IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 2 Ver. VIII (Feb. 2015), PP 73-77
www.iosrjournals.org

Management of Mutilated Right Maxillary Central Incisor and Reinforcement of Weekend Root with Custom Modified Fiber Post - A Case Report

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Abstract: *Crown fractures of permanent dentition are the most frequent type of dental injury. Ninety-two percent of traumatic injuries results in fracture of maxillary permanent central incisors because it's protrusive and anterior positioning. The young permanent maxillary central incisor root canal chamber is large and tapered and trauma to these type teeth results in wide variety of malformations. The present case report describes the management of mutilated young maxillary right central incisor with Ellis Class IV fracture by using custom modified fiber post technique.*

Keywords: *Crown fracture, Dental trauma, Custom modified fiber post, Ellis class IV frature*.

I. Introduction

Maxillary incisors are the most frequently injured teeth in the primary and permanent dentition. Injury to the young permanent teeth is a disturbing experience for the person because of their location, aesthetic and psychological/ emotional importance. Injury to the teeth can cause long-term consequences leading to their discoloration and malformation [1].The most common cause for traumatic dental injury is falls and Collision. The maxillary central incisors are the most common teeth affected during trauma [2]. Some articles have reported that 25% of patient population under 18 years old, sustained dental injuries in the form of crown fractures in maxillary incisors [3]. Subsequently, anterior crown fractures lead to discomfort and serious psychological, aesthetic, functional and phonetic problems that can affect social relationship [4]. This article highlights the management of Ellis Class IV fracture in young permanent maxillary central incisors with custom modified Fiber post.

II. Case Report

An 18 year old boy reported to the Department of Conservative dentistry and Endodontics with fracture of right maxillary central incisors (Fig. 1). He had history of trauma due to a road traffic accident 5 years back. On examination 11 had Ellis Class IV fracture with fracture of incisal one third involving the pulp chamber and was non-mobile. Intra oral periapical radiograph revelled fracture of enamel, dentine involving pulp (Fig. 2). Thermal test, Electric pulp tests revelled abnormal response and non tender on percussion. A resorptive defect has been observed on middle third of the crown on labial surface and very thin lip of enamel was observed around it. (Fig.3).The fracture involves the pulp chamber through the incisal edge (Fig. 4).

Fig.no.1: preoperative view.

Fig.no.2: preoperative radiograph.

Fig.no. 3: thin lip of enamel

Fig.no.4: fracture involving the pulp chamber through incisal edge

III. Procedure

Access cavity was prepared with incisal approach where it was an open cavity and working length was determined using apex locator (Densply,Propex II) and confirmed by IOPAR. The canal was constantly irrigated with 3% sodium hypochlorite, saline and EDTA solution. The canal was dried using paper points and intra canal medicament was placed for a week.

After one week temporary access cavity restoration as removed. The initial file binding to apical constriction was 30K file (MANI manufacturing) and the apical constriction as enlarged till 110 K file (MANI) (Fig.no.5,6). Circumferential filling was done with regular recapitulation and irrigation. During the instrumentation more amount of demineralized dentin was removed from both coronal and radicular part as it was contaminated continuously by the fracture involving the pulp chamber through incisal edge (Fig.no.4).

After the completion of the biomechanical preparation the canal was obturated with Guttapercha coated with AH plus sealer (DENSPLY) (Fig.no.7) and temporized with zinc oxide eugenol cement for 1 week. After one week the guttapercha was removed with use of Gates glidden drills and apical 5mm was retained for maintaining the apical seal (Fig.no. 8) and post space was not prepared as the root was very thin (Fig.no. 8). A trail pattern was made with use of inlay wax to evaluate internal anatomy, undercuts of the preparation and ease of removal. The department had Quartzix^{TM} High strength quartz fiber resinpost of size 1.6 mm. This size fiber post was loosely bound to the tapered and flared anatomy of root canal.

The entire post was then etched with 37% phosphoric acid for 30 seconds (N-Etch;invoclar vivadent) and then washed dried with three-way syringe. Bonding agent (Tetric N-Bond ; invoclar vivadent) was applied with micro tip brush and cured for 40 seconds on each side. The composite (Tetric N-Ceram ; invoclar vivadent ;A nano hybrid composite material) was adapted on to the post and just like during custom made post (Fig.no.9) and the entire unit was inserted into the root canal (Fig.no.10). Then it was retrieved immediately and cured for 40 seconds all around. The post dimensions were adjusted by yellow ring finishing bur.

The root canal was acid etched using micro brush. Bonding agent was applied and excess was removed using paper point. The custom made Composite reinforced fiber post was silanized using silanating agent. Then it was luted into the canal using light cure glass Ionomer cement (Rely X Luting 3M ESPE) (Fig. no.11).

The core restoration done with composite (Fig. no.12) and tooth preparation done for zirconium crown (Fig. no.13). Gingival retraction cord used for the exposure of finish line (Fig. no.14) and impression made with rubber based impression material. The temporary crown was given and patient recalled for the cementation. The cementation of Zirconium crown done with light cure glass ionomer cement (Rely X Luting 3M ESPE) (Fig. no.15).

The patient inference was taken and completely satisfactory over a follow up period of 12 months without any detectable changes both clinically and radigraphically. (Fig. no.16).

Fig.no.5: working length determination

Fig.no:6: master cone selection

Fig.no.7: Obturation

Fig.no.8: gp retrieval

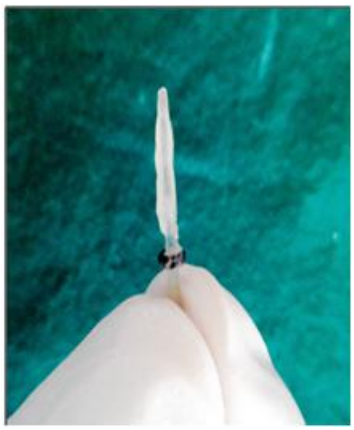

Fig.no.9: modification of fiber post with nano hybrid composite.

