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Dentinogenesis imperfecta (DI) is a congenital dentinal defect affecting both the deciduous and permanent dentitions with a prevalence of 1 in 8,000 individuals. Clinically, teeth affected by DI are characterized by opalescent discoloration accompanied by severe wear, which results in rapid loss of the occlusal vertical dimension (OVD). Radiographically, the crowns appear bulbous and present with cervical constriction. The roots are short and thin, and pulp is partially or totally obliterated. Early diagnosis is crucial for establishing a management strategy to minimize the functional and psychosocial impacts of the condition. The choice of rehabilitation strategy depends on the patient’s age and cooperation, severity of tooth wear, expectations, and resources.

Various approaches for managing DI with worn permanent dentition have been documented. Restorative techniques, ceramic restorations, or extractions and implant-supported fixed prostheses are frequently performed. Concerning a deciduous dentition with complete wear, a suggested option is removable complete overdenture prostheses (RCOPs). However, this option can be a challenge, particularly when the space available between opposing teeth is insufficient. Thinner prostheses can be obtained using monolithic RCOPs, but this approach is not easily...
achievable with conventional methods. An alternative method using computer-aided design/computer-aided manufacturing (CAD/CAM) technology has been successfully used to treat patients suffering from ectodermal dysplasia and oligodontia.12–14 The present clinical report describes the use of monolithic RCOPs and CAD/CAM technology for the management of a moderately cooperative child diagnosed with DI and presenting with limited vertical restorative space.

CASE HISTORY

A 7-year-old girl suffering from DI was referred to the Oral Manifestations of Rare Diseases Center (Hôpices Civils de Lyon, France). The patient’s chief complaint was discoloration and rapid wear of all teeth. Her father and 3-year-old brother suffered from the same condition. No remarkable medical findings were identified, and the patient was in good general health. A complete examination revealed good oral hygiene, no dental caries, and a high smile line with excessive gingival display. All teeth showed brown discoloration and severe wear (Fig 1). The girl had difficulty remaining seated during the initial examination and demonstrated moderate cooperative behavior. Radiography revealed mixed dentition, no missing teeth, bulbous crowns with cervical constriction, and obliteration of the permanent teeth pulp chambers (Fig 2). Despite dental wear, the OVD appeared slightly reduced, with an interocclusal rest distance of approximately 4 mm. As a result, the vertical space available for restoration was very limited. Due to this limitation and the child’s moderate cooperation, the treatment of choice was to opt for digitally assisted production of monolithic RCOPs. The importance of oral hygiene, caries control, and cooperation was emphasized. Following a discussion regarding the benefits, risks, and

Fig 1 Frontal view of permanent and deciduous teeth. Note the extremely short opalescent crowns.

Fig 2 Orthopantomogram at the age of 7 years, 3 months.

Fig 3 Digital preview showing virtual tooth arrangement according to an occlusal vertical dimension increased by 6 mm.
possible alternative treatments, the patient and her parents agreed to the proposed treatment plan.

First, a preliminary intraoral scan of both arches was made using an intraoral scanner (TRIOS 3, 3Shape). However, the scanning failed due to the sclerosed and glassy appearance of the exposed dentin. Therefore, preliminary impressions were obtained using alginate impression material (Pralg’x, Acteon). The definitive impressions were made of polyether material (Permadyne, 3M ESPE). The centric relation was recorded using a wax rim adjusted within a 6-mm OVD opening to obtain sufficient vertical space for RCOPs. The laboratory digitized (D2000, 3Shape) the definitive casts mounted on an articulator to create the digital files. Tooth arrangement and base design were performed using CAD software (DentalCAD, Exocad) (Fig 3) to provide printed trial RCOPs (MAX, Asiga). The trial session highlighted that the 6-mm OVD opening resulted in lip incompetence. Adjustments were needed to reduce the OVD and to suppress the maxillary flange in the incisor area, as lip support was too extensive (Fig 4). The maxillomandibular relationship was recorded once more using an occlusal registration material (Aluwax Dental Products). The digitized casts were articulated digitally with the new interocclusal record, and the design was then refined (Fig 5). A second set of trial RCOPs of very low occlusal thickness (2 mm) was printed.

During the new clinical evaluation session, the patient was very pleased with the esthetics and the comfort provided by the trial RCOPs and hence became more and more cooperative. The definitive RCOPs were milled from tooth-colored polymethyl methacrylate (PMMA) disks (VIPI Block Trilux, VIPI) and then characterized with a gingiva-shade composite resin (Gradia gum shades, GC America) (Fig 6). The prostheses were delivered with

Fig 4 Frontal views of printed trial dentures (a) before adjustments and (b) after maxillary adjustments.

