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Research Article

ENDODONTIC RETREATMENT OF CENTRAL INCISOR WITH BLUNDERBUSS CANAL AND FLARED ROOT USING MINERAL TRIOXIDE AGGREGATE & COMPO-POST (ANATOMIC POST) – A CASE REPORT

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A B S T R A C T

Clinicians have traditionally found it difficult to manage the rehabilitation of blunderbuss canals. Mismanagement of flared canals with extensive coronal destruction might result in an adverse fracture of the tooth, which can result in severe failure. To improve fracture resistance, post and core treatments require the reinforcement of such canals. Prefabricated fibre posts have a major disadvantage in that they are unable to adapt to non-rounded, wider canals and are not long-lasting. As a result, such canals are reinforced using contemporary procedures such as specific anatomic posts for optimal stability, fracture resistance, and dentin replacement. The focus of this case study is on endodontic re-treatment utilising MTA (Mineral Trioxide Aggregate) to achieve correct apical seal of open canal, followed by creation of a 'Compo-post' using glass fibre post and composite resin to restore the function as well as aesthetics of the weakened tooth.

INTRODUCTION

The rehabilitation of root canal treated tooth is still an obstacle to face for clinicians specifically when there is commendable loss of tooth structure.[1] Reasons of endodontically teeth to have diminished root strength include; tooth decay, internal resorption, over instrumentation, immature development, restoration that require aggressive preparation of post space, and tooth fractures.[2]

It's difficult to treat an immature root with a necrotic pulp and apical periodontitis. The conventional approach cannot be used to disinfect the infected root canal space. Because there is no apical barrier to confine the root filling material, obturation of the root canal is difficult. The apexification procedure, which involves creating an apical barrier, is the treatment of choice in such circumstances. Apexification is a technique for creating a calcified barrier in an open apex root or maintaining apical development in teeth with incomplete roots and necrotic pulp.[3] Mineral trioxide aggregate (MTA) has recently garnered a lot of momentum as an apexification material.

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In such cases, the classic cast post and core systems were considered the gold standard. They intimately adapt to the canal morphology, fit adequately, and have a high retention levels. However, various studies have reported that their rigidity and high elastic modulus eventually leads to root fracture.[4] A wide and rigid post in a fragile root is a sure recipe for failure in such cases.

Since their debut at the beginning of the 90's,[5] there has been continuous research on these products to modify the type of fibers (from carbon to quartz to glass) as well as the shape of the posts. The technological evolution has enabled manufacturers today to provide fiber posts that – besides offering superior esthetic and mechanical properties (which were the first qualities to be appreciated in comparison with metal or cast posts) – are also radiopaque and available in a great variety of shapes.[5,6]

The usage of prefabricated fibre post in the flared canals increased the usage of luting cement, which lead to the formation of voids and reducing the strength of the monobloc created within the flared root canal which causes an early debonding of the prosthesis.[1] Boudrias *et al* in 2001 suggested

customization of fiber posts to match the shape and contour of flared canals and called it the 'Anatomic post' concept. This was the technique followed in the current case report. Here, the fiber post is relined with composite resin to obtain the canal contour similar to the fabrication of a wax pattern. Physico-mechanical properties are said to be better using this strategy.[5]

The aim of this clinical case report is to exhibit the preparation of anatomical post by using composite resin and fiber-glass posts on upper left central incisor with weakened root, with the objective of increasing fracture resistance against masticatory forces.

CASE REPORT

A 19 year old female patient came to the Department of Cons. Dentistry & Endodontics, Jaipur Dental College, Jaipur, with the chief complaint of mild pain since a month in maxillary left central incisor due to accidental fall (7-9 years back). Patient gave a history of root canal treatment done on same tooth 2 years back. Radiographic examination revealed inadequate obturation with the presence resorption at apex, periapical lesion and evidences of fiber post and core buildup material present in coronal portion to 21. The root canal also seemed to be excessively flared probably due to over instrumentation by previous clinician; having immature apex with wide opening. After thorough clinical and radiographic examination, a decision was made to re-treat the canal by apexification with MTA and fabricate an anatomic post as part of the post endodontic restoration. (Fig. 1)

Under proper asepsis, access was gained by removal of old post and core material such that walls and coronal structures were preserved as much as possible through the old full ceramic crown with the help of endo-access bur #3 (Dentsply Sirona, USA); ultrasonics and GG drills (MANI, Japan). After gaining access to the root canal, the old gutta percha was removed using Hyflex Remover (Coltene Whaledent, Switzerland) along with saline irrigation. (Fig. 2) The canal was irrigated with 3% sodium hypochlorite carefully and correct working length was re-established.

