Analysis of Care Pathways of Children who present with an Avulsed Permanent Tooth

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to work of others

Dedication

To my parents, Michael and Kathleen: for starting me on this journey of life-long education.

To my wonderful fiancé, Mossie: for joining me along the way. I couldn't have done it without you!

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Summary

This thesis, examining care pathways of children who present with an avulsed permanent tooth, is divided into four parts. Chapter 1 presents a literature review, which looks specifically at the aetiology and treatment of tooth avulsion injuries. There is also a short review on the costs, both direct and indirect, associated with treating tooth avulsion injuries

Chapter 2 investigates data sources for the prevalence of tooth avulsion injuries in the Yorkshire region. Two major sources of epidemiological data on child dental health are available in the UK, decennial and annual surveys. Decennial surveys have been run in England and Wales since 1973 and in the whole of the UK since 1983 whilst the annual NHS Dental Epidemiology Programme was started in 1985 and is now run by Local Authorities. It surveys five-year-olds every other year, and older children in intervening years. The 2003 Child Dental Health Survey reported data on accidental damage to teeth but only unpublished data on traumatic damage to teeth is available from the 2008/2009 NHS Dental Epidemiology Programme surveys of 12-year-olds. This was obtained from The Dental Observatory for the purpose of this thesis. On examining the data neither survey was able to provide accurate information on the prevalence of tooth avulsion injuries in our child population. This lack of information potentially complicates the local commissioning of healthcare services, if this is to be based on the available epidemiological data.

Chapter 3 investigates the experience of Yorkshire dentists' in relation to the management of avulsed permanent incisors. The study was designed as a self-completion postal questionnaire of a random sample of dentists working in primary care in the Yorkshire region. A response rate of 59.7% was achieved. Thirty nine per cent of respondents had replanted an avulsed permanent tooth. The replantations took place most often in the primary dental care services. Almost forty per cent of all respondents currently have a child who has sustained an avulsion injury on review. Many dentists in the Yorkshire region have limited experience of treating children with avulsed

permanent teeth. A significant percentage currently has children with avulsion injuries under their care. Current guidance advises an early specialist multi-disciplinary team consultation for children following an avulsion injury.

Chapter 4 investigates parents' experiences of accessing emergency and follow-up care for their child following a tooth avulsion injury. This study used a qualitative approach and semi-structured interviews were undertaken to explore on how parents access emergency and follow-up care. Eight parents attending the Leeds Dental Institute were recruited to the study using purposive sampling. The framework analysis approach was used to analyse the data. Two core concepts of knowledge and access were inferred from the analysis. Parents found it difficult to access emergency dental care for their child. The knowledge of the parents, laypeople at the site of the accident and health care professionals involved in providing the emergency care had a direct impact on how emergency care was accessed. Accessing follow-up care proved more straightforward in our sample as could be expected from a cohort attending a tertiary service. A further core concept of emotion was also evident – parents were distressed by what happened to their child and also frustrated and disappointed with the difficulty in accessing emergency care.

The final chapter presents the conclusions of this research, together with some recommendations for further work.

Chapter Abstracts

Chapter Two –

The use of available epidemiological survey data to establish tooth avulsion prevalence

Background: Dental trauma is a common occurrence in childhood. In the UK, two major types of epidemiological surveys are undertaken of child dental health. Data describing the prevalence of tooth avulsion injuries in the child population of the UK has not been published.

Aim: To quantify the prevalence of tooth avulsion injuries in the Yorkshire area from the available epidemiological data.

Method: A literature search was undertaken in order to identify the most recent annual and decennial surveys of children's dental health. Reports on accidental damage to teeth from the 2003 Child Dental Health Survey were identified in the literature. Data on traumatic damage to teeth from the 2008/2009 NHS Dental Epidemiology Programme survey of 12-year-olds was obtained from The Dental Observatory. Simple descriptive analysis of the relevant data was undertaken.

Findings: In the 2003 Child Dental Health survey, 1.2% of 15-year-old children were missing anterior teeth due to trauma.

In the 2008/2009 NHS DEP survey 6,231 12-year-old children were examined in Yorkshire. Four instances of trauma were recorded in this sample. No teeth were recorded as missing due to trauma.

Conclusion: The Child Dental Health surveys, conducted every ten years provide detailed data on accidental damage to teeth. They do not, however, provide accurate information on the prevalence of avulsion injuries in the child population.

The 2008/2009 survey of 12-year-olds, conducted under the auspices of the NHS Dental Epidemiology Programme, may not have accurately recorded traumatic damage to teeth. This has implications for the local commissioning of healthcare services, if this is to be based on the available epidemiological data.

Chapter Three –

Yorkshire dentists' experience of treating avulsion injuries

Background: An avulsed permanent tooth is one of the few true emergency situations in dentistry. The prognosis is dependent on the measures taken at the place of the accident or the time immediately after the avulsion. It has been recommended that a specialist interdisciplinary team see these children soon after the initial injury. If a GDP (General Dental Practitioner) has little experience in managing avulsion injuries he/she may be unaware of the necessity for prompt referral to specialist services.

Aim: To assess Yorkshire dentists' experience of treating avulsed permanent teeth in children.

Method: The study was designed as a self-completion postal questionnaire of a random sample of one thousand GDPs working in the Yorkshire region. The questionnaire was posted with a letter inviting participation and a stamped addressed envelope for returns. A second mailshot was posted to non-responders. Responses were entered onto an Excel spread sheet and simple descriptive analysis was undertaken.

Results: Five hundred and ninety seven questionnaires were returned and suitable for analysis (response rate 59.7%). Less than 40% of respondents had replanted an avulsed permanent tooth in a child. Of those that had, the majority had replanted one or two teeth in one or two children. The replantation took place most often in the general or community dental setting. Almost 40% of all dentists surveyed currently have a child who has suffered an avulsion injury under their care.

Conclusions: Many dentists in the Yorkshire region have limited experience of treating children with avulsed permanent teeth. A significant percentage currently has children with avulsion injuries under their care. Children with these traumatic injuries may benefit from specialist-led care.

Chapter Four –

Parents' experiences of accessing emergency and follow-up care for their children following an avulsion injury

Background: A local dentist, accident and emergency department, dental access centre or a secondary dental care provider may provide emergency care for avulsion injuries. What happens in the time immediately after the accident has a direct effect on the long-term prognosis of the tooth, so appropriate emergency care within an appropriate timeframe is crucial if a good outcome is to be achieved.

Aim: To identify how parents access emergency care for their children following avulsion of a permanent tooth

Method: Semi-structured qualitative interviews were undertaken with parents of children who had suffered a tooth avulsion injury in the past two years, these parents were all selected from among those attending the LDI Trauma Clinic. A topic guide was used to ensure all relevant information was collected. The interviews were recorded and transcribed verbatim. The framework analysis method was used to analyse the data and interpret the core concepts from the interviews.

Findings: Eight parents of children who had sustained a tooth avulsion injury agreed to take part in the study. All of the children were boys, aged between 6 and 12 years old. None of the children received the appropriate emergency dental care within the appropriate timeframe. The core concepts that emerged following the analysis were knowledge, access and emotion.

Conclusions: The parents who were interviewed for this study had poor knowledge of what to do in the event of a tooth avulsion injury. This lack of knowledge directly impacted how they accessed emergency dental care for their child. All parents in this sample experience a wide range of emotions whilst attempting to access the appropriate care for their child. Further work is required to look at the pathways of care for children of ethnic minorities and those children who are not referred to specialist care for the management of their traumatised tooth.

Abbreviations

A&E	accident and emergency department
AAPD	American academy for paediatric dentistry
BASCD	British association for the study of community dentistry
BSPD	British society for paediatric dentistry
CAQDAS	computer assisted qualitative data analysis software
CDH	child dental health
CDS	community dental services
DH	department of health
FIS	family impact scale
GDC	general dental council
GDP	general dental practitioner
GDS	general dental services
GMC	general medical council
GPT	general practice training
HCP	health care professional
HRQoL	health related quality of life
HSCIC	health and social care information centre

IADT	international association of dental traumatology
NHS	national health service, UK
NHS-DEP	national health service dental epidemiology programme
NWPHO	north west public health observatory
OHRQoL	oral health related quality of life
PCT	primary care trust
PDL	periodontal ligament
SHO	senior house officer
SPA	Scottish pathways association
TDI	traumatic dental injury
TDO	the dental observatory
UG	undergraduate
VT	vocational training
WYCSA	West Yorkshire central services agency

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Chapter One

Literature Review

1.1 Avulsion - Description

One of the most severe dental injuries is avulsion, where the tooth is completely displaced out of its socket [Andreasen and Andreasen, 1993]. This injury accounts for 0.5 to 3% of dento alveolar trauma to permanent teeth [Glendor *et al.,* 1996, Andreasen *et al.,* 2007]. From a clinical perspective, since avulsion injuries occur infrequently, the average practitioner is unlikely to instinctively know how best to treat each (rare) case that he/she encounters [Trope, 2011].

Avulsions occur most commonly in the permanent dentition of 8-12 year olds at a time when there is a loosely structured periodontal ligament surrounding erupting teeth that often have short, incompletely formed roots [McIntyre *et al.,* 2009]. Recently published analysis of a large trauma database in Denmark, has demonstrated that the incidence of avulsion injuries increases with age; in those under 12 years, 6.5% of recorded injuries were avulsions, this figure increased to 10.2% in those over 20 years of age [Lauridsen *et. al.,* 2012]. It has been reported that 35% of all avulsions occur before the age of nine years, i.e. usually before completion of incisor root development [Andreasen *et al.,* 1995a]. Upper anterior teeth are most at risk for injury. Ninety seven per cent of teeth injured are the anterior teeth, of which 79% are upper central incisors [Jacobsen and Andreasen, 2001].

1.2 Avulsion - Aetiology

Accidental falls, sporting injuries, cycling accidents, and assault have been identified as the most common causes for dental injuries in childhood [Wright *et al.,* 2007, Gulinelli

et al., 2008]. Traumatic dental injuries (TDIs) usually affect a single tooth, but certain trauma events, such as sport, violence and traffic accidents result in multiple tooth injuries [Glendor, 2008].

There are a number of risk factors found to be associated with the incidence of dental trauma. Boys experience dental injuries at least twice as often as girls, though some commentators argue that this may change as girls participate more widely in sporting activities [Glendor, 2008]. Physical characteristics such as increased overjet and incomplete lip closure have long been identified as significant risk factors for dental trauma [Burden, 1995, Kania *et al.,* 1996].

Another important factor found to increase the risk of dental trauma while playing sports, was the lack of a properly fitted mouthguard/ faceguard. It has been observed that when a mouthguard was not worn during football games, the likelihood of a fractured or avulsed tooth was at least twice that of when a mouthguard was worn [Jolly *et. al.,* 1996].

Hamilton and colleagues reported that significantly more children in the lower socio-economic groups experienced dental trauma, compared with the higher socio-economic groups [Hamilton *et al.,* 1997a]. Since then, very few papers have commented on socio-economic status as a risk factor for dental injuries. Glendor's comprehensive review of the epidemiology of dental injuries states "Environment and activity probably is of greater importance to the occurrence of traumatic dental injuries than gender and age. Further research is needed to elucidate these relationships" [Glendor, 2008].

1.3 Avulsion – Sequelae

The alveolar bone, cementum, periodontal ligament, gingiva and the pulp are all damaged when a tooth is totally displaced out of its socket [Jacobsen and Andreasen, 2001]. The tooth is separated from the socket, mainly due to the tearing of the periodontal ligament that leaves viable periodontal ligament cells on most of the root

surface. In addition, due to the crushing/scraping against the socket, small, localised cemental damage also occurs [Trope, 2011]. Immediately after the injury, the PDL and pulp in the avulsed tooth begin to suffer ischaemic injury, which is then aggravated by drying, exposure to bacteria or chemical irritants [Andreasen et al., 2003].

The types of periodontal healing following an avulsion injury can be defined as regeneration, cemental/PDL healing (favourable healing), bony healing (ankylosis) or uncontrolled infection (inflammatory resorption) [Day and Gregg, 2012]. The two prognostic factors that have the strongest influence on the chances of periodontal healing are: extra-alveolar dry time and then total extra-alveolar time when stored in an appropriate medium such as milk or physiological saline. The aim of treatment is to facilitate cemental/PDL healing. For many teeth that suffer avulsion and replantation this is unrealistic, and therefore the optimal outcome is bony healing. Replacement resorption and ankylosis may be considered acceptable outcomes, as replanted teeth can survive for a number of years, and, if the patient has achieved physical maturity, infraocclusion and gingival irregularity due to surrounding alveolar growth will be minimal [Kenny *et al.,* 2003].

Types of pulpal healing can be defined as regeneration (revascularisation), controlled necrosis, and uncontrolled infection [Day and Gregg, 2012]. The most important prognostic factor when determining chances of pulpal regeneration is stage of root development. In a tooth with less than complete root length and half apical closure it may be possible for the pulp to regenerate. The more immature the tooth, the better the chance for regeneration. Although pulpal regeneration is desirable, especially in immature teeth, in most situations this is unrealistic and therefore elective disinfection of the root canal space is the optimal outcome [Day and Gregg, 2012].

Tooth survival is related to periodontal healing. When periodontal repair occurs by bony healing the root will slowly be replaced by bone. The speed of this process is governed by the age of the patient and speed of bone turnover. In children, the consequences of this ankylosis are complicated further by lack of vertical growth in this

area with the consequent infra-occluded appearance. Ankylosis must be detected as early as possible [Day and Gregg, 2012].

Treatment outcome is strongly dependent on the measures taken at the place of accident or the time immediately after the avulsion [Flores *et al.,* 2007]. An appropriate emergency management and treatment plan is essential for a good prognosis. It is important to remember that, while definitely the ultimate aim, success does not necessarily require that the tooth is healthy and functioning for the entire life of the patient. Therefore maintaining the tooth and surrounding bone for a few years can be considered a successful treatment in the growing patient [Trope, 2011].

1.4 Avulsion – Treatment

Replantation of the tooth is the treatment of choice, but it may not always be appropriate or the most pressing priority. The initial treatment at the site of the accident often relies on the children's parents, friends or their schoolteachers prior to the initial professional contact. It has been reported that 80% of physical education personnel and lay people would not want to replant an avulsed permanent incisor themselves, the main reason being lack of knowledge and training [Hamilton *et al.,* 1997b]. Panzarini and colleagues reported similar results– 86% of physical education undergraduates would not replant an avulsed permanent tooth into the socket, even though 50% of them knew what to do [Panzarini *et al.,* 2005]. An English study, published in 2007 reported that 60.8% of respondents (person in charge of first aid in the school) knew that immediate replantation was the treatment of choice for an avulsed tooth, but only a third of respondents (37.3%) were willing to carry out replantation themselves, due to perceived inadequacy in knowledge and skills and also for legal reasons [Addo *et al.,* 2007]. A recent study in Brazil found that 95% of elementary school teachers would not feel capable of replanting an avulsed tooth [Haragushiku *et al.,* 2010]. Other reported reasons for reluctance to replant teeth include reluctance to induce fear or pain in the child and personal fear of blood borne infections [Kenny *et al.,* 2003].

When immediate replantation is possible, the tooth should be immediately replanted in its socket, or, if obviously contaminated, rinsed for ten seconds in cold running tap water, or saline solution if available [Andreasen *et al.,* 2003]. Instructions may be given by telephone to the parents or caregivers at the emergency site. The patient should then seek an emergency service for further treatment. An information sheet containing telephone advice for parents or bystanders following avulsion injuries is available with the UK National Clinical Guidelines on Treatment of Avulsed Permanent Teeth in Children [Day and Gregg, 2012].

If tooth replantation is not possible the alternative is to store the tooth in a suitable medium and transport to the dental surgery with the patient. Numerous studies have shown that most lay people have poor knowledge of the appropriate transport media. Hamilton and co-workers reported that only 24% of lay people knew that milk was the preferred transport medium, and 53% suggested placing the tooth on ice or in a handkerchief [Hamilton *et al.,* 1997b]. Mori and colleagues in a questionnaire-based study reported that only 8% of school professionals suggested milk as an appropriate transport solution [Mori *et al.,* 2007]. A survey of mothers, also carried out in Brazil reported that 39% would attempt to replant the avulsed tooth. If replantation were not possible, 45% would elect to wrap the tooth in tissue or gauze, with only 10% placing the avulsed tooth in milk [Oliveira *et al.,* 2007]. There is some evidence to suggest that parents of children who regularly attend for dental check-ups are more knowledgeable about dental trauma and its emergency management [Vergotine and Koerber, 2010]. In a study of Kuwaiti children, none of the children demonstrated good knowledge about optimal transport media for avulsed permanent teeth, although they did have good knowledge of general first aid measures [Andersson *et al.,* 2006].

Emergency treatment by a HCP should be provided as soon as is reasonably possible after the trauma. Treatment strategies should always be considered in the context of limiting the root canal infection and limiting the extent of the peri-radicular inflammation, thus tipping the balance towards favourable (cemental) rather than unfavourable (osseous replacement or inflammatory resorption) healing [Trope, 2011]. If the tooth has already been replanted, leave it in situ. If not, place it in fresh milk or

physiologic saline. A full clinical examination is necessary, in particular to check for any other injuries that may have been sustained.

At this stage further emergency treatment decisions are based on stage of root development and the length of extra-alveolar dry time [Flores *et al.,* 2007]. The treatment outcome is strongly dependent on the length of the dry extra-alveolar period and the storage media used [Cvek *et al.,* 1974, Andreasen *et al.,* 1995b, Day and Gregg, 2012].

1.4.1 UK National Clinical Guidelines:

The current UK National Clinical Guidelines for treatment of avulsed permanent teeth in children state:

If the extra-oral dry time is less than thirty minutes and the total extra-oral time is less than ninety minutes when stored in an appropriate storage medium, then there is a chance of cemental or PDL healing.

For a mature tooth (complete root length with half or more apical closure),

- If a blood clot is present in the sulcus, irrigate it gently with saline solution.
- Replant the tooth.
- Splint to one adjacent non-injured tooth on either side for 7-14 days.
- Pulp extirpation should commence between 0-10 days post-trauma, depending on the maturity of the avulsed tooth and the inter-visit medicament chosen.

For an immature tooth (anything less than complete root length with half apical closure), it is possible for pulpal regeneration to occur so extirpation is not completed at the splint removal visit. The tooth must be monitored very closely and the parents advised to return if there are any signs or symptoms associated with the tooth.

For avulsed teeth with extra-oral dry time greater than thirty minutes, or total extra-oral time greater than ninety minutes, even when stored in an appropriate storage medium, there is little chance of cemental or PDL healing.

Repair, instead will be by bony healing. Prompt treatment is still necessary as evidence suggests that teeth replanted sooner will have slower bony healing than where the extra-alveolar period was longer.

- Extirpate the pulp and obturate the canal extra-orally.
- Replant
- Splint as per previous recommendations (although, if the tooth is excessively mobile the splint time may be increased as this will have no effect on the type of periodontal healing unless other teeth were injured and are incorporated in the splint).

For both scenarios it may be necessary to:

- Prescribe systemic antibiotics (at the clinicians discretion) – doxycycline for children over twelve years, penicillin for children less than twelve years.
- Refer to a medical practitioner for a tetanus booster if environmental contamination of the tooth has occurred.

For every case, the patient and their parents should be instructed in the appropriate oral hygiene measures, and advised regarding appropriate analgesia.

The guidelines also strongly recommend that due to the high chance of healing by bony ankylosis patients should be referred early to a specialist inter-disciplinary team for treatment planning in case such an eventuality occurs. Even in situations where a good outcome is expected, this early appointment is important to ensure the child and parents are fully aware of the possible outcomes and treatment options.

These extensive guidelines show that emergency management has a critical role in outcome. Follow-up care requires good coordination and communication between the initial provider of treatment and timely access to secondary care specialist services.

1.5 Healthcare Economics

The cost of treatment of an avulsion injury to the health service, parents and children is considerable, as these injuries require long-term dental care. The International Association of Dental Traumatology (IADT) guidelines recommend that an injured tooth should be clinically and radiographically examined at one, three and six months post trauma, at one year and then yearly post trauma for five years [Andersson *et al.,* 2012]. This estimate does not include any appointments that may be required for assessment by an inter-disciplinary team, or for treatments such as denture fabrication etc. Parents and children need to be fully informed of the prognosis of the avulsed tooth as soon as possible after the trauma. The potential costs and time required with regard to the different treatment options should be openly discussed. Short, medium and long-term planning for the loss of the tooth or teeth should be discussed at an early stage [Day and Gregg, 2012].

The majority of treatment occurs during the first year following injury. Nguyen and colleagues reported that the mean treatment time per individual, following replantation of a permanent incisor, was estimated to be 7.2 hours in the first year [Nguyen *et. al.,* 2004]. The authors advised that this was a conservative estimate, as it did not include time for radiographs, interdisciplinary assessment visits or denture fabrication, if required. There were approximately 1.2 emergency examinations and 4.8 reassessment examinations per individual. Ninety per cent of patients and 86% of parents reported loss of school and work time [Nguyen *et. al.,* 2004].

Glendor and colleagues in Scandinavia reported that on average there were 11.9 visits in the first year following severe dental trauma and that 1.7 hours were spent on the emergency visit and 6.9 hours spent on the planned visits. These estimates of time did not include travel time for the patient to and from the clinic, it was in fact estimated that direct dental chair time only made up 16% of the time taken by parents and children to attend these appointments [Glendor *et. al.,* 2000].

A UK study recently reported that following a TDI the median number of visits to a specialist centre for the required treatment was nine, with a range of 1-28 visits. The authors acknowledged that specialist centres in the UK rarely provide acute care for TDI and therefore this may be an underestimation of the total number of visits required to manage TDI. They also identified that 76% of children completed their treatment within four years – which implies that 24% were still attending for treatment over four years after the initial injury [Keasberry *et. al.,* 2013]

An estimation of treatment costs is challenging and may only be approximated; this is complicated by the fact that most injuries occur in childhood, while the rehabilitation costs may continue into adulthood [Lee and Divaris, 2009]. A Canadian study estimated an average financial burden of CAD$1,465 (£917, based on an exchange rate of £1 to CAD$1.60, June 2013) in the first year alone [Nyugen *et. al.,* 2004]. Another study, in Denmark calculated that the cost of treating a complicated TDI ranged from US$926 to US$1,490 (£606 to £975 based on an exchange of £1 to %1.53, June 2013) [Borum and Andreasen, 2001]. There have been two UK studies looking at the costs, both direct and indirect of treating TDIs. The first reported that the average cost of treating a TDI per patient was £856, attributing the majority of this to the indirect costs incurred – travelling to and from the clinic and time off work and school [Wong and Kolokotsa, 2004]. The second, and most recent, estimated that the average cost of treatment for any traumatic injury (i.e. not just complex injuries) is £1,097 [Keasberry *et. al.,* 2013]. The authors acknowledged that it is a simple estimate that does not take into account the future costs for on-going and potentially more definitive dental care in adulthood.

