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Case Series

Horizontal post- An innovative method to rehabilitate endodontically treated teeth

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ABSTRACT

Current literature suggests that tooth fracture post endodontic treatment is a more common complication than an endodontic reinfection. The best way to treat such complication is rehabilitation with complete coverage restoration with or without a foundation restoration. Critical analysis of several in vitro studies suggest that a posterior glass fiber reinforced composite restoration, particularly with glass fiber posts placed horizontally in a bucco-lingual direction improves the fracture resistance significantly. These case reports describe in detail the method of placement of posts horizontally rather than the conventional vertical placement in endodontically treated teeth to strengthen the remaining coronal tooth structure.

1. Introduction

To preserve the natural tooth is the primary goal of endodontic treatment.[1] Vitality of teeth may be affected or compromised due to dental caries, trauma, non carious cervical lesions, conservative treatment like cavity preparation, bleaching of tooth etc.[2] In case patient requires endodontic treatment he/she has to visit dental centres for root canal treatment followed by partial/ full coverage restorations.[3] With the advent of single visit endodontics concept, endodontic therapy can be completed in a one visit saving patient precious time which is a very important factor when considering serving troops posted in different terrain.[4]

Non vital endodontic treated teeth behave in a different biomechanical manner than a vital tooth.[5] Various endodontic treatment procedure like access opening, cleaning and shaping of root canal, full or partial coverage restorations result in decrease in tooth structure. It is already published and well-known fact in endodontic literature that the tooth structure damage involving single marginal ridge results in decrease in tooth rigidity by 46%, and the tooth structure damage involving both the marginal ridges results in decrease in tooth rigidity by 63%.[6] Decrease in tooth rigidity results in tooth fracture which ultimately leads to failure of meticulously completed endodontic treatment.

A novel concept of horizontal post placement in an endodontically treated teeth has come up with promising results both in ex-vivo and in vivo studies which has been well documented in reputed journals.[7–9] The aim of these case reports is to describe a gold standard technique for enhancing the fracture resistance of coronal tooth structure utilizing the of placement of horizontal fiber glass posts in a bucco-lingual direction inserted in a glass fiber reinforced

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composite resin foundation restoration after completion of root canal therapy.

2. Case Report 1

A 43 year old woman reported with a chief complaint of continuous severe sharp shooting pain in left lower back tooth since a day. Pain was spontaneous, aggravated on eating hot food and while reclining which subsided on taking medication. She gave a past dental history of root canal treatment w.r.t. tooth number 35,37. There was no significant medical history contributing to the case. On intraoral clinical examination there was restoration fractured distally w.r.t 36 (Figure 1a,b). Caries detected below contact point of restoration on mesial aspect. Upon pulp sensitivity testing there was heightened response with heat. Tenderness on percussion was present. Radiographic examination revealed radiolucency distally approximating pulp and radiolucency mesially below the restoration suggestive of secondary caries w.r.t 36. Widening of periodontal ligament w.r.t 36. Loss of lamina dura w.r.t 36 (Figure 1c). Diagnosis of acute apical periodontitis was made. The patient was explained in detail about endodontic treatment procedure of the affected teeth followed by reinforcing the tooth with 2 horizontal post placement inorder to save the tooth.

At the first visit, the patient was given local anesthesia with 1.7 mL lignocaine (1:80,000 epinephrine), and isolation with rubber dam was achieved. Access opening was done and 3 canal orifices (mesiobuccal, mesiolingual and distal) were located. Working length was determined using apex locator along with IOPA radiograph (Figure 3). Cleaning and shaping was carried out using crown down technique with rotary Pro taper Nickel Titanium files. 3% sodium hypochlorite and 17% EDTA as irrigant was used. Calcium hydroxide was placed in canals as the intra canal medicament. The access opening was temporized using teflon tape and temporary cement was placed. At the subsequent visit, coronal temporary filling was removed after application of dental rubber dam. 3% sodium hypochlorite was used to remove the intra canal calcium hydroxide and root canal irrigation. All the 3 canals were again reinstrumented using rotary Pro taper NiTi files. The root canal was obtured with AH plus sealer and single cone gutta percha points (Figure 1d).

Model mock up was done to fabricate template and determine and localize the exact site of post placement (Figure 2a-d). Holes were drilled in the cast and trial fitting of fiber post was done in the cast. Acrylic template fabrication on master cast. Trial of the template intraorally (Figure 3a,b).