Biomechanical cleaning and shaping was done minimally under light pressure using hand files up to size 80 K-file (MANI, Japan) with copious amount of saline as the canal was flared and later irrigated with 3 ml of 17% ethylenediaminetetraacetic acid (EDTA) for removal of smear layer. Calcium hydroxide paste was placed intra-canal for disinfection of the root canal and closed IRM dressing was given.

After 15 days, calcium hydroxide was infused with profuse saline and an apical barrier of 4 mm MTA plug was established. The canal was lined with moist cotton and an IRM was placed. (Fig. 3)

The MTA plug was confirmed with a finger plugger at the third appointment and obturation of the canal was completed with cold lateral condensation technique using epoxy based resin sealer Epoxidin (TechnoDent, India). (Fig.4)

In the later appointment, the post space was created using Peeso reamers (MANI, Japan) and size #3 Selfpost (Medicept, UK) was selected by confirming under radiograph. The canal was relieved from all undercuts using Peeso reamers and coated with glycerine as a separating medium. After treating the fiber post with silane (Ultradent, USA) for 1 minute, a flowable nano-hybrid composite resin (Filtek Z350 XT, 3M ESPE) was adapted to the post and inserted into the canal to mimic the canal configuration. This post-core assembly was first light cured inside the canal for 20 seconds followed by extra oral curing for an additional 20 seconds. Subsequently, layer by layer of composite resin was added in incremental fashion and fabrication was confirmed under radiograph for good intimacy to dentin walls maintaining same pathway of removal and insertion. Finally, the whole fabricated 'Compo-post' was checked for proper fit and interferences were removed to acquire smooth passive insertion. (Fig.5)

The canal was extensively cleaned with 5ml of 17 percent EDTA for 1 minute followed with saline to eliminate contaminants and clarify the smear layer prior to cementation of the post. Later, the luting procedure of the compo-post along with core buildup was carried out using primers, adhesives and dual-cure composite resin provided in Paracore Kit (Coltene Whaledent, Switzerland) as per the manufacturer's instructions. Excess of resin was removed and the compopost-core assembly was cured for 30 s. covering all margins. (Fig.6)

Fig 1-6 1] Preoprative radiograph; 2] Radiograph after old post and GP removal; 3] Radiograph after MTA plug formation of 4mm; 4] Post obturation radiograph; 5] Radiograph confirming final fit of compopost; 6] Postoperative radiograph after luting of compopost

DISCUSSION

Endodontists have a difficult time treating a young tooth with pulpal necrosis and periapical disease. Conventional apexification procedures with and without apical barriers are two endodontic therapy options for such teeth. MTA has been found to be a very effective root filling material for sealing young root canals with open apices, which can provide technical issues in producing proper obturation. MTA promotes periradicular healing by encouraging the development of hard tissue. However, proper MTA condensation can be difficult to obtain in some situations with broad open apices because the material could get extruded beyond the apex. Therefore an apical matrix can be used for the controlled placement of MTA to a desired level.[7]

$CaOH_2$ has the ability to provide an antibacterial environment thus, facilitate the decontamination of the pulp cavity.[8] Additionally, with its high pH, the prior use of $CaOH_2$ dressings becomes necessary to create favourable conditions for MTA setting and improve its properties.[9]

In such circumstances of current scenario, the quality of apical obturation determines the endodontic treatment prognosis. However, the treatment's success is directly dependent to the foramen's diameter or sealing ability, as well as the material's proper adaptation. Adel *et al*.[10] found that increasing the diameter of the apical foramen or decreasing the thickness of the apical plug greatly enhances barrier apical microleakage. In a dye leakage research comparing different MTA depths, 4-mm thick material was found to be much more effective,[11] which was employed to the case in our report.

