not statistically significant.

6.2.4 *Quality of life between the periods*

Overall, for the Bronze Age population of the Yorkshire Wolds, although life was harder and more stressful during their developing years, for those that reached adulthood there was an overall decrease in the number of individuals experiencing pain and discomfort as a result of the environment and culture in which they lived. Though 83.93% of individuals experienced at least one significant and severe episode of stress during their childhoods, among adults that rate was reduced to 55.3%. In contrast, during the Iron Age 86.36% had evidence of

stressful developing years and 69.7% of adults exhibited a reduced quality of life, suggesting that childhood, adulthood and everyday obstacles resulted in a reduction of well being from the Bronze to the Iron Age.

6.3 Social Stratification on the Wolds

With the exception of a particular class of burials, Iron Age square barrows with inhumations and the remains of vehicles, there has been little discussion beyond conjecture on the presence, state and expression of social stratification on the Yorkshire Wolds in prehistory. Understandably, compared to other regions across both Britain and Europe, in which elaborate or extensive grave goods characterised clear sections of large cemeteries, on the Wolds, outside the large cemeteries of the Iron Age there is very little associated artefactual evidence that has been relied upon to signify class distinctions.

To complicate matters further, there has been a long held belief that individuals and groups buried on the Wolds represented a distinct section of society (Parker Pearson 2005; Fenton-Thomas 2005) based largely on the mortuary landscape. The suggestion by Greenwell (1877) that certain individuals in the barrows had somehow earned the right to be buried here while the majority of the population had not is difficult to prove or disprove. If these skeletons represented the chosen few, where were the masses? An absence of evidence regarding class divisions would only create a circular argument. If the theory suggested by Tainter (1973) were true with regards to energy expenditure being conferred to certain strata, then this would suggest that all those buried on the Wolds shared a common upbringing or adulthood. Additionally, if Tainter's theory were to be applied to the Wolds it would actually suggest a reduction in the social stratification from the Neolithic to the Iron Age, which seems very unlikely. The complicated nature of multi-burial during the Bronze Age and single burial in the Iron Age makes it exceedingly difficult to determine who would be considered the familial or societal heads and who were the help, if such a distinction existed. As there is a multitude of evidence that Bronze Age barrows were reused throughout the period, even the identification of the primary burial may not be sufficient to provide an indication of the power structure.

Although Gilman and co-workers (1981: 1) put forth the theory that in Europe the burials "leave no doubt that marked social inequalities emerged during the 3rd and 2nd millennium BC" there are no clear-cut examples to support this on the Wolds in Britain. Beaker burials do present an interesting complication. As not all of the Bronze Age burials are considered Beaker burials, it provides for the possibility that these were in fact a distinct group. However, the question of whether this distinction lies in their social status or their identification as non-locals still remains, and will hopefully be tackled by the Beaker People's Project. Although much more recently Parker Pearson (2005: 128) stated that during the late

Neolithic and Early Bronze Age in Britain there was evidence of the first chiefdoms and the hereditary transmission of authority based on the presence of subadult burials with rich grave assemblages, this too is difficult to corroborate on the Wolds. What follows instead is an attempt to examine osteological evidence for the different treatment of individuals at both the site and time period level in order to uncover what might be interpreted as social differentiation.

6.3.1 Social Differentiation Based on Sex

Three aspects of everyday life were used to help uncover patterns of social differentiation that may have been present on the prehistoric Wolds. Although childhood variables have been discussed with reference to the Wolds sample as a whole, here they are examined with regards to how these rates differ between the sexes, to uncover any sex-related bias in childhood. Dietary markers including those derived from caries as well as stable isotopes were analysed to establish carbohydrate and protein distribution between the sexes and evidence of skeletal degeneration was assessed to determine the equal or unequal division of labour.

6.3.1.1 Evidence from Childhood

Evidence of childhood stress, though discussed for the overall populations, is examined within this context to determine any possible preference or neglect that may have been based on the sex of the subadult. Obviously as it was not possible to sex the subadult skeleton, these findings were explored once they had reached maturity, which allows us to look back on their lives. If, however the neglect was strong to the point of death then the individuals of that sex who were present as adults represent the subadults that were able to overcome that trauma. Alternatively, those that were preferred, if such a distinction existed, would exhibit a clean skeleton with respect to LEH and CO, as individuals provided with a better diet and more hygienic environment were less likely to have these skeletal alterations (Storey 1998: 135). These variables have been examined in other world regions and time periods in order to help identify patrilineal societies and those that practiced son preference (Storey 1998), however, on the Wolds this relationship was explored through time to consider if the childhood experiences for males and females remained the same or if it altered as time went on.

Study	Site	Male LEH	Male CO	Female LEH	Female CO
Current Project	Pooled	72%	13.33%	76.90%	16.67%
	Garton Slack	42.86%	9.09%	50%	16.67%
	Rudston	100%	0%	100%	50%
	Cowlam	66.67%	25%	100%	0%
	Willerby Wold	75%	0%	N/A	N/A
	Garrowby Wold	75%	20%	100%	0%
	Staxton Beacon	100%	0%	100%	0%
Roberts and Cox 2003	Pooled	53.33%*	N/A	6.67%*	N/A

Table 6.21 Bronze Age childhood stress by sex.

Those rates reported with an asterix represent the percentage of the total population with LEH that could be sexed.

During their childhoods on the Wolds, both Bronze Age males and females were experiencing similar levels of stress suggesting that the taxing mechanisms in their lives, whether environmental, cultural or pathological in nature, were negatively affecting both sexes in equal proportions (Table 6.21). From these findings it suggests that there was no clear-cut favouritism or neglect inflicted on one hand, and therefore, although a stretch with respect to the limited evidence, that the entire population was equally likely to suffer the negative consequences of childhood stress. Interestingly, the one exception is the difference in rates of CO for males and females at Garton Slack. This was found to be a statistically significant association, suggesting there was site level variability in the type or manifestation of stress experienced by both sexes ($p=0.046$, $x^2=12.838$, $df=6$).

The CO presence between both sexes from the Bronze to the Iron Age was quite different, with male expressions completely disappearing and female rates increasing. This association was found to be highly statistically significant, supporting the theory that subadult females were increasingly stressed in the later period ($p=0.001$, Fisher's=0.002, $x^2=10.092$, $df=1$). Extrapolating from these findings poses problems with regards to the small sample sizes that were available, but on the Wolds it offers the possibility that males were beginning to be more buffered during their childhood years. However, based on the findings in Table 6.22, it suggested this phenomenon was site specific as Danes Graves males were more likely to exhibit LEH. This was not found to be statistically significant at the site level though, most likely owing to the small sample size of Danes Graves males with observable anterior dentition ($n=3$). As the per cent of both males and females with child indicators of stress was still high in the later period, which points to the early year experiences being in a landscape of malnutrition and morbidity which had a substantial impact on their quality of life (Storey 1998: 135), the fact that more males compared to females were surviving childhood without these indicators implies their childhoods were improving. Unfortunately, as it is not possible to sex subadults, it cannot yet be known if more females were dying as a result of differential treatment or access to adequate nutrition.

Study	Site	Male LEH	Male CO	Female LEH	Female CO
Current Project	Pooled	70%	0%	82.35%	23.81%
	Cowlam	N/A	N/A	100%	33.33%
	Danes Graves	83.33%	0%	66.67%	16.67%
	Melton	50%	0%	100%	33.33%
Stead 1991	Pooled	20%	N/A	40%	N/A
Roberts and Cox 2003	Pooled	16.67%*	N/A	41.67%*	N/A

Table 6.22 Iron Age childhood stress by sex.

Those sites identified with an asterix represent proportions of the total number of adults with LEH that could be sexed.

Overall, the majority of females that survived into adulthood were, whether purposefully or not, missing out on the basic necessities of life and/or subject to pathological conditions that played a direct role in their reduced quality of life during the Iron Age. Interestingly, when adults with stress (LEH or CO) were examined statistically with respect to period and sex, a strong association was found ($p=0.025$, Fisher's=0.048, $\chi^2=5.042$, $df=1$). This further corroborates the theory that females had a better chance of having a less stressful childhood in the Bronze Age. These findings are complicated by work by Roberts and Manchester (2010: 34) that suggests females have a better immune system adapted to handling physiological stress. Additionally, Ortner (1998: 82) suggests that differential access to nutrition by sex in childhood was and still is prevalent, which would imply that females were more likely to suffer from infections owing to their reduced immune system status brought about by malnutrition. However, in Chen and colleagues' (1981:66) analogous study of Bangladesi children, a culture in which dietary access was differentiated, it was not the exposure to infection that separated the sexes but rather the ability and speed of recovery, which illustrated that female children were ultimately less susceptible to mortality. This suggests that Iron Age Wolds females, may in fact have been even more stressed than the osteological evidence illustrates.

As Roberts and Cox (2003: 82) were not entirely confident, or aware of the methodologies employed to sex adults at the sites they pooled, there were inconsistencies with the distribution of LEH by sex. However, of the fifteen people in the wider British sample outside of Yorkshire with LEH eight were males, one was female and the rest were unreported, which superficially suggests that males were more stressed during their childhoods in the Bronze Age. However, the proportion of 12.3% of people affected is drastically below that on the Wolds. This implies that though males might have been more stressed off the Wolds, overall they and females had a much higher quality of life compared to the Wolds dwellers during their formative years. Within their Iron Age sample of eight sites, Roberts and Cox (2003: 102) determined that of the 12 adults with LEH (16.67% of the total sample), five (41.67%) were female, two were male (16.67%) and five were unidentified. These results, when compared to those on the Wolds, follow the same pattern from the earlier to later time

periods with males improving their childhood quality of life and decreasing their presentation of stress, while the number of females with stress increased both on the Wolds and in the wider British archaeological community.

In an assessment of Stead's (1991: 128) excavations of Iron Age cemeteries on the Wolds, although only 2.03% of the combined populations had LEH, which is drastically below the results determined for this project, of the five affected, two were females, one was male and for the remaining two the sex was not discussed. Unfortunately, these findings cannot be realistically used to support or provide an alternative theory on well being among males and females in their early years on the Wolds due to the unknown sex of two people. As the data available for Bronze and Iron Age Wolds populations is limited in general and even more so with respect to sex-specific findings, there is not a lot to compare and contrast. However, those sites and individuals used for this project clearly suggest that Iron Age females, during their childhoods were not receiving the equivalent care and nutrition or access to hygienic living conditions in comparison to males.

6.3.1.2 *Diet*

Diet was another factor that was considered in the assessment of Wolds populations. The relationship between diet and sex was superficially examined with respect to caries, and stable isotopic analysis in conjunction with plant and animal remains to uncover diet and the possible restricted access of high sucrose foods. Cucina and Tiesler (2003) argued that certain members within a population might have had higher caries rates as a result of their unique access to cariogenic or exotic foodstuffs, while alternatively their presence could be used to differentiate with possible high protein diets as Larsen (1997) established a correlation between high protein diets and low caries rates. As the physical evidence for diet on the Wolds, in terms of clear meat consumption (as opposed to animal remains provided as grave goods), plant remains and agricultural and food processing tools is quite limited, these findings represent an osteological basis from which to conduct further work. The Bronze Age site of Staxton Beacon and the Iron Age site of Melton were analysed for carbon and nitrogen content in bones and these findings along with those from the Bronze Age Beaker Project and the Iron Age site of Wetwang Slack are considered in conjunction with the osteological evidence to establish an initial understanding of equality with respect to access to food on the Wolds in prehistory.

During the Bronze Age on the Wolds it was determined that 64.58% of adults had caries and 8.28% of teeth had disease. This is above the normal range of reported proportions in populations dependent on agriculture (Lukacs 1989) and is much higher than the rate of 16.2% of people from 22 sites and 4.8% of teeth from ten sites that Roberts and Cox (2003) stated for their pooled British sites outside Yorkshire. This suggests that perhaps the Wolds

inhabitants were even more dependent on carbohydrates compared to their outer-Yorkshire neighbours; that they had better access to high sucrose foods such as fruits and honey (though the environmental evidence is lacking); or possibly that oral hygiene was not a priority for this population. When males and females were compared it was determined that almost even proportions of both sexes were experiencing this disease which, to extrapolate with respect to diet, would suggest that both had equal access to the same types of foodstuffs. Interestingly, however, off the Wolds Roberts and Cox (2003) reported that of those sexed with caries from their pooled sites, a much greater proportion of males exhibited caries in comparison to females. This may suggest that outside Yorkshire access to particular cariogenic foods had already begun to be sexually differentiated.

Study	Site	Males Caries	Females Caries
Current Project	Pooled	62.86%	69.23%
	Garton Slack	72.72%	83.33%
	Rudston	42.86%	33.33%
	Cowlam	75%	100%
	Willerby Wold	25%	N/A
	Garrowby Wold	80%	100%
	Staxton Beacon	75%	0%
Roberts and Cox 2003	Pooled from 19 sites outside of Yorkshire	65.5%	34.5%

Table 6.23 Bronze Age caries prevalence by sex on the Yorkshire Wolds.

At the site level, with the exception of Staxton Beacon in which the sole female was caries free, at all sites with both sexes (and therefore to the exclusion of Willerby Wold), they were closely matched in the proportion and number of individuals with caries (Table 6.23). Therefore, this supports the belief that diet with respect to cariogenic foods was not differentiated based on biological sex, or alternatively, that both sexes neglected oral hygiene to a similar and very severe degree! Rudston did present the lowest proportions overall, possibly implying less access or dependence on carbohydrates or high sucrose foods, or conversely, more of a reliance on protein compared to other sites (Larsen 1997). Although it might be tempting to propose that the higher 'status' people at Rudston were the ones without caries and therefore the individuals with better and more regular access to protein as Larsen's (1997) study highlighted, the small sample size generally rules out such extrapolations. Additionally, by this logic more than 50% of the population might have been eating sufficient amounts of protein to counteract caries formation, which is a much higher percentage than would be expected to form the upper echelons of society. More likely, it is possible that overall, this site had more access to meat products and simply relied on them more than their agricultural bounty. Alternatively, it might mean this population was more concerned about oral hygiene, but it is doubtful the population of Rudston was spending a great deal of their daily lives brushing and flossing in comparison to their neighbours!

Stable isotopic analysis was also undertaken on four individuals (one female, two males and one subadult) at Staxton Beacon in order to uncover additional information regarding carbon and nitrogen values. As the sample is very small it inhibits extensive inferences, however it was determined that the four individuals had access to and ate similarly composed diets with an average nitrogen value of 10.18 (SD 0.47611968) and carbon average of -21.04 (SD 0.17755958). However, when caries presence was considered in conjunction with the stable isotopic evidence it was determined only the young adult male (Sk 9) exhibited caries. It was determined that with respect to carbon, the male with caries exhibited the most enriched value, however the difference was not significant compared to the rest of the sample (Figure 6.3). Additionally, when nitrogen was examined, no pattern emerged with respect to caries presence and isotopic signal (Figure 6.4). Overall these findings suggest Skeleton 9 may have simply been more susceptible to this dental disease.

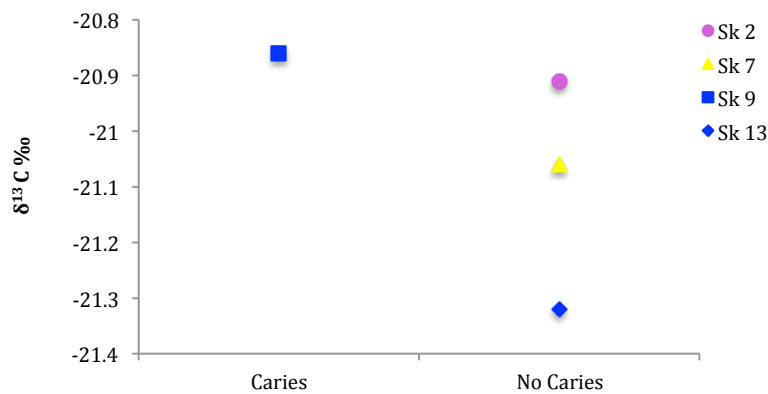


Figure 6.3: Carbon stable isotopic values against caries presence at Staxton Beacon.

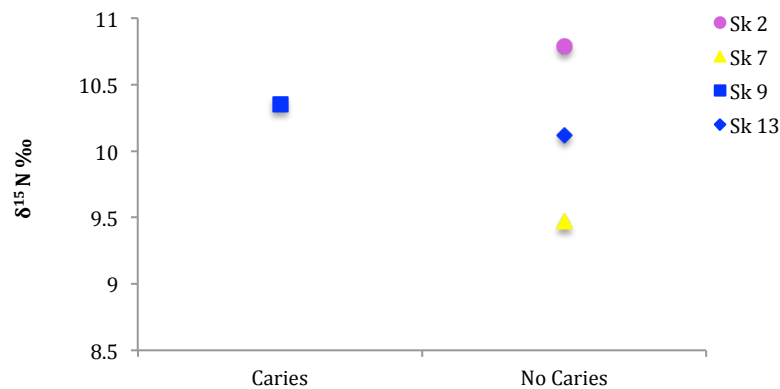


Figure 6.4: Nitrogen stable isotopic analysis and caries presence at Staxton Beacon.

Additionally, these stable isotopic values were considered in conjunction with associated grave goods in order to determine if there were any connections between artefact type and dietary signals. It was found that with respect to carbon there were no clear discernable patterns beyond the slightly enriched carbon signals attributed to those buried with a single type of grave good (Figure 6.5). However, this distinction was not large enough to imply a

statistical significance. When the nitrogen values were considered, once again it was the individuals with a single type of burial artefact that presented the most enriched values, though due to sample size no significant association was determined (Figure 6.6). These minor variations do point to a theoretical association between the variety of the grave good assemblage and the dietary signals, but a large number of additional Bronze Age Wolds samples are necessary to determine if an entrenched connection actually existed. It is hoped the extensive work associated with the Beaker People's Project may add to this understanding upon publication.

