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Case Report

Esthetic Rehabilitation of a patient with Amelogenesis Imperfecta: An innovative approach

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ABSTRACT:
Amelogenesis imperfecta is a term commonly used for a clinically and genetically heterogeneous group of conditions that affect the enamel formation and maturation. AI patients report with severe discoloration of teeth and a low self-esteem. The biggest challenge in management of patients suffering with amelogenesis imperfecta is to restore aesthetic, function and occlusal stability while conserving remaining tooth structure as much as possible. The article describes a case of 28-year-old male patient diagnosed with hypocalcified type of AI. A detailed treatment planning was carried out with the help of digital smile design (DSD) system and mock-up techniques. Digital smile designing and traditional mock-up techniques can serve as important diagnostic tools and will also help the patients to visualize the final result even before the treatment is initiated. Once the patient was satisfied with the mock-up, a full mouth rehabilitation was done with CAD/CAM fabricated zirconia crowns. The full mouth rehabilitation resulted in improved occlusion, better oral health, and improved esthetic appearance. The combination of techniques offered predictability to results and increased the patient satisfaction as well.
Key words: AI- Amelogenesis Imperfecta; DSD- Digital Smile Designing; VI- Vertical Dimension.

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INTRODUCTION

Amelogenesis imperfecta (AI) is an inherited and clinically heterogeneous disorder of tooth development that could affect all (or nearly all) primary and permanent teeth. Its prevalence ranges from1:700 to1:14,000, according to the studied population [1]. Mutations have been reported in different genes encoding for enamel proteins, such as amelogenin, enamelin, ameloblastin and tuftelin. Enamel may be modified in its width, microstructure or mineralization degree. Thus, clinical symptomatology varies from light discoloration to disintegration/break- down of the enamel of the entire tooth. Witkop's classification (1971) system based on analysis of pedigree and phenotype distinguished 4 different types of AI: hypoplastic, hypomature, hypomineralized and hypomature with taurodontism forms, with 14 specific subtypes [2].The hypoplastictype is defined as a deficiency in the deposition of organic matrix while the hypomineralization type of AI presents with a deficiency in the mineralization of the formed matrix. In hypomaturation, there are abnormalities in the final stage of the mineralization process because the enamel crystals remain immature and there is no contrast of radiopacity between the enamel and dentin. Dental anomalies associated with AI include enamel disorders, anterior open bite, pulpal calcifications, delayed eruption of teeth, pathological root and crown resorption, and taurodontism [3,4,5]. Craniofacial features may also be present, constricted maxillary arch (omega-shaped arch),a reversed curve of spee, a vertical growth pattern, and skeletal open bite with or without the clinical presence of anterior space resulting in occlusal instability. In addition, these patients may face nutrition problems due to dental sensitivity and loss of occlusal vertical dimension caused by attrition.[6]

Achieving functional and esthetic improvement for teeth affected by Amelogenesis Imperfecta is a

challenging process. There are many options proposed for the treatment of AI-affected teeth, including simple micro abrasion, composite veneers, porcelain laminate veneers, onlays, gold or stainless-steel crowns, metal ceramic crowns, and all-ceramic crowns [7-9]. The treatment planning for patients with AI is related to many factors, including the age of the patient, the type and severity of the disorder, intraoral conditions, and the socioeconomic status of the patient [10].

Herein we present a case of Hypocalcified type Amelogenesis Imperfecta in which DSD (Digital Smile Designing) and mock up techniques have been used for treatment planning and fixed rehabilitation completed with metal-ceramic crowns for posterior teeth and computer-assisted design (CAD)/computer-aided manufacturing (CAM) zirconia-based ceramic crowns for anterior teeth.

CASE DESCRIPTION

A 28-year-old male patient reported to the Department of Prosthodontics and Crown & Bridge with the chief complaint of yellowish-brown discoloration of teeth and sensitivity to cold food. He had no contributory medical history and family history revealed that his mother and maternal aunt had same clinical features. On clinical examination enamel layer was thin, the dentin was exposed in many teeth, and the enamel color was dark yellow-brown to orange (Fig 1). Extraoral examination and facial analysis showed a mandibular prognathism and cross bite. There were no anterior open bite and missing teeth. However, short crowns, occlusal wear with exposed dentin in the posterior areas, poor contact points and dental caries were the additional clinical findings. Oral hygiene was poor, with significant plaque accumulations.

The panoramic radiography revealed generalized loss of enamel, a lack of distinction in density between enamel and dentin, and carious lesions on maxillary first molars. Pulp chambers had normal shape, and no calcification was noted. It was determined that the patient was affected by hypocalcified (Type III) Amelogenesis Imperfecta. The standard treatment options requiring interdisciplinary approaches were discussed with the patient. Due to the patient's refusal of the orthodontics therapy, a decision was made to pursue with mainly a prosthodontics approach.

