Parents' Views and Experiences of Genetic Testing in Amelogenesis Imperfecta

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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 the work of others.

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Dedication

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Abstract

Title: Parents' Views and Experiences of Genetic Testing in Amelogenesis Imperfecta

Background

Amelogenesis Imperfecta (AGI) is a hereditary dental condition affecting enamel quality and quantity, with significant functional and psychosocial consequences. Although genetic testing is available within NHS dental pathways, little is known about how parents perceive and experience this process when it is offered for their child.

Aims

This study aimed to explore parents' views, motivations, concerns, and experiences in relation to AGI genetic testing, with particular attention to the perceived benefits and barriers influencing decision-making.

Methods

A qualitative study was undertaken using semi-structured interviews with 14 parents whose children had been offered genetic testing for AGI via an NHS targeted 21-gene panel test. Participants included parents who both accepted and declined testing, allowing for a range of perspectives. Interviews were conducted virtually via Zoom between November 2022 and April 2023. Each interview lasted approximately 45–60 minutes and was audio-recorded and transcribed verbatim. Data were analysed using reflexive thematic analysis (RTA). Ethical approval was granted by the UK Research Ethics Committee (IRAS Project ID: 293839) and the Leeds Research and Innovation Department (R&I No: DT22/148476). Verbal consent was obtained and recorded in line with ethical guidance and COVID-19 safety procedures.

Results

Four themes were developed from the data: (1) wanting an "explanation" for tooth appearance; (2) not feeling "listened to" or taken seriously by their dentist; (3) increasing awareness of AGI through diagnosis; and (4) AGI not viewed as a "serious condition". Parents' decisions were shaped not only by clinical considerations, but also by emotional and social factors. For many, genetic testing provided validation, reassurance, and relief from guilt by helping to reframe the condition as hereditary rather than attributable to parental

actions. It also strengthened parents' confidence in advocating for their child and navigating care. However, some parents questioned the necessity of testing, particularly when AGI was perceived as mild or manageable. Hesitations were influenced by practical concerns, including the invasiveness of blood testing, uncertainty about what the results might reveal, and limited guidance from general dental practitioners.

Conclusion

This study shows that parents' decisions about AGI genetic testing are shaped by more than clinical rationale alone. Genetic testing was experienced not simply as a diagnostic procedure, but as a source of legitimacy, reassurance, and support for advocacy within both healthcare and family contexts. Even among parents who declined testing, many recognised its broader value for family awareness, future generations, and research. The findings highlight the importance of family-centred and psychologically informed approaches to genetic testing in dentistry, supported by clear communication, professional understanding, and appropriate support for decision-making.

List of Abbreviations

Abbreviation	Definition
AGI	Amelogenesis Imperfecta
COVID-19	Coronavirus Disease 2019
DI	Dentinogenesis Imperfecta
DNA	Deoxyribonucleic Acid
EMPs	Enamel Matrix Proteins
GDPR	General Data Protection Regulation
GDP	General Dental Practitioner
HRA	Health Research Authority
IEE	Inner Enamel Epithelium
IRAS	Integrated Research Application System
MIH	Molar-Incisor Hypomineralisation
NGS	Next-Generation Sequencing
NHS	National Health Service
NIHR	National Institute for Health and Care Research
NORD	National Organization for Rare Disorders
NVivo	Computer-assisted qualitative data analysis software (CAQDAS) used to facilitate the organisation, coding, and analysis of qualitative data.
OEE	Outer Enamel Epithelium
PIS	Participant Information Sheet
PPIE	Patient and Public Involvement and Engagement
QoL	Quality of Life
REC	Research Ethics Committee
RTA	Reflexive Thematic Analysis
UK	United Kingdom
WES	Whole Exosome Sequencing
WGS	Whole Genome Sequencing

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Chapter 1 Literature Review

1.1.Introduction

Amelogenesis Imperfecta (AGI) is a rare hereditary condition that disrupts the formation of dental enamel, resulting in structural defects that compromise both the appearance and function of teeth (Wright *et al.*, 2021). Individuals with AGI often experience discoloured, fragile, or pitted enamel, which can lead to increased tooth sensitivity, wear, and psychosocial distress. Although it primarily affects the teeth, the impact of AGI extends far beyond oral health, influencing self-esteem, social interactions, and quality of life (QoL), particularly in children and adolescents (Smith *et al.*, 2020).

While much of the existing literature has concentrated on the clinical presentation, histological subtypes, and genetic underpinnings of AGI, relatively little attention has been paid to the lived experiences of affected individuals and their families, particularly parents who are often central to decision-making regarding diagnosis and treatment. As the availability of genetic testing becomes more widespread, understanding how parents perceive and respond to these technologies is crucial.

This literature review explores the current body of research on AGI, with a particular emphasis on four key areas: (1) the clinical and genetic classification of AGI, (2) psychosocial impacts on affected individuals and families, (3) the role of dental professionals in the diagnostic process, and (4) parental perceptions of and experiences with genetic testing. In doing so, the review identifies significant gaps in knowledge, especially regarding how parents interpret genetic information, make testing decisions, and manage their child's condition.

The review is structured thematically, enabling a critical analysis of how the literature has developed across different domains. By synthesising findings from clinical, psychological, and social perspectives, this chapter provides a comprehensive foundation for the present study. This research seeks to explore how parents view and experience AGI genetic testing, and how their perspectives shape decision-making and care pathways.

1.2.Tooth Development

Understanding the stages of tooth development is essential before discussing dental anomalies. During early embryonic growth, the oral ectoderm lines the primitive oral cavity, with underlying connective tissue primarily of ectomesenchymal origin. The ectoderm gives rise to the dental lamina, which forms the foundation of the tooth germ. Each tooth germ clusters to create a tooth bud that will grow into the underlying ectomesenchyme (Liu, 2020).

As development progresses, the deep surface of the bud invaginates, forming a cap shape, marking the cap stage of tooth development. Ongoing epithelial invagination leads to the bell stage, during which histodifferentiation and morphodifferentiation occur. At this point, the tooth germ comprises:

- Enamel organ (ectoderm derivative), which will produce enamel.
- Dental papilla and dental sac (mesenchyme derivatives), forming dentine, pulp, cementum, and periodontal ligament (Liu *et al.*, 2020).

This review focuses on an enamel-related anomaly; thus, it is worth briefly explaining the enamel formation process.

1.3.Enamel Formation

Enamel, the outermost layer of tooth structure, is the hardest tissue in humans. It is composed of approximately 96% inorganic material in the form of hydroxyapatite crystals and 4% organic material. Enamel formation, or amelogenesis, occurs in three stages: presecretory, secretory, and maturation (Ruan *et al.*, 2021). During amelogenesis, ameloblasts secrete an extracellular matrix that facilitates mineral deposition by producing necessary matrix proteins. The enamel organ differentiates into four distinct layers:

- Outer enamel epithelium (OEE)
- Inner enamel epithelium (IEE)
- Stellate reticulum, situated between the OEE and IEE
- Stratum intermedium, enclosed by the IEE and stellate reticulum (Smith *et al.*, 2020).

The OEE acts as an outer scaffold that supports enamel formation while IEE cells differentiate into pre-ameloblasts. Moreover, stellate reticulum and stratum intermedium aid in maintaining amelogenesis by producing glycosaminoglycans. The cells of the IEE stimulate the dental papilla to transform into odontoblasts which in turn initiates

dentinogenesis. The odontoblasts deposit dentine along with their movement to the centre of the tooth. As a result, ameloblasts are then activated to move outwards while depositing the enamel matrix in what is known as the appositional stage. Enamel formation is later carried on by a two-step stage called the mineralisation stage, in which the organic matrix is mineralised by 30%. Once the total enamel thickness is achieved, its mineral content increases more by the incorporation of calcium and phosphate into the matrix. This marks the calcification stage, which is followed by the enamel maturation stage just before tooth eruption (Nanci and Ten Cate, 2018).

1.4.Dental Anomalies

Dental anomalies represent deviations from normal dental development and form a broad category of conditions that affect the dentition. Tooth development, or odontogenesis, is a complex process initiated in early embryogenesis and continuing through adolescence. It involves a highly regulated sequence of cellular interactions guided by genetic, molecular, and environmental factors. These interactions ensure proper differentiation, size, shape, and mineralisation of the dental tissues. When disruptions occur at any stage of this process, they can result in congenital, developmental, or acquired anomalies involving the number, size, shape, structure, or eruption of teeth (Nanci, 2018; Newman and Black, 2014). The nature and extent of the defect depend on the timing, duration, and severity of the underlying insult.

The classification of dental anomalies is conceptually important in paediatric dentistry, as it allows clinicians to distinguish between conditions of genetic origin and those acquired due to systemic or local factors. Among these, structural anomalies are particularly significant because they frequently have lasting effects on dental health and function. Structural anomalies may arise from genetic mutations affecting tooth formation or from external insults that interfere with normal tissue development during critical stages of odontogenesis (Crawford *et al.*, 2007). The present study focuses specifically on enamel anomalies, as their prevalence, clinical impact, and aetiology are central to the aims of this thesis.

1.4.1. Enamel Defects

Enamel defects arise from disruptions during amelogenesis, the complex process involving secretion of enamel matrix followed by controlled mineralisation and maturation. The nature of the defect depends largely on when during amelogenesis the disturbance occurs and

whether the causative factor is local, systemic, or genetic. Accordingly, enamel defects are commonly classified using two complementary frameworks: (1) distribution, describing whether defects are localised or generalised, and (2) developmental stage affected, distinguishing between quantitative defects of matrix formation and qualitative defects of mineralisation (Bailleul-Forestier *et al.*, 2018).

1.4.1.1.Classification Based on Distribution

Localised Enamel Defects

Localised enamel defects typically affect a single tooth or a limited group of teeth and are commonly associated with local insults during tooth development. These may include trauma, periapical infection of a primary predecessor, or localised inflammation.
A classic example is Turner's tooth, in which enamel hypoplasia or hypomineralisation occurs as a result of trauma or infection affecting the developing permanent tooth germ. The severity and appearance of the defect depend on the developmental stage at which the insult occurs (Crawford et al., 2007).

Generalised Enamel Defects

In contrast, generalised enamel defects involve multiple teeth and often affect the dentition symmetrically. These patterns are more likely to reflect systemic, metabolic, or genetic disturbances occurring during critical periods of enamel formation. Systemic conditions such as metabolic disorders, chronic illness in childhood, or nutritional deficiencies can impede the secretion of the enamel matrix across a broad segment of the dentition. Historically, conditions such as congenital syphilis were associated with generalised enamel hypoplasia affecting the entire dentition (Newman and Black, 2014).

1.4.1.2.Classification Based on Stage of Amelogenesis

Enamel defects may also be classified according to the stage of enamel formation affected:

- Secretory-stage disturbances result in quantitative defects, such as enamel hypoplasia, characterised by reduced enamel thickness. Clinically, these defects may appear as pits, grooves, or large areas of absent enamel.

- Maturation-stage disturbances lead to qualitative defects, including hypomineralised or hypomature enamel, where enamel thickness is normal but mineral content and mechanical properties are compromised. Hypomineralised enamel is usually soft, porous, and prone to rapid post-eruptive breakdown, complicating restorative care (Bailleul-Forestier *et al.*, 2018).

1.4.1.3.Developmental Enamel Defects of Systemic Origin

Molar–Incisor Hypomineralisation (MIH) is a systemic developmental enamel defect affecting one to four permanent first molars, with or without involvement of the permanent incisors. MIH is characterised by demarcated white, yellow, or brown opacities caused by altered enamel protein and mineral composition. Clinically, affected teeth often demonstrate hypersensitivity, post-eruptive enamel breakdown, and an increased susceptibility to dental caries (Lygidakis *et al.*, 2022).

Dental fluorosis is another systemic enamel defect resulting from excessive fluoride ingestion during enamel formation. The condition leads to hypomineralisation, presenting clinically as diffuse enamel opacities or mottling, with severity dependent on the level and duration of fluoride exposure (Bailleul-Forestier *et al.*, 2018).

1.4.1.4.Hereditary Enamel Defects

Hereditary enamel defects arise from genetic mutations affecting enamel formation. Among these, AGI represents the most prevalent inherited enamel disorder. Due to its genetic heterogeneity, clinical variability, and relevance to this research, AGI is discussed in detail in a dedicated section in this thesis.

1.4.1.4.1. Amelogenesis Imperfecta (AGI)

AGI is a hereditary developmental condition affecting the quality and/or quantity of enamel in both primary and permanent teeth to a varying extent. AGI can be inherited as an Autosomal Dominant, Autosomal Recessive, or X-linked condition, or it may occur spontaneously. In some cases, AGI is associated with other syndromes or systemic phenotypic changes (Bloch-Zupan *et al.*, 2023).

AGI enamel defects are categorised as hypoplastic, hypomature, hypocalcified or a combination of any. These defects can result in discoloured, sensitive, or easily chipped enamel. Advances in genetic testing have significantly improved the ability to identify mutations associated with AGI, aiding in diagnosis and treatment planning (Wright et al., 2021; Smith et al., 2020).

Chronic conditions such as AGI can seriously affect the whole family by increasing psychological stress and families' financial burden (Dogba *et al.*, 2013). Moreover, the unaesthetic appearance of AGI teeth significantly affects individuals' social experiences and self-esteem (Coffield *et al.*, 2005). AGI follows a hereditary pattern and has no definitive cure. Reaching an accurate diagnosis of the condition will provide the patient with certainty and provide the practitioner with more confidence while shaping the treatment plan. In light of this, genetic testing can be a reliable tool to confirm a diagnosis and identify treatment options. For that purpose, the NHS has launched the targeted 21-gene panel test to diagnose suspected cases of AGI. Hence, dentists, healthcare providers, and involved families have to work hand-in-hand to achieve the utmost understanding and benefit of the genetic information (McDowall *et al.*, 2018).

1.4.1.4.2. Hereditary Pattern

In general, Autosomal Dominant refers to a patient being affected even if only one parent carries the defective gene. In contrast, Autosomal Recessive refers to the transmission pattern that requires two copies of the defective gene for the disease to occur (Crawford *et al.*, 2007). AGI may follow autosomal dominant, autosomal recessive, sex-linked, or sporadic inheritance patterns. For instance, a mutation in the amelogenin gene, AMELX, results in X-linked inheritance, while in the enamelin gene, ENAM represents the dominant form of the disorder (Bailleul-Forestier *et al.*, 2018). Most commonly, families with a known history and diagnosis of AGI tend to represent the recessive form of the disease. Therefore, AGI diagnosis is often based on family history, pedigree plotting and meticulous clinical observation in which genetic testing would have facilitated diagnosis (Crawford *et al.*, 2007). Although genetic testing is not commonly used as a diagnostic tool in dental practice, integrating it into the diagnosis and classification of AGI is a promising development for enhancing clinical diagnostics (McDowall *et al.*, 2018).

1.4.1.4.3. Epidemiology

The prevalence of AGI varies globally, influenced by population genetics and environmental factors. Studies report prevalence rates ranging from 1 in 700 to 1 in 14,000 individuals, highlighting the condition's variability across regions (Crawford *et al.*, 2007).

1.4.1.4.4. Clinical presentation

The clinical presentation of AGI varies significantly depending on the type of enamel defect. Hypoplastic AGI is characterised by a failure in the enamel matrix's formation, resulting in thin or pitted enamel. Teeth affected by this type often have small crowns, and their colour can range from opaque white to yellow-brown. The enamel surface may appear rough, and the condition can be associated with an increased prevalence of open bites. Hypomature AGI occurs when there is incomplete maturation of the enamel. While the enamel thickness may be normal, it is softer and prone to chipping. Affected teeth often exhibit mottled, opaque appearances, and the enamel's poor quality makes it more susceptible to wear. Hypocalcified AGI, by contrast, results from defective mineralisation. The enamel is poorly calcified, leading to a weak, chalky texture that often fractures soon after eruption. Teeth affected by this type are typically discoloured, with shades varying from orange-yellow to brown, and they display increased susceptibility to caries and rapid enamel loss. Across all types, patients frequently experience heightened tooth sensitivity, functional impairments, and aesthetic concerns, all of which significantly affect oral health-related QoL (Coffield *et al.*, 2005).

1.4.1.4.5. Classification of AGI

AGI mutations can occur at any stage of enamel development, with different genetic disruptions leading to distinct phenotypic outcomes. AGI is generally categorised into three main types based on the affected stage of enamel formation: hypoplastic, hypocalcified, and hypomaturation types. Mutations during the secretory stage result in insufficient enamel matrix formation, leading to hypoplastic AGI, characterised by a quantitative defect. Disruptions at the early stage of mineralisation cause hypocalcified AGI, where enamel remains poorly calcified, leading to weak and chalky teeth. Meanwhile, defects during the maturation phase result in hypomaturation AGI, characterised by enamel that is structurally normal but incompletely mineralised, leading to a softer enamel with mottled or opaque appearance (Crawford et al., 2007).

The classification of AGI has evolved significantly over the years, moving beyond phenotypic observations to include molecular and genetic insights. Early systems, such as that proposed by Weinmann *et al.* (1945), relied solely on enamel phenotype and broadly distinguished between hypoplastic and hypocalcified forms. By the mid-20th century, Darling (1956) introduced a more nuanced model incorporating clinical, microradiographic, and histopathologic criteria. This phenotypic focus continued with Witkop's 1957 and 1988 classifications, which provided structured subtypes including hypomaturation and combined forms like hypomaturation-hypoplasia with taurodontism (Witkop, 1988). These early models laid the foundation for clinical recognition but lacked genetic precision. In the 1970s, Schulze (1970) and Witkop & Rao (1971) began to incorporate inheritance patterns alongside enamel appearance, acknowledging the heritable nature of AGI. A significant turning point occurred in the 1990s and early 2000s, as molecular and biochemical markers were integrated into classification systems. Aldred and Crawford (1995) and Hart *et al.* (2002) pioneered the use of genetic markers such as AMELX in subclassification, establishing the link between specific gene variants and enamel phenotypes. By the early 2000s, a multifactorial approach combining clinical, radiographic, and molecular data had become the standard, as exemplified by Aldred *et al.* (2003) and Crawford *et al.* (2007). More recent classifications have gone beyond structural enamel features, incorporating developmental stages (Alachioti *et al.*, 2014), gene functionality (Sabandal and Schäfer, 2016), and patient-reported outcomes such as pain, psychosocial impact, and functional impairment (Appelstrand *et al.*, 2022). The most recent evolution, as seen in Bloch-Zupan *et al.* (2023), involves integrating next-generation sequencing (NGS) data with Witkop's phenotypic types to build a genotype-informed, clinically actionable classification now adopted by Genomics England's PanelApp. This shift underscores a broader move in dentistry from surface-level diagnosis to molecular precision, enhancing accuracy in prognosis, genetic counselling, and treatment planning (Bloch-Zupan *et al.*, 2023).

The classification systems of AGI discussed above have been summarised in **Table 1** to provide a clearer overview of how the systems have developed over time.