Using a translucent glass fiber post system 2 cross-sectional holes were prepared through the remaining buccal and lingual walls. A double tapered post drill of size #1 (0.9 mm), was used. Two glass fiber posts were fitted through the holes, traversing from the buccal and lingual walls. After the standard acid etching and prime bonding protocol for the coronal chamber, initially a flowable composite was syringed into the canal openings and over the pulpal floor. The same flowable composite was also used to cement the 2 horizontal posts in place. The bulk of the chamber was then filled with posterior composite restoration encompassing the 2 horizontal posts. (Figure 3c,d). After setting, the extra protruding portions of the posts on the buccal and lingual surfaces were cut off, and the restoration was then smoothed and polished. Radiograph taken before and after luting of fiber post (Figure 4a,b).

3. Case Report 2

A 29 years old male was transferred from his general dental practitioner after initiation of endodontic treatment. His chief complaint was intermittent recurring pain on the left upper posterior side since the past few months. Pain was dull, intermittent which aggravated during mastication and subsided on taking medications. There was no significant medical history contributing to the case. Clinical intraoral examination revealed temporary restoration w.r.t maxillary left second pre molar 25, no sinus tract, no mobility. Heat and cold pulp sensitivity test was negative. There was mild tenderness on percussion.

Radiographic examination of maxillary left second pre molar 25 revealed presence of peri apical radiolucency at the apex of 25 and radiopacity into the pulp chamber which suggestive of temporary restorative material (Figure 5a). Diagnosis of symptomatic apical periodontits was made. The tooth was endodontically treated in a similar manner as previous case and was rehabilitated using singe horizontal fiber post placement in a single visit appointment basis (Figure 5b, Figures 6 and 7).

4. Case Report 3

A 32 year old male patient reported with severe, throbbing, constant pain in the mandibular left first molar, i.e., tooth number 36, for the past seven days. The medical history was non contributory. On clinical examination 36 had a deep carious lesion. Mild tenderness on percussion was present. The color and surface texture of the oral soft tissues was normal and the patient had no carious lesions on the other teeth. IOPA parallel radiograph revealed the presence of an extra distal root with accompanying apical radiolucency. The buccal object rule (same-lingual opposite-buccal rule) confirmed the additional root as a distolingual root (radix entomolaris). A diagnoses of symptomatic apical periodontitis w.r.t tooth number 36 was made based on the patient history and clinical examination. The patient was informed about the endodontic treatment as an attempt to save and retain the tooth.

After excavating the caries, the distal missing marginal ridge was restored with posterior resin composite as a pre endodontic restoration. The standard protocol for access cavity preparation was followed using round and safe end tapered fissure bur. After removing the roof of the pulp chamber completely, two mesial and distal canal orifices were located. Endodontic treatment was completed in same visit and singe horizontal fiber post placement was completed as previously described (Figure 8 b, Figures 9 and 10).

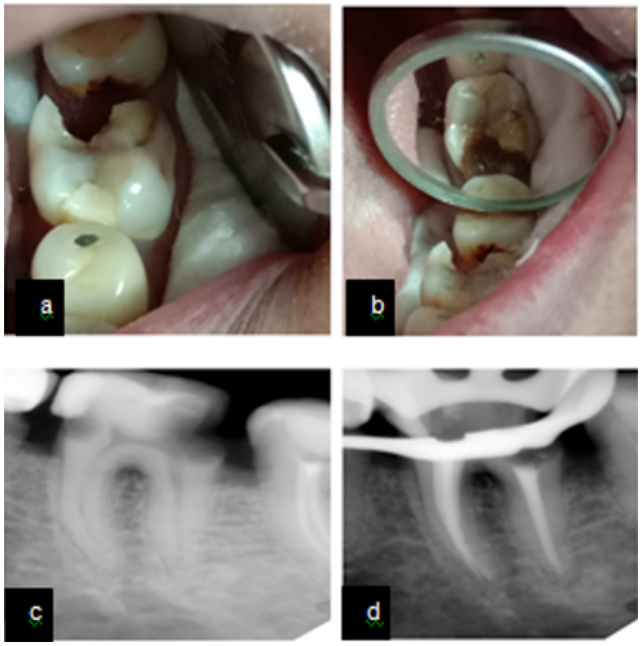

Fig. 1: Tooth number 36 showing fractured restoration distally w.r.t 36. Caries detected below contact point of restoration onmesial aspect; **a,b:** Pre operative radiograph revealed radiolucency distally approximating pulp and radiolucency mesially below the restoration suggestive of secondary caries. Widening of periodontalligament w.r.t 36; **c:** Post obturation radiograph(**d**).