Pre-prosthodontic procedures including dental scaling and restoration of the maxillary first molars using Type II GIC were carried out. Maxillary and mandibular complete-arch impressions were made using alginate (Zhermack Tropicalgin). Diagnostic casts was fabricated using dental stone (Kalrock kalabhai Karson Pvt Ltd) and mounted on a semi adjustable articulator in centric occlusion. The occlusal vertical dimension was determined by the Niswonger method and verified with the closest speaking space method. The interocclusal distance at the physiologic rest position was 5 mm. A full mouth rehabilitation was planned for the patient with increase in 3mm VD in the anterior region to ensure proper vertical dimension and to create enough space for a restorative reconstruction. Next, an esthetic analysis was carried out using the digital smile designing (DSD) software (Planmeca Romexis) [Figure 2]. Due to the differences in the virtual stimulation (DSD), a mock-up was proposed with composite resin to improve the communication between the clinician and the technician and to facilitate the visualization of the final result by the patient. A diagnostic wax up was carried out at increased vertical dimension [Figure 3].Using the diagnostic wax up as a reference, a silicone guide was prepared to make the mock-up with bis-acryl resin, which is tested aesthetically and functionally [Figure4& 5]. Once approved by the patient, it was used as a guide for tooth preparation. Posterior teeth were prepared with a chamfer margin and anteriors with a shoulder margin. The preparation of the molars was as minimal as possible, especially on the occlusal surface, in order to compensate for the reduced vertical dimension [Figure6]. Tooth preparations were finished by rounding sharp angles. An interocclusal record was prepared with a hard addition-type A-silicon material (Imprint™ Bite, 3MESPE) at the increased vertical dimension. The autopolymerising acrylic resin (DPI,Wallace Street, Mumbai) provisional crowns with a mutually protected occlusal scheme were fabricated extra orally by an indirect method, then they were cemented with temporary cement (Freegenol Temporary Pack, GC Corporation, Tokyo, Japan) [Figure 7].These restorations were assessed in terms of esthetics and phonetics. 1, 2 and 3-month regular check-ups were performed. The restorations were adjusted to avoid any occlusal interference in protrusive and lateral excursions. The speech, swallowing, anterior and posterior speaking space, muscle sensitivity, mastication, TMJ discomfort, were assessed during this period. The patient was asymptomatic. Once the patient is adapted to the increased vertical dimension, it was decided to fabricate the final restoration. The definitive impression was made using addition silicone (Virtual, Ivoclar Vivadent) and jaw relation recorded and transferred to a semi adjustable articulator using a facebow. Posteriors were restored with metal (J Bond Ga-cobalt chromium alloys) ceramic (IPS Classic, Ivoclar Vivadent) crowns and anteriors with zirconia based crowns. All zirconia frameworks were designed using CAD software (Lava CAD; 3M ESPE) with anatomical shape to guarantee sufficient support for the veneering porcelain, and a thickness of 0.5 mm. Pre-sintered zirconium oxide frameworks for each tooth were milled individually by CAM (Lava CNC 240; 3M ESPE). The zirconia copings were sintered and then clinically fitted on the abutments with a film of silicone material (Fit Checker; GC). All copings showed a satisfactory marginal adaptation with a dental explorer. For the veneering process, the copings were covered with a manual layering

technique using a ceramic material (Lava Ceram; 3M ESPE). The occlusion was constructed as mutually protected occlusion without eccentric contacts. Centric and eccentric occlusal contacts were then evaluated. Canines disengaged the posterior teeth during lateral movements. Protrusive guidance was evenly distributed across the maxillary and mandibular incisors. A trial evaluation of the ceramic before glazing enabled minor occlusal adjustments using a turbine and diamond burs with 30 to 40 µm grain size [Figure 8]. The luting of the crowns was achieved with resin modified GIC (GC Fujicem) [Figure 9-12]. A radiograph was obtained to ensure correct seating of each framework. In the follow up, maintenance of oral hygiene was emphasized, and an occlusal night guard was prescribed to prevent the restorations from chipping. The follow-up was carried out at 3, 6, 12, and 24 months with visual and radiographic examinations. No signs of complication associated with the restored teeth or periodontal structures or fracture of framework, chipping of veneered porcelain, or loss of retention was noted. Two year follow up revealed good stability of prosthodontic result and patient's satisfaction with function, dental esthetics and facial harmony [Figure 13].