Table 1: Classification Systems Applied to AGI

Author(s)	*Year*	*Classification Basis*	*Subtypes*
Weinmann et al	1945	Phenotype	Hypoplastic, Hypocalcified

Darling	1956	Clinical, Microradiographic, Histopathologic	5 groups: Group 1 - Pitting, Group 2 - Vertical grooves (X-linked), Group 3 - Generalised hypoplasia, Type 4A - Chalky yellow/brown enamel, Type 4B - Discoloured enamel with post-eruptive loss, Type 5 - Local/general discolouration with chipping
Witkop	1957	Phenotype	1. Hypoplastic, 2. Hypocalcified, 3. Hypomaturation, 4. Pigmented Hypomaturation, 5. Local hypoplasia
Schulze	1970	Phenotype + Inheritance	General approach to phenotypic/inheritance-based classification (Schulze, 1970)
Witkop & Rao	1971	Phenotype + Inheritance	Detailed 3-type model: Hypoplastic (6 subtypes), Hypocalcified (1), Hypomaturation (4 subtypes incl. pigmented, snow-capped)
Winter & Brook	1975	Phenotype (primary), Inheritance (secondary)	Types under each category: Hypoplasia (I–V), Hypocalcification (I), Hypomaturation (I–III), Hypomaturation-hypoplasia with taurodontism (I–II)
Witkop & Sauk	1976	Phenotype + Inheritance	Similar structure to 1971 model
Sundell & Koch	1985	Phenotype only	Focused solely on enamel appearance
Witkop	1988	Phenotype (primary), Inheritance (secondary)	Types I–IV: Hypoplastic (IA–IG), Hypomaturation (IIA–IIB), Hypocalcified, Hypomaturation-hypoplastic with taurodontism
Wright, J. T.	1988	Inheritance + Phenotype	Grouped AGI by autosomal dominant, autosomal recessive, and X-linked patterns; enhanced diagnostic classification
Aldred & Crawford	1995	Molecular, Biochemical, Inheritance, Phenotype	Integrated molecular knowledge into classification
Hart et al.	2002	Molecular (AMELX)	Subclassification based on AMELX DNA, cDNA, protein sequence data
Aldred et al.	2003	Inheritance, Clinical, Radiographic, Molecular	Multifactorial, modernised diagnostic guide

Crawford et al.	2007	Phenotype + Genotype + Inheritance	Grouped AGI into hypoplastic, hypocalcified, hypomaturation types with associated genes (e.g., ENAM, AMELX, MMP20)
Gadhia et al.	2012	Diagnostic limitations of phenotype-only systems	Proposed using molecular testing for all suspected AGI; emphasises need for genotype-driven classification
Alachioti et al.	2014	Functional/Developmental + Clinical Stages	Classification by enamel formation stage: secretion, maturation, mineralisation
Sabandal & Schäfer	2016	Clinical + Radiographic + Gene Data	AGI classification based on visible enamel defects, imaging, and molecular results
Appelstrand et al.	2022	Phenotype + Patient-Reported Outcome Measures	Incorporated psychosocial and pain/function outcomes into AGI classification
Bloch-Zupan et al.	2023	NGS-Based + Witkop Integration	Combined next-generation sequencing data with Witkop's types; used by Genomics England

1.4.1.4.6. Aetiology

The genetic basis of AGI has become increasingly clear with advances in molecular genetics. AGI is caused by mutations in genes encoding enamel matrix proteins (EMPs) and other associated factors involved in enamel formation. Recent research has identified over 70 genes linked to AGI phenotypes, some of which are also associated with broader health conditions beyond dental abnormalities (Wong *et al.*, 2022). The NHS introduced a targeted 21-gene panel test for AGI in 2016, and this is now represented in the NHS Genomic Medicine Service as R340 Amelogenesis imperfecta (McDowall et al., 2018; Genomics England PanelApp, 2025). The List of the genes tested under R340 AGI is provided in Appendix F. However, this discussion focuses on genes consistently reported across clinical and genetic studies as primary contributors to AGI. These genes form the cornerstone of a genotype-based classification system by offering clear correlations between inheritance patterns, phenotypic presentations, and clinical severity.

The genes most frequently associated with AGI include: AMELX, FAM83H, ENAM, MMP20, KLK4, WDR72, ODAPH, SLC24A4, and FAM20A. Their consistent identification

in next-generation sequencing studies underscores their significance in both clinical diagnosis and genetic counselling (Bloch-Zupan *et al.*, 2023).

Table 2 presents a summary of the main genes linked to AGI, highlighting their clinical subtype, inheritance pattern, and key clinical features.

Table 2: Main Genes Linked to AGI

GENE	AGI SUBTYPE	INHERITANCE	KEY CLINICAL FEATURE
AMELX	Hypoplastic (Type I)	X-linked	Banding in females, more severe in males (Witkop, 1988; Kim *et al.*, 2004)
ENAM	Hypoplastic	Autosomal dominant or recessive	Vary from localised pitting to generalised enamel thinning (Martinez *et al.*, 2022)
FAM83H	Hypocalcified (Type III)	Autosomal dominant	Fragile, rapidly wearing enamel post-eruption (Lee *et al.*, 2008)
MMP20	Hypomature (Type II)	Autosomal recessive	Soft enamel, prone to wear (Kim *et al.*, 2004)
KLK4	Hypomature	Autosomal recessive	Similar to MMP20; failure of enamel hardening (Simmer *et al.*, 2009)
WDR72	Hypomature	Autosomal recessive	Also associated with mild syndromic features (El-Sayed *et al.*, 2009)
SLC24A4	Hypomature	Autosomal recessive	Sometimes syndromic; affects enamel mineralisation (Jaureguiberry *et al.*, 2012)
ODAPH	Hypomature	Autosomal recessive	Recently discovered, enamel defect often generalised (Parry *et al.*, 2013)
FAM20A	Hypoplastic + Syndromic AGI	Autosomal recessive	Systemic involvement. Linked to enamel-renal syndrome (O'Sullivan *et al.*, 2011; Wang *et al.*, 2013)

1.4.1.4.6.1. Gene-Specific Insights

AMELX encodes amelogenin, the major enamel matrix protein, constituting around 90% of the enamel matrix. Mutations in AMELX lead to X-linked hypoplastic AGI. Males tend to exhibit more severe enamel defects, whereas heterozygous females often show banding due to X-chromosome inactivation. Clinical features include generalised thin enamel or enamel bands (Witkop, 1988; Kim *et al.*, 2004).

ENAM, encoding enamelin, represents less than 10% of enamel matrix proteins. Mutations in this gene cause autosomal dominant and recessive hypoplastic AGI. Defects vary from localised pitting to generalised enamel thinning, sometimes accompanied by malocclusion such as an anterior open bite (Martinez *et al.*, 2022).

MMP20 and **KLK4** are crucial proteases for enamel protein maturation. Mutations in these genes disrupt enamel hardening, resulting in autosomal recessive hypomature AGI. Clinically, the enamel appears normal in thickness but is significantly softer and more susceptible to wear and fracture (Kim *et al.*, 2004; Simmer *et al.*, 2009; Wong *et al.*, 2022).

FAM83H mutations lead to autosomal dominant hypocalcified AGI. Although its biological function is not fully understood, it is distinct in that it does not encode a matrix protein or protease. Mutations result in poorly mineralised enamel that rapidly disintegrates after eruption (Martinez *et al.*, 2022).

WDR72, **SLC24A4**, and **ODAPH** are linked to autosomal recessive hypomature AGI. These genes are associated with enamel maturation and mineral transport, and their mutations result in under-mineralised enamel. In some cases, syndromic manifestations such as renal or skeletal anomalies have been observed (El-Sayed *et al.*, 2009; Parry *et al.*, 2013; Jaureguiberry *et al.*, 2012).

FAM20A is associated with enamel-renal syndrome, a syndromic form of AGI involving both dental anomalies and nephrocalcinosis. Its inclusion in genotype-based classifications illustrates how AGI may serve as a marker for underlying systemic conditions (O'Sullivan *et al.*, 2011; Wang *et al.*, 2013).

1.4.1.4.7. AGI impact on affected children and their families

AGI is a genetic condition that typically presents in early childhood, affecting enamel development from the eruption of the primary teeth and continuing into the permanent dentition. Given its hereditary nature and lifelong implications, AGI impacts not only the affected child but also the wider family. While the clinical presentation of AGI, including enamel defects, tooth fractures, and increased dental treatment needs, is well established in the literature, there is increasing recognition of its wider impact. These wider impacts include emotional, psychological, and social consequences that affect the everyday lives of children and those who care for them. For this reason, the focus of this section is to explore the broader impact of AGI within the context of children and families. This includes examining the psychosocial burden, financial strain, stigma, and reduced QoL associated with the condition (Coffield et al., 2005; Sneller et al., 2014; Lundgren et al., 2019). The following

discussion outlines the key areas in which AGI has been reported to influence the lives of affected individuals and their families.

1.4.1.4.7.1.Psychosocial and emotional impact

Recent studies confirm that children with AGI experience significant social avoidance, bullying, and distress due to their condition. For instance, children are often judged or teased about the appearance of their teeth, leading to a reluctance to smile or laugh without covering their mouths. Parents, particularly those who also suffer from AGI, reported feeling fear and guilt over the possibility of their children facing similar bullying and social challenges (Martinez *et al.*, 2022). Additionally, children with AGI have been shown to have greater concerns about how they are perceived during social interactions, such as dates or job interviews (Parekh et al., 2014)

1.4.1.4.7.2.Aesthetic

The aesthetics of AGI significantly affect patients' psychological well-being. Around 80% of individuals with AGI express dissatisfaction with the colour of their teeth, and many prioritise improving their smile as a critical goal. Children with AGI often experience negative emotions during social occasions, such as photos and videos, due to the visible differences in their teeth (Wong *et al.*, 2022). Parents report seeking early treatment primarily for aesthetic purposes, aiming to protect their children from bullying and social stigma (Martinez *et al.*, 2022).

1.4.1.4.7.3.Function

In relation to oral function, AGI is associated with increased brittleness of teeth, sensitivity, and a higher risk of breakdown. Parents report avoiding certain foods, such as ice cream, fizzy drinks, or hard candies, to prevent discomfort for their children (Lundgren et al., 2019). In the study by Coffield *et al.* (2005), 82.3% of individuals with AGI experienced dental sensitivity. Restorative treatments for children with AGI have been shown to have shorter longevity compared to unaffected individuals, necessitating frequent dental visits, which adds to the families' financial and emotional stress (Lundgren et al., 2019; Sneller et al., 2014).

1.4.1.4.7.4.Treatment need

There is a high treatment demand among individuals affected by AGI due to its significant impact on both aesthetics and oral function; approximately 77% of affected individuals express a desire to improve their smile. Parents commonly seek dental treatment for their children at an early age, often prior to entry into primary school. A primary motivation for early intervention is the improvement of dental appearance, with the aim of protecting children from social stigma, bullying, and feelings of being different from their peers. Functional concerns also contribute to the decision to pursue early treatment (Alqadi and O'Connell, 2018).

In addition to the clinical treatment burden, AGI imposes a substantial psychosocial and logistical burden on families and caregivers. The need for frequent dental visits, long-term treatment planning, and repeated restorative interventions places significant demands on family time and resources. Evidence indicates that the number of dental visits per year is significantly higher in patients with AGI compared to unaffected individuals, contributing to increased caregiver stress and disruption to family routines (Pousette Lundgren *et al.*, 2019).

Furthermore, the financial burden associated with ongoing and often complex dental care may be considerable, particularly as treatment frequently extends throughout childhood and adolescence. Parents of affected children consistently report that obtaining an accurate diagnosis and accessing effective, long-term treatment options are among their primary concerns (Pousette Lundgren *et al.*, 2019). The cumulative impact of these factors highlights that AGI represents not only a clinical condition but also a chronic condition with far-reaching implications for families, underscoring the importance of timely diagnosis, appropriate treatment planning, and family-centred care.

1.4.1.4.7.5.Quality of life (QoL)

AGI has a profound impact on the QoL of affected children and their families. Over 90% of AGI patients report feeling self-conscious, stressed, or ashamed about the appearance of their teeth. This emotional burden is compounded by the physical discomfort and dietary restrictions caused by the condition. Families often experience significant financial strain due to the high cost of dental treatments, which are necessary to manage the AGI's aesthetic and functional aspects. Despite these findings, there are limited qualitative studies that explore the lived emotional impact of AGI in depth, particularly from the perspective of both children and their families.

Studies also suggest that emotional and social support systems are critical for both children and parents. Parents often express a desire for support groups, online communities, and educational resources to help them navigate the challenges of managing AGI. These resources can provide emotional support, practical advice, and a sense of connection with others facing similar challenges. Social interventions, such as peer groups and information leaflets for schools or workplaces, are also suggested to foster greater understanding and support for AGI-affected families (Martinez *et al.*, 2022). However, while these studies highlight the need for support, few explore in detail the specific experiences and unmet emotional needs of parents, who are the caregivers and may also be carriers of the condition. Therefore, the undesirable aesthetics and dental sensitivity and the increased demand for restorative treatment resulted in a negative psychosocial outcome for AGI patients. For that reason, understanding the psychosocial and emotional impact of AGI on affected children and families is crucial in addition to its effect on their QoL (Coffield *et al.*, 2005). Additionally, most parents with the condition experienced guilt and shame in passing on an inherited condition such as AGI to the next generation. For that reason, parents reported feeling extra responsible and had thoughts about genetic testing (Pousette Lundgren *et al.*, 2019). Although such findings highlight important emotional responses, these recent studies have been conducted outside the United Kingdom (UK), and there remains a gap in understanding how UK-based families experience and respond to these genetic and emotional challenges.

1.5.Genetic testing

A genome is the complete set of genetic information required to make up an organism and sustain life. Deoxyribonucleic acid (DNA) contains the chemical coding of our genome, and reading the DNA is through a process called gene sequencing (Genomics England, 2020). For that reason, genetic testing aims to detect any alterations in genes that are known to result in health conditions. It is mostly used in the diagnosis of rare and inherited health problems and some cancers (NHS, 2019). Commonly, patterns are noticed in the genome sequences of people with the same health condition, thus confirming their medical diagnosis (Genomics England, 2020).

Moreover, a genetic test can also demonstrate the inheritance pattern of health conditions within families and guide doctors in deciding on the right course of treatment. Hence, genetic testing can ensure the treatment plan is tailored to patient requirements and needs (NHS,

2019). Therefore, genetic testing is recommended as a reliable tool to confirm the diagnosis in patients with signs and symptoms relevant to a specific health condition (Burke, 2002).

1.5.1. Eligibility for genetic testing

In the UK, genetic testing is provided by the NHS if a gene mutation is suspected, there is a family history of a specific genetic condition, or there are concerns about passing a genetic condition to offspring (NHS, 2019). Genetic mutations cause 80% of rare diseases such as Amelogenesis Imperfecta; consequently, a genetic test is pivotal in confirming the diagnosis (Genomics England, 2020).

1.5.2. Genetic testing process

Given the hereditary nature of Amelogenesis Imperfecta, genetic testing plays a vital role not only in confirming a diagnosis but also in shaping how families understand and manage the condition. It influences decisions around treatment, informs eligibility for specialist care, and can significantly affect how families emotionally and practically navigate life with AGI. Therefore, to better understand its relevance, it is important to explore the purpose and function of genetic testing in more detail. To provide background, genetic testing involves collecting a sample of blood, saliva or body tissue sent to laboratories for DNA sequencing and analysis. Results are typically expected within weeks or months, depending on the indication of the test. Furthermore, a genetic counsellor will discuss the results with individuals and families to ensure their full understanding and to provide further support if needed. It is important to note that all test results are stored in secure national databases and accessed by authorised staff. In the UK, the NHS is responsible for managing and protecting this type of personal data (Genomics England, 2020).

1.5.3. Types of genetic testing

There are four common types of genomic testing: diagnostic, clinical predictive, pharmacogenomic, and tumour testing. In confirming the initial diagnosis of a rare disease as AGI, diagnostic testing is indicated. There are different approaches in diagnostic genomics that can confirm a diagnosis or rule out irrelevant causes of disease. The broad gene sequencing approach includes Whole Genome Sequencing (WGS) or Whole Exome Sequencing (WES), while the more focused approach includes targeted gene sequencing and

gene panel sequencing. WGS and WES are more commonly used as they aim to detect mutations at a genomic level. At the same time, targeted gene sequencing focuses on a narrower area of the genome in which specific genes may be linked to the disease of concern. The gene panel is high depth sequencing focusing on targeted genomic regions; hence, it is more cost-effective and less time-consuming (Berkovitz, Holland and Moxham, 2018). In 2016, the NHS launched the targeted 21-gene panel test to diagnose suspected cases of AGI. Within the NHS, genetic testing for suspected AGI cases is typically offered through specialised tertiary dental services or multidisciplinary clinics dedicated to hereditary enamel defects. In these settings, patients undergo clinical assessment and family history evaluation prior to being offered the NHS targeted 21-gene panel test. Public views on genetic testing vary widely and have not been explored thoroughly. As mentioned earlier, a study confirmed that clinicians approved their involvement with genetic testing in paediatric dentistry but requested more clarification and training. Further research is needed to explore public views as their acceptance is essential for genetic testing to reach its translational potential and improve patient care (McDowall *et al.*, 2018).

1.5.4. The impact of genetic testing on families

Once genomics results confirm the presence of an inherited disease, the whole family becomes involved. Additionally, these results are private information and can impact patients and their families, particularly because genetic information can confirm or refute biological paternity. Nonetheless, a study investigating public views on gene sequencing confirmed a positive perspective in most participants towards genomics. More than half of the participants strongly approved that relatives have the right to be informed about sequencing results if they confirmed a genetic disease (Ballard *et al.*, 2019). Maintaining confidentiality is a central issue when dealing with highly sensitive and personal data as genetic information. Hence, well-informed consent is required to ensure data protection and patients' full understanding (Gettig and Hart, 2003).

1.5.5. Genetic testing in dental practice

The integration of genetic testing into dental practice is promising for dental healthcare by enabling precise diagnosis, treatment planning, and the identification of systemic conditions linked to dental anomalies. Advances in genomics have already facilitated the identification of mutations responsible for conditions such as AGI, dentinogenesis imperfecta (DI), and

hypodontia. These genetic insights not only aid in the diagnosis of dental conditions but also shed light on systemic implications associated with the same genetic mutations, thereby enabling comprehensive patient care (Wong et al., 2022; Bloch-Zupan et al., 2023).
Genetic testing allows for the identification of specific mutations in genes such as AMELX and COL1A1, which are responsible for AGI, DI, respectively (Wong *et al.*, 2022). These advancements highlight the potential of genetic testing to provide definitive diagnoses, particularly in cases where clinical and radiographic findings are unclear (Martinez *et al.*, 2022).
As genetic testing becomes increasingly integrated into dental practice, the role of dentists as primary care providers in oral health is expanding. To effectively utilise genetic insights, dental professionals must be trained in genomics and equipped with the knowledge to interpret genetic testing results (Wong *et al.*, 2022).

1.5.5.1.Future Prospects in Genetic Testing for Dentistry

Genetic insights may, in the future, contribute to more individualised treatment planning and the development of biologically informed therapeutic approaches (Lundgren et al., 2024). Similarly, gene-editing technologies like CRISPR-Cas9 hold promise for correcting pathogenic mutations, potentially preventing or curing genetic dental disorders. Additionally, advancements in next-generation sequencing (NGS) technologies are expected to make genetic testing more accessible and cost-effective, broadening its applicability to routine dental care. Combined with artificial intelligence and big data analytics, genetic testing can provide predictive models for disease susceptibility, aiding in preventive care and early intervention (Bloch-Zupan *et al.*, 2023).

1.5.5.2.Challenges and Ethical Considerations

Despite its promise, the implementation of genetic testing in dental practice comes with challenges. Ethical considerations, including patient consent, confidentiality, and the psychological impact of genetic findings, must be addressed. Dentists must also navigate the complexities of explaining genetic results to patients in a way that is comprehensible and actionable. Collaborative guidelines and policies will be essential to ensure that genetic testing is used responsibly and effectively in dental settings (Martinez *et al.*, 2022).

1.6.Research Gap

After reviewing the literature, it is evident that qualitative research exploring parents' perspectives on genetic testing has been conducted within medical contexts, including paediatric oncology, rare diseases, and newborn screening programmes (Metcalfe *et al.*, 2011; Patenaude *et al.*, 2013). These studies have examined parental experiences and perceptions of genetic testing in relation to medical diagnosis, treatment pathways, and early life screening. However, this body of research is contextually distinct from dentistry, and to date, no qualitative studies have specifically explored parents' views or experiences of genetic testing for dental conditions, including AGI. This highlights a clear gap in the existing literature and underpins the rationale for the present study.

