

POLYMER-INFILTRATED-CERAMIC-NETWORK, COMPUTER-AIDED DESIGN/COMPUTER-ASSISTED MANUFACTURING RESTORATIONS FOR ORAL REHABILITATION OF PEDIATRIC PATIENTS WITH X-LINKED ECTODERMAL DYSPLASIA

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Abstract

Functional and esthetic oral rehabilitation of young patients affected by ectodermal dysplasia is traditionally performed with direct composite restorations, which encounter various limitations. However, recent advances in computer-aided design/computer-assisted manufacturing (CAD/CAM) composites have led to the introduction of high-performance materials. In the present case report, a 9-year-old patient was treated with 20 CAD/CAM partial and peripheral restorations in polymer-infiltrated-ceramic-network material to restore deciduous and permanent teeth. The restorations were minimally invasive, since they did not require any tooth tissue preparation. Appropriate occlusal relationships with increased vertical dimension of occlusion were obtained. Tooth anatomy and esthetics were significantly improved, and chairtime was reduced.

X-linked ectodermal dysplasia (DEX) (Online Mendelian Inheritance in Man [OMIM]: 305100) is the most common form of ectodermal dysplasia, with an incidence varying from 1 in 100,000 births to 1 in 50,000. Hypodontia and the conoid form of lacteal and definitive teeth are among the variable symptoms and are very characteristic of this syndrome.¹ The oral rehabilitation of children with DEX often requires the use of light-cured direct composites, while recent advances in computer-aided design/computer-assisted manufacturing (CAD/CAM) materials have led to the introduction of high-performance indirect composites, particularly polymer-infiltrated-ceramic-network (PICN) materials.² The objective of this case report was to introduce the use of PICNs in young patients affected by DEX for restoring deciduous and permanent teeth with minimally invasive CAD/CAM prostheses.

Case Report

A 9-year-old female patient with DEX was treated in the department of fixed prosthodontics at the University Hospital Center (CHU) of Liège. The clinical and radiographic examinations revealed the presence of intact lacteal and definitive conoid teeth, as well as numerous absences (Figs 1a, 1b, 1c, and 1f). The occlusion was Class I, and a lack of vertical dimension of occlusion (VDO) was observed (Figs 1d and 1e).

Fig 1 (a) Occlusal view of the preoperative maxilla, showing the conoid shape of the teeth. (b) Occlusal view of the preoperative mandible. (c) Frontal view of the maxilla and mandible. The lacteal molars do not have a conoid shape as marked as that of the incisors/canines. (d) Frontal view in occlusion, showing the lack of vertical dimension of occlusion. (e) The patient's smile with the conoid incisors and canines, which engender a social handicap. (f) Panoramic radiograph revealing the absence of permanent teeth 13, 16, 23, 25, 26, 27, 31, 32, 33, 36, 37, 41, 42, 43, 45, 46, and 47.



Study models obtained from alginate impressions were placed in an articulator based on an occlusion-recording wax, and a full wax-up was realized (Fig 2a). The new VDO was arbitrarily determined with the aim of restoring a normal dental anatomy and adequate occlusal relationships. Tooth tissues were not prepared (only the pointed ends of maxillary incisors were softened), and an optical final impression of the two arches was performed (Cerec Omnicam, Sirona Dental). The maxillary restorations were designed by superimposing the scan of the wax-up on the maxillary impression (Ceramill Motion 2 System, Amann Girrbach) (Fig 2c). A CAD/CAM mock-up was performed in wax and tried in to validate the esthetic result (Fig 2b). Ten PICN restorations (crowns from 13 to 23 [FDI system] and overlays on premolars and molars) (Vita Enamic, Vita Zahnfabrik) were then manufactured (Figs 2e and 2f). The restorations were etched with 9.5% hydrofluoric acid for 60 seconds, then silanized and bonded with composite resin cement in one session (Variolink Esthetic DC, Ivoclar Vivadent) (Fig 3a). Before bonding, teeth were cleaned with pumice and treated with an etch-and-rinse bonding agent (Adhese Universal, Ivoclar Vivadent). A rubber dam was placed for the bonding procedure of overlays.