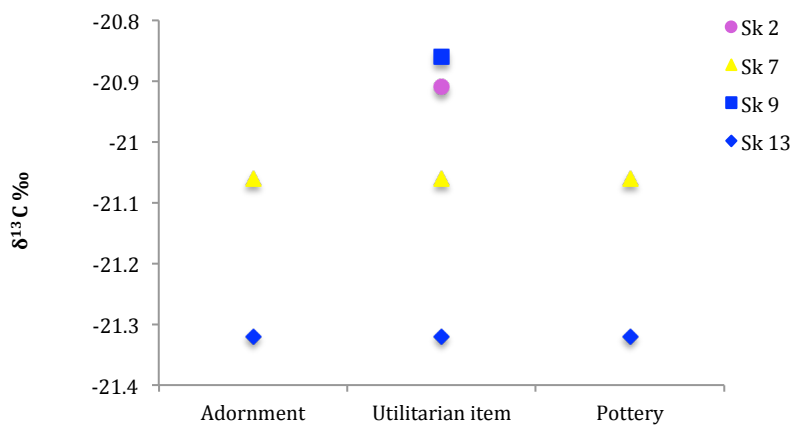


Figure 6.5: Carbon isotope values and grave good type presence at Staxton Beacon.

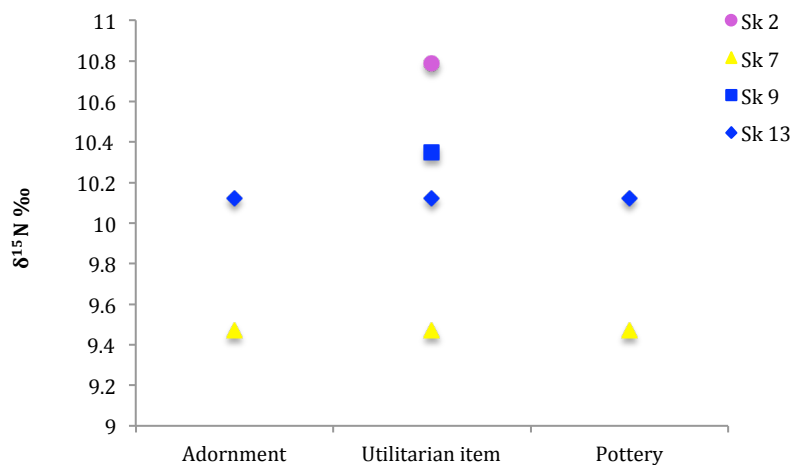


Figure 6.6: Nitrogen isotope values and grave good type presence at Staxton Beacon.

With the initial publication of a few isotope signals for Early Bronze Age Beaker skeletons from the Wolds (with Staxton Beacon values superimposed as the raw data has not yet been released), the current work falls within the range suggesting the Staxton Beacon values were typical for the region (Figure 6.7). As burial data was also not explicit, it is not possible at this stage to assess the connection between isotope values and grave good collections. Overall these findings suggest that animal protein was definitely terrestrial and formed an important component of diet for these individuals from Staxton Beacon. Unfortunately, an isotopic

signature can mask even high levels of carbohydrate consumption (Jay and Richards 2007: 183), therefore, these results cannot be used to corroborate the caries findings, but do provide support for the belief that diet was not differentiated based on sex in the Bronze Age Wolds populations.

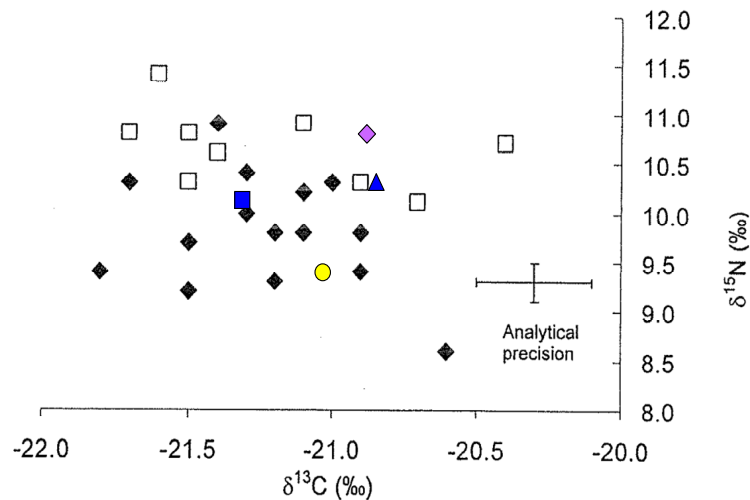


Figure 6.7: Stable isotopic values derived from initial Beaker People Project's results on the Yorkshire Wolds (in black and white) with Staxton Beacon data superimposed (with blue representing two males, pink a single female and yellow a single subadult).

In their initial work on the Beaker Project, on a selection of individuals from the Mortimer Collection on the Yorkshire Wolds, Jay and Richards (2007: 79) determined that if sex estimation was correct, the males presented elevated nitrogen values in comparison to females, which the authors speculated could be due to males consuming more animal protein relative to females. However, as the conclusion was based on an assumption of accurate sex estimation they were cautious in their theory. If their determinations were correct it provides results that are somewhat contradictory to those derived from Staxton Beacon with respect to isotopes, as both males had lower nitrogen values in comparison to the female. As caries rates were not examined by Jay and Richards (2007), it is unknown if this pattern is consistent with a dental disease. Unfortunately, as the population of Staxton Beacon only included one female, who, incidentally, did not have any caries, further isotopic work needs to be conducted on mixed-sex Bronze Age Wolds samples with equivalent levels of caries to determine if there actually is a connection between caries, biological sex and stable isotopes reflecting diet.

Study	Site	Males Caries	Females Caries
Current Project	Pooled	83.33%	42.86%
	Cowlam	N/A	66.67%
	Danes Graves	75%	41.67%
	Melton	100%	50%
Stead 1991	Pooled	17.89%	27.10%
Roberts and Cox 2003	Pooled (5 sites)	37.5% *	62.5% *
McKinley 1997a	Cockey Down	0%	14.3%
Keepax 1990	Gussage All Saints	6.25%	14.58%

Table 6.24 Iron Age caries prevalence by sex.

Those values with an asterix denote proportions of the total number of people with caries and not within each sex. The Roberts and Cox (2003) data does not include Yorkshire sites, Cockey Downs or Gussage All Saints.

During the Iron Age on the Wolds the emergent picture of diet and equal access takes a rather drastic turn compared to the preceding period (Table 6.24). Overall the proportion of adults with caries decreased to 57.5% of adults and 6.45% of teeth. The rate of males with caries increased by almost 20%, while that for females reduced by over a third resulting in almost half the rate observed for males. This distinction was found to be highly statistically significant with respect to sex and caries presence in the Iron Age ($p=0.007$, $\chi^2=9.835$, $df=2$). Based on the theories proposed for diet in the Bronze Age, these findings imply that in the following period females were no longer provided (or were able to obtain) cariogenic foods at nearly the same level as males. Furthermore, as the number of males with caries actually increased to almost 85% of the male population in the project sample, this further supports the belief that this was a sex-based differentiation, as age was not a contributing factor and rank or class would not be possible with such a high proportion. Among females, although it is certainly likely that some were still accessing these foods, due to the high proportion of males it is possible that it was their connection to these men, as partners, fathers, brothers or even sons, that enabled them to eat what had been unavailable to the majority of females. At the site level both Danes Graves and Melton mirrors these trends suggesting, on the surface, it was not a site-specific pattern. However, statistically, only Melton produced a significant association between sex and caries ($p=0.015$, $\chi^2=8.381$, $df=2$), which does imply that site-specific lifestyles did play a role. As Iron Age Cowlam is only represented by three female skeletons, all with caries, it presents something of an anomaly. However, as the sample is extremely limited and biased based on preservation, and as it has been reported that males were discovered here as well (Stead 1986: 12), it is not entirely possible to comment on the sex-specific findings, as they may not be representative of the wider Iron Age Cowlam trend.

Stead (1991) in his excavation of Iron Age cemeteries on the Wolds, along with Sheelagh Stead's skeletal analysis, reported entirely different caries rates with a pooled sample

proportion of 21.54% of the adult population, which translated to 27.1% of females, 17.89% of males and seven unsexed adults. These rates are dissimilar to those determined for this project in terms of overall rates, those for males and females and the disparity between them. Although location may have played a role with regards to access and crop availability between Melton and Stead's (1991) sites, the close proximity between them and Danes Graves negates this as a realistic explanation. Instead, while pure sample selection may be a contributing factor, it is probable that dietary selection and availability within sites accounted for the differences in proportion of people with caries. This theory is further supported by the rate of carious teeth between the two groups of samples. For this project, males had a rate of 10.14% and females 4.18%, in comparison, Stead (in Stead 1991: 131) reported a rate of 1.28% for males and 2.4% for females, which further hints that the populations of Cowlam, Melton and Danes Graves were more susceptible to caries, likely to be a result of diet or, conceivably, genetic variation. Perhaps, in this case, the populations explored by Stead (1991) were in fact exploiting more protein compared to agricultural products, while the sites under review here were relying more on carbohydrates.

Interestingly, Stead (in Stead 1991: 128) proposes that a calcium deficiency brought on by pregnancy was responsible for the increased number of females with caries as the stress of carrying a child would lead to a reduction in the quality of enamel and secondary dentine and therefore would have left them more susceptible to the dental pathology. However, at Melton and Danes Graves the majority of females were young adults and the presence of very young children implies that some were likely to have been mothers, and yet it is the females at these sites who were exhibiting a lack of caries in comparison to males. More recently, the calcium deficiency theory has come under criticism, as there is no modern clinical, scientific evidence to support it (Larsen 1998; Walker and Hewlett 1990). Although dietary insufficiency is a possible explanation, it is probably not a population-wide pathology, but rather one that may be genetic in nature, which may explain the difference in rates seen at these sites. In connection with this, the high rates of individuals with caries and carious teeth exhibited in the study sample might be evidence of a genetic predisposition to caries within these sites, and the fact that it occurred at two may just be a coincidence. If this theory is true, however, it does not cancel out the clear difference in pathological expression that was observed between females and males.

Roberts and Cox (2003: 101) report rates of 12.5% of people and 6.23% of teeth as exhibiting caries in their pooled Iron Age sample outside of Yorkshire. Interestingly, this is a decrease in the number of individuals but an increase in the number of teeth affected, suggesting fewer people were exhibiting more caries compared to the preceding period. There is once again disparity between the results outside and those inside Yorkshire with respect to number of

people with caries, but almost the exact same percentage of teeth affected. This suggests that on the Wolds, though more people presented caries, the actual number of caries per person decreased. Location in this case may play a role both with regards to what can be grown or grazed and access to wild and domesticated items, as the British sites were found in wide reaching areas including Wiltshire, Dorset, Winchester and Northamptonshire (Roberts and Cox 2003: 101). When sex was considered, more than twice as many females in comparison to males (13 to 6) were reported as exhibiting caries. As these findings are a pooled sample it is unlikely that all 13 females were experiencing a calcium deficiency following pregnancy, and as they are derived from several different sites it is not possible to comment on or determine any site level explanations for the sex-differences with respect to caries presence. However as the results are the opposite from that observed on the Wolds for this project with respect to sex-specific prevalence, it leaves open the possibility that diet, and specifically access to cariogenic foods, was not dependent on biological sex outside Yorkshire.

Interestingly, if the rates for both periods reported by Roberts and Cox (2003) are compared to those on the Wolds a pattern emerges which suggests that populations outside Yorkshire were exhibiting sexually-differentiated diets in the earlier period, while on the Wolds this was not observed until the Iron Age. As more work needs to be conducted on Bronze Age populations on the Wolds, it is unclear if this is merely an anomaly, but it presents an interesting theory with regards to the adoption of sex-specific roles and nutritional access. The site of Melton was further investigated using both carbon and nitrogen stable isotopic values to uncover an additional dimension about Iron Age diet on the Wolds. Overall, in comparison to the values determined for Bronze Age Staxton Beacon, the Melton population presented only slightly more elevated nitrogen values (average of 11.30, SD 0.6973515) and slightly less negative carbon values (average of -20.66, SD 0.25664241). The difference in carbon values was also observed by Jay and Richards (2007: 81) at Wetwang Slack and, as well and as opposed to dietary effects, an environmental explanation was suggested that proposed the change in climatic conditions, which affected deforestation, among other phenomena, and led to a progressively less negative carbon value from the earlier to the later period. With respect to the nitrogen value, however, it suggests an increased reliance on animal protein compared to that observed in the Bronze Age (Jay and Richards 2007).

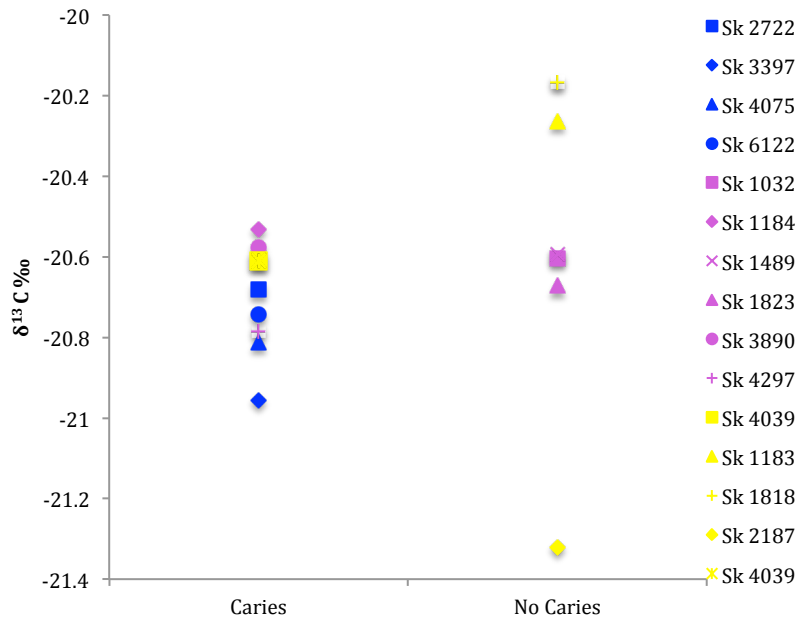


Figure 6.8: Carbon isotope values and caries presence at Melton.

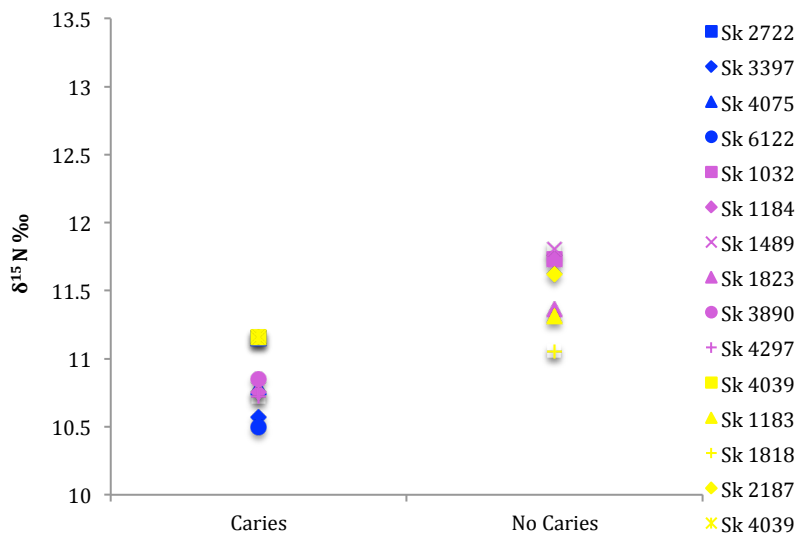


Figure 6.9: Nitrogen isotopic values and caries presence at Melton.

Caries presence was also considered in conjunction with both carbon and nitrogen signals among the individuals at Melton. It was determined, however, that with respect to both values independently no clear pattern emerged (Figures 6.8 and 6.9). However, carbon signals were found to be slightly more restricted among those with caries and they were also found to have slightly less enriched nitrogen values. This suggests that the presence of caries may not have been related to the consumption of animal protein, though as a high carbohydrate signal may still be masked, it is not possible to comment on the relationship between carbohydrate consumption and caries presence. The nitrogen findings do, however, suggest that females may have ingested more animal protein in comparison to males and when these results are combined with caries findings it provides for the possibility that

Larson's (1997) theory could be justly applied, as females presented with lower caries rates compared to males. To push this theory further, then, it may imply that females had better or more frequent access to animal products while males had more access to carbohydrates. Without placing any modern-day cultural constructs on prehistoric people with respect to the importance of animal products as signifiers of heightened social status, it presents us with an interesting conclusion.

Grave goods found in conjunction with individual burials were also considered in order to determine if the presence of a variety of types might be connected to dietary signals for both carbon and nitrogen (Figures 6.10 and 6.11). It was determined, however, that the signals did not exhibit an observable pattern with respect to either isotope, suggesting either the types or varieties of grave goods may not have been used to signify a societal distinction in life, or conversely that dietary signals and therefore differential access was not mimicked in death.

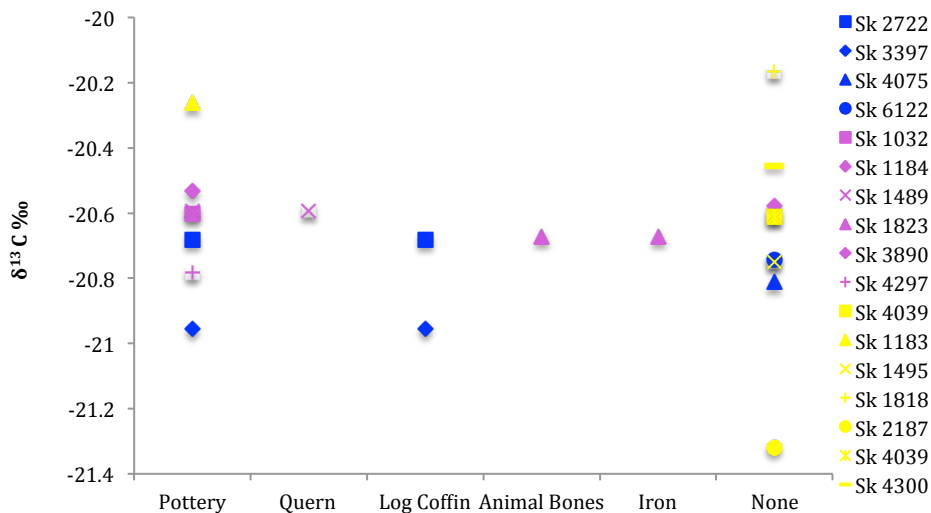


Figure 6.10: Carbon isotope values and grave good presence at Melton.