These calculations show that dental trauma has a significant financial and social cost on both the children and their immediate family. The indirect costs, time off work and school are considerable.

Chapter Two

The use of available epidemiological survey data to establish tooth avulsion prevalence

2.1 Background

Dental trauma is a common occurrence in childhood. By its nature it occurs suddenly and without warning, and a child who sustains a traumatic dental injury (TDI) will experience pain and discomfort. Those who suffer more severe trauma often need multiple follow-up and treatment appointments. Recently published evidence from Leeds, UK, found that the median number of total visits to the trauma clinic in a large teaching hospital following a traumatic injury to a tooth was 9, with a range of 1-28 visits [Keasberry *et. al.,* 2013] There is increasing evidence that TDIs can have an impact on the quality of life of the child and their family [Cortes *et. al.,* 2002, Porritt *et. al.,* 2011].

2.1.1 Prevalence

Prevalence refers to all cases, old or new, in a population at a given time. Studies published in the United States show that between 16 and 18% of adolescents have experienced a traumatic injury to a permanent tooth [Kaste *et. al.,* 1996, Shulman & Peterson, 2004]. Similar prevalence figures have been reported in Scandinavia (22%), the Middle East (14.2%) and South America (18.9%) [Andreasen & Ravn 1972, Rajab, 2003, Traebert *et al.,* 2003]. It has been reported that avulsion injuries account for 0.5-3% of all traumatic injuries to teeth [Andreasen *et. al.,* 2007].

2.1.2 Incidence

Incidence refers to the number of new patients with TDI during a given period, generally one year, in a specified population. The number of studies presenting incidence is low. The majority of these are from the Scandinavian countries, where the

Public Dental Health Service provides free regular dental care for all children and adolescents [Glendor, 2008]. The reported trauma incidence was between 1.3% and 3% [Andreasen & Ravn, 1972, Glendor *et al.,* 1996]. It was noted in one study that the incidence of tooth avulsion injuries was 0.6% [Skaare & Jacobsen, 2003]. Similar figures were reported in an Australian study, which took place in the late 1980's – there was an overall trauma incidence of 1.66%, with an incidence of avulsion injuries of 0.4% [Stockwell, 1988].

2.1.3 Difficulties with epidemiological studies

Most of the reported studies of dental trauma have concentrated on specific subpopulations such as children from schools, specific geographical areas or limited age groups [Bastone *et. al.,* 2000]. There are numerous retrospective studies on dental trauma [Andreasen & Ravn, 1972, Kaste *et. al.,* 1996, Traebert *et. al.,* 2003], but these have many disadvantages and the data produced may not give an accurate estimation of the trauma prevalence within the population being studied. Certain dental and oral injuries such as alveolar fractures and soft tissue injuries may not always be evident at the time of examination, if the injury occurred sometime beforehand [Bastone *et. al.,* 2000]. Non-visible injuries – such as to the root or pulp complex are unlikely to be recorded, particularly if there are no signs or symptoms at the time of examination [Bastone *et. al.,* 2000, Glendor, 2008].

Studies to determine incidence rates are generally conducted in a prospective manner, usually as a cohort study of a large population over a predefined period of time. One advantage is that data are collected as the dental trauma occurs so there is minimal risk of recall bias [Bastone *et. al.,* 2000]. However, TDIs not deemed as serious by the child or parent (such as minor enamel fractures or subluxations) may not present for treatment, so again, under-reporting of the trauma incidence is likely [Bastone *et. al.,* 2000, Glendor, 2008].

With both prospective and retrospective studies, direct comparison of results between centres or, over time, are difficult as various definitions and classification systems are used to record dental trauma [Glendor, 2008].

2.1.4 Epidemiological studies in the UK

In the UK, two major types of epidemiological surveys of child dental health are undertaken. Decennial surveys have been run in England and Wales since 1973 and in the whole of the UK since 1983. The second group is of annual surveys which were previously co-ordinated by the British Association for the Study of Community Dentistry (BASCD). Since April 2013, the Local Authorities have held responsibility for the running of these surveys. A number of organisations are now involved in this NHS Dental Epidemiology Programme (NHS-DEP): The British Association for the Study of Community Dentistry (BASCD), The Dental Observatory (TDO) and the North West Public Health Observatory (NWPHO). These local surveys have been undertaken since 1985, surveying the caries experience of 5-year-olds every other year, and older children in the intervening years [Dyer *et. al.,* 2008].

Both groups of surveys strive for high levels of methodological rigour and provide standardised definitions of diseases surveyed. The examiners are trained and calibrated, and there are clear guidelines on the sampling procedure [Dyer *et. al.,* 2008].

2.1.4.1 National Surveys of Child Dental Health (Decennial Surveys)

These surveys provide a 10-yearly summary of the condition of children's teeth in the UK. A large volume of detailed information is collected and published. This limits the number of children who can be examined and so the sample sizes tend to be relatively small. The strength of these surveys, however, is that they are cyclical in nature so allow both a cross-sectional 'snapshot' of the oral health of children in the UK, and also an indication of the long-term trends in oral health [Chadwick *et. al.,* 2006].

2.1.4.2 NHS Dental Epidemiology Programme (Annual Surveys)

Although started in 1985, the organisation of these surveys was changed in 2006. New responsibilities were placed on Primary Care Trusts (PCTs) to identify local oral health needs and thus commission dental services appropriately. Following these changes the Strategic Health Authorities, in association with the Department of Health had direct responsibility for the NHS surveys, directing the PCTs to undertake the agreed dental survey activity each year. Legislative changes were made to allow for this. Local authorities are currently responsible for the running of the surveys. The information gathered is not as exhaustive as in the decennial surveys. Larger sample sizes are thus possible. The survey data provide disease trend information over a short-term basis. The data are primarily used for commissioning of local dental services. It is also used to identify areas for targeting oral health promotion measures and data from subsequent surveys can contribute to evaluation of these programmes [Dyer *et. al.,* 2008].

Taken together, the Decennial and Annual surveys provide valuable information on the distribution of dental disease and conditions and also of their trends over time [Dyer et. al., 2008]

2.2 Aim

To quantify the prevalence of tooth avulsion injuries in the Yorkshire area from the available epidemiological data

2.3 Methodology

A literature search was undertaken in order to identify the most recent annual and decennial surveys of children's dental health. It was noted that information from surveys of 12-year-olds or 15-year-olds would provide the most useful dental trauma data. Children aged 12 years and older would be expected to have all of their permanent anterior teeth. It has been reported that the peak age for tooth avulsion in children is aged 8 to 12 years [McIntyre *et. al.,* 2009].

A number of papers describing the findings of the 2003 Child Dental Health survey, including data on accidental damage to teeth were identified in the British Dental Journal [Chadwick *et. al.,* 2006, Pitts *et. al.,* 2006]. Further information on the survey protocol, sampling procedures and statistical methods was available on the Internet [Office for National Statistics, 2003].

Information on the NHS (DEP) 2008-2009 12-year-old survey was retrieved. However, no data on accidental damage to teeth from this survey could be identified from a literature and online search. A local Consultant in Dental Public Health (Dr Jenny Godson) was contacted for further information regarding the NHS (DEP) data for the Yorkshire area. She advised the author to contact the local BASCD Committee. A proposal was written and sent to the relevant committee requesting data from the most recent 12-year-old survey (Appendix A.)

The data requested included:

1. Prevalence of Code T at tooth level
2. Prevalence of all surfaces Code T

The proposal was discussed at BASCD Committee meeting and permission was granted to obtain the relevant data. The Dental Observatory (TDO) receives, collates and stores the NHS (DEP) survey results. The Project Manager (Ms Janet Neville) at TDO was contacted following the BASCD committee meeting. Ms Neville undertook a count of the relevant codes, and simple descriptive statistics were then completed.

2.4 Findings

This section addresses in turn the key findings of existing epidemiological survey data in the UK.

2.4.1 Decennial Surveys

2.4.1.1 Child Dental Health Survey 2003 - Protocol

Accidental tooth damage has been recorded in all the Child Dental Health (CDH) Surveys since 1973. The survey protocols and criteria have remained unchanged and therefore the measurement of trauma has been consistent over the series of surveys [Chadwick *et. al.,* 2006].

The 2003 survey was based on a representative sample of children aged 5, 8, 12 and 15 years. A total of 12,698 children were sampled from participating schools and asked to take part in a dental examination in school. In total 10, 381 children were examined, a response rate of 82%. As part of the clinical protocol the teeth were examined specifically for evidence of previous trauma, tooth surface loss and enamel opacities using standard and widely used criteria. The survey protocol has been reported elsewhere [Office for National Statistics, 2003].

As part of the clinical examination component, the trained and calibrated examiners were asked to examine and code each incisor to the following categories (Table 2.1)

Table 2.1: Codes to describe accidental damage to permanent incisors

Code	Description
Code 0	No trauma
Code 1	Discolouration
Code 2	Fracture involving enamel
Code 3	Fracture involving enamel and dentine
Code 4	Fracture involving enamel, dentine and pulp
Code 5	Missing due to trauma
Code 6	Acid-etch composite
Code 7	Permanent replacement (denture, crown, bridge)
Code 8	Temporary restoration
Code 9	Assessment cannot be made

Source: UK Child Dental Health Surveys

There is no code to record an avulsed tooth, or if a tooth has been avulsed and replanted. It is important to note that if a tooth was lost due to trauma and then replaced (with, for example, a partial denture, or a resin-bonded bridge), this was recorded under the permanent replacement category [Chadwick *et. al.,* 2006]. Therefore, a tentative estimation of the prevalence of avulsion injuries can be made using the 'missing due to trauma' and 'permanent replacement' codes.

2.4.1.2 Child Dental Health Survey 2003 - Findings

Since 1983, the proportion of children with trauma has decreased by at least half in all age groups. In the decade 1993- 2003, the decline was most pronounced among twelve-

year-old boys, with a reduction in the proportion having accidental damage from 25% in 1993 to 14% in 2003 [Chadwick et. al., 2006].

More detailed information on accidental damage to teeth is presented in Table 2.2:

Table 2.2 Different types of accidental damage to teeth – rate per 1000 incisors

Age	12 years		15 years	
Year	1993	2003	1993	2003
Discolouration	0.8	0.7	2.1	1.5
Fracture (enamel)	16.8	10.0	11.6	10.2
Fracture (enamel and dentine)	5.9	2.9	5.0	2.6
Fracture (involving pulp)	0.5	0.1	0.3	0.1
Missing due to trauma	1.1	0.1	0.4	0.2
Acid etch composite	5.3	3.4	7.4	4.1
Permanent replacement	0.5	0.2	2.0	1.3

Source: Child Dental Health Survey 2003. Adapted from Chadwick et. al., 2006

For both 12 –year-olds and 15-year-olds there has been a significant decrease in incisor teeth that are missing due to trauma. It has been reported elsewhere [Day and Gregg, 2012] that the results of this survey show a prevalence of 1.2% of 15-year-old children with missing anterior teeth as a result of trauma. It is also clear from Table 2.2 that there has been a decrease in incisors which have been lost and then permanently replaced.

2.4.2 NHS Dental Epidemiology Programme Surveys

2.4.2.1 Survey Protocol – 12-year-old survey 2008/2009

The most recent dental survey undertaken as part of the NHS (DEP) programme was identified; a survey of 12 year-olds completed in 2008/2009.

A considerable amount of data from this survey, relating to dental caries in particular, has been published [The Dental Observatory, 2008, NWPH, 2011]. There was however, no published data available describing the prevalence of dental trauma.

A copy of the National Protocol for the NHS Dental Epidemiology Programme Oral Health Survey of 12 year-old children in England 2008/2009 was obtained [The Dental Observatory, 2008]. It was noted that the aims of the survey were threefold:

1. To measure the prevalence and severity of dental caries
2. To measure the need and demand for orthodontic intervention
3. To measure the self-perception of enamel opacities in 12-year-old children

The clinical examination codes did include a code for dental trauma – Surface Code T:

"A surface will be recorded as traumatised if, in the opinion of the examiner, it has been subject to trauma and as a result is fractured so as to expose dentine, or is discoloured, or has a temporary or permanent restoration (excluding a crown). Minor trauma, affecting enamel only, will be ignored. Where a tooth is missing through trauma, all surfaces should be coded T."

A number of survey conventions were also noted:

"*Caries takes precedence over non-carious defects"*

"Discoloured, non-vital incisors, without caries or fractures should be scored T for trauma on all surfaces"

There is no specific code for an avulsed tooth.

The code for a permanent tooth replacement is Code C:

"*This code is used for all surfaces which have been permanently crowned or which have received permanent items of advanced restorative care in the form of a veneer or a restoration constituting a bridge abutment…..(Note: missing teeth replaced by a bridge are coded either 6,7,8 or all surfaces T)"*

Therefore, if it is determined that a tooth missing due to trauma has been replaced by a bridge, this will be coded all surfaces T.

It is not clear from the survey protocol how a partial denture (a common replacement for incisor teeth lost following trauma) was to be coded.

2.4.2.2 Survey Findings – 12-year-old survey 2008/2009

The stratified sampling procedure for the 12-year-old survey has been described elsewhere [Pine *et al.,* 1997].

In Yorkshire, 6,231 12-year-old children were surveyed during 2008-2009. Four instances of trauma were recorded in this sample. No teeth were recorded as missing due to trauma.

This implies an estimated dental trauma prevalence of 0.06% and an avulsion prevalence of 0% in 12-year-old children in Yorkshire.

2.5 Discussion

2.5.1 Child Dental Health Survey 2003

Accidental damage to teeth has been recorded in all Child Dental Health surveys, since they were started in 1973. The same coding system has been used in each of the surveys, so it is possible to directly compare the findings from survey to survey. The coding system used is simple to follow, and a high level of detail on accidental tooth damage is captured.

Despite this, there is no specific code to record an incisor tooth that has been avulsed. It is thus necessary to extrapolate the data available, to estimate how prevalent avulsion injuries are amongst our child population. Using Code 5 'missing due to trauma' is one way in which we could estimate the prevalence of avulsion injuries. An avulsed permanent tooth is one of the most severe dental injuries and is one of the few traumatic injuries that could lead to early loss of the tooth, even if it has been replanted soon after the initial injury. Thus, it could be argued that any tooth missing due to trauma is likely to have been as a result of an avulsion injury. However, it is also true to say that a severe intrusion injury, or a vertical root fracture could also lead to early loss of a permanent tooth.

There is still an issue of how to use the data to estimate the number of teeth that have been avulsed and replanted and are 'surviving' in the mouth. Another code may be applied to the tooth – for example Code 1 if it is discoloured, but it would then be analysed under that code, and the fact that it had been avulsed is overlooked.

The survey demonstrates that there is a prevalence of 1.2% of 15-year-old children with missing anterior teeth as a result of trauma. The prevalence is lower in the 12-year-old cohort at 0.6%. However, as discussed above, there are significant difficulties with extrapolating this data to arrive at a figure for prevalence of avulsion. Perhaps all that we can say (and perhaps inaccurately) is that at least 1.2% of fifteen-year-olds in the UK have experienced a tooth avulsion injury.

The decennial Child Dental Health surveys demonstrate that it is possible to record a high level of detail on accidental damage to teeth in epidemiological surveys. Despite the inherent difficulties in completing an oral examination in a survey of this type (non-dental setting, limited dental instruments and lighting etc.), there is good information on the various types of fractures that can a child can sustain, as well as the type restoration that was placed.

However, it is difficult to use this information to get an accurate picture on how prevalent avulsion injuries are in our child population. This is disappointing, as avulsion injuries are among the most serious traumatic dental injury a child can sustain.

As described by Chadwick and co-authors, the strengths of the Child Dental Health surveys lie in the fact that they are cyclical in nature, so provide both a cross sectional snapshot of the oral health of children in the UK, and an indication of the long term trends in oral health [Chadwick *et. al.,* 2006]. The measurement of trauma in particular, has been consistent over the series of surveys. Thus a trend analysis over time can be undertaken either by age group or geographical location. The data can also be used to compare with oral health trends internationally.

Perhaps the most important function of this national data is however, its use when it comes to planning health services and public health measures at a national level. The paucity of information on tooth avulsion injuries may mean that the services for treatment of these injuries and public health measures (for example prevention of tooth injury campaigns) are over looked. It must be remembered that children who suffer avulsion injuries often require a lifetime of dental care following the injury, and so a significant burden is placed not only on the child and their family, but on the health service also.

2.5.2 NHS Dental Epidemiology Programme Survey

It was clear from the National Protocol for the 2008/2009 NHS Dental Epidemiology Programme Oral Health Survey of 12 year old children in England that the emphasis was placed on dental conditions other than dental trauma – namely, dental caries, enamel opacities and need for orthodontic treatment. The survey included not only direct clinical examination, but also questionnaires sent to the parents of children involved in the survey, measurement of children's' own self perception of enamel opacities, and analysis of self reports of dental conditions and impact on quality of life. As more data is collected, the survey becomes more time-consuming and difficult to manage. This can lead to inaccuracies in data collection and analysis.

The code related to dental trauma is limited – one code only, to cover the full remit of traumatic dental injuries. If there is caries present in a traumatised tooth, by survey convention, only the caries is recorded. Use of only one code renders it difficult to get an accurate representation of the TDIs occurring in the child population. The use of Code T all surfaces is confusing – a tooth ascribed all surfaces T could be either discoloured or missing due to trauma or missing due to trauma an replaced with a bridge. It is thus not possible to get an accurate indication of the prevalence of avulsion injuries in the child population. The decennial surveys of Child Dental Health have collected more, descriptive data relating to TDIs and show that it is indeed possible to record detailed information on the various types of TDI that can occur in the population.

The trauma prevalence of 0.06% and the avulsion prevalence of 0% found in the 2008/2009 12-year-olds survey are far lower than levels reported in other populations [Traebert *et. al.,* 2003, Andreasen *et. al.,* 2007]. There are two possible reasons for this: there is actually a far lower level of dental trauma in Yorkshire than in other areas, or the recording of traumatic injuries to teeth is inaccurate and not a true reflection of the actual prevalence in the population. The experience of local specialists in Paediatric Dentistry, and that of Consultants in Paediatric Dentistry in the two main teaching

hospitals in Yorkshire (University of Leeds and University of Sheffield) would suggest that traumatic injuries to children's teeth in Yorkshire are at least as prevalent as in other regions and countries. Children present frequently for acute management of dental trauma and there are numerous referrals from GDPs on a monthly basis for the management of children who have sustained a traumatic injury to their teeth.

It would seem then, that traumatic injuries to children's teeth are not being recorded accurately in the NHS (DEP) surveys.

During correspondence with the Dental Project Manager of The Dental Observatory it was noted that there had been no previous requests for this data on traumatised teeth. No calculations were automatically undertaken on the prevalence or extent of dental trauma. It was acknowledged that this may have been related to some difficulties with DSP2, the software packaged used during the survey.

Locally, survey data from the NHS (DEP) programme have been used to identify areas for targeting in oral health. The importance of this localised data collection and subsequent interpretation is increasing, particularly in England, with the move to commissioning of health services on a local basis [Hancocks, 2013]. It is important to know the levels of dental trauma in the population in order to plan appropriate levels of service provision and resource allocation, including workforce planning. The information on TDIs from the recent survey of 12-year-old children in Yorkshire is minimal, if not misleading. If there is no, or very limited, information on traumatic dental injuries in the population, local health commissioners will be unlikely to make provisions for the treatment needs of these children. GDPs have consistently reported many barriers to treating TDI in children, including: inadequate financial remuneration; the feeling that the time spent on trauma was excessive; the irregular frequency and thus unfamiliarity with managing complicated injuries [Jackson *et. al.,* 2005, Hamilton *et. al.,* 1997b]. Even in specialist centres, treatment of TDIs in children is time-consuming, and recent evidence has shown that almost one quarter of children who had been referred to a specialist centre following a TDI were still receiving treatment four years

after the initial referral [Keasberry *et. al.,* 2013]. Who then, is to provide treatment for children who have sustained a traumatic dental injury, if the local dental services are commissioned without accurate information on the levels of TDIs in the population?

2.6 Conclusions

The decennial surveys on Child Dental Health provide a significant amount of detailed information on accidental damage to teeth in children aged 8, 12 and 15 years. Despite this, it is not possible to deduce the prevalence of tooth avulsion injuries in the child population.

Coding limitations in the recent NHS (DEP) surveys have raised questions about its ability to provide accurate information on the level of dental trauma in the child population in the England – the use of Code T is not sufficient to adequately record dental trauma in an epidemiological survey. Currently, epidemiological data cannot provide an exact figure for the prevalence of avulsion injuries in Yorkshire. These surveys placed emphasis on gathering data relating to dental caries, orthodontic treatment need and self-perceptions of enamel opacities. It seems an opportunity has been missed to gather valuable data on traumatic dental injuries including severe injuries such as avulsions.

The limitations of dental epidemiology programmes have been discussed recently in the literature [Rhouma et. al., 2013] and indeed Dr. Ben Cole commented in his editorial that "epidemiological systems need to be robust and frontline clinicians should be involved in their design from the outset" [Cole, 2013].

A key recommendation in the UK National Clinical Guidelines on Avulsion of Permanent Teeth is that a clinical care pathway be implemented to provide high quality care for these children [Day and Gregg, 2012]. Until the prevalence of avulsion injuries is known, restructuring of current services to implement this care pathway will be difficult to justify.

2.7 Recommendations

A standardised method of collecting and retrieving trauma data is required. It is also important to attempt to accurately record the prevalence of avulsion injuries in the child population.

Prospective epidemiological studies, where the incidence of traumatic dental injuries is recorded in pre-specified locations over a period of time, usually one year, are likely to be logistically challenging and expensive to run.

The epidemiological surveys that are in place currently in England and Wales are well organized, with good procedures in place to ensure representative sampling. The decennial surveys demonstrate that high levels of detail about traumatic injuries to teeth can be determined from clinical examination, and perhaps this protocol should be included in the next NHS DEP surveys of 12 and 15 year olds at least.

