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"Resin Veneers For Amelogenesis Imperfecta: Aesthetic Rehabilitation And 10-Year Follow-Up On Veneer Longevity And Replacement".

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Abstract
Introduction
Amelogenesis Imperfecta (AI) is a rare genetic disorder that affects enamel development, resulting in structural weakness, discoloration, and significant aesthetic concerns. Composite resin veneers provide a conservative and cost-effective approach to managing AI-related enamel defects.
Case Presentation
This case report presents the aesthetic and functional rehabilitation of a 33-year-old female with hypoplastic AI, undergoing her third set of composite resin veneers. The patient initially sought treatment due to severe enamel loss, discoloration, and dental sensitivity. Over a 10-year follow-up, multiple veneer replacements were performed, primarily due to wear, staining, and marginal deterioration. Despite these challenges, composite veneers remained a viable and minimally invasive treatment option, with the latest restorations demonstrating improved retention and aesthetics due to enhanced adhesive protocols and material selection.
Conclusion
Composite veneers can offer a conservative, straightforward, and cost-effective solution for patients with hypoplastic AI. Long-term follow-up and individualized care are essential to optimize outcomes.
Keywords: *Amelogenesis Imperfecta, Resin Veneers, Esthetic restoration*

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I. Introduction

Amelogenesis Imperfecta (AI) is a rare inherited disorder affecting enamel formation without systemic involvement. It is classified into four main types, hypoplastic, hypomaturation, hypocalcified, and mixed with 20 subtypes determined by genetic inheritance (X-linked, autosomal dominant, or recessive). AI leads to thin, weak, or mineral-deficient enamel, with severity depending on the affected gene and mutation type. Mutations in amelogenin, enamelin, and kallikrein-4 are commonly associated with AI, along with other genes essential for enamel development[1,2].

Beyond dental challenges, AI has a significant psychological impact. Patients often experience low self-esteem, social anxiety, and emotional distress due to discoloration, enamel fragility, and aesthetic concerns[3]. Many struggle with reluctance to smile and social interactions, particularly in adolescence. As a result, effective management of AI should address both restorative treatment and psychological support to improve patients' overall well-being.

II. Materials And Methods

The patient presented to the dental practice seeking replacement of her composite resin veneers, expressing concerns about her appearance and self-confidence. She reported a history of Amelogenesis Imperfecta (AI) and stated that the current set of veneers was her second. Her first set was placed at 15 years old and lasted 10 years before being replaced at age 25 with the veneers she currently wears.

Regarding her medical history, the patient reported being in good overall health, aside from having Grave's disease (hyperparathyroidism). She denied any other systemic conditions. When asked about a family history of similar dental issues, she stated that no other relatives were affected. She also reported a normal birth process, with no complications such as preterm birth, maternal illness, or neonatal interventions. Additionally, she did not experience systemic diseases during childhood but noted that her teeth were more sensitive before veneer placement.

It is noteworthy that the patient has lived her entire life in a suburban region of northern Greece, an area known for its agricultural activity and elevated pesticide levels in local water supplies.

Diagnostic Assessment

Clinical examination revealed generalized enamel thinning, pitting, and irregular translucency. The teeth appeared yellow-brown with visible dentin exposure in some areas. Sensitivity tests confirmed mild to moderate response to cold stimuli. Radiographic imaging showed normal root and pulp morphology, with reduced enamel radiodensity consistent with hypoplastic AI. Genetic testing was not performed, but diagnosis was made based on phenotype and clinical history. Differential diagnoses such as fluorosis and enamel hypoplasia of environmental origin were excluded based on medical and geographic history.

Therapeutic Intervention

At age 15, the patient underwent initial veneer placement using a conventional total-etch technique with a microhybrid composite material. Veneers were applied to both the anterior maxillary and mandibular teeth. Due to adhesive degradation and marginal breakdown over time, the restorations were replaced at age 25 with nanohybrid composites, employing a selective-etch protocol alongside a universal bonding system.

