

Modern Access Cavity Concept: A Review

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ABSTRACT

A proper coronal access cavity preparation is the foundation of pyramid of endodontic treatment. Any inappropriately prepared access cavity preparation can impair the biomechanical preparation, irrigation and obturation resulting in poor prognosis. This paper reviews the various aspects in access cavity design focusing mainly on minimally invasive access cavity concept.

Keywords- Access cavity design, Minimally invasive access cavity, Peri cervical dentin, Soffit, traditional endodontic access cavity.

INTRODUCTION

The main goal of endodontic treatment is to eliminate microorganisms and pathologic debris from the root canal system and prevention of reinfection. [1] Endodontic therapy comprises of three factors and they are cleaning and shaping, disinfection and three-dimensional obturation of the root canal system. Among the various steps of root canal treatment access cavity preparation is one in the entire key step for the undefeated treatment. Inadequate access cavity preparation may also result in difficulty in locating or negotiating the root canals, instrument separation and aberrations of the canal shape which may bring about deficient cleaning, shaping and filling of the root canal system. Primary target of access cavity is conservation of sound tooth structure as much as possible. The structural integrity of the tooth is a significant factor

that determines prognosis as it relates to the post endodontic survival rate of tooth. Maintenance of strength and stiffness that resists structural deformation becomes the objective of every single restorative procedure, fundamentally in endodontics. To prevent the fracture rate following should be preserved-

- A) Peri Cervical Dentin - The dentin encompassing the alveolar crest is called as the "Irreplaceable Critical Most Zone". [2] It is round 4mm coronal to the crestal bone and 6mm apical to the crestal bone. This critical zone is sacred because of three reasons 1) ferrule, 2) fracturing and 3) dentin tubule orifice proximity from inside to out. It should be conserved as much as possible to ensure long term retention of the tooth.
- B) 3D Ferrule – Band that encompasses the external dimensions of the residual tooth, like the metal bands around a barrel. Three components of three dimensional ferrule are -
 1. Vertical component – It is around 1.5 to 2.5 mm [2]
 2. Dentin thickness (Girth) – The absolute minimum thickness is 1-2 mm [2]
 3. Total occlusal convergence/ Net Taper- Total occlusal convergence relies upon how much ferrule is required. For 3mm vertical ferrule 10 degree, for 4mm 20 degree & for new porcelain crowns 50 degree or more is needed owing to its deep chamfer line.

C) Soffit / Banking – In architecture, a soffit is depicted as underside of the ceiling & wall but in dentistry it is the stepped access which is 360°. In the tooth, this tiny “lip” or “cornice” could be as small as 0.5 mm, or as large as 3.0 mm at times (where additional strength is required, or when the anatomy allows it).

This paper reviews the various aspects in access cavity design focusing mainly on modern access cavity concept.

Traditional endodontic access cavity

G.V. Blacks preparation were altogether acknowledged for an extended time. Traditional access cavities (TAC) suggest removal of dental caries & restorations subsequently ensuring the healthy tooth structure of the tooth. The roof of the pulp chamber is completely eliminated in order to discover all orifices of the root canal & give direct access to the apical foramen or to the initial curvature of the canal by eliminating cervical dentin protrusions & enlarging the canal orifices. The fundamental objective behind traditional endodontic access cavity is localization, chemo mechanical preparation & root canal filling. However, consistent with some authors, traditional endodontic access eliminates more layer of dentin structure which can weakens the tooth structure. Recently, the traditional access cavity designs are questioned & altered.

