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Full-mouth Rehabilitation of Hypocalcified-type Amelogenesis Imperfecta With Chairside Computer-aided Design and Computer-aided Manufacturing: A Case Report

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Clinical Relevance

This case report describes the use of a few sessions of chairside computer-aided design and computer-aided manufacturing for esthetic restoration of dentition severely affected by amelogenesis imperfecta. We describe the successive treatment steps to help practitioners treat similar disorders.

SUMMARY

Background: This case report describes the complete full-mouth treatment of hypocalcified amelogenesis imperfecta (AI) by chairside computer-aided design and computer-aided manufacturing (CAD/CAM).

Case summary: After several years of interrupted dental care, a 17-year-old female patient presented with pain and also esthetic and functional discomfort. With loss of enamel and dyschromia affecting all teeth, the diagnosis was hypocalcified AI. Affected tissues were eliminated, gingivectomy with laser was performed, an indented jig was used to record the centric relationship during optical impres-

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sions, and 28 full ceramic crowns were created by chairside CAD/CAM in four sessions. The patient reported rapid pain relief and an overall improvement of well-being.

Conclusion: AI sequelae can be treated promptly and conservatively with chairside CAD/CAM, obtaining esthetic and functional results.

INTRODUCTION

Amelogenesis imperfecta (AI) is a rare inherited disease.[1] It may assume different phenotypic forms related to anomalies in the structure and appearance of the enamel and affect all or almost all of the teeth in both the primary and permanent dentition.[2] Regardless of the AI type, the follow-up of young patients is difficult, first because of the evolution of the dentition, then because of the extent of tooth destruction or dyschromia, and finally because of the psychological and often financial difficulties associated with treatment. Until the young permanent dentition has been established, conservative temporary restorations are needed to preserve dental tissues and provide acceptable esthetics. In the early permanent dentition, permanent restorations are required. To improve the quality of life and limit the psychological impact of AI, the practitioner must restore function but also esthetics.[3-5] Because of the diversity of AI phenotypes, no clinical trial has been performed to help choose the best treatment option; hence, the amount of tooth destruction and dyschromia guide this choice.[6] Treatment planning and implementation are often long and tedious with conventional prosthetics.

The use of chairside (ie, made in a dental office) computer-aided design and computer-aided manufacturing (CAD/CAM) may be advantageous for these full-mouth rehabilitations: with computer-aided planning, digital wax-ups can be obtained almost immediately and then transferred to the mouth by machining mock-ups; tooth preparation, fabrication of restorations, and bonding can be performed in the same session, avoiding provisional restorations and limiting the number of treatment sessions; finally, the patient can be a participant in the treatment, especially in the planning and design of future restorations, which enhances adherence to treatment. In fact, AI-affected patients receive numerous care sessions at a specialist beginning in childhood, often during school hours and not necessarily near their home, which often leads to demotivation and missing appointments. A limited number of care sessions and the patient's involvement in treatment may enhance patient observance.

AI-affected patients have been previously treated partially with chairside CAD/CAM or completely with indirect CAD/CAM (made in a dental laboratory),[7-9] but, to our knowledge, not completely with chairside CAD/CAM.

This case report presents, in a step-by-step manner, the full-mouth and entirely digital CAD/CAM chairside rehabilitation of a patient with hypocalcified AI in the early permanent dentition.

METHODS AND MATERIALS

Patient Information

A 17-year-old girl in good general health presented at the clinic with pain when eating or drinking something cold, as well as masticatory difficulties. She also complained of her unsightly teeth and being mocked by others. In her younger years, she had received treatment for her primary and then permanent teeth in the pediatric dentistry department of Charles Foix Hospital, Ivry-sur-Seine, France, but the follow-up had been interrupted for various reasons, particularly financial. The patient was an only child. Her father had AI, as did several individuals in the maternal line.

Clinical Examination, Complementary Examinations, Diagnostic Assessment, and Therapeutic Proposal

Extraoral examination revealed three balanced facial thirds (Figure 1a). The profile was hyperdivergent, and the patient presented a retrusive chin associated with slightly lower retrusive lip (Figure 1b). The patient was in early permanent dentition.

Intraoral examination revealed generalized loss of the tooth structure and a yellowish-brown enamel with a relatively crumbly texture, which rapidly wore off, characterizing hypocalcified AI (type III). Because the maternal and paternal lines were affected, the dominant (type IIIa) or recessive (type IIIb) character of this type III AI was difficult to determine. In addition, there were inadequate old restorations: provisional restorations on teeth 5 to 12; composite restorations on 3, 14, 19, 23, 26, and 30; and provisional crowns on 4 and 13, which were lost (Figures 1c-g). The patient had a thick periodontium, moderate to severe gingivitis (especially in the mandibular anterior area), and periodontal recession (in the mandibular incisor area). Oral hygiene was imperfect, with plaque and tartar, because of the pain caused by brushing. She had a