Fig 5 New virtual design after taking the adjustments into account.
excellent retention and stability and were adjusted for optimal occlusion using articulating paper. Both the patient and her parents were very satisfied with the esthetic result. During follow-up, maintenance of oral hygiene was emphasized, and daily application of a fluorine-containing compound was recommended. The patient was recalled for follow-up at 1 week, 1 month, and 6 months, and evaluation at the final follow-up showed good stability and no signs of complications. The esthetic result greatly impacted the patient’s quality of life (Fig 7).

DISCUSSION

Complete mouth rehabilitation in young children is tricky, and practitioners are often forced to propose a therapeutic compromise to delay tooth preparation. RCOPs, which can be easily adjusted or replaced according to dental-skeletal evolution, constitute an interesting reversible approach. Digitally assisted production of monolithic RCOPs offers several advantages over conventional processes, including better mechanical properties and a reduction in polymerization shrinkage. The digital control of tooth arrangement, associated with minimal base distortion and tooth displacement, greatly minimizes occlusal errors. Denture base adaptation and retention can also be improved. CAD/CAM also reduces the number of patient visits required and thus simplifies the treatment. However, the cost of CAD/CAM RCOPs is currently higher than conventional RCOPs, which limits its application.

The 2-mm final thickness in the molar regions was less than the 3-mm minimum thickness recommended when producing CAD/CAM monolithic overdentures. Nevertheless, this complied with the 1-mm minimum thickness stipulated by the manufacturer of the PMMA.
CONCLUSIONS

In the presented clinical context, CAD/CAM RCOPs constitute a reversible treatment that can help prepare children for definitive treatment. This strategy needs regular denture replacement as the child grows. It also helps gain patient cooperation over time, which is essential for a future global fixed rehabilitation treatment plan.

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Effect of High-Dose Vitamin D Supplementation on Volumetric Bone Density and Bone Strength: A Randomized Clinical Trial

Few studies have assessed the effects of daily vitamin D doses at or above the tolerable upper intake level for 12 months or longer, yet 3% of US adults report vitamin D intakes of at least 4,000 IU per day. The objective of this study was therefore to assess the dose-dependent effect of vitamin D supplementation on volumetric bone mineral density (BMD) and strength. A 3-year, double-blinded, randomized clinical trial was conducted in a single center in Calgary, Canada, from August 2013 to December 2017, including 311 community-dwelling healthy adults (53% men; mean [SD] age: 62.2 [4.2] years), 287 (92%) completed the study. Baseline, 3-month, and 3-year levels of 25(OH)D were, respectively, 25.9 [9.5], 24.8 [9.4], and 24.6 [9.3] nmol/L. Calcium supplementation was provided for participants with dietary intake of less than 1,200 mg per day. The co-primary outcomes were total volumetric BMD at the radius and tibia, assessed with high-resolution peripheral quantitative computed tomography, and bone strength (failure load) at the radius and tibia, estimated using finite element analysis. Of the 311 participants who were randomized (53% men; mean [SD] age: 62.2 [4.2] years), 287 (92%) completed the study. Baseline, 3-month, and 3-year levels of 25(OH)D were, respectively, 25.3 [9.6], 24.6 [9.2], and 24.4 [9.1] nmol/L for the 400-IU group; 81.3, 115.3, and 132.2 for the 4,000-IU group; and 78.4, 188.0, and 144.4 for the 10,000-IU group. There were significant group × time interactions for volumetric BMD. At the end of the trial, radial volumetric BMD was lower for the 4,000-IU group (–3.9 mg HA/cm³ [95% CI: –6.5 to –1.3]) and 10,000-IU group (–7.5 mg HA/cm³ [95% CI: –10.1 to –5.0]) compared to the 400-IU group, with a mean percent change in volumetric BMD of –1.2% (400 IU), –2.4% (4,000 IU), and –3.5% (10,000 IU). Tibial volumetric BMD differences from the 400-IU group were –1.8 mg HA/cm³ (95% CI: –3.7 to 0.1) in the 4,000-IU group and –4.1 mg HA/cm³ in the 10,000-IU group (95% CI: –6.0 to –2.2), with mean percent change values of –0.4% (400 IU), –1.0% (4,000 IU), and –1.7% (10,000 IU). There were no significant differences for changes in failure load (radius: P = .06; tibia: P = .12). Among healthy adults, treatment with vitamin D for 3 years at a dose of 4,000 IU per day or 10,000 IU per day, compared to 400 IU per day, resulted in statistically significantly lower radial BMD; tibial BMD was significantly lower only with the 10,000 IU per day dose. There were no significant differences in bone strength at either the radius or tibia. These findings do not support a benefit of high-dose vitamin D supplementation for bone health. Further research would be needed to determine whether it is harmful.