Moreover, a key distinction of this research is its reliance on semi-structured interviews instead of survey-based methods. While previous studies, such as those conducted by Ballard *et al.* (2019) and Martinez *et al.* (2022), have predominantly collected quantitative data on public perceptions of genetic testing, they often lack detailed personal narratives. Importantly, qualitative research provides families with an opportunity to share their experiences in their own words, giving voice to perspectives and challenges that structured survey tools may overlook.

A further primary contribution of this research is its exploration of the emotional and social dilemmas parents face when considering genetic testing for AGI. This study delves into concerns about the potential psychological impact of a genetic diagnosis on families, and whether genetic testing should be a routine part of dental care for hereditary conditions. While prior studies, such as those by McDowall et al. (2018), have focused on the technical accuracy and feasibility of genetic testing in dentistry, they often neglect the broader emotional implications. This study addresses this gap by exploring the lived experiences of parents, offering insights into the interplay between emotional well-being, social perceptions, and the decision-making process surrounding genetic testing in the context of AGI.

Additionally, this research examines the barriers to genetic testing adoption, a topic that has been largely underexplored in previous literature. While genetic testing is widely accepted, existing studies have primarily focused on families who have opted in. As a result, these studies are limited in capturing the perspectives of those who choose not to pursue testing. Understanding barriers to genetic testing is crucial for improving communication strategies in dental genetics and for addressing participants' thoughts, feelings, and experiences fully.

Therefore, this study includes both parents who accepted genetic testing and those who declined it.

In conclusion, this research provides rich, real-world insights that are currently missing in the literature. These findings are expected to contribute to understanding genetic testing adoption in dentistry and offer practical recommendations for patient education and counselling. Ultimately, this study contributes new knowledge on the practical, social, and emotional dimensions of genetic testing, making it a valuable resource for future policy development, clinical practice, and genetic counselling frameworks in dental healthcare.

1.7.Aims of this study

- To explore families' experiences of and views on AGI genetic testing
- To identify any concerns or barriers to genetic testing

Chapter 2 Materials and Methods

2.1.Introduction

To address the research aim, a qualitative research design was employed to explore parents' perspectives on genetic testing for Amelogenesis Imperfecta (AGI). Given the subjective and experience-based nature of this topic, a qualitative approach using semi-structured interviews was most appropriate in capturing the depth and complexity of parents' motivations, concerns, and lived experiences in relation to the NHS targeted 21-gene panel test for AGI. Reflexive thematic analysis (RTA) was applied to systematically identify patterns and themes within the data, providing insights into how parents navigate genetic testing in the context of a hereditary dental condition. The following sections outline the study's methodological approach in detail, including participant recruitment, data collection, ethical considerations, and the analytical process used to generate findings.

2.2.Study Design and Rationale

A qualitative approach was selected for this study to explore the perspectives and experiences of parents in relation to genetic testing for AGI. This methodology aligns with the study's aim of exploring parents' perceptions and experiences of genetic testing. Qualitative research enables an in-depth exploration of complex emotional and social dimensions that are not easily captured through quantitative methods (Denzin and Lincoln, 2018). By using semi-structured interviews, this study was able to generate rich, detailed accounts that reveal the nuanced ways in which parents view genetic testing and the factors that influence their lived experiences. This approach is particularly suited to the research question, which seeks to explore how parents perceive and interpret AGI genetic testing (Mason, 2018).

Semi-structured interviews were chosen specifically because they offer the flexibility to adapt to participants' responses in real time. This adaptability allows the researcher to follow up on relevant topics raised by participants, providing deeper insight into areas that might not emerge through a fixed-question format (Bryman, 2016). It ensures that the data remain closely connected to participants' lived experiences and what matters most to them.

RTA was employed as the method of analysis due to its suitability for identifying, analysing, and reporting patterns or themes within qualitative data (Braun and Clarke, 2006). Although

RTA allows for both inductive and deductive approaches, this study adopted an inductive framework to allow themes to emerge directly from the data. This method enabled a comprehensive exploration of how parents' views and experiences relate to the psychosocial aspects of AGI, while also allowing for the identification of both shared and divergent perspectives. This was essential in capturing the complexity and variability of hereditary dental conditions.

2.3.Philosophical and Epistemological Positioning

This research aligns with the interpretivist paradigm, emphasising that reality is subjective and constructed by participants' own lived experiences. Interpretivism is particularly suitable for this qualitative research as it values differences in the thoughts and attitudes of participants. Interpretivism also supports the thematic analysis approach used in this study, where data is understood as reflections of participants' subjective realities. By adopting this epistemological positioning, the research provided rich, contextualised insights into the social and emotional dimensions of parental attitudes towards AGI genetic testing.

2.4.Sampling Strategy

The target population for this study comprised parents of children diagnosed with AGI, including both those who had consented to and those who had declined genetic testing for their child. A purposive sampling strategy was employed to recruit information-rich participants whose experiences were directly relevant to the study's aims. Purposive sampling was appropriate as participants were deliberately selected based on predefined inclusion criteria, specifically parents whose children had been offered AGI genetic testing, ensuring that all participants had direct experience relevant to the research question. This approach was chosen to ensure that participants had first-hand experience of the diagnostic and care pathways associated with AGI, allowing for a more meaningful and in-depth exploration of their perspectives. Efforts were made to achieve maximum variation within the sample by including participants from diverse ethnic backgrounds, socioeconomic statuses, and differing experiences with genetic testing.

Participants were selected based on the following criteria:

Inclusion Criteria:

- Parents who consented to AGI genetic testing for their child.
- Parents who declined AGI genetic testing for their child.

2.5.Ethical Approval

Ethical approval for this study was obtained from the Research Ethics Committee (REC) in the UK under IRAS project ID 293839 (Appendix A). Appropriate approval from the Leeds Research and Innovation Department was also granted (R&I No: DT22/148476).

The study adhered strictly to professional and university standards, ensuring the highest level of credibility and ethical compliance. Given the sensitive nature of the discussions and the impact of COVID-19 restrictions, several protocols were implemented to safeguard participants' rights, confidentiality, and well-being. All interviews were conducted virtually via Zoom. This adjustment ensured participant safety while maintaining accessibility and convenience. In adherence to COVID-19 guidelines, the original proposal was amended to require participants to return signed consent forms by post if they agreed to take part in the study. All participant consents were taken verbally at the beginning of each interview and audio-recorded after their approval, following the University's protocol. Consent recordings were securely stored, separate from interview data recordings, ensuring participants' confidentiality.

To handle any emotional or sensitive situations during the interviews, participants were explicitly informed that they could pause, reschedule, or terminate the interview at any time without providing a reason. This flexibility ensured that participants felt respected and empowered.

The researcher was trained in qualitative interviewing techniques, particularly in framing open-ended questions to avoid leading participants or imposing personal opinions, while maintaining a neutral non-judgemental tone.

Participants' anonymity was ensured by removing all identifying information from the data. Participants were assigned unique numeric identifiers, and no personal details, such as their child's name, addresses, or specific clinic visits, were included in the transcripts or analysis.

2.6.Pilot Study

Following ethical approval, a pilot study was undertaken to assess the feasibility and clarity of the interview process prior to data collection. The pilot involved five individuals with experience relevant to qualitative research, but who were not eligible for inclusion in the

main study. These comprised two university-based researchers with prior experience in qualitative methodologies and three paediatric dentistry residents at the University of Leeds. The researchers were included to provide feedback on how the questions were structured and delivered, while the paediatric dentistry residents brought relevant clinical insight without being members of the study population. This combination allowed assessment of both methodological clarity and topic accessibility.

The pilot had several objectives. First, it tested the usability of Zoom as the interview platform and evaluated the clarity and reliability of audio recordings using an external recording device. Second, it assessed the topic guide to ensure that questions were open-ended, non-leading, and understandable to participants with varying levels of knowledge about genetic testing. Particular attention was paid to the tone, sequencing, and wording of questions to ensure they encouraged reflective discussion rather than short or directive responses.

Feedback was collected immediately after each pilot interview through informal verbal debriefing and reflective notes made by the researcher. Participants were asked specifically about question clarity, length of the interview, ease of understanding terminology, and whether any questions felt repetitive, leading, or unclear. This feedback informed several refinements to the interview guide. Minor wording adjustments were made to improve neutrality and reduce overly clinical phrasing. Some questions were reordered to improve the logical flow of discussion, beginning with broader, less technical questions before moving to more specific topics. In addition, prompts were incorporated to encourage participants to elaborate on their responses and to facilitate richer data generation.

No data from the pilot interviews were included in the final analysis. Instead, the pilot served to enhance the clarity, accessibility, and methodological rigour of the interview process prior to commencing the main study.

Examples of finalised interview questions included:

- “What were your initial thoughts when the genetic testing was offered to you?”
- “Can you describe any challenges you faced while deciding whether to pursue the test?”
- “How has your child’s dental condition impacted your family’s daily life?”

2.7.Patient and Public Involvement and Engagement (PPIE)

Patient and Public Involvement and Engagement (PPIE) was incorporated into this study to ensure the study design and data collection tools were relevant, sensitive, and acceptable to the target population. PPIE contributors were parents of children with enamel defects who had previously received dental care from the researcher. Although they did not wish to participate in the study interviews, they provided advisory input to inform study development. To maintain a clear distinction between involvement and participation and reduce potential bias, these contributors were excluded from the study sample.

Three mothers were involved after completion of the pilot study and prior to finalising the interview topic guides. Drawing on their lived experiences, they reviewed draft guides provided in printed form during routine dental appointments and returned feedback to the researcher via NHS email, allowing time for reflection while maintaining secure communication.

Feedback focused on improving clarity, tone, and relevance of interview questions. Contributors recommended simplifying clinical terminology, using more conversational language, avoiding potentially judgemental wording, and adding prompts to explore emotional and practical impacts on families. They also advised that Zoom interviews would be acceptable and convenient for parents managing childcare and work commitments, provided confidentiality was clearly explained.

This input resulted in refinements to question wording and ordering, and the inclusion of additional prompts to support richer discussion. Overall, PPIE involvement strengthened the face validity, accessibility, and participant-centred nature of the study materials.

The reporting of PPIE in this study was guided by the GRIPP2 (Guidance for Reporting Involvement of Patients and the Public) short form checklist to ensure transparent and comprehensive description of how public contributors were involved and how their input influenced the research design (Staniszewska *et al.*, 2017).

2.8.Recruitment

Participants for this study were identified through two main sources. Although some participants were approached during clinic attendance, eligibility was determined using predefined inclusion criteria to ensure that recruitment remained purposive rather than

convenience based. The first included reviewing clinical records of patients registered at the AGI clinic, which allowed the researcher to identify eligible families already receiving care for AGI. The second involved accessing appointment schedules to identify parents attending their child's consultation at the AGI clinic, ensuring that families currently engaged with dental services were also considered for participation. The AGI clinic is a specialist multidisciplinary service located within a tertiary dental care setting in the United Kingdom. The clinic focuses on the assessment and management of patients presenting with suspected hereditary enamel defects, particularly Amelogenesis Imperfecta. Patients are typically referred by general dental practitioners or other dental specialists when enamel abnormalities raise suspicion of a genetic aetiology. The clinic is led by consultants in paediatric dentistry with expertise in dental genetics, enabling a comprehensive evaluation of clinical features, family history, and eligibility for genetic testing through the NHS genomic testing pathway. During these consultations, families are provided with information about the nature of hereditary enamel defects, available treatment options, and the potential role of genetic testing in confirming diagnosis and informing long-term care planning.

Recruitment was carried out using multiple methods in order to maximise accessibility and promote inclusivity. One method involved sending postal invitations to the home addresses of parents who met the inclusion criteria. Each letter contained a Participant Information Sheet (PIS) outlining the purpose of the study, what participation would involve, and the rights of participants, along with the contact details of the researcher in case parents wished to ask questions or express interest in taking part.

In addition to postal recruitment, parents who were attending their child's appointment at the AGI clinic were approached in person. During these clinic visits, the researcher distributed invitation letters and the accompanying PIS directly to eligible parents. This face-to-face approach allowed the researcher to provide further clarification about the study and answer any immediate questions, helping to build rapport and encourage informed, voluntary participation.

To facilitate the recruitment process, R.B., a consultant paediatric dentist at the AGI clinic, played a key role. R.B. acted as a liaison between the researcher and potential participants, ensuring that all ethical considerations were adhered to, including protecting participant confidentiality. Participants were not previously under the care of the researcher, minimising the potential for pre-existing biases. However, participants were aware that the researcher was conducting this project as part of her academic requirements, which was explicitly stated in the Participant Information Sheet (PIS). The invitation letters and PIS had the email of the

researcher in case parents had any questions or required any further clarification. Participants were encouraged to contact the researcher directly via email if they were interested in participating. Participants were reminded that their involvement was entirely voluntary and that declining to participate would not affect their child's dental care in any way. Upon expressing interest, participants were offered flexible scheduling options for their interviews, conducted via Zoom. This accommodated their availability and minimised any inconvenience.

2.9.Informed Consent

Informed consent was obtained verbally and audio-recorded before each interview, in accordance with ethical protocols. The verbal consent process ensured transparency and minimised the potential power dynamic issues, particularly as the researcher is a dentist. To address this, R.A. emphasised her role as a researcher rather than a practicing dentist to create a neutral and approachable atmosphere. This clarification was key to reducing any perceived authority or influence that could pressure participants into joining the study. Participants were informed of their right to withdraw at any point without providing a reason, further reinforcing their autonomy in the process. Following the interviews, participants received brief follow-up emails to thank them for their contribution and to confirm any outstanding queries regarding the research process.

2.10. Data Collection

Semi-structured interviews were conducted using a topic guide designed to ensure consistency across discussions while remaining adaptable to individual participant contexts. Two distinct versions of the guide were created: one tailored for parents who accepted the genetic test (Topic Guide A) (Appendix D) and another for those who declined (Topic Guide B) (Appendix E). While the majority of questions remained the same to allow for collective thematic analysis, each version was adapted slightly to reflect the participant's decision regarding testing. Topic Guide A included prompts exploring motivations, expectations, and reflections on undergoing the test, whereas Topic Guide B focused on participants' reasons for declining, including their concerns and perceived barriers. Each guide was carefully crafted to encourage open dialogue and elicit detailed responses.

Development of the guides was grounded in a detailed examination of existing literature concerning parental views on genetic testing for inherited conditions. Key themes from the literature, such as barriers to testing, motivations, and psychosocial implications, informed the initial draft of the guide. Additionally, input was sought from Patient and Public Involvement and Engagement (PPIE) contributors to ensure the questions were relevant and sensitive to the participants' perspectives.

Interviews were conducted virtually via Zoom using video conferencing between November 2022 and April 2023, with each interview lasting approximately 45–60 minutes. The use of virtual interviews was influenced by the COVID-19 pandemic, which necessitated remote data collection to ensure participant safety. Zoom's user-friendly interface allowed participants to join the interviews using a simple link, eliminating the need for account registration. The virtual setting offered participants the comfort of joining from their own homes, reducing logistical barriers and increasing accessibility.

All interviews were conducted by the researcher, R.A., who had no prior relationship with the participants. R.A. disclosed her role as a researcher conducting this study as part of her academic requirements, emphasising her position as an independent, non-clinical interviewer. This was essential in minimising any perceived power dynamics, given the researcher's professional background as a dentist.

To build rapport, the researcher began each interview with informal conversation, such as asking about the participant's day or their familiarity with virtual meetings. Before asking any formal questions, the researcher reiterated the purpose of the study, addressed any concerns, and reassured participants about confidentiality and their right to withdraw at any point. At the end of the study 14 participants were interviewed.

In this study, thematic adequacy was a key consideration in determining the final sample size. Unlike methodologies such as Grounded Theory, which aim for theoretical saturation, this research adopts RTA, where meaning is not discovered in data but co-constructed through an interpretative process (Braun and Clarke, 2021). RTA does not seek "data saturation" in the traditional sense, as themes are not pre-existing elements to be uncovered but are actively generated by the researcher during analysis. Therefore, the notion of "no new data emerging" is less applicable. Instead, the adequacy of the sample was assessed in relation to the richness, relevance, and diversity of the data in addressing the research questions. Data

collection ceased after 14 interviews, at which point no new conceptual insights were developing, and the existing dataset was judged sufficient to support well-developed, meaningful, and nuanced themes. This decision was shaped by iterative reflection, discussions with the supervisory team, and the researcher's ongoing engagement with a reflexive journal. As Braun and Clarke (2021) argue, in RTA, the value lies not in numeric thresholds but in the analytic quality and depth achieved through interpretation.

Interviews were audio-recorded using an external audio recording device. The recordings were securely stored on a password-protected University's OneDrive account. This ensured the data remained confidential and accessible only to authorised personnel involved in the research.

All audio recordings were transcribed verbatim by a University-approved transcription service. Transcripts were reviewed by the researcher to verify accuracy against the audio recordings before coding and analysis. To maintain confidentiality, all personal identifiers were removed from the transcripts, and participants were anonymised using unique identifiers.

2.11. Data Analysis

RTA was employed to analyse the data in this study. This method was chosen because it provides a systematic yet flexible framework for identifying and interpreting patterns of meaning within qualitative data (Braun and Clarke, 2006, 2019). RTA aligns with the interpretivist paradigm adopted in this research. Unlike framework analysis, RTA does not restrict the researcher to predefined coding structures. This flexibility was essential for this study, as it ensured that the themes were data-driven and reflective of the participants' lived experiences. (Braun *et al.*, 2022).

The analysis process followed Braun and Clarke's six-phase approach, tailored to the reflexive nature of RTA, which involves familiarisation with the data, generating initial codes, constructing themes, reviewing and refining themes, defining and naming themes, and finally producing the report (Braun and Clarke, 2006).

Step 1: Familiarisation with the Data

The first step involved the researcher reviewing the data in depth, starting with listening to the audio recordings of the interviews and thoroughly reading the verbatim transcripts.

Detailed notes were taken during this process to capture initial impressions, recurring ideas, and significant observations. This step was critical in developing a deep understanding of the dataset.

Step 2: Generating Initial Codes

Using an inductive approach, the researcher systematically coded the transcripts. Inductive coding involved identifying data-driven codes directly from the transcripts without preconceived categories. NVivo software (version 12) was utilised to organise and manage the coding process. Each transcript was reviewed line by line, and meaningful data segments were highlighted and labelled with descriptive codes. Examples of initial codes included "concerns about comments on child's teeth," "importance of early diagnosis," and "family history awareness."

Step 3: Developing Preliminary Themes

After completing the initial coding, related codes were grouped to identify broader patterns for theme development. For instance, codes such as "concerns about comments on child's teeth," and "AGI diagnosis resolved parental guilt towards child's teeth" were grouped under a broader pattern reflecting "Parents want an "explanation" for tooth appearance " This process required constant comparison of codes to ensure they accurately represented participants' perspectives.

Step 4: Reviewing Themes

Themes were continuously reviewed and discussed with research supervisors to ensure they were meaningful and represented the data. This step involved refining the themes by splitting overly broad categories and merging overlapping ones. For example, the initial themes of "Managing comments on child's teeth", and "Finding the cause for tooth appearance" were merged into the broader theme of "Wanting an explanation for tooth appearance"

The refined themes were validated by revisiting the raw data to confirm alignment with the transcripts. Any discrepancies were resolved by revising the themes and discussing it with the research supervisors.

Step 5: Defining and Naming Themes

Themes were clearly defined and described using a thematic table in a Word document, which included:

- A concise definition of each theme.
- Supporting quotes to provide evidence for the theme.
- A description of how the theme aligned with the study's research aims.

For example:

- **Theme:** Wanting an explanation for tooth appearance
- **Description:** Captures parents' concerns about the social and emotional consequences of not having a diagnosis and how genetic testing can provide an explanation for why their child's teeth are in poor condition.
- **Supporting Quote:** "*I suppose then it makes it easier to explain the condition of his teeth. So, if his teeth look so bad that people thought perhaps you had poor dental hygiene, then I suppose it is a way of socially of explaining it away.*"

The thematic table was reviewed by the research supervisors to ensure the themes were relevant to the research objectives and not influenced by the researcher's subjective interpretation.