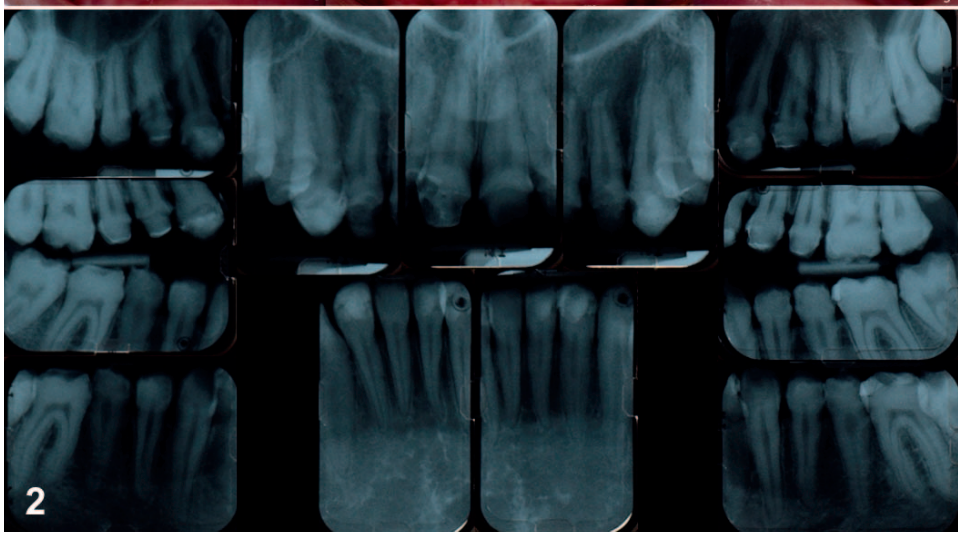


Figure 1. *(a,b): Extraoral and (c,g): intraoral views of the initial situation showing generalized loss of the tooth structure and inadequate old restorations.*

Figure 2. *Radiographic images: bitewings and periapical X-rays.*

class II malocclusion, an increased overjet (common with AI[10]), a right posterior crossbite, a slight midline deviation, a slight loss of the posterior vertical dimension, and a major open bite (from 4 to 13).

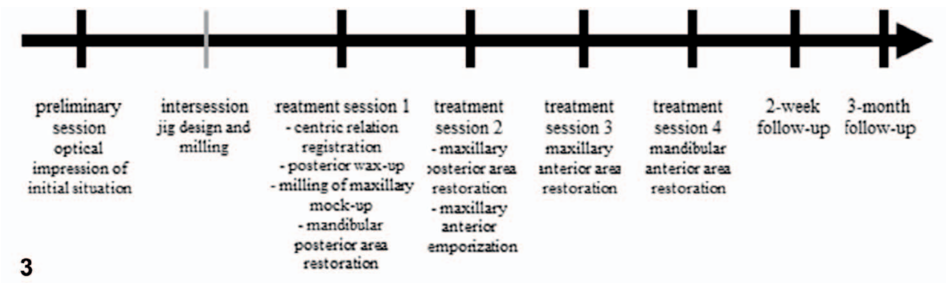
Complementary examinations (sensitivity and percussion tests, X-rays) confirmed the presence of primary caries (almost always associated with AI[10]) and secondary caries under provisional crowns, without an underlying pulpal pathology; the pulp chambers appeared retracted (Figure 2).

The patient had a high caries risk (presence of active lesions, enamel defects, defective restorations, and low socioeconomic status[11]), and all teeth needed to be restored. Because of the crumbly texture of the enamel over the whole tooth surface, full-coverage restorations were required. To combine strength and esthetics, the posterior teeth were restored with lithium-disilicate reinforced glass ceramic (e.max CAD, Ivoclar Vivadent, Liechtenstein) and the anterior teeth with leucite-reinforced glass ceramic (Empress CAD, Ivoclar Vivadent). In addition, for access to the entire affected tissue and to slightly increase the height of the clinical crowns, gingivectomies were also necessary.

Interventions

The interventions involved laser periodontal treatment and prosthetic restorations of all teeth. The treatment consisted of a preliminary session to study and plan the sessions, followed by four care sessions. The chronology of the treatment is described in Figure 3.

Preliminary Session: Optical Impressions for Digital Study Models—The first session consisted of taking optical impressions (CEREC Omnicam, Dentsply Sirona, York, PA, USA) to obtain digital study models (Figure 4), evaluate the clinical situation, and plan the treatment using CEREC v4.4 software (Dentsply Sirona) with a multidisciplinary approach: two general practitioners and a