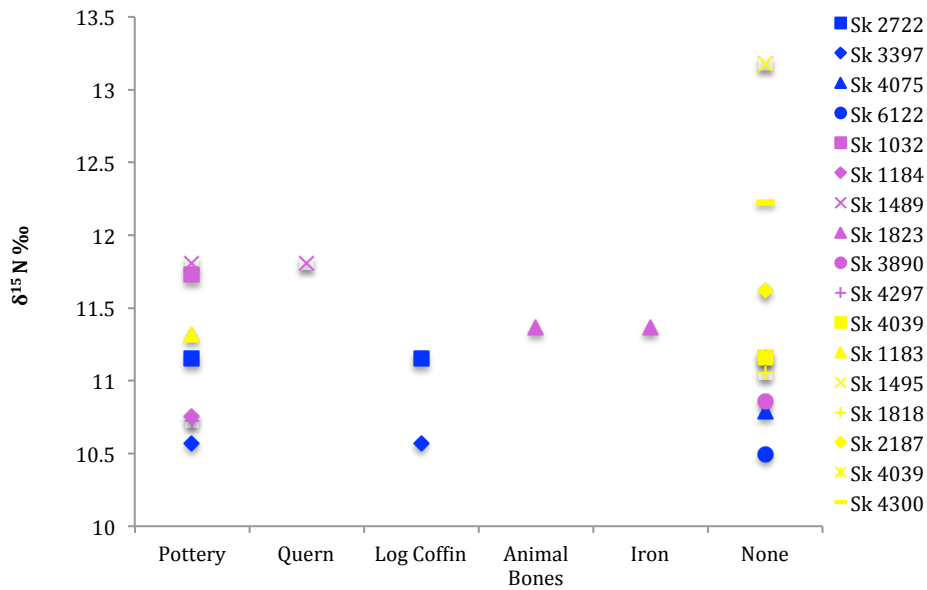


Figure 6.11: Nitrogen isotope values and grave good presence at Melton.

Finally, the extensive isotopic work conducted on the Wetwang Slack population by Jay (2005), as well as by Jay and colleagues (2008), enabled the consideration of site-level differences on the Yorkshire Wolds with respect to sex (Figure 6.12). Additionally the availability of local animal isotopic signals, though not necessarily directly comparable with Melton, do provide estimated signals attributed to a variety of Iron Age animals. It was found that, overall, both human populations were very consistent with one another, suggesting similarly composed diets between the sites. Interestingly an exception was found with respect to subadults. Those identified in Figure 6.12 representing a distinct and less carbon-enriched subset of the population. The large group from Wetwang Slack identified in the figure represent foetuses and newborn infants, their signals of which were interpreted by Jay and co-workers (2008: 336) as suggesting that infants had been weaned at an early age and therefore, by extension, that human milk had been restricted and supplemented by animal milk, plant based foods or a combination of both. Although only two such subadults were present at Melton with isotopic signals, it was interesting to note that they did not conform to this weaning pattern, which may suggest it was a site-specific phenomenon. Perhaps therefore, at Melton, infants were being weaned more gradually and at a later age. However, more values from Melton and additional Iron Age sites on the Wolds are necessary in order to determine the realities of this pattern.

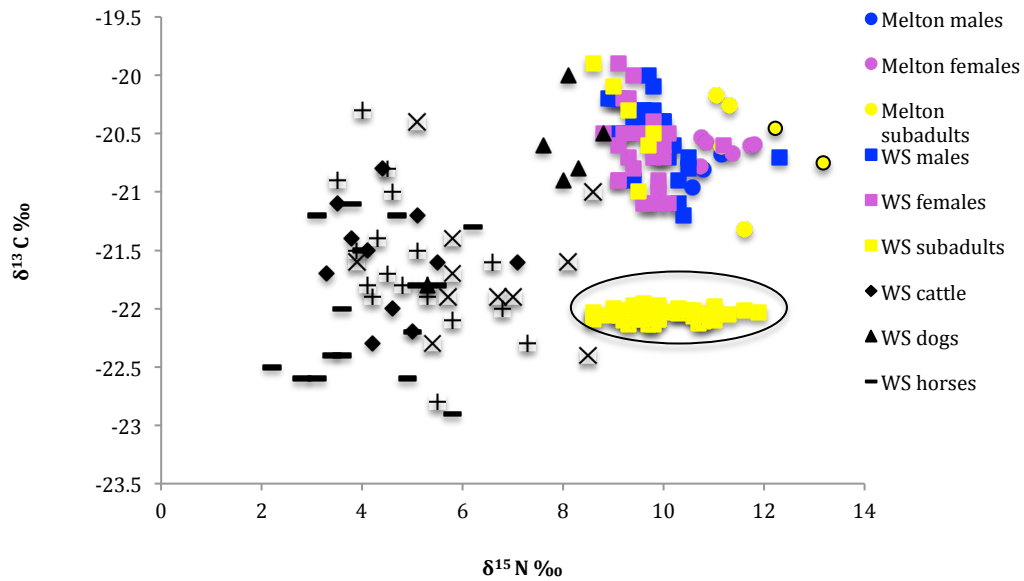


Figure 6.12: Combined isotopic values derived from Wetwang Slack and Melton, divided by sex.

The highlighted circle represents very young subadults at Wetwang Slack, while the two highlighted signals attributed to Melton represent similarly-aged subadults.

Finally, additional stable isotope signals were obtained from the Iron Age sites of Danebury and Gussage All Saints in order to evaluate the Yorkshire Wolds range in comparison to those attributed to sites in the south of England (Figure 6.13). It was found that the southern sites clustered slightly as more enriched carbon and slightly reduced nitrogen in comparison to those determined for the Wolds sites. This may be related more to the regional environmental variation, but it is an interesting observation.

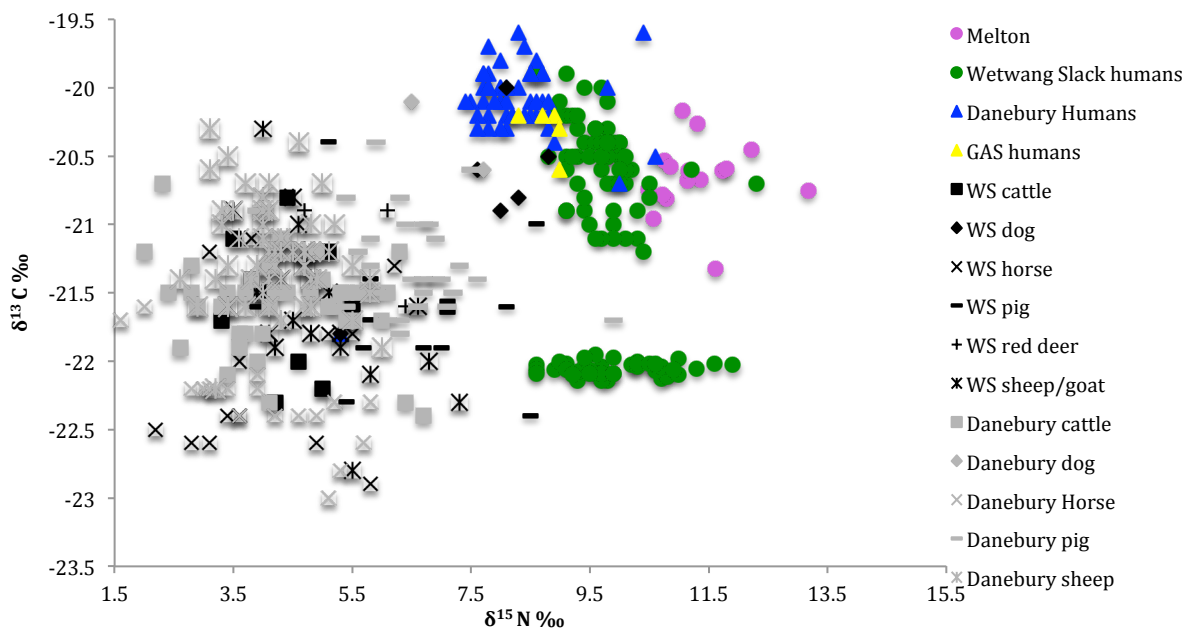


Figure 6.13: Combined carbon and nitrogen values for humans and animals at several Iron Age sites in England.

Although sparse, the environmental evidence at Melton also offers some interesting additional perspectives. Domesticated cattle, sheep/goats, pigs and horse were discovered at the site, however there was little evidence of wild animal exploitation, suggesting to Jaques and co-workers (2010) that either the settlement was low status, or conversely that the consumption of wild resources may have been subject to taboos (Hill 1995). During his excavations at Danes Graves, Mortimer (1911b: 50) commented on the lack of goats (whom it is believed he felt were wild) relative to pigs based on grave goods and also offered the suggestion that the consumption of their flesh may have been purposefully avoided. Additionally, at Melton, Fenton-Thomas (2010) determined that the cattle had been kept past maturity implying their use for by-products and as animal power before being used for food, while the sheep/goats were slaughtered at a young age suggesting they were relied on mainly for meat (Jaques *et al.* 2010: 292). When these findings are considered in conjunction with the isotopic work they raise interesting possibilities about who was gaining access to protein sources. Jay and Richards (2007: 180) theorised that high levels of nitrogen may be indicators of the consumption of weaned or recently weaned animals, and although they highlight suckling pigs, the evidence of young sheep/goats at Melton coupled with the elevated nitrogen levels among females, provides for the possibility that it was them who were regularly ingesting these animals, which, although a stretch, could suggest the male members of the population were eating the older cattle on a more regular basis.

In their bioarchaeological investigation into Iron Age diet at Wetwang Slack, Jay and Richards (2007: 180) determined that isotopic signatures were very similar across all adults and furthermore that there were no noticeable patterns of dietary discrimination based on age, sex, burial rites or any other explored variable. The values did suggest that the entire population was consuming high levels of animal protein based on the nitrogen signatures (which, as it happened were lower than those seen at Melton), however, unlike at Melton, and unlike their findings at Bronze Age Wolds sites, males and females did not present any apparent differentiation in consumption. When these results were combined with the caries rates as determined by Stead (in Stead 1991), suggesting that the theory regarding females and calcium deficiencies may in fact be corroborated, which further supports the theory that this was a site-specific phenomenon as patterns for both caries and carbon and nitrogen values were different between Stead's (1991) sites and those under review for this project. Further work on additional, unassessed sites on the Wolds is necessary with respect to both osteology and bioarchaeology in order to determine the true pattern that is prevalent in the region, however this mixture of findings points towards a restricted region with various diets and cultural practices with respect to access.

6.3.1.3 Skeletal Degeneration

Finally, skeletal degeneration, in the form of OA and VJD, though previously detailed with regards to the general patterns, was examined in the context of sex-specific patterns as they may provide an indication of the individuals involved in heavy manual labour or repetitive tasks, and how this can be related to one's place in society. The continuous or changing social customs with respect to these activities, or by extension occupations, are explored through time to uncover the relative positions of men and women on the Wolds (Kennedy 1989). When referring to the term occupation in prehistory, it is necessary to specify that this time period-specific definition does not refer to our modern cultural construct of occupation being synonymous with paid activity comprising a set of established work hours, but rather it refers to repetitive activities that may, or were likely to have been necessary for daily life and survival.

Study	Site	Male OA	Male VJD	Female OA	Female VJD
Current Project	Pooled	28.75%	50%	30.77%	0%
	Garton Slack	27.27%	0%	33.33%	0%
	Rudston	28.57%	0%	33.33%	0%
	Cowlam	0%	0%	50%	0%
	Willerby Wold	0%	0% #	N/A	N/A
	Garrowby Wold	60%	100%	0%	0% #
	Staxton Beacon	50%	75%	0%	0% #
Roberts and Cox 2003	Pooled	75% *	76.67% *	25% *	23.33% *

Table 6.25 Skeletal degeneration in the Bronze Age.

Those values with an asterisk denote proportions of a total sample with degenerative changes outside of Yorkshire and not of each sex, while those with hash marks represent sites and/or sexes without any observable vertebrae.

On the Wolds during the Bronze Age, although almost 30% of the populations had degeneration of the joints and vertebrae, it was discovered that both males and females were likely to develop OA, though with respect to VJD it was only the males that presented spinal degeneration (Table 6.25). As was expected the relationship between age and OA was found to be statistically significant for females ($p=0.042$, $x^2=6.35$, $df=2$) as no young adult females exhibited skeletal degeneration. However, no such relationship was uncovered for males despite OA also being confined to the middle and old adults. This suggested that Bronze Age males were likely to be involved in the majority of activities that required heavy, manual labour or excessive bending and stooping during their daily lives.

These rates overall were much higher than those discussed by Roberts and Cox (2003) from 13 sites outside of Yorkshire for OA and 22 sites for VJD, which additionally resulted in a total prevalence of 12.2% for OA and 14.1% for VJD. This suggests that the Bronze Age Wolds people were involved in more arduous activities compared to those outside of East Yorkshire. Although sex-specific information was not available for all sites, of those that detailed those

findings (n=12), 75% of sexed adults with OA were male and 76.67% of those with VJD were also male. The OA and VJD results imply that outside Yorkshire during the Bronze Age, males were predominantly affected and therefore involved in substantial labour-intensive work and repetitive activities, while females, though they did present some evidence, were largely free from these occupations. On the Bronze Age Wolds, these activities, which may have led to OA, appeared to have been more evenly shared by both sexes.

In contrast, during the Iron Age on the Wolds, although there was a slight decrease in the overall evidence of OA, when sex was examined it was found that the males were increasingly free from extra-spinal joint degeneration, while more females were presenting with the disease (Table 6.26).

Study	Site	Male OA	Male VJD	Female OA	Female VJD
Current Project	Pooled	8.33%	75%	33.33%	80%
	Cowlam	N/A	N/A	0%	0% #
	Danes Graves	0%	0%	25%	50%
	Melton	25%	75%	66.67%	100%
Stead 1991	Pooled	7.37%	26.32%	3.74%	80.37%
Roberts and Cox 2003	Pooled	100% *	80% *	0% *	20% *
McKinley 1997a	Cockey Down	50%*	50%*	50%*	50%*
Hooper 1984	Danebury	33.33%*	18.9%	66.67%*	26.32%
Keepax 1990	Gussage All Saints	66.67%	66.67%	57.14%	57.14%

Table 6.26: Skeletal degeneration in the Iron Age.

Those values with an asterix denote proportions of a total sample with skeletal degeneration and not of each sex while those with hash marks represent sites and/or sexes without any observable vertebrae. The Roberts and Cox (2003) data is based on two sites for OA and three sites for VJD and does not include Yorkshire, Cockey Down, Danebury or Gussage All Saints findings.

Sex and OA for the Iron Age was found to be statistically significant ($p=0.039$, $\chi^2=6.468$, $df=2$), suggesting there had been a significant shift in skeletal degeneration for females. Vertebral joint disease, in contrast, almost doubled in overall prevalence and between the sexes. As males slightly increased from the previous period, the number of females drastically increased from zero evidence to 80% of all females with available vertebrae. The association of VJD was also found to be highly significant with respect to period overall and period for females, while within the Iron Age sample the presence of VJD was significant for sex and site for both sexes overall and specifically at Melton (Table 6.27). These findings suggest a highly significant shift in the presence of spinal degeneration for both sexes, and imply a pivotal alteration in the lifestyle and habits in the Iron Age on the Wolds.

Variable	Probability	Value	Degrees of Freedom
Period and VJD	0.038	6.543	2
Period and VJD (females)	0.025	7.394	2
Sex and VJD (Iron Age)	0.002	16.787	4
Site and VJD (Iron Age males)	0.008	9.750	2
Site and VJD (Iron Age females)	0.005	15.034	4
Sex and VJD (Melton)	0.001	15.00	2

Table 6.27: Statistical summary of VJD.

When these results are considered in conjunction, they suggest that females were becoming more involved in detailed, repetitive and stressful activities, while in the Bronze Age both sexes were equally taking part. At the same time however, although in the Bronze Age the males might have been much more focused on the heavy labour involving lifting and carrying a great deal of weight, in the Iron Age both groups increased these endeavours intensely which took a toll on their spines. These results imply that for both sexes life became harder in the Iron Age, but activities appear to be increasingly differentiated based on sex, with females taking on more of the detail oriented work such as the preparation of animal hides which had an affect not only on their upper limbs but also the constant kneeling position they may have conducted this work in. To further support this difference the relationship between OA and VJD was significant with respect to all adults, adults in the Iron Age and at the site of Melton. Additionally, when presence of OA and VJD were combined, strong associations were found for Iron Age females and site as at Melton 66.67% of females presented both forms of degeneration while only 25% of males were similarly affected (Table 6.28).

Variable	Probability	Value	Degrees of Freedom
OA and VJD (all adults)	0.001	13.130	2
OA and VJD (Iron Age adults)	0.001	13.503	2
OA and VJD (Melton adults)	0.009, Fisher's=0.029	6.923	1
Site and (OA + VJD) (Iron Age adults)	0.007	9.808	2
Site and (OA + VJD) (Iron Age females)	0.014	8.597	2

Table 6.28: Statistical summary of OA and VJD.

At Stead's (1991) Iron Age cemetery sites, it was determined that the prevalence of OA among the population was quite low and with respect to males and females, only 7.37% of men and 3.74% of women had evidence of joint degeneration. These findings are contradictory to those at both Melton and Danes Graves and points to both a society in which repetitive and strenuous activities were not manifesting on the skeleton to the same degree as well as the fact that these activities had not become sexually differentiated in the same way, or really at all compared to the sites under review for this project. With respect to VJD, Stead (in Stead 1991: 138) found that 26.32% of males with vertebrae and 80.37% of females with vertebrae had evidence of spinal alterations. As the females here were very similar to those at Melton and Danes Graves it does offer the possibility of a certain amount of continuity. However it also implies that males were not involved to the same degree in activities which negatively affected the spine as they were at the project sites, which might ultimately suggest that, here too, females were involved in more of the labour intensive work than males, and the difference in skeletal expression may be entirely due to the different types of occupations being carried out. Though the sex specific details were sparse, Roberts and Cox (2003: 97), found that males were much more likely to exhibit degenerative changes with respect to both OA and VJD. As at other sites reported above there was a range of degenerative prevalence

for both sexes, which is suggestive of site-specific lifestyles and tasks rather than an Iron Age-period phenomenon with respect to labour.