A novel way of ascertaining the prevalence of avulsion injuries may be to ask the children themselves have they ever had their front tooth knocked out?

Chapter 3

Yorkshire Dentists' Experience of Treating Avulsed Permanent Teeth

3.1 Background

3.1.1 Avulsion Injuries

An avulsed permanent tooth is one of the few true emergency situations in dentistry [Andreasen *et. al.,* 1995a]. This type of injury occurs infrequently (it accounts for 0.5% - 3% of trauma to permanent teeth), so it could be expected that few dentists will see or treat a child with an avulsed permanent tooth throughout their career. In the most severe scenarios, the tooth or teeth are lost, e.g. not replanted, or extracted due to the failure of the replanted tooth [Day and Gregg, 2012].

Children who suffer an avulsion injury require emergency dental care immediately after the injury. There is evidence to suggest that, in the UK, only 10% of children receive adequate emergency care within the appropriate time frame [Day *et. al.,* 2012]. These children subsequently require access to appropriate follow-up care within a well-defined time period after the injury. Early involvement of specialist inter-disciplinary teams to identify the likely prognosis and treatment planning over the short, medium and long term is strongly recommended [Day and Gregg, 2012]. This needs to be supplemented by clear communication between parents, children and primary and specialist care providers to ensure each is clear about the treatment required and who will provide it [Day and Gregg, 2012]. This care pathway should improve the outcome for each child by ensuring they receive the most appropriate dental care within the appropriate timeframe.

3.1.2 Dental Trauma Research in Primary Care

In the UK, the National Health Service provides children's dental care free at the point of delivery with the main providers of dental care being GDPs [Jackson *et. al.,* 2005]. The Community Dental Services also provide primary dental care across the UK. It has been reported that a majority of TDIs occur during normal working hours [Glendor, 2000, Zaitoun *et. al.,* 2010], so it could be expected that initial management of dental trauma would occur in the primary care setting. A retrospective study undertaken in a UK dental hospital found that most of the dental trauma cases seen in the secondary care setting had initially presented in general dental practice. However, this study had looked primarily at complicated crown fractures [Maguire *et. al.,* 2000]. It is imperative that general dental practitioners have a sound working knowledge of managing dental trauma, especially the initial treatment and management [Jackson *et. al.,* 2005].

Research regarding the provision of treatment for dentoalveolar trauma in general dental practice is limited. A review by Australian authors identified only four published studies investigating dentists' knowledge of the management of dental trauma injuries, and one study investigating dentists experience and confidence in treating dental trauma [Yeng & Parashos, 2008]. These studies have been conducted as survey questionnaires investigating GDPs in either private practice or community dental services [Yeng & Parashos, 2008].

In general it was found that dentists had poor knowledge of the management of dentoalveolar trauma. It was noted that many had minimal experience in treating traumatised teeth, and that most had low confidence in their ability to treat more complex traumatic injuries such as root fractures and avulsions [Jackson *et. al.,* 2005, Kostopolou and Duggal, 2005, Yeng and Parashos, 2008].

There is very limited evidence on the quality of care and outcomes of avulsion injuries in primary care. Chadwick and co-workers undertook an audit survey of GDPs in Wales to assess their experience of treating and managing avulsed incisor teeth. A questionnaire was designed and posted to all GDPs in Wales. The results were presented at a European conference, but to date, have not been published [Chadwick & Butler, 2008].

3.1.3 Use of Questionnaires in Research

Where clinical data on oral health are required, it has been considered that the gold standard is oral examinations undertaken by dentists. Where information is needed on dentists' or patients' behaviour, knowledge and/or attitudes, techniques other than direct examination may be appropriate [Tan and Burke, 1997]. Traditionally this has included the personal or 'face-to-face' interview, telephone interview or mailed surveys. In the recent past, electronic questionnaires have become increasingly popular. Each survey methodology has advantages and disadvantages, and the choice of methodology will depend upon the research question under investigation and the resources available to the research team.

The personal interview has a number of advantages, notably the ability of the researcher to ensure that all questions are understood and answered fully. However, this type of survey is time consuming and expensive to run. There is some evidence that the response bias (due to the interviewer effect) can be considerable and, depending on the study population, it may be difficult to achieve an externally valid sample [Dillman *et. al.,* 2009]. Unless a representative sample of the study population can be obtained, it may be difficult to achieve results that are generalisable to other populations and are thus externally valid. Depending on the research topic in question, it can be difficult to achieve a representative sample, as there will always be sections of the population who are unwilling to participate in a one to one interview.

Telephone surveys are somewhat less time-consuming and thus less expensive to run and historically it was possible to achieve excellent response rates with appropriately representative samples [Messer, 2009]. However, with the advent of mobile phone usage, fewer and fewer people have landline telephone services. This has significantly decreased the researchers' ability to ensure representative sampling, as it is more difficult to truly randomise a set of mobile phone numbers, compared with landline numbers [Messer, 2009].

The potential to use the Internet as a research tool and not merely an information resource is growing [Eysenbach and Diepgen, 1998]. Key advantages of using electronic surveys are their relative ease of implementation, and the potential to conduct large-scale surveys whilst eliminating the costs of stationery, postage and administration [Braithwaite *et. al.,* 2003]. However, researchers using this methodology have found it difficult to obtain a sufficiently high response rate or large enough proportion of Internet respondents to realise these advantages compared to a mail-only design [Messer and Dillman, 2010]. The Internet has been found to produce consistently lower response rates than mail or telephone modes, by an average of 11% [Manfreda *et. al.,* 2006], and particularly in older populations [Bech and Kristensen, 2009]. There are a number of possible reasons for this including use of incorrect or obsolete email addresses, technical errors with the server that can lead to loss of responses [Braithwaite *et. al.,* 2003], and whether the respondent can complete and submit the questionnaire with ease. Creation of a web-based survey can be complex, and formatting needs to take into account the clarification of possible responses and the ability to avoid submitting data before the survey is completed. Decisions must also be made about the complexity of visual design, bearing in mind that there will be variation in individual respondents computer hardware and software [Braithwaite *et. al.,* 2003].

Postal questionnaires are a relatively inexpensive way to collect information from people for research purposes [Edwards *et al.,* 2010]. They are particularly useful when small amounts of information are to be collected from a large sample [Tan and Burke, 1997]. Postal questionnaires are commonly used in health care professional research

but response rates are declining [Cook *et. al.,* 2009]. Low response rates can introduce bias and subsequently threaten the validity of the study results [Glidewell *et. al.,* 2012].

3.1.3.1 Questionnaire Design

Questionnaire design is an important stage in the research process. A well-designed questionnaire will help ensure a reasonable response rate and valid results. These features that improve response rate to postal questionnaires were confirmed and summarised in a recent Cochrane Collaboration review on the topic [Edwards *et. al.,* 2010]. They include:

- Shorter questionnaires
- Follow-up contact and provision of a second copy of the questionnaire at follow-up
- Use of stamped returned envelopes as opposed to franked
- Assurance of confidentiality
- University sponsorship

Some of the salient features to be considered are discussed further:

3.1.3.1.1 Nature of cover letters

The cover letter enclosed with a questionnaire can influence whether or not a response is returned. Such features as the prestige of the sender, personalisation and promised anonymity have been found to influence response rate. Studies sponsored by Market Research organisations had a 10% lower response rate than others, while those sponsored by university –sponsored studies obtained a 10% higher response rate [Lockhart, 1984, Edwards *et. al.,* 2010]. Some researchers suggest that personalisation of cover letters and mailing envelopes affects response rates positively [Tan and Burke, 1997].

3.1.3.1.2 Follow-up contacts

Follow-up contacts have long been recognised as an effective way of increasing response rates. These can take the form of repeat mailings or telephone contacts and have been found to offer the most promising method of maximising response to questionnaire surveys [Nakash *et. al.,* 2006]. A quantitative study of postal questionnaires undertaken in the US in the late 1970's found that follow-up mailing nets a return of nearly 20% of the initial sample, although the authors advised that there is substantial variability in the effectiveness of follow-ups, which makes simple generalisations difficult [Heberlein and Baumgartner, 1978].

3.1.3.1.3 Length

The length of the questionnaire has been found to influence responses: short questionnaires are more likely to be returned [Tan and Burke, 1997, Glidewell et. al., 2012]. However, length of the questionnaire can be a double-edged sword – if the questionnaire is quite short, the respondent may perceive it as 'less important' than a longer questionnaire.

3.1.3.2 Respondent rates

Non-response to postal questionnaires reduces the effective sample size and can introduce bias [Edwards *et. al.,* 2010]. It has been demonstrated that response rates in surveys of health care professionals have declined slightly to an average of 57.5% [Cook *et. al.,* 2009]. There are many potential reasons for this including day to day pressures experienced by health care professionals, perceived lack of saliency and an element of 'research fatigue' [Kaner *et. al.,* 1998]. It has previously been reported that a response rate of greater than 43% in questionnaire surveys of dental practitioners is high enough to provide a representative response [Hovland *et. al.,* 1980].

3.1.3.3 Salience

A salient topic is defined as "one which deals with important behaviour or interests, which are also current" [Heberlein & Baumgartner 1978]. Saliency of a questionnaire to the recipient has been shown to be one of the strongest predictors of response [Nakash *et. al.,* 2006]. For example, it is likely that a participant in a health care study receiving a questionnaire regarding their response to a treatment intervention, or their views on a therapeutic encounter would find the question highly salient [Nakash *et. al.,* 2006]. Response rates to non-salient questionnaire surveys rarely exceed 50% [Heberlein and Baumgartner, 1978].

3.1.3.4 Validity

Validity is the degree to which an assessment measures what it is supposed to measure [Kazi & Khalid 2012]. Three types of validity have been identified in the literature: content validity; construct validity, and criterion validity. A valid questionnaire helps to collect better quality data with high comparability [Kazi & Khalid 2012].

The most important types of validity for a descriptive questionnaire are criterion (also described as external validity) validity and content validity.

Content validity refers to observing all the specific items on the questionnaire to determine whether it addresses the topic overall. Experts in the field generally undertake content validation. It can also be undertaken in a simple manner, by the research team involved in the questionnaire design, called face validation. This is a form of common sense applied to a questionnaires purpose [Gillham, 2008]. External (criterion) validity is an assessment of whether the technique adopted measures what the researcher intended it to, i.e. do the dentists' stated experiences of tooth avulsion injuries correspond with their actual experience of tooth avulsion injuries.

3.2 Aims and Objectives

The aim of was to assess the experience of Yorkshire dentists' in relation to the management of avulsed permanent incisors

The objectives were to ascertain the following through the use of a postal questionnaire:

1. How many dentists in the Yorkshire area have replanted an avulsed permanent incisor tooth in a child?
2. How many teeth they have replanted?
3. If they use clinical guidelines or other information sources when treating children who have sustained an avulsion injury?
4. Do they provide follow-up care for children who have had an avulsed permanent tooth?
5. Have they had any postgraduate training in dental trauma?

3.3 Methodology

3.3.1 Study Design

This study was designed as a self-completion postal questionnaire of a random sample of dentists working in the Yorkshire region.

3.3.2 Ethics

The local Dental Research Ethics Committee (DREC) granted ethical approval on 10/02/2012 (Appendix B). Under new research governance procedures, NHS ethical approval was not necessary in order to conduct the study because it did not involve NHS service users or their relatives/carers. An application was made to the Research and Development Committee of the Leeds Teaching Hospitals Trust and permission to undertake the study was granted on 23/07/2012 (Appendix C).

3.3.3 Study Population

The GDC publishes monthly reports outlining the numbers of registrants (dentists and dental care professionals) in the UK and the regions.

In November 2012 there were 30,449 registered dentists in England(www.gdc-uk.org/newsandpublications/factsandfigures/Documents).

As it was planned to survey the experience of GDPs in the Yorkshire area in relation to avulsion injuries, it was necessary to obtain a database with the names and addresses of all GDPs in Yorkshire.

This was discussed with the local Consultant in Dental Public Health who suggested accessing the Dental Performers lists as a way to obtain the names and addresses of GDPs in Yorkshires. The Dental Performers List is a list that every dentist working in primary care has to be approved onto in order to work in England [West Yorkshire Central Services Agency, 2012]. The Performers List is completely separate from GDC Registration and a dentist is unable to treat NHS patients until his/her name is included on a list in England [Kent Primary Care Agency, 2012]. This is, therefore, the most complete and up to date list of NHS dentists working within the Yorkshire area.

A request was sent to the Dental Commissioners in each region of Yorkshire (North, South, East and West) asking for their current Dental Performers list. Each Commissioner sent the Performers List of their region as an Excel database. The databases were collated and checked for duplicates, which were then removed.

The number of GDPs on the Dental Performers Lists in Yorkshire totalled 1,294. The author met with the statistician to discuss sample size. It was noted that an earlier study in Wales had a sample size n=1,121 and achieved a response rate of 40% (n=448) [Chadwick and Butler, 2008]. It had initially been expected that there would be approximately 2,000 dentists in Yorkshire. The costs associated with a postal questionnaire, in particular the postage costs, precluded inclusion of all dentists in Yorkshire. It was felt that a sample size of 50% of the total number of dentists in the

region (n=2000) would allow for non-responders and still ensure a representative sample. It would also enable comparison to the Welsh data. Therefore a sample size of 1000 Yorkshire GDPs was decided upon.

A random number generator was accessed on the Internet (www.random.org/sequences; accessed 11/02/2012), and 1000 GDP names and addresses were randomly generated from the Dental Performers List database using this. Each dentist was assigned a unique identifier number from 1 to 1000 inclusive. The identifier number was printed on each questionnaire and the stamped-addressed envelopes for returns. The respondents were assured that this number would be used only to track returns and would not identify them in any way to the author.

3.3.4 Questionnaire Design

Permission was sought and granted from Professor B Chadwick, University of Cardiff to modify and use the questionnaire used in the Welsh audit (attached as Appendix D). This had looked at the experience of dentists in Wales in relation to the management of avulsed incisors [Chadwick and Butler, 2008].

The Welsh questionnaire consisted of a series of closed-ended questions (thirteen questions in total) with either single or multi-choice answers. Section 1 (Question 1 to 4) looked at respondent demographics. Section 2 (Question 5 to 13) looked at the dentists' experience of avulsion injuries. If the respondent had not replanted an avulsed tooth (Question 5) they were directed to move onto Question 12. Respondents were given the opportunity to provide a comment if they wished at the end of the questionnaire.

The layout of the Welsh questionnaire was altered to allow it to be printed on one A4 sheet. A question asking the dentist to send copies of relevant clinical records was removed. This was removed to prevent any issues arising with patient confidentiality

and data protection. Professor Chadwick also felt this question may have been a contributory factor to the poor response rate to the Welsh survey (Professor B Chadwick, *personal communication*). Questions relating to dentists use of clinical guidelines and other sources of information when treating children with avulsion injuries were added. The modified questionnaire is included as Figure 3.1

Figure 3.1 Questionnaire used to assess primary care dentists experience of treating avulsed permanent teeth.

Questionnaire

Section I – About Yourself

1. What is your sex?

Male □ Female □

2. What was your year of qualification?

1971 or earlier	
1972–1981	
1982-1991	□
1992-2001	□
2002-2011	□

If you work exclusively in the Hospital Dental Services you do not need to complete the rest of the form but please return it in the provided envelope.

3. Do you work in general practice? Yes ☐ No ☐

a) Do you work part time or full time? Part-Time ☐ Full-Time ☐
b) Are you a practice owner or an associate? Owner ☐ Associate ☐
c) Is your practice NHS or privately funded? NHS☐ Private☐ Mixed☐

4. Is your practice limited to a specialist area?

Yes ☐ No ☐

<u>If yes:</u>

Orthodontics	☐
Special Needs	☐
Restorative	☐
Oral Surgery	☐
Children	☐
0ther	☐ please specify _____

Section II – Experience of treating avulsed incisors

5. Have you ever re-implanted an avulsed incisor yourself?

Yes No

If no please go to question 12.

6. Please indicate how many teeth you have re-implanted since qualifying.

1 tooth	☐
2 teeth	☐
3 teeth	☐
4 teeth	☐
5 or more	☐

7. Please indicate how many patients:

1 patient	☐
2 patients	☐
3 patients	☐
4 patients	☐
5 or more	☐

V2 12/11

Questionnaire

8. Please indicate in which work environment did you re-implant an incisor (Tick all boxes that apply)

Junior hospital post ☐
GPT/VT ☐
GDS/CDS ☐
Out of hours emergency ☐
Other ☐ Please specify _____

9. Were you responsible for the continuing care of the patient? (e.g. review, splint removal, endodontic therapy)

Yes ☐ No ☐

10. What, if any, clinical guidelines have you used to assist in treating patients with avulsed incisors?

BSPD (British Society Paediatric Dentistry) Guidelines ☐
IADT (International Association Dental Traumatology) Guidelines ☐
AAPD (American Academy Paediatric Dentistry) Guidelines ☐
Other (please specify) _____

11. What, if any, sources of information have you used when treating patients with avulsed incisors?

Andreasen Text Book ☐
General Paediatric Dentistry Text ☐
www.dentaltrauma.org ☐
Other (please specify) _____

12. Do you currently have under your care patients with re-implanted teeth under review, or who had re-implanted teeth which failed and have been extracted?

Yes No

13. Have you had any postgraduate training in dental trauma?

No ☐
Yes ☐
Please describe _____

Please tick the box if you are interested in receiving results from this audit ☐

Thank you for your help, **please return the questionnaire in the envelope provided**. We would welcome any comments you may have, please use the back page.

Contact Details:

3.3.5 Cover Letter

A cover letter was written, outlining the reason for the study and what was required of the respondent. Confidentiality for the respondents was assured. The author (KC) and the Academic Supervisor (PD) signed the cover letter (Appendix E).

3.3.6 Pilot

The questionnaire was piloted in Leeds Dental Institute. Ten postgraduate students from a number of specialties (Paediatrics, Orthodontics, Restorative Dentistry) were asked to read the cover letter and to complete the questionnaire. Some minor modifications to layout were made following this pilot.

3.3.7 Printing and Posting

The cover letter and questionnaire were printed on white A4 paper and placed in an envelope along with a stamped addressed envelope for return of the questionnaire. The questionnaire and the envelope were numbered with the identifier number assigned to each dentist on the list. This was carried out in order to ensure anonymity for the respondents and to enable tracking of returns. The initial mailing was posted on 6th of November 2012.

The author checked returns as they arrived against a number chart. This chart was used to identify non-responders. It had been planned to post the second mailshot to non-responders six weeks after the initial mailing, but this coincided with the start of the Christmas period. It was elected to delay the second mailshot until mid-January 2013. The Academic Supervisors (PD and GD) used the number chart to identify the non-responders and a new database was created to enable the second mailing, thus preserving the anonymity of respondents.

A note was added to the cover letter, apologising if the questionnaire had already been completed and returned. The questionnaire, cover letter and stamped addressed envelope were posted to all non-responders on 15th of January 2013.

3.3.8 Data Analysis

The anonymised data was entered on an Excel spreadsheet by the author and checked for errors. Simple descriptive analysis was undertaken using Excel tools of the following:

Demographics

- Gender
- Year of qualification
- Work practices

Had the GDP replanted an avulsed tooth? If so:

- How many teeth?
- In how many children?
- In what work setting?
- Were they responsible for the follow-up care for the child?
- Did they use clinical guidelines or other sources of information when treating these children?

Do they have children with avulsion injuries on review?

Do they have any postgraduate training in trauma?

3.4 Results

3.4.1 Response Rate

A total of 1000 questionnaires were sent to dentists whose names were included on the Dental Performers List for Yorkshire. Four hundred and fifty five (45.5%) were returned after the initial mailing and a further 158 (15.8%) were received after the second mailing. Thus a total of 613 questionnaires were returned (response rate 61%). Sixteen questionnaires were excluded from analysis because the practitioner had changed address (n=14), or the questionnaire was returned without having been completed (n=2). A final total of 597 questionnaires were analysed (response rate 59.7%).

3.4.1.1 Completion rate of questions asked

The following table records the percentage of respondents who answered each question appropriately (Table 3.1)

Table 3.1 Completion rates of questions from the analysed questionnaires

Question	**Completion Rate (%)** **(N=597)**
Q1 Gender	98% (n=585)
Q2 Year of Qualification	99.4% (n=593)
Q3 Work Practices – do you work in general practice?	100% (n=597)
a) Part-time or full-time	96.4% (n=575)
b) Owner or associate?	93.9% (n=560)
c) NHS or Private or Mixed practice?	94.6% (n=565)
Q4 Is your practice limited?	100% (n=597)
Q5 Have you replanted an avulsed tooth?	100% (n=597)
Q6 How many teeth?	100% (n=232)
Q7 In how many children?	100% (n=232)
Q8 In which work environment?	100% (n=232)
Q9 Were you responsible for continuing care?	99.6% (n=231)
Q10 Did you use clinical guidelines?	99.2% (n=230)
Q11 Did you use other information sources?	99.6% (n=231)
Q12 Do you have a child with avulsion under your care?	99.8% (n=596)
Q13 Have you had postgraduate training in dental trauma?	100% (n=597)

3.4.2 Gender and Year of Qualification

Twelve respondents declined to answer the question on gender. Of those that did, 58% were male and 42% were female. Just under half of the sample (n=292) had qualified since 1991. A small percentage had qualified before 1971 (2.8%, n=17).

3.4.3 Place of Work

Three respondents worked exclusively in the Hospital Dental Services, these were asked not to continue with the questionnaire. Forty respondents did not fully complete this section. Of those that did, 95% (n= 564) worked in general dental practice. A small percentage (4.6%, n=27) answered that they worked in limited practice (i.e. as a specialist). A significant majority work full-time, and a large cohort work in mixed (NHS and Private) practice. This data is presented in Table 3.2.