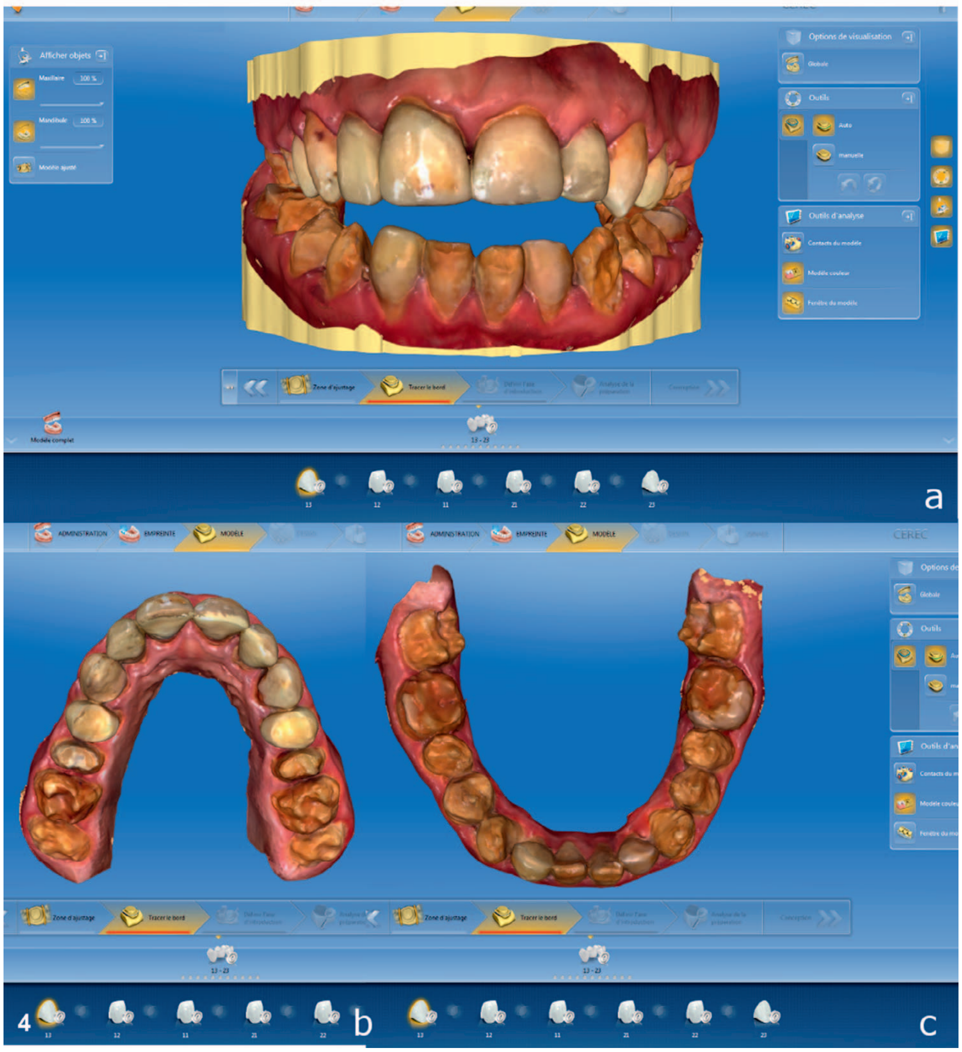


Figure 3. *Treatment planning and treatment timeline.*

Figure 4. *Digital study models after optical impressions.*

pediatric dentist were involved in the treatment planning, and an orthodontist was asked for advice. One of the general practitioners (CM) performed all steps. Two dental students were also present during the care sessions to help the practitioners.

Intersession: Jig Fabrication—For restorations in centric relation occlusion, the digital models were used to model a jig (Figure 5a), which was machined (MC XL, Sirona, Bensheim, Germany) in a block of polymethyl methacrylate (PMMA; Telio CAD, Ivoclar Vivadent; Figure 5b,c). The jig (assigned as "bridge" in the CEREC software) consisted of crowns connected via a lingual extension. It was modeled in the static position (but was then adjusted in the mouth). This jig also helped to maintain the existing vertical dimension. Indeed, as the three facial thirds were initially balanced, we needed to avoid exacerbating the anterior overjet and open bite.

First Session (January 7, 2017)—The first session consisted of bite registration, gingivectomy, tooth

Figure 5. *(a): Modeling of a jig. (b,c): Fabrication of the jig machined in a block of polymethyl methacrylate. (d): Sandblasting of the jig on the surface of contact with the mandibular incisors. (e): Light curing after application of a fluid methyl methacrylate resin.*

preparation, and crown placement in the mandibular posterior quadrants (right and left).

The jig was sandblasted on the surface of contact with the mandibular incisors (Figure 5d), and then a fluid methyl methacrylate resin (SR Connect, Ivoclar Vivadent) was applied and light cured (Figure 5e) to allow bonding between the PMMA and composite. The jig was placed on the maxillary anterior teeth (Figure 6a), and a microhybrid composite layer (Gaenial, GC, Japan) was applied with a spatula (Optrasculpt, Ivoclar Vivadent) on the sandblasted and primed area (Figure 6b). The mandible was guided and positioned in a centric relationship with the jig through the uncured composite (Figure 6c). When the centric relationship was reached, the composite was light cured in the mouth to fix the new bite (Figure 6d). The anterior mandibular teeth thus indented the jig, transforming it into a wedge. The jig was then removed, and light curing was completed outside the mouth (Figure 6e).