Intriguingly, the excavation at Melton led to the discovery of sheep/goat metapoidals and phalanges in four deposits in post holes and pit fills of a non-ritual structure, which were interpreted by the specialists Jaques and colleagues (2010) as being associated with skin or hide preparation of an occupational, as opposed to ceremonial, nature (Jaques *et al.* 2010: 292). This evidence provides a potential connection between occupational activities and female OA, adding to the theoretical belief that this sex, on the Wolds, was involved in these types of repetitive tasks. A statistically significant relationship was found with respect to sex and OA at Melton as the prevalence of OA for females was more than twice that reported for males ($p=0.022$, $\chi^2=7.615$, $df=2$), adding additional weight to the sex-specific activity theory.

To extrapolate from these findings to discussions of social differentiation and, by extension, status within the Wolds population is difficult, as the social perceptions of these activities cannot be known. It is also problematic to suppose that females were becoming more involved in the domestic sphere or were increasingly relegated to these tasks while males appeared to be involved with activities associated with agriculture and land clearing. As the skeletal, archaeological and environmental material is not currently sufficient to make such sweeping generalisations, the evidence discovered and presented thus far simply implies the social realm of Iron Age Wolds life was leaning in this direction.

6.3.1.4 Demographic profiles through time

There is a clear difference in the demographic composition between the Bronze and Iron Ages. This may be partially attributed to sample selection, as it was biased towards the better preserved skeletons, but as there are a number of subadults in both samples, including very young infants and a foetus, preservation was not necessarily biased towards *robust* individuals. When the age distribution was examined statistically there was a strong correlation with respect to period and age for the whole sample as well as for females (Table 6.29).

Variable	Probability	Value	Degrees of Freedom
Period and age (total sample)	0.032	13.810	6
Period and age (females)	0.023	7.583	2

Table 6.29: Statistical summary of time period and age.

Based on the presence of middle and old adults, individuals appeared to be living longer lives in the Bronze Age, while in the Iron Age, people were apparently not reaching their life-length potential. Subadults in the Iron Age were also dying at an earlier age interval compared to their Bronze Age age-counterparts, as the youngest individuals then were children (aged 3 to

12), compared to a foetus and infants which made up 45.45% of the total subadult population in the Iron Age.

When sex of the adults were also considered, more females were dying at a younger age compared to males in the Iron Age, with 53.85% of females over 35 in the Bronze Age compared to only 23.8% in the Iron Age. Among males, in the Bronze Age 48.57% of males were over 35, while in the Iron Age 58.33% reached the same age. This connection between period and sex was found to be highly significant for the total population (with subadults identified as a third sex) as well as among adults (Table 6.30). Clearly, females were not able to achieve the longer lives that males were beginning to be accustomed to in the later period. As wide age ranges were employed, these differences should be seen as realistic and reliable.

Variable	Probability	Value	Degrees of Freedom
Period and sex (total sample)	0.002	12.349	2
Period and sex (adults)	0.001, Fisher's=0.001	10.728	1

Table 6.30: Statistical summary of time period and sex.

Combining the presence of very young subadults and young adult females, maternal and infant health and well being need to be examined as they are likely to be contributing, if not direct factors leading to death. This pattern was investigated at other Yorkshire Wolds sites including Garton and Wetwang Slacks excavated by Brewster (1980: 732-3, 739), the remains uncovered by Dent (1982) at Iron Age Wetwang Slack and Stead's (1991) excavations of Iron Age Kirkburn and Rudston, which identified very different rates of infant presence from the Bronze to Iron Ages. Additionally, a desk-based analysis of excavations by Mortimer (1905) at the Bronze Age sites of Garrowby Wold, Garton Slack, Rudston and Willerby Wold revealed very low proportions of infants (Figure 6.14). This suggests a major shift in the health and well being of very young subadults, further supporting the theory that infant mortality increased from the Bronze to the Iron Age on the Wolds.

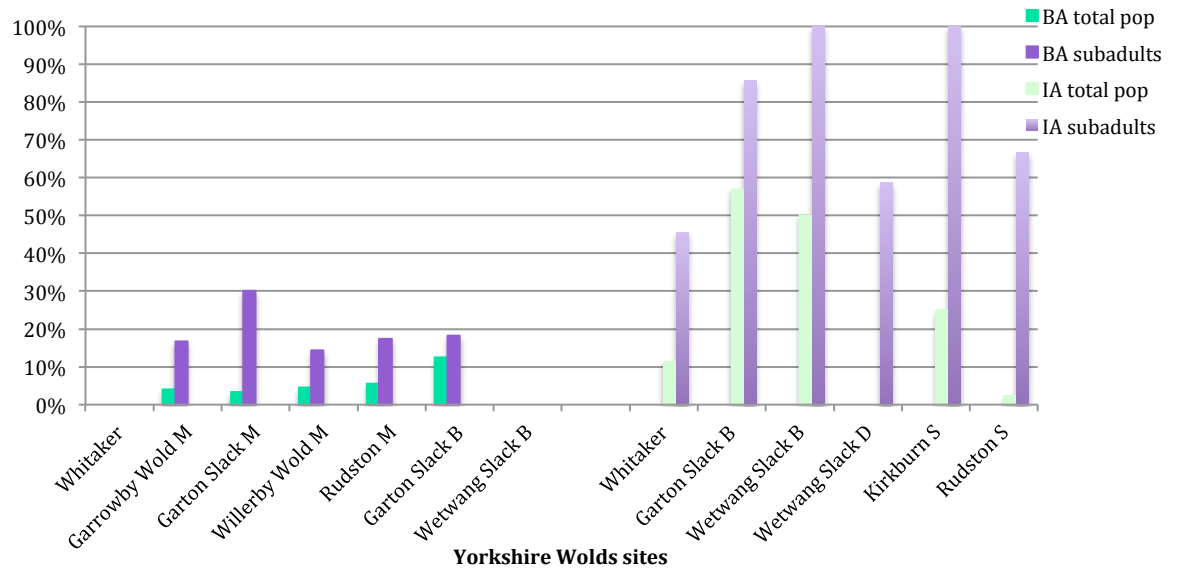


Figure 6.14: Percentage of infants within the total population and subadult subset for this project and other samples on the Wolds.

Abbreviations: M represents Mortimer's infant findings not included in the project sample, B represents Brewster's excavations, D represents Dent's excavations and S represents Stead's excavations.

The presence of young adult females was also inspected and although not all of the ages were reported for females, at Garton Slack 33.33% of Bronze Age females (three of nine) were determined to be less than 35 years, while for the Iron Age that proportion jumped to 66.67% (10 of 15) young adult females (Brewster 1980: 732). Although only a small sample to begin with, at Iron Age Wetwang Slack, 100% of females (n=3) were aged as young adult, compared to 60% (three of five) attributed to the Bronze Age. However in his more detailed assessment of the Iron Age in East Yorkshire (an assessment which he readily admits is lacking in skeletal data or discussion), Dent (2010: 66) does briefly mention that, among his findings at Garton and Wetwang Slack, a higher proportion of females were dying during peak child bearing years (17-25) compared to males. These results further solidify the theory that young adult females and very young subadults were experiencing less than ideal qualities of life and their daily experiences and health were likely to have been related to or have caused their deaths.

With respect to the adults, Sheelagh Stead, in the remains uncovered during Stead's (1991) excavations, determined 38.32% of females (41 of 107) died before their 35th year, compared to 27.12% of males (27 of 95), and overall 72% of the entire adult population died before they reached middle adulthood (Stead 1991: 127). Sheelagh attributed this female disparity to trauma associated with childbearing, and as two females were likely to have died during childbirth, with one buried with a newborn and another buried with a subadult in utero, it suggests that pregnancy may have led to a significant number of young adult female deaths (Stead 1991: 127, 136). Although these proportions are lower compared to those reported in this study and those uncovered at Garton and Wetwang Slack, they reinforce the persistence

of much younger subadults and more young adult females being discovered on the Wolds in the Iron Age compared to those in the Bronze Age.

Unfortunately, as age categories were not defined or consistently recorded by Mortimer and Greenwell, it is not possible to comment on the overall age at death of females they attributed to the Bronze Age. At the Iron Age cemetery site of Danes Graves, however, after multiple field seasons of excavations, Mortimer (1911b: 48) commented on the total absence of 'old persons', suggesting he had also noticed this age shift from his earlier Bronze Age excavations.

Outside of East Yorkshire, Roberts and Cox (2003) suggest there was evidence of obstetrics difficulties in Iron Age Britain, and identified a three-month-old foetus found buried in situ with its mother at Bishopstone in Sussex (originally reported in Wilkinson and Concannon 1977). Although they examined publication and site reports for 45 British sites, they did not draw attention to a single infant or foetus being uncovered that was attributed to the Bronze Age. Due to the unreported methodologies of estimated age, or the lack of age estimates within the publications and reports they examined, Roberts and Cox (2003: 5) did not provide a discussion of the age at death of males and females in Britain for either time period. Finally, Redfern and DeWitte (2011: 277) examined age patterns of mortality among Middle and Late Iron Age populations in Dorset and determined that infants had the highest risk of mortality among all age categories in comparison to the later Roman period, though no discussion was provided for adults by sex.

Although Brothwell (1972: 83) did not detail infant deaths in the British Bronze or Iron Ages, when compiling publications on female age at death outside East Yorkshire he found Bronze Age averages of 29.9, while among males it was 31.3. In the Iron Age in southern England, females appeared to maintain their average age at death with 29.9, while males slightly increased to 31.9. This pattern was not present on the Wolds among the females, but the males followed this increased age at death. Brothwell (1972: 84) also assessed the frequency of individuals reaching 50+ years and determined that in the Bronze Age 3.3% of adults reached that milestone, while among those attributed to the English Iron Age there was a marginal decrease to 2.7% of individuals. If these two factors are considered in conjunction, it may be that the females were the catalyst for the decrease in individuals attaining an age of fifty years, however as the figure was not broken down by sex it is not possible to assess this suggestion.

These results all indicate that the Iron Age period led to an increased risk to the length of life expectancy from birth with a large proportion of individuals (at some sites up to 57% of the population) dying during infancy. If however, they lived through this period, outside East Yorkshire adults could expect to live into middle adulthood, while on the Wolds the majority

of females died before they reached 35 years. When these findings were combined with those describing differential health and quality of life patterns, it was found that overall, on the Wolds in the Iron Age, females experienced a reduced quality of life during their childhood and adult years and upon reaching adulthood there were differences in food access and labour contributions that appeared to be entirely based on biological sex.

6.3.1.5 Summary

When all of these variables are considered in conjunction, including well being in childhood, dietary patterns and skeletal degeneration, it provides a glimpse of prehistoric life on the Wolds and lends itself to a number of socially relevant conclusions. From the Bronze to the Iron Ages it appears as though life altered a great deal for the inhabitants. Life became more taxing both in child and adulthood, life expectancy appeared to decrease and daily nutritional options were no longer equally available. When these characteristics were further explored however, it was actually the females that exhibited a reduced quality of life in childhood, suffered from more specialised skeletal degeneration, and were more likely to die in early adulthood than males. Each of these life altering changes may have a complex range of aetiologies and may also speak to a division of roles as opposed to a strict demotion of female worth, however when all were considered together, the Iron Age Yorkshire Wolds environment appears to be one that did not favour females. This is not to say that the preceding period was one of utopian ideals with males and females experiencing and sharing all aspects of life, but, with the exception of a differentiation in diet, which at this time is too complex to determine favoured foodstuffs, the remaining indicators negatively affected more females than males. Reasonably there is a possibility that this stress was not purposefully induced: Iron Age Wolds females were not able to cope as well as males, which ultimately, at the very least, led to the premature death of many young adult females.

6.3.2 Evidence of Class or Rank

Classically, and still today, archaeological inferences with respect to status have largely centred on associated grave goods as well as the manipulation and alteration of the landscape. On the Wolds, as these artefacts are often incongruent with the burial record (Pierpoint 1980: 9), the potential evidence of social differentiation has been examined through an osteological lens. As a number of sites were excavated in modern times and the antiquaries highlighted select instances that they felt were clear cases of social differentiation, this evidence was also considered within the context of osteology in order to determine whether there truly was an evidentiary basis and therefore any actual indications of status on the Wolds during the Iron Age.

6.3.2.1 *Class Distinctions in Iron Age cemeteries*

In Europe Collis (1997) determined that among the Hallstatt C communities, burials were set up as corporate cemeteries with clear lineage or social groupings, which further exemplified the social differentiation that was exhibited in their settlements. While in the La Tène C and D sites in central Europe, their Oppidae of dense settlement and specialised production provided clear evidence of a class system, on the Wolds, in contrast, as burials were the dominant form of evidence, these distinctions were much more subtle. The early, but extensive work by Mortimer and colleagues at Danes Graves as well as the modern large-scale cemetery excavations by Brewster and Dent at Garton and Wetwang Slack and the work by Stead at Rudston, Garton Station, Burton Fleming and Kirkburn provided the opportunity to explore archaeological evidence of status in conjunction with human remains.

Mortimer, based on his extensive digging at Danes Graves, proposed a theory based on the absence of grave goods within a certain area of the cemetery. These findings were coupled with the presence of not only a chariot burial (as he termed it), but also a number of additional burials with a range of grave goods, both with respect to the number present and their exotic nature (Mortimer 1911b: 47). Mortimer (1911b) proposed that the burials excavated in the southern area of the site (those opened in 1897, 1898, 1899 and 1900) were the high class members of the populations while those excavated in 1864, 1902 and 1909 in the northern area of the site represented the low class or poor members of society. This theory was investigated using the skeletons available from Danes Graves that were assessed for this project and the osteological assessment determined some interesting patterns.

Overall, there is a possibility that the theory suggested by Mortimer (1911b), with regards to a division of Danes Graves burial by wealth, is partially supported by the osteological evidence. The prevalent childhood stress throughout the population, in the form of LEH and CO suggests that class, if it existed, was not a buffer against early developmental period strain, as both the lower and higher class sections presented half the individuals with these enamel and skeletal alterations, and sex was not determined to be a factor in their presence or absence. The higher presence of caries among the lower class section may corroborate the archaeological evidence if the focus on carbohydrates and cariogenic foods is a diet for lower status individuals, and possibly, therefore that higher protein intake, speculated based on the reduced caries rates (Larsen 1997) of high class people, buffered them from developing caries. This association was found to be moderately significant with respect to the number of caries present and status among Danes Graves adults ($p=0.054$, $\chi^2=7.639$, $df=3$). Lower status individuals had a higher number of caries on average with 66.67% exhibiting one or more versus 33.3% of high status individuals.

The presence of such a high proportion of lower class people (46.2% compared to 10% of high status) with cranial fractures could be seen as supporting the theory, as these might either be due to violent altercations or accidents that may be related to a more hazardous work environment. Although not strongly statistically significant, there was an interesting relationship between status and cranial fracture presence among females ($p=0.038$, Fisher's=0.071, $\chi^2=4.286$, $df=1$). As 57.1% of low status females had fractures, compared to 0% of high status females, it suggests a theoretical pattern, but additional samples attributed to both ranks would probably clarify this relationship further. Only degenerative changes are puzzling. Although overall rates were low, among those identified as higher class (females only, as none of the males at the site had evidence of OA or VJD), their rates of OA were three times that of their lower class female counterparts (40% versus 14.3%), which suggests that these high class females were more active or involved in more labour intensive work. However, statistically there was no association suggesting this may have been an anomaly related to sample selection. As their joint locations (knee and hip) were not connected with specific forms of repetitive tasks or actions, and instead they suggest a more generalised activity that these young adult females were participating in.

With the exception of the degenerative evidence, these osteological findings lend support to Mortimer's (1911b) theory that the Iron Age cemetery of Danes Graves was divided or arranged by wealth. However, the limited statistical associations also point to the limitations of using grave goods as a marker of status, as there may be a number of explanations for their presence or absence. More work, however, needs to be conducted with bioarchaeological methods to provide a further level of understanding by exploring dietary composition across the site as well as evidence of childhood mobility, which may also be connected to perceived or real wealth. Additionally, and ideally, DNA work might determine family groupings within the cemetery and therefore the entrenchment of wealth divisions both in life and in expressions of death.

In comparison to these findings, the excavations conducted at the Iron Age cemetery complex including Rudston, Garton Station, Burton Fleming and Kirkburn by Stead (1991) and the extensive excavation carried out by Brewster (1980) and Dent (1982, 1983) at Garton and Wetwang Slack provided for a modern assessment of the possible evidence of wealth and prestige on the Wolds during the Iron Age. In their initial publications, both Brewster (1980) and Dent (1982, 1983) put forth the image of an area under use for several generations, with changing burial and settlement patterns as time went on. Although a majority of the graves did not have any evidence of grave goods, those that did, including three chariot burials, provided evidence of extensive and exotic goods. However, Dent (1983: 3) found that the

excavated settlement evidence, which included ritual enclosures and over eighty round houses, did not match up with this clear presentation of wealth.

In Stead's (1991) excavations he too aimed to uncover differences in burial rites and grave goods across the four cemeteries. Sheelagh Stead found patterns with respect to burial position, and in conjunction with that, the presence of particular grave goods, which enabled them to identify three distinct burial types. Sheelagh (in Stead 1991) concluded that, based on the presence of certain non-metric traits including metopism, wormian bones and dental crowding, it was possible to identify familial groupings within sites which suggested an attempt to regulate and define space within the cemeteries. However, the identification of status groups was not attempted at the time of publication, though that was a future aim.