The most recent restorative intervention utilized the injection molding technique, guided by a translucent mock-up fabricated from a digitally designed wax-up. An advanced injectable composite resin (G-ænial Injectable Flow, GC, shade A1) was used to achieve high precision and enhanced aesthetics. Prior to injection, the enamel surfaces were etched with 35% phosphoric acid for 15 seconds, followed by the application of a universal adhesive (Scotchbond Universal). The composite material was injected directly into the mock-up, ensuring consistent morphology and optimal adaptation. Rubber dam isolation was maintained throughout the procedure to ensure moisture control. Finishing and polishing were performed using a multi-step disc system and diamond-impregnated polishers, with final occlusal adjustments made to minimize functional stress.

Key steps to achieve optimal bonding in teeth affected by Amelogenesis Imperfecta included:

- Enamel surface roughening with fine-grit diamond burs to enhance micromechanical retention.
- Application of self-etch primers in severely hypomineralized enamel regions to avoid over-etching.
- Use of a dual-cure adhesive system to ensure adequate polymerization in areas of reduced enamel translucency.
- Application of glycerin gel during final light curing to prevent oxygen-inhibited layer formation and enhance surface hardness.

III. Results

The patient was reviewed at 1 month, 6 months, and annually. The first and second sets of veneers showed common failure patterns, marginal staining, loss of surface gloss, and occasional chipping. However, the third set has remained functionally and aesthetically stable for over three years, with only minor polish touch-ups required. The patient reported significantly improved confidence and no further sensitivity. Photographic documentation at each follow-up confirmed good color stability, marginal integrity, and anatomical preservation.

IV. Discussion

Amelogenesis Imperfecta (AI) is a rare yet genetically diverse disorder that affects enamel formation in both primary and permanent teeth. Its prevalence varies significantly, from 1 in 718 in northern Sweden to 1 in 14,000 in the USA. First described by Weinmann et al. in 1945, AI has undergone multiple classification revisions as knowledge of the condition has expanded.

The most recent classification by Witkop categorizes AI into four main types based on phenotype:

- Type I: Hypoplastic
- Type II: Hypomaturation
- Type III: Hypocalcified
- Type IV: Combined variants with taurodontism

Each type is further divided into 15 subtypes according to appearance and inheritance pattern (autosomal dominant, autosomal recessive, and X-linked dominant or recessive) as it is described in Table 1. However, phenotypic variability is common, even among family members. In some cases, AI occurs spontaneously without

a family history. Given the potential for recessive inheritance and incomplete penetrance of dominant genes, a thorough patient assessment is essential.

Amelogenesis Imperfecta (AI) is a heterogeneous group of inherited disorders characterized by defects in the formation of enamel. These defects may manifest as abnormalities in enamel thickness, translucency, mineralization, or texture, depending on the underlying genetic mutation[1,2]. The condition can affect both primary and permanent dentition, with symptoms including enamel fragility, discoloration, and early tooth loss[4].

The management of AI is particularly challenging due to the compromised bonding substrate. Enamel bonding is critical for adhesive restorations; however, AI-affected enamel may exhibit reduced mineral content and prism irregularities, making it less responsive to etching and more prone to debonding over time[5,6]. In some cases, bonding to dentin becomes necessary, which requires careful technique and appropriate material selection.

Numerous restorative options exist for patients with AI, ranging from preventive interventions to full-coverage crowns. The decision depends on patient age, severity of enamel defect, aesthetic needs, and economic factors. In younger patients, direct composite restorations and veneers are often preferred due to their conservative nature and reparability[7].

A 2020 systematic review by Lopes et al. emphasized the importance of early diagnosis and the use of minimally invasive techniques to reduce the restorative burden over a patient's lifetime[8]. Composite resin veneers, when placed with proper adhesive protocols, can provide satisfactory aesthetics and function, although their long-term durability is limited compared to ceramics[9].

Studies have shown that composite veneers in AI patients generally require replacement every 5–7 years due to marginal breakdown, color change, and wear[6,10]. However, advancements in nanohybrid composites and universal adhesives have improved bonding to irregular enamel and reduced failure rates[11].

Ceramic veneers and crowns offer enhanced aesthetics and wear resistance but require greater tooth reduction and may not be suitable for young patients with large pulp chambers or limited enamel for bonding[12]. A case series by Rao et al. (2019) reported a 90% survival rate of ceramic veneers in AI patients over a 5-year period, with most failures due to debonding or chipping[13].