A buccal optical impression of the bite was taken with the jig in the mouth. The initial study models were then mounted in a centric relationship. Numerical wax-ups were created (Figure 7) to restore an optimal curve of Spee and obtain mock-ups to guide the preparations and gingivectomy. The posterior mock-ups (Figure 8a) corresponding to these wax-ups were simultaneously machined in

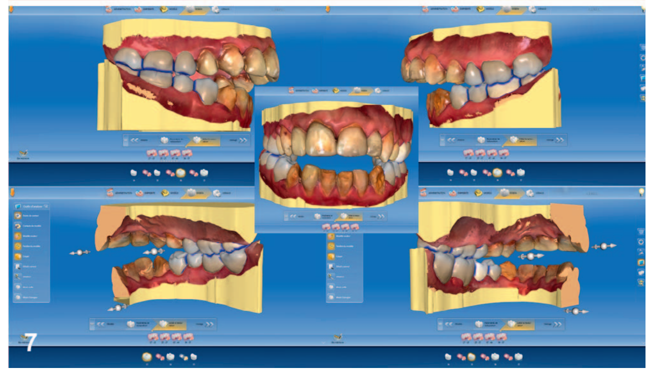


Figure 6. *(a): Fitting of the jig. (b): Application of a microhybrid composite layer on the sandblasted and primed zone. (c): Mandible positioning in a centric relationship with the jig through the uncured composite. (d): Light curing in the mouth in a centric relationship. (e): Extraoral light curing. (f): Final appearance of jig.*

Figure 7. *Models in a centric relationship after buccal optical impression of the occlusion with the jig.*

blocks of PMMA. In fact, we were equipped with three milling units.

The maxillary mock-ups were positioned in the mouth (Figures 8b,c), and the treatment was initiated in the right mandibular quadrant. Laser gingivectomy (Sirolaser blue, Dentsply Sirona) provided access to the entire loss of tooth structure and slightly increased the clinical crown height. Preparations involved the use of diamond burs and sonic inserts (Sonic flex, KaVo Kerr, Washington, DC, USA). Optical impressions of the right mandibular quadrant (Figure 9a) and of its antagonist with the mock-up were obtained (Figure 9b). The jig was placed, and a buccal optical impression of the bite (Figures 9c,d) was obtained. The crowns were designed using CEREC v4.4 software (Figure 10) and then machined in blocks of lithium-disilicate–reinforced glass ceramic (e.max CAD, Ivoclar Vivadent) of the A1-MT shade (Figure 11a,b). Three crowns were machined simultaneously via three milling units, and the fourth was machined immediately afterward. During the milling process, in the same way, the left mandibular teeth were prepared, optical impressions were obtained, and crowns were then designed and machined.

During the milling of the left mandibular crowns, the right milled crowns were evaluated in the mouth (Figure 11c), stained and glazed (IPS e.max CAD Crystall Shades/Stains/Glaze, Ivoclar Vivadent; Figure 11d), and crystallized in the furnace. During crystallization, the left mandibular milled crowns were evaluated in the mouth, stained and glazed, and then crystallized in the furnace.

During crystallization of the left mandibular crowns, each right mandibular crown was individually bonded using a rubber dam. The tooth surface was treated as follows: air abrasion with alumina (27 μm), enamel etching with orthophosphoric acid (Figure 12a), thorough rinsing, application on the enamel of 5% sodium hypochlorite for one minute (Figure 12b), thorough rinsing, and finally application of a one-step self-etch adhesive (Multilink Primer A+B, Ivoclar Vivadent) on the entire prepared tooth surface (Figure 12c).

In addition, another practitioner treated the inner surface of the crown as follows: application of 5% hydrofluoric acid for 20 seconds, rinsing with water in an ultrasonic tank for three minutes, and application of silane (Monobond Plus, Ivoclar Vivadent).

The crown was then bonded with a dual-cure resin composite cement (Multilink Automix, Ivoclar Vivadent; Figure 12d). The excess was removed with a disposable brush while maintaining the crown under pressure (Figure 12e). The excess residual cement was removed with a mini CK 6 scaler and dental floss. Final light curing was performed under glycerin (Figure 12f,g) for 20 seconds per surface. After rubber dam removal, the occlusion was checked with respect to the maxillary mock-up. In the same way, the left mandibular crowns were successively bonded.

Second Session (January 14, 2017)—The second session consisted of gingivectomy, tooth preparation, and crown placement in the maxillary posterior

Figure 8. *(a): Posterior mock-ups corresponding to wax-ups. (b,c): Positioning of the maxillary mock-ups in the mouth.*

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Figure 9. *(a): Optical impressions of the prepared quadrant. (b): Optical impressions of its antagonist with the mock-up. (c,d): Bite registration with the jig by buccal optical impression of the posterior teeth.*