Recently, Dent (2010) published a volume of pooled resources and findings from East Yorkshire during the Iron Age, and was able to make several conclusions regarding the social state of the Wolds at this time. Beyond the non-metric traits, Dent was able to also apply these findings to those at Garton and Wetwang Slack, and came to the same conclusions as Sheelagh Stead. He (Dent 2010: 68) also determined that, although grave goods were in part divided based on sex, there was no evidence of sexual discrimination based on burial quality. When he applied the burial types suggested by Stead (1991), and added a fourth which characterised many of the burials at Wetwang Slack, he found that types A, C and D, when found in contemporary settings, represented social differences. These findings presented an interesting conundrum as the settlement evidence did not suggest or support any evidence of status to the extent that the burials did. Therefore, Dent (2010: 81) concluded there was no evidence of a strongly stratified society on the Yorkshire Wolds during the Iron Age, although osteological evidence was not incorporated into his deductions. Dent's (2010) theories may be entirely accurate, and the archaeological evidence does, on the surface, support these findings. However, based on the osteological work conducted for this project, it would appear that during the later period of prehistory, males and females were not being treated and experiencing life in the same way. As this is not evident in the burials Dent examined, this actually raises additional questions as to the mechanisms behind this social differentiation that require additional investigation.

6.3.2.2 *Special Burials – Chariots and Carts*

One additional aspect of social variation warrants discussion within the context of Iron Age societies and those are the burials with clear influences from the continent but which, upon arrival (in the form of people or ideas) made their home for the most part in East Yorkshire. This involved the deposition of, most often, a single inhumation below a square ditched barrow. However, unlike the majority of those found in the region, these also contained the remains of vehicles and the horse trappings used to pull them (Table 6.31).

Publication	Year of Discovery	Site	Human Burial	Sex	Age	Stature
Greenwell 1906	18XX	Arras	Yes	M	OA	N/A
Greenwell 1906	18XX	Arras	Yes	M	N/A	N/A
Greenwell 1877	1877	Arras	Yes	F	MA	152 cm approx.
Sheppard 1907	?	Hunmanby	No			
Mortimer 1905	1849	Cawthorn Camps	No			
Greenwell 1877	1875	Beverley	No			
Mortimer 1897	1897	Danes Graves	Yes	M	YA	N/A
Kirk 1911	1911?	Pexton Moor	No			
Brewster 1971	1965?	Garton Slack	Yes	M	YA	175 cm
Brewster 1980	1965?	Wetwang Slack	Yes	F	YA	160 cm
Dent 1985	1984	Garton Slack	Yes	M	YA	N/A
Dent 1985	1984	Garton Slack	Yes	F	YA	N/A
Dent 1985	1984	Garton Slack	Yes	N/A	N/A	N/A
Stead 1989	1985	Garton Station	Yes	M	N/A	N/A
Stead 1989	1987	Kirkburn	Yes	M	N/A	N/A
Hill 2002	2001	Wetwang Slack	Yes	F	MA	171.91 cm

Table 6.31 Chariot burial discoveries in East Yorkshire.

Although there is yet to be an established name attached to these unique burials, whether that be carts or chariots, all who have excavated or assessed them agree that these vehicles were used by a select few and therefore implied individuals with considerable political power (Brewster 1976: 110; Dent 2010). Though Stead (1965) believed the Arras King's Barrow chariot owner was not an aristocrat who fought his way across the Wolds, he put forth the notion that this individual wielded considerable influence among his tribe of peaceful herdsman. With each additional discovery, from the first two uncovered by Rev. Stillingfleet at Arras to the most recent at Wetwang examined by Sheelagh Stead (in Hill n.d.), pages and detailed analysis have been devoted to every aspect of the vehicle construction from the wood used for the wheels to the lynch pins and nave hoops (Hill 2002: 412). However, despite the constant reference to status and power, beyond a few lines glossing over the sex, age and occasional stature estimation of the skeleton, virtually nothing has been published on the osteology and paleopathology of these *special* individuals.

Based on the reports by Greenwell (1877; 1906), Mortimer (1898; 1905; 1911b), Stead (1965; 1989), Brewster (1971; 1976; 1980), Dent (1985), and Hill (2002), the majority of skeletons belonged to males. However, the burial discovered by Greenwell (1877), one by Brewster at Wetwang Slack (1980), one by Dent (1985) and that discussed by Hill (2002) were female, which led the last author to comment that the significant proportion of females in these special graves raised additional questions about the role and status of women in the Iron Age. The majority of both males and females were aged as young adults (under 35) with the exception of the middle aged female discovered by Greenwell in the Lady's Barrow at Arras (1877: 457) and Hill's (2002: 410) middle adult female at Wetwang Slack, these

findings coincide with the established pattern of a younger age at death during this period on the Wolds. However, their ages imply two possible associations with respect to status. These individuals either represent a society with ascribed status which was conferred at birth, although that might lead to an expectation of a wider range of age ranges being afforded this burial treatment, or they represent an achieved form of status, and the fact that both males and females were able to be honoured with this burial rite implies that sex may not have been a barrier to increased individual wealth and prestige.

Sheelagh Stead (in Hill n.d.: 18) commented on the issue of status with respect to the dental attrition exhibited in the middle adult female. As her teeth reflected a younger age than her skeleton suggested, Stead surmised it may have been her inherited “better than average genes” that provided her with higher quality enamel as well as access to superior nutrition resulting in less wear on her teeth. Furthermore, as this female had a higher stature than those females excavated by Stead (1991) and also the males from Rudston and Burton Fleming, she further postulated that it was her status differentiation that enabled this female to attain a more prominent height. When her height was also compared to those females excavated by both Brewster and Dent (157 cm and 156 cm respectively) it would support the theory that her status had indeed buffered her in some way during her developing years.

Overall, beyond the basic demographical information, osteological evidence from these burials is sparse. Rolleston (in Greenwell 1877: 457) commented that the female discovered at Arras had considerable muscular strength, while Brewster (1971: 291) determined that the male at Garton Slack was also robust, had lost two teeth earlier in life and, although a possible explanation was not provided, presented with his left leg being shorter than his right. In a later publication Brewster (1976: 113) mentioned that the male may have also had an abscess or a brain tumour, however no further information was available. Sheelagh Stead’s assessment of the Wetwang Slack female chariot burial also included some interesting discoveries. It has been reported elsewhere (BBC Meet the Ancestors *The Chariot Queen*, originally aired February 19, 2002) that this female presented a facial deformity. However, upon inspection of the skull by Brothwell, as well as more detailed radiographic and macroscopic analysis by Stead, it was concluded that this alteration was the likely result of post mortem deposition and not a pathological process. Further osteological analysis determined the female suffered from a single severe caries in the molar of her right maxilla, an abscess also in the right dentition and had lost a single right second molar in her mandible earlier in life. She also had evidence of mild LEH, which contributes to the theory that females, irrespective of status, were dealing with non-specific stress in their childhoods. Furthermore, Stead (in Hill n.d.: 19) determined the female had experienced either a blow to the jaw or a fall, which resulted in the secondary fracture of three molars. Additionally, this resulted in

secondary OA in her right TMJ, which led to the disuse of the right side of her dentition. Her right shoulder also had evidence of severe OA with eburnation, and Stead (in Hill n.d.: 19) postulated this may be the result of an earlier fall or rigorous and repetitive use of the joint. When the damage to her dentition and shoulder as well as the OA in her TMJ, were considered together, they all appeared consistent with a fall from a height, such as from a horse or chariot. Finally, the presence of VJD throughout her spine further supports the suggestion that this female had been engaged in intensive and repetitive activities (Stead in Hill n.d.: 20).

For this project it was possible to assess the skeleton discovered by Mortimer at Danes Graves in 1898, which he determined to be the chariot owner. Although, as usual with antiquarian work, only the skull had survived the trip from the earth to the collection, it was established that the individual was a middle adult male with no evidence of LEH, CO, caries, AMTL, abscesses, cranial trauma or OA in the sole joint (TMJ) available. As there is very little evidence to work with, the conclusions may be limited, however, among the other individuals Mortimer (1911b) theorised to be high class at Danes Graves. This male was the oldest adult and followed the established pattern within his class with respect to limited LEH, CO, OA, and trauma among the males, but he was the only high class male without caries, which may suggest a further division within the classes with respect to carbohydrates and protein, or it may mean he was genetically predisposed to stronger and more impervious enamel which limited their expression. This suggestion may be superficially supported by Stead's findings at Wetwang. From this partial evidence, it is possible to say that strictly with respect to LEH and CO he did not have a stressful childhood, though due to the complete lack of post-cranial elements it is not possible to comment on the stress he may have experienced as an adult.

6.3.2.3 *Summary*

Status and the social differentiation of individuals in prehistory is a complex aspect of community and regional life on the Wolds. Osteologically as well as archaeologically, the results presented do not provide a clear answer with regards to the question of whether class or rank was evident on the Wolds. Although there are some clear differences based on burial rites, the osteology suggests that the theoretical status was not, in and of itself, a barrier to non-specific stress in childhood, adult skeletal degeneration or trauma. Therefore, it would imply that had there been a social hierarchy, the extent of the differentiation was not entrenched enough to impact health and well being to a significant degree. However, differences based on biological sex were statistically more apparent in the Iron Age compared to the preceding period. Despite Harding's (2000: 434) theory that by the end of the Bronze Age most areas in Britain had "developed tribal organisation, a high degree of political centralisation and powerful elites" this does not appear to be the case, even in the later Iron

Age, on the Wolds. The implication, therefore, is that this region was indeed different from areas outside Yorkshire and this instead points to a situation in which individuals were still subject to a reduced quality of life as a result of lifestyles and the local environment. However, unlike in the Bronze Age, males were becoming better adapted (with or without cultural intervention) to the Iron Age way of life.

6.4 Mobility on the Yorkshire Wolds

Population and small-scale movements have been identified as the root causes of artefact distribution, cultural diffusion and conflict brought about by the influx and/or invasion of outsiders. The simplistic correlates of a distinct feature at archaeological sites with foreigners is no longer the assumption in archaeology today. However it remains a natural initial assumption that requires a multidisciplinary approach in order to uncover the true connection that may exist between the movement of people or ideas throughout the prehistoric landscape.

6.4.1 Variability on the Yorkshire Wolds

Two sites were examined in detail to uncover the possible evidence of movement within the lifetime of individuals buried at Bronze Age Staxton Beacon and Iron Age Melton. Strontium isotopes, derived from two molar teeth were used as a correlate with hypothetical migration in order to determine the homogeneity or heterogeneity with respect to individual members during their childhoods. When the results were assessed against those published by Cooper (2004) from the Bronze Age sites of Towthorpe, Calais Wold and Aldro, along with the Neolithic/Bronze Age and Iron Age individuals from West Heslerton (Montgomery *et al.* 2005), it was found that those assessed for this project fit into the expected range of mobility seen at other sites on the Wolds (Figure 6.15).

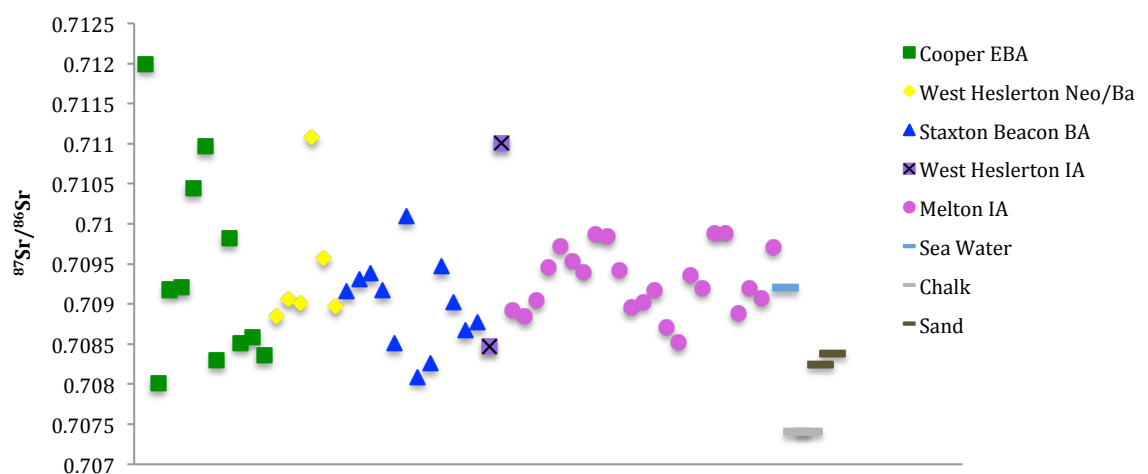


Figure 6.15: Strontium values determined for Bronze and Iron Age sites on the Wolds.

These results suggest that throughout the Wolds there was a mixture of migrations back and forth in the region. More specifically, however, it implies that mobility was more likely to have taken place at the individual level as opposed to small-scale group migrations. Interestingly, unlike the results reported by Montgomery and colleagues (2005), there does not appear to be a similar migration root, as those identified as non-locals at the site level were equally variable in their signals, both for the earlier and later developing years, based on rates determined for the first, second and third molars. As no significant association was determined between all of these results (ANOVA between group p value = 0.065424) it supports the theory that the degree of mobility between sites was negligible, suggesting instead that the catalyst for movement was at the individual level. These results were also separated by sex to determine if any sex-specific mobility could be detected in the Bronze or Iron Ages (Figure 6.16).

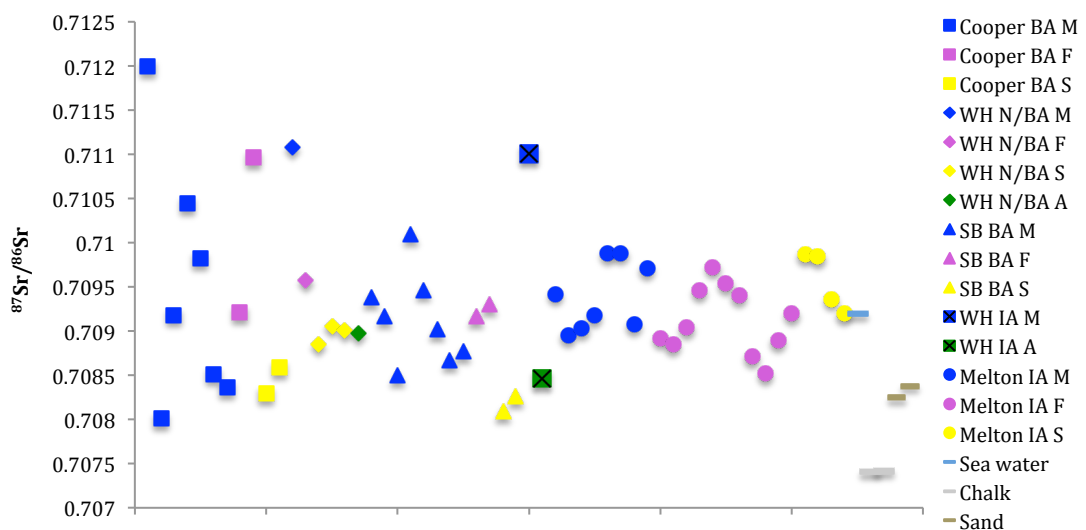


Figure 6.16: Strontium signals from multiple prehistoric Yorkshire Wolds sites, identified by sex.

WH= West Heslerton, SB= Staxton Beacon, M= male, F= female, S= subadult, A= unsexed adult.

Interestingly, it would appear that during the Bronze Age on the Wolds there was, overall, more variability with respect to strontium signals, and for both males and females the earlier period exhibited a wider range, suggesting there may have been more mobility in the Bronze Age (Figure 6.17). Values attributed for the Iron Age appear to be more tightly clustered, suggesting a reduction in movement, and as there were fewer signals consistent with a non-local environment it provides for the possibility that these individuals were operating within a more restricted region. However, as there are still values that reflect a different signal than that attributed to the Wolds (between 0.707 and 0.7092), it suggests that some were still venturing further afield than the type of homogeneous chalk environment in which they eventually were buried. Interestingly, the subadults from the Iron Age exhibited an upward shift in their values compared to those attributed to the Bronze Age. As the signal for Bronze

Age subadults is consistent with a region similar to the Yorkshire Wolds, and that for the Iron Age is not, it suggests that certain individuals in the Iron Age were more likely to have spent part of their developing years away from a homogenous chalk environment. As the sex of these individuals is unknown it cannot be assumed that this is a sex-specific pattern. When the males for both periods were investigated it was found that each group exhibited similar, though non-local averages. Conversely, among the females the Bronze Age average was above that determined to represent a local signal, while the Iron Age females had an average that was consistent with a homogeneous chalk environment. This may suggest that both males and females were moving about the landscape, while in the later period, it was the males that were more likely to be mobile.

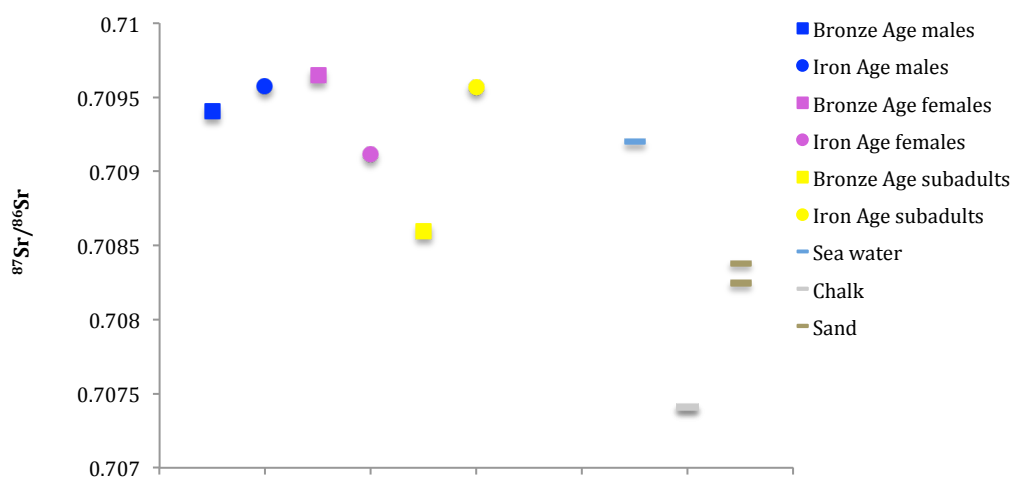


Figure 6.17: Average strontium values in the Bronze and Iron Age on the Yorkshire Wolds.