Two weeks later, an impression of the maxillary restorations was performed, and the mandibular restorations were manufactured and bonded following the same procedure (Figs 2d, 3b, 3c, 3d, 3e, and 3f). Slight occlusal adjustments were performed with an Arkansas bur and polished with silicon points. The patient was entirely satisfied with esthetics and function, and did not report any complaint related to the VDO increase.

Fig 2 (a) Maxillary and mandibular wax-ups. (b) Try-in of the anterior mock-up in wax on the maxilla. (c) Digital set-up in transparency of restorations for the maxillary teeth. (d) Digital set-up in transparency of restorations for the mandibular teeth. (e) Frontal view of PICN restorations for the maxilla. Some stains were used before mechanical polishing (Optiglaze color, GC). (f) Palatal view of PICN restorations for the maxilla. Dental lab: Jean-Michel Paulus, Liège, Belgium.

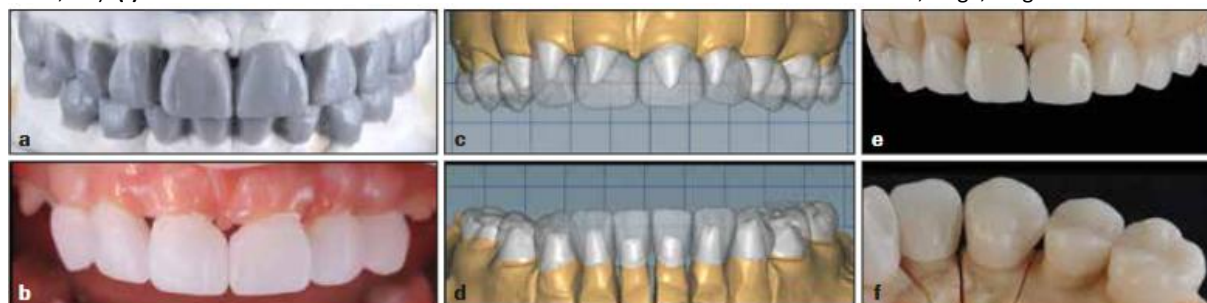


Fig 3 (a) Postoperative occlusal view of the maxilla. (b) Postoperative occlusal view of the mandible. (c) Frontal view in occlusion showing integration of restorations at the gingival level. (d) Integration of the restorations in the smile highlighting the esthetic rendering and increase in vertical dimension of occlusion. (e) Postoperative radiograph of maxillary incisors to check the absence of excess cement. (f) Postoperative radiograph of the right maxilla.



Discussion

Rehabilitation with CAD/CAM composite restorations overcomes the disadvantages of direct composites by avoiding the adverse effects resulting from polymerization shrinkage and, most of all, by allowing the realization of appropriate dental anatomy, interproximal contact points, occlusal relationships, and esthetics; moreover, the VDO is easily increased. This technique is less operator dependent, the chairtime is reduced (which is important, given the lack of compliance of children), and allows the use of high-performance materials. The specific microstructure and polymerization method of PICN leads to a particularly high degree of monomer conversion compared to direct composites^{2,3}; this was shown to have a significant impact on the material mechanical properties, resistance to chemical solubility, and biocompatibility due to the release of free monomers.⁴ In addition, PICNs exhibited bonding properties equivalent to glass- ceramics and superior to other CAD/CAM composites,⁵ which is important regarding partial bonded prostheses. Compared to ceramic materials, composites exhibit higher machinability: they can be milled in very low thicknesses (up to 0.2 mm thick) to perform minimally invasive restorations with less edge chipping. Composite materials are easier to adjust— particularly regarding occlusal contact points—and to repair, and direct composite

can be added for adaptation (for example, to the evolution of gingival tissue until adulthood). The only drawback of this treatment is the cost, which is often not covered by social insurance systems.

Conclusions

Rehabilitation with PICN CAD/CAM restorations is straightforward and in this case allowed the patient to regain well-being related to esthetics and occlusal stability with a material that offers better properties than direct composites.

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