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# Intraradicular Rehabilitation of Weakened Immature Teeth: A case report

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***Abstract:*** *Anterior teeth frequently present with weakened coronal and radicular tooth structure. Restoring such teeth can be challenging owing to the compromised geometry. The flared canal can be due to developmental defects, internal resorption or open apex. Trauma is very common in young age leading to incomplete root formation. Apexification using calcium hydroxide is a long process and the quality of calcific barrier obtained may be inadequate. Nowadays, one visit apexification with MTA is generally preferred. Earlier, metal post or prefabricated fibre post were used to rehabilitate such teeth. However, they do not adapt to the canal anatomy causing inadequate stress distribution. The root canal of such debilitated teeth can be reinforced by intraradicular rehabilitation. This paper presents a technique of restoring grossly mutilated teeth with Ribbond fiber and composite resin.*

***Key Word****: Intraradicular rehabilitation, fiber post, composite, apical barrier.*

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## I. Introduction

Teeth with grossly mutilated coronal structure are usually restored with post and core. However, such teeth might fail due to overly flared canal because of the incomplete root formation or recurrent caries around pre-existing post. Trauma is usually common at the age of 9 to 10 years when the root formation is not complete yet. Also, conditions like internal resorption, fusion, germination and aggressive access preparations might lead to weakened tooth structure.[1] It might be difficult to manage such teeth because of the compromised geometry.

Earlier, calcium hydroxide was used to induce a calcific barrier formation. In case of long apexification procedure, the canal is susceptible to fracture and reinfection during treatment. Hence, single step apexification is preferred, especially in tooth with compromised structure.[2] Such teeth with wide flared canals have minimal remaining dentin in coronal portion of canal and are prone to fracture and tend to retain post with difficulty.[3] Restoration with cast metal posts can cause wedging forces coronally that may result in irreversible failure because of fracture of an already weakened root.[4,5]. Hence, fiber post are chosen for such cases.

However, when prefabricated fiber post is used, then a major portion of the canal space is occupied by luting cement. Such teeth cannot take the brunt during occlusal stresses. Thus these conventional ways of salvaging such teeth might fail, resulting in extraction of tooth. For a young patient it might pose as a debilitation for which she might have to seek prosthetic rehabilitation. This case report aims towards describing a technique of rehabilitation of severely compromised teeth with single step apexification, Ribbond and composite.

## II. Case Report

A 20 year old female patient reported to the Department of Conservative Dentistry and Endodontics, People's College of Dental Sciences and Research Centre, Bhopal with a chief complaint of broken and discoloured front tooth. On history taking, it was found that she underwent trauma in the concerned tooth 10 years back. Clinical examination revealed discolored maxillary central incisor with minimal coronal tooth structure. Radiographic examination revealed open apex with a shortened root (Fig 1).

After having achieved isolation with rubber dam, access cavity was prepared. The access cavity for open apex has to be slightly large in order to remove infected, necrotic tissue from the big pulp horns. The working length was determined with the help of an intraoral periapical radiograph and the canal was instrumented to #100 K file (Fig 2). Sodium hypochlorite and EDTA were used as irrigant using side vented neeedle to remove the organic tissue and smear layer respectively. The canal was dried using large inverted paper points. It was packed with calcium hydroxide as the intracanal medicament for 2 weeks. The temporary restoration must be tightly sealed to prevent leakage.

When the tooth was free of symptoms, it was reisolated. The canal was washed off with citric acid to remove calcium hydroxide and any remaining debris. Citric acid acts as a chelating agent and readily dissolves calcium hydroxide. Sodium hypochlorite was used as the final irrigant and the canal was dried with paper points that were measured to the working length. MTA Angelus (Angelus, Londrina, Brazil) powder was mixed with sterile distilled water into a thick consistency. It was loaded in the Dovgan carrier and placed in the canal as near to apex as possible. The stopper on Buchanan plugger was set at 1 mm short of the working length. It was used to gently condense the MTA in the apical 3-4 mm. The remaining post space was cleaned with a moist paper point to remove any MTA remaining on the walls. A radiograph was taken to check for the thickness and condensation of the apical plug (Fig3). Although MTA Angelus sets in 15 minutes, the canal was packed with moist cotton and temporary filling, and the patient was recalled on the next day.

When the tooth was accessed again, the MTA had set. An adequate length of Ribbond fiber (Ribbond, Seattle, WA) was cut and placed on a glass slab. Adhesive resin (Tetric N Bond Universal, Ivoclar Vivadent, Schaan, Liechtenstein) was dispensed on the slab and the fiber was wetted with the help of an applicator tip (Fig 4). The excess resin was soaked on a piece of gauze. Dual cure self adhesive resin cement (Maxcem Elite, Kerr, CA, USA) was mixed on a pad and coated on the walls for cementation. Flowable composite ( Tetric N Flow, Ivoclar Vivadent, Schaan, Liechtenstein ) was injected in the canal. The fiber was held with a plugger from the midpoint and inserted to the most apical point of the post space (Fig 5). By rotating the plugger, Ribbond was packed in the post space with the ends protruding outside.

