

Fully digital fixed orthodontic prosthesis: use of PEEK technopolymer in cases of early loss of primary incisors

PRESENTATION

Beginning with this issue, this column will walk us through technological developments, innovations in materials and tools, as well as new operative trends in paediatric dentistry of today and tomorrow. The goal, rather ambitious, is to explore, with a very practical approach and a broad clinical vision, what "avantgarde" actions we can implement to take care of our little patients.

We want to promote solutions, not only for treatment and achievement of specific therapeutic goals, but for the well-being of children and their families, where more often than not, "how" is more important than "what".

Luigi Paglia
Editor in Chief EJPD

ABSTRACT

Background The aim of this paper is to illustrate a new, fully digital approach to temporary rehabilitation in the case of premature loss of deciduous incisors, using a metal-free fixed orthodontic prosthesis made of polyether ether ketone (PEEK).

Clinical report Technopolymer Orthodontic Prosthesis (TOP) is a complete CAD-CAT (Computer Aided Design-Computed Aided Technofabrication) fixed device that can be used to rehabilitate the mouth of very young patients, both from an aesthetic and functional point of view as well as maintaining space and controlling growth. The appliance is customised, designed to be cemented with adhesive technique, using deciduous teeth as anchorage. Two cases of patients in deciduous dentition with early loss of incisors are illustrated to present this procedure. In the first case the patient lost 2 central incisors and in the second one 3 lower incisors were lost due to trauma.

Conclusion TOP, made by metal-free technopolymer and cemented on deciduous teeth, proved to be comfortable, aesthetic, easy to apply and efficient in rehabilitating smile and mastication in case of trauma or premature loss of deciduous incisors.

AUTHORS

M. BERETTA¹,
F. FEDERICI CANOVA²,
A. GIANOLIO³,
L. ZAFFARANO⁴

¹DDS, MS Ortho, MS Digital Dentistry, Private Practice in Varese, Italy

²DDS, MS Ortho, Private Practice in Viadana, Italy

³DDS, MS Ortho, Private Practice in Bra, Italy

⁴DDS, MS Paediatric Dentistry, Private Practice in Viadana, Italy

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KEYWORDS

Deciduous teeth trauma, avulsion of primary incisors, metal-free orthodontic prosthesis, digital paediatric dentistry, digital paediatric orthodontics.



FIG. 1



FIG. 2

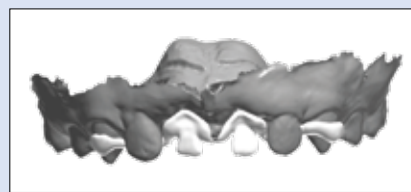


FIG. 3



FIG. 4



FIG. 5



FIG. 6

FIG. 1 Intraoral scan of a 4-year-old child with traumatic loss of both primary upper central incisors and a chief request by family to restore the aesthetics. FIG. 2-5 The child was treated with bilateral (right and left part are separated at the midline) full digital POP (design and project by Dr. Matteo Beretta and Gaetano Frascina, digital orthodontic technician, Bari, Italy) anchored on the primary lateral incisors and canines and cemented using a bioactive composite light curing resin. FIG. 6 The child at the 6-month follow up.

Introduction

Dental prosthesis for children in the primary dentition needs to be planned in case of traumatic loss of deciduous incisors [Biagi et al., 2011; Coutinho et al., 2011; Bucchi et al., 2021] not only to preserve function and for space maintainance [Beau et al., 2015; Beretta and Cirulli, 2017; Flores et al., 2019], but for social and self-esteem reasons as well [Giannetti et al., 2007; Re et al., 2014, Attardo Parrinello et al., 2021]. Digital technology and new technopolymers can play an important role in simplifying and optimising our approach to this scenario, requiring the integration of prosthetics and orthodontics. The traditional rehabilitation in these cases consisted of removable appliance, sometimes very bulky, with replacement teeth that were not easily accessible for children and not suitable to follow the normal growth. In other cases fixed devices were used; with an orthodontic wire soldered on metal bands anchored on the deciduous molars, supporting a resin flange with the teeth.

