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Treating the Amelogenesis Imperfecta Patient

INTRODUCTION

Amelogenesis imperfecta (AI) represents a group of inherited conditions that affect the structure and appearance of the enamel of all or nearly all the teeth, with a prevalence in the United States of approximately one in 14,000.^{1,2} The variable range of AI enamel defects involves abnormalities that are classified as hypoplastic (defect in quantity of enamel), hypomaturation (defect in final growth and development of enamel crystallites), and hypocalcified (defect in initial crystallite formation followed by impaired growth), with diagnosis traditionally determined by clinical presentation.^{2,3}

Four main types of AI classifications exist, based on the type of enamel defect. Fourteen unique subtypes exist and are based on the clinical appearance and mode of inheritance.^{3,4} Although AI primarily affects enamel formation, AI has been associated with a more constricted maxillary arch as well as with a skeletal open bite with anterior space, resulting in occlusal instability.⁵⁻⁸

The following case report will outline how a young man with AI was treated in our office. The importance of properly managing these patients with AI can be found in the outcomes. Redesigning a smile by establishing harmonious function of the stomatognathic system can positively impact a patient's physiological and psychological health.

CASE REPORT

Diagnosis and Treatment Planning

This young man presented with a desire to be able to chew foods more efficiently and to have an attractive smile (Figures 1 and 2). He is the fifth generation in his family to have AI. He had impaired masticatory function due to a significant open bite with occlusion only on 3 teeth in maximum intercuspation (Figures 3 to 5).

The patient presented with multiple restorative challenges. Although there was no sensitivity with the defective and deficient enamel, functional and aesthetic concerns needed to be addressed. He had an open bite and had adapted to occlusal contact only between teeth Nos. 2, 3, and 31. His tongue was serving as the occlusal stop between all remaining dentition. An arch size discrepancy with a posterior bilateral crossbite relationship was present in addition to underdeveloped teeth with diastemata.

Closing the significant open bite and re-establishing a new and stable neutral zone by achieving balance between the horizontal position of the teeth with the outward pressure of the tongue and inward pressure of the buccinators would be necessary.⁹

In our office, a comprehensive TMJ examination is always completed during the diagnostic phase. A stable Piper Stage I TMJ diagnosis was confirmed for both right and left TMJs after negative muscle palpation, negative history of clicking and symptomatic joints, TMJ Doppler auscultation, centric relation (CR) load testing, and normal range of motion testing were completed.^{9,10} Six structural elements, including disc alignment, disk shape, ligament anatomy, masticatory musculature, joint space, and condylar bone anatomy, were assessed as normal.^{9,10} Successful treatment of functional and aesthetic deficits in young AI patients requires an eye to the future during

treatment planning as conservative preparation design and occlusal stability are key to ensuring long term success.

To establish improved function and aesthetics, 22 full-coverage lithium disilicate (IPS e.max Press [Ivoclar Vivadent]) (teeth Nos. 2 to 15, 18 to 21, and 28 to 31) and 6 lithium disilicate veneers (IPS e.max Press) (teeth Nos. 22 to 27) were treatment planned. The low translucency bleach shade 2 ingot (LTBL2) was selected due to the similarity of the low translucency of this ingot to that of natural dentin. This makes these ingots ideal for creating natural brightness and chroma in the posterior and, with a cut-back technique, maximal aesthetic appearance in the anterior teeth.¹¹

Clinical Protocol

One of the first steps in establishing an aesthetic reconstruction is to define the proper plane of occlusion.¹² Without a proper plane of occlusion, the remaining features that establish proper form and function are adversely affected. Embrasures will not

be perpendicular to the proper plane of occlusion and no tooth dimensions will conform.¹³ Therefore, the sequence of treatment began with restoring the mandibular teeth first to establish the proper Curve of Spee and incisal edge position.

Due to the need to close the open bite without affecting the patient's vertical dimension of occlusion (VDO), a CR bite reg-

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Figure 1. Full-face photo, demonstrating an open bite and amelogenesis imperfecta enamel defects.



Figure 2. Frontal view, showing open bite and hypoplastic and hypomaturational of the enamel.



Figure 3. Frontal retracted view in maximum intercuspation (MI), demonstrating an open bite.



Figure 4. Right lateral view in MI.



Figure 5. Left lateral view in MI.