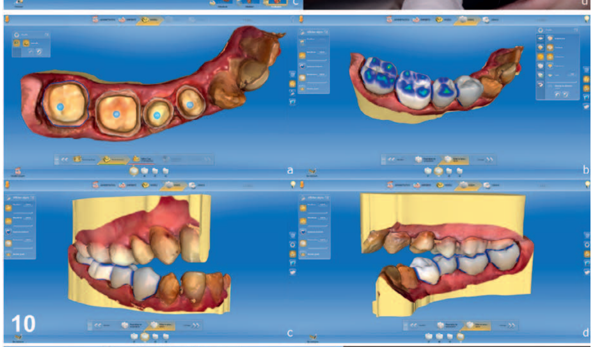

Figure 10. *(a,b,c,d): Virtual design of the mandibular posterior crowns.*

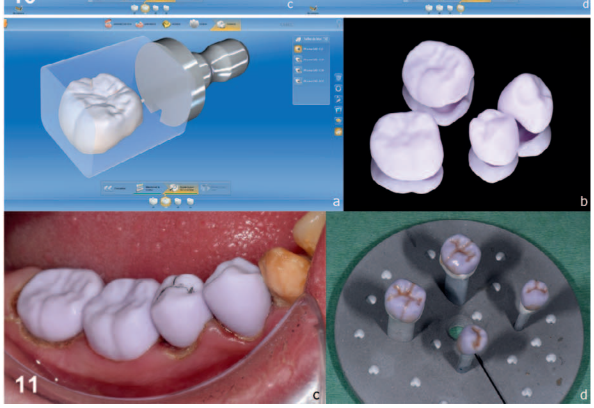

Figure 11. *(a,b): Fabrication of the crowns from blocks of lithium-disilicate–reinforced glass ceramic. (c): Fitting of the milled crowns. (d): Staining and glazing before crystallization in the furnace.*

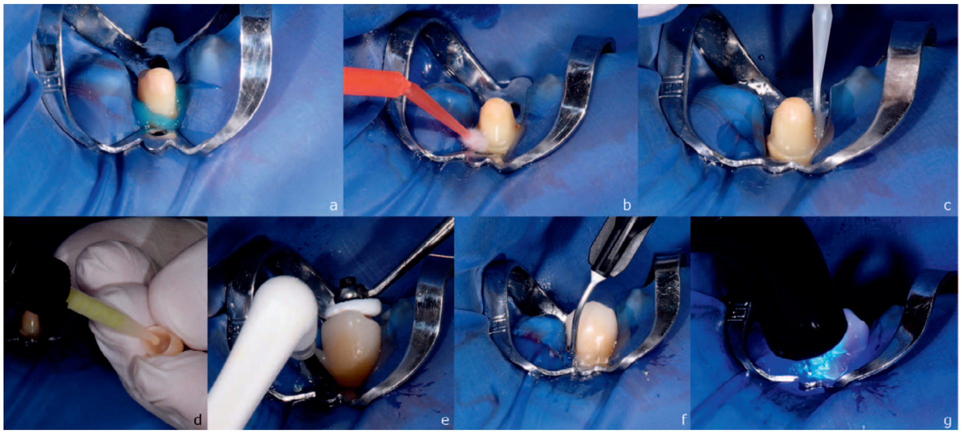

Figure 12. *(a): Enamel etching with orthophosphoric acid. (b): Application of 5% sodium hypochlorite for one minute on the enamel strip. (c): Application of a one-step self-etch adhesive on the entire prepared tooth surface. (d): Introduction of a dual-cure resin composite cement in the crown. (e): Removal of excess adhesive cement. (f): Application of glycerin. (g): Final light curing.*

quadrants (right and left) as well as preparation of the maxillary anterior teeth.

The following week, the session consisted of treating the right and left maxillary posterior teeth. The workflow was exactly the same as the first session. The mock-ups guided the gingivectomy (Figure 13a) as well as the depth of the preparation (Figure 13c). Then, right and left maxillary posterior teeth were prepared and restored.

Subsequently, a silicone key of the maxillary incisors and canines was made. The former anterior restorations were used as a reduction guide for the preparation: depth markers were generated (Figure 13b). The old restorations were removed or drilled, and then the preparations were finalized after caries excavation. A composite acrylic resin (Protemp4, 3M, St Paul, MN, USA) was poured into the silicone key, which was then applied onto the prepared incisors and canines to create a provisional bridge. After adjustment and polishing, the bridge was cemented with temporary cement without eugenol (Tempbond NE, KaVo Kerr, Washington, DC, USA; Figure 13d). Preparation of the anterior maxillary teeth at this step allowed more time for the following session, requiring considerable time for tooth characterization.

Figure 13. *(a): Gingivectomy guided by the mock-up. (b): Depth marking. (c): Depth of the preparation guided by the mock-up. (d): Cementation of the provisional bridge.*

Third Session (January 21, 2017)—The third session consisted of crown characterization and placement for the maxillary anterior teeth.

The following week, the marginal periodontium was sufficiently healthy for creating the maxillary anterior crowns. The gingival margin was corrected using a laser. The gingival retraction cord was placed, and the optical impression was obtained. Because of the open bite, optical impressions of the antagonist and bite registration were not necessary. The crown design was conducted using the "biogeneric" mode. The preparation margins and insertion axis were defined for the six anterior teeth, and then the crown volume was proposed by the software. The virtual model (Figure 14a) was incorporated into the patient's image using the "Smile Design" software (Figure 14b,c). Harmony of the teeth in the face could thus be confirmed. Position or volume changes were possible if necessary. Then, the proximal contact strength of each crown as well as the thickness of adjacent crowns could be checked (Figure 14d). Crowns were characterized with perikymata and vertical fissures (Figure 14e). The crowns were then machined three by three in leucite-reinforced glass-ceramic ceramic blocks with a shade and translucency gradient (EMPRESS CAD, multi A1, Ivoclar Vivadent). The block size was determined according to the tooth volume and its orientation. An oblique orientation in the block allowed full benefit for the shade gradient (Figure 14f). The transition lines and other characterizations of the buccal surfaces were finished with diamond

