A Conservative Treatment for Amelogenesis Imperfecta with Direct Resin Composite Restorations: A Case Report

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ABSTRACT
Rehabilitation of a patient with amelogenesis imperfecta (AI) from both the functional and esthetic standpoints represents a challenge. The complexity of the condition requires an interdisciplinary approach for optimal treatment outcomes. A number of treatment options have been proposed. Recently, the use of bonded restorations has gained popularity because of the many benefits associated with these materials; excellent esthetics, conservative approach, and improved wear make their use advantageous. This article describes a direct approach with resin composite restorations for the transitional treatment of an adolescent with hypoplastic AI who had not completed skeletal growth. Protection against further wear, sensitivity, and plaque accumulation while significantly enhancing the patient's esthetic appearance made this case a success. Furthermore, this article describes the use of a "Clear matrix" technique, which considerably helped simplify the placement of the bonded restorations.

CLINICAL SIGNIFICANCE
This article highlights (1) the importance of an interdisciplinary approach to the successful treatment planning of a patient with hypoplastic amelogenesis imperfecta (AI), and (2) the conservativeness and suitability of full coverage direct resin composite restorations for the transitional treatment of AI-affected teeth on an adolescent patient who has not yet completed skeletal growth.

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INTRODUCTION

Amelogenesis imperfecta (AI) is a heterogeneous inherited disorder of tooth development affecting both primary and permanent teeth[1] that causes them to be unusually small, discolored, pitted or grooved, and prone to rapid wear and breakage. This genetic disorder is known to be associated with the malfunction of the enamel-forming proteins ameloblastin, enamelin, tuftelin, and amelogenin.[2] The manifestations vary greatly among individuals, with discoloration (yellow, brown, or gray), generalized areas of dentin exposed, pitted enamel with an increased susceptibility to plaque accumulation, caries, and hypersensitivity to temperature changes as some of the most commonly occurring signs.[3]

The prevalence of AI is 1 in 14,000 in the United States[4] and

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greatlydepends upon the population studied and diagnostic criteria used.

To date, at least 14 forms of AI have been described based on the specific dental abnormalities and pattern of inheritance.[5] Although they all seem to exhibit similar complications, this clinical heterogeneity makes accurate diagnosis difficult.[6]

Generally, the literature describes three types of AI: hypocalcified, hypoplastic, and hypomaturation.[5–7] In the hypoplastic type, there is a deficiency in the quantity of enamel. The enamel is correctly mineralized and appears hard and shiny but is malformed. In the hypocalcified type, the enamel is formed in relatively normal amounts but is poorly mineralized, soft, and friable and can be easily removed from the dentin. In the hypomaturation type, abnormalities in the maturation stage of enamel formation result in a mottled appearance, opaque white to red-brown coloration, and enamel that is softer than normal and tends to chip from the underlying dentin.[6]

Different treatment options have been proposed for the treatment of AI-affected teeth; from simple microabrasion in cases of hypomaturation AI[8] to gold or stainless steel crowns,[9–13] all-ceramic crowns,[10,13] metal-ceramic crowns,[9,10,13–15] porcelain laminate veneers, and onlays.[10,13,15,16]

A more recent approach is the use of direct and indirect resin composite restorations.[1,11,17,18] A recent clinical study showed that complex composite restorations in permanent hypomineralized molars with defective enamel offer good, long-term performance.[19] The authors stressed the fact that great attention should be given to the removal of all clinically defective, soft enamel in order to ensure stronger bonds to the underlying, possibly normal enamel.[19] The present report describes a direct approach with resin composite restorations for the transitional rehabilitation of an adolescent with hypoplastic AI.

CASE REPORT

A healthy, 14-year-old Afro-American male was referred to the College of Dentistry for the treatment of his “fragile teeth.” His chief complaints were an extreme sensitivity to hot and cold, dissatisfaction with the appearance of his teeth, and a compromised masticatory function. The medical history indicated no contraindications for dental treatment.