Table 3.2: Work Practices of Respondents

Variable	**Number**
Full-time	390
Part-time	176
Owner	254
Associate	286
NHS	230
Private	16
Mixed	307

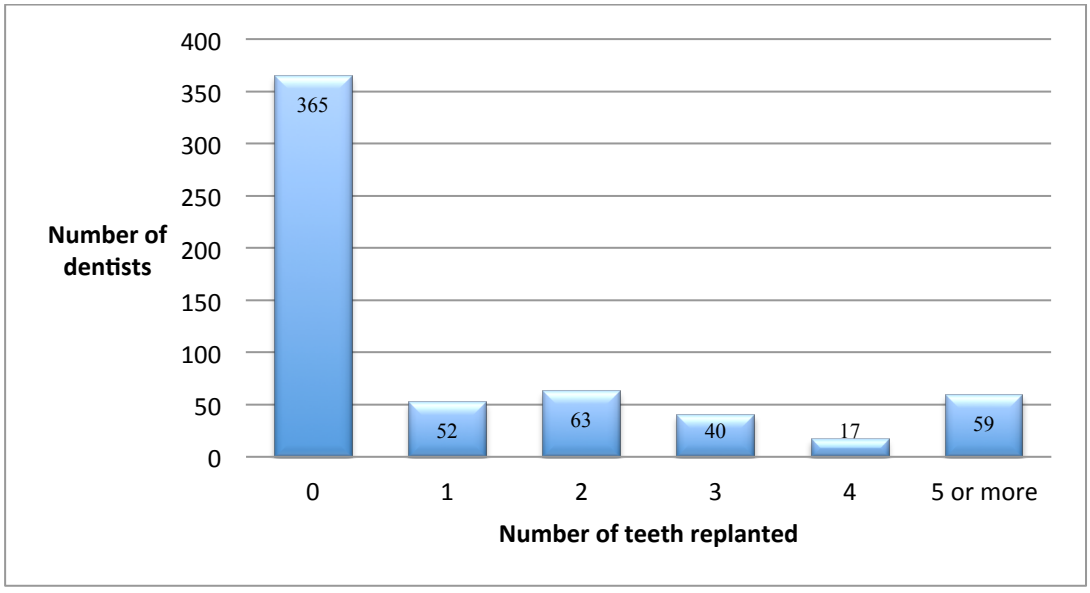
3.4.4 Replantation data

All respondents (n=597) were asked 'Have you ever replanted an avulsed incisor yourself?' Thirty nine per cent (n=232) of respondents had replanted an avulsed incisor.

3.4.4.1 Number of avulsed permanent teeth replanted

These two hundred and thirty two respondents were then asked further questions about their experience of replantation. The majority had replanted one or two teeth, but one quarter (25.4% n=59) had replanted five or more teeth (Figure 3.2)

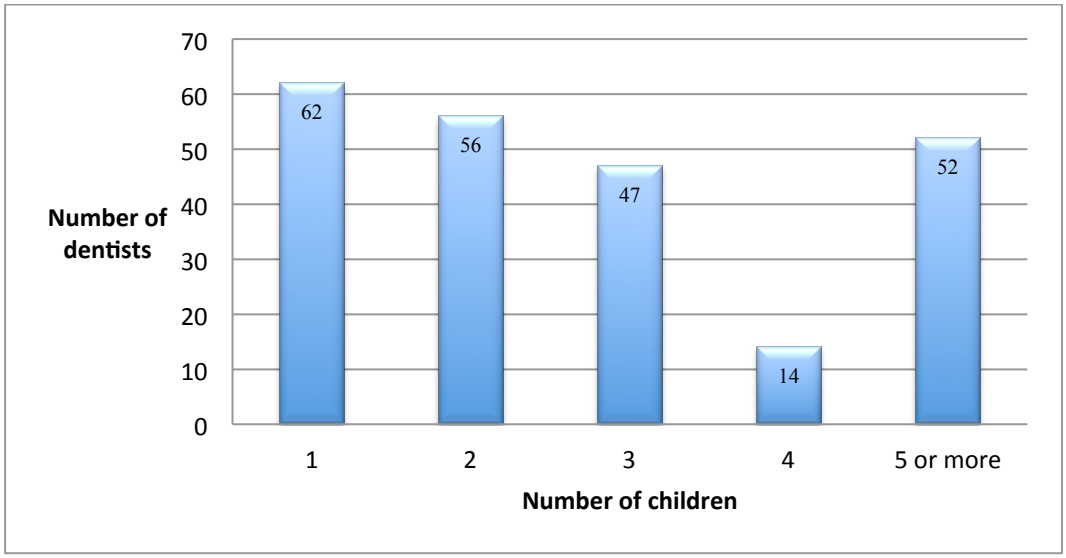
Figure 3.2: Number of teeth replanted by number of dentists



3.4.4.2 Number of children in whom dentists had replanted avulsed permanent teeth

A similar pattern was again seen in the number of children in whom dentists had replanted teeth (Figure 3.3)

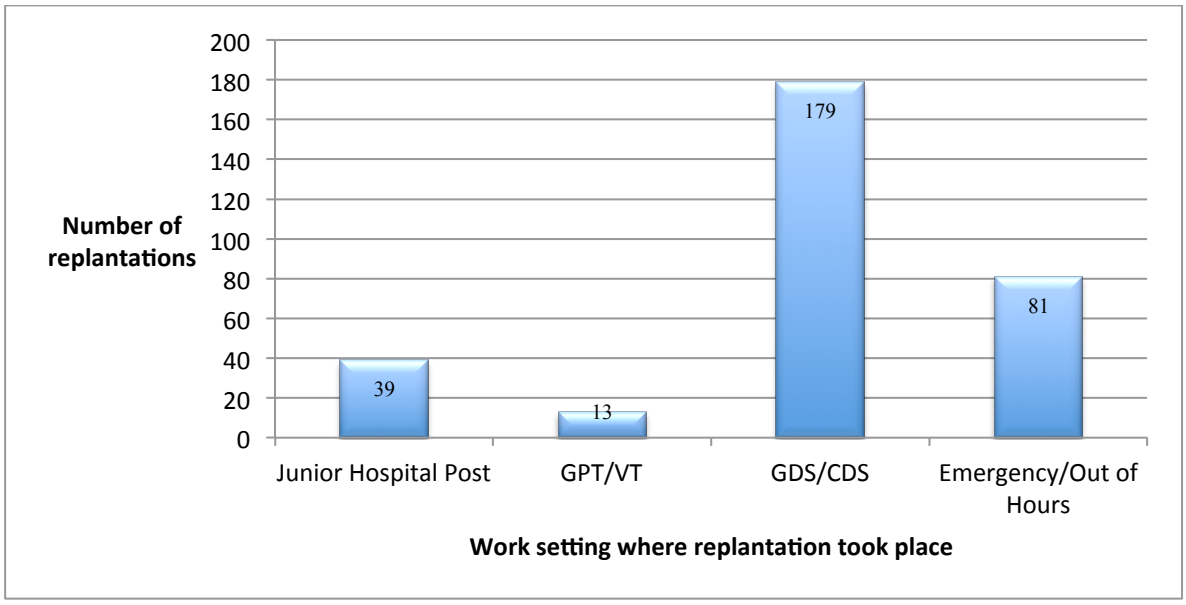
Figure 3.3: Number of children in whom dentists had replanted teeth



3.4.4.3 Work setting in which the replantation took place

The vast majority of these replantations took place in either the general dental services or the community dental services (Figure 3.4). The dental setting was not a mutually exclusive category; some respondents had replanted teeth in a variety of dental settings.

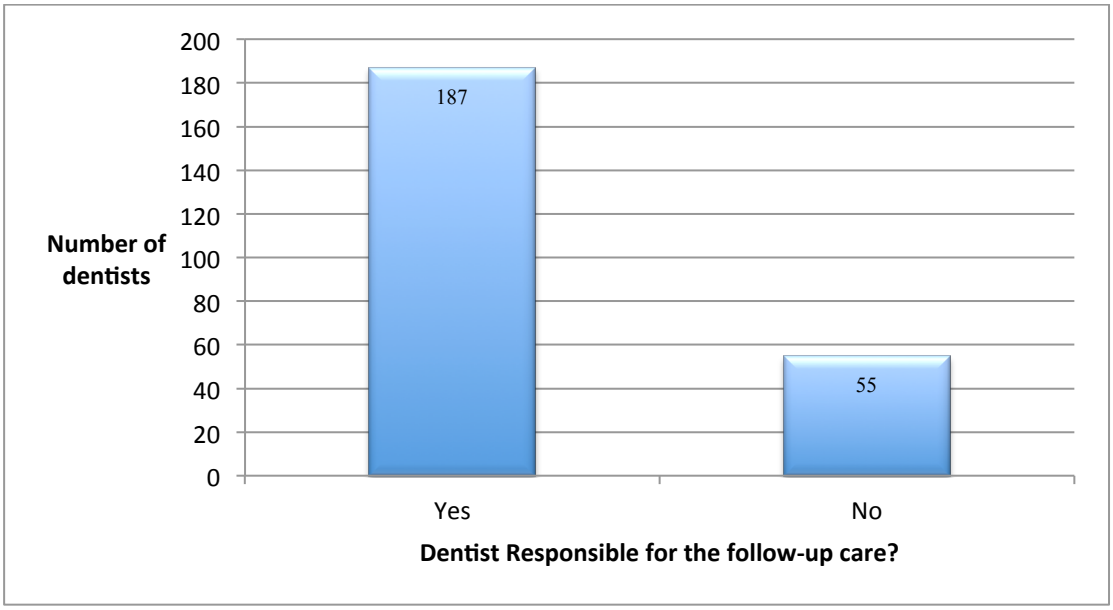
Figure 3.4: Work setting where replantation of avulsed permanent tooth took place



3.4.4.4 Was the dentist responsible for the follow-up care after replanting the avulsed tooth?

Respondents were then asked if they were responsible for the continuing care of the child. Again, this question was not a mutually exclusive category. However, the majority answered that they were responsible for follow-up care (Figure 3.5)

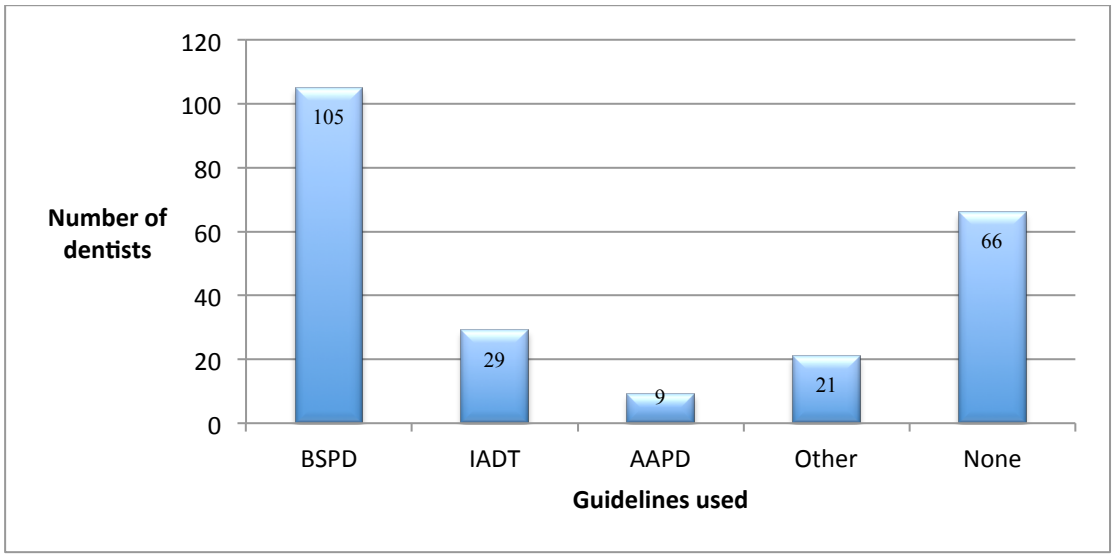
Figure 3.5: Responsibility for the follow-up care after replanting the avulsed tooth



3.4.4.5 Use of clinical guidelines and other information resources

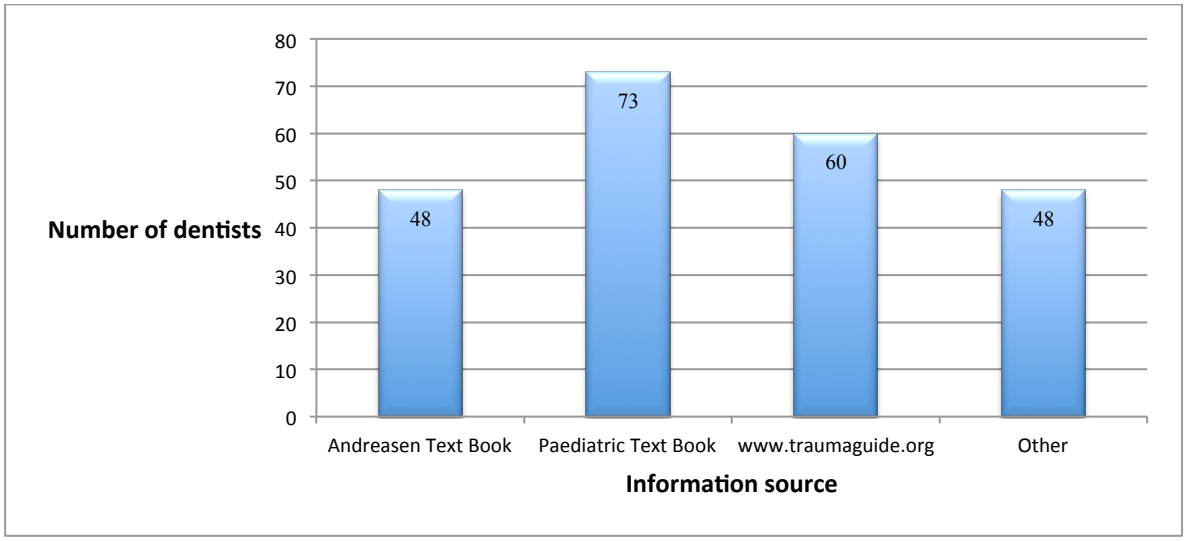
The dentists who had replanted avulsed teeth were then asked if they had used any clinical guidelines, textbooks or other information resources when treating children with avulsed teeth. The results are presented in Figures 3.6 and 3.7:

Figure 3.6: Clinical guidelines used when treating children who had experienced avulsion injury



'Other' included advice from a local dental hospital, notes from undergraduate training, maxillo-facial training and BOS (British Orthodontic Society) guidelines.

Figure 3.7: Other information resources used when treating children who had experienced avulsion



'Other' included magazine articles, own experience and BSPD lectures.

3.4.4.6 Do dentists have children with avulsion injuries under their care?

All questionnaire respondents (n=594) were asked to complete the remaining questions, starting with 'Do you have any children with avulsion injuries under your care?" Two respondents did not answer this question. Almost 40% (n= 226) have children with avulsion injuries under their care currently. Table 3.3 demonstrates those that have children with avulsion injuries on review, whether they have replanted avulsed teeth or not.

Table 3.3 Number of dentists who have children with avulsion injuries on review

		Replanted teeth	
		Yes	No
Avulsion injuries on review	Yes	96	135
	No	130	231

3.4.4.7 Have dentists received any postgraduate training in dental trauma?

The final question asked whether respondents had received any postgraduate training in dental trauma. Forty per cent of respondents (n=237) stated that they had received training in dental trauma since graduation

3.4.5 Dentists' who had replanted avulsed teeth.

For those who had replanted avulsed teeth, the demographic details were different. Just over 70% (n=162) were male. Seventy per cent of them had graduated before 1991 (n=160). Over half of these dentists had received postgraduate training in dental trauma (57, n=133).

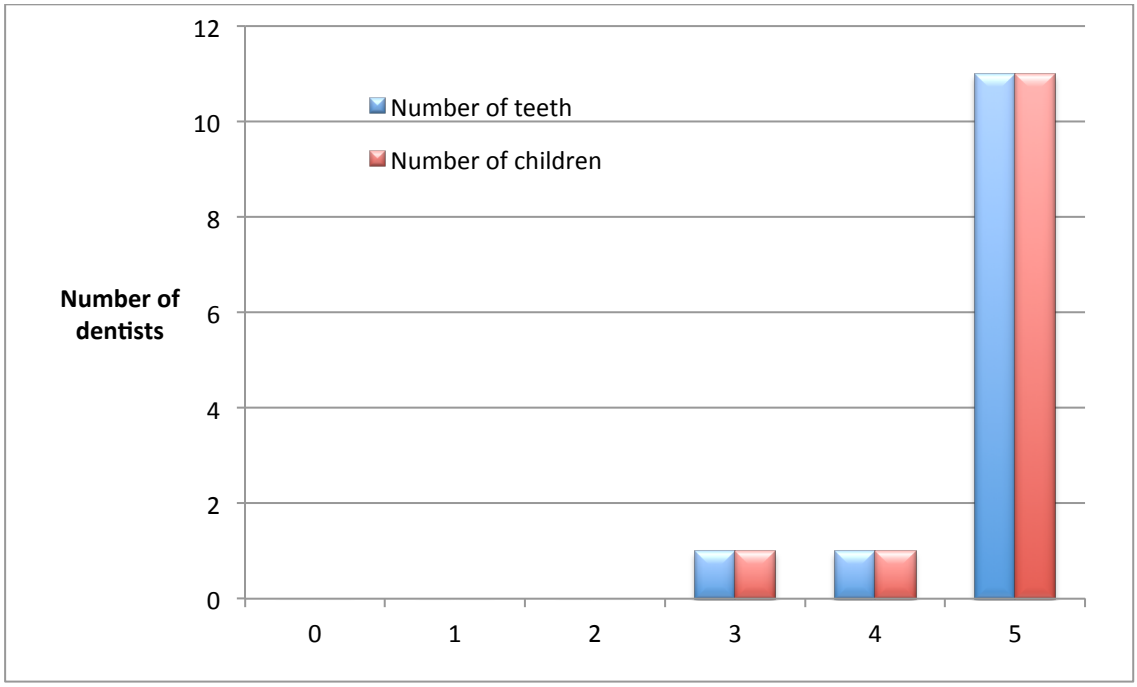
Fifty-nine dentists (25% of those who had replanted teeth) had replanted five or more avulsed permanent teeth in children. Just over 70% (n=42) were male. A significant majority had graduated before 1991 (n=48). Only 19% of this cohort had graduated in the past twenty years. The majority of the replantations took place in the GDS/CDS setting (n=48), but almost equal numbers took place whilst the dentist was in a junior hospital post (n=24) or during an out of hours emergency (n=24). These dentists were often responsible for the on going care of the patient following the replantation (n=51). A slight majority currently have children with avulsion injuries under their care (n=31), compared with all respondents who answered this question.

As discussed below, eleven dentists who had replanted five or more avulsed permanent teeth were in specialist practice.

3.4.6 Specialist Dentists

Almost five per cent (n=27) of the respondents were specialist dentists. The majority of these were specialist orthodontists (n=12) or special care dentists (n=7). Just over half of the specialist dentists (n=14) had replanted an avulsed permanent tooth in a child. A significant majority of these (n=11) had replanted five or more avulsed teeth in five or more children. This is demonstrated in Figure 3.8:

Figure 3.8 Specialist dentists who had replanted teeth – number of teeth and in number of children



The findings of the analysis are summarized in Table 3.4

Table 3.4 Summary of findings from analysed questionnaires

	All Dentists	Dentists who had replanted a tooth	Dentists who had replanted 5 or more teeth	Specialists	Specialists who had replanted teeth
Number	597	232	59	27	14
Gender M v F	58% v 42%	71% v 29%	72% v 28%	48% v 52%	64% v 36%
Year of Graduation - % before 1991	51%	70%	81%	56%	71%
Work setting of replantation (n=)	-	GDS/CDS 179 Out of Hours 81 Hospital Post 39 GPT/VT 13	GDS/CDS 40 Out of Hours 19 Hospital Post 17 GPT/VT 2	-	GDS/CDS 10 Out of Hours 2 Hospital Post 11 GPT/VT 1
Responsibility for follow-up care	-	77%	82%	-	64%
Children with avulsion on review - % Yes	38%	42%	53%	26%	29%
Post graduate training	40%	57%	56%	52%	64%

3.5 Discussion

3.5.1 Methodology

3.5.1.1 Questionnaire

The choice of methodology is an important consideration in the research process. The postal questionnaire was chosen as it was felt it offered a number of advantages over the other available methodologies. Face to face interviews and telephone interviews were not considered, as it was likely that the costs and time involved to survey a suitable sample size would be excessive. An Internet survey was considered carefully. It was likely that an Internet based survey would be the most cost-effective [Braithwaite *et. al.,* 2003]. However, the issues surrounding creation of a data base of dentists email addresses and the appropriate randomisation of the database to obtain the final sample were felt to be likely to have a significant effect on the representativeness of the sampled dentists [Messer and Dillman, 2010].

Postal questionnaires can provide a cost-effective method of surveying the values and opinions of a large number of participants in a literate population [Glidewell *et. al.,* 2012]. The use of a postal questionnaire would also enable direct comparison of results with the data obtained from the Welsh survey [Chadwick and Butler, 2008]. There are some inherent limitations associated with postal questionnaires. Low response rates reduce the effective sample size and can introduce bias. This can threaten the validity of the results [Glidewell *et. al.,* 2012]. In every postal survey, a proportion of the questionnaires are returned which have not been completed – commonly due to change of address of the recipient. Details of the true non-responders – i.e. those who received the questionnaire but chose not to return it, are generally difficult to obtain [Tan and Burke, 1997]. This can make it difficult to assess the issue of non-response bias.

3.5.1.2 Pilot study

The pilot study was undertaken to ensure that the questionnaire was easy to follow and to identify any areas or questions that required clarification. It also ensured that the questions were valid in terms of obtaining the information they were intended to capture.

The pilot study participants found the questions easy to read and understand, and they felt that the questionnaire had obtained a good overview of their experience of treating children with avulsion injuries. The questionnaire took the pilot participants no longer than ten minutes to complete.

The pilot study sample group was however, derived from the authors colleagues in the Post Graduate room at the Leeds Dental Institute. Although the majority did not speak English as a first language, these are a group of highly motivated and educated dental professionals. There may also have been an element of response bias if they felt uncomfortable advising the author, a colleague of theirs, of any difficulties they faced when completing the questionnaire, or any changes they would have made.

A more appropriate pilot study sample may have included a number of GDPs who were not involved in postgraduate education. A focus group involving the author and GDPs may have been helpful to ascertain how the GDPs understand the topic area and in particular what aspects of treating avulsion injuries in children are most salient to them. This may have led to an increased response rate for the study.

3.5.1.3 Study Sample

Obtaining a database of names and addresses of GDPs in Yorkshire proved difficult. The GDC no longer provide a CD-ROM with details of all registered dentists. The

search function on the GDC website, which allows a search to be undertaken based on name, location or postcode (www.gdc-uk.org/pages/searchregisters.aspx), proved cumbersome and laborious to use. Contact was made with the GDC directly on a number of occasions, requesting information on GDPs in Yorkshire, but on each occasion the author was directed to use the website search function.

