

# Dental Rehabilitation of Patients with Amelogenesis Imperfecta using Zirconia Crowns, Stainless Steel Crowns, and Composite Veneers: A Case Report

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## Abstract

Amelogenesis imperfecta (AI) is related to a group of developmental tooth abnormalities (also referred as hereditary dysplasia), which affect the genome of the individual and retard at least one of the stages of enamel formation. AI is, in general, a hereditary disorder with clinical impact on both deciduous and permanent teeth. Patients with AI often complain of tooth sensitivity, difficulty in chewing, self-consciousness about the appearance of their teeth, and an anterior open bite. We present a case report of AI (hypocalcified), which was diagnosed based on classical clinical and radiographic features.

**Key words:** Amelogenesis imperfecta, Composite, Esthetics, Stainless steel crowns, Zirconia crowns

## INTRODUCTION

Amelogenesis imperfecta (AI) is a group of inherited disorders characterized by abnormal or incomplete formation of the dental enamel; it manifests itself in both the primary and the permanent dentition. Estimates of the prevalence of AI appear to vary from one population to another. A Swedish study arrived at the conclusion that one out of every 700 individuals is affected by AI, while a study conducted in North America determined that it affects one person out of every 14,000 individuals.<sup>1</sup> Patients with AI are frequently complain of tooth sensitivity. Anterior open bite frequently occurs as a consequence of AI.

Four types of AI have been identified, and they are classified according to the phenotypes associated with them. Type I is characterized by hypoplastic enamel;

the enamel that is present is well mineralized, but the amount of enamel present is less than normal. Type II is characterized by hypomineralized enamel; its most noticeable feature is discolored enamel. Hypomineralized enamel can appear brown, yellow, or mottled. Type III is characterized by hypocalcified enamel; the enamel is dark and so soft that it is easily scraped by the instruments used in dental prophylaxis. Type IV is characterized by dental enamel that is both hypomatured and hypoplastic. By far, the most common type of AI is the hypoplastic type, which accounts more than 60% of cases. The hypomaturational type accounts for at least 20% of cases, and 7% of cases of AI are of the hypocalcified type.<sup>1</sup>

Inheritance patterns of AI can be autosomal dominant, autosomal recessive, or X-linked. Haldane identified AI as the first dominant X-linked trait found in humans.<sup>2</sup> While AI affects both sexes, its presentation in males is different from that in females. Schulze and Lenz (1952) noted that hypoplastic AI tends to present as uniform hypoplasia in males. Whereas in females, the hypoplasia appears as vertical ridges in the dental enamel.<sup>3</sup> Likewise, in males with hypomaturational type AI, the mottling of tooth enamel is present all over the tooth, but in affected females, the mottling occurs in vertical bands and is less noticeable than

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the mottling in the teeth of affected males. These findings are consistent with the Lyon hypothesis.<sup>4</sup>

All types of AI present substantial challenges from the perspective of dental care and orthodontics. Patients with AI usually have tooth sensitivity that makes everyday maintenance of dental hygiene even more difficult. Manifestations such as decreased occlusal vertical dimension and anterior open bite can make chewing difficult; because of these orthodontic factors and because of the tooth sensitivity, some patients with AI avoid eating hard foods.<sup>5</sup> Other complications of AI can include congenitally missing teeth, impacted teeth, root and crown resorption, abnormal root formation, pulpal calcification, and taurodontism.<sup>6</sup>

Despite these problems that can arise from AI, the concerns that lead many parents of children with AI to seek treatment for the condition are esthetic ones. The abnormalities associated with AI are so noticeable and so troubling to affected children and their parents that early and radical interventions should be done as early as possible on early mixed dentition to reduce tooth sensitivity, restore normal chewing function, and improve the esthetic appearance of the teeth to minimize negative social consequences.<sup>7</sup>

## CASE REPORT

An 8-year-old male reported to the Pediatric Dentistry Department at King Abdulaziz University Dental Hospital with the chief complaint of yellowish discoloration of his primary and permanent teeth, which manifested thermal sensitivity and bad breath. A detailed medical, dental, and social history was obtained. The patient was examined dentally and medically. However, medical history and family history were unremarkable.

Clinically, the child's oral hygiene was unsatisfactory, he brushes his teeth irregularly, and he exhibited chronic marginal gingivitis. Clinical examination also showed that enamel thickness of all teeth was reduced, and in some teeth, dentin was exposed. The teeth had dark yellowish discoloration with severe anterior open bite (Figure 1a-e). Radiographic investigation included an orthopantomogram done (Figure 2).

### Treatment Objectives

The treatment objectives were to improve the esthetics, eliminate the tooth sensitivity, prevent further loss of tooth structure, modify the child's attitude and behavior toward dental treatment, and improve his periodontal health by using a model to demonstrate proper brushing techniques to the patient and his family.