Step 6: Producing the Report

The final step involved synthesising the themes into a coherent narrative for the report. The thematic analysis provided the framework for presenting the findings, with each theme illustrated by supporting quotes to give voice to the participants. This ensured that the analysis was both rigorous and reflective of the participants' lived experiences.

By following these steps, the thematic analysis maintained a structured, transparent, and data-driven approach, ensuring reliability in the findings.

2.12. Reflexivity

2.12.1. Researcher Background and Positionality

The researcher, R.A., who conducted the interviews, has a professional background in paediatric dentistry. This provided valuable contextual knowledge of AGI and its clinical implications but also required careful consideration of positionality and potential bias. The researcher's familiarity with AGI, together with a professional belief in the potential value of genetic testing for hereditary conditions, may have shaped both data collection and interpretation. In addition, participants may have perceived the researcher through her dual identity as both a dentist and a researcher, which could have influenced how openly they shared their experiences. To minimise this effect, the researcher emphasised her role as a researcher undertaking the study for academic purposes and maintained a neutral, non-judgemental stance during interviews to encourage candid discussion.

Reflexivity was therefore embedded throughout the study as an ongoing methodological practice. The researcher acknowledged that complete neutrality in qualitative research is not possible; instead, the aim was to make researcher influence transparent and subject it to

critical reflection. Following each interview, a reflective journal was maintained to document personal reactions, assumptions, and emerging interpretations. Regular debriefing meetings with academic supervisors were also undertaken to discuss developing codes and themes, challenge potential bias, and ensure that analysis remained closely grounded in participants' accounts. During coding, the researcher identified an initial tendency to privilege narratives consistent with established clinical understandings of AGI; this was addressed through repeated revisiting of transcripts to ensure that theme development reflected participant meaning rather than clinical assumptions. Consistent with Reflexive Thematic Analysis, themes were understood as interpretative constructions developed through the researcher's active engagement with the data rather than as objective entities discovered within it. Reflexivity was thus integrated across data generation, coding, interpretation, and presentation of the findings.

2.12.2. Researcher Training and Experience

Prior to data collection, the researcher underwent university-led training in qualitative research methods. This training included principles of qualitative methodology, semi-structured interviewing techniques, reflexive research practice, and the application of Reflexive Thematic Analysis. The training emphasised the importance of open-ended questioning, active listening, and avoiding leading or directive prompts during interviews. The researcher also gained practical preparation through the pilot study conducted prior to the main data collection phase. This process allowed refinement of interview questions, development of interviewing skills, and familiarisation with the virtual interview platform. Feedback from pilot participants and supervisors informed adjustments to the wording and sequencing of questions to ensure clarity, neutrality, and accessibility for participants with varying levels of familiarity with genetic testing.

In addition to formal training, the researcher's clinical background in paediatric dentistry contributed to an understanding of the clinical context of AGI and the care pathways experienced by families. However, awareness of this professional background was maintained throughout the study to ensure that clinical knowledge did not lead the direction of interviews or interpretation of data. Interviewing therefore prioritised participants' own perspectives and experiences rather than clinical assumptions.

Ongoing supervisory support was provided throughout the research process to ensure methodological rigour. Supervisors reviewed aspects of the interview approach, coding

process, and theme development, providing guidance and critical feedback during regular research meetings.

2.12.3. Rigour

Rigour in this study was approached through methodological transparency and coherence between the study design, epistemological position, and analytic approach. Consistent with Reflexive Thematic Analysis, rigour was understood as the outcome of systematic and thoughtful engagement with the data, alongside clear documentation of the interpretative decisions made throughout the research process.

Reflexive practices described earlier contributed to the overall rigour of the study by supporting critical awareness of how the researcher's positionality and assumptions may shape data interpretation. In addition, ongoing supervisory discussions provided opportunities to reflect on coding, theme development, and interpretative choices, helping to ensure that analytical insights remained closely grounded in participants' accounts while maintaining analytical depth.

Analytic transparency was further strengthened through clear documentation of the stages of coding and theme development, creating an audit trail that demonstrated how themes were developed from the data. Transferability was supported by providing detailed contextual descriptions of participants, the research setting, and the clinical context of AGI genetic testing. Although statistical generalisability was not the aim of this qualitative study, these strategies contribute to the credibility, transparency, and interpretative integrity of the findings.

Chapter 3 Results

3.1.Participant Recruitment and Characteristics

This chapter presents the findings of the qualitative analysis of parents' views and experiences of genetic testing for Amelogenesis Imperfecta (AGI). The findings are organised around the four themes developed through Reflexive Thematic Analysis (RTA). To contextualise the analysis, this section first outlines the recruitment process and characteristics of the study sample. The chapter then presents the main themes and subthemes identified from the interview data, supported by illustrative quotations.

A total of 57 parents were approached to participate in the study. Of these, 38 were contacted through postal invitation letters and 19 were approached directly in the AGI clinic. Postal invitations resulted in five responses, of whom one parent subsequently withdrew prior to participation. In contrast, clinic-based recruitment resulted in ten parents expressing interest and contacting the researcher to confirm their willingness to participate. Overall, 14 parents were enrolled in the study and completed interviews. The primary reason for non-participation was lack of response following invitation, particularly among parents contacted through postal invitations.

A summary of the recruitment process and response outcomes is presented in **Table 3**.

Table 3: Recruitment Process and Outcomes

Recruitment stage	***Email approach***	***Clinic approach***	***Total***
Parents approached	38	19	57
Parents who responded / expressed interest	5	10	15
Withdrawn before participation	1	0	1
Enrolled participants	4	10	14
Completed interviews	4	10	14
Did not respond / declined	33	9	42

Participants were recruited through purposive sampling to capture a range of experiences and decisions regarding AGI genetic testing, including the perspectives of parents who both consented to and declined testing for their child. The demographic characteristics of participants are summarised in **Table 4**.

Table 4: Participants' Demographic Characteristics

Participant ID	*Relation to child*	*Ethnicity as Identified by Participant*	*Occupation*	*Decision on genetic testing*	*Family History with Enamel defects*	*Length of interview*
P1	Mother	White British	Housewife	Declined	Yes (Brother)	22:57
P2	Mother	Mixed African British	Accountant	Opted-in	Yes (Father)	20:44
P3	Mother	White British	Housewife	Opted-in	Yes (Father and Brother)	19:07
P4	Mother	White British	Housewife	Opted-in	Yes	46:28
P5	Mother	White British	Stay at home Mum	Opted-in	None	28:26
P6	Father	White British	Data analyst	Declined	None	16:32
P7	Mother	White British	Hairdresser	Opted-in	Yes (Mother)	40:16
P8	Mother	White British	Housewife	Opted-in	None	16:29
P9	Mother	English British	Sales Assistant	Declined	None	15:40
P10	Mother	Mixed	Nursery Assistant	Opted-in	None	24:17
P11	Mother	White British	Housewife	Opted-in	Yes (sister)	38:25
P12	Mother	White British	Nurse	Opted-in	None	32:49
P13	Mother	Pakistani	Teacher	Opted-in	Yes (Two Brothers)	33:57
P14	Mother	White British	Housewife	Opted-in	None	24:13

The themes and subthemes identified through analysis are outlined in **Table 5**.

Table 5: Summary of Themes and Subthemes

Main Themes	*Subthemes*
1. Wanting an "explanation" for tooth appearance	1a. Blame self over tooth appearance
	1b. Managing negative comments made by others

2. Not feeling "listened to" or taken seriously by their dentist	2a. Feeling "brushed off" by dentist
	2b. Feeling blamed by dentist for child's perceived poor oral health
	2c. Wanting AGI diagnosis to manage care
3. Increasing awareness of AGI through diagnosis	3a. Sharing AGI diagnosis with family has helped increase awareness of the condition
	3b. Genetic testing research can help future generations
	3c. Concerns for future children
4. AGI not viewed as a "serious condition"	4a. Testing causes unnecessary pain and discomfort of child
	4b. Additional time taken off to attend appointments is burdensome
	4c. AGI perceived as having no serious medical impact
	4d. Not wanting to share AGI diagnosis with others

The following section presents each theme in detail, beginning with Theme 1.

Theme 1: Wanting an "explanation" for tooth appearance.

A recurring finding across the interviews was parents' need for a clear explanation for their child's dental condition. Many participants described feelings of guilt, frustration, and uncertainty when trying to understand why their child's teeth appeared different. Parents frequently reflected on their own behaviours and questioned whether aspects of parenting, such as oral hygiene practices or diet, may have contributed to their child's tooth appearance. Several participants expressed that having a diagnosis would alleviate self-blame and provide reassurance. Similarly, other parents emphasised that obtaining a formal diagnosis would help them explain their child's condition to others and counter assumptions that poor oral hygiene or parenting were to blame. From an analytic perspective, these accounts suggest that emotional experiences, particularly guilt and self-blame, may have influenced parents' motivations for pursuing AGI genetic testing. Beyond diagnosis, genetic testing appeared to offer emotional reassurance by helping parents understand the condition as genetic rather than self-caused. The first subtheme "blaming self over tooth appearance" delves into

parents' deep emotions of guilt over their child's tooth appearance as they reflected on their own parenting. Parents sought a confirmed diagnosis through a genetic testing would help alleviate these feelings by providing them an explanation to their child's teeth appearance. Furthermore, the second subtheme "managing negative comments made by others" delves into how parents actively sought AGI diagnosis and genetic information to better prepare themselves for navigating social interactions. By equipping themselves with this knowledge, they aimed to confidently address and respond to comments, inquiries, or misconceptions from others. Parents expressed that this knowledge allowed them to manage conversations more effectively, ensuring that they could provide accurate information, correct misunderstandings, and maintain a sense of control over potentially challenging or sensitive conversations. The information gained from genetic testing was viewed to help both parents and children feel more confident in social interactions.

1a. Blaming self over tooth appearance

Many parents described feeling responsible for their child's condition, as they were unaware that it was due to an enamel defect. They shared moments of distress and helplessness as they sought explanations and solutions to address their child's dental challenges. This emotional burden was compounded by misconceptions about the cause of AGI, with some parents questioning whether it was linked to their parenting, as one parent explained,

> *"So, I've noticed that his teeth were looking discoloured, and you think, are we not brushing his teeth enough? Because I know—because he was breastfed for, exclusively breastfed for quite a long time, and you think, oh, is there something about him having breast milk that's made him, you know, affected his teeth or the enamel on his teeth? All those kind of guilt feelings that you get I think as a mother."* (P5, Opted-in)

Another discussed how she wanted a diagnosis to prevent misunderstandings and stop others from thinking they or their child were to blame, stating,

> *"Yeah, I think so, yeah, knowing definitely what it is, you can say, you know, this is why she's got brown spots on her teeth. It is not because she eats too many sweets or because she doesn't brush her teeth or, you know, I think it will help to have a name and a label and yeah. And, you know, it is not her fault. This is the way it is."* (P10, Opted-in)

Similarly, another parent highlighted the importance of ensuring that parents do not blame themselves for their child's condition, explaining:

> *"I think it is really important that all parents need to know that actually your child doesn't have a really bad case because you've done X, Y, Z."* (P3, Opted-in)

Interestingly this feeling of blame was not limited to the parents themselves. Many interviews revealed that children affected by AGI also developed a sense of self-blame. They internalised the belief that their dental appearance was somehow their fault despite making efforts to look after their teeth.

As one parent mentioned,

> *"He kept saying 'maybe it is because I did not brush them properly'. But he does, he always brushes twice a day… He really thinks it is his fault, and that breaks my heart." (P6, Opted-in)*

Parents mentioned that this tendency to blame themselves had an impact on their confidence, how they interacted with others as well as how they saw themselves compared to their peers. Parents perceived AGI diagnosis through genetic testing helped alleviate this burden of guilt both for themselves and their children. They also believe that genetic testing could offer insights and validation by providing a diagnosis. This diagnosis would not only shed light on the origins of their child's condition but also dispel any misconceptions they may have had. Parents hoped that understanding the basis of AGI would help reassure their children that it was not their fault and empower them to embrace their uniqueness.

One parent expressed the importance of genetic testing in alleviating this burden:

> *"Yeah, I think so, yeah, knowing definitely what it is, you can say, you know, this is why she's got brown spots on her teeth. It is not because she eats too many sweets or because she doesn't brush her teeth or, you know, I think it will help to have a name and a label and yeah. And, you know, it is not her fault. This is the way it is."* (P10, Opted-in)

1b. Managing negative comments made by others

Diagnosis was seen as a tool that helped in managing the comments and questions parents received from others, particularly the child's peers. Parents expressed that the idea of having a diagnosis gave both the child with AGI and their parents a sense of certainty. They discussed how it empowered them and their children with the knowledge to confidently explain AGI.

As one parent described it,

> *"So, I suppose again it would give her that confidence to be able to say, well, actually it is this and I have it because of that."* (P2, Opted-in)

Parents also mentioned instances when people, including friends and family would make comments about their child's teeth often misinterpreting it as a sign of poor oral hygiene. These comments left parents feeling helpless as they tried to dispel the misconception that their child's condition was not due to negligence. Parents stressed the importance of having a diagnosis to help explain their child's appearance, particularly in social settings where misunderstandings might arise.

As another participant stated,

> *"I think anything that stands out is not sometimes unfortunate and other children or family kind of pick on things, do not they, and kind of draw attention to things. And I think in a way having the diagnosis, it is like anything has been able to explain it."* (P7, Opted-in)

Children with AGI sometimes faced teasing or intrusive questions about their discoloured teeth, which caused them distress. Parents shared instances where their children became upset and angry due to comments. This, in turn, had a profound emotional impact on the parents, who not only had to witness their child's hurt but also manage the emotional fallout, often feeling helpless, protective, and frustrated.

One parent shared how these interactions affected their child emotionally and said,
"I see him getting emotional with the way his teeth look, and he gets angry, he gets upset, and people do comment, mostly little children now, in older children because they're in a specialist school that do not really talk about appearance and things, but like my friend's children who are non-autistic, they...they talk about it, they go, oh, what's wrong with my child's teeth? And he gets really emotional." (P4, Opted-in)

In response, parents often found themselves in the role of educator and advocate, trying to defend and explain their child's condition to others in order to reduce stigma and protect their child's self-esteem. As another participant explained:

> *"So, it means the same with the teeth, why is his teeth yellow? Well, he's got a condition called amelogenesis, and this, this, and this, and then I can explain to him why it is and that it is not his fault. It is not that doesn't brush his teeth because he*

does, his condition into his teeth, and then that might help him and others, do you know what I mean, to be not as probably as mean kind of thing because it is quite a lot of people out there who are mean." (P10, Opted-in)

In this theme, parents expressed how visible differences caused by AGI can affect how children are treated by others. When something about a child's appearance stands out, it may lead to teasing or unwanted attention from other children. This can affect the child's confidence and how they feel about themselves. Parents shared feeling upset when they see their child going through this emotional distress. In this context, a genetic diagnosis is perceived not only as a medical explanation, but also as a means of reducing blame and enabling both parents and children to better navigate these challenging social situations. It appeared that, having an explanation for their child's tooth appearance was perceived as a key motivator for seeking an AGI diagnosis through genetic testing.

It is important to note that accounts within this theme were predominantly reported by parents who had opted in to genetic testing. Parents who declined testing did not strongly emphasise these experiences, which may reflect differences in how AGI was perceived within families. It is possible that parents who chose testing were caring for children with more severe or visibly impactful forms of AGI, which may have increased feelings of guilt, the desire for explanation, and motivation to seek diagnostic confirmation. In contrast, parents who perceived their child's condition as less severe appeared less inclined to pursue testing and therefore less likely to describe these motivations.

Theme 2: Not feeling "listened to" or taken seriously by their dentist

This theme explores how parents' interactions with their family dentists, who were perceived to have limited understanding of AGI, influenced their decision to pursue genetic testing, as they hoped it would provide reassurance and clarity. Parents often felt unheard and dismissed when they attempted to communicate their child's dental needs.

According to one parent,

"I think it is really important that dentists pick up that the children have maybe a genetic problem to help the parents, help the children get through the situation by ignoring it and by blaming somebody is not going through and helping anybody." (P3, Opted-in)

The first subtheme, "feeling "brushed off" by dentist", portrays how parents felt dismissed by their family dentists, who provided unclear or minimally informative responses to their concerns. This dismissal left parents feeling unheard and uncertain, heightening their anxiety about their child's condition. Parents in this group viewed the AGI genetic testing as a tool that might provide them with clarity and answers.

Furthermore, the second subtheme, "feeling blamed by dentist for child's perceived poor oral health" delves into parents' deep emotions of guilt and helplessness. Some parents reported that dentists attributed their child's dental issues to poor oral hygiene. Despite their efforts to maintain good oral health, parents felt blamed for their child's enamel defects, further complicating their trust in the medical advice they received.

Later, the third subtheme "wanting AGI diagnosis to manage care" illustrates parents' experiences at not being able to discuss or receive the necessary care for their child's condition due to their dentists' inability to identify AGI. Some parents believe on the necessity of AGI diagnosis for securing referrals to multi-disciplinary care, including orthodontics, which is crucial for managing the complex dental needs associated with AGI.

After a brief introduction to the second theme, a more detailed explanation of each subtheme is provided below:

2a. Feeling "brushed off" by dentist

Data highlighted experiences where parents received responses from their family dentists which were perceived as unclear or minimally informative. Parents felt dismissed for not having their concerns on their children's dental health validated. This perceived dismissal left parents feeling unheard and uncertain about their child's condition, leading to heightened anxiety and distress.

The analysis suggests that parents' experiences of feeling "brushed off" by family dentists had a profound emotional impact on parents. They expressed a range of emotions, including distress, confusion, and a deep sense of helplessness. Many parents noted that their family dentists would only offer fluoride regimes and prevention care which caused parents to feel that their concerns were not being taken seriously as they believed their child requires a conventional treatment plan to restore their oral health.

One parent described her experience of feeling disregarded by her dentist:

> *"Sort of felt by the dentist that I was a bit sort of brushed off by a normal dentist like, because… yeah, that is sort of how I felt. Whether that was the case or not, I do not*

know, but that is how I perceived it to be that because it was not super obvious, that it was just me being very aware of it." (P13, Opted-in)

One mother stated that she was certain that her child's teeth were not related to dental caries but instead an enamel defect as she was diagnosed with AGI herself. Her concern was if she lacked the experience and knowledge, her child may not have been referred to specialised care for diagnosis and dental care.

As she mentioned,

"In my mind, I am not a dentist, I am a mum who is been through this process myself. I think, well, I would be hopeful depending on what the outcome is that my own personal dentist would actually take me a bit more or make me feel like I was being listened to more." (P7, Opted-in)

Amid these challenges, parents expressed a strong desire for clear and transparent communication from their dentists. Parents stressed the need for training family dentists on how to pick on dental defects as that would empower them with the knowledge and experience to make informed decisions about their child's dental care. As one parent explained,

"I just think with the new generation of dentists that are coming through, it is really important they understand what Amelogenesis is. When my daughter and son were babies, being told I was not looking after their teeth properly really affected me. It would help if more dentists could spot the signs earlier so parents do not have to go through that." (P3, Opted-in)

2b. Feeling blamed by dentist for child's perceived poor oral health

Some parents reported instances where they felt a sense of guilt and blame when dentists referred to their child's dental condition as a result of poor oral hygiene. This perceived blame overwhelmed parents, as they felt they were not doing enough to prevent their child's teeth discolouration and enamel chipping. Parents reported that despite their best efforts to ensure proper teeth brushing habits, their child's dental condition did not improve which resulted in them feeling helpless.