Regardless of the material, long-term success in AI patients hinges on meticulous bonding protocols, strict moisture control, occlusal planning, and regular follow-up. Multidisciplinary collaboration including prosthodontists, pediatric dentists, and orthodontists is often required, particularly in patients with altered vertical dimension or associated skeletal discrepancies[14,15]. The comparison between composite veneers and ceramic veneers in patients with Amelogenesis Imperfecta is described in Table 2.

V. Conclusion

Amelogenesis Imperfecta (AI) is a complex hereditary condition that demands individualized, well-planned restorative care. This case highlights how direct composite resin veneers, when placed using updated adhesive protocols and high-quality nanohybrid materials, can achieve excellent aesthetic and functional outcomes in AI patients. While composite veneers may not match the longevity of ceramic alternatives, they offer a conservative, reparable, and cost-effective solution particularly valuable for young adults or patients with compromised enamel.

Over a 10-year follow-up, the patient's experience underscores the importance of regular monitoring, material advancements, and refined clinical technique in prolonging restoration survival. Improvements in adhesive systems, surface preparation methods, and clinician awareness of AI-specific bonding challenges have significantly enhanced the long-term performance of composite restorations.

This case reinforces the growing body of evidence supporting composite veneers as a viable option in managing hypoplastic AI, especially when combined with personalized care and ongoing maintenance.

Ethical Approval and Patient Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

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Table 1: Witkop Classification of Amelogenesis Imperfecta

Type 1 - Hypoplastic		
IA	Hypoplastic Pitted	autosomal dominant
IB	Hypoplastic Local	autosomal dominant
IC	Hypoplastic Local	autosomal recessive
ID	Hypoplastic Smooth	autosomal dominant
IE	Hypoplastic Smooth	x-linked
IF	Hypoplastic Rough	autosomal dominant
IG	Enamel Agenesis	autosomal recessive
Type 2 - Hypomaturation		
IIA	Hypomaturation Pigmented	autosomal recessive
IIB	Hypomaturation	
IIC	Snow capped	x-linked
IID	Snow capped	autosomal dominant
Type 3 - Hypomineralized		
IIIA	Hypomineralized	autosomal dominant
IIIB	Hypomineralized	autosomal recessive
Type 4 - Hypomatured Hypoplastic with taurodontism		
IVA Hypomatured/Hypoplastic with taurodontism		autosomal dominant
IVB Hypoplastic/Hypomatured with taurodontism		autosomal recessive

Table 2. Comparison of Composite and Ceramic Veneers in AI Patients

Feature	Composite Veneers	Ceramic Veneers
Aesthetic quality	Good, moderate translucency	Excellent, superior translucency
Invasiveness	Minimally invasive	Moderately invasive
Longevity	5-7 years (average)	10-15 years(average)
Reparability	Easily repairable	Difficult to repair
Cost	Lower	Higher
Bond Strength in AI	Variable, depends on enamel quality	Generally better with enamel but limited with dentin
Technique sensitivity	Moderate	High
Suitable for young patients	Yes	Limited (due to pulp size, enamel thickness)

Figure 1: Second set of resin veneers.

