Case Report

One Visit Apexification And Intra-Radicular Rehabilitation In Maxillary Right Central Incisor : A Case Report.

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ABSTRACT :

This case report explains the management of structurally compromised fractured maxillary right central incisor. Treatment of nonvital immature permanent teeth with calcium-hydroxide are often associated with some difficulties such as weakened tooth structure, root canal reinfection and long treatment time. Mineral trioxide aggregate (MTA) apical plug method is an alternative treatment option for open apices, and has gained popularity in the recent times. Many anterior teeth requiring restoration are severely weakened, having wide flared canal spaces and thin dentinal walls, and are at a high risk of getting fractured. But now recent advancements in dentistry, the canal is reinforced intra-radicularly with flowable composite, resin cement and light transmitting glass fiber post, rendering the endodontically treated root capable of supporting the post and core and thereby ensuring continued function of the badly damaged tooth. This case report describes the intra-radicular rehabilitation and one visit apexification in maxillary right central incisor.

Key words : Intra-radicular rehabilitation, Mineral trioxide aggregate (MTA), Glass fiber post, Flowable composite, Resin cement.

Introduction :

Trauma to dentition is most common in the age group of 9-10 years [1]. During this period, the roots are still in the process of maturing hence there is less intra-radicular dentinal thickness and the tooth and root are more prone to fracture. The flared canal arising as a result of carious extension, trauma to immature tooth, pulpal pathosis, iatrogenic or endodontic misadventure or idiopathic causes, can present a difficult restorative problem to the practicing dentist [2].

Complete formation of the root and closure of the apical foramen continues for up to 3 years following eruption of the tooth [3]. If the pulp of young permanent teeth is damaged before the closure of the apical foramen, pulp necrosis may occur. The biggest problem in endodontic treatment of these teeth is obtaining an apical seal. The purpose of the apexification therapy used in nonvital immature teeth is to induce the formation of a hard tissue barrier at the root apex or the completion of apical development [3]. Mineral trioxide aggregate (MTA) is the most popular material for this aim. MTA has been suggested to create an apical plug at the root-end and helps to prevent the extrusion of the filling materials [4].

Factors such as location and quantity of the remaining healthy dentinal structure and the internal configuration and morphology of the root, affect the choice of post system. Also, the principals for retention of the posts such as length, diameter and surface configuration should be considered [5], [6], [7]. The primary objective of post endodontic rehabilitation by post and core is to replace the missing coronal tooth structure sufficiently to provide the required retention and resistance for the final restoration. It should also be esthetically compatible, cost effective and minimize chair side time.

For many years, cast posts were most commonly used for the treatment of endodontically treated teeth with wide canals. Their disadvantages include catastrophic root fractures in teeth with reduced remaining dentinal thickness, shadowing and graying of the root and discoloration at the tooth's gingival margins, which will adversely affect the esthetic results required for bonded resin and ceramic restorations in the anterior region.

In the last several years there have been significant advances in the development of bondable, fiber-reinforced, esthetic posts to reinforce endodontically treated teeth [8]. In clinical situations, where the post does not allow light transmission, the resin can be polymerised within the intra-radicular space to a maximum depth of 2-3 mm, due to the limited effect of trans-illumination within the composite resin. However, introduction of commercially available light transmitting posts allow light polymerization by transillumination, that effectively polymerises the composite along the entire length of the radicular preparation [7]. Glass fiber post has modulus of elasticity and biomechanical behaviour which is nearly identical to that of dentin [9].

The objective of this case report is to describe a step by step multidisciplinary conservative approach of rehabilitating a fractured maxillary right central incisor with a immature root apex using flowable composite resin, resin cement and Glass fiber post.

Case Report :

A 19 year old female patient reported to the Department of Conservative Dentistry and Endodontics, Faculty of Dental Science, Dharmsinh Desai University, Nadiad, Gujarat with a complaint of fractured maxillary right central incisor with history of trauma 9-10 years back. Patient had complaint of mild pain, with no incidence of intra or extra oral swelling. On clinical examination, there was Ellis class II fracture on maxillary left central incisor and Ellis class III fracture on maxillary right central incisor (Fig. 1).

Fig. 1 PRE-OPERATIVE PHOTOGRAPH

On radiographic examination, the maxillary left central incisor had fracture localized to dentin without involving pulp and the maxillary right central incisor had wide pulp chamber and root canal with less dentinal thickness, with an open apex with periapical changes, and without any evidence of root fracture and resorption (Fig. 2).