As one parent expressed,

"I did think that, but actually I think just coming to the clinic and it being explained to him was enough for him to understand that it is, you know, it is not because he has not been cleaning his teeth." (P8, Opted-in)

Another parent highlighted their frustration with not being believed by their dentist, stating,

> *"It is just having a dentist not believe you, that you are taking your children's best interest to heart, that you are doing all that you can to protect their teeth even though they have this kind of malfunction."* (P3, Opted-in)

This could be interpreted as parents feeling a sense of responsibility for their child's tooth appearance and experiencing frustration at being unable to protect them, despite their best efforts to clean their child's teeth. It may also reflect a perception that their parenting was being scrutinised by the dentist, as highlighted in their later statement,

> "*I just think with the new generation of dentists that are coming through, I think it is so important that they understand what Amelogenesis is because the way that I was—when my daughter and my son were babies and being told that I was a bad mom and not treating their teeth properly is really damaging to my self-esteem."* (P3, Opted-in)

Some families described feeling more at ease after receiving reassurance from their family dentist, which made their visit to the AGI clinic less stressful. These parents felt that, for the time being, genetic testing was not necessary, as they already understood the condition to be genetic in nature and preferred to concentrate on securing the appropriate dental treatment for their child.

As one parent explained,

> *"I think the first thing you do as a parent is what have I done, why has this happened? And now how can we deal with? What should be done? But yeah, our dentist was really reassuring, really, really reassuring."* (P6, Declined)

Another parent appreciated their dentist's willingness to refer them to specialists, stating,

> *"I think our dentist was really good. She's happy to refer you and say, yes, this is something I cannot do. It needs more, you know, more specialist treatment. So, she's always been happy to do that. She's probably let the hospital then explain it to me rather than her explain it to me if that makes sense which is fair enough."* (P10, Opted-in)

2c. Wanting AGI diagnosis to manage care

Parents hoped to be presented with a range of treatment options for their child's dental condition and actively be involved in the delivery of care. Parents perceived that some family dentists lacked the ability to recognise or suggest AGI as a possible diagnosis, which they felt made it more difficult to access treatment plans that fully addressed their concerns and their

child's needs. This has left parents feeling concerned about their child's dental health. When armed with accurate information and a diagnosis, parents believed they could have more meaningful discussions with their family dentists. Hence, parents wanting an AGI diagnosis, was not only to address their child's dental condition but also to validate their own concerns and avoid potential misdiagnoses. The research findings revealed that parents viewed an AGI diagnosis as a way to avoid misconceptions about their child's dental health which will contribute to more effective delivery of care.

As one parent explained,

> *"Yeah, so I think the more knowledge that you can have as a parent to be able to be armed with when you go back into the dentist as well and say actually look, we need to do this and thinking about orthodontic work and how that affects teeth and… yeah."* (P7, Opted-in)

Similarly, another parent described how an AGI diagnosis would allow for a more structured approach to treatment, stating,

> *"If it is Amelogenesis Imperfecta, then at least I know it is that and then we can deal with it, as a, as a team, like, with the dentist and stuff."* (P4, Opted-in)

Some parents viewed an AGI diagnosis as important for their child's eligibility for multi-disciplinary dental care. They believed that having a confirmed diagnosis would help explain the complexity of their child's dental needs and ensure access to appropriate treatment. Parents were aware that the NHS only covered orthodontic treatment for children with severe malocclusions or those linked to specific medical conditions. Without a confirmed diagnosis, their child's condition might be considered mild and therefore not meet the criteria for NHS funded orthodontic treatment. Some parents who could not afford private orthodontic care felt that an AGI diagnosis might improve their child's chances of receiving NHS support. As a result, they saw the diagnosis as a potential means of securing a referral for necessary orthodontic treatment.

One parent highlighted the importance of having a diagnosis for her daughter's referral, stating:

> "*My daughter was not only bothered by the colour of her teeth but also how crowded they are. I was hoping that we could be referred to an orthodontist by the NHS because we cannot afford it otherwise"* (P7, Opted-in)

Similarly, this theme was largely shaped by accounts from parents who had opted in to genetic testing. One possible explanation is that families experiencing greater clinical or psychosocial impact from AGI may have been more motivated to seek further diagnostic

clarification and validation through testing. Parents who declined testing, and who often described AGI as less serious, appeared less likely to report these experiences.

Theme 3: Increasing awareness of AGI through diagnosis

Parents described the AGI genetic testing as a potential source of clarity, helping them better understand their child's condition and feel more confident in navigating future care. While not all parents sought a formal diagnosis, many expressed the importance of accessing reliable information that could support long-term treatment planning and inform key decisions as their child grows. For those who opted in, the test was seen as a way to validate concerns, clarify the nature of the condition, and help guide referrals or specialist support. Others, including those who declined testing, still valued the idea of gaining knowledge that could empower them in conversations with healthcare professionals and contribute to their role in managing their child's dental health. Across both groups, parents saw understanding the genetic basis of AGI as a way to reduce uncertainty, enhance communication with their child, and plan for the future with greater confidence.

As one parent stated,

> *"What I want to know more in greater detail is what happens now, what happens in the treatment, what happens to his future, you know, that's more important to me, his treatment plan and how he can be helped."* (P3, Opted-in)

The first subtheme, "sharing AGI diagnosis with family has helped increase awareness of the condition", explores how parents valued an AGI diagnosis through genetic testing and how they perceived such information as beneficial. For instance, parents emphasised that understanding AGI's implications was crucial for raising awareness within the family and ensuring that other members could also benefit from early diagnosis and treatment.

The second subtheme, "genetic testing research can help future generations", revealed an optimistic tone among parents, who believed that participating in AGI genetic testing would contribute to research, which in turn could benefit future generations by improving diagnostic and treatment approaches.

Finally, the third subtheme, "confirming AGI inheritance pattern was not viewed as a barrier to having children", represents parents' perspectives on confirming AGI's inheritance pattern, which was not considered a deterrent to having more children. Parents believed that knowing the genetic aspects of AGI could provide peace of mind and better prepare them for managing the condition in future offspring. All parents interviewed understood that genetic

testing results might come back inconclusive, which does not necessarily mean their child does not have AGI.

Parents acknowledged that, regardless of their child's individual results, genetic testing would still provide a benefit either by helping their child directly or by contributing to research. As explained earlier, most parents were happy to opt in for the test, as they believed it would add value to ongoing research and assist in identifying other genes related to the clinical diagnosis of AGI.

The three subthemes related to this main theme will be discussed in more details below:

3a. Sharing AGI diagnosis with family has helped increase awareness of the condition

Parents commonly stated that an AGI diagnosis provided them with an opportunity to understand their child's dental condition. This, in turn, played a crucial role in eliminating any concerns and misconceptions they may have had regarding their child's dental health. The introduction of AGI as a diagnosis enabled parents to develop a comprehensive understanding of the underlying factors contributing to their child's poor oral health.

As one parent explained,

> *"Well now we know what it is, this is how we can deal with it, and this is how we can make it better. So, I would hope it would help in that sense that we know what the issue is. It is got a name. And you can have treatment."* (P3, Opted-in)

Another parent shared similar sentiments, highlighting the reassurance that came with having a diagnosis, stating,

> *"I think it is knowing that your children are going to be okay at the end of the day and not having to lose all the teeth."* (P14 Opted-in)

Parents acknowledged that exploring the dental implications and inherited nature of AGI can be overwhelming, as it is entirely new to them and may present potential challenges for their child's dental health and future generations. Despite the tension such knowledge may carry, such as the emotional burden of knowing AGI is hereditary and could be passed on to future children, some parents still chose to be informed. They viewed this knowledge as a means of being forearmed and empowered as their child's caregiver. For these parents, knowledge was a form of empowerment and a shield against uncertainty; for them, the benefits of having a diagnosis outweighed the potential challenges it might bring.

One parent reflected on this perspective, stating,

> *"I think if your fore warned your fore armed as long as you got an understanding of something, I can get my people quite happy to sort of bury their head in the sand and perhaps not address this information. But for me personally, I'd rather just know, again, a thorough understanding of this as best as possible and what the potential implications of it are might you say, you know the side issues and so on."* (P6, Declined)

Another parent expressed gratitude for the opportunity to participate in genetic testing, explaining,

> *"Because we wanted to find out more. And so, we were really pleased that you guys were kind of taking it seriously and interested in finding out more, so for us that it was really beneficial and something that we wanted to do."* (P2, Opted-in)

Even parents who declined genetic testing, viewed AGI genetic testing as a powerful tool and an interesting advancement in dentistry.

As one parent expressed,

> *"It was interesting to know that this is something that can be followed up through dentistry, you know, before going into the hospital and finding out about this. I didn't imagine this is something that you'd…yeah, you would discover by going to your dentist, really. So, it was certainly interesting to know that that's something the field is looking into, but yeah."* (P1, Declined)

Similarly, another parent reflected on the benefits of genetic testing, highlighting how having access to this knowledge can be empowering and prepare individuals for future decisions:

> *"But I think to have the knowledge provided by gene testing, that you're for, forearmed really."* (P7, Opted-in)

Other perspectives shared by parents during the interviews shed light on the profound impact that knowledge about AGI can have in raising awareness. They emphasised that raising awareness about this condition can have an impact and help create support networks for families affected by it.

As one parent commented,

> *"I think giving more support to families is really key, there is so much going on and there is so many, particularly for younger people growing up now, there is so many expectations to be perfect, you look perfect, have everything perfect. But to navigate*

> *that as a parent and sort of guide your child through that, particularly when you see them sort of trying and them feeling like they are failing because they are not matching up to other people, I think that is really empowering."* (P7, Opted-in)

Parents recognised that having and being able to share knowledge about AGI in such groups could empower them as parents. It would equip them with the tools to help support their child in a world where everyone is expected to have a perfect smile and facial looks often takes precedence. Parents were hoping that this awareness about AGI could lead to the formation of support groups where families and children dealing with AGI could find comfort, share experiences, and build a sense of community.

One parent also highlighted the potential role of support groups in fostering a sense of community among families affected by AGI, stating,

> *"Yeah, yeah, definitely support groups. Depending on how bad it is, if it is mild, then some people might not go for a support group, they might just deal with it. If it is really major or anything like that and it affects."* (P4, Opted-in)

3b. Genetic testing research can help future generations

Parents commonly expressed a sense of optimism, rooted in their perception that genetic testing holds promise for meaningful progress in medical research. This perception was shaped by their belief that such advancements could benefit not only their own children but also contribute positively to the lives of future generations. Many parents viewed their participation in AGI genetic testing as a proactive step towards progress, expressing hope that their contribution could lead to improved diagnostics, better treatment options, and a greater understanding of AGI over time. This sense of hope was further reinforced by their trust in scientific advancements and the possibility of expanding research to identify additional genes associated with AGI, which could ultimately lead to more targeted and effective care.

One predominant sentiment that emerged was parents' belief in the impact of generic testing and research not only on their own children but also on the coming generations.

As one parent explained,

> *"If ever your child had children, at least then he'd know that he bears a genetic gene, because along the lines, I may...I might, do you know what I mean, pass away and him not know anything about his teeth and at least then he knows if there's anything that can be done, do you know what I mean, later down the line."* (P4, Opted-in)

Similarly, another parent highlighted the long-term benefits of genetic research, stating,

> *"Then I've got it could be something that could then go under the radar and then when I'm not on this earth anymore several generations later, there might be something there that actually if they have had the knowledge from them when they are producing their own children to pass down."* (P7, Opted-in)

Moreover, parents hoped that in the future, AGI genetic testing could provide insights into the severity of AGI in affected individuals. They also hoped that the information gathered from genetic testing could help tailor treatments to meet the unique needs of each child, ultimately improving their dental experience.

One parent emphasised this point, explaining,

> *"It might help with a treatment plan because he might understand how severe he had it, and then you might be able to tell him how severe his children might get it, and that might be something for my son to think about in the future as well as my daughter, you know, that it is something for them and their future and the next generation."* (P3, Opted-in)

A particularly striking aspect of these findings was parents' motivation to opt in for AGI genetic testing, despite the possibility of inconclusive results. Parents viewed their participation as a way to contribute to a broader understanding of AGI by adding value to scientific research. Rather than perceiving genetic testing solely as a means of obtaining definitive answers, these parents regarded it as an opportunity to explore the origins of AGI in their child and to develop a deeper understanding of the condition.

As one parent expressed,

> *"It would be nice to get a reason why it is happened. But I'm not, you know, I wouldn't be devastated if it was inconclusive or anything like that. But it would be nice to get an explanation as to why it is happened. Like I said, I have not got it and my husband hasn't got it and we've never seen it before. So, it would just be interesting really to know where it is come from. But it wouldn't be devastating if, you know, if nothing was concluded."* (P10, Opted-in)

Another parent echoed the value of genetic testing in understanding family patterns, explaining,

> *"It is helping them find out if it is a certain pattern within the family for other members of the family as well."* (P8, Opted-in)

Significantly few parents have openly discussed their experiences of growing up with AGI and the profound influence it had on their adolescent years. They placed emphasis on the long-lasting psychological impact associated with AGI and its unaesthetic appearance thus stressing the crucial need of early diagnosis and professional supportfor future generation. One parent reflected on her own experience, stating,

> *"I think from… for me, I know because I was diagnosed with myself, there wasn't a gene test when I was younger and it massively affected my teenage years, it massively affected me. I suppose the gene test will her help deal with it better."* (P7, Opted-in)

Similarly, another parent shared concerns about her child's increasing awareness of their appearance, explaining,

> *"She is slightly more aware of her appearance now. So, I think maybe in a few years, it might affect her but she's getting this treatment now, this abrasion thing."* (P10, Opted-in)

Some parents who declined the AGI genetic testing still recognised its potential to contribute positively to future research and care. For these parents, the decision to opt out did not necessarily reflect a lack of appreciation for the value of genetic testing, but rather a belief that it may benefit others even if not directly relevant to their own child at that time.

One parent who opted out stated:

> *"Genetic research might not be right for our family right now, but I do see how important it is for the future. If it helps other children one day, then it is worth supporting." (P9, Declined)*

This quote reflects a broader understanding among some parents that genetic testing holds promise beyond individual cases. Even without pursuing testing for their own child, they recognised the role such research could play in improving knowledge, guiding future treatment, and supporting other families navigating similar conditions.

3c. Concerns for future children.

Through the in-depth interviews with parents, diverse perspectives regarding the impact of confirming AGI inheritance pattern were highlighted. All parents interviewed did not view the knowledge on AGI's inheritance pattern as a barrier to having children, however their opinions varied on the significance of this knowledge and its impact. In fact, some parents

find comfort in knowing the inheritance pattern, as that will provide them with an understanding of how AGI is passed down in their family. For these parents, knowing the inheritance pattern was not about satisfying curiosity; it was more about bringing them peace of mind by unravelling the origins of their child's condition.

As one parent stated,

> *"I think it is probably just something we'd want to know, but it wouldn't... well, it wouldn't put me off having another child."* (P8, Opted-in)

Another parent shared a similar view, explaining

> *"Yeah. I mean, he's aware of the condition. But I do not—yeah. I guess it could be something that he might consider in the future but I do not think it will be something that would prevent him from wanting a family."* (P5, Opted-in)

Moreover, amidst this diversity of opinions a distinct concern emerged. Few parents were aware that with certain types of AGI as confirmed by genetic testing showed a greater prevalence in boys compared to girls and can also affect boys more severely. It raised worries about gender preference or bias and the emotional challenges that might arise when faced with such knowledge. For these parents the results of the test held the possibility of revealing information that extended beyond AGI itself. As one parent noted,

> *"I suppose part of me was curious, but then I started wondering what else it might tell us. Like if it showed something about boys being more likely to have it or worse off somehow... I didn't quite know how I'd feel about that."* (P6, Declined)

Another parent articulated this concern, stating,

> *"Actually, if you find out that it is in boys and not in girls and then choosing because of that, that does frighten me that's use of knowledge."* (P7, Opted-in)

This subtheme reflects the range of perspectives among parents. For many, confirming the inheritance pattern of AGI offered reassurance and a sense of clarity. For others, however, it raised concerns about the level of detail genetic testing might reveal. While few others, felt uncertain about how they would cope with results that suggested differences in how the condition may affect boys and girls.

Theme 4: AGI not viewed as a "serious condition"

This theme and its subthemes highlight how parents evaluated the potential impact of AGI on their child's well-being, assessing its severity in comparison to other more pressing health concerns. Parents' thoughts and experiences reflect a careful consideration of the emotional and physical burden associated with genetic testing, particularly when the results might not alter the treatment plan or improve their child's quality of life (QoL).

Four subthemes were derived from this main theme, demonstrating the various barriers that influenced families' decisions regarding the AGI genetic testing:

First subtheme "testing causes unnecessary pain and discomfort of child" presented parents who declined the AGI genetic testing due to concerns about subjecting their child to unnecessary discomfort or pain, especially when the results were not expected to alter treatment. This sentiment was particularly strong among parents whose children had a needle phobia or had already undergone numerous medical procedures.

Second subtheme "additional time taken off for appointments"

Another significant barrier was the inconvenience of scheduling additional hospital visits for genetic testing, especially when parents had to take time off work or school. This logistical burden further discouraged families, particularly when they believed the test would not provide essential new information.

Moreover, the third subtheme "AGI perceived as having no serious medical impact" focuses on how some parents viewed AGI as a relatively minor issue that did not warrant genetic testing. They often compared it to more serious health conditions, concluding that AGI did not pose a significant threat to their child's health.

Finally, the last subtheme "Not wanting to share AGI diagnosis with others" elaborates on few parents' decision to withhold their child's AGI diagnosis from family members. These parents perceived AGI as a non-serious condition and saw little benefit in disclosing the diagnosis, particularly when it did not significantly impact their child's life. However, in cases where AGI was more severe, parents were more likely to share the diagnosis with relatives, particularly to raise awareness and encourage preventive measures.

According to one parent who did not perceived AGI as a serious condition,

> *"I think again given the nature of it, the fact that you know I keep saying it is not a significant condition. It is not life threatening or sort of impacting on anyone's life. I know some people it may do but it doesn't with our child then I wouldn't see that as any kind of issue at all."* (P6, Declined)

In summary, these subthemes collectively underscore a broader perception that AGI, especially in its milder forms, is not considered a serious condition, influencing parents' perspectives on the value and necessity of genetic testing. These will be further described in the four subthemes below:

4a. Testing causes unnecessary pain and discomfort of child

Some parents declined AGI genetic testing as to them the potential discomfort and pain their child may experience exceed the potential benefit. For some parents, the fear of causing unnecessary pain and discomfort outweighed the need for a genetic diagnosis especially when the genetic results will not change the treatment approach. Parents wanted to avoid adding an extra burden to their child particularly when genetic testing is deemed unnecessary to them.

In relation to the previous, a mother who declined genetic testing for her child mentioned,

> *"So, trying to minimise any un-comfort to my son is my main concern."* (P1, declined)

Similarly, another parent shared her concerns, stating,

> *"I know for us, I wasn't that interested in it, my main concern was just minimising inconvenience to my child."* (P6, Declined)

Some parents worried that their child might develop a phobia of future dental treatments after undergoing the AGI genetic testing, as it involves a needle for blood withdrawal. Others expressed concerns about subjecting their child to invasive procedures, particularly if the child was already needle-phobic.

One parent voiced this concern, saying,

> *"I just do not think my child will like to do a blood test and I do not want to make him feel scared or uncomfortable"* (P9, Declined)

Even parents who accepted genetic testing still expressed worries and concerns about it being a blood test.

As one parent stated,

> *"But the only thing I didn't feel fine about was the fact that it was a blood test."* (P5, Opted-in)

Another parent explained her thought process, saying,

> *"So, I guess what you need to be mindful of is that lot of the children are a bit fearful of needles, and I wouldn't put my child through a blood test unless I was sure they are*

> *100% okay with it. My child didn't have a problem so, it went alright."* (P12, Opted-in)

From an analytic perspective, the perception of testing as invasive influenced parents' views on AGI testing. Many felt their child would struggle with needles and were unwilling to subject them to unnecessary pain. Interestingly, parents framed this as their own decision, using 'I' rather than indicating that the child made the choice themselves.