A detailed extra- and intraoral clinical examination and a radiographic evaluation revealed poor oral hygiene with moderate to severe plaque accumulation, which had led to generalized gingivitis throughout the mouth. The patient presented short clinical crowns with generalized areas of thin, discolored, hypoplastic enamel and areas of fractured enamel and exposed dentin (Figure 1A–F). A premature loss of vertical dimension, as well as an overbite of 30% and an overjet of 6 mm, was evident. A Class II Angle molar relationship, division I malocclusion was evidenced on both right and left sides (Figure 1E–F). The flare of the anterior teeth had led to multiple diastemas. Existing restorations at the time of evaluation were defective resin composites on all maxillary and mandibular incisors and stainless steel crowns on teeth #19 and #30.

Diagnosis of hypoplastic AI was made based on the Witkop’s classification.[5] Caries risk was assessed by interviewing the patient regarding diet, oral hygiene, and general lifestyle habits. Although free of active caries at the time of evaluation, the patient was placed by the assessment in a “high risk” category, given the presence of several predisposing factors, with AI carrying the most weight of all.

Maxillary and mandibular full arch irreversible hydrocolloid impressions were made (Jeltrate Alginate/ Dentsply Intl., York, PA, USA).

Figure 1. Preoperative clinical pictures of AI-affected teeth. A, *Smile.* B, *Anterior view.* C, *Maxillary arch, occlusal view.* D, *Mandibular arch, occlusal view.* E, *Lateral view, right side.* F, *Lateral view, left side. AI = amelogenesis imperfecta.*

Registration of skeletal relations was made with facebow and appropriate bite registration materials, and the case was mounted in a semiadjustable articulator (Hanau, Teledyne, Colorado Springs, CO, USA).

The complexity of this condition required a multidisciplinary approach to treatment planning to ensure optimal long-term treatment results. Pediatric Dentistry, Orthodontics, Periodontics, and Prosthodontics participated in treatment planning. The following main goals of treatment were identified: (1) transitional restorations for the protection of remaining tooth structure against further wear and sensitivity, (2) periodontal health improvement, and (3) patient instruction regarding oral hygiene habits and prevention. Given the age of the patient, the following considerations were discussed:

- Achievement of a Class I occlusion through orthodontic therapy, although needed, was not deemed a priority on the treatment sequence. Furthermore, the placement of fixed orthodontic devices was not feasible because of the shape and size of the affected teeth.
- Complete coverage of all teeth with fixed partial dentures was identified as the ideal definitive treatment; however, the patient's incomplete skeletal growth at the time of evaluation excluded this as an immediate option.
- Direct resin composite restorations were deemed to provide an excellent transitional restorative alternative until completion of skeletal growth.

The following treatment plan sequence in two phases took place:

1. Prevention and maintenance. A detailed caries risk assessment as well as a *streptococcus mutans* count was completed to assess the bacterial activity at the time of initial examination. The following preventive regimen was prescribed: Topical 1.1% neutral sodium fluoride toothpaste (PreviDent 5000/Colgate, New York, NY, USA) twice a day and a 0.12% chlorhexidine gluconate oral rinse (Periogard Oral Rinse/Colgate) once a day. Every 3 months, oral hygiene recalls followed by topical 5% sodium fluoride varnish applications (Vanish/OMNI Preventive Care-3M ESPE, St. Paul, MN, USA) were performed.
2. Reconstructive. Glass ionomer restorations (Fuji IX/GC America, Alsip, IL, USA) were planned for protection of noncarious, partially erupted occlusal surfaces of teeth #2, #15, #18, and #31. Stainless steel crowns (Unitek/3M ESPE) were indicated for coverage of weakened teeth #3 and #14, and direct resin composite restorations with a microhybrid resin (Filtek Supreme/3M ESPE) were indicated for the transitional treatment of teeth #4 to #13 and #20 to #29. Upon completion of the restorative phase, the patient would be referred to the orthodontic clinic for fabrication of a headgear that would be used at nighttime for approximately $1\frac{1}{2}$ years to achieve Class I occlusion. Re-evaluation will evidence whether or not future fixed orthodontic therapy is necessary to reposition the roots prior to the definitive treatment with fixed partial dentures. Upon completion of skeletal growth, the patient will undergo a complete rehabilitation with full coverage fixed partial dentures.

