

## Conservative Access Cavity Preparations

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### Abstract

**Introduction:** In a root canal treatment, the first step that is done is endodontic access, the access cavity plays an important role in good instrumentation and delivery of irrigants during the endodontic process. If a good endodontic access cavity is lacking, then the entire procedure is compromised at some level since an effective cleaning and shaping is the most essential for the success of a root canal procedure. An inadequate endodontic access cavity makes everything difficult in the treatment starting from locating the canals to negotiation, debridement, disinfection, and later on, the obturation of the root canals. A good endodontic access cavity also helps in prevention of any iatrogenic error during root canals like perforation, ledge formation, and instrument separation.

**Aim of the Work:** This study aims at assessing the conservative access cavity designs and comparing them with the traditional access cavity designs.

**Methodology:** The review is a comprehensive research of PUBMED from the year 1994 to 2017.

**Conclusion:** Minimal invasive dentistry involves the use of natural tooth structure more than any artificial restoration for strength and esthetic functions. The conservative access cavity has a stepwise approach that aims at conserving the natural tooth structure. The advent of microscopes and CBCT imaging are the most important aids that help in the success of the endodontic cavity.

**Keywords:** Contracted Access Cavity; Truss Cavity Design; Ninja Access Cavity; Soffit; Pericervical Dentin

### Introduction

The recent pass in Conservative Dentistry and Endodontics has seen a new revolution which aims at preserving the natural tooth structure as far as possible and being the most conservative one can get [1]. In a root canal treatment, the first step that is done is endodontic access, the access cavity plays an important role in good instrumentation and delivery of irrigants during the endodontic process. If a good endodontic access cavity is lacking, then the entire procedure is compromised at some level since an effective cleaning and shaping is the most essential for the success of a root canal procedure [2]. An inadequate endodontic access cavity makes everything difficult in the treatment starting from locating the canals to negotiation, debridement, disinfection, and later, the obturation of the root canals. A good endodontic access cavity also helps in prevention of any iatrogenic error during root canals like perforation, ledge formation, and instrument separation [3].

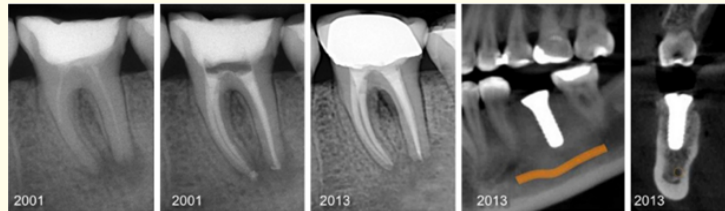
### Conventional endodontic access cavity

The traditional endodontic access cavity has a predetermined shape according to the type of tooth (Figure 1).



**Figure 1:** Traditional Trapezoidal shaped endodontic cavity for lower first molar [4].

Like a conventional cavity preparation, the endodontic cavities also have an outline form that determines the extent of the cavity occlusally, convenience form of the cavity is also made according to the amount of tooth removal that must be done for straight-line access [5]. In the traditional cavity design, an extension for prevention is done which extends the straight-line access to the foramen or the primary curvature of the canal [3]. This step in the conventional cavity design leads to loss of crucial dentin, which causes the weakening of tooth structure, which may lead to fracture. The traditional designs of the endodontic access cavity stayed on for a very long time since there were not enough imaging and diagnostic facilities available. The conventional access designs lead to loss of crucial dentin, which then leads to weakening of the tooth structure, and hence, the radicular or coronal dentin should be saved, and the root geometry should be maintained, which conserves the mechanical strength of the endodontically treated tooth (Figure 2) [6].

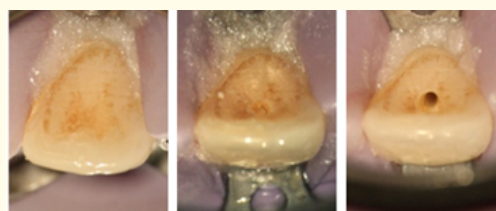


**Figure 2:** A case study of Conventional access cavity design with excessive tooth cutting leading to loss of tooth after a few years due to a fracture of the tooth [4].