Parents' thoughts illustrate how they perceived the blood test of the AGI genetic testing as a potential emotional and physical burden for their children. While the test is non-therapeutic and diagnostic in purpose, some parents perceived the method of testing as intrusive, particularly when their child was already anxious about medical procedures. For those who opted in, the decision to proceed was often accompanied by careful consideration of the child's comfort and readiness. For those who opted out, the presence of needles played a significant role in their decision-making.

For some parents, the opportunity to have the blood test performed under general anaesthesia during their child's dental treatment alleviated their concerns. As one mother shared,

> *"Actually, doing the blood test was my biggest concern, but when they said they could do it when she was under, having her teeth out, I was fine with it. I think thankfully the genes test was done in the right way for us, which was under general anaesthetic."* (P11, Opted-in)

Another parent decided against the AGI genetic testing to avoid overwhelming her autistic child with additional hospital visits, as he already struggled with sensory overload in medical settings. She explained,

> *"There it was more of a problem coming in, being seen, that was just for him, a bit of a total sensory overload in the whole busy environment, so many people in the clinic."* (P1, Declined)

Based on interview findings, parents preferred for AGI genetic testing to be conducted through a saliva sample rather than a blood test. Parents highlighted the advantages of the saliva test emphasising that it is less invasive and eliminates the need for an extra

appointment for blood collection. This preference reflects a broader desire among parents to reduce the burden of testing while still obtaining a diagnosis for AGI.

One parent clearly articulated this preference, stating,

> *"Well, the saliva test would be a lot easier, much easier, particularly for a child."* (P7, Opted-in)

Similarly, another parent noted,

> *"I'd be happy to consent to that really, you know, as a saliva test wouldn't bother my child in any way. So, there's no harm there, really."* (P1, Declined)

These narratives suggest that parents perceive saliva testing as a more acceptable and less distressing alternative to blood-based methods. The non-invasive nature of the saliva test appeared to align more closely with parents' concerns about their child's ability to manage medical procedures, particularly in emotionally sensitive contexts. For many, this preference was not simply about convenience but about safeguarding their child's comfort and emotional wellbeing. It reflects how the method of genetic testing can significantly shape parents' overall perception of the testing process and influence their willingness to engage with it.

4b. Additional time taken off to attend appointments is burdensome

Participants shared their thought processes when they were considering AGI genetic testing and what could be a barrier. They weighed the potential benefits of confirming the genetic condition against the burden it could have on their child. Some participants' reasoning for declining the test was that the appointments require taking time off school and an additional trip to the hospital. One of the primary concerns of those parents is the potential negative impact on their child's education.

As one parent explained,

> *"We've had four appointments with the hospital and my child is all out of patience now with making visits to the hospital, he doesn't like missing school."* (P1, Declined)

Even parents who accepted genetic testing for their child preferred to avoid any unnecessary appointments as they themselves had to take time off work. Some parents highlighted that genetic testing was only available at a specific hospital, requiring a long journey from their home, school, or workplace.

One parent described the challenge, stating,

> *"It was just too overwhelming, and we then had to come back again for the blood test when he could manage that. So, that was my biggest concern."* (P7, Opted-in)

Another parent elaborated on the logistical difficulties, saying,

> *"Especially because it is a 24-mile roundtrip because I go that way to you at the LGI and James is at Menston, at school, so by the time I've got to you, then seeing you and then got in the car and took him back to school, it is like half a day over."* (P12, Opted-in)

From an analytic perspective, these concerns underscore the various psychological and practical barriers that shaped how parents perceived AGI genetic testing. For many, factors such as the invasiveness of the procedure, the emotional impact on their child, and uncertainty about the implications of the results played a significant role in influencing their attitudes towards genetic testing. These perceived obstacles were noted particularly among those who were unsure about the test's immediate relevance or benefit.

4c. AGI perceived as having no serious medical impact

Some parents compared AGI to other more severe health conditions and, in doing so, perceived AGI as less serious. They felt confident that their child was generally healthy and believed that the AGI genetic testing would not provide any therapeutic benefit beyond confirming the presence of a dental defect.

One parent explained their reasoning, stating:

> *"So, I think that again, if it had been something sort of more serious, I would probably push to her have the test, but really it doesn't impact us either way."* (P9, Declined)

Other parents raised concerns about the potential genetic information that might be revealed through AGI testing. They worried that the test could inadvertently uncover information about other medical conditions, some of which could be more serious or have implications beyond dental health. As a result, a few parents were hesitant to proceed with genetic testing.

One parent shared their concern and explained,

> *"I suppose my worries about it were not about him having the blood test, that's fine because I think he knew, he's old enough to know what he was having, was maybe if*

> *they found something else that we were unsure of…if they found something more medically serious then they would get tested."* (P8, Opted-in)

Another parent who opted in described a conversation with a friend that made them reflect on the potential implications of genetic testing, stating,

> *"Like my friend said, what if it brought up something else? And I was like, well, I'll just deal with it when it comes, and she's like, really, aren't you nervous? I says, yeah, I says, I've been a bit nervous"* (P4, Opted-in)

Similarly, one more parent who opted in expressed feelings of being overwhelmed by the potential implications of test results. Their focus was primarily on prioritising their child's well-being rather than engaging with detailed genetic explanations.

They explained,

> *"I suppose my worries about it were not about him having the blood test, that's fine because I think he knew, he's old enough to know what he was having, was maybe if they found something else that we were unsure of."* (P8, Opted-in)

Moreover, another parent openly admitted,

> *"That scares me, the whole gene thing."* (P7, Opted-in)

This demonstrates that even among parents who opted into AGI testing, there were mixed feelings and moments of hesitation. While they had concerns about what the test might reveal, particularly around unexpected findings or the idea of genetic conditions in general, they remained focused on doing what was best for their child. These parents appeared to weigh the possible burden of knowing more against the potential benefits of having answers and guidance. In the end, they perceived more value in proceeding with the test, hoping it would support their child's care and help them feel more informed and reassured.

4d. Not wanting to share AGI diagnosis with others

The final subtheme explores the perspectives of parents who chose not to disclose their child's AGI diagnosis to family members. These parents perceived AGI as a non-serious condition and saw little benefit in sharing the diagnosis, particularly when it did not significantly impact their child's daily life nor percieved as life-threatening.

One parent explained their reasoning, stating:

> *"I think again given the nature of it, the fact that you know I keep saying it is not a significant condition. It is not life-threatening or sort of impacting on anyone's life. I know some people it may do but it doesn't with our child, then I wouldn't see that as any kind of issue at all."* (P6, Declined).

Additionally, parents explained that if AGI was a serious medical condition they will be more likely to share the diagnosis to raise awareness and encourage preventive measures within the family.

As one parent explained,

> *"I have not told anybody else, but they do not need to know, but if it were, if it were something serious, then yeah, fair enough, I would tell my family, do you know what I mean, so like the amelogenesis is genetic and all."* (P8, Opted-in)

This final subtheme underscored how perceptions of AGI severity significantly shape parental attitudes toward both disclosure and the perceived value of genetic testing. When parents viewed AGI as a mild and manageable condition, they were less inclined to disclose the diagnosis to extended family or to see the necessity of further genetic investigation. For these families, the absence of visible or functional impact reduced the urgency to seek additional explanations or share diagnosis with family members. Conversely, in families where AGI presented with more pronounced symptoms, the diagnosis was seen as more relevant and worth sharing. This reflects a broader pattern in which the perceived impact of AGI directly informs how parents viewed the role of genetic testing in their lives. Ultimately, these findings reveal that decisions around testing are not solely based on medical need, but are deeply influenced by personal evaluations of significance, seriousness and perceived benefit.

Chapter 4 Discussion

4.1. Purpose and Overview

The purpose of this study was to explore parental experiences and perspectives on genetic testing for Amelogenesis Imperfecta (AGI), focusing on their motivations, barriers, and expectations. The study aimed to answer how parents navigate the decision-making process for genetic testing, what factors influence their choices, and what their experiences reveal about the broader psychosocial dimensions of genetic testing for hereditary dental conditions.

Through reflexive thematic analysis of interviews with 14 parents, four primary themes were developed:

1. Wanting an "explanation" for tooth appearance
2. Not feeling "listened to" or taken seriously by their dentist
3. Increasing awareness of AGI through diagnosis
4. AGI not viewed as a "serious condition".

This chapter reflects on each theme, situates them within existing research, and highlights the novel insights contributed by this study.

4.2. Thematic Discussion

Theme 1: Wanting an "explanation" for tooth appearance

The findings of this study suggest that obtaining a confirmed genetic diagnosis played a significant role in enabling parents to construct a clearer and more coherent understanding of their child's condition. This, in turn, facilitated more confident communication with others, particularly in situations involving external judgement or questioning. In this sense, diagnosis appeared to function not only as a clinical tool but also as a social resource, supporting parents in explaining their child's condition and managing interactions within broader social contexts. This aligns with existing literature in genetic and medical research, which has consistently demonstrated that diagnostic confirmation can legitimise a condition, reduce uncertainty, and enhance communication within families and with others (Metcalfe *et al.*, 2011; Patenaude *et al.*, 2013; Smit *et al.*, 2021).

However, while such communicative and legitimising functions of genetic testing are well established in broader healthcare contexts, they have received relatively limited attention within the field of AGI and hereditary dental conditions. Much of the existing AGI literature has focused predominantly on clinical presentation, restorative management, and the psychosocial burden associated with dental appearance and treatment. In contrast, less consideration has been given to how genetic confirmation may shape parental identity, influence social interactions, or contribute to coping processes. The present findings therefore extend current understanding by demonstrating that, within a dental context, genetic diagnosis holds value beyond diagnostic clarification alone.

A particularly noteworthy contribution of this study is the way in which genetic testing appeared to facilitate a reframing of parental perceptions of causation. Parents described how receiving a diagnosis enabled them to view the condition as hereditary rather than as a consequence of their own actions, thereby alleviating feelings of guilt and self-blame. This shift was accompanied by a greater sense of confidence in advocating for their child and engaging with others about the condition. In this regard, the findings highlight a psychological transition from uncertainty and perceived responsibility towards empowerment and more active forms of support.

This process of reframing and its impact on parental wellbeing has been observed in other areas of genetic research. Studies within paediatric oncology and inherited conditions have similarly reported that diagnostic clarity can reduce parental self-blame, strengthen coping strategies, and support families in adopting more proactive roles in managing their child's condition (McConkie-Rosell *et al.*, 2011). While these parallels suggest that the present findings are consistent with broader genetic research, they also underscore the relative novelty of this insight within the context of hereditary dental conditions.

Furthermore, although earlier work in AGI has highlighted the social impact of the condition, particularly in relation to visible differences in tooth appearance and associated stigma (Coffield *et al.*, 2005). The current study provides a more nuanced understanding of how genetic diagnosis may mediate these experiences. Rather than merely documenting psychosocial burden, the findings indicate that genetic confirmation can actively support parents in constructing clearer, less stigmatising narratives about their child's condition. In doing so, it appears to strengthen parental confidence in navigating social interactions and in supporting their child's overall wellbeing.

Theme 2: Not feeling "listened to" or taken seriously by their dentist

The findings of this study suggest that parents' experiences of not feeling listened to or taken seriously by general dental practitioners were closely linked to perceived gaps in clinician awareness and understanding of AGI. These experiences appeared to shape not only parents' satisfaction with care but also their decision-making in relation to genetic testing. Within this context, genetic testing functioned as more than a diagnostic tool; it was perceived as a means of legitimising the child's condition within clinical encounters, enabling parents to challenge assumptions and advocate more confidently for appropriate care pathways. This interpretation is consistent with broader healthcare literature, where parental dissatisfaction with clinician knowledge and perceived lack of recognition have been identified as key drivers of help-seeking behaviours and parental advocacy, particularly in the context of rare or complex conditions.

The identified gap in clinician knowledge regarding rare hereditary conditions is consistent with existing research. Bloch-Zupan *et al.* (2023) reported limited awareness of such conditions among general dental practitioners and emphasised the need for ongoing professional education. Similarly, Mijiritsky *et al.* (2021) highlighted insufficient formal training in the management of rare dental and genetic disorders. While these studies primarily focus on clinical knowledge and management, the present findings extend this understanding by illustrating how such gaps may also influence parents' trust in dental professionals and contribute to a perceived need for diagnostic validation.

Evidence from wider healthcare contexts further supports the importance of early diagnosis and clinician awareness in shaping care pathways. Research involving children with complex health conditions has demonstrated that early recognition and referral to multidisciplinary teams can improve access to appropriate treatment and long-term outcomes (Kuhlthau *et al.*, 2011). Comparable patterns have been observed in cleft lip and palate care, where timely diagnosis facilitates coordinated multidisciplinary management (Mossey *et al.*, 2009).

Within this broader context, the findings of the present study suggest that genetic diagnosis holds practical significance for families, functioning as recognised evidence that supports access to specialised services and reduces barriers to referral within NHS systems.

Taken together, these findings indicate that genetic testing may operate not only as a clinical diagnostic tool but also as a mechanism through which parents negotiate credibility and access to care within healthcare systems. This highlights a broader systemic issue concerning the interaction between clinician awareness, diagnostic legitimacy, and equitable access to

specialised care for children with hereditary dental conditions. Addressing these challenges may require training for general dental practitioners, alongside the development of clearer referral pathways for rare genetic dental disorders.

Theme 3: Increasing awareness of AGI through diagnosis

This theme highlights how parents understood genetic testing as a means of gaining clarity about inheritance patterns and supporting informed family decision-making. Rather than viewing genetic information as a source of anxiety or a barrier to future family planning, parents appeared to interpret knowledge of inheritance as empowering, enabling informed reproductive and practical decisions within their family context. In this way, genetic testing extended beyond diagnostic clarification and functioned as a resource for anticipatory planning and family preparedness. Notably, inheritance knowledge was not framed as discouraging future pregnancies; instead, it appeared to support confidence and informed choice, suggesting that genetic information was experienced as reassuring rather than restrictive.

These interpretations are consistent with wider research on genetic testing in rare disorders, where understanding inheritance patterns has been shown to support reproductive decision-making and enhance families' sense of control and preparedness (McAllister *et al.*, 2008). Within the context of AGI, genetic information similarly appeared to contribute to parental confidence by reducing uncertainty surrounding future pregnancies and facilitating clearer discussions within extended families. This aligns with previous work indicating that families affected by AGI perceive genetic testing as valuable not only for individual diagnosis, but also for increasing family-wide awareness and guiding planning for future generations. (Appelstrand *et al.*, 2022).

Beyond immediate family decision-making, the analysis also suggests that parents positioned genetic testing within a broader collective framework. Consistent with findings reported by Hunter *et al.* (2024), participation in genetic testing appeared to be understood as contributing to wider medical understanding and potentially benefiting other families affected by hereditary conditions.

This future-oriented perspective remained evident even when results were inconclusive or offered limited direct benefit to their own child, suggesting an altruistic dimension to parental decision-making extending beyond individual clinical outcomes.

Overall, the analysis suggests that genetic testing may serve as a mechanism for future-oriented understanding, enabling families to move from uncertainty towards preparedness and shared understanding. Within hereditary dental conditions such as AGI, this highlights the importance of recognising genetic testing not solely as a diagnostic intervention but as part of a broader process through which families negotiate knowledge, responsibility, and planning across generations.

Theme 4: AGI not viewed as a "serious condition"

Perceptions of condition severity appeared to play a central role in how parents evaluated the value of genetic testing for AGI. Within this analysis, AGI was frequently positioned as a condition with limited medical seriousness, which shaped parental judgements about whether pursuing genetic testing was necessary or proportionate. This interpretation aligns with broader genetic testing literature suggesting that families are more likely to prioritise testing when conditions are perceived as severe, progressive, or associated with clear clinical consequences (Hayeems *et al.*, 2019). When a condition is viewed as manageable or non-life-threatening, the anticipated benefits of testing may be weighed against practical and emotional burdens, influencing decisions about whether to decline or postpone testing.

In this context, decisions appeared to reflect a broader evaluation of utility, where parents considered whether genetic confirmation would meaningfully alter treatment pathways or outcomes. When testing was perceived as unlikely to influence management, its value was often questioned, particularly when logistical demands such as time or additional appointments were involved. This suggests that decision-making was shaped not only by attitudes towards genetics itself but also by perceptions of proportionality between the effort required and the expected clinical gain. The discussion therefore reinforces the importance of clearly communicating the potential practical implications of testing, including how results may inform future care planning or access to services, as emphasised in recommendations for tailored genetic counselling (Lewis *et al.*, 2022).

Parental decisions regarding disclosure of genetic information can also be interpreted through this lens of perceived utility and seriousness. Similar to observations reported by Archibald *et al.* (2021), willingness to share genetic information appeared to depend on whether parents viewed the diagnosis as having wider relevance for family planning or health decision-making. When AGI was regarded as relatively benign, genetic information was sometimes perceived as less essential to communicate beyond immediate family contexts. Importantly,

this interpretation appeared to be more common among parents whose children experienced milder forms of AGI. This highlights that parental perspectives were not uniform and were shaped by the clinical variability of AGI, with differing severity influencing how parents perceived the value, relevance, and communicative importance of genetic information.

Another interpretative finding emerging from a small number of parents was uncertainty about what genetic testing might reveal beyond the immediate clinical question. Although AGI testing involves targeted gene panel analysis rather than whole exome or whole genome sequencing, and therefore carries a lower likelihood of incidental findings, apprehension about uncovering broader or unexpected information remained evident. This suggests that parental concerns were shaped less by the technical scope of testing and more by wider societal understandings of genetics. Similar patterns have been observed in medical genetics, where families often associate genetic testing with the possibility of identifying unforeseen health risks or wider familial implications, even when testing is clinically targeted (Miller *et al.*, 2021; Lewis *et al.*, 2022). Within this context, uncertainty itself may function as a barrier to engagement. These findings reinforce the importance of counselling that clearly explains the scope and limits of targeted testing, enabling parents to align their expectations with clinical realities and approach decision-making with greater confidence.

4.3.Overarching Patterns and Relationships

Across the dataset, parental experiences appeared to reflect an ongoing process of negotiating uncertainty associated with hereditary dental conditions. Rather than representing isolated findings, the themes collectively suggest a dynamic interaction between emotional responses, healthcare encounters, and perceptions of condition severity, which together shaped how parents interpreted the value and relevance of genetic testing.

A central pattern linking Themes 1 and 2 relates to the search for legitimacy and reassurance within healthcare interactions. Uncertainty surrounding the cause of the child's dental presentation, combined with perceived gaps in professional understanding, appeared to intensify parental self-doubt and emotional burden. Within this context, genetic testing functioned not only as a diagnostic intervention but also as a mechanism through which parents sought validation, credibility, and greater confidence when navigating clinical systems. This suggests that the perceived value of testing extended beyond clinical clarification to include important social and psychological dimensions of care. From a

reflexive standpoint, the researcher's clinical experienceas a paediatric dentist and prior exposure to parental accounts of guilt and dental frustration may have shaped analytic sensitivity, particularly in relation to Themes 1 and 2, and therefore influenced how these narratives were emphasised within the interpretation.

Theme 3 further expands this interpretation by illustrating how genetic knowledge was positioned within a broader family and future-oriented context. Genetic confirmation appeared to support wider sense-making processes, enabling families to contextualise the condition within hereditary frameworks and to consider its implications across generations. The value attributed to testing therefore extended beyond immediate clinical outcomes, encompassing family communication, identity, and long-term planning.

In contrast, Theme 4 demonstrates how engagement with testing was strongly influenced by perceptions of condition severity and personal relevance. When AGI was understood as mild, manageable, or primarily cosmetic, the perceived benefits of testing were reduced, and practical burdens or concerns about necessity became more prominent. This interpretation is further supported by the observation that parents who declined testing were more commonly those whose children presented with milder forms of AGI and who themselves did not have AGI or a known family history of the condition. The absence of personal or familial experience may have reduced perceived urgency or emotional investment in obtaining genetic confirmation, influencing both how the condition was interpreted and the extent to which testing was viewed as meaningful or necessary. These variations highlight that parental decisions were shaped not by uniform attitudes towards genetics but by how families understood the lived impact and relevance of AGI within their own circumstances.