Finally, individual tooth values were also considered. As each mineralises at a different age, it is possible to assess whether age was a factor in the presence of a local or non-local signal, and therefore, by extension, if age was a correlate with mobility (Figure 6.18).

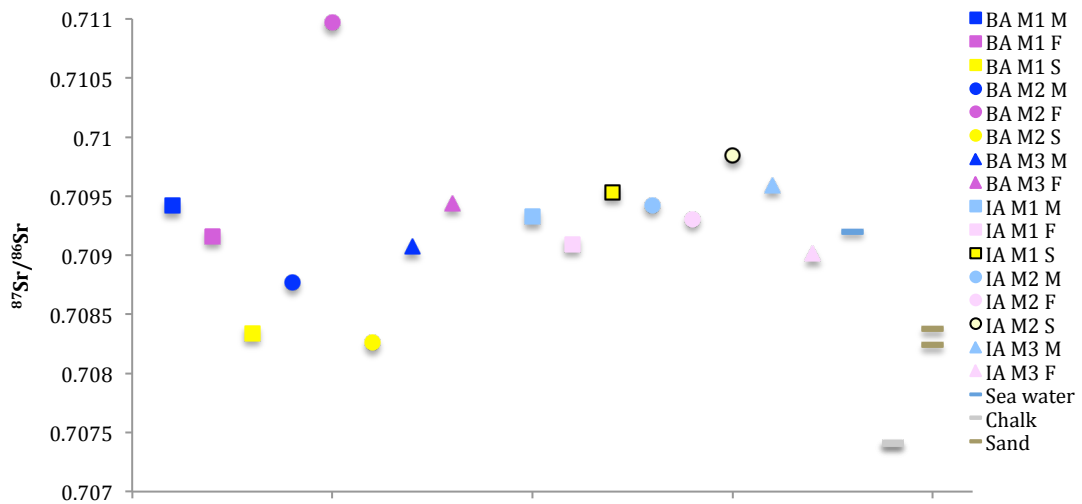


Figure 6.18: Representation of molar teeth with respect to average strontium values by both sex and time period.

Interestingly, there were several shifts with respect to average strontium signals for both males and females. The first molars are representative of the mineralisation of enamel that takes place between the ages of one and three (Hillson 1996). For both males and females it was found that, from the Bronze to the Iron Ages there was a slight decrease in strontium signals, possibly indicating a reduction in mobility from the earlier to later period. However, as the signals still remained above that determined to represent a local homogeneous chalk environment, it suggests that there was still a mixture of individuals both remaining in and moving about the landscape. The second molar mineralises between the ages of four and seven and it was found, on the Wolds that among males there was a theoretical increase in average strontium signals from the Bronze to the Iron Ages. Additionally, this average shifted from a local signal to one consistent with a non-homogeneous chalk environment, which may imply that an increased number of male subadults were travelling further afield than the Yorkshire Wolds region. In contrast, there was a decrease among females from the earlier to the later period, which may on the surface imply a reduction in mobility, however both signals still remained above the local range. The Bronze Age female M2 signal, however, is not likely to be representative of a larger Bronze Age trend. The average is only represented by a single value, derived from West Heslerton, which Montgomery and colleagues (2005: 135) concluded was likely to represent a migrant who had come from another area in Britain including the north and the west. Therefore, for females aged between four and seven, the extent of mobility from the Bronze to the Iron Age is still unclear.

Finally, the third molars represent the latest period of tooth mineralisation which correspond to a wider age range of between seven and 13, and it was determined that males continued to exhibit increased levels of mobility from the earlier to the later period. Additionally, the average signal also shifted from one denoting a region consistent with a homogeneous chalk

environment to one suggesting non-local landscapes. Among the females, however, the trend of decreased mobility exhibited in the first molars was also observed in the later subadult years, with a shift from a non-local average signal in the Bronze Age to an average value consistent with the Wolds region in the Iron Age. These findings suggest that movement between regions may have been connected to the sex of subadults, though as it is not possible to identify the theoretical parents and therefore their complementary movements (assuming these subadults were not venturing out on their own before the age of 13), it is not necessarily probable that this theory can be explored in more detail. However, if additional Yorkshire Wolds samples are obtained that support this trend among males, it may shed further light on the mechanisms involved in prehistoric movement in England.

6.4.2 *Presence of artefacts as correlates for mobility*

Artefacts uncovered in association with burials on the Wolds have led to the identification of Early Bronze Age Beaker people as well as the continental remnants of Early Iron Age La Tène and Arras populations. Although these items create inferences of a distinct subset of individuals or groups, the direct correlation between the people buried with these items and their non-locally-derived cultural affinities is, at this stage in prehistoric archaeology, conjecture. Off the Wolds, in the south, the stable isotopic analysis of the Amesbury Archer did indicate a continental origin, one that paralleled that based on the associated grave goods. However, subsequent studies, such as that by Evans and colleagues (2006) on the Boscombe bowmen determined that a Beaker veneer was not necessarily indicative of a community movement, but rather small scale and individual mobility in some cases (the related multi-person burial), and no evidence of extensive migration in others.

As the Beaker People's extensive study of Early Bronze Age movement is still ongoing, it is unclear what the ultimate interpretation of Early Bronze Age burial rites and mobility will reveal. Based on the available evidence, however, it appears the relationship between the presence of distinct grave goods and labels of non-locals is far more complex. This project analysed the strontium values of six individuals from the Bronze Age site of Staxton Beacon in order to uncover evidence of mobility in its various forms. Additionally, these values were set against the grave goods found in association with these individuals to examine whether it was realistic to make inferences based on their presence (Figure 6.19).

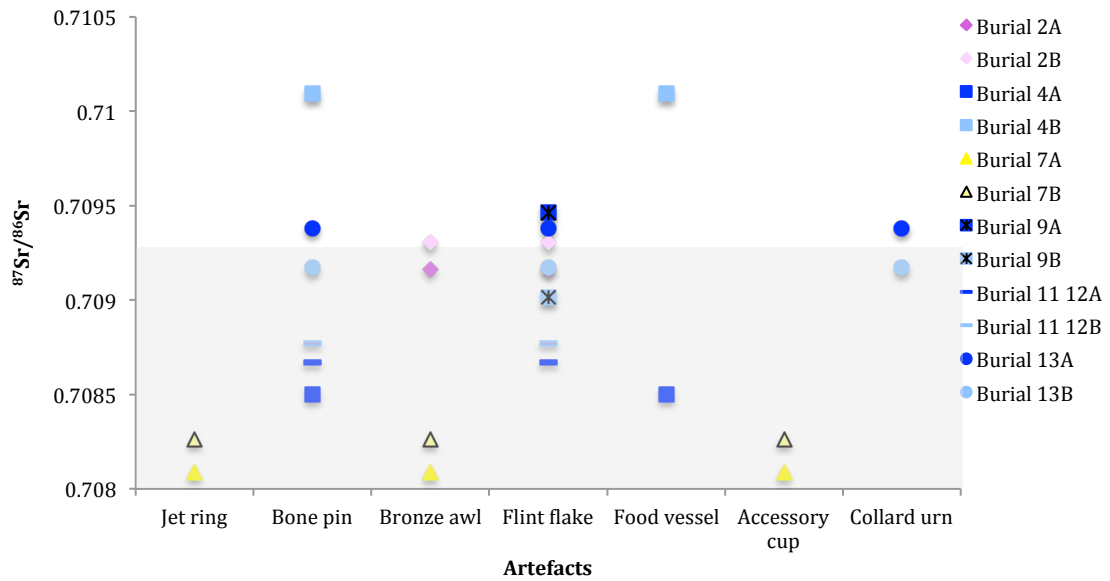


Figure 6.19: Burial presence of artefacts against strontium signals determined at Staxton Beacon.

The shaded area represents the local Yorkshire Wolds signal as determined by Montgomery and co-workers (2005). Symbols have also been coded for sex with blue representing males, pink representing females and yellow signifying subadults.

It was determined that flint flakes and bone pins were items provided for those with and without a local signal, suggesting they could not be used to differentiate individuals. Additionally, only males were found in association with bone pins, which may point to a sex-specific deposition practice, however additional samples are necessary to determine whether this is a chance encounter or a standardised burial item at this site.

Dent (2010: 37), in his discussions of Early Bronze Age grave goods determined it was rare, and therefore, by extension, important to discover pottery and metal in the same burial context. One individual from Staxton Beacon, an adolescent (Sk 7), was found with a small accessory cup, a jet ring and a bronze awl. When the strontium signals of this subadult were examined in light of Dent's assertion, it was discovered that both the M1 and M2s revealed values that were consistent with a homogenous chalk environment, such as that on the Wolds (M1= 0.708089, M2= 0.708261). Although Dent (2010) did not elaborate on his theory regarding the type and meaning behind the importance of pottery and metal grave artefacts, without further work their mixed presence does not seem to signify or differentiate this individual in any way. With respect to the osteological evidence, this subadult was the only individual without evidence of non-specific stress (of those with anterior dentition and orbits) and did not have any dental diseases, which may point to a more culturally buffered individual in comparison with the others buried in the barrow. However, they were the only individual with a cranial fracture, that likely contributed to death. These findings pointed to an accidental demise and when the grave goods are considered in conjunction with these findings it may suggest their placement was more related to the unexpected nature of their

deaths, and not necessarily their status within the group or their theoretical identification as a local.

When sex of the individuals in the barrow was considered in conjunction with condensed artefact types (adornments, utilitarian items and pottery), it appeared as though males were more likely to have a variety of grave goods (Figure 6.20).

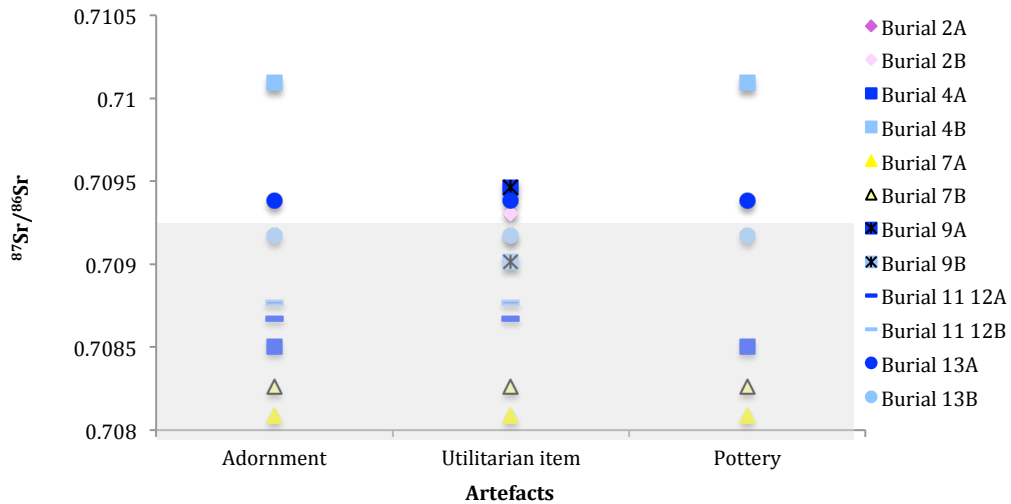


Figure 6.20: Burial presence of condensed artefact types against strontium values at Staxton Beacon.

Adornment items include jet rings and bone pins, utilitarian items include flint flakes and bronze awls and pottery includes food vessels, accessory cups and collard urns. Although not visible, the strontium values for Skeleton 2A are almost identical to Skeleton 13B and therefore are imposed on one another (Sk2A= 0.709165, Sk13B= 0.709171). The shaded area represents the local Yorkshire Wolds signal, as determined by Montgomery and colleagues (2005).

As there was only a single female in the barrow, who, possibly coincidentally was buried with utilitarian items to the exclusion of personal adornments, and additionally the single subadult buried with all three types of artefacts, it may illustrate the initial formation of another sex-specific grave good pattern, however this is highly speculative considering the limited sample size. Interestingly, the Amesbury Archer, also a male, was buried along with a wide variety of items (Fitzpatrick 2002: 630), which may add to the speculation, but does not provide enough evidence to justify this sex-specific distinction.

The results obtained by Cooper (2004) were also considered within the context of grave goods that Mortimer (1905) stated were found in association with the burials (Figure 6.21). However, despite the addition of nine further individuals, no discernable pattern emerged. This was likely to have been hampered by the limited number of females (only two when both samples were combined) suggesting that until additional females are sampled it may not be possible to equate burial goods with a local or non-local signal on the Wolds.

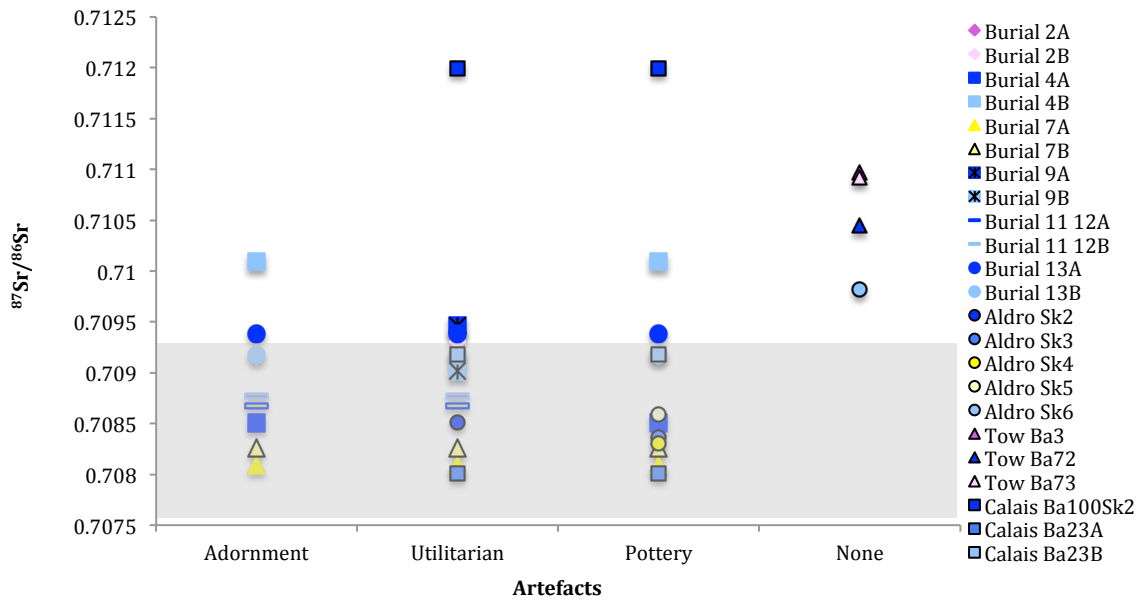


Figure 6.21: Combined samples derived from this project and the work of Cooper (2004) with regards to strontium signals while attributed grave goods are derived from the original excavations of Mortimer (1905).

Interestingly however, it was noted that none of the burials from the sites assessed by Cooper (2004) were accompanied by adornments (such as bone pins or jet rings). As this project is only represented by one site within this context, and as three individuals within the Staxton Beacon barrow presented these items, it suggests there may have been a site-specific burial practice with respect to artefact type. Additionally, a further differentiation may be speculated based on sex outside of Staxton Beacon, as both females from Towthorpe were found without grave goods, but further strontium values need to be obtained with respect to sex before any overall conclusions can be suggested.

The Iron Age, in comparison to the preceding Bronze Age, was a period in which a new level of social differentiation began to permeate burial rites with regards to the types of grave goods that accompanied certain individuals. At Melton the burial artefacts were somewhat limited in nature (as no chariot or horse trappings were uncovered), and only included, pottery, a quern stone, animal remains, iron objects and, in two cases, log coffins. Additionally, the burial without grave goods (or without those that preserved through time) was also a common occurrence. These artefacts were plotted against the strontium signals derived from 12 individuals to determine if there was a correlation between grave goods and a non-local signal (Figure 6.22).

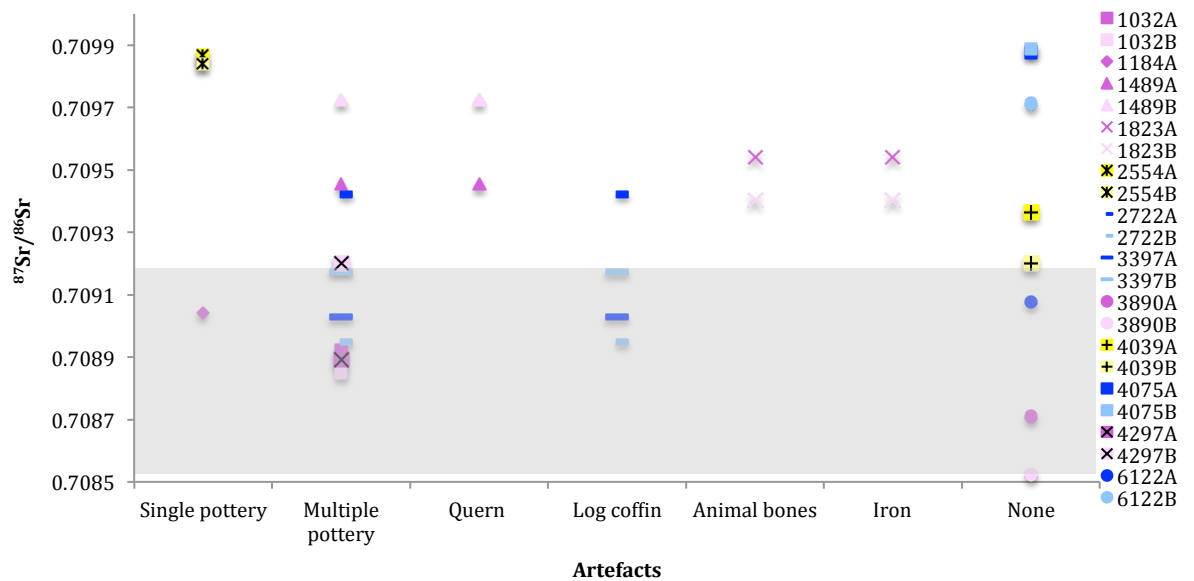
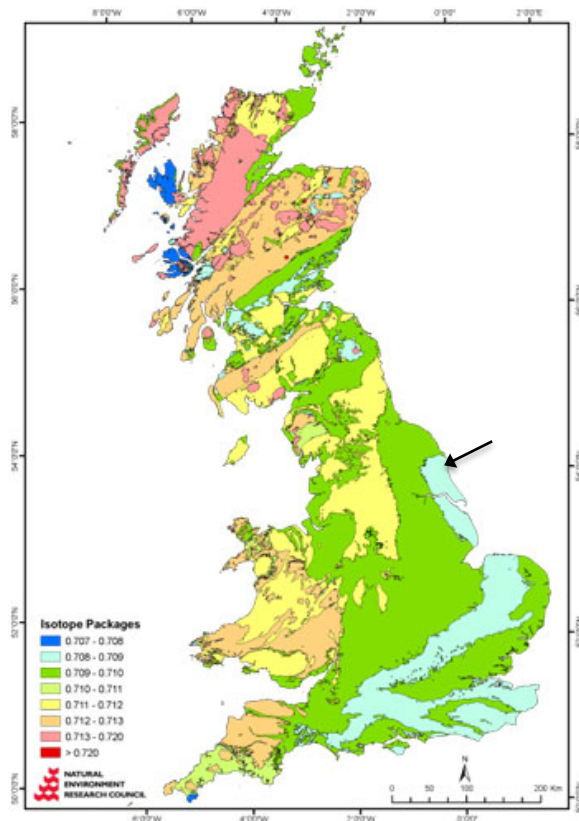


Figure 6.22: Burial presence of artefacts plotted against strontium values at Melton.