A minimally invasive approach called ‘Endolight’ [3] to access design by shifting the outline configuration toward greater dentin preservation and idealizing the endodontic restorative interface is the most recent development. [4]

Newer access design includes-

- 1) Conservative endodontic access cavity
- 2) Ultra conservative access cavity / ‘Ninja’ endodontic access cavity
- 3) Orifice – directed dentin conservation access cavity / Truss access cavity
- 4) Caries driven access cavity
- 5) Restorative driven access cavity

- 6) Cala lilly enamel preparation
- 7) Image guided endodontic access
- 8) Dynamically guided endodontic access
- 9) Micro guided endodontic access

Conservative access cavity

David Clark and John Khademi have changed the traditional access cavity design and these new design are referred to as conservative endodontic access cavities. The design are been supported to lessen the tooth structure removal. [5-6] The conservative access cavity was contemplated as another traditional access cavity in maintaining the mechanical stability of the tooth. This mechanical stability helps the long time survival & function of root canal treated tooth. In conservative access cavity, the teeth are accessed at the central fossa and they are extended out to discover canal orifices. This aids in protecting the pericervical dentin and a part of the chamber floor. The pericervical dentin is that the dentin that is placed 4mm above and 6mm below the crestal bone and it helps in distribution of stresses in teeth. Subsequently its vital that we safeguard this pericervical dentin in order to keep up the biomechanical response of the radicular dentin. [5-6]

Ultra conservative access cavity / Ninja endodontic access cavity

In this cavity design, an oblique projection is made towards the central fossa of the root canal orifices. This projection is made parallel with the enamel cut of 90 degree or more to the occlusal plane. This makes simpler to discover the canal orifices from different visual angulations. [7]

Orifice- directed dentin conservation access cavity / ‘Truss’ access cavity

The orifice-directed design is referred to as the ‘truss’ access cavity. In this access cavity design separate cavities are made to approach the canals. [8] For example, two separate cavities are prepared in mandibular molars to approach the mesial and distal canal. For maxillary molar, two

cavities are prepared. One cavity approaches the mesio and distobuccal canal and another separate cavity is prepared for palatal canal. The point of this methodology is to preserve dentin with the minimally invasive approach i.e. leaving a truss of dentin between the two cavities that have been prepared. [9] The restricting components of this methodology which are past the operator's control are position of tooth, patients mouth opening capability, degree of calcification & other patient related variables. All of these factors result in increased time required for the endodontic treatment. This methodology requires significant training & technical competency.

Caries driven access cavity

In caries driven access cavity design, entry into the pulp chamber is carried out by extracting caries and maintaining all the remaining structure of the tooth.

Restorative driven access cavity

Restorative driven access cavity design is performed in teeth that are restored but are having no caries. In this approach entry to the pulp chamber is done by eliminating the current restoration completely or partially and preserving the residual tooth structure.

Cala lilly enamel preparation

Usually, unfavourable C factor and weak enamel rod engagement are present when eliminating old amalgam or composite restoration or with the traditional endodontic access cavity. Enamel in the form of cala lilly is cut back at 45. [8] This modification permits the involvement of almost the entire occlusal surface.

Image guided endodontic access

The aim of image guided endodontic access is to extract and preserve dentin strategically and to create the smallest possible access cavity. It utilizes available image modalities for the clinicians.

Dynamically guided endodontic access

In dental implants dynamically guided endodontic access is used. Dr. Charles M introduced it for the first time. In this information from patients CBCT is used to design an access cavity. Overhead cameras are used to trace the location of patients jaw and clinicians bur in three dimensional space. After looking at the software interface, the clinician provides input about the bur location. This position of the bur relates to the position of planned access.

Micro guided endodontic access

Virtual planning of an ideal access cavity is carried out by-

- 1) using some special software [10]
- 2) arrangement with a CBCT
- 3) surface scan

By using a 3D printer, a template can be delivered afterwards.

CONCLUSION

Traditional access cavity has been established several decades ago. As discussed above, minimally invasive endodontic access is also a better choice for preserving peri cervical dentin. There is however lack of evidence to support the argument that it preserves the fracture resistance of root filled teeth more than traditional access preparation. Therefore, clinician should strike the right balance between traditional endodontic preparation and minimal endodontic preparation to achieve the purpose of endodontic treatment.

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- How to cite this article: Vats S, Mishra P, Nikhil V. Modern access cavity concept: a review. *International Journal of Research and Review*. 2021; 8(2): 450-453.