Taken together, these patterns indicate that parental decision-making regarding AGI genetic testing emerged through the interaction of emotional experience, healthcare relationships, perceived severity, and personal context. Genetic testing therefore functioned not solely as a biomedical diagnostic tool but as a socially and psychologically embedded process through which families negotiated uncertainty, legitimacy, and control. Viewed collectively, the themes suggest that the meaning parents attach to genetic testing is relational and context-dependent, shaped by both their prior experiences and the degree to which the condition disrupts everyday life. Supporting families effectively may therefore require not only improved clinical knowledge of AGI but also communication approaches that acknowledge these differing contexts and perceptions of need.

4.4.Implications of Study Findings

This study highlights several critical clinical and psychological implications for dental practitioners, healthcare systems, and families navigating AGI genetic testing.

4.4.1. Clinical Implications

The study's findings have several implications for how hereditary enamel defects are recognised, explained, and managed within routine dental care. A key clinical implication is that uncertainty around diagnosis can create avoidable harm when enamel defects are interpreted through a hygiene-focused lens. In such contexts, families can experience not only delayed recognition of a hereditary condition, but also the emotional burden of perceived blame and the erosion of trust in primary dental care. This suggests that the clinical challenge is not simply "diagnosing AGI", but managing the downstream consequences of misattribution, including repeated ineffective care, fragmented help-seeking, and widened inequities in access to specialist services.

A further implication concerns variability in how the seriousness of AGI is appraised in practice. When AGI is framed as largely cosmetic or manageable, the perceived value of genetic confirmation may reduce, particularly if families anticipate little change in treatment planning. Yet conditions such as AGI can carry substantial functional and psychosocial burden that may be underestimated outside specialist settings, and this mismatch can shape expectations about why testing is offered and what it is for (NORD, 2023). Clinically, this highlights the importance of positioning genetic testing as part of a broader care-planning conversation, rather than solely as an optional add-on, and of explaining how confirmation may support long-term management decisions, orthodontic eligibility considerations, and inheritance counselling (McDowall *et al.*, 2018).

Finally, the practical design of testing pathways has implications for acceptability and engagement. When testing is perceived as burdensome or invasive, families may weigh anticipated benefits against logistical and emotional costs. These considerations underline the importance of transparent, psychologically informed communication at the point testing is offered, including clear explanations of what a targeted AGI panel can and cannot reveal, and why particular sampling methods are used. Addressing these issues is not merely an information task; it is part of maintaining trust and supporting shared decision-making in dental genetics.

4.4.2. Psychological and Social Implications

Psychologically, the study highlights the intense guilt felt by parents in the absence of a clear explanation for their child's tooth appearance (Theme 1). Many blamed themselves for their child's condition, and testing provided relief by reframing AGI as a genetic condition rather than a consequence of poor parenting. This underscores the importance of psychological support for families at the point of diagnosis or when genetic testing is offered, as parents may need support in processing feelings of guilt, self-blame, and anxiety (Shiloh, 2006).

Additionally, the presence of stigma surrounding visible dental anomalies was evident in parents' descriptions of social challenges and their children's emotional distress. Parents often felt compelled to seek a diagnosis to defend against negative societal judgments. This points to a wider need for public health initiatives aimed at raising awareness about AGI, promoting understanding of hereditary dental conditions, and work towards reducing stigma. Unlike prior research, which focused on the general psychosocial impact of AGI, this study draws attention to the specific psychological weight carried by parents during the decision-making process for genetic testing.

Finally, the findings contribute to a growing body of literature highlighting the importance of genetic literacy among both healthcare providers and the public. As noted by the National Organization for Rare Disorders (NORD), limited awareness and misperceptions of rare conditions such as AGI can perpetuate misunderstanding and stigma. Within this context, the present study extends existing knowledge by demonstrating how these broader gaps in understanding intersect with parents' psychosocial experiences, shaping feelings of legitimacy, self-blame, and confidence in navigating care. Taken together, the findings underscore the socially constructed nature of genetic diagnosis, not only as a clinical label but as a resource through which families interpret, negotiate, and respond to their child's condition.

4.5.Strengths and Limitations

This section critically reflects on the methodological strengths and limitations of the study, situating the findings within their appropriate interpretive context. Such reflection is essential in qualitative research, as it clarifies the scope of the conclusions that can be drawn while identifying areas where further investigation may strengthen the evidence base.

Strengths

A primary strength of this study lies in its qualitative design, which enabled an in-depth exploration of parents' lived experiences and perceptions regarding genetic testing for AGI. Previous research examining AGI or genetic testing within dentistry has largely relied on quantitative survey methodologies (Pousette Lundgren *et al.*, 2019). While such approaches are valuable for identifying prevalence patterns and general attitudes, they often provide limited insight into the emotional, psychological, and social processes underlying decision-making. By contrast, the use of semi-structured qualitative interviews in this study allowed participants to narrate their experiences in their own words, revealing nuanced dimensions of parental meaning-making that are not easily captured through structured questionnaires.

Another important strength is the study's focus on parents as the primary participants. Parents play a central role in managing their child's healthcare, making decisions about genetic testing, and advocating for appropriate treatment pathways. Despite this critical role, previous studies in dental genetics have often prioritised clinician perspectives (McDowall *et al.*, 2018). By foregrounding parental voices, this study provides a patient-centred perspective that is essential for informing future developments in genetic counselling, diagnostic pathways, and family-centred models of dental care.

The sampling strategy also strengthened the study's contribution. Purposive sampling enabled the recruitment of parents with diverse experiences of AGI and genetic testing, including individuals who both accepted and declined the test. This diversity allowed the study to explore contrasting viewpoints and motivations, providing a richer understanding of how families interpret the value and implications of genetic testing. Participants also represented a range of ethnic backgrounds, socioeconomic circumstances, and family histories of AGI, enhancing the conceptual breadth of the findings.

Additionally, the use of virtual interviews reduced logistical barriers associated with travel, time constraints, and childcare responsibilities, thereby supporting broader participation and inclusivity. Although virtual interviewing can limit observation of non-verbal cues and potentially affect rapport (Archibald *et al.*, 2019), efforts were made to mitigate these limitations through deliberate rapport-building strategies, including reflective listening, verbal encouragement, and allowing participants to guide the pace and emotional depth of discussion.

A further strength relates to the study's contribution to theoretical transferability. Unlike quantitative studies that seek statistical generalisability, qualitative research aims to generate contextually rich insights that may inform understanding in comparable settings (Lincoln and

Guba, 1985). In this study, transferability is supported through the detailed presentation of participant demographics and contextual information. This transparency enables readers to assess the relevance of the findings to similar clinical contexts where families are navigating rare hereditary dental conditions and decisions regarding genetic testing.

Finally, reflexivity was actively incorporated throughout the research process. The researcher maintained awareness of how her professional background as a paediatric dentist could shape both data interpretation and interactions with participants. Reflexive reflection during data analysis helped ensure that participants' perspectives remained central to theme development, while analytic decisions were documented and discussed to maintain methodological transparency.

Limitations

Despite these strengths, several limitations should be acknowledged when interpreting the findings. First, the study involved a relatively small sample of fourteen participants. While this sample size is consistent with qualitative research seeking depth of understanding rather than statistical representation, it can inevitably limit the range of experiences captured. Additional participants may have revealed further perspectives, particularly among families with different levels of engagement with healthcare systems.

A related limitation concerns potential sampling bias. Individuals who agreed to participate in the study may have been more open to discussing their experiences or more comfortable engaging with healthcare professionals and research activities. Consequently, the perspectives of parents who are highly distrustful of healthcare institutions or disengaged from clinical services may be underrepresented. This is a common challenge in qualitative health research, where participation often depends on willingness to share personal experiences.

Furthermore, although both parents who accepted and those who declined genetic testing were included, the sample contained a greater proportion of parents who consented to testing. This imbalance may reflect the recruitment context, as families who had already engaged with genetic services or expressed interest in the topic may have been more inclined to participate in research interviews. As a result, the findings may somewhat overrepresent perspectives that are supportive of genetic testing, while the views of those strongly opposed to testing may be less fully captured.

Another limitation relates to the study's focus on parental experiences alone. While parents are central decision-makers in their child's healthcare, children and adolescents living with AGI are directly affected by the condition and may hold distinct perspectives regarding

diagnosis, treatment, and genetic information. Their voices remain absent from this study, limiting the ability to fully understand how genetic testing is perceived within the broader family unit. Future research that incorporates the perspectives of young people with AGI could provide a more comprehensive understanding of the psychosocial dimensions of genetic testing and hereditary dental conditions.

Finally, although reflexive strategies were employed throughout the research process, interpretation inevitably remains shaped by the researcher's positionality. As a paediatric dentist with professional familiarity with AGI and its clinical management, the researcher may have been more attuned to aspects of participants' narratives relating to diagnosis, treatment pathways, and interactions with dental professionals. While reflexive awareness was used to minimise potential bias, it is important to acknowledge that qualitative analysis is inherently interpretive and influenced by the researcher's professional and experiential background.

Taken together, these strengths and limitations highlight that the study offers valuable insight into parental perspectives on genetic testing for AGI while also indicating areas where further research could deepen understanding. In particular, future studies incorporating larger samples, broader recruitment strategies, and the perspectives of affected children and adolescents would further enrich knowledge in this emerging area of dental genetics research.

4.6.Rationale for Selecting Zoom as the Interview Platform

Zoom was selected as the interview platform to support accessible and flexible data collection. Although ethical approval was obtained during the COVID-19 period, interviews were conducted towards the end of 2022, when virtual communication platforms had become widely integrated into both professional and social life. Consequently, many participants were likely to be familiar with online interaction, which may have reduced technological barriers and supported comfort during interviews. Previous research suggests that virtual interviewing can enhance participant openness by allowing individuals to engage from familiar environments (Gray *et al.*, 2020).

Compared with platforms such as Microsoft Teams, Zoom was considered more informal and user-friendly, enabling participants to join via a simple link without mandatory registration, thereby reducing participation barriers (Archibald *et al.*, 2019). The platform also reduced

travel demands, which was particularly beneficial for parents managing childcare and other responsibilities.

Despite the widespread adoption of virtual communication by 2022, potential limitations remained. Differences in digital access, internet reliability, or technological confidence may have influenced participation or the flow of interviews. While no interviews were discontinued due to technical issues, occasional connectivity disruptions occurred. In addition, virtual interviewing may limit the observation of non-verbal cues and can influence rapport building compared with face-to-face interaction (Archibald *et al.*, 2019). To minimise these challenges, participants were provided with clear instructions beforehand, and time was allocated at the start of interviews to establish rapport and ensure comfort with the platform.

Overall, Zoom enabled practical and inclusive participation aligned with contemporary communication practices at the time of data collection, while acknowledging that digital access and the virtual format may have shaped aspects of the interview experience and data generation.

4.7.Recommendations for Clinical Practice and Future Research

Based on the findings and limitations of this study, several recommendations are proposed to improve the clinical management of AGI, enhance the provision of genetic testing, and guide future research.

4.7.1. Recommendations for Clinical Practice

Improving care for families affected by AGI and other suspected hereditary enamel defects requires a clearer, more consistent pathway that begins in primary dental care. First, there is a need to strengthen GDP education so that clinicians can recognise patterns suggestive of hereditary enamel defects and differentiate them from more common explanations such as poor oral hygiene. Training should train the eye clinically (pattern recognition, key features, red flags) while also developing empathic, non-judgemental communication that avoids implicit blame and validates parental concerns. This dual focus is likely to improve both diagnostic accuracy and family experience within routine encounters.
Second, professional development should be paired with clearer referral guidance. Readily accessible clinical guidance and case-based continuing professional development (CPD)

could support consistent decision-making in primary care and reduce delays in appropriate escalation. A structured referral pathway for suspected hereditary enamel defects would help GDPs understand when specialist input is required, facilitate timely multidisciplinary assessment, and minimise repeated unsuccessful treatment attempts. Clear referral criteria and pathways are also likely to improve equity of access, particularly for families who may otherwise struggle to advocate for specialist review.

Third, genetic counselling input should be embedded within dental testing pathways. Genetic testing can be emotionally complex for families, and counselling support can improve informed decision-making, enhance understanding of inheritance and uncertainty, and help families navigate psychosocial implications of diagnosis (Resta *et al.*, 2006). Integrating counselling within referral and testing processes would therefore strengthen the clinical pathway by aligning technical information with psychological support.

Fourth, counselling should explicitly address practical aspects of testing procedures, particularly when concerns about invasiveness arise. Although saliva-based sampling is often perceived by families as simpler and more acceptable, saliva testing is not currently offered within the AGI testing pathway. It is therefore clinically useful to discuss sample options proactively, so that if parents ask “why not saliva?”, they receive a transparent explanation rather than a perceived dismissal. Blood-derived deoxyribonucleic acid (DNA) has historically been the standard for clinical genetics and early genetic research because it generally provides more consistent DNA quality, higher human DNA yield, and lower microbial contamination, which is important when establishing and validating diagnostic pipelines. While saliva can be suitable for some applications, sample quality can be more variable and may have higher quality-control failure rates due to non-human DNA from the oral microbiome (Samson *et al.*, 2020). In targeted AGI testing, where workflows were developed and validated using blood-derived DNA, these quality-assurance requirements help explain why blood remains the more reliable option. Explaining this distinction can support shared decision-making, reduce uncertainty, and help parents feel more involved in the process even when saliva collection is unavailable.

Finally, recommendations should extend beyond individual clinician behaviour to service design. Families’ lived experience is central to how diagnosis is sought, understood, and acted upon; involving parents in co-designing information materials, pathway explanations, and support resources can improve the clarity, acceptability, and practicality of services. Together, these recommendations support a coherent pathway in which early recognition, timely referral, counselling-informed testing discussions, and stigma-sensitive

communication are integrated into routine dental care for hereditary enamel defects (McDowall *et al.*, 2018; NORD, 2023).

4.7.2. Recommendations for Future Research

While this study focused on the perspectives of parents, it did not include the voices of adolescents living with AGI. Including adolescents themselves could provide deeper insight into the family experience by capturing aspects that parents may not fully observe or articulate, such as lived experiences of appearance-related stigma, social interactions at school, identity development, and how young people make sense of genetic explanations in their own words. Incorporating adolescent perspectives would therefore strengthen understanding of the wider psychosocial impact of AGI and inform age-appropriate support within dental and genetic care pathways.

A further priority for future research is to examine parental experiences after receiving genetic test results. This study primarily explored views around decision-making and engagement with testing; however, follow-up interviews after results are returned could clarify how parents interpret and use the information over time. This would help to explore whether receiving results changes parental reassurance, family communication, coping strategies, or engagement with clinical services, particularly when results are inconclusive or do not align with expectations. A longitudinal design would therefore add important insight into how the implications of genetic testing unfold beyond the initial testing decision.

Building on this, future work should also strengthen knowledge mobilisation by developing practical strategies to share research outcomes with both participants and dental professionals. Findings could be shared with participants through email updates, as parents expressed interest in the outcomes and provided their email addresses during recruitment. Sharing findings with dental professionals could similarly be supported through NHS email distribution lists or clinicians' work emails, alongside brief summaries tailored to general dental practitioners. These approaches could help ensure that the knowledge generated through research is accessible, meaningful, and more likely to influence awareness, communication, and referral practices.

To address potential sampling limitations, future studies could broaden recruitment beyond families already engaged in specialist pathways and genetic services. Recruiting through multiple routes, such as general dental practices, community dental services, and hospital

clinics, may help capture a wider range of experiences and reduce the likelihood that the sample over-represents families who are already confident in navigating healthcare systems. Finally, while this research focused on AGI, the psychosocial dynamics identified are likely to be relevant across other hereditary dental disorders. Future qualitative work could explore experiences of genetic testing, stigma, and family decision-making in conditions such as dentinogenesis imperfecta (DI), ectodermal dysplasia with hypodontia or anodontia, and cleft lip and palate where genetic and developmental explanations may also shape family narratives and engagement with care. Extending research across these conditions would support more inclusive and psychologically informed models of care within dentistry and strengthen the evidence base for communication and support strategies across rare genetic dental disorders.

Chapter 5 Conclusion

This qualitative study explored the views and experiences of parents offered Amelogenesis Imperfecta (AGI) genetic testing for their child within a UK dental setting. Through in-depth interviews, it examined how parents understood and navigated the decision-making process, including the motivations, concerns, and emotional responses associated with testing.

The findings demonstrate that parental decision-making was shaped not only by clinical considerations, but also by emotional and social factors. For many, genetic testing functioned as a means of validation and reassurance, helping to reframe the condition as hereditary rather than attributable to parental actions, and thereby alleviating feelings of guilt. This, in turn, supported more confident communication and advocacy for their child. However, some parents questioned the necessity of testing, particularly when AGI was perceived as mild, with hesitations influenced by concerns about test invasiveness, uncertainty around results, and limited guidance from general dental practitioners.

A key contribution of this study is the identification of genetic testing as more than a diagnostic tool, functioning instead as a resource through which parents seek legitimacy, reassurance, and confidence within both clinical and social contexts. Even among those who declined testing, its broader value for family awareness, future generations, and research was recognised.

Overall, these findings highlight the importance of understanding genetic testing for AGI not only in clinical terms, but also in relation to its psychosocial and relational significance. They underscore the need for approaches to care that are family-centred, psychologically informed, and supported by clear communication and professional understanding.

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Appendices

Appendix A Research Ethics Committee approval letter

Ymchwil Iechyd a Gofal Cymru
Health and Care Research Wales

NHS
Health Research Authority

Dr Richard Balmer
Level 6, School of Dentistry Worsley Building
Clarendon way, University of Leeds
Leeds, UK
LS2 9LU

Email:
HCRW.approvals@wales.nhs.uk

17 March 2022

Dear Dr Balmer

HRA and Health and Care Research Wales (HCRW) Approval Letter

Study title:	**Participants' Views and Experiences of Genetic Testing in Amelogenesis Imperfecta**
IRAS project ID:	**293839**
Protocol number:	**N/A**
REC reference:	**22/WA/0083**
Sponsor	**University of Leeds**

I am pleased to confirm that **HRA and Health and Care Research Wales (HCRW) Approval** has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications received. You should not expect to receive anything further relating to this application.

Please now work with participating NHS organisations to confirm capacity and capability, in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.

How should I work with participating NHS/HSC organisations in Northern Ireland and Scotland?
HRA and HCRW Approval does not apply to NHS/HSC organisations within Northern Ireland and Scotland.

If you indicated in your IRAS form that you do have participating organisations in either of these devolved administrations, the final document set and the study wide governance report (including this letter) have been sent to the coordinating centre of each participating nation. The relevant national coordinating function/s will contact you as appropriate.

Please see IRAS Help for information on working with NHS/HSC organisations in Northern Ireland and Scotland.

How should I work with participating non-NHS organisations?
HRA and HCRW Approval does not apply to non-NHS organisations. You should work with your non-NHS organisations to obtain local agreement in accordance with their procedures.

What are my notification responsibilities during the study?

The standard conditions document "*After Ethical Review – guidance for sponsors and investigators*", issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

Who should I contact for further information?
Please do not hesitate to contact me for assistance with this application. My contact details are below.

Your IRAS project ID is **293839**. Please quote this on all correspondence.

Yours sincerely,
Sue Byng

Approvals Specialist

Email: HCRW.approvals@wales.nhs.uk

Copy to: *Jean Uniacke*

IRAS project ID	293839

Information to support study set up

The below provides all parties with information to support the arranging and confirming of capacity and capability with participating NHS organisations in England and Wales. This is intended to be an accurate reflection of the study at the time of issue of this letter.