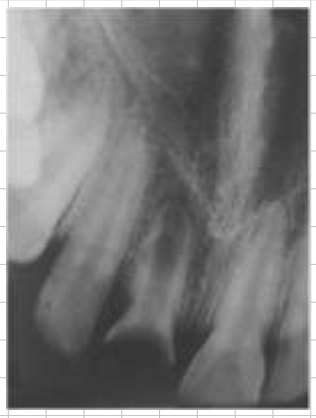

Fig. 2 PRE-OPERATIVE RADIOGRAPH

Treatment procedure

During first session, access cavity preparation was done under isolation. Multiple radiographs with different angulations were used to confirm the actual working length (Fig. 3).

Fig. 3 WORKING LENGTH RADIOGRAPH

The canal was then lightly mechanically cleaned by using intracanal instruments and with sodium hypochlorite 5.25% irrigation. Then the canal was dried with sterile absorbent paper points and calcium hydroxide mixed with sterile water was placed into the canal for 15 days for complete drying and disinfection of the root canal system (Fig. 4).

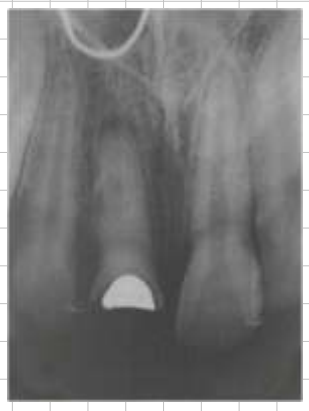

Fig. 4 INTRACANAL PLACEMENT OF CALCIUM HYDROXIDE

After 15 days follow-up, clinically the patient was asymptomatic. Then, intracanal medicament of calcium hydroxide was removed with intracanal instruments and repeatedly rinsed with sodium hypochlorite 5.25% solution followed by final irrigation with normal saline. After complete removal of calcium hydroxide, canal was dried with sterile absorbent paper points.

During second session, mineral trioxide aggregate (Angelus) apical plug was placed in the apical portion of canal with a thickness of 3 to 5 mm, using a modified spinal anaesthetic needle (16 gauge) to deliver MTA in the apical portion and compact it using hand pluggers and verified by taking radiographs (Fig. 5).

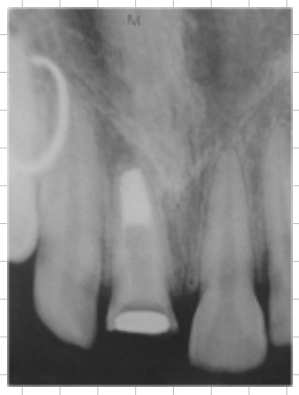

Fig. 5 MTA APICAL PLUG

A sterile cotton pellet moistened with sterile water was placed over the canal orifice and the access cavity was sealed with temporarily. After 2 days, the Cavit and cotton were removed and hand plugger was inserted to check the complete setting of MTA.

Then the canal was etched with 37% phosphoric acid (d-tech, Pune) for 15 seconds, thoroughly rinsed with water and gently air dried followed by application of dual cure adhesive (Prime and bond NT mixed with self cure activator, Dentsply) for 20 seconds & light cured for 40 seconds to enhance the bond strength to root dentin. This was followed by injection of flowable composite resin (Fusion Flo, Prevest Den Pro Ltd) into the canal along the light transmitting post which was centered for adequate reinforcement. These light transmitting posts allow light to pass through and completely polymerize the composite resin along the entire length of the root space. Dual cure resin cement (Dentsply) was then injected into the ideal post space created which was then followed by the placement of a glass fiber post (Angelus) and then cured for 40sec [10]. The excess post was trimmed and the core was built with a nano-hybrid composite resin (Tetric Ceram) (Fig. 6).

Fig. 6 COMPOSITE CORE BUILD-UP

The Tooth was then prepared to receive a metal ceramic crown (Fig.7)

Fig. 7 METAL CERAMIC CROWN PREPARATION

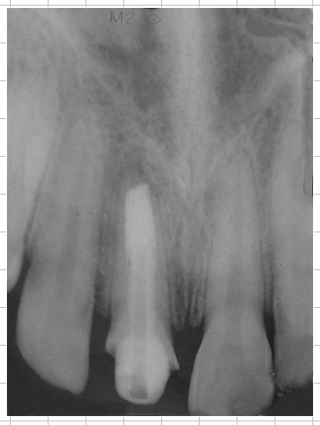

Fig. 8 RADIOGRAPHIC VIEW OF METAL CERAMIC CROWN PREPARATION

Gingival retraction was followed by a definitive impression with Polyvinyl Siloxane Impression material. Fractured maxillary left central incisor was restored with composite resin and metal ceramic crown was fabricated and cemented in place using type I Glass Ionomer Cement (Fig. 9).