Endodontic therapy results in severe tooth structural loss, necessitating the use of intraradicular retainers and filling cores to hold the final restoration in place.[12] After endodontic treatment, it is not uncommon to have a residual root canal shape that is not perfectly round.[13]

The patient was young and presented with flared non-round canal with thin radicular dentin thickness of 0.6 to 0.9mm. According to the literature, the treatment options for such cases include cast post, post with accessory post or anatomic post. Therefore, case was ideal for customized post and core. Due to the uncertain prognosis of the teeth, a cast post would result in catastrophic tooth failure.[1] The custom produced cast post's elastic modulus is higher than that of dentin, causing wedging on the remaining radicular dentin.[14] A fibre post with a low modulus of elasticity would transmit forces across the dentin and be more conservative, according to Duret *et al*.[15] However, due to the flared shape of the canal space, without close adaptation to the radicular space, the post would fit inappropriately. This necessitates the use of many layers of resin-based luting cement around the post, to avoid adhesive failures or post debonding.[2, 16] On the other hand, a post individualized to closely match the shape of the canal will be surrounded by a thin and uniform film of resin cement, which represents ideal conditions for retention.[5]

The reason behind promoting use of anatomical post techniques in laboratory studies can be attributed to the high hydraulic pressure they exert on the cement against the dentin walls, resulting in better contact between the post-cement-dentin interfaces. This pressure reduces voids/blisters formation in the cement, eliminating sources of flaw-initiating sites; increases the number of tubules filled with the resin cement because of better penetration of resin into demineralized dentin and results in a more uniform hybrid layer, with greater resin tags and adhesive lateral branches.[17]
The curing of the post lined with composite lining was done in incremental layering technique to reduce poymerisation shrinkage. Furthermore, resin was designed by both direct (sculpted intraoral) and indirect (extroral curing) methods. This double curing reduced the stresses inside the anatomical post system.[18]

The roots reinforced with simply one prefabricated post or those with auxiliary posts all showed similar stress distribution, according to a finite element analysis investigation on flaring canal stress distribution. Increased resin luting cement thickness resulted in greater overall stress accumulation values at the root dentin as compared to the anatomic post model. Anatomic posts kept stress inside the post body and directed less stress to the remaining root structure, according to this study.[19]

In the present case, before modelling the glass fibre post with composite resin, we used a silane coupling agent as pre-treatment. This was done because studies have shown that silanization of the fibre post improves composite resin adherence.[20]

In-vitro and in-vivo studies are increasingly recommending the use of traditional two-step etch and rinse adhesive systems in conjunction with dual cure or chemically cured resin cement.[20] Self-etching or self-adhesive cement compositions are clearly inferior to these.

Bulk fill flowable composite for fortifying the flared root canal with a fibre post has been found to have advantages of rapid curing and composite placement, wasting less time and speeding up the procedure. More in-vitro and in-vivo research is needed to confirm the technique's stability and efficacy in repairing flared root canals.

CONCLUSION

Managing a tooth with open apex with a biocompatible material MTA has become a widely used approach. This unique process is more predictable and requires less time. The management of a structurally weakened root through conservative approach by reinforcement with flowable liner and modified glass fiber post (Compo-Post) can be a simple and efficient procedure for the treatment of immature anterior traumatized teeth with excellent esthetic and functional results. Such teeth restored with this technique best serve the needs of the patients.

Although "individualizing" the post through the resin layer is recommended in all cases, it appears to be especially effective for improving post retention when dealing with elliptic-shaped canals or those with a reduced amount of residual root structure after endodontic treatment; this latter situation obviously precludes further dentin removal to match the post shape. In these clinical conditions, the development of a "anatomic post," that is, moulding the post to the root anatomy rather than vice versa, is the preferred approach.[5]

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