Beginning with these considerations and trying to explore “avantgarde” solutions that could be easier, more comfortable and child-friendly, this article describes a new fully digital approach for temporary rehabilitation of premature loss of deciduous incisors, using a metal-free fixed orthodontic prosthesis made of Polyether ether ketone (PEEK) [Beretta et al., 2021; Ozawa et al., 2018]. The appliance is almost radiolucent, which is very useful when an x-ray is required during treatment or follow-up.

Clinical report

The Technopolymer Orthodontic Prosthesis (TOP) is a complete CAD-CAT (Computer Aided Design-Computed Aided Technofacturing) [Beretta, Federici Canova, Gianolio et al., 2021] fixed device that is used to rehabilitate—

for aesthetic-functional needs, space maintenance and controlling growth of the face — either the upper or the lower arch in children that lost incisors due to a dental trauma or extractions for complicated Early Childhood Caries. It is customised, designed to be cemented with adhesive technique, using deciduous teeth as anchorage. Because the introduction of new technologies has started a new era in the field of dentistry [Federici Canova, Beretta et al., 2021], today we can digitally analyse our cases [Federici Canova et al., 2021] and program their treatment plan starting from an easy intraoral scan, which is especially effective and comfortable for children. Device planning starts with an intraoral scan (Trios, 3Shape, Denmark). The device is designed on the STL file, using the Appliance designer and Dental Designer software (3Shape, Denmark), generally with thin bands on canines and pads on lateral incisors, when present, in order to make the device as sleek and comfortable as possible for the child, taking care to facilitate speech and cleaning. Once the project is designed, the related STL file is generated and used for the 3D printing of the orthodontic appliance in PEEK and the dental crowns that are resin-bonded on it. The clinical procedure consists of etching and adhesive cementation, using preferably a self-adhesive or light-curing bioactive cement (Activa Bioactive Cement, Pulpdent, USA; Transbond Plus, 3M, USA) or other materials (Transbond LR, 3M, USA; Relyx, 3M, USA) to bond the PEEK structure to teeth. Two cases of growing patients in deciduous dentition with premature loss of incisors are illustrated to present this new system. In the first case (Fig. 1–5) the patient lost 2 upper central deciduous incisors and in the second one the patient lost 3 lower deciduous incisors (Fig. 6–10).

Discussion and conclusion

Following premature extractions or loss of deciduous



FIG. 7



FIG. 9



FIG. 11



FIG. 8



FIG. 10



FIG. 12

FIG. 7 A 3-year-old girl with traumatic loss of three primary lower incisors and a strong request to restore the aesthetics. FIG. 8-11 The girl was treated with full digital POP (design and project by Dr. Matteo Beretta and Gaetano Frascina, digital orthodontic technician, Bari, Italy) anchored on lower canines and left lateral incisors, cemented using composite light curing resin. FIG. 12 The 1-year follow-up.

incisors due to trauma [Emerich et al., 2013], traditionally complete maxillary or mandibular removable prosthesis with customised occlusion and age-appropriate artificial teeth have been used for functional and aesthetic rehabilitation [Kotsiomi et al., 2000, Guinot et al., 2021]. Oral functions are particularly important in children, not only for correct swallowing and normal evolution of speech, but also for facial growth and development, and the use of removable appliance is not easy nor comfortable. Therefore, in order to overcome these critical issues, the "avantgarde" full digital treatment described here improves the patient's speech, masticatory function and facial aesthetics [Re et al., 2015], contributing to the development of normal dietary habits and social integration, trying to simulate the presence of natural fixed teeth in a comfortable, conservative and safe way [Oleszkiewicz et al., 2015]. In fact, tooth preparation of the anchor teeth is not needed, but the appliance is fixed by means of a child-friendly adhesive procedure. During time and for guiding tooth exchange together with the growth, this kind of ortho-prosthesis can be easily further cut or modified directly in the mouth, because of favourable characteristics of PEEK. The next evolution will be a new "avantgarde", more aesthetic PEEK to mill the structure and the teeth in one piece. However, since there is no limit to ingenuity, we will continue to explore more solutions that improve oral health, aiming at the complete well-being and serenity of the child and his/her family, that go beyond dental care.

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