An approach was made to the Postgraduate Dental Dean of Yorkshire and the Humber to access the required details from the Deanery database. This had been used previously as a database of GDPs in Yorkshire [Kostopolou and Duggal, 2005]. Access was refused as the Dean felt that dentists whose names and details were given to the Deanery had not given consent for their details to be used for the purposes of distributing research questionnaires.

This issue was discussed with the local Consultant in Dental Public Health who suggested accessing the Dental Performers lists as a way to obtain the names and addresses of GDPs in Yorkshires. As described previously, the Dental Performers List is a list that every primary care dentist working in England has to be approved onto in order to work as an NHS primary care provider [WYCSA, 2012]. Once the Performers List from each of the regions had been collated, the total number of GDPs in Yorkshire was noted to be 1,294. A random number generator was used to randomise the sample of 1000 dentists. This was carried out to improve the representativeness of the sample. A representative sample will improve the external validity of the results obtained.

In hindsight it is evident that this collated list of Dental Performers in Yorkshire did not include all dentists in Yorkshire. Information accessed from the Health and Social Care Information Centre (www.hscic.gov.uk) showed that there were 2,370 dentists working in primary care in Yorkshire in the year ending March 31st 2012. Contacting a Dental Commissioner in each region of Yorkshire (North, South, East and West) did not provide access to all Performers Lists. These lists are held in what were formerly the PCTs. There were fourteen PCTs in Yorkshire in the year ending March 31st 2013. However, there was at least a geographical spread of dentists included in the database, and by looking at demographic details such as gender, as discussed in the following

section, it does appear to be a representative sample of primary care dentists in Yorkshire.

It may have been preferable to send the questionnaire to all dentists on the database but it has been acknowledged that increasing the sampling frame size does not necessarily strengthen the validity and generalisability of the study [Glidewell *et. al.,* 2012]. The increased costs incurred with posting to all dentists on the database may then not have been justified.

3.5.2 Results

3.5.2.1 Avulsed teeth: An audit of Welsh dentists experiences

The questionnaire used in this study was based on a questionnaire used in a Welsh study of dentists' experiences of treating children with avulsed permanent teeth. The first author of that study (Professor B. Chadwick) gave permission for the questionnaire and the data it generated, to be used in this project. Questionnaires were sent by post to all dentists identified as working in primary care in Wales (n=1121). In total 453 (40.4%) questionnaires were returned. The results from this survey are used for comparison purposes throughout the rest of this discussion and are summarized in Table 3.5.

Table 3.5 Comparison of results from Yorkshire and Welsh studies on dentists' experiences of treating avulsed permanent teeth

	Yorkshire	Wales
Response rate	59.7%	40.4%
Replantation experience	39%	46%
Number of teeth		
1 or 2	50%	55%
5 or more	25%	22%
Work setting	GDS > out of hours > hospital post > VT	GDS > hospital post> out of hours > VT
Responsible for follow-up	77%	70%
Avulsion injuries on review	40%	34%

3.5.2.2 Response Rate

As discussed previously, non-response to postal questionnaires reduces the effective sample size and can introduce bias (Edwards *et. al.,* 2010). A number of efforts were made to maximise the response rate for this study, including:

- Length of the questionnaire – printed on one A4 sheet
- Inclusion of a cover letter, introducing the author and research supervisor (PD). The author signed the cover letter, which was printed on University headed paper
- Promise of anonymity and confidentiality for the respondents
- Inclusion of a stamped addressed envelope for returns
- Second mailing to non-responders, again including a stamped addressed envelope for returns

There is some evidence to suggest that inclusion of a monetary incentive for the responders can increase the response rate [Edwards et. al., 2010], but there are some ethical issues associated with this practice. It may also have been possible to improve the response rate by telephone contact with the non-responders, as carried out by Jackson and co-workers in their earlier study on the management of dental trauma in primary care. Their response rate increased from 54% to 73% following telephone contact (as a reminder) with those who had not returned the questionnaire [Jackson *et. al.,* 2005].

A response rate of 45.5% was achieved after the initial posting and this increased to 61% following the second posting to the initial non-responders. Two questionnaires were returned with insufficient questions answered to enable analysis and a further 14 were returned not completed as the GDP had changed address. Thus a total of 597 questionnaires were available for analysis (response rate 59.7%). This is comparable to Cooks figure for average response rate to Health Care Professional questionnaire surveys of 57.5% [Cook *et. al,* 2009] and greater than the response rate achieved in the Welsh survey of dentists' experiences of treating avulsion injuries [Chadwick and Butler, 2008, *supplemented by personal communication*]. It is however, less than the response rate achieved in previous questionnaire surveys on dental trauma in Northern

England [Jackson *et. al.,* 2005, Kostopolou and Duggal, 2005], of 73% and 71% respectively. There may have been an element of research fatigue involved in this lower response rate - GDPs may have felt they have already completed a questionnaire on a similar topic in the past and felt that this 'extra' questionnaire was not necessary. It is also possible that as this questionnaire asked only about avulsion injuries, those who have no experience of avulsion may have felt that they had nothing to contribute to the survey findings. Thus, the findings may represent an underestimation of those GDPs with no experience of treating avulsion injuries. However attempts were made to address this issue in the letter of invitation where the respondents were advised that

'*Even if you have no experience of avulsed incisors your response is very helpful'*

It must also be accepted that there is minimal information on the cohort of GDPs who did not return the questionnaire. The Dental Performers List contains only the GDP name and practice address. It is thus not possible to comment on the demographics of this particular group and the issue of non-response bias.

3.5.2.3 Respondent Demographics.

Fifty eight per cent of the respondents were male. This approximates well to the 56% of male registrants with the GDC in England and is very slightly less than the percentage of male respondents (62.3%) in the Welsh survey [Chadwick and Butler 2008].

Just under half of the sample (n=292) had qualified since 1991. A small percentage had qualified before 1971 (2.8%, n=17). A similar pattern was noted in the Welsh data. The question was written as a closed ended question, with respondents ticking a box that correlated with their year of qualification e.g. 1971-1982 or 1991-2001. The question was used to enable direct comparison with the Welsh cohort, but it may have been preferable to ask for the age of the dentist. Most demographic information describing the dental workforce that is available uses age of dentist as a descriptor [Robinson *et. al.,* 2011]. It may then have been possible to comment more accurately on the representativeness of the sample. However, date of qualification provides information on years in practice, and what is likely to have been taught in dental school.

Ninety five per cent of the respondents stated that they worked in general dental practice. This is significantly higher then the 82.6% of respondents that worked in the GDS in Wales. The Welsh figure may be more representative of the dental workforce in general, as data from the Medical Education England body showed that 83.7% of dentists in the UK work in general dental practice [Robinson *et. al.,* 2011]. This discrepancy was not surprising, as the sampling frame for each study was different. The Welsh study looked at all dentists working in Wales, but this study deliberately sampled dentists working in primary care.

It has been reported that almost 20% of the dental workforce here have qualified outside of the UK [Robinson *et. al.,* 2011], so it may have been useful to include a question on place of qualification in the questionnaire. Little is known about the dental curriculum in other countries and whether dental trauma is taught at UG level

3.5.2.4 Avulsion Experience

Thirty nine per cent of respondents (n=232) had replanted an avulsed permanent tooth in a child, less than the 46.2% (n=206) who had done so in Wales. This shows there is a large cohort of dentists in both regions, who have not replanted an avulsed tooth. This is not surprising, considering that avulsion injuries are rare. A dentist who has replanted an avulsed tooth is likely to remember it, even if it occurred several years ago. However it is not possible to deduce the likely number of avulsion injuries that occur in Yorkshire or even England in any given period of time, due to the paucity of epidemiological data available. It is important to remember that this may be an over estimation of GDPs experience as it could be expected that the cohort of non-responders may include many dentists with no experience of treating children with avulsion injuries.

3.4.2.4.1 Number of teeth in number of patients

The two hundred and thirty two respondents who had replanted avulsed permanent teeth were then asked further questions about their experience of replantation. A majority

had replanted one or two teeth, but almost one quarter had replanted five or more teeth. This was similar to the Welsh data, where 55% had replanted one or two teeth and 22% had replanted five or more avulsed teeth.

For those who had replanted avulsed teeth, the demographic details were somewhat different. Just over 70% (n=162) were male. This may be explained by the fact that male dentists are more likely to work full-time, and less likely to take any protracted period of time off work (as a female dentist might as maternity leave). Seventy per cent of them had graduated before 1991 (n=160) – this makes sense as the longer your career is, the greater the chance of treating an avulsion injury.

The majority had replanted teeth in one or two children, and almost one quarter had replanted teeth in five or more children and this pattern was again seen in the Welsh data.

3.5.4.2.2 Dentists who had replanted five or more teeth

Fifty-nine dentists (25% of those who had replanted teeth) had replanted five or more avulsed permanent teeth in children. It was found that a significant majority were male and had graduated before 1991. Only 19% of this cohort had graduated in the past twenty years. The reasons for this are likely to be similar to those discussed above – working practices and length of career.

3.5.4.2.3 Work setting in which the replantation took place

The vast majority of these replantations took place in either the general dental services or the community dental services. This was also the case in the Welsh study. This shows that when an avulsion injury occurs during normal working hours, parents are likely to bring their child to their GDP. It is important to note that it was possible for the respondents to tick more than one option – a number of the respondents had replanted avulsed teeth in a variety of work settings. Eighty-one dentists had at some stage replanted a tooth as an emergency, out of hours. This data cannot tell us whether the

dentist had opened their practice to facilitate this emergency treatment, or if they were working for an out-of-hours dental service at the time.

It is important to note that the organization of out-of-hours dental care has changed considerably in the past decade. Prior to the introduction of the 2006 NHS dental contract in England and Wales, GDPs were responsible for the provision of out-of-hours emergency dental care. This led to greater national variation in service provision [Austin *et. al.,* 2009]. It had become apparent that not all dentists provided, or made arrangements to provide out-of-hours care for their patients. Under the contractual arrangements introduced in 2006, local commissioning agencies became formally responsible for the provision of out-of-hours emergency dental care [Austin *et. al.,* 2009]. The responsibility for providing out-of-hours care no longer lies with the GDP.

3.5.4.2.4 Responsibility for follow-up care

The answers for this question were again mutually exclusive, in that the respondent could answer both yes and no. The majority indicated that they were responsible for the follow-up care following the replantation. Some respondents noted that this depended on where they were working at the time – if they were in a junior hospital post they were less likely to be responsible for the follow-up care for the child.

3.5.4.2.5 Use of guidelines and other information resources

These were novel questions, included to assess the work practices of dentists, in this an increasingly evidence-based era of dental practice. They were not asked by the Welsh survey and were added as an indirect way of assessing what dentists are doing in relation to the treatment of children who have avulsion injuries. They may also provide an indication what value (if any) primary care dentists place on the available clinical guidelines Almost 30% of those who had replanted avulsed teeth have not used clinical guidelines during their treatment (n=66). A number of respondents had noted that they didn't use guidelines because they had "years of clinical experience". This is disappointing as these dentists are then less likely to be up to date with the

recommended treatments and procedures for children who have avulsed a permanent tooth.

Of those that do use clinical guidelines, those written by the BSPD are by far the most popular (n=105). Interestingly, far more dentists (99%) indicated that they used other sources of information when providing treatment for avulsed teeth. The majority indicated that they used a general paediatric dental textbook (n=73), but a good proportion (26%, n=60) have used the relatively recently introduced web-based resource www.dentaltraumaguide.org. Fifty-five per cent of dentists who have undertaken postgraduate training in dental trauma have used www.dentaltraumguide.org. It is difficult to validate this question as it has not been asked previously. There is no other source of information on the use of clinical guidelines in primary care with which to compare this data to. It is possible that the respondents indicated that they have used guidelines and other information resources because they know that they should be using them in their clinical practice.

3.5.4.2.6 Specialist dentists

Almost five per cent (n=27) of the respondents were specialist dentists. It was important to look at this subset, as dentists who have pursued specialist training are likely to have spent at least some of their careers working in a hospital setting. They could then have been expected to see more complex TDIs. However, they do represent only a small proportion of the total sample. Just over half of the specialist dentists (n=14) had replanted an avulsed permanent tooth in a child. A significant majority of these (n=11) had replanted five or more avulsed teeth in five or more children – this represents almost 20% of the cohort of dentists who had replanted five or more avulsed teeth.

3.5.4.2.7 Dentists with avulsion under review at present

All respondents were asked to answer the final two questions of the questionnaire. Dentists in the Welsh survey were asked do they currently have children who have suffered avulsion injuries on review – 34% indicated that they did. Dentists in Yorkshire were asked the same question and almost 40% indicated that they had a child who had suffered an avulsion injury on review. This may be because the incidence of avulsion injuries is higher in Yorkshire than in Wales. In another way it is however surprising, as there are proportionately more specialist paediatric dentists working in the Yorkshire area than in Wales (32 on the Specialist Register with an address in Yorkshire, compared with 9 on the Specialist Register with an address in Wales). These Paediatric Dentistry specialists in Yorkshire work not only in the Hospital Dental Services, but also within the Community Dental Services. Thus, dentists in Yorkshire should have less difficulty in arranging local specialist follow-up and care for these children. This is perhaps an indication that either they are not aware of the importance of specialist input in the management of these cases, or they are aware of the potential benefits, but choose not to make the referral.

3.5.4.2.8 Postgraduate training in dental trauma

The entire cohort was asked this question, and almost 40% (n=237) reported that they had engaged in postgraduate training in dental trauma at some stage since qualification. This question was not asked in the Welsh study, but was included in other surveys of dentists' experiences in dental trauma [Jackson *et. al.,* 2005, Kostopolou and Duggal, 2005], and thus it can be used as an indirect way of measuring the validity of the sample. In Jackson's study of dentists in North East England, 36% had undertaken postgraduate training in dental trauma. The figure was higher in the Kostopolou study, which was based on dentists in Yorkshire – 47% had engaged in postgraduate training in dental trauma. Dentists in Yorkshire are likely to be able to access this training more easily because of the number of paediatric dentists working in the region and because of the significant publicity that was undertaken during a recent multi-centre randomized

controlled trial on treatment for avulsed teeth, where the lead centre was in Leeds [Day *et. al.,* 2012].

In this study, over half of the dentists who had replanted avulsed teeth had received postgraduate training in dental trauma (57%, n=133). This is greater than the 40% of the entire sample. This increase may be because these dentists sought out postgraduate training in dental trauma, because of the experience they had in replanting an avulsed tooth or teeth. Or it could be the converse – the dentists felt able to proceed with replantation of an avulsed tooth because of the postgraduate training they had received. A focus group involving primary care dentists would be useful to ascertain this sort of detailed information, which is difficult to procure from a self-completion questionnaire.

3.6 Limitations

A number of limitations must be acknowledged when considering the results of this study:

The sampling frame did not include all dentists in primary care in Yorkshire. However, there was a good geographical spread of dentists included in the database. Looking at the gender and year of qualification of respondents, they do seem representative of the primary dental care workforce in Yorkshire.

There is also limited information on the non-responders to the questionnaire and because of this, it has not been possible to undertake a non-response analysis.

The response rate of 59.7% is not optimal, although similar to the proposed average for response to Health Care Professional questionnaire surveys. It is also less that other questionnaire surveys on dental trauma in the region.

These limitations may impact both the validity and the reliability of the study results

3.7 Conclusions

Many dentists working in primary care in the Yorkshire region have no or very limited experience of treating children with avulsed permanent teeth.

Their experience is broadly similar to that of dentists working on primary care in Wales.

A significant percentage of both groups currently have children with avulsion injuries under their care: this differs from the guidance issued by the BSPD that an interdisciplinary team should see children with avulsion injuries soon after the initial injury [Day and Gregg, 2012].

3.8 Recommendations

A number of recommendations for areas of further research can be made from the results and conclusions of this study:

1. Focus groups involving dentists in primary care may give a better understanding of the results seen in this and the Welsh study. They may also deduce any barriers that primary dentists perceive in both treating children with avulsion injuries, and with involving specialist paediatric dentists in these children's care.
2. There is currently no information for the outcomes for children whose avulsion injuries are managed in primary care. A method to measure these outcomes needs to be devised.
3. It is important that there is on-going and improved communication to primary care dentists about the importance and potential benefits of specialist input when managing these child patients
4. It would be useful to create a database of primary care dentists both in Yorkshire, and in England for future questionnaire-based research.

Chapter Four

Parents' experiences of accessing emergency and follow-up care for their children following an avulsion injury

4.1 Background

4.1.1 Avulsion

Avulsion is one of the most severe dento-alveolar injuries. It also carries one of the poorest outcomes for dentoalveolar trauma with 73-96% of replanted teeth being lost prematurely [Andreasen *et. al.,* 2007]. The damage to the periodontal ligament at the time of the injury, the condition of a tooth's subsequent storage and the interval prior to replantation all profoundly influence the prognosis for the tooth [Andreasen et. al., 1995b, Barrett and Kenny, 1997 Kinirons et. al., 2000,]. The local dentist, accident and emergency department, dental access centre or a secondary dental care provider may provide emergency care for avulsion injuries [Day and Gregg, 2012]. As discussed in Chapter One, parents, lay people and medical professionals have been shown to have poor knowledge of what to do in the event of an avulsion injury. It was noted in a recent UK based multi-centre randomised controlled trial that the failure to recruit sufficient patients for the trial stemmed from the poor levels of access to emergency dental care and treatment, the failure of accident and emergency departments to prioritise avulsion injuries and public ignorance of the appropriate treatments for an avulsed tooth [Day *et. al.,* 2012].

4.1.2 Care Pathways

In planning treatment services it is important to know how and where injuries to teeth occur, in order that appropriate strategies can be devised to aid prevention and effective treatment of dentoalveolar trauma [Blinkhorn, 2000]

A care pathway can be defined as a documented sequence of effective clinical interventions, placed in an appropriate timeframe, written and agreed by a multi-disciplinary team [Department of Health, 2002]. They are also referred to as Integrated Care Pathways. The standards along the care journey are based on evidence and best practice, and facilitate monitoring of these standards [Scottish Pathways Association, 2010]. They help a patient with a specific condition or diagnosis move progressively through a clinical experience to the desired outcome [Hally and Pitts, 2004]. The move towards the use of care pathways within the NHS has been driven by their ability to deliver consistent, high quality patient care. They can also be used as a tool to incorporate local and national clinical guidelines into every day practice [Middleton *et. al.,* 2001]. The first Integrated Care Pathway introduced to dentistry in the NHS was the Oral Health Assessment: A Clinical Pathway, which promotes a standard of oral health assessment, identification of needs and disease risk and evidence-based prevention for patients. The report of the Evidence and Learning group, published in October 2012, showed widespread support amongst pilot practices and patients for this type of approach [Department of Health, 2012]. At present there is no defined care pathway for children presenting with significant dental trauma. It has been recommended in the recently published UK National Clinical Guidelines for Treatment of Avulsed Permanent Teeth in Children [Day and Gregg, 2012] that a clinical care pathway is devised to ensure that more complex injuries, avulsions being one, are seen soon after the injury and emergency care by a specialist inter-disciplinary team.

4.1.3 Provision of Emergency Care

Patients with significant dental trauma, such as avulsion, attend a wide variety of treatment centres due, in part, to the fact that dental injuries occur in a variety of locations and can occur at any time of the day or night.

A large-scale study involving clinical examination and interview in the North West of England, reported that 34.8% of injuries happened at home and 25.2% occurred at

school [Blinkhorn, 2000]. The remainder occurred in a wide variety of other locations such as parks, playgrounds and swimming pools. Interestingly, it was reported that a larger number of severe dental injuries resulted from accidents occurring at school than at other locations [Blinkhorn, 2000]. An Australian study reports similar levels of injury at school and home [Stockwell, 1988]. However, Glendor's two-year prospective study reported that 18% of all complicated dental traumas occurred at school, which was significantly less than those sustained in traffic accidents (bicycles) and in other places [Glendor *et al.,* 2000]. Unfortunately Glendor does not identify the 'other places', which constitute 47% of places of injury, although this may be due to the heterogeneity of these locations.

Nguyen and colleagues, who were based at an acute children's hospital that provided emergency care around the clock, reported that only 11% of injuries presented during school time and that 50% of the children included in the analysis were injured during weekends and holidays. The remaining 39% were injured during weekday evenings [Nguyen *et. al.,* 2004]. Glendor's earlier prospective study of dental trauma in children and adolescents found that 19% of patients with an injury to a permanent tooth sought emergency treatment outside working hours [Glendor *et al.,* 2000]. This was regardless of severity of the injury. Zaitoun and co-workers' recent multi-centre evaluation of initial management of dental trauma reported that two-thirds of children were initially seen within working hours [Zaitoun *et al.,* 2010]. This prospective and cross-sectional survey involved 150 consecutive, referred and emergency patients attending dental hospitals and children's hospitals in Liverpool, Manchester and Sheffield. Initial care was provided by GDP's, Community Dental Services and access centres in 38.7% of cases. A further third of the sample were first seen by an A&E (dental) service, with 16% seen out of hours by maxillo-facial surgical SHOs.

Emergency departments in general hospitals usually give dental injuries a low priority for care and attention. Dento-facial emergencies represent between 0.3% and 4% of the overall patient workload in the emergency department [Pennycook *et. al.,* 1993, Patel and Driscoll, 2002]. It has been reported that avulsions are the most common type of dental injury for children younger than 15 years of age seeking treatment in hospital

emergency rooms [Bhat and Li, 1990]. Research in the United States demonstrated that the mean number of avulsed teeth seen each year in a hospital emergency department after-hours ranged between 26 and 39 [Majewski *et. al.,* 1989]. Slightly later research, this time from Belfast, showed that of the dental trauma cases that presented to an emergency department, 42.7% involved 1 tooth, 38.5% involved 2 teeth and 11.4% involved 3 or more teeth [Fleming *et. al.,* 1991].