5. Discussion

Single-visit endodontics is defined as the conservative, nonsurgical treatment of an endodontically involved tooth consisting of cleaning, shaping and obturation of the root canal system in one visit. Advantages include making the patient comfortable because of the reduction in the number of visits and injections, reduced pain during subsequent visits, economics, minimizes the fear and anxiety.[10] In our second and third cases we completed the endodontic treatment in a single visit.

The susceptibility to tooth fracture from start of endodontic treatment to final foundation restoration is high.[11] Immediate therapy using reinforcement with horizontal posts once endodontic therapy is completed with the rubber dam being still in place may reduce the

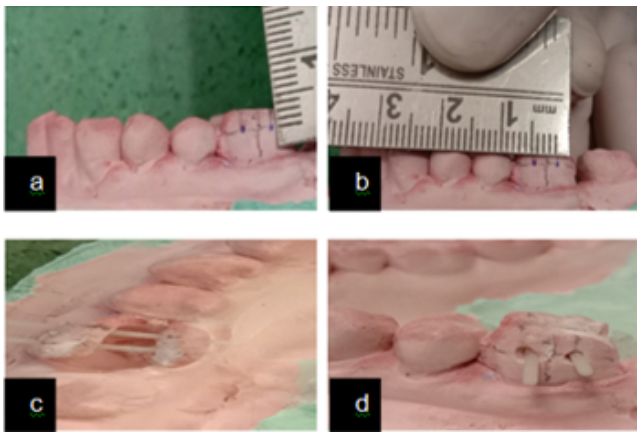

Fig. 2: Model mock up was done to fabricate template and determine and localize the site of post placement; **a,b:** Holes were drilled in the cast and trial fitting of fiber post was done in the cast (**c,d**).

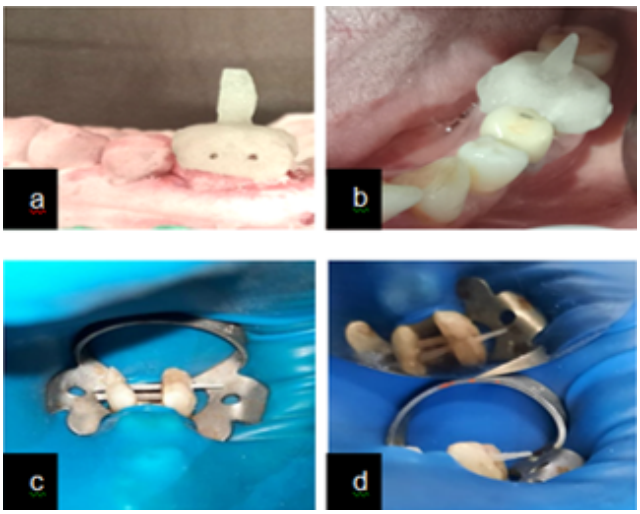

Fig. 3: Acrylic template fabrication on master cast; **a:** Trial of the template intraorally; **b:** Holes were drilled and fiber post placed intra orally (**c,d**).

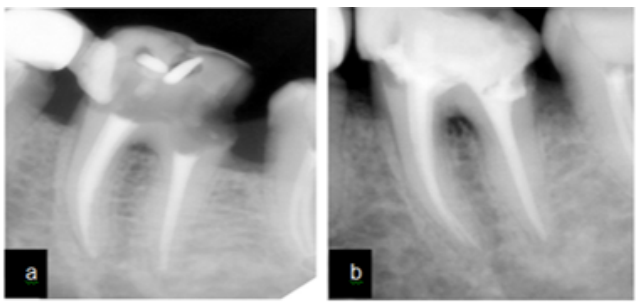

Fig. 4: Radiograph taken before luting of fiber post; **a:** Radiograph taken after luting of fiber post (**b**).

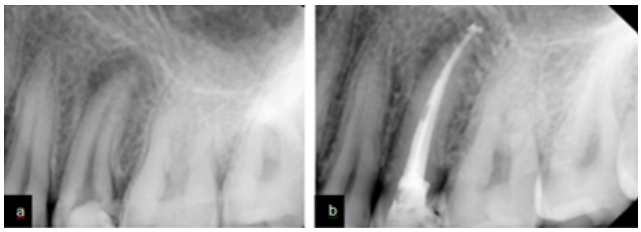

Fig. 5: Tooth number 25 revealed presence of peri apical radiolucency at the apex of 25 and radiopacity into the pulp chamber which suggestive of temporary restoration; **a:** Post obturation radiograph **b**.

