Conservative endodontics: A truss access case series

Hussain Mookhtiar, Vivek Hegde, Srilatha S and Meheriar Chopra

Abstract

The prime objective of this case report is to obtain access cavity designs that is strategic dentin preservation (ie, leaving a truss of dentin between the 2 cavities thus prepared). Three permanent teeth with an indication for endodontic treatment were 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. Truss access approach mainly emphasizes on the preservation of the healthy tooth structure with the minimally invasive approach. This minimal invasive approach in access opening avoids the need for conventionally placed crowns.

Keywords: Access cavity, truss access, conservative access cavities

Introduction

Endodontic therapy is comprised of three factors which are cleaning and shaping, disinfection and three-dimensional obturation of the root canal system. 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) mainly due to pathology. For restoration of these teeth, various treatment modalities may be used, ranging from a simple direct restoration with or without a post and core to more complex indirect restorations, including inlay, onlay and full-coverage crowns [2]. TEC has been shown to demonstrate a significantly higher percentage of non-restorable fractures of teeth which was reasoned to be 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 preservation (ie, leaving a truss of dentin between the 2 cavities thus prepared).

Trials of more conservative access cavity designs such as contracted (a small conservative approach in access opening avoids the need for conventionally placed crowns), truss access approach mainly emphasizes on the preservation of the healthy tooth structure with the minimally invasive approach. This minimal invasive approach in access opening avoids the need for conventionally placed crowns.

The pericervical 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 pericervical dentin in order to maintain the biomechanical response of the radicular dentin [4].

The prime objective of this case report is to obtain access cavity designs that is strategic dentin preservation (ie, leaving a truss of dentin between the 2 cavities thus prepared). Three permanent teeth with an indication for endodontic treatment were 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. Truss access approach mainly emphasizes on the preservation of the healthy tooth structure with the minimally invasive approach. This minimal invasive approach in access opening avoids the need for conventionally placed crowns.

Keywords: Access cavity, truss access, conservative access cavities

Introduction

Endodontic therapy is comprised of three factors which are cleaning and shaping, disinfection and three-dimensional obturation of the root canal system. 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) mainly due to pathology. For restoration of these teeth, various treatment modalities may be used, ranging from a simple direct restoration with or without a post and core to more complex indirect restorations, including inlay, onlay and full-coverage crowns [2]. TEC has been shown to demonstrate a significantly higher percentage of non-restorable fractures of teeth which was reasoned to be 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 pericervical dentin [4].

The pericervical 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 pericervical 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 access cavity designs that is strategic dentin preservation (ie, leaving a truss of dentin between the 2 cavities thus prepared).
Case report(s)

Case 1
A 27-year-old female patient came to the dental clinic with dull spontaneous pain in the right lower back tooth region. Intraoral examination revealed disto-proximal caries of the right lower first molar (FDI no. 36). Tooth was tender to percussion and there was absence of sinus tract or extra-oral swelling. Pulp Sensibility test gave a positive response. Radiographic examination showed disto-proximal radiolucency involving enamel, dentin, and pulp with periapical widening suggestive of chronic irreversible pulpitis. [Fig 1]

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 was performed. Tooth was isolated using a rubber dam. Coronal access was made out just exactly above the mesial pulpal horn and the access to pulp chamber was gained from occlusal surface to roof of the pulp chamber by orienting the bur parallel to the long axis of the tooth in oval shape buccolingually with a small round bur (Mani Inc. bur size no #2). The mesiobuccal and mesiolingual orifices were conformed using a DG-16 probe Then, the bur was placed over the distal pulpal horn and the access to the pulp chamber was gained. De-roofing above the canal orifices was done using safe ended diamond bur (Mani Inc.) (Fig 2)

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 lengths of the root canals were determined with size 15 stainless steel hand file and a Root ZxII electronic apex locator (J. Morita and Co, Tustin, CA, USA. Glide path was made using proglider rotatory file (Dentsply Maillefer, Ballaigues, Switzerland). (Fig 3) After establishing glide path shaping of the canals were performed using crown-down technique with ProTaper gold rotary system (Dentsply Maillefer, Ballaigues, Switzerland). Final irrigant i.e 17% EDTA was activated prior to obturation using Endo activator sonic activation.

Obturation and post endodontic restoration
The canals were dried with absorbent paper points (Dia Dent). A master gutta-percha point of F2 0.6 taper of length 18 mm was placed and master cone radiograph was taken [Fig 4]. Then, the Ca (OH)₂ based root canal sealer (Kerr Sybron endo) was prepared according to the manufacturer’s instruction 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 visualize adequate packing of the restorative material. [Fig 5]

Case 2
A 46-year-old female patient came to the dental clinic with dull spontaneous pain in the upper right back tooth region. 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. [Fig 6]

**Coronal access**
After delivering of local anesthesia caries around the disto-proximal marginal ridge was excavated with a small round bur (Mani Inc. bur size no #2) after which pre-endodontic build-up was performed. Isolation was done using a rubber dam. After isolation coronal access was made just exactly above the buccal pulpal horn. The access to pulp chamber was gained from occlusal surface to roof of the pulp chamber by orienting the bur parallel to the long axis of the tooth in oval shape buccolingually with a small round bur (Mani Inc. bur size no #2). The buccal were conformed using a DG-16 probe. Then, the bur was placed over the palatal pulpal horn and the access to the pulp chamber is gained. (Fig 7)

![Fig 7: Truss access cavity](image)

**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 ZxII electronic apex locator (J. Morita and Co, Tustin, CA, USA. Glide path was made using proglider rotatory file (Dentsply Maillefer, Ballaigues, Switzerland). (Fig 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.

