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Case Report

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Conservative endodontics II: A truss access/ orifice-oriented access case series of premolars

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Abstract

Strategic dentin preservation is the prime objective of this case report (i.e. leaving a truss of dentin between the 2 cavities thus prepared). Permanent teeth with an indication for endodontic treatment can be treated via the truss access cavity design rather than traditional access cavity protocol using copious irrigation. The teeth were then given post-endodontic restorations. Endodontically treated teeth did not show any post-operative symptoms or any presence of post-operative periapical radiolucency or flare-up. The main objective of Orifice oriented access/truss access approach mainly stresses on the preservation of the healthy tooth structure with the minimally invasive approach. This minimal invasive approach in truss access designs avoids the need for conventionally placed crowns. Thus, the aim of this case report was to strategically plan truss access cavity designs on premolars.

Keywords: Access Cavity, Truss Access, Conservative access cavities.

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INTRODUCTION

Endodontic therapy is comprised of three factors which are cleaning and shaping, disinfection and three-dimensional obturation of the complex root canal morphology. However, access cavity preparation is known to be one of the most challenging and an important step for a successful endodontic treatment [1].

Weakening of tooth structure is a major drawback in Traditional Endodontic Access Cavity (TEC). For restoration of these teeth, various treatment modalities may be used, ranging from a simple direct restoration inlay, onlay, and full-coverage crowns to more complex indirect restorations, with or without a post and core [2].

Studies have shown that higher percentage of non-restorable fractures of teeth in TEC has been related to the higher volume of coronal tooth structure loss in TEC [3].

To overcome this, Clark and Khademi modified the endodontic access cavity design to minimize the tooth structure removal and this was known as the Conservative Endodontic access Cavity (CEC). The aim of the CEC was to preserve some of the chamber roof and the peri-cervical dentin [4].

The peri-cervical dentin is the dentin that is located 4 mm above and 4 mm below the crestal bone and they serve in distribution of functional stresses in teeth. Thus, it is necessary that we preserve this peri-cervical dentin in order to maintain the biomechanical response of the radicular dentin [5].

Trials of more conservative access cavity designs such as Contracted (a small conservative cavity on the occlusal surface that allow the clinician to access all the canal orifices), Truss (a direct access from the occlusal surface to expose the mesial and distal canal orifices and leaving the intervening dentin intact), and ninja (ultraconservative approach) access cavity preparation methods have been previously reported to improve fracture resistance of endodontically treated teeth and reduce the dependency on complex, more expensive post endodontic restorations [6]. The differences between traditional access cavity and contracted access cavity is mentioned in Table 1.

One approach of CEC is the orifice-directed design (also called the ''Truss'' access cavity), in which separate cavities are prepared to approach the mesial and distal canal systems in a mandibular molar, whereas for maxillary molars the mesio-and distobuccal canals are approached through one cavity and the palatal canal through another [6].

The prime objective of these access cavity designs is strategic dentin preservation (i.e. leaving a truss of dentin between the 2 access cavities).

Table 1: Comparison between Traditional Endodontic Access Cavity and Conservative Endodontic Access Cavity [12]

Traditional Access Cavity	Conservative Access Cavity
• It follows the principle of 'Extension for Prevention' • During cavity preparation, the center of the pulp chamber should be the target of the initial penetration, at a point where the roof and floor of the pulp chamber are at the widest. • Widening of access cavity prevents iatrogenic possibilities during access cavity preparation. • No preservation of peri-cervical dentin • Possibility of Soffit is less probable • Attempted for all the teeth during Endodontic Treatment • No possibility of pulp tissue remnants.	• It follows the concept of 'Prevention of extension' • During cavity preparation only the tooth structure required to be removed is prepared and the access is made as conservative as possible • During access cavity preparation lack of clinical judgement may lead to iatrogenic complications • Preservation of peri-cervical dentin • Soffit is prepared during conservative access preparation • Cannot be attempted for all teeth during endodontic treatment • Possibility of endodontic failure if shaping and cleaning protocol is not followed

CASE REPORT

Case 1

A 27-year-old female patient came to the department of endodontics with dull spontaneous pain in the lower right back tooth region which lingered even after the stimulus of causing the pain was removed. Intraoral examination revealed disto-proximal caries of the right second premolar (FDI no. 36). Tooth was tender to percussion and there was absence of sinus tract or extra-oral swelling. Pulp Sensibility test using cold and electric pulp testing gave a delayed positive response. Radiographic examination showed disto-proximal radiolucency involving enamel, dentin, and pulp suggestive of chronic irreversible pulpitis. [Figure 1]

