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Forced Eruption Without Orthodontic Brackets Using Fiber Reinforced Composite Prostheses: A Case Report.

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Abstract - *Maintenance of periodontal health is one of the most important factors governing success of the restoration and longevity of teeth. For proper maintenance of periodontal health, the biologic width functions as a protective barrier against the entrance of microorganisms in to the internal medium of the periodontal ligament and osseous connective tissue. This clinical case describes a technique to reestablish the biologic width surrounding a fractured central incisor by forced eruption without orthodontic brackets, using fibre reinforced composite prostheses. Main advantages of using fibre reinforced composite prostheses are aesthetic maintenance during the treatment period, no need for occlusal adjustments, simplicity, low cost, and stability.*

KEY WORDS: Tooth fracture, Glass fibre reinforced composite, forced eruption.

INTRODUCTION

Dental caries, root resorption, fractures, erosion, abrasion, occlusal wear; noxious habits may lead to loss of tooth structure to the level or below the crest of alveolar ridge making restoration of tooth difficult[1]. In such cases various treatment options include extraction, surgical crown lengthening, and forced eruption [2-4]. At times, traditional surgical crown lengthening cannot be performed on the tooth in question because of possible compromise of aesthetics, osseous support, compromise to adjacent teeth and long-term prognosis to justify the treatment [2]. Forced eruption is the treatment of choice in such cases for proper restoration function and aesthetics of the tooth without encroaching on the biological width. Forced eruption, first described by Heithersay and Ingber, is a well-documented clinical procedure for extruding sound tooth structure from alveolar socket for placement of restoration margins[3,5]. Forced eruption is the treatment choice in the aesthetic zone, as long as there are no acute inflammatory periodontal conditions, minimum 1:1 crown: root ratio can be maintained, tooth in question is endodontically treated with resolution of periapical pathology, and most importantly the patient is motivated.

In the aesthetic zone, particularly in the anterior maxilla forced eruption can be very challenging. Different methods proposed for forced eruption includes bonding a wire to adjacent teeth and transferring the force by elastic from the wire to the root[6,7]. by bonding brackets to the target tooth and adjacent teeth using nickel titanium wire[6,8], using a temporary crown with a hook on the residual root and connecting the hook to the wire bonded to the adjacent teeth with elastics[2], using forced eruptor in the form of a C clasp with an occlusal rest and transitional arm[9], using removable appliances and magnets[10,11,12].

A recent method proposed by Oshagh *et al*. using fiber reinforced composite for forced eruption has many advantages such as aesthetic maintenance during the treatment period, no need for occlusal adjustments, simplicity, low cost, and stability of the treatment outcome[13]. We present a case in which a fibre reinforced composite prostheses was used for forced eruption of a traumatically fractured maxillary central incisor.

REPORT

A 30-year-old female patient was referred to the department of Prosthodontics for the restoration of the fractured maxillary right central incisor. On clinical examination an oblique crown fracture in the labio-palatal direction was seen in relation to maxillary right central incisor and tooth was endodontically treated previously. As a result there was not enough sound tooth structure remaining on palatal and mesial aspect for placement of the restoration margins without encroaching on biological width. Maxillary left central and right lateral incisors were missing, with resultant alveolar ridge deficiencies. On radiographic examination root canal filling was seen in relation to maxillary right central incisor with no pathology in the surrounding bone. Different treatment options were discussed with the patient, including tooth extraction and replacement by a removable partial denture, fixed partial denture or implant prosthesis. Patient rejected extraction as treatment and preferred to save the tooth. Crown lengthening surgery would have resulted in accentuation of discrepancies of the gingival level with a poor aesthetic outcome; hence forced eruption was the preferred treatment. Coronal 3mm of gutta percha was removed from maxillary right central incisor and a piece of wire in the form of a loop was fixed in to it using resin cement. Diagnostic impressions were made for both arches in alginate impression material to obtain diagnostic casts in hard dental stone. Diagnostic wax up for maxillary right central incisor, missing left central and right lateral

* MDS

incisor was completed. Putty index of the diagnostic wax up was made and used to prepare composite teeth with minimum thickness. A loop in the wire was formed and O ring elastic was engaged in it. The loop was then embedded on the palatal aspect of composite teeth at an appropriate position at 6mm distance from first hook in the maxillary right central incisor. Polythene sheet was adapted on the maxillary right canine and left lateral incisor. Two strips of fibre splint were cut to adequate length, wetted with bonding agent, and adapted on labial and lingual aspects of composite teeth, maxillary right canine and left lateral incisor on the diagnostic cast. Except over maxillary right canine and left lateral incisor the strips were light cured and covered by thin layer of flowable composite. To bond the fibre reinforced composite (FRC) complex to maxillary right canine & left lateral incisor, crowns were cleaned by rubber polishing cup and etched with 37% phosphoric acid. After irrigation and drying a bonding agent was applied to etched surfaces and light cured. Uncured portion of the fibre was wetted with bonding agent and placed over the adjacent tooth surfaces at appropriate position and light cured. The FRC complex was covered with flowable composite and light cured. The FRC prosthesis was checked for proper phonetics, aesthetics, and occlusion. Two hooks were connected by O ring elastic and instructions regarding proper oral hygiene maintenance were given to the patient.