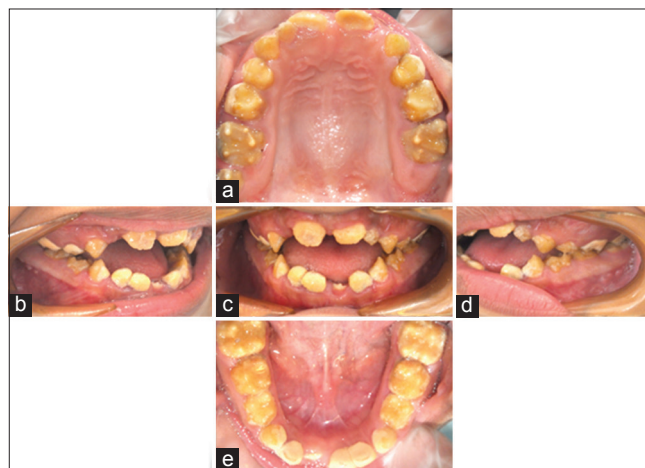
### Treatment Plan

The parents were informed of the diagnosis, and all the treatment modalities were discussed with them. As part of the treatment plan, the treatment alternatives were explained to the child and his parents. This included the amount of tooth structure that needs to be removed, the expected clinical longevity of the restorations, and the length of the treatment period. After considering all the treatment options, it was decided to place direct composite veneers (3M™ ESPE™ Filtek™ Z250 universal restorative) on the permanent lower and upper incisors, zirconia crowns (NuSmile) on the primary molars and canines, and stainless steel crowns (SSCs) (3M™ ESPE™) on the 1<sup>st</sup> permanent molars. After completing the dental rehabilitation, the patient will be referred to an orthodontist.

### Clinical Managements

Initial periodontal therapy consisted of oral prophylaxis and oral hygiene instructions, scaling, and root planing.

A universal restorative composite was chosen to restore the defective tooth structure of the permanent incisors. No preparations were performed on the incisors, other than cleaning with a rotary bristle brush with pumice



**Figure 1: (a-e) Pre-operative clinical picture showing irregular dark yellow-discolored labial surface of maxillary and mandibular teeth**



**Figure 2: Pre-operative panoramic radiograph**

prior to acid etching with 35% phosphoric acid for 30 s followed by rinsing with water spray and after that, bonding and light curing. The labial surfaces of the maxillary and mandibular incisors were then directly restored with resin composite. Mandibular right lateral incisor was left un-restored as it partially erupted (Figure 3).

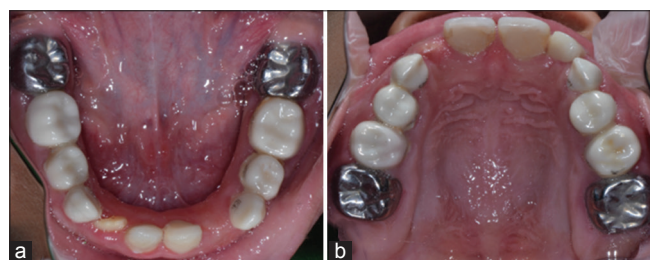
Preformed SSCs (3M) were placed following minimal slice preparations of the permanent 1<sup>st</sup> molars (Figure 4a and b). Preformed zirconia crowns (NuSmile) were placed following moderate preparation of the primary molars and canines (Figure 4a and b).

The adaptation and quality of the margins of the preformed SSCs and the zirconia crowns were evaluated using panoramic (Figure 5) and bitewings radiographs (Figure 6a and b).

The SSCs on the first permanent molars are temporary restorations only. Once the second permanent molars and premolars established the level of the occlusal plane, and the SSCs on the first permanent molars were replaced by cast full-coverage restorations, the patient was referred to an orthodontist.



**Figure 3:** Post-operative clinical picture showing esthetic composite veneering in mandibular and maxillary incisors



**Figure 4:** (a) Post-operative clinical picture showing composite veneering and stainless steel crowns in 1<sup>st</sup> permanent molars and zirconia crowns in primary molars and canines in mandibular arch. (b) Post-operative clinical picture showing composite veneering and stainless steel crowns in 1<sup>st</sup> permanent molars and zirconia crowns in primary molars and canines in maxillary arch

## Follow-up

Every 6 monthly follow-ups were done at 18-month period.

### 6 months

After the completion of treatment, no deterioration was visible in the restorations. The gingiva was slightly inflamed, and heavy calculus accumulation was seen due to insufficient brushing. The lateral incisors erupted (Figure 7a-c).

Scaling and root planing were done, and oral hygiene was reinforced.

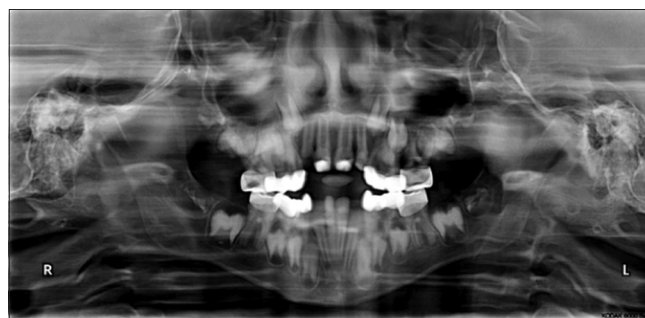
### 18 months

No deterioration was visible in the restorations. The 1<sup>st</sup> upper left premolar erupted, gingiva was slightly inflamed due to insufficient brushing and calculus accumulation (Figure 8a-c).