### Conservative endodontic access cavities

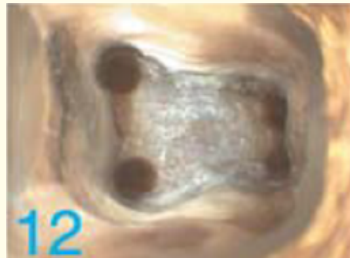
The conservative access cavity designs have been developed recently to save the tooth structure and the crucial dentin to enhance the life of the tooth; they aim at minimizing the tooth structure to be removed hence increasing the amount of original tooth structure remaining [7]. The tooth loss that happens during endodontic preparation cannot be replaced completely by any kind of restorative material, and hence, the conservation of dentin is the only way to increase the strength of the tooth [8]. The recent diagnostic, instrumentation, and imaging techniques help in making the conservative designs possible. The newer instruments which are super flexible, microscopes with higher level of magnification, highly potent irrigation kits and thermoplasticized obturation techniques, and most importantly, the Cone-beam computed tomography, which allows 3D scanning of the tooth have made conservative endodontic access cavity designs possible [4].

The conservative endodontic access cavities have changed the basic concept of cavity making and made it more tooth centric compared to the earlier concept of operator centric cavities. Now the contracted cavity has a design feature where restorative material must be removed before the natural tooth cutting is done, it concentrates on cutting enamel before dentin, and the occlusal structure of the tooth is to be removed before cervical dentin that is left [9]. The whole concept of Straight-line access and deroofting of the pulp chamber has been changed, and more importance is given to saving the crucial dentin, which is called pericervical dentin that is present 4 mm below and 4 mm above the crestal bone [7]. This pericervical dentin helps in the distribution of forces around the teeth and hence increases the strength of the tooth. In the incisors area near the cingulum has the maximum strength and acts as a cushion; this area is called the pericingulum dentin and is crucial for the strength of the tooth (Figure 3) [10].



**Figure 3:** Pericingulum dentin [4].

The contracted access cavity suggests the formation of soffit which is a portion of the pulpal roof which is present around the coronal portion of the pulp chamber; this portion of the dentin is called the dentin roof strut or soffit (Figure 4 and 5) [7].



**Figure 4:** Clinical picture depicting soffit [7].



**Figure 5:** Preservation of pericervical dentin and soffit is depicted by the overlaying black line diagram [7].

### Developments and aids that help in dentin preservation in conservative endodontic access techniques

#### Operating microscopes

Magnification plays a very important role in the success of conservative access designs. The root canal orifices are very minute, and hence, making good access without cutting excess tooth structure is not possible. Microscopes and loupes with good amount of lightening have become one of the most important aids in the conservative access cavity [11].

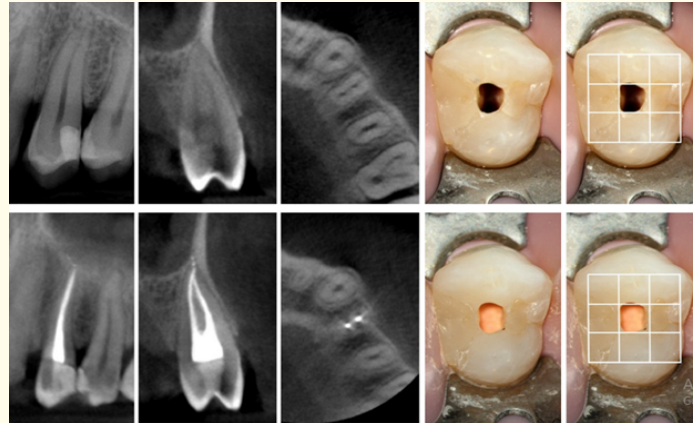
#### Dental radiography

The shift from two-dimensional radiography to 3-dimensional radiography has the highest impact on access cavities. A 2-dimensional radiograph does not depict the entire anatomical variations that are present in the tooth. Morphology of the root canal is very complicated, and to do a success localization, disinfection, and filling of the canal, it's important to achieve straight-line access, which requires excessive cutting of the tooth structure. In a two dimensional visual the exact location of the canal is not clear and a lot of tooth structure surrounding the orifice has to be removed, whereas because of the development of Cone Beam Computed Tomography (CBCT) the exact location and direction of the canal can be located in the three dimensional scans that are provided [12]. CBCT gives us a three dimensional visual of the tooth anatomy and hence all the orifices, the shape of the root, the orifice shape, calcification if any present in the tooth, the exact number of canals that are present become easily visible making it easier for the clinician to do a conservative preparation [13].