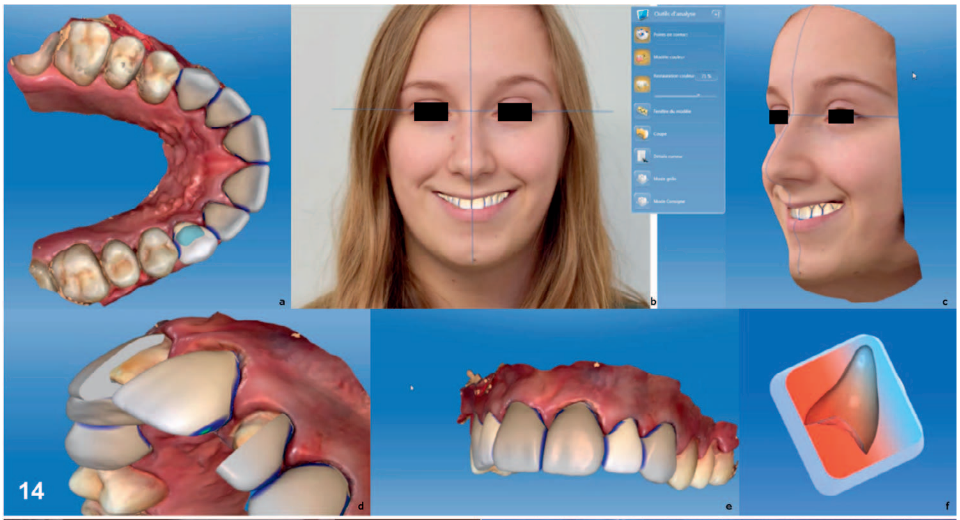

Figure 14. *(a): Crown design using the biogeneric mode. (b): Incorporation of the virtual model in the patient picture by Smile Design. (c): Profile picture obtained with Smile Design. (d): View of the proximal contact strength and thickness of adjacent crowns. (e): Crown characterization. (f): Oblique orientation of the crown in the block.*

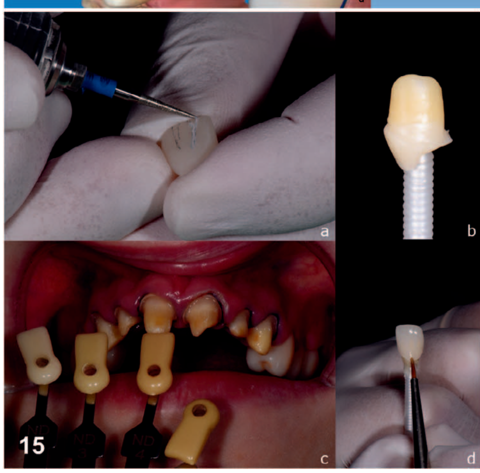

Figure 15. *(a): Design of the transition lines and other characterizations of the buccal surfaces. (b): Determination of the two shades with a dedicated shade guide. (c): Fabrication of bicolor dyes using a specific composite. (d): Staining and glazing of the crowns positioned on the dyes.*

Figure 16. *Bonding of the two central incisors simultaneously.*

burs for the handpiece (Figure 15a; H&D Crescenzo kit, ref TD2818, Komet, Rock Hill, SC, USA). Because the prepared teeth were bicolor, we chose two shades with a dedicated shade guide (Figure 15c) and then fabricated two-color dyes with a specific composite (Natural Die Material, Ivoclar Vivadent; Figure 15b). The crowns were positioned on these dyes for staining and glazing to simulate the final esthetic appearance (Figure 15d). The glaze and stains were fired in a furnace.

The crowns were then evaluated and bonded under a rubber dam using the same protocol applied for the posterior crowns. First, the central incisors were simultaneously bonded to avoid positioning error of the interincisal line (Figure 16), and then the canines and finally the lateral incisors were bonded. This chronology also aided in perfectly adjusting the proximal contact points.

Fourth Session (January 28, 2017)—The fourth session involved preparation and crown placement for the mandibular anterior teeth.

The following week, the final treatment session consisted of producing crowns for the mandibular incisors and canines. The teeth were prepared by simple removal of the affected enamel (Figure 17). Optical impressions were obtained, and then the crowns were designed. The height of the crowns was

Figure 17. *Preparation of the mandibular incisors and canines by simply removing the affected enamel.*

deliberately increased to reduce the open bite. The anteroposterior position was slightly modified by the labioversion of the crowns to improve support of the lower lip. The crowns were also machined three by three in leucite-reinforced glass-ceramic blocks with a shade and translucency gradient (EMPRESS CAD, multi A1, Ivoclar Vivadent). They were stained, glazed, crystallized, and bonded under a rubber dam using the same chronology as described for the maxillary anterior crowns (Figure 18b).