Many studies have shown that emergency medical personnel tend to have poor knowledge of appropriate action when presented with an avulsed tooth [Holan and Shmueli, 2003, Abu-Dawoud *et al.,* 2007]. In contrast, a UK study reported that 74.1% of emergency room personnel in a major teaching hospital were aware that immediate replantation of an avulsed permanent tooth is the most appropriate initial management [Addo *et al.,* 2007]. The respondents also demonstrated satisfactory knowledge levels regarding other aspects of management of avulsion such as suitable cleansing medium. Despite this, most of the respondents when presented with avulsion would refer the patient to a maxillofacial or dental department, even though this would cause an obvious delay before replantation was eventually carried out [Addo *et al.,* 2007]. A retrospective observational study of avulsion injuries in Scotland found that 50% of children with avulsion injuries presented initially to the A&E department of a general hospital, but only 36.7% of the children were seen within one hour of presentation [Kargul and Welbury, 2009]. A more recent questionnaire-based study reported that emergency department physicians do not feel confident in managing some dento-facial emergencies, and indeed lowest confidence was reported for managing dental avulsion injuries [Trivedy *et. al.,* 2012]. However, 69% of the participants stated that they would see a patient with an avulsed tooth within one hour. It was also reported by the authors that a low proportion of these physicians felt that staff in the emergency department should be responsible for managing either dental or maxillofacial emergencies [Trivedy *et. al.,* 2012]. However, acute management of dental trauma is part of the emergency medicine curriculum in the UK [General Medical Council, 2006].

It is clear from the literature that initial and emergency treatment for severe dental injuries is provided by a variety of clinicians. Thus, initial management, which has such

a critical role in the outcome for avulsion injuries, is highly variable [Andreasen *et al.,* 2002].

4.1.4 Quality of Life Impacts

Quality of life (QoL) includes perceived physical, psychological and social functions as well as a sense of wellbeing [Fakhruddin et al., 2008]. The American Academy of Paediatrics defines child health as the social functioning, physical and emotional development of children and children's families [Fink, 1989]. Therefore, the current concepts of child health consider the quality of life from the perspective of the child and the family [Antunes et. al., 2012].

It is widely acknowledged that the appearance and position of the anterior teeth have psychological and social impacts on children [Helm *et. al.,*1985, Cortes *et. al.,* 2002]. There is some evidence that children with visible dental differences, such as traumatised incisors, may be subject to negative social judgements and teasing by their peers about their social appearance [Rodd *et. al.,* 2010]. Oral health problems have thus been increasingly recognised as important causes of negative impact on the quality of life of individuals and society [Traebert *et. al.,* 2013].

Specific oral health-related quality of life (OHRQoL) measures such as the Child Perception Questionnaire and the Child Oral Health Impact Profile have been designed to capture the impacts of oral conditions on children's wellbeing and quality of life [Rodd *et. al.,* 2012]. These can differ depending on the age of the child. It is also important to assess the quality of life-impact on the family; questionnaires such as the Family Impact Scale and Parental Perception Questionnaire are used.

There is increasing evidence that childhood dental trauma has the potential to influence children's oral health related quality of life [Cortes *et. al.,* 2002, Fakhruddin *et. al.,* 2008, Berger *et. al.,* 2009, Porritt *et. al.,* 2011]. Children and adolescents who sustain a dental injury severe enough to warrant splinting of the maxillary anterior teeth suffer an immediate decrease in their quality of life [Berger *et. al.,* 2009]. This impact can still be measured up to a year after the initial injury [Berger *et. al.,* 2009]. At least two studies assessing the impact of severe dental trauma on the quality of life of children found that scores obtained on the Child Perception Questionnaire approximated to values reported in children with cleft lip and palate, and exceeded values for children with dental caries or undergoing orthodontic treatment [Berger *et. al.,* 2009, Rodd *et. al.,* 2011]. A recent study by Antunes and colleagues in Brazil found that dental trauma is one of the oral conditions that generate the worst impact on OHRQoL [Antunes *et. al.,* 2012].

Parents of children who sustain a severe dental injury also report an immediate negative impact on their quality of life. Again these impacts can be measured up to one year following the trauma; the persistence of high mean FIS (family impact scale) scores at one year indicates the impact on the family long after the accident [Berger *et. al.,* 2009]. Porritt and colleagues' recent study suggested that the number of teeth children had injured was a significant predictor of parental worry at follow-up [Porritt *et. al.,* 2013]. The authors also found that children's OHRQoL was a significant predictor of parental HRQoL at follow-up, and they felt that this " highlights how child and parental outcomes are intrinsically linked following dental injuries".

4.1.5 Qualitative research in dentistry

Research in dentistry has predominantly been quantitative in nature, driven in particular by the move towards evidence-based dentistry [Stewart *et. al.,* 2008]. Qualitative approaches are commonly used to explore, interpret, or obtain a 'deeper understanding' of certain aspects of human behaviour, such as people's personal experiences and perspectives [Stewart *et. al.,* 2008]. Such approaches are therefore ideally suited to research where little is already known or understood [Stewart *et. al.,* 2008]. They are appropriate for exploring the complexities of health and well-being and can help in creating an in-depth understanding of the patient experience [Smith & Firth 2011]. Qualitative approaches are gaining popularity in dental research [Marshman *et. al.,* 2009, Tran *et. al*., 2010, Rodd *et. al.,* 2012, Bradbury-Jones *et. al.,* 2013]. The methods used in qualitative research include direct observation, interviews, the analysis of texts or documents and the analysis of recorded speech or behaviour using audio or videotapes [Pope *et. al.,* 2006]. In order to understand how and where children with severe dental trauma access emergency and follow-up care, qualitative interviews should prove to be a valuable source of information.

4.1.5.1 Qualitative Interviews

The purpose of the research interview is to explore the views, experiences, beliefs and/or motivations of individuals in specific matters [Gill *et. al.,* 2008]. There are two main types of qualitative research interview: semi-structured and unstructured. Unstructured interviews do not reflect any preconceived theories or ideas; their use is generally only considered where significant 'depth' is required, or where little is known about the subject area [Gill *et. al.,* 2008]. In contrast semi-structured interviews consist of several key questions that help to define the areas to be explored. Practical constraints due to time, research agendas, financing and access mean that semi-structured qualitative interviews are more often used in research in healthcare settings [Stewart et. al., 2008]. The interviewer asks the key questions in the same way each time and does some probing for further information but this probing is more limited

than in the unstructured, in-depth interviews [Arthur & Nazroo 2003]. Good questions are open-ended, neutral, sensitive and understandable [Gill *et. al.,* 2008]. The flexibility of this process, particularly when compared with structured interviews, allows for the discovery or elaboration of information that is important to participants but may not previously have been thought of as pertinent by the research team [Gill *et. al.,* 2008]. All interviews should be tape-recorded and transcribed verbatim afterwards, as this protects against bias and provides a permanent record of what was and was not said [Gill *et. al.,* 2008]. Another advantage of audiotaping is the opportunity the tapes offer for subsequent analysis by independent observers [Mays and Pope, 1995].

4.1.5.2 Topic Guides

Topic guides are documents that identify the key issues and subtopics to be explored [Arthur & Nazroo, 2003]. A well-designed topic guide will provide flexible direction to the interview process. It can also enhance the consistency of data collection, particularly if there are a number of researchers involved in the interview process. Ritchie and co-authors emphasise the importance of including the topic guide used in the study report as an important element of documenting the research approach and making it transparent [Ritchie and Lewis, 2003].

4.1.5.3 Sampling in Qualitative Research

Statistical sampling methods used in quantitative research are uncommon in qualitative research. Qualitative research uses non-probability samples for selecting the study population: units are deliberately selected to reflect particular features of, or groups within, the sampled population [Ritchie *et. al.,* 2003]. This is known as purposive sampling. Events, incidences and experiences, not people per se, are typically the objects of purposive sampling [Sandelowski 1995]. Purposive sampling is widely used in qualitative research as a means of recruiting participants who share experience of a certain phenomenon [Bradbury-Jones et. al., 2013]; in this case how parents accessed emergency dental care for their child following an avulsion injury.

Qualitative samples are usually small in size. As discussed by Ritchie and colleagues in their 2003 text on qualitative research practice, there are three principal reasons for this:

1. If the data is properly analysed, there will come a point where very little new evidence is obtained from each additional fieldwork unit. This is because phenomena need only to appear once to be part of the analytical map
2. Statements about incidence or prevalence are not the concern of qualitative research
3. The type of information that qualitative studies yield is rich in detail

There is a point of diminishing return where increasing the sample size no longer contributes to the evidence [Ritchie *et. al.,* 2003].

It has been recommended that studies directed towards discerning the essence of experience include about six participants, and that grounded theory studies, where little is known about the topic at hand, comprise about 30-50 interviews/observations [Sandelowski 1995]. However, this small scale only works if good purposive sampling has taken place [Ritchie *et. al.,* 2003].

4.1.5.4 Qualitative Data Analysis

Historically, there have been three main categories of qualitative data analysis [Smith & Firth 2011]:

- Sociolinguistic methods, such as discourse and conversation analysis, that explore the use and meaning of language,
- Methods typified by grounded theory, that focus on developing theory,
- Methods such as content and thematic analysis, that describe and interpret participants views

More recently, the framework approach, which developed from thematic analysis, has been gaining in popularity as a means of analysing qualitative data derived from health care research because it can be used to manage qualitative data and undertake analysis

simultaneously. It is a matrix based analytic method for organising and synthesizing data. It facilitates rigorous and transparent data management such that all stages involved in the 'analytical hierarchy' can be systematically conducted [Ritchie & Lewis, 2003]. The analysis is designed so that it can be viewed and assessed by people other than the primary analyst [Pope *et. al.,* 2000].

4.1.5.4.1 Computer assisted qualitative data analysis software (CAQDAS)

There are several computer assisted qualitative data analysis software (CAQDAS) packages available that can be used to manage and help in the analysis of qualitative data [Burnard *et. al.,* 2008]. They can enable complex organisation and retrieval of data [Pope *et. al.,* 2000]. For example, computer packages can help to manage, sort and organise large volumes of qualitative data, store, annotate and retrieve text, locate words, phrases and segments of data, prepare diagrams and extract quotes [Burnard *et. al.,* 2008]. They can thus make the process of data analysis easier, more accurate and comprehensive. Examples of CAQDAS packages include NVivo, ATLAS.ti and WinNAX. It should be noted however, that such programmes do not 'analyse' the data – that is the task of the researcher – they simply manage the data and make handling of it easier [Burnard *et. al.,* 2008].

4.1.5.5 Rigour, Reliability and Validity in Qualitative Research

The analysis of qualitative data is in general, more subjective than the process associated with quantitative data analysis [Burnard *et. al.,* 2008]. However, in order for the research findings to have some meaning, it is imperative that processes are undertaken throughout the research project to ensure the findings are true and valid.

Reliability is the degree of consistency or dependability with which an instrument measures the attribute it was designed to measure [Long and Johnson, 2000]. Although efforts may be made to enhance a qualitative study's reliability, in most cases the nature

of the data and the sample make this difficult at best: qualitative researchers may have to accept that reliability is unlikely to be a strength of their work [Long and Johnson, 2000]. The reliability of the analysis of qualitative data can be enhanced by organising an independent assessment of transcripts by additional skilled qualitative researchers and then, comparing agreement between the raters [Mays and Pope, 1995].

As in quantitative research, the basic strategy to ensure rigour in qualitative research is systematic and self-conscious research design, data collection, interpretation, and communication [Mays and Pope, 1995]. The researcher must create an account of method and data which can stand independently so that another trained researcher could analyse the data in the same way and come up with essentially the same conclusions [Mays and Pope, 1995]. Various strategies are available to protect against bias and enhance the rigour of qualitative research [Stewart *et. al.,* 2008]. These include:

- Purposive sampling – to address bias concerns
- Triangulation – to confirm or refute internal validity
- Multiple coding – to stimulate inter-rater reliability
- Respondent validation – to confirm or refute interpretation of the data

Respondent validation, along with peer review, has been identified as playing an important role in the verification or validation of qualitative research.

Respondent validation (or member check) involves returning to respondents and asking them to carefully read through their interview transcripts for them to validate, or refute, the data [Burnard *et. al.,* 2008]. This could help to refine theme and theory development. However, unless this occurs relatively soon after data collection, participants may have changed their views. They may want to modify their opinions, if they now feel that their original comments were not 'socially desirable', or they may not recognise some of the emerging themes, as each of them will have contributed only a portion of the data [Burnard *et. al.,* 2008].

The process of peer review involves at least one other suitably experienced researcher independently reviewing and exploring interview transcripts, data analysis and emerging themes [Burnard *et. al.,* 2008]. However, as Burnard and colleagues explain, this approach is not without its issues. It is possible that each researcher may interpret the data differently. If both perspectives are grounded in and supported by the data, is one interpretation necessarily stronger or more valid than the other?

There is no definitive answer to the issue of validity in qualitative analysis. The process of analysis should be systematic and rigorous and researchers should provide a detailed explanation of how data was collected and analysed [Burnard *et. al.,* 2008].

4.2 Aims

The aim of this study was to identify how parents access emergency care for their children following avulsion of a permanent tooth.

4.3 Methodology

4.3.1 Ethics

Ethical approval for the project was granted by Dental Research Ethics Committee, National Research Ethics Service and the Research & Development Department of the Leeds Teaching Hospitals Trust [Appendices F, G, H]

4.3.2 Design of Topic Guide

The use of topic guides in qualitative research is strongly recommended and careful investment in their design is required [Ritchie and Lewis, 2003]. The literature review informed the topic guide design, by establishing the subjects to be covered in data

collection. The opening question 'In your own words could you tell me what happened on the day your child had their accident' aimed to collect some basic information about the cause of the accident, where it occurred and at what time from the parent. Subheadings under the theme on the topic guide served as a prompt to the author to collect all the relevant information. The key themes, as identified in the literature, to be explored included:

- Parental action/knowledge – avulsed tooth
- Access to emergency care – access to emergency dental care
- Time
- Treatment provided
- Access to follow-up care

Each theme was broken down into topics and subtopics. The topic guide was deliberately kept short, in order to allow more in-depth data collection and to ensure it was used as an *'aide-mémoire'* for the author. There was space on the page for the author to make any relevant notes during the interview. The topic guide is included as Figure 4.1.

Figure 4.1 Topic guide used during the semi-structured interviews

Topic GuideV1.09/12

In your own words can you tell me what happened on the day your child had their accident?

- Where did it take place
- When?
- What time?

What did you do immediately after it happened?

- Find the tooth
- Replant it
- Carry it/place it in something

Did you try to phone someone? Or bring straight to hospital/dentist?

Who did you take advice from?

- Other adults (friend, neighbour..)
- Grandparent
- Internet/smart phone

Who was the first medical/dental person to see your child?

- Nurse
- Doctor
- Dentist

How long was it before your child was seen by this person?

- What care did they provide

Were you given any information about the type of injury/ likely treatment necessary?

Was any treatment provided?

- And if not, were you referred anywhere?
- What, if any, treatment did they then provide?
    - At what time approx.. did the treatment start (i.e. how long after the accident)
- Did they send you on to anybody else?
    - What did they do?

How easy was it to get the problem sorted out?

- When were you referred to the LDI?

4.3.3 Sample

Parents of children who had suffered avulsion injuries were recruited from Leeds Dental Institute Trauma and Emergency clinics using purposive sampling. To be included in the study the participants' child must have suffered an avulsion injury to a permanent tooth in the past two years. Participants were recruited to the study until it was felt that no new themes were emerging from the on-going analysis.

4.3.4 Procedure

Participants were recruited in both a prospective and retrospective manner in order to achieve a sufficiently large sample – avulsion injuries happen infrequently. The author identified potential participants.

The author's colleagues in the department were made aware of the study through email, and asked to contact the author if they treated a child who presented with an avulsion injury. The author did not approach the parents on the day of the injury, but arranged to be present on the day of the review appointment. The parent was given the letter of invitation (Appendix I) to read and the author was then present to answer any questions. If the parent agreed to participate, the interview was arranged for a time suitable for the parent. The author took informed consent. A copy of the consent form (Appendix J) was given to the parent and another was filed in the patients' clinical record. The final copy was kept by the author with the other research documents.

The author reviewed clinical records of children attending the weekly Trauma Clinic at LDI, and children who had sustained an avulsion injury in the past two years were identified. They were either posted the letter of invitation to the study with their child's appointment notice, or given the letter of invitation by the reception staff as they waited to be called on the day of their appointment. The author was present to answer any

questions the potential participant may have had, and if they indicated a willingness to take part, the author took informed consent, and the copies of the form were distributed as described above.

Data were generated through semi-structured, one to one interviews undertaken between April and June 2013. The parents were asked when would be the most suitable time for them for the interview. The author conducted the interviews, which took place on the clinic, usually in a side surgery. The topic guide was used in each interview and participants were asked to describe what happened on the day their child 'knocked-out' their front tooth. All interviews were audio recorded and subsequently transcribed verbatim. A copy of the interview transcript, with a stamped addressed envelope for returns was posted to each participant in the week after the interview. The participant was asked to read the transcript and identify if there were any changes they would like to make. They were given the option of contacting the author by phone or email, or they could post the transcript with any changes required back to the author using the stamped addressed envelope provided. The topic guide, the interview transcript and the patients demographic details were kept together by the author. To protect participants' anonymity they were each assigned a code from P1 to P9.

4.3.5 Data Analysis

The interview transcripts were read and re-read by the author to start the process of familiarisation with the data. Data were analysed using the sifting, charting and sorting of data that is characteristic of the framework approach described by Ritchie and Lewis [Ritchie and Lewis, 2003]. Smith and Firth described this further in a recent paper, and their approach was followed to guide the author through each stage [Smith and Firth, 2011]. The stages of this process were:

<u>1. Data management –</u>

- Becoming familiar with the data (reading and re-reading)

- Identifying initial themes/categories
- Developing a coding matrix
- Assigning data to the themes and categories in the coding matrix

Each line of each transcript was considered, and codes and categories were developed, by attempting to summarise what each parent was describing. This was undertaken with printed versions of the transcripts. Important or key phrases were highlighted, and comments were written in the margins to record preliminary thoughts. Key phrases were summarised using participants' own words ('in-vivo' codes). In-vivo codes are advocated in the framework approach as a means of staying true to the data [Ritchie and Lewis, 2003]. A coding matrix was generated as initial thoughts developed into more formal ideas. Table 4.1 is an example of the coding matrix.

Table 4.1- Example of coding matrix created during data analysis to identify codes and categories

Interview Transcript P1	Description (in-vivo codes)	Preliminary thoughts (what is this about?)	Initial categories
"He was brought home by his rugby coach with his tooth in his hand"	"…tooth in his hand"	Rugby coach didn't know what to do	Lack of knowledge
"We took him straight to the local A&E….they refused to treat him"	"…refused to treat him"	A&E felt they weren't responsible for this dental emergency	'Ownership' of dental trauma
"I was so fraught because I knew it had to be sorted out straight away"	"Fraught….had to be sorted"	Parent knew what had to be done and was upset and frustrated that it wasn't being done	Parental knowledge Distress

Each in-vivo code initially formed a potential category. As coding progressed, the categories were then grouped together into broader categories. Similar categories were eventually brought together to form initial themes and these categories and themes were then used to form a 'coding index'. The coding index was then utilised to organise the entire dataset. Table 4.2 is an example of the coding index.

Table 4.2 – Example of the coding index created as data analysis progressed

Initial Themes	Initial Categories
Knowledge	• Lack of knowledge • Knowledge of parent • Knowledge of child
Emotion	• Frustration • Anger • Distress – parent, child
Access	• Availability of emergency dental services • A&E access to dental services

The full coding matrix and coding index are included as Appendix K.

2. Descriptive accounts –

- Summarising and synthesising the range and diversity of coded data by refining initial themes and categories
- Identifying associations between the themes until the 'whole picture' emerges
- Developing more abstract concepts

Descriptive accounts involve summarising and synthesising the range and diversity of coded data by refining initial themes and categories [Smith and Firth, 2011]. It is

essential to identify links between codes and categories and links between categories and themes. To ensure the themes were grounded in participants' descriptions (staying 'true' to the data), the author constantly referred to the original transcripts and checked for meaning across the interviews. Table 4.3 gives an example of moving from the initial themes and categories in the coding index, and the links between the refined categories and final themes. From these, the core concepts began to emerge.

Table 4.3 Developing the core concept, labeled knowledge and the final themes within the concept

Initial Themes	Initial Categories	Refined Categories	Final Themes	Core Concept
Knowledge	Lack of knowledge Putting knowledge into practice	Lack of knowledge Knowledge Putting knowledge into practice	**Knowledge** – didn't know what to do, if did didn't act on knowledge **Delays –** parent and HCP unaware of need for prompt action Once some knowledge of the situation parents then **actively sought care**	**KNOWLEDGE**
Time	Waiting Actively seeking care	Delay Actively seeking care		
Access to emergency care	Access to dentist out of hours A&E as point of contact	Who to contact Limited dental services out of hours		

3. Explanatory accounts –

- Developing associations/patterns within concepts and themes
- Reflecting on the original data and analytical stages to ensure participant accounts are accurately presented
- Interpreting/ finding meaning and explaining the concepts and themes
- Seeking wider application of concepts and themes

Explanatory accounts were started by reflecting on the original data and on the stages of analysis. It was noted that reflecting on the original data was a very important part of this process as it would ensure that the experiences of the parents were accurately reflected and that misinterpretations would be minimised [Smith and Firth, 2011]. Following the framework approach elicited three core concepts that appeared to illustrate the parents experiences of accessing emergency and follow-up care following a tooth avulsion injury: knowledge, access and emotion. The final stages involved making sense of the concepts and themes in terms of the parents' experiences [Smith and Firth, 2011]. This was achieved by exploring the relationship between the core concepts, the parents' experiences and the established literature.

4.4 Findings

4.4.1 Study Sample

Ten parents were approached during the study period and all agreed to read the letter of invitation. Eight parents agreed to take part in the study; one parent gave no reason for not participating, another parent felt she would become too upset during the course of the interview and so did not want to participate.

The details of the children whose parents agreed to participate are summarised in Table 4.4

Table 4.4 Demographic details of participants' children who had sustained an avulsed permanent tooth

	Gender	Age	What happened	Where	When
P1	M	12yrs10m	Accident at rugby training	Rugby pitch	Thursday evening
P2	M	12yrs10m	Accident on water slide	Tunisia	Sunday afternoon
P3	M	12yrs7m	Fell off skateboard	Skate park near home	Thursday afternoon (Easter Holidays)
P4	M	7yrs2m	Playing with his sister	Grandmothers house	Friday evening
P5	M	7yrs5m	Playing football	Back garden	Sunday afternoon
P6	M	6yrs11m	Fell off scooter	Local park	Monday evening
P7	M	6yrs11m	Playing golf	Local park	Saturday evening
P8	M	9yrs	Climbing up a football net	Indoor football venue	Saturday afternoon

4.4.2 Pathways to Care

Table 4.5 summarises what happened immediately after the accident and how the parents accessed emergency and follow-up care for their children. In each case, the extra-oral time is approximate.