Fig.no.10: trail fitting of custom modified glass fiber post.

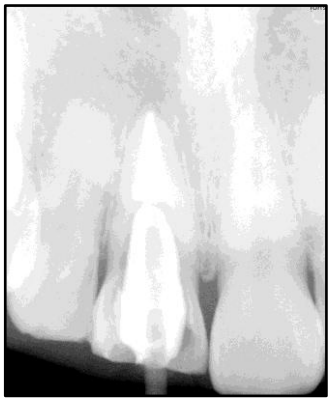

Fig.no. 11: cementation of post with light cure glass Ionomer cement.

Fig.no.12: clinical photograph of completed core restoration.

Fig.no.13: tooth preparation for zirconium crown.

F**ig.no.14:** application of gingival retraction cord.

Fig.no.15: cementation of zirconium crown (clinical view after 12 months)

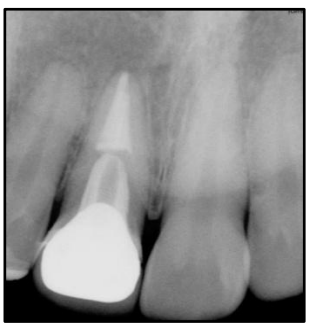

Fig.no.16. radiograph after 12 months

IV. Discussion

Ellis class IV fracture is defined as 'the traumatized teeth that become nonvital with or without loss of crown structure. The maxillary incisors are the most frequently injured teeth in the primary and permanent dentition. Teenage years cause a significant number of dental injuries as they engage in contact sports [5].

The traumatic dental injury increases bacterial potential to invade dentinal tubules and therefore produce acute inflammation of pulp [6]. In this case it has been not treated over a long period of time and its open cavity leads to increased demineralization of dentin. So that greater amount of infected soft dentin was removed during the cleaning and shaping of root canal.

Restoration of fractured treated teeth is complicated procedures because various factors have to be considered before initiating the treatment. These factors include retention and resistance of the restoration, the amount of remaining sound tooth structure left, masticatory forces, prevention of microleakage and also the aesthetic performance in the case of anterior teeth [7].

In the present case it is critical to establish a minimal circumferential ferrule of 1.5 mm. This effect requires approximately 4.5 mm of sound tooth structure above the osseous crest i.e. 1.5 mm for the ferrule and 3.0 mm of biologic width. Failure to need this guideline reduces the prognosis and longevity of the restoration [7].Since patient did not want his aesthetics to be compromised at any cost. The tooth was too weak to provide necessary coronal restoration. The root was very thinned for intra radicular rehabilitation through the cast post. So the present treatment was chosen as a choice because fiber post affords pleasant aesthetics and modulus of elasticity similar to that of dentin. To accommodate the remaining spaces around the post it was reinforced with composite material after the surface treatment of the post. The entire unit of post along with the luting cement will acts as single unit to efficiently deliver forces to root. This will mimics the monoblock concept of adhesive Obturation.

The traditional custom-cast dowel core provides a better geometric adaptation to excessively flared or elliptical canals, and almost always requires minimum tooth structure removal. Custom cast post-and cores adapt well to canals with extremely tapered canals or those with a noncircular cross section and/or irregular shape, and roots with minimal remaining coronal tooth structure. This technique incorporates the advantages of both Fiber post and custom-made post. [8]

Glass fiber posts were introduced as an aesthetic alternative; their use is based on the mechanical notion that materials restoring endodontically treated teeth should have similar mechanical properties with that of tooth substance**.** [9]

Several authors have stressed the use of fiber posts in such teeth requiring reinforcement as these posts have a favourable matching modulus of elasticity (30-40GPa) to dentin (15-25GPa) resulting in a biomechanical homogenized unit inside the root canal.[10]

Composite resin bonds well to the dentinal walls after conditioning, bonding procedures and serves to reinforce the weakened root. Modulus of elasticity of composite resin (20 GPa) is also close to that of dentin thus creating a more homogenous restorative system consisting of the post, resin cement, core material along with the tooth substance. In this way, distribution of stresses to the root is more even and there is less risk of a root fracture.[11]

Post endodontic restoration done by using zirconium crown because of its conservative design of preparation and high translucence which enhances patient aesthetic needs. Another beneficial characteristic of zirconia is its ability to resist crack propagation through a property known as "transformation toughening," the Zirconia particles that normally exist as a tetragonal crystal structure undergo phase transformation into a monoclinic crystal structure when a stress such as a crack tip is applied. Because the monoclinic crystal structure is larger than the tetragonal crystal structure, the crack is "sealed" before it propagate. [12]

V. Conclusion

Composite resin bonds well to the dentinal wall after the acid etching and the tooth bonding procedure, and serves to reinforce the weakened root. The use of fiber post along with light curing composite resin facilitates complete polymerisation to the depths of the canal. The placement of identical size fiber post and composite core build up ensures optimum resistance and retention form. This technique has advantages like reinforced root strength as light-cured composites internally reinforce the root structure along with the fiber post, providing maximum sheer load support and retention. There is also improved control since light-curing composites are easy to control, are more adaptive and safer than auto-cured composites that may prematurely harden. Also, centred canal position, superior aesthetics and technique versatility are its additional advantages. Thus, even badly mutilated teeth need not necessarily be extracted. They can be restored with this technique to best serve the needs of the patient.

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