RESULTS

Follow-up and Outcomes After Two Weeks and Three Months

The gingiva showed good healing (Figure 18c-g), and the patient was satisfied with the esthetic integration of the restorations (Figure 18a). She reported a real improvement in well-being, with a noticeable decrease in sensitivity, a marked improvement in chewing, and greater self-confidence. At three months (Figure 19), no adverse events had occurred: no sensitivity, no loss of restoration, no marginal discoloration or staining of the material, no chipping, no excessive wear, and no periodontal damage. Even though the World Dental Federation has recommended an annual assessment for indirect restorations,[12] a biannual follow-up was agreed upon.

Follow-up and Outcomes After 1.5 Years

The gingival status seemed to be stable (Figure 20a-c). There were still no adverse events: no sensitivity, no loss of restoration, no marginal discoloration or staining of the material, no chipping, no excessive wear, no periodontal damage, and no secondary caries (Figures 20 and 21).

DISCUSSION

This case report describes four sessions of chairside CAD/CAM used to restore hypocalcified AI-affected teeth—loss of enamel and dyschromia reaching all the teeth—in a 17-year-old girl. The patient reported rapid pain relief and overall improvement in well-being after the treatment.

Chairside CAD/CAM Interest

The main feature of this case is that it was performed in full by chairside CAD/CAM. For this patient, who was tired of repeated dental treatment since childhood, we could obtain a rapid and effective final result in four long sessions.[13] In addition, the planning stages and design of the restorations were performed in partnership with the patient, which is difficult to do when the work is delegated to a dental technician. The involvement of the patient was of great importance in integrating the new restorations and for psychological success of the treatment. Of course, the sessions were long (approximately eight hours), but their painfulness seemed to be offset by the immediate effect on function and esthetics.

Gingival Management

The diode laser used for gingivectomy (wavelength 445 nm, optical fiber diameter 320 μm) allowed for precise gingival excision. Gingivectomy could be performed because of the sufficient height of the attached gingiva. The biological space was probably not respected everywhere, but a good adhesive interface and timely restoration seemed to allow for good periodontal healing.[14] The young age of the patient favored gingival maturation around the restorations.

Material Selection

In terms of material selection for the crowns, we hesitated to use composite or polymer-infiltrated ceramic network (PICN) material (Enamic, Vita, Bad Säckingen, Germany). Indeed, the periodontium is considered mature at approximately 20 years of age, and reintervention is easier with composite than with ceramic material. Our patient was 17 years old, and the periodontium was probably almost mature. It also seemed preferable to use homogeneous materials in the anterior and posterior teeth for homogenous wear and biomechanical deformation. We opted to use ceramic for the following reasons.

In terms of optical properties, glass ceramics were the most interesting materials. Moreover, surface staining and glazing of composites and PICNs is less durable. Hence, improved esthetics of ceramic crowns were found in a clinical trial.[15] In the anterior area, leucite-reinforced glass ceramic (Empress CAD Multi) was the best option because it is the most translucent CAD/CAM ceramic[16] and contains blocks with an optical gradient. Empress CAD Multi is not a very resistant material, but the anterior teeth are subjected to lower mechanical stress than the posterior teeth, in particular in this patient with an open bite. In terms of mechanical resistance and fracture risk, lithium-disilicate–reinforced glass ceramic (e.max) and zirconia (full or covered with e.max through the CAD-on system) were the two best options in the posterior area.[17,18] We could not sinter zirconia, so we opted for e.max. In terms of biocompatibility, ceramics are favorable

Figure 18. *(a): Photograph of the smile at the two-week follow-up. (b): Slight modification of anteroposterior position by labioversion of the crowns to improve support of the lower lip. (c-g): Final intraoral view at the two-week follow-up.*

Figure 19. *Final intraoral views at the three-month follow-up.*

Figure 20. *Final intraoral views at the 1.5-year follow-up.*

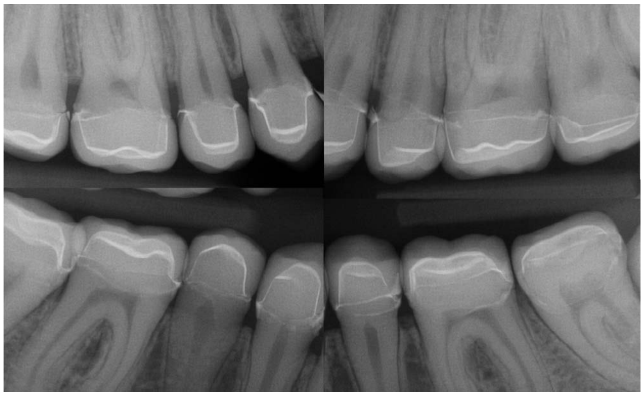

Figure 21. *X-rays at the 1.5-year follow-up.*

for periodontal health[19] and in general.[20] Finally, in terms of adhesion, CAD/CAM glass ceramics provided higher bond strength values than composites/hybrids.[21]

Bonding to AI-Affected Teeth

It seemed preferable to bond the crowns rather than cement them, not only because the preparations were sometimes not very retentive but also because of biomechanical reasons, to reinforce the ceramic and the tooth,[22,23] which were already weakened by the structural defects.