The shaded area represents the Yorkshire Wolds local signal as determined by Montgomery and colleagues (2005).

Interestingly, although no clear pattern emerged with respect to signals and specific burial items, the burials within log coffins were restricted to males. Additionally, both the instance of multiple pieces of pottery and a complete absence of artefacts were the norm for both adult sexes as well as local and non-local signals. The two subadults had limited or no grave goods respectively, but despite the fact that they presented different signals, with one exhibiting values consistent with the Wolds region and the other with values suggesting a non-local area, both graves were sparsely furnished with only a single piece of pottery for the subadult with a non-local signal. This suggests that at Melton there were no clear correlates between strontium signals and specific artefact types.

In his report on the excavation at Melton Fenton-Thomas (2010) and Sills (2010) reported on the discovery of a contemporary forgery of a Corieltauvian gold starter coin within the ditch fill of the square barrow containing skeleton 1823. Sills (2010: 201) determined that the usual distribution of the real coin had been much further south but that forgeries were more common outside of this zone, as they may go unrecognised as such. He further surmised that the two most likely explanations for its presence (if it had not been a random later deposition), were that it either arrived through trade or in the hands of a refugee fleeing from the Claudian invasion taking place in the south. As the square barrow is attributed to the Late Iron Age, this aspect of the correlation superficially matches, and the strontium signals, being non-local, present an additional hypothetical correlate. The values of 0.70954 for the female's M1 and 0.709403 for the M2 suggest an area that is dissimilar to a homogeneous chalk environment (Map 6.1).



Map 6.1: Strontium biosphere values in Britain, with the Yorkshire Wolds highlighted (Evans *et al.* 2010).

As these values are consistent with several regions in the south of England (represented as bright green and values between 0.709 and 0.710 on the map), it is possible to theorise this individual may have been connected to the coin, and may therefore have come from the south, though it is equally likely, without the influence of the coin, that the individual may have travelled from other regions to the west and north of the Yorkshire Wolds. However, as this barrow was not radiocarbon dated, a date more specific than the Late Iron Age is not currently possible. Therefore the coin and the skeleton may be unconnected, and thus separated by several decades. These findings imply the very complex nature associated with understanding the connection between burials and their grave goods, and although in some cases they may lead to inferences that prove to be parsimonious, in others they appear to have no relation to the identification of non-locals.

6.4.3 Distinct burials as correlates for non-locals

In the early and amateur days of archaeology, a popular inference made upon the discovery of an unusual burial was the identification of foreigners in a local population (Mortimer 1905, Mortimer 1911b; Greenwell 1877, Greenwell 1906). Today archaeologists are less likely to jump to such conclusions, however the uniqueness of certain funerary rites often give rise to hypotheses concerning the individuals buried within. The mass grave at London Road, although pointing towards a distinct subset of the population, was actually found to exhibit overlapping strontium and oxygen values with a neighbouring formal cemetery, suggesting a

catastrophic event, and not that their identification as an isolated group led to their burial differentiation (Chenery *et al.* 2010: 157). While the mass grave discovered at Eulau also appeared to identify a group of interconnected individuals the strontium values determined they were actually varied in their movement patterns and, more importantly that the females were attributed to a different region in comparison to the males and subadults (Haak *et al.* 2008: 18230). These studies all suggest that diversity in burial rites may provide initial indications of some type of societal variation, but complementary work, such as stable isotopic analysis must be incorporated in order to determine the mechanisms of this distinction.

Staxton Beacon, as a single barrow mound presents an interesting perspective with respect to mobility. The single burial rite afforded to these individuals (albeit at different points of time) would suggest some form of shared similarity between the individuals within. As previously discussed, this was not found to be the case with respect to osteological manifestations of non-specific stress, skeletal degeneration or trauma. Additionally, diet appeared to be equally variable. When the strontium signals obtained for six of the individuals were assessed, it was found that there was a certain amount of variation within the group (Figure 6.23). Only skeletons 2 and 13 exhibit similar, but opposite values, suggesting they may have each travelled to geologically consistent regions, but at different periods in their childhoods. However, other than these two exceptions, there is no distinguishable pattern with respect to sex, age or possible evidence of mobility at Staxton Beacon. This variability points to individual or very small-scale movement throughout several landscapes, perhaps suggesting small family groups were returning or moving away from a homogeneous chalk region several times throughout their developing years before finally being buried on the Wolds. As the signals deemed non-local are not drastically different it certainly does not support the idea of a continental migration of individuals or groups, but rather movement throughout central England. One middle adult male, Sk 4, did present an M3 value consistent with regions including the Lake District and the West Country, suggesting after the age of three he left a region consistent with a homogeneous chalk environment and arrived between the ages of 7 and 13 in areas such as either the Lake District resulting in roughly 115 miles and 1.5 day's journey or the West Country which may have taken 270 miles, or 3.5 days to traverse (Google Maps, consulted September 13, 2011)! As the Lake District is much closer it may be the more likely region, however there is more evidence of settlements during the Bronze Age in the West Country (Somerset Research Framework 2007), further complicating the possible movements of this individual.

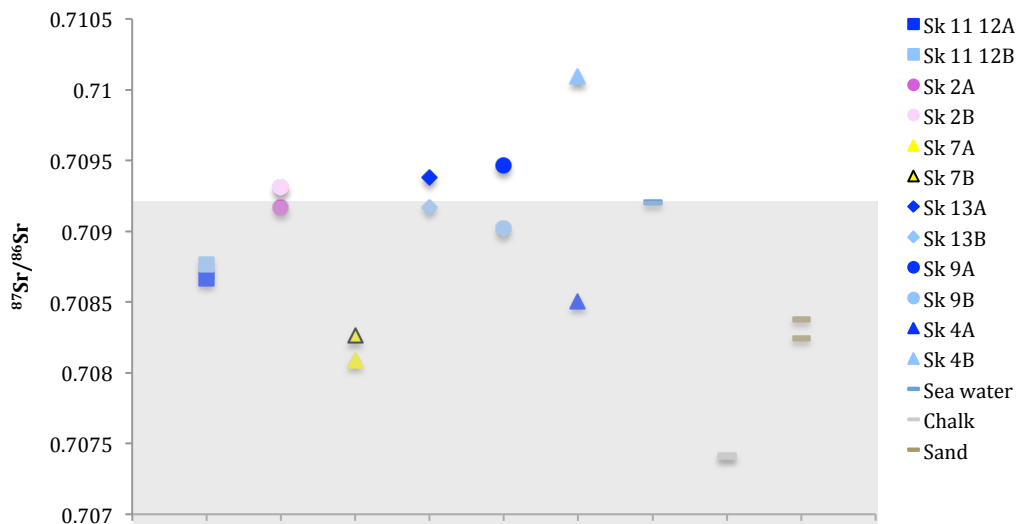


Figure 6.23: Strontium values at Staxton Beacon identified by sex.

The shaded area represents the local Yorkshire Wolds signal as determined by Montgomery and colleagues (2005).

If the burial goods associated with this individual are also considered, as he was the only one found in association with a food vessel it is possible that this individual was differentiated from the rest of the group. As there have additionally been multiple site examples of food vessels in the west (Somerset Research Framework 2007: 86), in comparison to the Lake District, it lends further support to the suggestion he may have travelled from quite a remote location. However, as his first molar is consistent with a region similar to the Wolds, and as his early childhood non-specific stress, exhibited as severe LEH is consistent with the other individuals buried in the barrow, it adds weight to the suggestion that the conditions of his early childhood may have been similar to those he was found in association with.

In the Iron Age, burial differentiation took on several distinct forms including square barrows, flat graves, chariot or cart burials, so-called warrior graves and single and multiple internments, all, on occasion, present within a single cemetery site. This suggests the presence of several different culturally constructed roles or hierarchies that may have mirrored that which was present among the living. The identification, however, of non-locals within the contexts is more complex due to the adoption and adaptation of initial continental forms, such as those found at La Tène sites in France and Germany (Cunliffe 1995), which may imply the movement of people, ideas or the combination of both. Currently the research project *Migration phenomena in the early La Tène period*, led by Ramsel (2004) is ongoing and is aiming to determine if artefact distributions present at the Mannersdorf cemetery, which have been connected to both the Marne and Vix regions in Champagne are correlates for strontium values derived from skeletons at the same cemetery. Although no values have yet been published, this project provides for the possibility of interesting results regarding the

actual connection between artefacts and the movement of people. However as Snow (2005: 12) stated “La Tène artefacts were probably the blue jeans, CDs and Coke bottles of their time... [and as] one did not have to be a Celtic speaker to covet them, I doubt that La Tène artefacts can be associated with any particular people or language”, this suggests the relationship might be highly complex, and only with the publication of extensive strontium values will any conclusions be made.

At Melton, although there were no chariot or warrior graves, among the burials there was a single inhumation found within a square barrow (Sk 1823). A second square barrow was also uncovered, but it proved to be void of an inhumation. Additionally, there was a single example of a double inhumation, that of a middle adult female (Sk 1184) and an infant (though not a newborn), suggesting they may have been connected in some way. If the theory regarding distinct burials and a possible non-local affinity were to be applied in both of these contexts, a complex picture of Melton arises which suggests that there were multiple mechanisms involved in the final deposition of individuals (Figure 6.24).

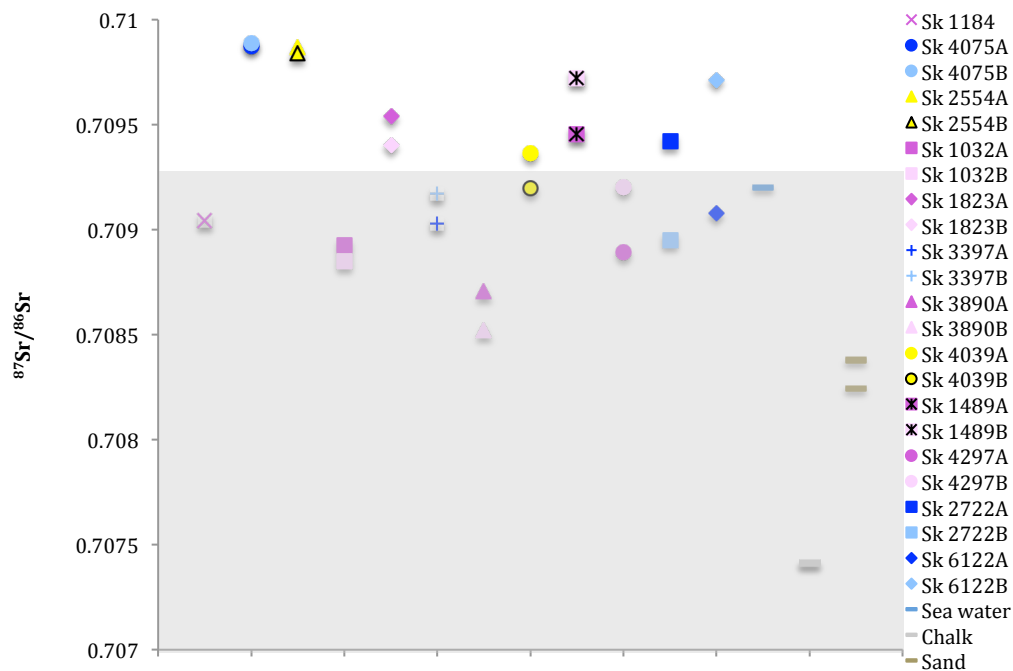


Figure 6.24: Strontium values attributed to Iron Age Melton, identified by sex.

The shaded area represents the local Yorkshire Wolds signal, as determined by Montgomery and colleagues (2005).

Both signals attributed to Sk 1823, the square barrow, are above the local values consistent with a homogeneous chalk environment. Based on the unique burial, it would appear that with respect to square barrows in a site in which they are not the established norm, they may in fact suggest a non-local inhabitant. As this is the only example it both supports and makes it difficult to validate such a theory as there is no other corroborating evidence at this site.

However, as this individual has been dated to the Late Iron Age, in comparison to the predominant Early Iron Age date of a majority of the square barrows on the Wolds (Dent 2010), this may point to a further level of differentiation within the group. More work is required on square barrow inhumations with respect to both mobility related signals as well as absolute dating in order to arrive at a better understanding of the connection between this burial rite and movement throughout the wider landscape. Interestingly though, when the strontium values are corroborated with the distinct grave goods and associated artefacts they do all imply a distinction that may have been present in the social realm. However, with respect to the osteological assessment, this female did not appear to be different with regards to non-specific stress, degenerative alterations or trauma, suggesting whatever might have differentiated her from others that was mirrored in her funerary rites was not dominant enough to buffer her in childhood or improve her quality of life throughout her adult years.

The second distinct burial of a double inhumation of a middle adult female and an infant subadult also warranted further discussion. Unfortunately strontium values were not obtained for the infant and as a result of the lack of all but a single tooth in the dental arcade of the adult, only one signal is available for this burial. Therefore, it is necessary to limit discussions concerning mobility, but interestingly, the single value that has been determined is consistent with a local homogeneous chalk environment, suggesting that during her early childhood, this individual was living in an area similar to that in which she was eventually buried. The grave goods found in association with these skeletons, specifically only single pieces of pottery, also do not point to a distinct rite that may have been based on a living differentiation. Furthermore, the osteological assessment of the infant (Sk 1183) determined it had been severely stressed which resulted in an age disparity between the skeletal and dental development. The middle adult female (Sk 1184) conversely, did not present any childhood non-specific stress but did exhibit an edentulous dentition, mild OA, moderate VJD throughout her spine and a post-cranial fracture to her right scapula. Fenton-Thomas (2010) surmised that there must have been a connection of some sort between these individuals, and although the subadult was told old to suggest a complication as a result of childbirth, their relationship was likely to have been entrenched in life, as they represent the only multi-inhumation attributed to the Iron Age at Melton. It would appear, however, that a local versus non-local distinction was not in and of itself a contributing factor in this purposeful burial association.

6.4.4 Pilot project: oxygen and strontium isotopes

Although it was not feasible to assess all of the individuals that were tested for strontium to also examine their oxygen isotopic signatures, four males from Melton were analysed with this method to uncover a more detailed picture of the movement of these people. Based on

the strontium signals derived from their earliest tooth (the first molar for skeletons 3397, 4075 and 6122 and the second molar for skeleton 2722) it was determined that skeletons 3397 and 6122 exhibited values consistent with a homogeneous chalk environment, while those for skeletons 2722 and 4075 suggested a non-local signature. When this data was combined with oxygen values derived from these same teeth the image of mobility at Melton became more complex (Figure 6.25).