Figure 1: Initial presentation of the patient with hypocalcified AI. The photograph shows extensive discoloration of the teeth

Figure 2: Virtual stimulation using Digital Smile Design and Paint 3D

FIGURE 3: Diagnostic wax up at increased vertical dimension

Figure 4: Silicone index made out of the wax model is filled with bis-acrylic resin and placed on upper teeth

Figure 5: Frontal view of the mock-up using bis acrylic resin

Figure 6: Posterior tooth preparation with minimum occlusal reduction

Figure 7: Fixed interim prosthesis for adaptation period

Figure 8: Crowns placed on cast for evaluation

Figure 9: Post treatment frontal view in centric occlusion position

Figure 10: Post treatment occlusal view of maxillary arch

Figure 11: Post treatment occlusal view of mandibular arch

Figure 12: Post treatment view of the left lateral working side

Figure 13: Post treatment smile frontal view

DISCUSSION

This clinical report demonstrates that a comprehensive diagnosis and treatment planning helps to improve treatment predictability and execution efficacy in AI patients. In this case we have used DSD and mock-up techniques to evaluate the final outcome. Digital imaging allows patients to visualize the expected result, besides facilitating the presentation of the current condition of his oral health [11,12]. DSD when combined with mock-up technique allows three-dimensional visualization of the final result of the proposed treatment. While in the diagnostic wax-up, one can only see the desired shape for the teeth, the mock-up allows the visualization of the shape integrated to the gingiva, lips, face, and phonetics during the evaluation period [13].

Numerous treatment modalities have been described for rehabilitation of AI patients: adhesive restorative techniques, overdentures, fixed dental prostheses, all-ceramic crowns, metal ceramic restorations, and inlay/onlay restorations[14].Treatment modality includes consideration of a patient's age, severity of AI, orthodontic and maxillofacial needs, periodontal condition, financial implications for the patient's family, and long-term prognosis

When the skeletal growth is completed, it is reported that full-mouth prosthetic rehabilitation with all-ceramic or porcelain-fused to metal restorations seems to be the best treatment option for AI. Most of the soft and hard tissues are completed until 18-20 years old [15], hence a full mouth fixed prosthetic restoration has been planned to restore the dentition.

In the present case, there was a need to increase vertical dimension to provide an adequate interocclusal space. The factors that should be considered as determinants for increasing the OVD are the remaining tooth structure, the space available for the restoration, occlusal variables and aesthetics. Minimizing the increase in OVD is useful to reduce the overall complexity of the prosthodontic treatment and increasing OVD by more than 5 mm is rarely indicated [16]. In the current case report, Occlusal Vertical Dimension (OVD) was increased 3 mm in the anterior region, and 1 to 2 mm in the posterior region respectively.

Several methods have been described to increase the vertical dimension of occlusion using a removable acrylic resin occlusal splint, direct bonded composite resin, or an onlay or interim fixed prosthesis[16]. Splints are indicated before definitive restorations only when patient has TMD symptoms. The use of a removable splint in a TMD-free patient can generate signs and symptoms related to splint wearing rather than OVD increase [17].

In the present case metal-ceramic restorations were selected for posteriors because of their better durability and strength properties when compared to zirconia based crowns. However, for anteriors zirconia-based restorations were selected because they have better esthetic properties when compared to metal ceramic restorations. Besides, all ceramic materials have other advantages including low plaque retention and optimum biocompatibility inducing favourable biological responses in the soft tissues. Studies have shown higher incidents of chipping of veneering porcelain for zirconia based restorarations but anatomically designed zirconia copings and consistent veneering porcelain thickness can minimize chipping. Further research shows better results for hand-layered veneering porcelain than for veneering porcelain pressed over the frameworks [18].

The occlusion was constructed as mutually protected occlusion without eccentric contacts to prevent the restorations from chipping during functional and parafunctional movements.

The choice of the luting agent is also important because as the restoration ages, the bond strength decreases in the oral cavity. It has been reported that resin and resin-modified glass ionomer cements have higher retention strength to zirconia ceramic restorations on prepared teeth [19]. Hence, we have chosen resin modified GIC.

The patient was followed up for 3, 6, 12 and 24 months and clinical and radiographic examinations were carried out. He did not report any significant complications or complaints and was satisfied with the treatment.

CONCLUSION

Poor esthetics, worn dentition, and interocclusal space problems (both insufficient space and open bite) complicate the treatment course of AI patients. Coordinated interdisciplinary procedures are critical for a successful outcome and patient satisfaction. The prosthodontic rehabilitation of AI with metal-ceramic and zirconia crowns have resulted in well-adjusted vertical dimension of occlusion and an improvement in masticatory function, oral health, and esthetic appearance. Combining traditional and new techniques such as mock-up and DSD as presented in this article offered predictable and highly satisfactory results.

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