Table 4.5– Summary of pathways to care for the participants' children

	Point of Contact	Transport Medium	Initial Emergency Care	Total Extra-Oral Time	Follow-up care
P1	A&E then NHS Direct	Milk	A&E	180 minutes	GDP
P2	Hotel doctor	Ice – Milk	GDP (Tunisia)	120 minutes	CDS
P3	Ambulance	Milk	A&E	120 minutes	GDP – LDI (immediate)
P4	NHS Direct	N/A	Nil	2-3 minutes	GDP – LDI (immediate)
P5	Grandmother	Milk	A&E	55 minutes	GDP
P6	Grandfather	Milk	A&E	110 minutes	GDP
P7	Ambulance	Milk	A&E	90 minutes	LDI
P8	Dentist at scene	Milk	A&E	120 minutes	LDI

Figures 4.2 and 4.3 show, in more detail, timelines for two of the children (P1 and P3) from the time of their accident until they are seen in LDI. The timelines for the other children are included as Appendix L

Figure 4.2 Timeline from accident to specialist care for P1

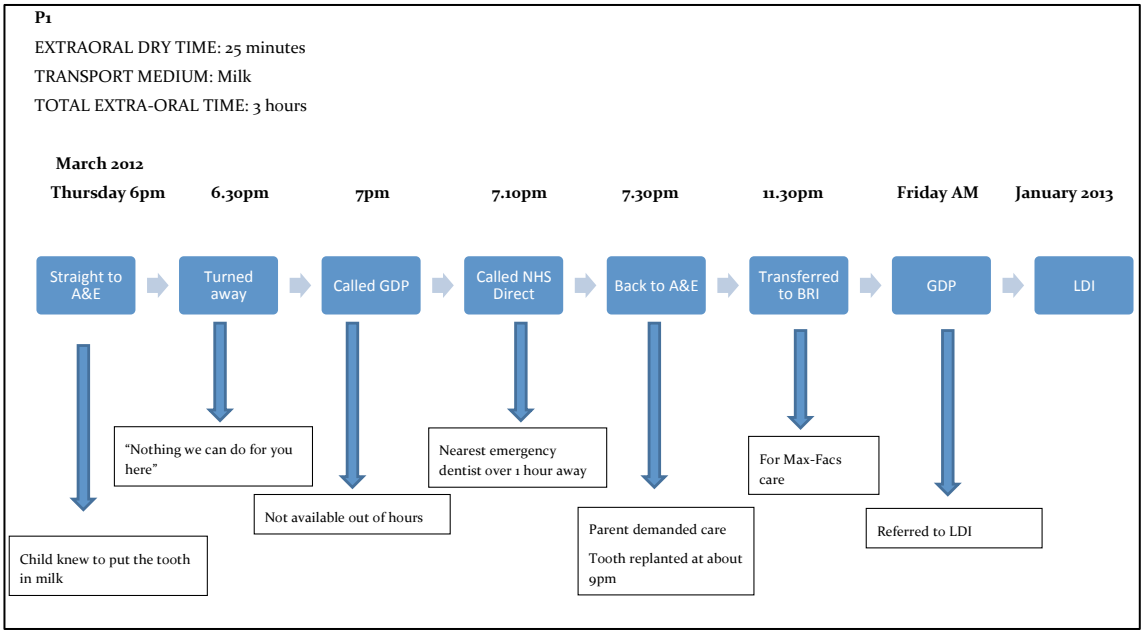
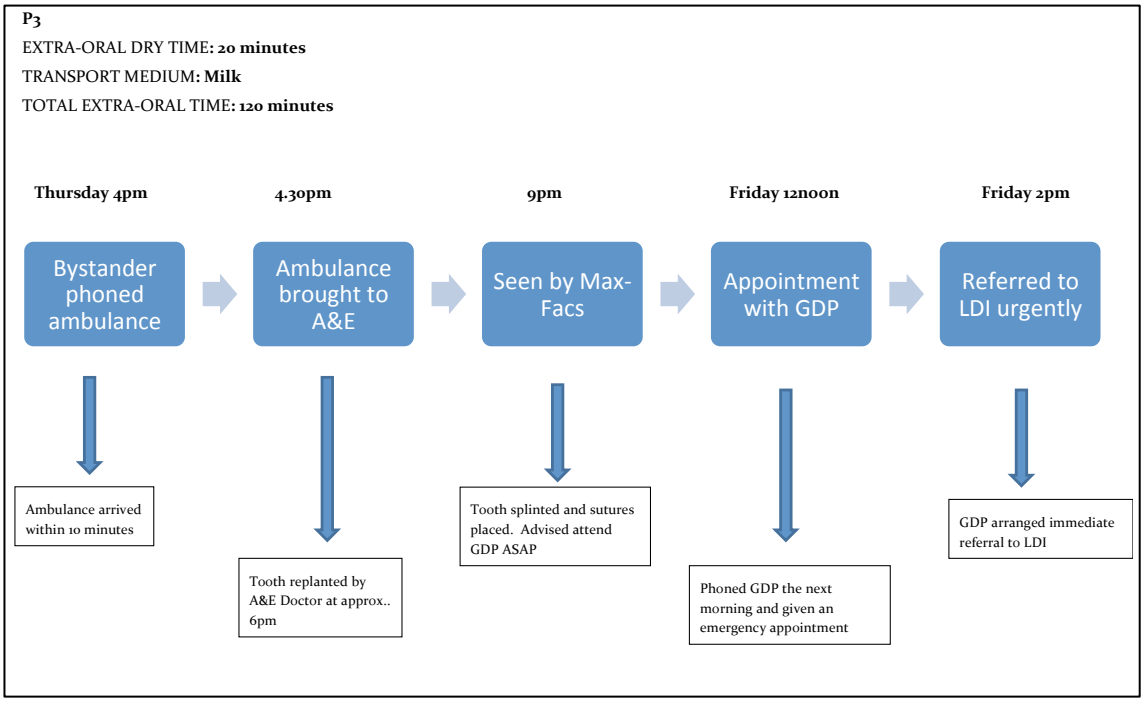


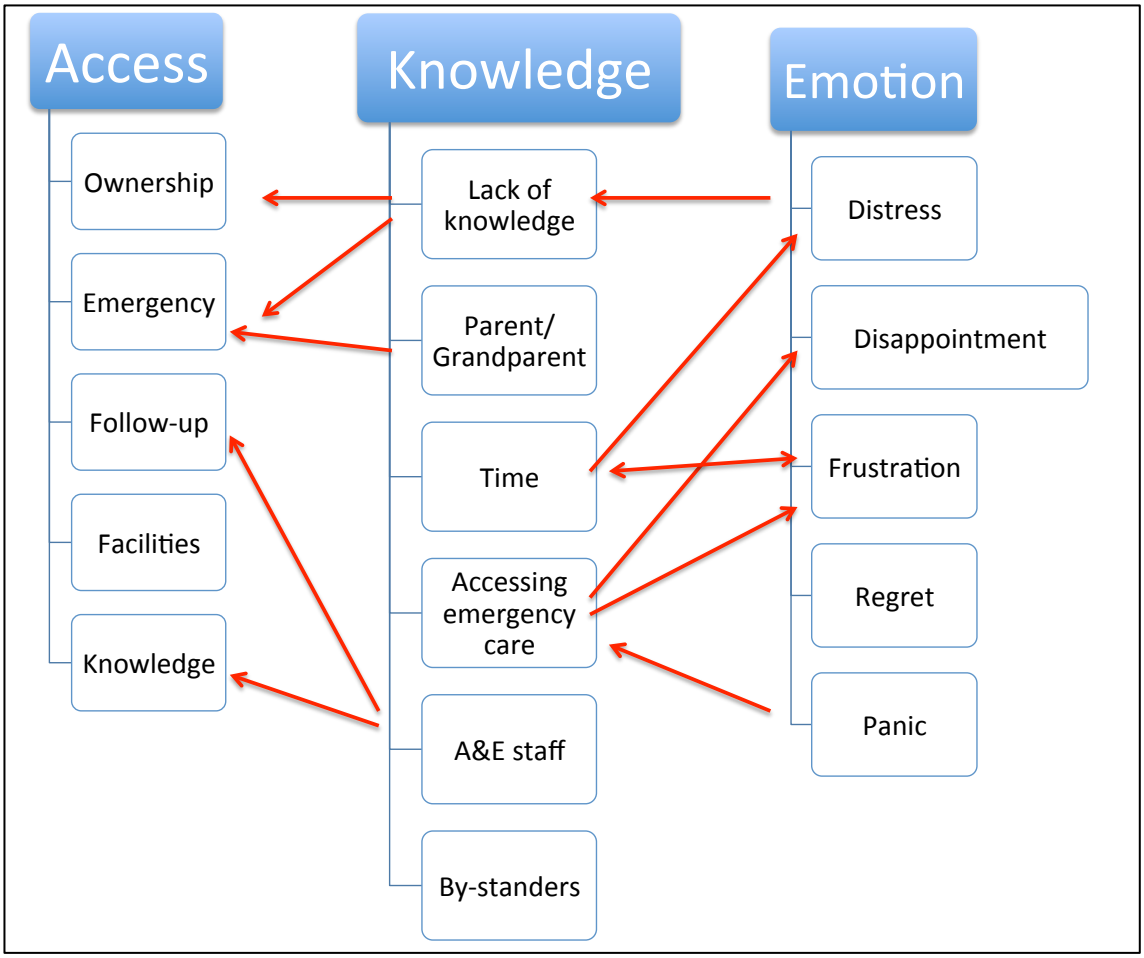
Figure 4.3– Timeline from accident to specialist care for P3



4.4.3 Framework Analysis

The results of the analysis of the semi-structured interviews are presented under the core concept headings: knowledge, access and emotion. They are summarised in Figure 4.4

Figure 4.4 The core concepts, and how they are linked, as elicited from the semi-structured interviews



4.4.3.1 Knowledge

4.4.3.1.1 Parental Knowledge

Knowledge emerged as a key theme or concept from the very first interview. P1, a mother, used to be a dental nurse, so was aware of the need for prompt treatment following avulsion of a permanent tooth:

"I said 'I need to see somebody' because I knew that, as I used to be a dental nurse myself, I knew that they had to be put back in as soon as possible" (P1)

This knowledge prompted the mum to go back to A&E (they had previously been turned away and told to find a dentist) and actively seek emergency dental care for her child:

"We were seen by a doctor, but only because I demanded it" (P1)

One other parent had some knowledge of what to do following an avulsion injury:

"I was a first aider and a child minder so I had basic first aid" (P3)

She also knew that timely treatment was important. Whilst waiting for a doctor in A&E she noted:

"I knew that time was ticking" (P3)

Despite their knowledge of what to do following avulsion of a tooth, neither Mum felt able to replant the tooth:

"No well, when I saw the size of it, it was complete and I just thought no..and his mouth was such a mess anyway" (P3)

The other parents had no knowledge of what to do when a tooth has been avulsed. Some did not realise that their child had their front tooth knocked out:

"The ambulance come and he says somebody needs to go have a look because with a face like that he will have a tooth missing" (P7)

"We didn't really understand what had happened. We thought the tooth was broken, so failed to understand that was the situation" (P8)

Grandparents emerged as a very valuable source of information for parents when their child had avulsed a tooth. As it is the parent of the child who avulsed their tooth that is speaking, when they refer to 'Mum' or 'Dad' they mean their own parent, i.e. the child's grandparent:

"I rang me Mum. I panicked and didn't know what to do so I rang her. She said usually what they do is say to put it sort of in your own saliva in your own mouth, but with him being so young, its safer to put it in milk" (P5)

"My Dad went and got his tooth. He put it straight in a glass of milk"(P6)

One grandmother, despite having no prior knowledge of what to do, replanted the avulsed tooth herself:

"She just thought she better push it in as she didn't…she just thought you know she'd push it in" (P4)

Once the parents understood what had happened and that the tooth needed to be replanted as soon as possible, they used this knowledge to actively seek timely care for their child:

"I said to the lady at the desk when we were checking in, I don't mean to be rude but there's only this certain amount of window you know and I want him to be seen" (P5)

"About half an hour later my dad rang me. He said you better tell them it's priority because you've got the tooth in milk. So I went up to reception, mentioned it to them again and he was basically seen straight away after that" (P6)

"We understood that time was of the essence and tried to explain the circumstances in the accident and emergency"(P8)

4.4.3.1.2 Bystander knowledge

Other people at the scene of the accident had poor knowledge of what to do:

"He was brought home by his rugby coach with his tooth in his hand" (P1)

"A lady at the skate park had found it and put it in the back pocket of his pants" (P3)

On two occasions, a dentist was present (as a bystander) shortly after the accident:

"A German dentist said you need to put it on ice, then somebody else said it needed to be in milk"(P2)

"One of the other parents who is a dental surgeon turned up and said really it's not looking very good, you've got to put it in milk" (P8)

4.4.3.1.3 Paramedic Knowledge

Two of the children were brought to A&E by ambulance. On both occasions, the paramedics present sent someone to get milk so that the avulsed tooth could be stored in milk on the way to the hospital.

4.4.3.1.4 Knowledge of A&E Staff

Knowledge of staff in A&E was mixed; some parents had positive experiences of accessing emergency dental care quickly for their children:

"I remember being surprised you know, how quick we were seen, considering it was A&E I think probably 15 minutes tops from us getting there" (P5)

"We were brought straight in. I think they were down within 5-10 minutes. They were really fast" (P7).

Other parents experienced delays before their child received the appropriate emergency care:

"Essentially at this A&E we were given completely the wrong information" (P1)

"It were quite a while later before a doctor and a nurse came and pushed it back in" (P3)

"The receptionist can't have known it was important" (P6)

"The on-call dental person didn't come for another hour or thereabouts" (P8)

"There was still a sense that it could have been handled substantially differently in the A&E"(P8)

4.4.3.1.5 Knowledge of GDPs

None of the children were seen by their GDP for acute treatment immediately following the accident. Although, two children were referred directly to LDI from A&E, the others were told to attend their dentist the next day after the accident. Once contacted, all GDPs offered an emergency appointment that day. Once they had assessed the child, two dentists arranged immediate referral to the LDI.

"She rang after we left to say can you get into Leeds for 2 o'clock" (P3)

"She phoned straight away here (LDI) and we was here the same afternoon" (P4)

One dentist arranged to refer the child to LDI two weeks after the accident. Two dentists provided some treatment and kept the children on review for 6 months (P5) and over a year (P1).

4.4.3.2 Access

As coding progressed, 'access' was noted to be recurring frequently. Very often, access to care was linked to knowledge (as demonstrated in Figure 4.4), as once the parents understood what treatment was required they made every effort to ensure their child received emergency care.

4.4.3.2.1 Access to emergency care

In two cases (P3, P7) an ambulance was called and this was due to the severity of other injuries sustained following the accident – one boy had lost consciousness, another had a very severe lip laceration. These children were brought directly to A&E by the ambulance.

In the majority of cases, the parent brought their child directly to A&E. None of these parents had attempted to contact a dentist locally.

"We took him straight to the local A&E" (P1)

"We put it in a glass of milk and took him straight to A&E" (P5)

"We set off to A&E" (P6)

P1 was initially sent home from A&E and advised to contact a dentist. She first phoned the family GDP:

"I then contacted my dentist, obviously out of hours, he wasn't available" (P1)

Her next step then was to contact NHS Direct whom she found very helpful. However, the nearest available emergency dentist was in Glossop, which is over an hours drive away. Mum felt this was not appropriate and decided to bring her son back to A&E.

Another family had a similar problem when trying to access an emergency dentist:

"I phoned NHS Direct cos it was on the weekend, it was when we had the bad snow. He was in Selby and the only place we could get him in was York or Malton and with the snow we just couldn't get there" (P4)

On this occasion, the parent did not find NHS Direct particularly helpful. She was not offered any other information on the injury or what to do. In her own words:

"It were take it or leave it basically" (P4)

Even if the snow had not been a factor, there would have still been a journey of at least an hour from Selby to York to access the emergency dentist.

4.4.3.2.2 Responsibility for dental trauma treatment

At least one A&E department did not feel that they were required to provide emergency treatment for a child with an avulsed tooth

"They said there's no dentist here, nobody who can deal with it, go back home and find a dentist" (P1)

Two of the children had their teeth replanted by doctors in A&E (P1, P3) and were then referred to the Maxillo-Facial team for splinting of the tooth and suturing, if required. However, one mum noted:

"It didn't seem to be a priority. To say that there was only him and another child in the children's A&E it didn't seem to be a priority to put it back in" (P3)

One child was seen by a Plastic Surgeon (P6) who appeared to have been the person on –call to A&E for dental emergencies. For the other children who were seen in A&E, the replantation, splinting and any other treatment that was required, was undertaken by the maxillo-facial team, who had been called to the emergency department by the A&E staff. It is unclear whether it was a triage nurse or doctor who decided to call the maxillo-facial team. In two cases, the maxillo-facial team arrived promptly (P5, P7), but in other cases it resulted in delays before the tooth/teeth were replanted:

"The on-call dental person didn't come for another hour or thereabouts" P8

P8 felt that the only reason the doctors proceeded with replantation was because his wife (the boy's mother) was a medical consultant in the same hospital:

"The doctor who was on-call, I think felt perhaps, I think they perhaps changed their opinion based on my wife's profession and her job in that hospital" (P8)

A number of parents noted that A&E departments often deal with very serious medical emergencies:

"I know it's something minor compared to what they're used to" (P1)

"It could have been that there was a dire medical emergency going on, bigger than teeth, that there was a lack of urgency" (P8)

One parent noted that the facilities in A&E were not suitable for providing dental treatment:

"A&E did the best they could but they didn't have the facilities. We were just in one of those little A&E rooms and she was all by herself" (P6)

4.4.3.2.3 Access to follow-up care

All parents in this sample found it was relatively straightforward to access follow-up care for their child. Two were referred directly to the Children's Department of LDI by their treating doctor at A&E, and both had appointments at LDI within a couple of days of their accident. The other parents were told to attend their GDP the next day, and all were able to arrange an emergency appointment for their child with their GDP. Three of the GDPs then went on to arrange prompt referral of the child to LDI.

One boy had avulsed his tooth whilst on holiday in Tunisia. The family were not registered with a dentist locally, so the Mum went to her local A&E a couple of weeks after returning from their holiday. The A&E staff advised her to contact the local community dental services and gave her the appropriate phone number. When she called the CDS she was given an appointment for her son:

"I explained the situation and they made an appointment for him and I think they were pretty quick. We didn't have to wait long" P2

4.4.3.3 Emotion

During each interview, the parents made numerous references to how they felt in the time following the accident and while they were attempting to access the appropriate care for their child.

4.4.3.3.1 Distress

Some parents described the upset and panic they felt following the accident that ultimately led to an avulsed permanent tooth:

"I panicked, I didn't know what to do" (P5)

"When I saw his mouth I started vomiting because it were that bad. I couldn't look at him" (P7)

A number of parents became more distressed while their child was having the avulsed tooth replanted. They noted that their child had not been given any form of pain relief prior to this emergency treatment:

"He was distraught, I was distraught and this doctor put his tooth back in without anything. That was horrifying" (P1)

"No pain relief or anything. As a mother that's heart breaking" (P1)

"She explained she was going to put it back in. She tried for quite a while but they didn't give him any pain killers or anything….I said…you can't keep doing that to him. He was already in enough pain as it was, with it coming out" (P5)

One child's treatment was managed in the A&E department with the use of inhalation sedation ('happy air'). It is interesting to note that his mother was a medical consultant in the same hospital, and the family strongly felt that the only reason their child had his tooth replanted was because of his mother's profession.

Parents were aware that it was an adult tooth that had been knocked out, and, not surprisingly, acknowledged that their child's teeth were important to them:

"I know it's something minor compared to what they're used to but when it's your child's teeth it's different"(P1)

"I was just hoping beyond hope that it could be saved" (P4)

"I sort of said look, I want this tooth to survive" (P5)

"His mother was more distressed because it was one of his adult teeth" (P8)

4.4.3.3.2 Frustration, disappointment

A sense of frustration and ultimately disappointment was evident in many of the interviews, particularly in relation to the emergency care their child received:

"I took it upon myself to take him back to A&E. I was absolutely furious" (P1)

"The initial emergency care that was most important, I was really disappointed with" (P1)

"Somebody should have got there and done it" (P3)

"I just thought there might have found one nearer to Selby" (P4)

"I think they did appreciate the urgency was there. They did phone across several times to get hold of this person but, eh, I understand it's a relatively straightforward thing to do and they should perhaps have done it themselves" (P8)

"There was still a sense that it could have been handled substantially differently in the A&E"(P8)

4.5 Discussion

4.5.1 Choice of Methodology

4.5.1.1 Qualitative Interviews

Qualitative approaches can help create an in-depth understanding of the patient experience and so a qualitative methodology was used in order to identify how parents access emergency care for their children following avulsion of a permanent tooth. In qualitative research, data collected can be described as "generated data" or "naturally occurring data". This study used "generated data" with participants giving information on their experiences of seeking emergency and follow-up care for their children following a tooth avulsion injury. Two main methods exist for collecting generated

data; focus groups and semi-structured interviews. Both have benefits that could be useful to investigate this topic area, with each allowing clarification of comments and supplemental questions to probe the subject's answer. A focus group may have been useful to generate data, but it is unlikely such detailed information about each child's pathway to care could have been collected from a group discussion. It is also possible that parents would not have felt comfortable talking about their child's experience in front of other parents.

Qualitative interviews offer greater depth and methodological flexibility than quantitative research methods such as structured questionnaire [Stewart *et. al.,* 2008]. This interview format is used most frequently in healthcare, as it provides participants with some guidance on what to talk about, which many find helpful. In this study the semi-structured interviews worked well, in that each parent had sufficient time to recall what had happened following their child's accident, and to describe their 'journey' to emergency and follow-up care for their child.

Each of the participants were sent a copy of their interview transcript and asked to contact the author if they wanted to make any changes, or had anything else to add. These quality control mechanisms were built into the data collection process to ensure that the data analysis was systematic and verifiable [Gussy et. al., 2006]. None of the parents contacted the author to make any amendments or additions and so it can be assumed that each were happy with what they had said, and that all relevant details were included.