![Fig 8: Working length determination](image)

**Obturation and post endodontic restoration**
The canals were dried with absorbent paper points (DiaDent) similar to the master apical file size. A master gutta-percha point of F3 0.6 taper of length 18 mm was placed and master cone radiograph was taken [Fig 9]. Then, the Ca(OH)$_2$ based root canal sealer (Kerr Sybron endo) was prepared according to the manufacturer’s instruction 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 visualize adequate packing of the restorative material. [Fig 10]

![Fig 9: Master cone selection](image)

![Fig 10: Post obturation](image)

**Case 3**
A 30-year-old female patient was referred to a dental clinic with dull spontaneous pain in the left lower back tooth region. Intraoral examination revealed disto-proximal caries of the lower right first molar (FDI no. 46). Tooth was tender on percussion and there was absence of any sinus tract and extra-
oral swelling. Pulp Sensibility test gave a positive response. Radiographic examination showed radiolucency disto-proximal radiolucency involving enamel, dentin, and pulp suggestive of chronic irreversible pulpitis. [Fig 11]

**Coronal access**

After delivering of local anesthesia caries around the disto-proximal marginal ridge was excavated with a small round bur (Mani Inc.bur size no #2) after which pre-endodontic build-up was performed. Isolation was done using a rubber dam. After isolation coronal access was made out just exactly above the mesial pulpal horn. The access to pulp chamber was gained from occlusal surface to roof of the pulp chamber by orienting the bur parallel to the long axis of the tooth in oval shape buccolingually with a small round bur (Mani Inc. bur size no #2). The mesiobuccal and mesiolingual orifices were conformed using a DG-16 probe. Then, the bur was placed over the distal pulpal horn and the access to the pulp chamber is gained. Distobuccal and distolingual orifices were conformed using a DG-16 probe. De-roofing above the canal orifices was done using safe ended diamond bur (Mani Inc.) (Fig 12).

**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. The working lengths of the root canals were determined with size 15 stainless steel hand files and a Root ZxII electronic apex locator (J. Morita and Co, Tustin, CA, USA). Glide path was made using proglider rotatory file (Dentsply Maillefer, Ballaigues, Switzerland). (Fig 13) After establishing glide path shaping of the canals were performed using crown-down technique with ProTaper gold rotary system (Dentsply Maillefer, Ballaigues, Switzerland). Final irrigant i.e 17% EDTA was activated prior to obturation using Passive ultrasonic activation.

**Obturation and Post endodontic Restoration**

The canals were dried with absorbent paper points (DiaDent) similar to master apical file. A master gutta-percha point of F2 0.6 taper of length 18 mm was placed and master cone radiograph was taken [Fig 14]. Then, the Ca(OH)₂ based root canal sealer (Kerr Sybron Endo) was prepared according to the manufacturer’s instruction 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 visualize adequate packing of the restorative material. [Fig 15]

**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. Root canal treatment mainly relies on complete cleaning 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 an 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].

Table 1: Comparison between traditional access cavity and conservative access cavity [12]

<table>
<thead>
<tr>
<th>Traditional access cavity</th>
<th>Conservative access cavity</th>
</tr>
</thead>
<tbody>
<tr>
<td>It follows the principle of ‘Extension for Prevention’</td>
<td>It follows the concept of ‘Prevention of extension’</td>
</tr>
<tr>
<td>During cavity preparation, the centre of the pulp chamber</td>
<td>During cavity preparation only the tooth structure required to</td>
</tr>
<tr>
<td>be the target of the initial penetration, at a point where the</td>
<td>be removed is prepared and the access is made as conservative as</td>
</tr>
<tr>
<td>roof and floor of the pulp chamber are at the widest.</td>
<td>possible</td>
</tr>
<tr>
<td>Widening of access cavity prevents iatrogenic possibilities</td>
<td>During access cavity preparation lack of clinical judgement may</td>
</tr>
<tr>
<td>during access cavity preparation.</td>
<td>lead to iatrogenic complications</td>
</tr>
<tr>
<td>No preservation of pericervical dentin</td>
<td>Preservation of pericervical dentin</td>
</tr>
<tr>
<td>Possibility of Soffit is less probable</td>
<td>Soffit is prepared during conservative access preparation</td>
</tr>
<tr>
<td>Attempted for all the teeth during Endodontic Treatment</td>
<td>Cannot be attempted for all teeth during endodontic treatment</td>
</tr>
<tr>
<td>No possibility of pulp tissue remnants.</td>
<td>Possibility of endodontic failure if shaping and cleaning</td>
</tr>
<tr>
<td>protocol is not followed</td>
<td>protocol is not followed</td>
</tr>
</tbody>
</table>

Conclusions

Conservative access endodontics has challenged the traditional conventional approach in the recent years. Truss access approach mainly emphasizes on the preservation of the healthy tooth structure with the minimally invasive approach. This minimal invasive approach in access opening 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”

Conflict of interest
None.

Acknowledgements
None.

References