Figure 6. Prior to preparation of the mandibular arch, centric relation (CR) bite registration (Genie Bite [Sultan Healthcare]) captured the anterior vertical dimension of occlusion.



Figure 7. Both mandibular posterior quadrants were prepped with the CR bite registration in place.



Figure 8. Reduction cuts were marked for accuracy using a permanent marker. When the marks were eliminated, the desired reduction was achieved.



Figure 9. Once all mandibular teeth were prepared, Genie Bite was used to capture the bite registration of the anterior sextant (with both posterior bite registrations in place).

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istration (Genie Bite [Sultan Healthcare]) captured the anterior VDO (Figure 6). (Note: This CR bite registration was obtained *prior* to preparation of the mandibular arch.) Having the ability to evaluate preparation clearance and refer to the original inter-arch relationship is especially critical when treating open bites. The right posterior quadrant preparation was completed first, using the unprepared anterior bite registration to verify clearance.

Due to the hypomaturational of this patient's dentition and the anticipation that this full mouth rehabilitation will likely need to be refreshed during the course of his life, conservative preparation design was crucial. A minimal 1.5-mm occlusal and axial reduction of the mandibular posterior teeth was prepared, and a right posterior bite registration was taken with the anterior registration in place. After the left posterior quadrant was prepped identically to the right quadrant, a bite was taken of the left quadrant. Figure 7 illustrates the improvement in the open bite arch discrepancy.

After both posterior quadrants were prepped, a 0.5-mm depth-cut diamond (No. 900-7136 [Henry Schein]) was utilized to attain minimal reduction for the veneer preparations on teeth Nos. 22 to 27. The depth of the initial cut was marked using a permanent marker since this is the most accurate method



Figure 10. A clear, thermoplastic matrix fabricated from the diagnostic wax-up was used to make the provisional restorations (Luxatemp [DMG America]).



Figure 11. Frontal view of mandibular provisionals bonded in place, with ochre characterization of the gingival third.



Figure 12. Frontal retracted view of the completed case. Lithium disilicate (IPS e.max Press [Ivoclar Vivadent]) (teeth Nos. 2 to 15, 18 to 21, and 28 to 31) and 6 lithium disilicate veneers (IPS e.max Press) (teeth Nos. 22 to 27) are shown.



Figure 13. Right lateral retracted postoperative photo.



Figure 14. Left lateral retracted post-op photo.



Figure 15. Frontal view of the completed case.

for ensuring a specific reduction. Then a round-ended diamond (No. 112-5161 [Henry Schein]) was used to conservatively remove the enamel to a 0.5-mm total facial reduction (Figure 8). Next, interproximal clearance and an incisal edge reduction of less than 0.75 mm was completed. By preparing the anterior teeth with cleared contacts, we gained several advantages: our technician was provided with control over placing and correcting misaligned midlines; alterations in color could be made in this area to mimic natural teeth; and the lingual margin

was placed in a free cleansing area, also increasing retention form.

To finalize the preparations, all of the external line angles were removed. Then the preparations were polished using a diamond (No. 8878K-31 [Braseler USA]). The anterior bite registration was obtained (Genie Bite) with both posterior bite registrations in place (Figure 9). Next, a facebow transfer was taken (SAM Axioquick Facebow [Great Lakes Orthodontics]). The final impression was taken using a vinylpolysiloxane (VPS) putty (Genie) and a rapid set light body VPS (Genie).

Provisional restorations (Luxatemp [DMG America]) were made using a clear thermoplastic matrix that had been previously fabricated from the diagnostic waxup (Figure 10). The provisional restorations were bonded to the prepared arch by placing one drop of OptiBond FL (Kerr Dental) adhesive in the intaglio surface of each provisional, then fully seating and light curing them. This technique allows for clean, cement-free preps when the provisionals are removed because the adhesive bonds to the provisional material, not the prepared tooth struc-

ture. Ochre characterization from the Kolor + Plus Kit (Kerr Dental) was added to the gingival third of the provisionals (Figure 11). Final mandibular restoration shade and characterization were selected via patient and lab technician interaction.

During the temporization phase, the patient was provided with 0.12% chlorhexidine gluconate (Henry Schein) to use for rinsing and brushing, helping to ensure optimal gingival health. Even with well-adapted margins, temporaries are notorious for creating an environment that causes excessive gingival bleeding. If this is not controlled, the post cementation color changes at the margins of all-ceramic restorations can compromise aesthetics.