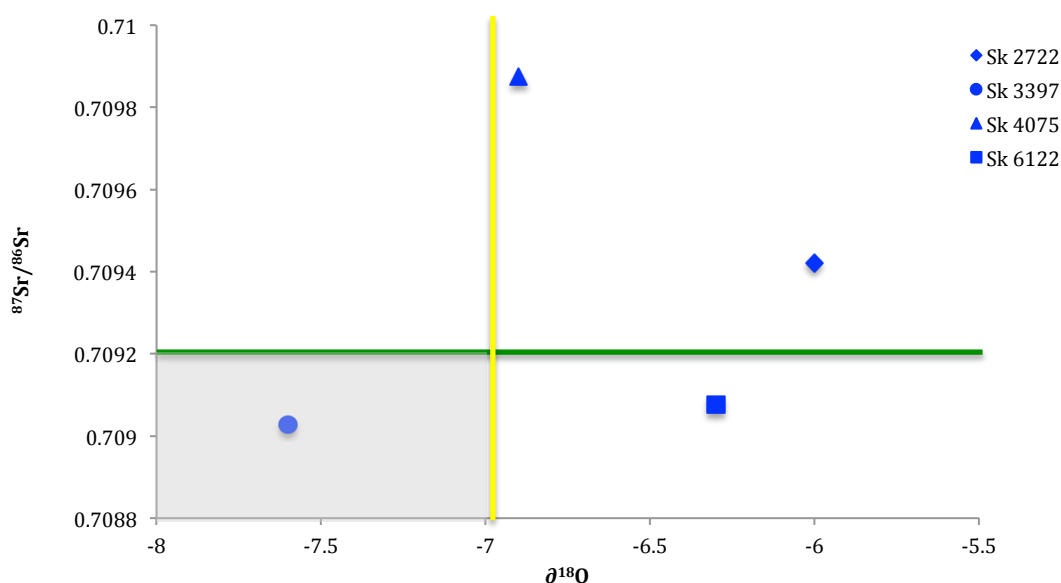
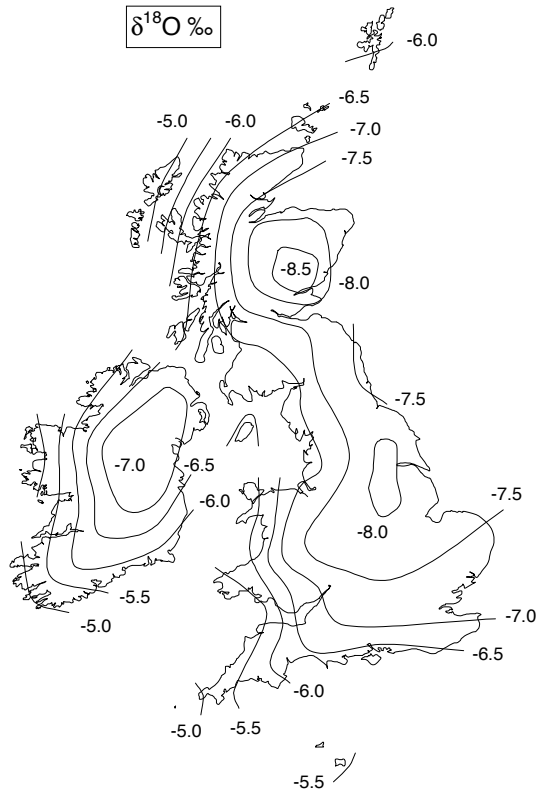


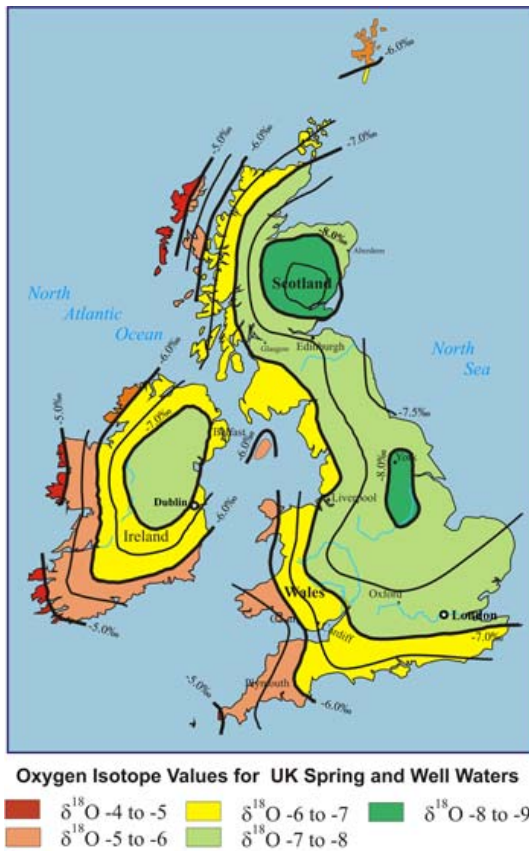
Figure 6.25: Oxygen and strontium values for four males from Iron Age Melton.

The green line represents local strontium values for the Yorkshire Wolds as reported by Montgomery and co-workers (2005), while the yellow vertical line represents the local groundwater oxygen ranges for the same region as reported in Gale and Rutter (2006). The shaded area represents the combined values that would be considered local for the Yorkshire Wolds.

Based on the combination of these isotopes it was determined that only skeleton 3397 was likely to have had a childhood in a region consistent with the Yorkshire Wolds. In contrast, the other three males exhibited oxygen values that were more enriched than those found on the Wolds. When both values were considered in conjunction, it was determined the published values for both spring and well water as well as rainwater signified several different possible regions of mobility (Maps 6.2 and 6.3).



Map 6.2: Oxygen values derived from rainfall throughout Britain (Darling *et al.* 2003).



Map 6.3: Oxygen values derived from ground water in Britain (Darling *et al.* 2003).

Based on this data the oxygen values of skeletons 2722 (-6) and 6122 (-6.3) would point to several overlapping regions including the far north-western coast of Scotland, the mid-southwest of England and parts of Ireland. Additionally, when their strontium values were considered (Map 6.1 above) they only included the parsimonious region in the southwest of England, suggesting this region was the most consistent with both stable isotopic values. Skeleton 4075 presents an interesting dilemma with respect to his values because although his strontium implies a non-local signal (0.709876), his oxygen value (-6.9) is just below that determined for the Yorkshire Wolds region. This individual may have also travelled to the southwest of England, suggesting there might have been purposeful mobility between these two regions. This pilot study has clearly highlighted the importance of combining several forms of stable isotopic analysis to uncover individual mobility in prehistory and with the additional assessment of those assessed at Staxton Beacon as well as the remainder from Melton, a more precise understanding of movement and migration may be determined for prehistoric Yorkshire Wolds inhabitants.

6.4.4.1 Mobility Summary

The movements of individuals and groups in prehistory has been characterised through several different mediums in archaeological studies. Through the presence of artefacts and distinct burials inferences have been made regarding the make-up and mobility patterns of populations. The findings presented here suggest that these material and culturally constructed correlates should be used as a starting point as opposed to a direct indication of movement. Due to the meanings and importance placed on ritual and/or funerary practices, it is too simplistic to conclude that distinct means different. Instead, a multidisciplinary approach should be employed to uncover the multifaceted nature of prehistoric mobility and how that might, or might not relate to an individual or group's membership in a population. The Yorkshire Wolds appears to represent an area and a people that are inclusive and do not insist on rigid distinctions in death that may have been evident in life.

6.5 Summary

This chapter has brought together multiple lines of evidence in order to explore the well-being, social differentiation and mobility associated with individuals from the Bronze and Iron Ages on the Yorkshire Wolds. It has been determined that the inhabitants were subject to a multitude of stressors in their earlier and later years, and that they experienced severe hardships in order to survive. The quality of life of these people decreased through time, and most specifically, it was the women that lost out on the opportunity to improve their chances for survival and reproduction. The mechanisms associated with these changes may have been related to maternal health and stress as well as the social differentiation that may have favoured males in the later period. As opposed to representing a single homogeneous

collective inhabiting this region of East Yorkshire, these groups encompassed individuals with a variety of backgrounds and movements. Although in some respects they may have been identified as distinct during life, this did not positively or negatively affect their quality of life in comparison to those considered to be local. Everyone was subjected to a harsh and difficult existence, and this, in the end, is what unified them.

Chapter Seven: Conclusions

7.1 Introduction

This project surveyed the prehistoric human skeletal remains from the Yorkshire Wolds in order to consider whether the quality of life changed for individuals and groups from the Bronze to the Iron Age. Additionally, osteological and stable isotopic evidence was assessed to determine if there was evidence of social differentiation in either period and furthermore attempted to determine its form. Finally, stable isotopic analysis was also examined with respect to mobility signals derived from both strontium and oxygen values, and where available these were considered in conjunction with associated burial evidence, as well as what has been determined for other sites on the Wolds to investigate if there was a pattern or alteration in individual and group movement in both periods. What follows here is a brief summary of the results and conclusions with regards to the over arching themes, as well as suggestions on future work that will maximise what may be learned from these Yorkshire Wolds inhabitants.

7.1.1 *The Sample*

Fifty-six individuals attributed to the Bronze Age and 44 belonging to the Iron Age were examined from a total of eight sites spread throughout the Wolds region. Their archaeological histories include excavations by antiquarians, prominent archaeologists and a commercial firm, and have resulted in a mixture of preservation levels owing to the varied funerary rites, digging methodologies and curatorial practices. These individuals form an important part of British prehistory and should be used to uncover aspects of everyday life, health, status and movement to aid our complex, but still incomplete knowledge of the past. Due to the restricted number of skeletons available from these periods, both on and off the Wolds, individuals are often only represented by skulls, but this should not be a deterrent to exploring the information they have to offer. Human skeletons are a limited and finite resource, and if we are to justify their permanent position in museum and university storehouses it is necessary to think “outside the box” with regards to the best ways to maximise their use. Although, since the introduction of the formalised practice of archaeology, those skeletons uncovered by the antiquaries JR Mortimer and Canon Greenwell have been relegated to random inspection and assessment, this project has highlighted the sheer quantity of data that is available to osteologists willing to take on the task of analysing such collections.

7.2 Quality of Life

This undertaking has determined a number of interesting conclusions with respect to the quality of life of individuals and groups on the Yorkshire Wolds. Non-specific stress in Bronze Age childhoods was commonplace on the Wolds, with a much higher percentage of individuals experiencing a reduced quality of life in comparison to sites located outside the region with respect to LEH. During the Iron Age, childhoods were found to be equally stressful suggesting populations had not been able to improve the lives of their youngest members to any significant degree with respect to LEH as the proportion of individuals affected was still much higher than that reported elsewhere. In contrast, CO rates were found to be similar or lower than those determined for areas outside of Yorkshire, implying either different mechanisms at play or more likely, different skeletal manifestations of stress.

Bronze Age adulthood on the Wolds was also worse than that experienced outside the region suggesting these individuals were involved in more strenuous and/or more repetitive labour and activities, implying different lifestyles at different sites. Dental diseases were also a common and more prevalent problem on the Wolds, which may suggest a reduced emphasis on, or knowledge of oral hygiene; different lifestyles; or a stronger genetic predisposition to dental disease susceptibility. In the Iron Age OA decreased from the preceding period, and although it also did outside Yorkshire, it still remained much higher, suggesting that lifestyles remained distinct and harder on the Wolds. However, VJD increased significantly from the Bronze Age and this was not equalled in other regions signifying a lower quality of life with respect to skeletal degeneration. Since dental diseases had in fact decreased, which pointed to improved oral health in comparison to the earlier period, it was still more commonplace than that reported at outside sites. Finally, when trauma was examined, the Bronze Age presented higher levels than the later period, though there was no indication of large scale conflict in either time. Instead, although the evidence shifted to more weapon-related wounds, as it did outside Yorkshire, as opposed to the accidental form that characterised the Bronze Age, on the Wolds in the Iron Age these interpersonal interactions still remained small-scale. As females were more likely to be affected than males, this pointed away from formalised combat, and instead towards minor disputes.

Overall, although it has been suggested that the populations on the Yorkshire Wolds represented some type of special subsection of society (Mortimer 1905; Greenwell 1877; Manby 1998; Fenton-Thomas 2003, Parker Pearson 1999), the available data on the populations under review for this project did not point to groups that were culturally buffered or free from hardships related to adequate nutrition, pathogens or interactions with people and the wider landscape. Instead it suggests these individuals were struggling as children, were experiencing tough everyday lives in order to perform activities that were

likely necessary for their survival and were subject to trauma, whether accidental or purposeful, often to a greater degree than individuals at sites located elsewhere in England. Although the lasting funerary monuments that attest to their presence and identification as somehow different from the wider British culture remain predominant, this did not positively identify them in life as it did in death.

7.3 Social differentiation on the Wolds

The Bronze Age data presented an image of very little social differentiation based on sex with respect to non-specific stressors in the childhood years of Wolds individuals. This implied that sex was not, in and of itself, a buffer to the presence of non-specific stress. In comparison, the Iron Age individuals displayed more of a distinction with respect to sex as, overall, males were less likely to exhibit LEH and did not exhibit any evidence of CO. This suggested that during their childhoods, purposefully or not, males may have been more buffered from non-specific stress in comparison to females. Off the Wolds the evidence for sex specific stress during childhood presented a different pattern. It was during the Bronze Age that males and females began to display different rates of stress, proposing that the mechanisms involved in buffering males outside of Yorkshire, if they were corollaries, were not present on the Wolds until the proceeding period. Whether this implies a delay in the uptake of social differentiation on the Wolds, earlier contact with the continent, and therefore burgeoning social status among the sites further south, or completely unrelated features requires additional work.

With respect to diet based both on caries presence and carbon and nitrogen stable isotopic signals, it would appear that the pattern exhibited with non-specific stress was correlated with access to foodstuffs. Although limited in its scope, the findings presented here suggest that social differentiation with respect to diet was much more complex than that for stress. However, the signals determined for Staxton Beacon depict a more restricted range with regards to both carbon and nitrogen in comparison to those determined for Melton. Additional isotopic work is required for the Bronze Age Wolds variation to be understood. In comparison, the Iron Age exhibited more inter-site variability based on the values obtained for Melton as well as Wetwang Slack, and they suggest that access to human and animal milk may have been a local culturally-induced phenomenon. However, as both sites were quite similar in comparison to sites situated in southern England, it suggests that the Wolds region may have been nutritionally distinct.

Finally, with respect to skeletal degeneration it was determined that osteoarthritis presence followed the pattern established by non-specific stress with more similar rates between the sexes and more divergent percentages in the Iron Age with females once again exhibiting a lower quality of life in the Iron Age. Interestingly however, it was vertebral joint disease that

remained consistent in its skeletal manifestation from the earlier to the later period. This suggested that groups on the Wolds were still experiencing a labour intensive life, irrespective of sex. When these rates were compared to those derived from sites further afield they were also much higher, implying that the populations outside Yorkshire might have improved their lifestyles and interaction with the landscape, while those on the Wolds were still experiencing extensive hardships. As the Iron Age rates of VJD on the Wolds were not differentiated by sex, it suggests that to a certain extent both male and female adults were equally and negatively affected. The implication of this, therefore, is that although as children and to a lesser extent with respect to dietary availability, the sexes were differentiated in the Iron Age, both sexes were sharing the hardships associated with daily life in adulthood. This suggests that if social differentiation based on sex was present on the Wolds, it did not extend to the manual labour that was required by all able-bodied adults in order to ensure survival.

7.4 Mobility in the Bronze and Iron Ages

Although the evidence of population, small group and individual movement is complex in its own right owing to the varied nature of the reasons behind artefact deposition, funerary rites and the mechanisms of isotopic variability, this project has determined that Bronze Age Wolds inhabitants were more diverse in their mobility compared to the later period. As the southwest region of England was connected to individual-level migration in both the Bronze and Iron Ages it suggests a certain continuation and connection between the two regions that remained present over a long period of time. Interestingly, it was the males that remained variable in their strontium (and oxygen) signals between both periods and, as movement was detected at several distinct subadult age periods, it provides for the possibility that it was a regulated, though wide ranging activity. As female strontium signals actually became more restricted from the earlier to later periods, it suggests that unlike in areas in Europe, which exhibited patrilocal movements, on the Wolds, the females were progressively appearing to present more local signals, suggesting that whether purposefully or otherwise, during certain sections of the childhood years, females were less likely to venture outside of a homogeneous chalk environment.

With respect to distinct artefact types there was no evidence of a clear correlation suggesting non-local individuals within the burial assemblages of either Bronze Age Staxton Beacon or Iron Age Melton. This may imply that if such delineation existed in the living society it was not mirrored in death, though it might also suggest that the artefact types were not distinct enough to identify these subtle differences. Additionally, although there were several types of discrete burials at Melton, there was no clear evidence of a direct correlate between burial rite subsets and mobility. As several individuals were identified as exhibiting non-local signals the implication of the lack of connection to both artefact distributions and funerary

rites suggests that these individuals were not treated as particularly different from the remainder of the population. This may therefore imply that the Wolds region during both the Bronze and Iron Ages was an area that included a variety of individuals and groups from several different backgrounds, who were, to the extent determined for this project with respect to osteology, relatively equal.

7.5 Future Work

The Yorkshire Wolds is an exciting region with respect to both prehistoric activity and archaeological intervention. As a result, there are a number of avenues that can and should be explored in order to create a better understanding of the region and its position in comparison to the wider British prehistoric landscape. Since antiquarian times the region has attracted an abundance of attention and this has led to vast stores of material, both artefactual and osteological in nature. However, due to the range in reporting and cataloguing in the early antiquarian period, the collections compiled by both Mortimer and Greenwell require extensive curatorial work. Although a massive undertaking, the gazetteer of site and burial information provided in Appendix A is but a starting point from which supplementary work must extend. So as to create a complete understanding of the evidence available; its preservation levels; and the scope of work, whether osteological, paleopathological or bioarchaeological in nature, that may be undertaken with these prehistoric remains.

Additionally, it would be highly beneficial to establish more formal and firmly entrenched relationships with and between the curatorial staff at the various regional and national museums that house Yorkshire Wolds material with academic institutions. During our current age of repatriation requests and both storage and budgetary constraints, it is imperative that these collections are accessed and analysed in order to justify their retention, which is often at the expense of more recently uncovered evidence. Although it would be a monumental commission, it would be advantageous to establish, by extension, a national Yorkshire Wolds database of all types of finds which will facilitate scholarly work and enable interdisciplinary collaboration at the site, regional and continental scale to consider the ongoing unanswered questions highlighted in this project.

7.6 Summary

The Yorkshire Wolds is a unique and distinct region with respect to prehistoric activity and quality of life, and its extensive record of excavations and discoveries has resulted in a wealth of opportunities to uncover the daily life and life experiences of the individuals that temporarily and permanently called this region home. TG Manby stated that the position of the Yorkshire Wolds “at the midpoint of the eastern coastlands of Great Britain proved to be very significant at all periods of human history for the transmission of commodities and ideas” (1988: 35) and this has been exemplified in the prehistoric evidence thus far revealed.

However it was Wright (1906: 323), who said it best: “No county, in all probability, suffered a more complete alteration of its population than did Yorkshire. No county gives better evidence of the change”. The Yorkshire Wolds has offered up evidence of human interaction since the Mesolithic times and to go back to the beginnings of archaeological discovery is how this project will end:

What further discovery may be made in the future is impossible to say, but I fully concur with Canon Greenwell's remarks that 'it may be as a reason, it is hoped a good and sufficient one, why the skilled investigation of the sepulchral mounds should be continued. An examination of any one of them may disclose important, but hitherto unknown evidence in relation to our predecessors in Britain, in the various phases of their life and habits' (Greenwell 1906: 322). These remarks are the inspirations derived from long experience, and if carefully acted upon must lead to further interesting discoveries, which will increase our knowledge of the prehistoric occupants of East Yorkshire, of whom we as yet know so little and must dig to know more.

Mortimer 1911b: 52, after his last excavation at Danes Graves before he passed away.