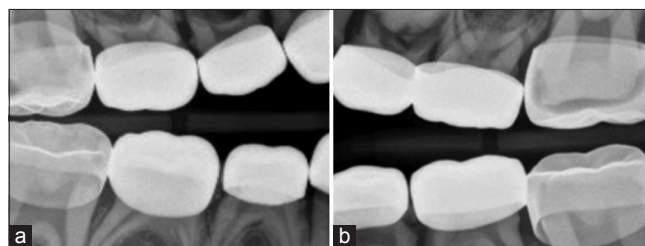
Scaling and root planing were done, and oral hygiene was reinforced.

## Treatment Outcomes

The application of zirconia crowns, composite veneers, and SSCs was a success. The treatment improved the vertical dimension of the patient's teeth, made chewing easier, and reduced tooth sensitivity. The zirconia crowns and composite veneers on the anterior teeth had the desired esthetic appearance.



**Figure 5:** The post-operative panoramic radiograph after restorations of all the erupted teeth



**Figure 6:** (a) The post-operative bitewing radiograph showing adaptation and quality of the margins of the preformed stainless steel and zirconia crowns in the right side. (b) The post-operative bitewing radiograph showing adaptation and quality of the margins of the preformed stainless steel and zirconia crowns in the left side





**Figure 7: (a) 6-month follow-up clinical picture showing intact restorations in the maxillary arch. (b) 6-month follow-up clinical picture showing intact restorations and heavy calculus accumulation in the mandibular arch. (c) 6-month follow-up clinical picture showing intact veneering composite with slightly inflamed gingiva and the laterals incisors were fully erupted in the frontal view**



**Figure 8: (a) 18-month follow-up clinical picture showing intact restorations. The left 1<sup>st</sup> premolar was erupted in the maxillary arch. (b) 18-month follow-up clinical picture showing intact restorations and calculus accumulation in the mandibular arch. (c) 18-month follow-up clinical picture showing intact veneering composite with slightly inflamed gingiva in the frontal view**

The biggest challenges in the management of this patient's oral health remain his diet and brushing habits. Despite that the patient and his parents were counseled on how to brush the patient's teeth and were advised that he should reduce his intake of sugary foods and drinks, his oral hygiene did not improve, and calculus accumulation and gingival inflammation remained a problem. Possible next steps in improving the patient's oral hygiene may include suggesting a reward system for brushing his teeth each day. The parents should also be counseled to take a more active role in brushing the child's teeth if he is unwilling to brush his own teeth.

If this does not improve his brushing habits, he may need to visit the dentist's office more frequently for prophylaxis.

## DISCUSSION

The patient was diagnosed with Type III AI, based on a review of the literature and of the patient's signs and symptoms. His treatment consisted of the application of SSCs, zirconia crowns, composite veneer, counseling on diet and oral hygiene, and a referral to an orthodontist.<sup>8</sup>

Cases of AI vary in type and severity, and it is important to assess each patient's case on an individual basis before deciding on the course of treatment. It is important to look after the patient's dental, periodontal, and orthodontic health as early as possible. AI tends to present in primary teeth, usually with caries and tooth sensitivity. It can adversely affect the child psychologically and socially, as the tooth sensitivity and orthodontic problems associated with AI can make chewing difficult. Children with AI may also be self-conscious about the abnormal appearance of their teeth. Some children with AI only eat soft or pureed foods, and in that case, restorative treatments and diet counseling should be geared toward introducing the child to a more age-appropriate diet.

It is necessary to consider social factors in deciding on a course of treatment for children with AI. Orthodontic treatments, restorative dental treatments such as crowns, and even frequent visits to the dentist can be expensive. Often, the most esthetically appealing treatments are not the most affordable ones. Dentists should discuss with parents regarding the various options for treatment of AI and what each option costs.

Restorative treatment for AI consists of crowns and veneers applied to primary and permanent teeth. If a tooth requires pulpal treatment, the pulpal treatment should be completed before any type of crown is applied. SSCs are appropriate for posterior teeth, especially primary posterior teeth. Materials used for crowns on permanent anterior teeth include porcelain and zirconia.<sup>9</sup>

Patients with AI are prone to orthodontic problems, especially loss of vertical dimension and complications that arise from it, such as temporomandibular joint (TMJ) problems. Malocclusion and delayed eruption of permanent teeth are also associated with AI. Restorative procedures can restore vertical dimension, but temporary bite-raising jigs can be used before the restorative treatments are done to help the pediatric patients' TMJ adapt to the new vertical dimension.<sup>10</sup>

## CONCLUSION

AI is an inherited condition that can be managed through restorative dental and orthodontic treatment. Patients who receive proper treatment to manage their AI have a good prognosis esthetically and in terms of dental function. SSCs, zirconia crowns, and composite veneers are an effective intervention and can be applied to early permanent dentition. As shown in this case report, management of oral hygiene in pediatric patients remains a challenge.

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