The patient was reviewed at weekly interval for 4 weeks, during which oral hygiene and soft tissue health was evaluated. At the end of 4 weeks 3mm of eruption was evident clinically and radiographically (Fig. 1.). The FRC complex and loop in the maxillary right central incisor was removed and fibre post was placed in the space remaining after removal of wire loop. A fixed partial denture was planned to replace the missing maxillary left central and right lateral incisors. Accordingly, maxillary right central and left lateral incisors were prepared for full veneer PFM crowns and maxillary right canine for 3/4th metal crown. Two month retention period was planned for the patient, during which an acrylic provisional fixed partial denture was cemented in place with temporary cement. At the two month recall visit the acrylic provisional restoration was removed. Gingival tissue retraction was achieved using retraction cords and impressions were made in polyvinyl siloxane impression material by a putty wash technique. The impressions were poured in type IV dental stone to obtain working casts. A porcelain fused to metal (PFM) fixed partial denture was fabricated and cemented in place (Fig. 2, and 3). Gingival discrepancy between maxillary right central incisor and adjacent teeth was corrected by using gingiva toned porcelain to get better aesthetic outcome. The patient was instructed regarding proper oral hygiene maintenance and follow up visits were scheduled at 3 month interval. At the one year follow up visit function and aesthetic of prostheses were satisfactory and the surrounding soft tissues healthy.

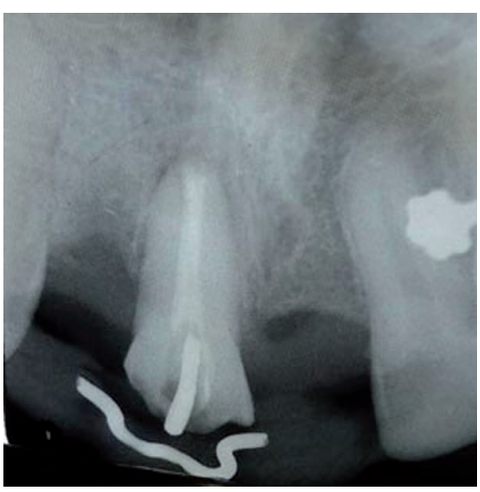

Figure 1. *IOPA radiograph of extruded tooth*

Figure 2. *Definitive prostheses cemented in place*

Figure 3. *IOPA radiograph after cementation of definitive prostheses*

DISCUSSION

It is important to respect the biologic width when restoring the teeth. Encroaching on it can lead to periodontal problems and to the ultimate failure of the final restoration. The concept of biologic width, first described by Garguilo *et al.*[14, 15]. It comprises the connective-tissue attachment and the junctional epithelium. In a healthy adult, this width usually measures an average of 2.04 mm. To place a restorative margin with adequate marginal seal, one needs an additional 1 mm to 2 mm of sound tooth structure, thus making the total minimum amount of tooth structure needed for a sound restoration to be between 3 mm and 4 mm to prevent any encroachment on the biologic width. In cases where the gingiva is thicker and flatter, 4 mm of total tooth structure from the alveolar crest is necessary[16]. Forced eruption should be considered in cases where traditional crown lengthening via ostectomy cannot be accomplished. In the anterior area, it is difficult to do an ostectomy without creating an aesthetic deformity. Ostectomy also removes bone from adjacent teeth, which can compromise the function of these teeth. It can also compromise a tooth that already had questionable support or lead to an inverse root-to-crown ratio with an increased clinical crown[17]. Some of the contraindications to forced eruption are inadequate crown-to-root ratio, lack of occlusal clearance for the required amount of eruption and any possible periodontal complications. Forced eruption is generally best in the anterior region where aesthetics is important and ostectomy can lead to negative architecture[1]. In some methods, a transitional crown or the fractured part of the crown is attached to the root to provide aesthetics during the treatment and to prevent adjacent teeth from tipping into the edentulous space[18]. The primary disadvantage of this method is movement of the temporary crown during the root extrusion, and as a consequence, occlusal adjustment would be necessary at each appointment[2]. But in the method described in this article, the transitional crown is attached to adjacent teeth and does not move during extrusion.

The time required for forced eruption depends upon age of the patient, the distance the tooth has to be moved, and the viability of periodontal ligament. In general, extrusion can as rapid as 1mm per week without damage to PDL, so 3-6 weeks is sufficient for almost any patient[6]. Extrusion rate used in the present case was similar to that recommended by other authors [2, 3, 19, 20]. After 4 weeks, approximately 3 mm of forced eruption was achieved at the rate of 1mm per week. According to some studies the force required for extrusion is 30-60 g [2, 12, 19, & 21], while other authors recommended 70-150 g [22]. In the present case 70 g force was used.

Recommendations regarding the retention period required for reorganization of periodontal ligament, bone remodelling, & to prevent relapse after extrusion varied from 3-6 weeks [23] by some studies to 7-4 weeks [3, 5, 19, 21, 24, 25] by others. In present case 2 month retention period was followed.

The technique presented is relatively simple, efficient, conservative, and an economic modification of an earlier technique that provides aesthetics during long period required for forced eruption until the final restoration (3-4 months).

CONCLUSION

Forced eruption has several advantages over other treatment options for a fractured tooth. These include; preservation of the root structure, enhancement of the gingival level and aesthetics of the fractured tooth and adjacent teeth, and significantly lower cost. The technique presented for forced eruption using fiber reinforced composite provides aesthetic maintenance during treatment period without need for occlusal adjustment.

MANUFACTURER'S DETAILS

- Woven glass fiber strip (Polydentia SA, CH-6805 Mezzovico, Switzerland)
- Etchant gel (SS White, England)
- Universal resin cement ((Rely X U100, 3M ESPE, Germany)
- Bonding agent (Single bond, 3M ESPE, Germany)
- Flowable composite (Filtek supreme plus, 3M ESPE, Germany)
- 19 gauge Stainless steel wire (Smith & Smith, India)
- O ring elastic (JP Orthodontics, California, USA)
- Polyvinylsiloxane putty & light body (Express XT, 3M ESPE, Germany)
- Irreversible hydrocolloid impression material (Tropicalgin, Zhermack, Italy)

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