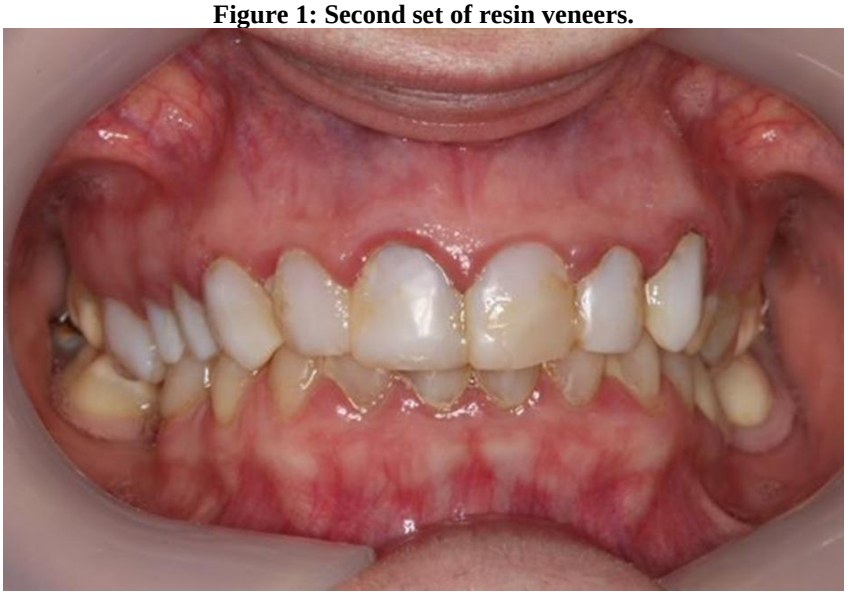

Figure 2: Teeth after removal of second set of resin veneers, AI clinical image.

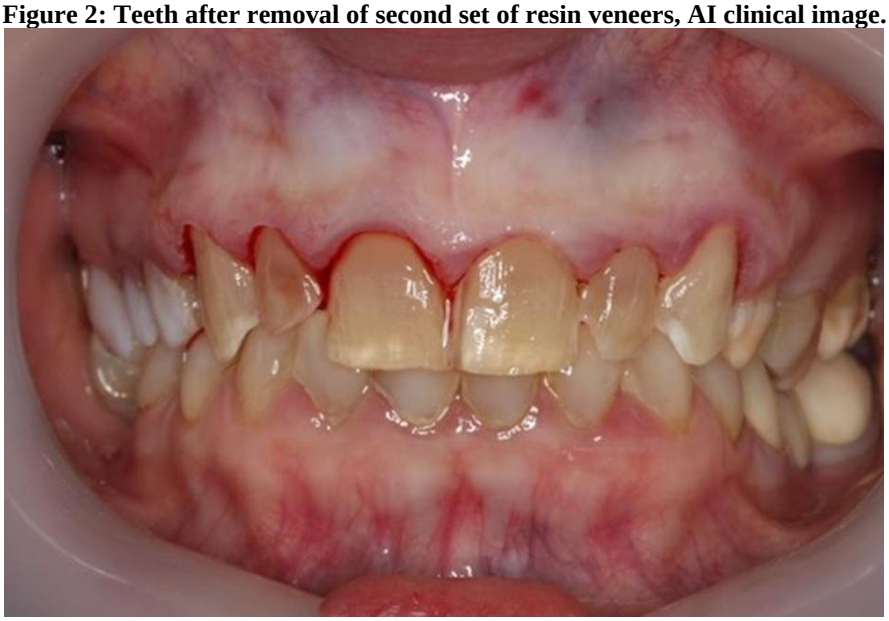

Figure 3: Third set of resin veneers.

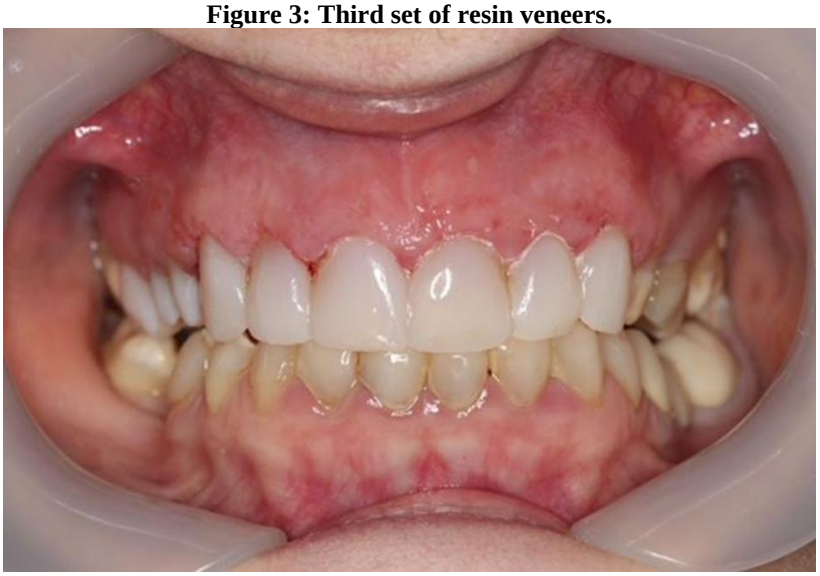

Figure 4: Panoramic X-ray of the patient with resin veneers.