Reconstructive Phase Sequence of Treatment

Rubber dam isolation was not always attainable given the size and conical shape of some teeth. The patient's excessive salivary flow made treatment a challenge, especially on areas of difficult isolation. Other major limiting factors were the patient's apprehension to dental treatment and his inability to tolerate long appointments. After two unsuccessful appointments, nitrous oxide sedation (50% nitrous/50% O_2) was instituted to facilitate comfort of the patient during dental treatment.

Evaluation of the articulated study models determined the need to increase the occlusal vertical dimension by 1 mm to allow enough thickness of resin material for the restoration of the posterior teeth. Treatment was initiated on the posterior teeth, and the anterior teeth were left for last. Remnants of faulty pre-existing restorations were removed from teeth #2, #15, #18, and #31, and new glass ionomer sealants (Fuji IX) were placed.

Teeth #19 and #30 presented pre-existing stainless steel crowns that were in acceptable condition and were not treatment planned for replacement. Teeth #3 and #14 were minimally prepared to receive stainless steel crowns. Tooth preparation involved only the smoothing of surface irregularities as well as the removal of weakened unsupported enamel. Stainless steel crowns (Unitek) were adapted and cemented with glass ionomer cement (Ketac Cem/3M ESPE). The cemented stainless steel crowns provided a 1-mm vertical dimension increase, allowing sufficient interocclusal space for the premolars to receive resin composite restorations.

After cementation of the stainless steel crowns, maxillary and mandibular full arch impressions were remade and skeletal relations and interocclusal records were re-recorded with the 1-mm increased vertical dimension. A diagnostic wax-up of the eight premolars was made, as well as partial impressions of each quadrant, with a clear quick-set vinyl-(poly-siloxane) impression material (Affinity Crystal Clear/Clinician's Choice, New Milford, CT, USA).

All four quadrants' premolars were restored by using the "Clear matrix" technique. Tooth preparation of the premolars involved a minimal chamfer and an occlusal reduction limited to the removal of affected areas of pigmented pits and grooves as well as areas of thin hypoplastic enamel (Figure 2). Rubber dam isolation was not always possible, especially in the maxillary arch; cotton rolls, salivary shields, and retraction cords were used for field control instead. Placement of a rubber dam with ligatures was successfully accomplished in the mandibular arch.

A self-etch, single-step bonding system (G-Bond/GC America) was used for all restorative procedures. In the clear matrix quadrant impression, the axial walls of the premolar area were filled with microhybrid resin composite (Filtek Supreme) shade A2. The occlusal surface was left free of resin (Figure 3) so that, upon digital pressure, some of the excess resin material would be allowed into the space corresponding to the occlusal surface. The success of this technique greatly depends on the placement of an adequate amount of resin material in the matrix, so that neither major cervical overhangs nor major voids along the cervical finishing line are produced.

The matrix was carefully seated in place and kept in position through slight digital pressure, and the

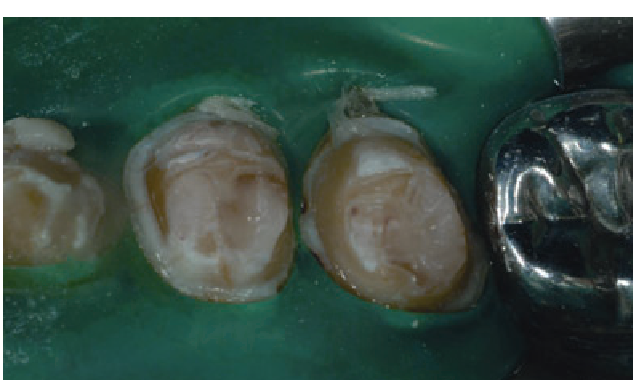

Figure 2. Minimal chamfer preparation of two premolars.

Figure 3. Placement of ring of resin material in the vinyl-(poly-siloxane) clear matrix.