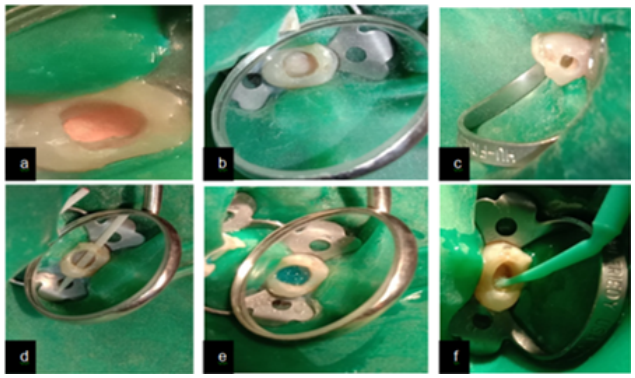

Fig. 6: Intra oral view shows gutta percha in the root canal orifice after obturation; **a:** Flowable composite was placed to seal the root canal orifice; **b:** Hole was made using post drills supplied with the post kit; **c:** Trial fitting of fiber post; **d:** Acid etching of the pulp chamber; **e:** Placement of bonding agent **f.**

Fig. 7: Light curing of the bonding agent; **a:** Resection of the protruding portions of horizontal posts and after luting of fiber post and posterior composite placement; **b:** IOPA radiograph after final restoration using horizontal post **(c,d)**.

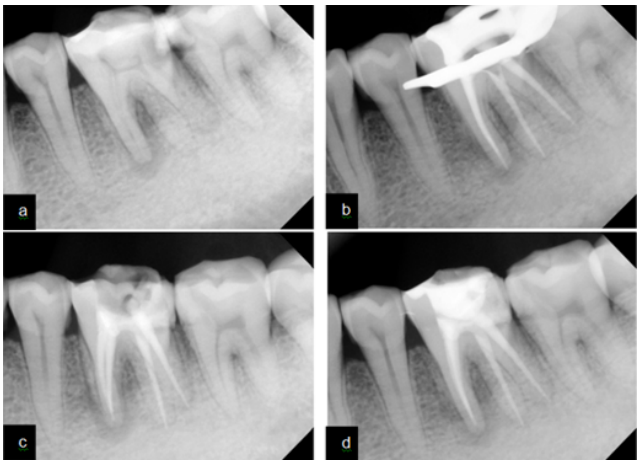

Fig. 8: Pre operative radiograph of tooth number 36 shows additional disto lingual root, presence of peri apical radiolucency in mesial and distal roots; **a:** Postoperative radiograph(**b**).

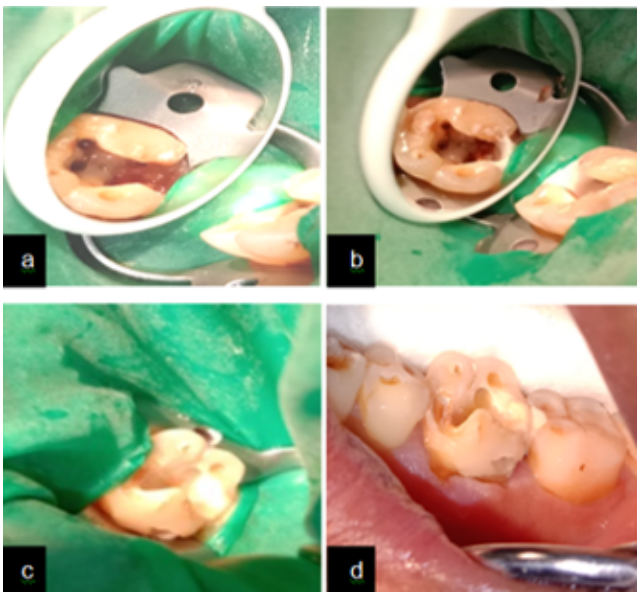

Fig. 9: Intra oral view showing four root canal orifices; **a:** Distal wall build up was done using composite restoration; **b:** A single hole was drilled from buccal to lingual wall (**c,d**).

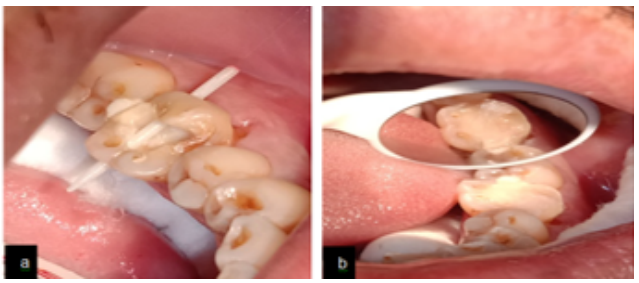

Fig. 10: Trial fitting of fiber post prior to cementation; **a:** Resection of the protruding portions of horizontal posts and after luting of fiber post and posterior composite placement (**b**).