Figure 1: Pre-operative Radiograph

Coronal access:

After delivering of local anesthesia excavation of caries was performed using a small round bur (Mani Inc.bur size no #2) after which pre-endodontic build-up by tunnel preparation was performed. The tooth was isolated using a rubber dam. After isolating the tooth, straight line access to the canal was gained by orienting the a round bur (Mani Inc. bur size no #2) just exactly above the pulpal horn in the center of the tooth parallel to the long axis of the tooth until a drop into the pulp chamber was obtained. The orifice was conformed using a DG-16 probe. (Figure 2).

Figure 2: Truss Access Cavity

Shaping and Cleaning:

Apical Patency was established with a pre-curved, K-file size #10 (Dentsply/ Maillefer) using a watch-winding motion until it reaches the root apex. Pulp extirpation was done till size 15 stainless steel hand file. After which, the working length of the root canal were determined with size 15 stainless steel hand file and a Root Zx II electronic apex locator (J. Morita and Co, Tustin, CA, USA. Glide path was made using Proglider rotatory files (Dentsply Maillefer, Ballaigues, Switzerland). (Figure 3) After establishing glide path shaping of the canals were performed with ProTaper gold rotary system (Dentsply Maillefer, Ballaigues,

Switzerland). Final irrigant i.e 17% EDTA was activated prior to obturation using Endoactivator sonic activation.

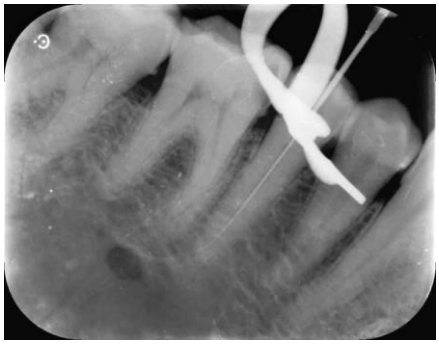

Figure 3: Working Length Determination

Obturation and Post endodontic Restoration:

The shaped canal was dried with absorbent paper points (DiaDent). A master gutta-percha point of size F2 was placed and master cone radiograph was taken. (Figure 4) Ca $(OH)_2$ based root canal sealer (Kerr Sybron endo) and inserted into the root canal together with the gutta-percha point to the working length.

The gutta-percha was then sheared off at the canal orifice and then bulk-fill nanohybrid composite restoration was used for post-endodontic restoration and radiograph was taken to verify adequate packing of the restorative material. (Figure 5)

Figure 4: Master cone radiograph

Figure 5: Post-operative Radiograph

Case 2

A 46-year-old female patient came to the department of endodontics with dull spontaneous pain in the upper right back tooth region of jaw. Intraoral examination revealed disto-proximal caries of the upper right first premolar (FDI no. 14). Percussion test showed a positive result. There was absence of sinus tract and any extra-oral swelling. Pulp Sensibility test gave a negative response. Radiographic examination showed radiolucency disto-proximal radiolucency involving enamel, dentin, and pulp with periapical widening suggestive of apical periodontitis. (Figure 6)

Figure 6: Pre-Operative Radiograph

Coronal access:

After delivering of local anesthesia caries around the disto-proximal marginal ridge was excavated with a small round bur (Mani Inc) after which pre-endodontic build-up was performed. Isolation was done using a rubber dam. After isolation, access to buccal canal was gained from occlusal surface by orienting the small round bur (Mani Inc. bur size no #2) parallel to the long axis of the tooth above the buccal pulp horn till a drop was gained. The buccal canal was conformed using a DG-16 probe Then, the bur was placed over the palatal pulpal horn and the access to palatal canal was gained. (Figure 7)

Figure 7: Truss Access Cavity

Shaping and Cleaning:

Multiple visit endodontic treatment was recommended for the patient. In the first visit, apical Patency was established with a pre-curved, K-file size #10 (Dentsply/ Maillefer) using a watch-winding motion until it reaches the root apex. The working lengths of the root canals were determined with size 15 stainless steel hand files and a Root Zx II electronic apex locator (J. Morita and Co, Tustin, CA, USA. Glide path was made using proglider rotatory file (Dentsply Maillefer, Ballaigues, Switzerland). (Figure 8) After establishing glide path shaping of the canals were performed using crown-down technique with ProTaper gold rotary system (Dentsply Maillefer, Ballaigues, Switzerland). Water-based calcium hydroxide dressing was given and patient was recalled after 7 days.