Furthermore, the absence of temporization allowed the achievement of the same objectives as with immediate dentin sealing. With chairside CAD/CAM, the adhesive system does not need to be light cured under glycerin, in contrast to immediate dentin sealing, allowing for an improved copolymerization between the adhesive system and the resin composite cement.

Bonding involved the use of a dual-cure resin composite cement (Multilink Automix) together with its bonding agent (Multilink primer), which is a one-step self-etch adhesive system. Multilink Automix was recently compared with Rely X Ultimate + Scotchbond Universal and NX3 Nexus + Optibond XTR for the retention of lithium-disilicate crowns; Multilink Automix and RelyX Ultimate yielded the best retention, and clinical experience with Multilink Automix has been much more frequently documented.[24] Moreover, Multilink Automix is a copper-containing cement, which was recently shown to reduce biofilm formation at the margins of restorations.[25]

A one-step self-etch adhesive system (Multilink primer) was chosen to achieve adhesion to the enamel and dentin. Indeed, etch-and-rinse systems did not seem to be more reliable than self-etch systems in the context of AI.[26] In addition, a self-etch system seemed particularly indicated because of the patient's sensitivities.[27,28] Selective enamel etching was performed in accordance with current recommendations.[29-31] A two-step self-etch adhesive could have been preferred to optimize the adhesion durability,[32,33] but it is better to use a cement with its corresponding bonding agent.

A reliable and long-lasting adhesion is difficult to obtain for AI-affected tissues. Superficial enamel and crumbly tissue were removed during the tooth preparation. Thus, except on the margins, bonding was carried out on sound dentin. Regarding the enamel, it seemed beneficial to treat it with 5% sodium hypochlorite after etching and before adhesive application[34-36] to reduce the excess of proteins of AI-affected enamel and thus improve the bond strength. Regarding the dentin, a conventional adhesion protocol was performed because hypochlorite does not significantly increase the bond strength.[37] Crowns were individually (or by two for central incisors) bonded with a rubber dam for moisture control when applying the adhesive system and the resin composite cement and to prevent contamination of the margins.

Centric Relationship and Jig

The proposed PMMA jig is an adaptation of Lucia's jig[38-40] used to guide the mandible in a centric relationship and as a wedge for optical impressions of the posterior quadrants. A methyl methacrylate resin was applied onto the PMMA jig (Figure 5e) to increase the bond of the resin composite before bite registration. In fact, the sole application of PMMA is not very efficacious, particularly because of the evaporation of the monomer. Although it seems desirable for better penetration to leave the primer or the composite on the PMMA surface for a long time, we followed the protocol recommended by the manufacturer (waiting 30 seconds before light curing).[41] Indeed, the jig was to be used in the mouth only temporarily, and maximum bond strength was not necessary.

Caries Risk Management and Treatment Prognosis

Longevity will depend on regular follow-up and maintenance by the patient. Because the protocols were rigorously followed, the prognosis seemed favorable; the weakest link in this treatment probably resides in the adhesion to hard tissues, which may be affected in part by the AI. Therefore, the risk of recurrent caries or pulpal involvement must be rigorously monitored. Use of ceramics prevents the adherence of plaque and thus also contributes to reducing the initial caries risk.

After the treatment, tooth sensitivity was resolved and mastication improved, which allowed the patient to achieve better oral hygiene and to reduce consumption of soft and sticky food. In fact, the patient was carefully advised about oral hygiene and diet. She was educated regarding optimal oral hygiene practices, including brushing with fluoride toothpaste twice a day and flossing daily. She was instructed to consume a healthy diet, limiting the amount and frequency of sugar intake and high-acid foods and drinks, especially between meals. She was also motivated to chew sugar-free gum with xylitol to promote salivary flow and to stop carbohydrate metabolism by cariogenic bacteria.

The wisdom teeth were impacted but did not cause complications, and we decided not to extract them immediately. Orthodontic treatment could have been planned. However, it could not be initiated before tooth restoration because of the bonding difficulty in the initial situation. In addition, orthosurgical treatment would be needed because of the severe skeletal discrepancy.[42,43] At the time, the patient did not want orthodontic treatment. However, we will encourage her to continue with such treatment in the near future.

Our treatment seems to have had a significant psychosocial impact, and the patient reported rapid improvement in quality of life and social and mental well-being. Thus, good management of the dental consequences of AI seems to positively affect all dimensions of the health of patients.[13,44,45]

CONCLUSION

Four sessions of entirely chairside CAD/CAM were used to treat the entire dentition affected by hypocalcified AI in a 17-year-old patient. We used a jig to secure the registration of the centric relation by optical impression before making the posterior permanent restorations. Her 28 teeth were restored with ceramic crowns, bonded under a rubber dam to ensure good longevity.

Hypocalcified AI can be rapidly treated with CAD/CAM, with restoration of function and esthetics while preserving residual tissues as much as possible. The latter objective is important to maintain the patient's teeth over the long term.

Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of Paris Descartes University. The patient read the article before its submission and accepted its publication.

Conflict of Interest

The authors of this article certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article. The patient did not pay for the treatment. The practitioner was partly paid by French social security and the patient's private insurance.

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