possibility of developing a fracture postoperatively. This is a relatively fast and easy to perform procedure, can be completed within 30 minutes. It can be placed by the endodontist or general dentist at a low cost. The only prerequisite is that the buccal and lingual walls should remain intact. The significant benefit of being cost effective therapy far outweighs the treatment alternatives such as extraction and implant or post-core crown buildup.[12]

Fiber posts are highly fatigue resistant, have a high tensile strength, and an elastic modulus similar to that of dentin. Although a consensus in the literature is lacking, their use may decrease the risk of coronal or radicular fracture.[13,14] In the present study, the holes made to support the posts were less than 1 mm deep this ensured that the integrity of the tooth was not adversely affected resulting in a better ability to withstand occlusal load.

Jurema et al did a systematic meta analysis and review to analyse the fracture resistance of post endodontically treated anterior teeth and to evaluate the answer to the research question, "Does the use of a fiber post influence the fracture resistance of endodontically treated and restored anterior teeth compared with alternative restorative treatments?" They concluded that use of glass fiber in posts definitely increases the fracture resistance value of endodontically treated teeth.[15] Clinical outcome of this study was that placing glass fiber post is an authenticated technique of improving the fracture resistance of restored anterior endodontically treated teeth, including those with veneer preparations or cervical cavities.

Scotti et al[16] investigated the fracture resistance values and patterns of fracture propagation in endodontically treated mandibular first molars restored with glass fiber reinforced direct composite restorations. They concluded that for the direct technique for restoration of endodontically treated molars, reinforcement of composite resins with glass fibers or fiber posts can enhance fracture resistance significantly. The SEM analysis showed a lower capacity of horizontal glass fibers to deviate the fracture, but this effect was not sufficient to result in to a more favorable fracture patterns above the cemento enamel junction (CEJ). Salameh et al[17] study aimed to compare the fracture resistance and failure patterns of 90 mandibular molars restored using resin composites with or without fiber posts, with respect to the number of residual cavity walls. It was concluded that the resistance of endodontically treated mandibular molars restored with composite resins is mainly affected by the number of residual walls. Using fiber-reinforced posts optimized fracture patterns.

Karzoun et al[18] did a in vitro study to evaluate the effect of a horizontal glass fiber post on the fracture strength of endodontically treated maxillary premolars with mesioocclusaldistal (MOD) cavities. They concluded that a composite resin core buildup with a single horizontal fiber glass post running bucco lingually doubled the fracture resistance over a restoration with composite resin alone. Mergulhao VA et al[19] did a in vitro study to evaluate the resistance and patterns of fracture of endodontically treated maxillary premolars (ETPs) restored with different methods. ETPs restored with conventional composite resin with or without horizontal fiber post, bulk-fill composite, and ceramic inlay showed fracture resistance similar to that of sound teeth. Conventional composite resin restorations exhibited the highest prevalence of unrepairable fractures, and the insertion of a horizontal fiber post decreased this prevalence. Intact teeth showed 100% of repairable fractures. They however also stated that it is difficult to extrapolate the results directly to a clinical situation due to the limitations of this study.

The vertical stresses created in preparing and seating vertical posts can lead to root fracture.[20,21] Post space preparation for a vertical post may, by removing dentin in the critical cervical area of the tooth, weaken the tooth even further and subject it to horizontal fracture along with strip perforation in the furcal area.[22] The placement of a horizontal post may provide a short-term benefit in increasing fracture resistance for the patients who cannot afford the immediate cost of a full coverage restoration after root canal therapy. Eventually, when the patient has a full-coverage restoration, the horizontal post-core buildup can provide sufficient retention so that a crown alone will suffice without a vertical post and core. However, if a vertical post were required at that time, it could be readily prepared because the horizontal post does not block the dentist's access to the root canals. However, if there was a vertical post in place from a previous buildup, it is far more challenging and time-consuming for the dentist to remove it before he or she can retreat the tooth.

6. Conclusion

In our case series we have presented an intraoral method to enhance the fracture resistance of a tooth immediately post completion root canal therapy. This technique can be very useful in far-flung areas where dental laboratory facilites are not available and placement of full coverage prosthesis can be delayed without resulting in fracture of teeth. Based up on the positive results in various in vitro studies as well as case report published, we tried to utilize this new concept in our clinical scenarios, however a prospective clinical trial is required to validate the concept of horizontal post technique.

7. Conflict of Interest

None.

8. Source of Funding

None.

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