Figure 4. Activation of light-curing unit through the vinyl-(poly-siloxane) clear matrix.

Figure 5. Immediate postoperative clinical picture of final restorations on premolars.

light-curing unit was activated to shine through the matrix from its occlusal, facial, and lingual aspects on both first and second premolars (Figure 4) for 10 seconds per surface. Upon removal of the matrix, each surface was polymerized for an additional 20 seconds. Any areas of cervical overextension were trimmed, and any unsealed areas along the margin were filled with a flowable resin (Flow-it/Jeneric Pentron, shade A2, Wallingford, CT, USA). The occlusal surfaces were "free-handed" with the same resin. Contouring, finishing, and initial polish of the resin crowns was accomplished with finishing and polishing disks (SofLex/3M ESPE) followed with polishing cups and points (Diacomp polishing kit/Brasseler, Savannah, GA, USA). The final restorations (Figure 5) exhibited not only good esthetics but also a return to an optimal masticatory function as well as providing complete coverage of all affected areas of the exposed dentin. These restorations not only addressed the patient's hypersensitivity issue but also contributed to the prevention of plaque accumulation.

Upon completion of the posterior teeth, anterior maxillary and mandibular teeth were "free-handed" by using the same self-etch bonding and resin composite systems. Rubber dam isolation with ligatures was successfully accomplished for all anterior teeth. All restorations were contoured, finished, and polished with the same systems described. Final images of the completed transitional treatment are presented in Figure 6A to F.

One of the most, if not the single most, important aspect of the comprehensive treatment of this patient was the strong emphasis placed on an adequate oral home-care regimen. Education of the patient and parent guardian on an adequate tooth brushing technique and recommended oral hygiene habits was required. Equally important to the success of this treatment are the periodic recall visits every 3 months for monitoring of the restorations placed. Unfortunately, much of the future outcome of this treatment will depend on the patient's compliance regarding oral hygiene habits as well as periodic recall visits.

DISCUSSION/CONCLUSION

With careful considerations of the patient's expectations and conditions, an interdisciplinary approach was critical for the successful treatment planning and outcome as well as the patient's overall satisfaction. For optimal results, treatment of AI-affected

Figure 6. Postoperative clinical pictures of completed transitional treatment. A, *Smile.* B, *Anterior view.* C, *Maxillary arch, occlusal view.* D, *Mandibular arch, occlusal view.* E, *Lateral view, right side.* F, *Lateral view, left side.*

teeth must be determined on an individual basis and in consultation with specialists from different disciplines.

Different treatment options for the treatment of AI-affected teeth have been proposed in the literature. A number of cases have used fixed partial dentures given the predictability and high esthetics achieved with complete crowns. However, this approach requires the removal of a substantial amount of tooth structure.[6,20,21]

Direct resin composite restorations offer an alternative treatment that provides excellent esthetics and preservation of tooth structure given that the preparation is limited to only areas of affected unsupported enamel. However, bonding resin composites to AI-affected enamel can be problematic, especially in areas of poorly mineralized, friable enamel.[22] Thus, this option should not be indicated in all cases. Case selection must be carefully considered when using direct-bonded restorations, as insufficient evidence is available to support their use in these situations.[23]

The present report stresses the advantages of using direct resin composite restorations as a transitional treatment. Given that the patient had not completed skeletal growth at the time of initial evaluation, a direct approach for the transitional rehabilitation was made. Other factors that also influenced the selection of treatment were the extent of the disorder that exposed dentin, which generated substantial sensitivity, and the need to provide adequate structure for the future placement of fixed orthodontic devices.

The use of the "Clear matrix" technique considerably helped simplify the restorative procedures by allowing a ring of resin material to be built around the tooth preparation, providing a framework upon which the remaining restoration could be "free-handed."

Based upon the complexity of this condition and considering the complications encountered during treatment, we can conclude that, with proper isolation and careful handling, direct-bonded resin composite restorations provide an excellent conservative transitional treatment for protection of AI-weakened teeth.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are included in this article.

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