In the next visit, the residual calcium hydroxide was removed using passive ultrasonic activation of 17% EDTA. The canals were then ready for obturation.

Figure 8: Working Length Radiograph

***Obturation and Post endodontic Restoration**:*

The shaped canals were dried with absorbent paper points (DiaDent) similar to the master apical file size. A master gutta-percha point of F3 of length 18 mm was placed and master cone fit radiographically verified. [Figure 9]. Then, the Ca $(OH)_2$ based root canal sealer (Kerr Sybron endo) was prepared and inserted into the root canal together with the gutta-percha point to the working length.

Figure 9: Master Cone Radiograph

The gutta-percha was then sheared off at the canal orifice and then bulk-fill nanohybrid composite restoration was used for post-endodontic restoration and radiograph was taken to visualize adequate packing of the restorative material. [Figure 10]

Figure 10: Post-operative Radiograph

DISCUSSION

One of the most important factors in conservative endodontic treatment is the conservation of tooth structure which affects the survival of endodontically treated teeth. The benefits and possible drawbacks of the conservative endodontic access cavity concept have not been well supported by research data.

Endodontic treatment mainly relies on complete shaping and disinfection of root canals and filling it biologically compatible materials [7].

The access cavity preparation depends on the G.V. Black's principles. 'Extension for prevention,' is the major concept that has been followed universally for many decades. A little modification of the principles and they include the outline form, the convenience form, removal of the carious dentin and the toilet of the cavity. Underlying these principles is Black's concept of 'extension for prevention', which promotes the sacrifice of additional tooth structure to prevent iatrogenic complications and to best achieve the ultimate goals.

To overcome the problem of preservation of tooth structure especially pericervical dentin, different conservative access cavity designs came into existence [8].

There are different paradigms within the realm of conservative access cavity (conservative endodontic access, ultraconservative ''ninja'' access, and orifice-directed ''truss'' access), and no ''definitions'' exist for each of these designs at this time [9].

However, a major drawback is that there is lack of evidence to support the use of truss access cavity preparation which can be used as a alternative method to Traditional access cavities on a daily basis [10].

In a study conducted by Corsentino et al concluded that TRECs do not increase the fracture strength of endodontically treated teeth in comparison with CECs and TECs. Moreover, the loss of mesial and distal ridges reduced the fracture strength of teeth significantly [11].

This was the first known case series where Truss access was used on maxillary and mandibular premolars [12].

Also, the approach of creating a Truss access was performed according to the diagrammatic representation which was used in a study performed by Neelakattan et al [13].

According to Plotino et al, Teeth with TEC access showed lower fracture strength than the ones prepared with CEC or NEC. Ultraconservative "ninja" endodontic cavity access did not increase the fracture strength of teeth compared with the ones prepared with CEC [14].

One of the major disadvantage in Truss access is inaccuracy which may lead to gauging and worst may even lead to perforation. Thus, clinical experience and proper radiographic assessment is necessary while planning a Truss access. There are even chances of improper pulp tissue removal and missed canals [15].

In a study performed by Ozyurk et al CEC preparation did not increase the fracture strength of teeth with class II cavities compared with TEC preparation [16].

Silva et al reported that, there was no increase in fracture resistance of root filled 2-rooted maxillary premolars in ultraconservative access cavities [17].

In contrast, Roperto et al, reported that preservation of marginal ridge integrity did not affect the resistance to fracture, failure mode, or stress distribution in maxillary premolars restored with composite resin in conservative access cavities [18].

Thus, numerous clinical and laboratory studies are needed to be performed on the biomechanical merits and demerits of Truss Access cavities especially in bicuspids as several studies are already present on cuspids.

CONCLUSION

The new approaches in conservative access endodontics has been challenging the traditional conventional approach in the recent years. Truss/orifice-oriented access approach mainly stresses on the preservation of the healthy tooth structure with the minimally invasive approach. This minimal invasive approach in access opening reinforces the tooth avoids the need for conventionally placed crowns. Researches and clinical evidences of Truss should be performed in endodontics to help conservative access openings to overcome traditional access and changing the paradigm of "Endodontics" to "Conservative Endodontics"

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Conflict of Interest

The authors declare no conflict of interest.

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