Fig. 9 FINAL CEMENTATION OF METAL CERAMIC CROWN

Discussion :

Calcium hydroxide is the most commonly used material for apexification. It has had a high success rate when used for apexification treatment in several studies [11, 12, 13]. However, there are some disadvantages of this material. One of them is that the treatment requires a very long time which is from 3 to 21 months [4]. The required time is dependent on the diameter of the open apex, the rate of tooth displacement and the tooth repositioning method after trauma [14]. During a long period of time, root canal may be reinfected by the leakage of the temporary coronal filling. The success rate decreases by 10% in teeth with poor coronal filling [4]. Hence, performing a permanent treatment is better, as it avoids the reinfection of the root canal. Also there is possibility of fracture of the weakened teeth. After leaving calcium hydroxide in the root for more than 30 days, the fracture resistance reduces [15].

In recent times, creating MTA apical plug in one visit is suggested for the treatment of the non-vital immature permanent teeth as an alternative to long-term apexification treatment. MTA is a material which has less leakage, better antibacterial properties, high marginal adaptation, short setting time (~ 4 hours), a pH of 12.5 and is more biocompatible [13]. Scaffolding is provided for the hard tissue barrier by MTA [16]. A bioactive material MTA stimulates the production of interleukins and cytokine release. So it is capable of promoting the hard tissue formation [17]. The clinician may restore the tooth after setting of MTA [15]. Thus, the fracture resistant of the teeth with thin dentinal walls increases.

In MTA plug technique, root canals must be disinfected with temporary calcium hydroxide dressing before placing MTA for two weeks [18]. This is because performing chemomechanical preparation alone is not effective for the complete elimination of microorganisms. Hence, we used calcium hydroxide dressing for two weeks in this case. In teeth with wide open apices, the irregular dentinal walls and the divergent apices such as blunderbuss open apex make the adaptation of MTA more difficult. Aminoshariae et al. suggested that hand condensation resulted in better adaptation and fewer voids than ultrasonic compaction[19].This article describes, placement of MTA as apical plug with modified anesthetic spinal needle (16 gauge) and hand pluggers. Some authors have postulated that possible leakage of MTA could be influenced by the thickness of the apical plug. de Leimburg et al. reported that the orthograde use of MTA provided an adequate seal against bacterial infiltration regardless of the thickness of the apical barrier[20]. This result is in agreement with Hachmeister et al. who underlined that the thickness of the apical barrier may have a significant impact only on displacement resistance [21]. In the present case, the thickness of the MTA apical plug varied from 3mm to 5mm.

The important criteria for post core design include: i) to provide sufficient retention to the core and ii) to distribute functional stresses uniformly through-out the tooth-root. In 2004, Anil Kishen et al. suggested that the structure of inner dentin, which surrounds the root canal is less mineralized and has more collagen, hence posses low modulus of elasticity. The conservation of the inner dentin is crucial to offer toughness or fracture resistance to the tooth structure. Undue loss or removal of inner dentin would compromise the toughness criteria in dentin structure, which in turn would predispose such a tooth to catastrophic fracture.

Lack of dentin support at the coronal end of the root canal also poses a problem to the restorative dentist. To restore the lost dentin, in 1987, Lui et al. advocated the use of composite resin as a lining of the root canal surface to reinforce the weakened canal walls. Use of resins for the rehabilitation of a root canal is also supported by

Saupe et al. in 1996[5]. The modulus of elasticity of composite resin approaches that of dentin. The replacement and reinforcement of intra-radicular tooth structure with a material that is elastically compatible with dentin is far better than morphologic dowel [22], which has higher modulus of elasticity and hence higher potential to transfer and concentrate applied stresses to the surrounding compromised root structure.

Conclusion :

Multidisciplinary approach in the management of a structurally weakened fractured tooth through reinforcement with Flowable composite, Resin cement and Glass fiber post can be a simple and efficient procedure for the treatment of immature anterior traumatized tooth with excellent esthetic & functional results.

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