Types of participating NHS organisation	Expectations related to confirmation of capacity and capability	Agreement to be used	Funding arrangements	Oversight expectations	HR Good Practice Resource Pack expectations
There are two site types participating in the study **Site Type 1** and **Site Type 2**. **Site Type 1** –Will arrange identification of eligible participants and send out PIS and invitations **Site Type 2** –Will identify eligible participants through prospective clinic visits	Research activities should not commence at participating NHS organisations in England or Wales prior to their formal confirmation of capacity and capability to deliver the study.	An Organisation Information Document has been submitted and the sponsor is not requesting and does not expect any other site agreement to be used.	No external funding has been sought No study funding will be provided to sites as per the Organisational Information Document	A Principal Investigator should be appointed at study sites.	No Honorary Research Contracts, Letters of Access or pre-engagement checks are expected for local staff employed by the participating NHS organisations. Where arrangements are not already in place, research staff not employed by the NHS host organisation undertaking any of the research activities listed in the research application would be expected to obtain a Letter of Access based on standard DBS checks and occupational health clearance.

Other information to aid study set-up and delivery

This details any other information that may be helpful to sponsors and participating NHS organisations in England and Wales in study set-up.
The applicant has indicated that they do not intend to apply for inclusion on the NIHR CRN Portfolio.

List of Documents

The final document set assessed and approved by HRA and HCRW Approval is listed below.

Document	*Version*	*Date*
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Sponsor indemnity]		09 February 2022
Interview schedules or topic guides for participants [topic guide A]	4	14 March 2022
Interview schedules or topic guides for participants [topic guide B]	3	14 March 2022
IRAS Application Form [IRAS_Form_01032022]		01 March 2022
Letters of invitation to participant	3	09 February 2022
Organisation Information Document [OID]	3	09 February 2022
Other [public indemnity]	1	09 February 2022
Participant consent form [Consent verbal script]	3	14 March 2022
Participant information sheet (PIS)	6	14 March 2022
Research protocol or project proposal [Literature review and research protocol]	8	09 February 2022
Schedule of Events or SoECAT [SOE]	2	09 February 2022
Summary CV for Chief Investigator (CI)		29 October 2021
Summary CV for student [Student CV]		31 December 2021

Appendix B Participant's Information Sheet

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Participant Information Leaflet

Study Title: Patients' Views and Experiences of Genetic Testing in Amelogenesis Imperfecta

We invite you to take part in a research study

- Before you decide whether to take part, it is important you understand why the research is being done and what it will involve
- You are free to decide whether to take part in this study. You can stop taking part in the study at any time.
- Any information you provide will be treated as confidential.
- If you have any questions or would like more information, please contact us.

Important things that you need to know

- We want to find out about your experience following your child's genetic testing
- We want to know what your overall thoughts on genetic testing are, including your expectations and any concerns
- Take your time to decide whether you wish to take part in a virtual interview and online survey
- You can stop taking part at any time

Contents

1. Why are we doing this study?
2. Why have I been invited to take part?
3. Who is doing the study?
4. Do I have to take part?
5. What will be involved if I take part in this study?
6. What are the possible benefits and disadvantages of taking part?
7. Can I withdraw from the study at any time?
8. Will the information obtained in the study be confidential?
9. What will happen to the results of the study?
10. Who has reviewed this study?
11. What next?

How to contact us

If you have any questions about this study, please contact Clare Skinner who is Head of Research Governance and Integrity at University of Leeds.
Email: C.E.Skinner@leeds.ac.uk

UNIVERSITY OF LEEDS

1. Why are we doing this study?

We are keen to find out what are parents' overall thoughts and experiences after studying their inheriting pattern of amelogenesis imperfecta through a test (genetic test). We also want to identify on what information may be important to them and their child to help better understand their condition. The overall aim of the research is to explore families experiences and thoughts of genetic testing in AI. We also want to identify any concerns or barriers families may have towards genetic testing.

2. Why have I been invited to take part?

We have invited you to take part in this study because you are a parent of child who has had opted for a test (NHS targeted 21-gene test) that aimed to help understand the transmission pattern of amelogenesis imperfecta. We want to interview up to 30 parents/carers on an online platform (Zoom).

3. Who is doing the study?

The study is being organised by Raghad Al Attal, who is a postgraduate student in Paediatric Dentistry at the University of Leeds, School of Dentistry. The researcher will be under the supervision of Dr Richard Balmer, Dr Alan Mighell, and Dr Kate Kenny from School of Dentistry at the University of Leeds. Funding to support this study was awarded by the Royal College of Surgeons, Faculty of Dentistry Research Fellowship.

4. Do I have to take part?

No, it's up to you to decide and it is your choice. If you choose not to take part, it will not affect any treatment or care your child will have in the future. Neither will it affect any other research study you are involved in.

5. What will be involved if I take part in this study?

If you do choose to take part, you will need to sign a consent form to say you agree.
You can still change your mind at any time after this and you don't need to explain your reason. The research study will involve a member of our team who will discuss your overall thoughts and experiences after opting for a test (NHS targeted 21-gene test) which tried identifying your inheritance pattern of amelogenesis imperfecta. You will only be interviewed once. The interview will be online on one of the virtual platforms at any convenient for you. The interview can last as long as you wish, but on average will last between 20-40 minutes. We will record the interview so that we can remember what is said, but all answers will be private, and we will not use your name.

6. What are the possible benefits and disadvantages of taking part?

Although this study will not benefit either you or your child directly, we hope that it will help other families and the public who are concerned about genetic testing. There are no risks to you from taking part in the study.

7. Can I withdraw from the study at any time?

You are free to withdraw from the study at any time, and do not have to give a reason. However, any data which has been analysed up to that point will be used in the study.

8. Will the information obtained in the study be confidential?

The University of Leeds will use your name and contact details to contact you about the research study, and make sure that relevant information about the study is recorded and to oversee the quality of the study. Individuals from the University of Leeds and regulatory organisations may look at your dental and research records to check the accuracy of the research study. Your dental clinic will pass these details to the University of Leeds along with the information collected from you and your child's dental records. The only people in the University of Leeds who will have access to information that identifies you will be people who need to contact you to check or audit the data collection process. The people who assist in the analysis of the information will not be able to identify you and will not be able to find out your name or other contact details.
The University of Leeds will keep identifiable information about you from this study for 5 years after the study has finished.

9. What will happen to the results of the study?

University of Leeds is the sponsor for this study. We will be using information from you in order to undertake the study and will act as data controller for this study. This means that we are responsible for looking after your information and using it properly. University of Leeds will keep identifiable information about you for up to 5 years after the study has finished.
Your rights to access, change or move your information are limited, as we need to manage your information in specific ways if order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally-identifiable information possible. You can find out more about how we use your information at: http://www.leeds.ac.uk/secretariat/data_protection.html.

The information collected will be uploaded to the University of Leeds research database. The information that is uploaded will all be anonymous. The results will be published in a scientific journal, and we may use quotes from your interview, but we will not use your name on anything. We will let all the parents who took part in the project know about what we found out.

10. Who has reviewed this study?

This research has been looked at by an independent group of people, called a Research Ethics Committee. Their role is to look after your interests.

11. What next?

If you would like to take part, would like more information or have any questions or concerns about the study, please contact Clare Skinner who is Head of Research Governance and Integrity at University of Leeds. Email: C.E.Skinner@leeds.ac.uk

Appendix C Verbal Consent Script

Verbal Consent Script

Participant Identification Number:

Hello, I'm currently a researcher in the department of Paediatric dentistry. I would like first to thank you for your time and agreeing to take part in my study. I want to kindly ask you to confirm that you have read and understood the Participant Information Sheet (PIS) provided earlier. Do you have any questions on the PIS or your participation today?

Before starting the interview, I want to obtain your verbal consent which will be audio recorded as well as your interview. Are you happy that I start my audio recording now?

In my study, I want to explore your and other families' experience (if their child has done the test) and thoughts of genetic testing which has been offered to your child. I want to confirm that you are aware of and agree to the following points:

- ☐ You have read and understood the Participant Information Sheet for my study. Also, have had the opportunity to consider the information given, ask questions, and have had these answered satisfactorily.

- ☐ Your participation is voluntary, and you are free to withdraw at any time without giving any reason, and without your child's dental care, participation in other research studies or legal rights being affected.

- ☐ You are aware that audio recordings will be made. Your recordings will be shared with transcription services without your name or your personal details, and only for the purpose of transcribing. Transcription services are governed by a data processing agreement and are approved by the University of Leeds for that purpose.

- ☐ You understand that any information obtained will be used for research purposes only. This will include research publications. Anonymity and confidentiality will be preserved at all times.

- ☐ The purpose for which recordings and transcriptions will be used has been explained in terms that you have understood.

(Participant will confirm each point verbally by saying "Yes" or I agree")

After confirming all the above, do you agree to start our interview?

Let's start

Appendix D Topic Guide A

Topic Guide A – Interviews

Consent will be obtained verbally from the parent taking part in the study and audio recorded just before starting the interview.

Interview draft and points of discussion

Hi. I'm a postgraduate student. I'm calling you as you kindly agreed to take part in my study and do the interview. I would like to discuss your overall thoughts of genetic testing that can confirm your child's diagnosis with Amelogenesis Imperfecta (AGI).
I will be doing the interview with you. Is this a good time to talk?

If no: OK no problem, when would be convenient for me to call you back?
If yes: OK great.

As you know, we are planning to record this meeting so I can listen instead of taking notes, and so that we make sure we understand everything you say correctly. Is that ok?

If yes: proceed with interview.

The following interview questions will be for participants who agreed to opt-in for the NHS targeted 21-gene panel test

Opening Questions

1. To start, could you tell me a little bit about yourself and your family including ethnicity, socioeconomic status?
2. Can you describe your experience of being invited to participate in the NHS 21-gene panel test for AGI?
    - What were your initial thoughts and feelings about it?
    - How was the process explained to you?

Understanding of AGI and Diagnosis Process

3. Can you tell me about any previous diagnoses your child received regarding their condition before considering genetic testing?
    - How clear or helpful was this diagnosis in explaining your child's symptoms (e.g., tooth discoloration or poor enamel quality)?
    - What, if anything, was missing from this initial diagnosis?

Expectations and Perceptions of Genetic Testing

4. What were your expectations before receiving the genetic test results?
    - What were you hoping to learn?
    - How did you feel about the potential findings?
5. What is your understanding of how your child's genetic information will be used?
    - Do you feel you have a clear understanding of where this information will be stored and who will have access to it?
    - Have you been given enough information about the implications of genetic data storage?

Decision-Making Process and Motivations

6. Can you describe the main reasons why you decided to proceed with genetic testing for your child?
    - Were there specific factors that influenced your decision?
    - Did anyone (e.g., family, doctors, community) play a role in your decision?
7. Were there any concerns or hesitations you had before undergoing the genetic test?
    - Were you concerned about insurance coverage?
    - Did you feel anxious about the potential results?
    - Were there any concerns about long hospital visits or waiting times?

Impact of Genetic Testing on You and Your Family

8. Now that you have undergone genetic testing, what was the most valuable outcome for you?
    - Did the test provide a clearer diagnosis for your child?
    - Has it changed how you explain the condition to your child or others?
    - Do you think the results have influenced or improved your child's care?
    - Has it helped you adapt to the condition better?
9. After receiving the test results, what kind of support or resources do you think would have been helpful?
    - Would access to support groups or connecting with families in a similar situation be beneficial?
    - Did the test results bring you a sense of relief or additional concerns?
10. Do you feel the information you received from your genetic test results was sufficient?

- If not, what additional information would you have liked to receive?

Future Implications and Perspectives on Genetic Testing

11. Based on your experience, what do you think about integrating genetic testing into routine dental care for children with suspected AGI?

- Do you think it should be a standard diagnostic tool?

12. Do you have any concerns about your child's genetic information being stored in their medical records?

- How do you feel about its availability for NHS research?
- Do you have any thoughts on data security and privacy?

13. How do you feel genetic testing for AGI fits into family planning?

- Do you think knowing the genetic nature of AGI is useful for future family planning decisions?

14. How do you feel about sharing the genetic information with other family members who might carry the same affected gene?

- Have you discussed it with them? If so, what was their reaction?

Feedback on the Testing Process and Information Provided

15. What was your experience of receiving the test results?

- Do you think the results were communicated in a way that was clear and easy to understand?
- Is there anything that could have been improved in how the results were delivered?

16. We are developing informational leaflets for parents considering genetic testing for AGI.

- What key information do you think should be included to help parents better understand the process?
- What would have been helpful for you at the time of making your decision?

Closing and Next Steps

17. Is there anything else you would like to share about your experience with genetic testing?
18. Is there anything I haven't asked that you think is important for me to know?

Ending:

- Thank the participant for their time and contribution.
- Reassure them about confidentiality and data protection.
- Explain to contact the researcher through email in case they have further thoughts or concerns.

Appendix E Topic Guide B

Topic Guide B – Interviews

Consent will be obtained verbally from the parent taking part in the study and audio recorded just before starting the interview.

Interview draft and points of discussion

Hi. I'm a postgraduate student. I'm calling you as you kindly agreed to take part in my study and do the interview. I would like to discuss your overall thoughts of genetic testing that can confirm your child's diagnosis with Amelogenesis Imperfecta (AGI).
I will be doing the interview with you. Is this a good time to talk?

If no: OK no problem, when would be convenient for me to call you back?
If yes: OK great.

As you know, we are planning to tape record this meeting so I can listen instead of taking notes, and so that we make sure we understand everything you say correctly. Is that ok?

If yes: proceed with interview. Wonderful. I'm going to ask you some questions about your general thoughts of genetic testing as the NHS panel genetic test for AGI. I would like to remind you that a genetic test is a test that intends to find out any changes in your DNA (blueprint of your body).
From there, I would like to discuss your feelings
after declining for the test
Does that sound OK?

The following interview questions will be for participants who declined the NHS targeted 21-gene panel test

Before we start, did you have a chance to read the information sheet about the study that we sent you? Do you have any questions about the information sheet you were sent or anything else relating to this study?

Opening Questions

1. To begin, could you tell me a little bit about yourself and your family?
2. Can you describe how you were invited to participate in the NHS 21-gene panel test for AGI?
    - How did you first learn about the test?
    - What were your initial thoughts and feelings about it?

Experiences with Diagnosis and Referral

3. What were the most important outcomes for you after being referred to the AGI clinic at our institute?
    - How did this referral impact your understanding of your child's condition?
    - In what ways, if any, did it change the care or support you received?

Decision-Making and Concerns about Genetic Testing

4. What were the main concerns or challenges that influenced your decision **not** to opt for molecular gene testing?
    - Did factors such as insurance coverage, privacy concerns, or long hospital visits affect your decision?
    - How do you feel about discussing inherited conditions within your family?
    - Was sharing this information with family members a consideration in your decision?
5. What are your thoughts on the possibility of genetic testing results being stored in your child's medical records and available for NHS research?
    - Do you have any concerns about data security and privacy?
    - Would knowing more about how the data is stored and used influence your decision?

Perceptions of Genetic Testing and AGI Inheritance

6. In your view, what are the potential benefits of undergoing a genetic test for AGI?
    - Do you think it could help in reaching a more definitive diagnosis?

- How do you think it might help you better understand the inheritance pattern of AGI?
- In what ways do you think genetic testing could improve your child's care or treatment options?

Expectations and Emotional Impact

7. If you were to participate in genetic testing, what kind of support or resources would be most helpful for you?
   - Would access to support groups for families with similar experiences be beneficial?
   - How do you think participating in genetic testing might affect your feelings of relief or concern?
   - What would help you feel more comfortable or confident about the decision to undergo testing?
8. If you haven't opted for the gene test yet, what factors might encourage you to consider it in the future?
   - What kind of information or assurances would you need to make a decision?

Perspectives on Genetic Testing in Dental Care

9. From your perspective, do you think genetic testing should be incorporated into routine dental care for individuals with suspected AGI?
   - What potential benefits or challenges do you see in making it a standard diagnostic tool?

Improving Patient Information and Support

10. We are developing leaflets to provide more information about genetic testing for AGI.

- What information do you think is most important for parents considering genetic testing?
- What kind of resources would have been helpful for you when making your decision?
- Do you think having clearer information might encourage more families to opt for the test?

Closing and Next Steps

11. Is there anything else you would like to share about your experience with genetic testing or AGI?
12. Do you have any thoughts or suggestions for improving the way genetic testing is offered and explained to families?

Ending:

- Thank the participant for their time and insights.
- Reassure them about confidentiality and data protection.
- Explain the next steps and provide contact information in case they have further questions.

Appendix F Genes' list tested under R340 Amelogenesis imperfecta

Entity Name	Entity type	Gene Symbol	Sources(; separated)
ACP4	gene	ACP4	Expert Review Green;Other
AMBN	gene	AMBN	Expert Review Green;Other;Radboud University Medical Center, Nijmegen
AMELX	gene	AMELX	Expert Review Green;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
C4orf26	gene	C4orf26	Expert Review Green;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
CNNM4	gene	CNNM4	Expert Review Green;Other;Emory Genetics Laboratory
COL17A1	gene	COL17A1	Expert Review Green;UKGTN;Eligibility statement prior genetic testing
DLX3	gene	DLX3	Expert Review Green;Illumina TruGenome Clinical Sequencing Services;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
ENAM	gene	ENAM	Expert Review Green;Illumina TruGenome Clinical Sequencing Services;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
FAM20A	gene	FAM20A	Expert Review Green;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
FAM20C	gene	FAM20C	Expert Review Green;UKGTN;Eligibility statement prior genetic testing
FAM83H	gene	FAM83H	Expert Review Green;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
GPR68	gene	GPR68	Expert Review Green;UKGTN;Eligibility statement prior genetic testing
ITGB6	gene	ITGB6	Expert Review Green;Radboud University Medical Center, Nijmegen;Other
KLK4	gene	KLK4	Expert Review Green;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
LAMA3	gene	LAMA3	Expert Review Green;UKGTN;Eligibility statement prior genetic testing
LAMB3	gene	LAMB3	Expert Review Green;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
LTBP3	gene	LTBP3	Expert Review Green;UKGTN;Eligibility statement prior genetic testing;Other
MMP20	gene	MMP20	Expert Review Green;Illumina TruGenome Clinical Sequencing Services;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
ORAI1	gene	ORAI1	Expert Review Green;UKGTN
PEX1	gene	PEX1	Expert Review Green;UKGTN;Eligibility statement prior genetic testing
PEX26	gene	PEX26	NHS GMS;Expert Review Green;Expert Review;Literature
PEX6	gene	PEX6	NHS GMS;Expert Review Green;UKGTN;Eligibility statement prior genetic testing
RELT	gene	RELT	Expert Review Green;Literature
ROGDI	gene	ROGDI	Expert Review Green;Other
SLC10A7	gene	SLC10A7	Expert Review Green;Literature
SLC13A5	gene	SLC13A5	Expert Review Green;Literature
SLC24A4	gene	SLC24A4	Expert Review Green;Radboud University Medical Center, Nijmegen;Other
SP6	gene	SP6	NHS GMS;Expert Review Green;Literature
STIM1	gene	STIM1	Expert Review Green;UKGTN;Eligibility statement prior genetic testing
WDR72	gene	WDR72	Expert Review Green;Illumina TruGenome Clinical Sequencing Services;UKGTN;Radboud University Medical Center, Nijmegen;Eligibility statement prior genetic testing
AMTN	gene	AMTN	Expert Review Amber;Literature
CLDN16	gene	CLDN16	Expert Review Amber;Literature
CLDN19	gene	CLDN19	Expert Review Amber;Literature
ITGB4	gene	ITGB4	Expert Review Amber;UKGTN;Eligibility statement prior genetic testing
LAMC2	gene	LAMC2	Expert Review Amber;UKGTN;Eligibility statement prior genetic testing
KCNJ1	gene	KCNJ1	Literature
SMARCD2	gene	SMARCD2	Other
TMEM165	gene	TMEM165	Other
TP63	gene	TP63	Literature
TUFT1	gene	TUFT1	Other