If there is any remaining space, another piece of Ribbond can be used between the ends. Flowable composite was used in the first increment to ensure less voids (Fig 6). This was followed by packable composite in the subsequent increments. Composite (Te Econom Plus, Ivoclar Vivadent, Schaan, Liechtenstein) was used to built core on the protruding ends (Fig 7). A radiograph was taken to ensure the quality of post and core build up (Fig 8). Care should be taken to not leave any fiber part uncovered as it would affect core and crown cementation. This was followed by tooth preparation and crown placement (Fig 9).

## III. Discussion

Apexification is a process that includes formation of hard tissue barrier in order to achieve apical closure. Calcium hydroxide has been the material widely used to induce calcific barrier formation. Hydroxyl ion is responsible for the high pH, which directly neutralizes the acids produced by resorptive cells, and prevents progression of resorption. Also, it causes denaturation of bacteria-derived lipopolysaccharides. The alkaline pH causes activation of alkaline phosphatases, which causes liberation of inorganic phosphatase that then reacts with calcium ions from the bloodstream to form hydroxyapatite. Calcium ion potentiates cellular proliferation, differentiation and mineralization.[6]

However, there are certain known disadvantages linked with the use of calcium hydroxide. The paste has to be changed in 3 to 6 months until a barrier can be detected, barrier formation may take as long as 9 to 24 months, long term use may cause increased risk of tooth fracture, closure of the apex may be incomplete with minute communications with the periapical tissues.[7] Hence, mineral trioxide aggregate (MTA) is used nowadays to form apical barrier. It promotes proliferation and differentiation of odontoblast like cells. It also increases expression of genes for mineralization after matrix deposition by stimulating production of messenger RNA.[8] MTA promotes a biocompatible, antibacterial, noncytotoxic environment and surface morphology for calcific bridge formation.

In the former days, metal post was used to restore extensively damaged teeth. Metal post are rigid, hence do not transmit forces, resulting in fracture of tooth. On the other hand, fiber post has flexural modulus nearer to that of tooth and is bonded to the canal. A bonded fiber post is considered to distribute stresses and is more retentive in nature.[9] The traditional fiber post with fix dimensions can't be used in such compromised teeth. Ribbond is a high molecular weight polyethylene fiber (PFR), in a woven fashion. The triaxial or lenowave design enhances the retention with the resin cement and hampers crack propagation. Sirimai found that the chances of vertical root fracture is less in cases of PFR as compared to metal post.[10] Eskitascioglu compared two different post systems and found that the there is minimum stress accumulation in case of PFR.[11] Ribbond fits according to the canal anatomy which is necessary in case of blunderbuss canals like in open apex. Newman compared the fracture resistance of teeth restored with PFR and GFR (glass fiber reinforced post) in narrow canals and found that PFR is better because it takes the shape of the canal.[12] Hence, looking at the literature, Ribbond was used to rehabilitate this tooth.

Earlier, etch and rinse system were used for adhesion. However, it is not always possible to completely remove etchant and control moisture in the canal, which affects the impregnation of adhesive into collagen fibers. Eventually, the use of self etch adhesives became popular. But it also had a drawback of incomplete removal of smear layer.[13] Nowadays, self etch cements are used that are dual cure in nature. They contain multifunctional phosphoric acid methacrylate group that demineralize and impregnate the dentin simultaneously.[14] They do not require any pretreatment with etchant. The use of composite resin in the root

canal strengthens the thin walls. The modulus of elasticity of composite and dentin is close, hence there is better distribution of stresses. Therefore, even grossly mutilated teeth with poor prognosis can be salvaged with good clinical success.

## IV. Figures

**Fig 1:** Preoperative radiograph revealing open apex with thin dentinal walls

**Fig 2:** Working Length measured using 100 # K file

**Fig 3:** MTA apical plug of 4 mm

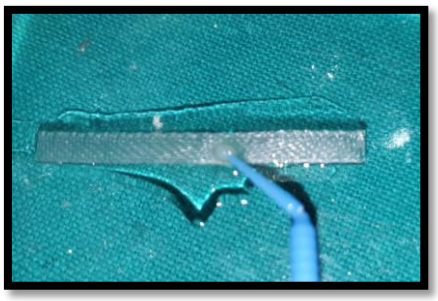

**Fig 4 :** Ribbond fiber wetted using adhesive resin

**Fig 5 :** Ribbond fiber inserted into the canal by apical pressure application by Buchanan plugger

**Fig 6:** flowable composite application

**Fig 7 :** core build up with composite

**Fig 8:** fibre post and core build up

**Fig 9:** Tooth preparation

## V. Conclusion

The occurrence of grossly mutilated teeth with immature apex is quite common. Rehabilitation of such teeth with fiber post and composite can have predictable results. This method provides an easy and economic way of salvaging teeth with immature apex.

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