The classical acid-etch technique was used when these restorations were bonded into place. The preparations were etched with Etch-Rite (Pulpdent) 38% phosphoric acid gel for 20 seconds and then washed thoroughly and dried with air. Next, several coats of Dentin Desensitizer (Pulpdent) were applied. Then several coats of OptiBond FL primer (Kerr Dental) were placed, followed by one coat of adhesive. These coats were slightly dispersed with air and light cured (Rembrandt Sapphire plasma arc curing light [DenMat]) for 20 seconds. The intaglio surfaces of all the restorations were cleaned (Ivoclar Ivoclar Vivadent) for 20 seconds, rinsed, and air-dried. One drop of silane (Silane Primer [Kerr Dental]) was then applied and air dispersed. The final cementation was done with Calibra Esthetic Resin Cement (Dentsply Sirona Restorative).

The proper finishing of restorations is essential for success. Three burs were used to initiate the finishing process. A red-striped 30-grit diamond (Brasseler USA) was used around all margins, followed by a yellow-striped 15-grit diamond (Brasseler USA) and a white-striped 30-blade finishing bur (Brasseler USA). Next, Shofu Dental's polishing points were used, starting with the no-stripe point, then the yellow-striped, and, lastly, the white-striped polishing point. The interproximal finishing began, utilizing a Ceri-Saw (DenMat) to first clear out excess cement in the interproximal areas. Then a red-striped diamond strip (Gateway Flexi [Brasseler USA]) was used to smooth each interproximal surface. The last and most significant interproximal polishing was achieved with a series of Epitex Strips



Figure 16. Before treatment.



Figure 17. The completed case.

An attractive smile with restored masticatory ability transformed this patient's quality of life....

(GC America). After the blue, green, gray, and tan strips were used, flossing between the teeth was extremely smooth and the polishing sequence was complete.

A CR bite registration was taken using the Schuyler/DeLar bite registration wax technique (Mizzy Master Wax [Great Lakes Orthodontics] and Bite Registration Wax [DeLar]), with the final mandibular restorations in place and following minimal occlusal adjustments to the maxillary arch. This bite registration ensures predictability and precision with the occlusion and functional harmony of the maxillary arch waxup.

Unlike the preparation sequence of the mandibular arch, the anterior maxillary teeth (Nos. 6 to 11) were first prepared using a 0.5-mm depth cut diamond (No. 900-7136 [Henry Schein]) to achieve minimal facial reduction. A round-ended diamond (No. 112-5161 [Henry Schein]) was used to remove enamel to the precise 0.5-mm depth cuts. We then proceeded with a minimal 0.75-mm incisal reduction for all-ceramic lithium disilicate (IPS e.max Press) crowns. The same sequencing of obtaining 3 separate bite registrations was performed with the mandibular arch as was followed for the prepared maxillary arch to evaluate clearance. The final impression was obtained

with the rapid set light body VPS and VPS putty. The arch was temporized with Luxatemp, using a clear thermoplastic matrix.

Due to the significant open bite, the inter-arch spacing discrepancy was split between both arches. To produce an aesthetic and pleasing smile, the final mandibular restorations were given more hue to create a muted appearance that toned down the length of the mandibular restorations, accentuated the maxillary restorations, and, in effect, created a fuller and more youthful smile. The finishing sequence of the maxillary restoration was identical to the order followed with the mandibular arch. To ensure occlusal stability, equilibration was completed with stable stops in CR, canine guidance in harmony with border movements of the envelope of function, disclusion of posterior teeth in protrusive and on the nonworking side, and noninterference on all posterior teeth on the working side with canine guidance.⁹

CLOSING COMMENTS

While treatment goals aim to completely eliminate deficits, often total deficit elimination may compromise the functional stability of the case and provide minimal case enhancement.¹² To achieve a more balanced gingival

architecture of the maxillary arch, crown lengthening of teeth Nos. 7 and 8 could have made aesthetic improvements. However, due to the patient's low lip line, there was no significant benefit to the patient in performing this additional procedure.

This young man had originally presented with multiple aesthetic and functional deficiencies associated with AI. Identifying the deficiencies and successfully resolving them can be rewarding for the clinician and fulfilling for the patient (Figures 12 to 17). An attractive smile with restored masticatory ability transformed this patient's quality of life (Figures 16 and 17). ♦

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