4.5.1.2 Framework Analysis

Analytical frameworks such as the framework approach are gaining in popularity because they systematically and explicitly apply the principles of undertaking qualitative analysis to a series of interconnected stages that guide the process [Smith and Firth, 2011]. For the novice researcher, a framework to guide the stages of the data analysis has the potential to assist in developing the skills required to undertake robust qualitative data analysis [Smith and Firth, 2011]. Although eight participants may be a relatively small sample, the eight interviews generated pages and pages of data. The framework approach proved very useful, as it provided some structure for the author to

follow throughout the analysis. Moving back and forth between the data, the interview transcripts and the links with initial categories resulted in the emergence of the final categories and the development of the final conceptual framework that describes the parents' experiences. This iterative process resonates with the central tenet of the framework approach - the interconnected stages are not linear, but a scaffold that guides the analysis [Ritchie and Lewis, 2003].

4.5.2 Study Sample

Participants were recruited in both a prospective and retrospective manner. For those recruited retrospectively, the injury must have happened in the previous two years. In this was it was hoped to minimize recall bias – it was felt by the author that if the incident had happened more than two years ago, it may have been difficult for the parents to remember all the relevant details of what happened. By using both prospective and retrospective recruitment, it was hoped to maximise the sample size and thus record a variety of experiences of parents' accessing emergency and follow-up care for their children. The recruitment of participants took place over a three-month period. During this time, three children presented to the department having recently avulsed a permanent tooth. It is possible that the author was not notified of all children who presented with avulsion injuries during this time. A number of efforts were made to prevent this, including notification to all members of the department that the study was on going. There is some evidence to suggest that the incidence of dental trauma peaks in the summer time [Glendor *et. al.,* 1996] so it may have been possible to recruit more participants whose children had recently had an avulsion injury, if the study had been run over the summer time.

The remaining five participants were recruited from the weekly trauma clinic that takes place in LDI. Whilst checking the patient files for those children who had sustained an avulsion injury in the past, the author noted that many potential participants were excluded, because the avulsion injury had happened more than two years ago. This in itself demonstrates that treatment following an avulsion injury continues long after the initial injury, as described recently by Keasberry and colleagues [Keasberry *et. al*,

2013]. Two further children were identified as fitting the inclusion criteria following review of the patient files but the parents declined to participate. One parent gave no reason for not wanting to take part in the study. The other parent declined because she felt she would become too upset during the course of the interview. Her son was fifteen years old when he avulsed his upper front tooth, and the injury had happened over one year ago. This demonstrates the profound impact an avulsion injury can have on the family, and that the impacts are felt for a significant time period after the initial injury.

Six of the interview participants were mothers; participants 6 and 8 were fathers. All had been present at the time of the injury. All of the children who had sustained an avulsion injury were boys. It has been found that boys experience dental injuries at least twice as often as girls [Glendor, 2008, Zaitoun *et. al.,* 2010]. A retrospective observational study of the time to initial treatment in avulsion injuries in Scotland found that almost 60% of the sample was boys [Kargul and Welbury, 2009]. The sample in this study is therefore certainly skewed in respect of gender. The average age of the children at the time of the injury was 9 years, 11 months, with a range from 6 years 11 months to 12 years 10 months. It has been reported that avulsion injuries occur most commonly in 8-12 year olds [McIntyre *et. al.,* 2009], with 35% occurring before the age of nine [Lauridsen *et. al.,* 2012]. The sample is thus representative in terms of age at time of injury.

All of the participants were White British. In West Yorkshire, where all of the participants were from, just over 10% of the population are Asian or Asian-British [Office for National Statistics, 2012]. Thus the sample may not be representative of the local population in respect of ethnicity.

It must also be noted that all of the participants were recruited from the Children's Department at LDI. They had all therefore, accessed specialist care, as recommended in the UK National Clinical Guidelines Treatment of Avulsed Permanent Teeth in Children [Day and Gregg, 2012]. The findings from Chapter Three would indicate that there are a significant number of children in Yorkshire who have had an avulsion injury

but have not been referred to specialist care. Further investigation into their pathway to care may be indicated in the future.

4.5.3 Pathways to Care

All of the children in this sample sustained their injury outside of normal working hours. Previous reports have indicated that up to one quarter of all TDIs occur at school [Blinkhorn, 2000, Glendor *et. al.,* 2000], although at least one study has reported that only 11% of avulsion injuries occurred during school time [Nguyen *et. al.,* 2004]. It may be that the increased number of health and safety rules in schools prevent any 'boisterous' play that may lead to a severe dental injury and that is why none of this sample sustained their injury at school. However, it may also be true that when an injury like this occurs at school, the parent is able to bring their child directly to their GDP for emergency treatment. The child then may or may not be referred on to specialist care.

A Canadian study found that 50% of avulsion injuries occurred at weekends, and 39% occurred during a weekday evening [Nguyen *et. al.,* 2004]. This matches more closely with this study sample, where four occurred at the weekend and four occurred on a weekday evening and thus, the GDP was not available to provide the emergency care. This may go some way to explaining why none of the children had their emergency care provided by their GDP and that in fact seven of the sample had their initial treatment at their local A&E. In contrast, Zaitoun and co-workers in a cross-sectional survey covering Liverpool, Manchester and Sheffield found that in 67% of cases, the parents reported that their children were initially managed within working hours and that the initial care was undertaken by a dental primary care practitioner in almost 40% of cases. However, this sample looked at all types of TDI, from minor to complex, and so a direct comparison of the findings may not be appropriate. It may also reflect the provision of dental care services in these local areas. The Scottish study [Kargul and Welbury, 2009] may provide more valid comparison as it looked exclusively at children with avulsion injuries. Fifty per cent of the children who had sustained an avulsion injury initially

presented to an A&E department, 32.5 % initially presented to their GDP and the remaining 11.7% presented at a dental hospital.

In at least two cases in this study sample, the child was brought to A&E via an ambulance because of other injuries (P3, P7). Other parents brought their child directly to A&E (P1, P5, P8), without attempting to first contact a dentist. The parents may have been aware that their GDP practice would not be open, but they then had little or no knowledge of the available emergency dental services, and how to contact them. However, it is also possible that when a severe injury like this occurs, the parents aren't just thinking about their child's teeth and what dental treatment is required, but they are also concerned for their child's overall well-being. There is likely to be significant bleeding from the oral cavity following an avulsion injury and there may be other extra- and intra-oral injuries also. So even if out of hours emergency dental services were readily available, it may be that some parents would still bring their child to A&E in the first instance.

For all participants the pathway to follow-up care was much more straightforward. Two were referred directly from A&E to the Children's Department at LDI. The six other participants phoned their dental practice the day after their child's accident, and all were given an emergency appointment and were seen that day. This indicates that GDPs are aware of the severity of these injuries and that the children need to be seen promptly. All parents were pleased with the care their GDP provided:

"All the help we've had afterwards has been fantastic" (P1)

Three GDPs arranged very prompt referral to the LDI, by contacting the department directly, by phone or email. This demonstrates the long-term commitment to training and support for local dentists in the region. This is related to the finding in Chapter 3 that 40% of dentists in Yorkshire have accessed post graduate training in dental trauma.

Many of these courses will include case discussions and treatment planning and this is likely to inform the GDPs decision on whether to treat or refer to specialist services.

4.5.4 Core Concepts

4.5.4.1 Knowledge

Initial treatment at the site of the accident often relies on the children's parents, friends or their schoolteachers prior to the initial professional contact. In general, the parents in this sample had poor knowledge about what to do if a child avulses a permanent tooth. This is in line with what has previously been reported in the literature [Oliveira *et. al.,* 2007, Al-Jame *et. al.,* 2007). Grandparents proved to have good knowledge of what to do – placing the tooth in milk and immediately seeking emergency care. This is a novel finding and has not been reported previously.

It is interesting to note that there were two parents who did know what to do i.e. that the tooth should be replanted as quickly as possible. Despite this knowledge, neither parent felt able to attempt to replant the tooth: due to the child's distress, and the significant bleeding that is to be expected after an avulsion injury. This makes it all the more remarkable that one grandmother, who had no prior knowledge of what to do, instinctively 'put the tooth back in'.

One participant (P1) noted that her child knew it was necessary to put the tooth in milk. A previous study of Kuwaiti children found none of them knew the correct transport medium for an avulsed tooth [Andersson *et. al.,* 2006]. Another parent had noted that his son is now learning about teeth in school and felt that teaching children about the correct procedure in the event of an avulsion injury may be beneficial:

"You know, if, they're aware that if your tooth comes out this is what you do, they are likely to remember it, they're going to tell their parents. That's probably a more reliable route to take with education" (P8)

The themes of knowledge and access are closely linked here, as once the parent gathered some knowledge of what needed to happen, they used this to actively seek emergency care for their child.

Other people at the scene of the injury also demonstrated poor knowledge of what to do when a child knocks out their front tooth:

"He was brought home by his rugby coach with his tooth in his hand" (P1)

"A lady at the skate park had found it and put it in the back pocket of his pants" (P3)

This again, is in line with previous reports in the literature [Hamilton *et. al.,* 1997b, Mori *et. al.,* 2007]. In two cases, a dentist happened to be at the scene shortly after the avulsion. Neither dentist attempted to replant the avulsed tooth, and one (a German dentist, on holidays in Tunisia) suggested placing the tooth on ice. This is disappointing, as expedient intervention is critical in the management of avulsed teeth, where the periodontal cells rapidly lose their potential to regenerate [Andreasen et. al., 1995b]. Their decision not to replant the avulsed tooth may be a reflection on an increasingly litigious society; there is evidence that first aid personnel in schools were reluctant to replant a tooth if required, because of legal reasons [Addo *et. al.,* 2007].

It is difficult to ascertain the levels of knowledge of A&E staff from the information given by the parents in this study, but it would appear that many have poor levels of knowledge, particularly with regard to the importance of timely treatment. It has previously been reported that emergency medical personnel have poor knowledge of what to do when presented with an avulsed tooth [Holan and Shmueli, 2003, Abu-Dawoud *et. al.,* 2007]. More recent reports from the UK have found that ED staff have

good levels of knowledge of what treatment is required for an avulsed tooth, though many would still refer the child to the maxillo-facial team, even if this contributed to a delay in treatment [Addo *et. al.,* 2007, Trivedy *et. al.,* 2012]. It is important that all staff in A&E are aware of the prompt need for treatment, including reception and triage staff. One Dad felt that the reason they were kept waiting when they arrived in A&E was that:

"The receptionist can't have known it was important" (P6)

Maxillo-facial doctors, who had been contacted by the staff in A&E, treated a number of children in this sample. Maxillo-facial registrars and consultants are dual qualified – in medicine and dentistry - and so are likely to be best placed to treat a child with an avulsed permanent tooth. They have a wide range of clinical responsibility and are not always available to immediately attend the A&E department if called to manage an avulsed tooth. The management of their on-call rota is also complex. It is often a junior member of the team who is 'first on-call' – they may be a dentist, or a singly qualified medic. The on-call may involve cross-cover, where the Plastic Surgery or ENT team provides on-call care. These doctors are not likely to be dentally qualified, and thus may have limited experience in dealing with dental emergencies.

One parent described how referral to the maxilla-facial team contributed to a delay in treatment for her son; the doctor in A&E had contacted the maxillo-facial surgeon on-call, but he was in theatre at the time and there was nobody else from their team available:

"The nurse kept coming back, saying she has tried, she has tried but he's in surgery at the moment" (P3)

In this case, the doctor in A&E did replant the tooth, although Mum had noted it did not seem to be a priority for them. This has previously been identified as a potential problem in the literature when the majority of respondents (A&E doctors) who were presented with an avulsion injury would refer the patient to a maxillofacial surgeon,

even though this would cause an obvious delay before replantation could be carried out [Addo *et. al.,* 2007].

For other children in this sample, maxillo-facial doctors were available to attend the A&E soon after the children had been registered. Parents were both surprised and pleased that their child had been seen so promptly

"We were brought straight in. I think they were down within 5-10 minutes. They were really fast" (P7)

If maxillo-facial surgeons are to be responsible for the acute management of avulsion injuries in children, it is important that they have sufficient resources to provide the acute care in a timely manner. As described earlier they have a wide remit of clinical responsibility and it is reasonable to expect that tooth avulsion injuries may not always be the priority when there is limited availability of staff. The fact that the prevalence of avulsion injuries in Yorkshire is unknown, as discussed in Chapter Two, makes it difficult to ensure the service is adequately resourced to deal with these injuries. It is also imperative that the maxillo-facial team is up to date with the recent clinical guidelines for treatment of avulsed permanent teeth [Day and Gregg, 2012]. It may also be useful to forge links between their teams and the specialist paediatric dentists in the region so there can be smooth transition of care following the initial emergency management of the avulsed tooth.

A novel concept that may improve the outcomes for children who suffer an avulsion injury is that of the Tooth Rescue Box. The rescue box contains a specially compose storage medium including amino acids, vitamins and glucosis [Filippi et. al., 2008]. The medium has been shown to maintain vitality and proliferative capacity of PDL cells for up to 48 hours at room temperature in vitro [Pohl et. al., 1999] and to be successful for storage of avulsed teeth in clinical use [Pohl et. al., 2005]. Storage of a tooth rescue box at locations where an avulsion injury may happen, for example a sports ground, and in ambulances and A&E departments may 'buy some time' for the HCPs involved in

providing the acute care for the child. Short term results for teeth stored in the rescue box are good, with good rates of functional healing seen, despite extended extra-oral times [Filippi et. al., 2008]. However, there is limited evidence that has low risk of bias; nor are there any trials that utilize comparison with a control group. There are no long-term outcome results available. Until these are known, it will be difficult to determine if the initial costs of providing tooth rescue boxes across the region will be of long term benefit.

4.5.4.2 Access

Access to emergency care proved difficult for all participants, and indeed one parent (P4) could not access any emergency care for her child over a weekend period. The period from the initial injury to receiving emergency care is the most critical [Andreasen et. al., 2007], but it was during this period that the children in this sample experienced significant delays.

Many of the parents elected to bring their child directly to A&E for emergency care, and as discussed in the previous section on knowledge, this may have been because of other injuries their child had sustained, or the severity of the trauma to their mouth.

It became clear during the framework analysis process that knowledge and access were intrinsically linked. Parents used their prior knowledge or knowledge they obtained shortly after the accident to proactively access the appropriate care for their child as discussed previously. Not all parents would feel confident to voice their wishes in this way, particularly if there were any language or communication barriers. What then, happens these children, if their parents cannot proactively access emergency treatment for them? The sample that we collected was not able to answer this question.

At least one child in this sample experienced a significant delay in accessing emergency care because of emergency care providers' reluctance to accept responsibility for treatment of dental trauma:

"We took him straight to the local A&E. They refused to treat him….they said there's no dentist here, nobody who can deal with it, go back home and find a dentist" (P1)

There are many HCPs in various locations, who can provide emergency care for tooth avulsion injuries – the local dentist, the accident and emergency department, dental access centre or a secondary dental care provider. Perhaps because of this variety, no one group is ultimately responsible for the provision of emergency care, particularly out of hours. This has been identified as an issue in the literature previously [Day et. al., 2012, Trivedy et. al., 2012]. The UK National Clinical Guidelines for Treatment of Avulsed Permanent Teeth include this as one of the five key areas that need improving in the current services:

"Better provision of emergency dental care with a clinician competent in making the diagnostic decisions and delivering the appropriate treatment"

Experts in the field of dental trauma research have advised that emergency dental care should be organised so that the service could be provided on a 24-hour basis and that emergency dental staff experienced in acute dental trauma treatment should provide the service [Glendor, 2009]. This is currently the model used in some areas of Australia. Although it would be hoped that a service like this would improve the outcomes for children who sustain a complex dental trauma, it is likely to be an expensive service to run. Certainly, in these difficult financial times, a robust cost benefit analysis would be required before local commissioners could consider putting such a system in place.

4.5.4.3 Emotion

Throughout each of the interviews parents made reference to the wide range of emotions that they felt in the time after their child's accident and whilst they were seeking dental care for them. Again, this core concept was in many ways linked with the other core concepts of knowledge and access, as demonstrated in Figure 4.4. As this is the first qualitative study into parents' experiences of accessing dental care for their children following avulsion injury, this is a novel finding. It is though, perhaps not surprising for the clinicians who treat children following complex traumatic injuries – they are often acutely aware of the distress and upset such an injury can have not only on the child, but on the parents too. As discussed in the background for this chapter, there is increasing evidence of the impact TDIs can have on the HRQoL of parents, with

persistently high scores on the FIS for at least one year following the trauma [Berger *et. al.,* 2009, Porritt *et. al.,* 2013]. It is possible that the emotional impact following an avulsion injury contributed to the high scores obtained on the HRQoL and FIS scales.

A number of parents remarked that they were very pleased to be able to share their experience and hoped that it would lead to improvements in the service so that other children and parents could have a more positive experience in the future.

4.6 Limitations

There are several limitations with this study that need to be acknowledged. Firstly, this was a qualitative study that drew on perspectives of a purposively selected sample from a region of Yorkshire. Therefore, like most other qualitative studies, transferability to other contexts needs to be considered thoughtfully.

Although every effort was made to undertake good purposive sampling, it is clear that the final sample is not fully representative of the local population. Further research is required to determine if girls, or children from predominantly Asian communities experience a similar pathway to care. It is also important to identify children who have received all of their dental care following an avulsion injury in primary care and to then ascertain if their experiences of accessing care were any different.

The reliability of the analysis could have been enhanced by organising an independent assessment of transcripts by an additional skilled qualitative researcher., Agreement (or not) between raters could then have been compared.. This is particularly relevant here, as the author had no prior experience of undertaking qualitative research

4.7 Conclusions

The qualitative approach was effective and gave a rich source of information on how parents access emergency and follow-up care for their child following a tooth avulsion injury.

In general the parents who were interviewed in this study, found it difficult to access appropriate emergency care for their child following a tooth avulsion injury. None of

the children in the sample received the appropriate acute treatment in the appropriate time frame.

These parents had a low level of knowledge of what to do in the event of a tooth avulsion injury. Those that knew that the avulsed tooth should be replanted promptly, felt unable to do this, as both they and their child were too distressed.

Grandparents emerged as a valuable source of knowledge and in many cases prompted the parents to proactively seek emergency dental care for their child.

It is not possible, from this sample, to describe or analyse, how parents of girls, or Asian or other ethnic minority families access emergency care for their child if they sustain a tooth avulsion injury.

The majority of those interviewed found that accessing follow-up care much more straightforward and a number of children reached specialist care just a couple of days after their accident.

4.8 Recommendations for further research

A number of recommendations for further research can be made following this study. They include:

1. Identifying children who have attended primary dental care services for both emergency and follow-up care following a tooth avulsion injury. Semi-structured interviews with their parents to deduce their pathways to care
2. Identifying parents of girls and those from Asian or other ethnic minority backgrounds to determine if their pathways to care following a tooth avulsion injury are different, and if so, how.
3. Contacting the local commissioners to discuss the findings of this project in relation to the provision of out of hours dental care and how best to move forward and plan a care pathway for complex dental injuries. Design of a care pathway is likely to require a multi-agency approach.

4. Contacting the agencies involved in providing phone advice for non-life threatening emergencies (formerly NHS Direct, now 111) to ascertain if their staff are trained to give advice on what to do in the event of a tooth avulsion injury. If they do not have this training, to discuss how best to incorporate this into their existing curriculum.
5. Ascertaining school children's knowledge in relation to management of an avulsed permanent tooth. Discussion with the relevant education bodies to propose inclusion of acute trauma management in the school health curriculum

Chapter Five

Conclusions and Recommendations for Further Research

5.1 Research Conclusions

The decennial surveys on Child Dental Health provide a significant amount of detailed information on accidental damage to teeth in children aged 8, 12 and 15 years. Despite this, it is not possible to deduce the prevalence of tooth avulsion injuries in the child population. Epidemiological data from the NHS (DEP) surveys cannot provide an exact figure for the prevalence of avulsion injuries in Yorkshire. It seems an opportunity has been missed to gather valuable data on traumatic dental injuries including severe injuries such as avulsions. A key recommendation in the UK National Clinical Guidelines on Avulsion of Permanent Teeth is that a clinical care pathway be implemented to provide high quality care for these children [Day and Gregg, 2012]. Until the prevalence of avulsion injuries is known, restructuring of current services to implement this care pathway will be difficult to justify.

Many dentists working in primary care in the Yorkshire region have no or very limited experience of treating children with avulsed permanent teeth. Their experience is broadly similar to that of dentists working on primary care in Wales.A significant percentage of both groups currently have children with avulsion injuries under their care: this differs from the guidance issued by the BSPD that an interdisciplinary team should see children with avulsion injuries soon after the initial injury [Day and Gregg, 2012].

The qualitative approach taken in Chapter Four was effective and gave a rich source of information on how parents access emergency and follow-up care for their child following a tooth avulsion injury. In general the parents who were interviewed in this study, found it difficult to access appropriate emergency care for their child following a

tooth avulsion injury. None of the children in the sample received the appropriate acute treatment in the appropriate time frame. Grandparents emerged as a valuable source of knowledge and in many cases prompted the parents to proactively seek emergency dental care for their child. It is not possible, from this study sample, to describe or analyse, how parents of girls, or Asian or other ethnic minority families access emergency care for their child if they sustain a tooth avulsion injury. The majority of those interviewed found that accessing follow-up care much more straightforward and a number of children reached specialist care just a couple of days after their accident.

5.2 Recommendations for further research

The next logical step on completion of this project is to proceed with the design and implementation of a formal clinical care pathway for children who sustain complex dental injuries. However, further work is required before such a project could be undertaken.

It is important to ascertain the prevalence of avulsion injuries in our child population. It is likely that the most cost-effective way of doing this is to incorporate some specific questions and a specific code for avulsed teeth in the NHS (DEP) surveys for 12 and 15-year-olds.

Outcomes for children who receive all of their care following an avulsion injury in primary care need to be determined. Until these outcomes are known it will not be possible to advise that all children with tooth avulsion injuries should be referred for specialist care.

Focus groups or semi-structured interviews with primary care dentists may provide some further insight into how primary care dentists manage children with avulsion injuries, and what, if any barriers they perceive in referring these children for specialist care.

It is also necessary to determine the care pathways for children other than those in our sample – particularly those from ethnic minority backgrounds, following a tooth avulsion injury.

It will also be important to involve local commissioners and those charged with providing emergency dental care services in the region to identify how best to proceed with pathway design and implementation.

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List of Appendices

The following appendices are enclosed on the accompanying CD