#### Steps to follow during a conservative endodontic access cavity preparation

- Three-dimensional imaging: By doing 3-dimensional radiography the exact location of the orifice is visible. The clinician can take the exact measurement of the tooth on the scan and project it on the tooth, which negates the need unnecessary removal of the radicular dentin (Figure 6) [4].
- Prepare the conservative access cavity: Preparation of Endodontic access cavity should aim at the removal of minimal tooth structure but maintaining the biological objective of cleaning and shaping. For the anterior tooth, the cutting should be as incisal as possible, and for posterior teeth, cavity should be centered between the roots and the root canal. The endodontic access must be wider than the coronal extension of the root canal thus making the soffit area, which helps in cushioning of the tooth thereby increasing the strength [4].

- The cervical preparation: The main aim of this step is to maintain the pericervical dentin, which helps in better transfer of the forces applied on the occlusal surface to the radicular portion of the tooth. For this, the natural funnel shape of the canal should be maintained [4].
- Instrumentation: The instruments used for the preparation of the canal should be maintained according to the taper present in the root. The apical foramen should also be kept as small as practically possible [4].



**Figure 6:** CBCT image of 1<sup>st</sup> premolar, dimensions of the tooth are taken and projected onto the tooth which makes a contracted cavity possible [4].

**Types of conservative endodontic access cavities**

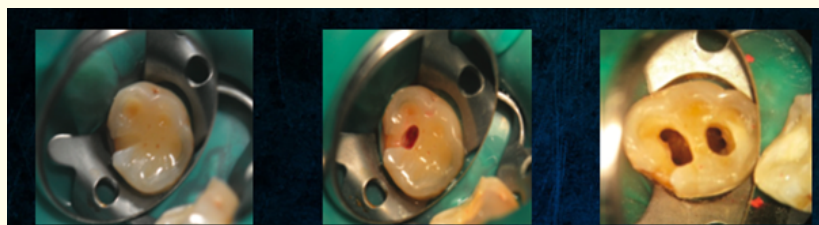
In recent years many authors have given different approaches to conservative access techniques (Table 1).

Contracted access cavity	Clark and Khademi
Truss cavity design	Auswin and Ramesh
Ninja Access cavity	Belogard M
Guided Access cavity	Zehnder and Connert

**Table 1:** Conservative access opening techniques [7].

**Contracted endodontic access:** Proposed by Clark and Khadeemi in the year 2010 came up with the contracted endodontic access cavity design, which aims at preserving the pericervical dentin and making a soffit which helps in cushioning the forces applied on the tooth and transferring it to radicular dentin [7].

**Truss access cavity design:** Proposed by Auswin and Ramesh in 2017 This cavity aims at the removal of dentin just above the orifice, thereby maintaining the maximum amount of sound tooth structure (Figure 7) [14].



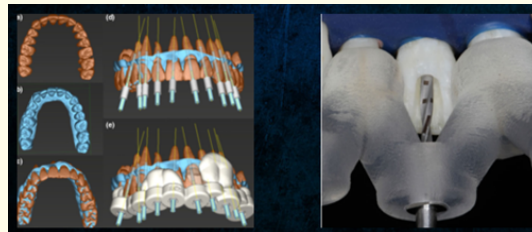
**Figure 7:** Truss access cavity design [14].

**Ninja access cavity design:** Ninja access cavity designs has been developed as an ultraconservative approach for access cavity preparation [15]. Ninja access has been compared for fracture resistance with contracted access cavities and has given the same result. Ninja access cavity has given better fracture resistance than a traditional cavity (Figure 8) [16].



**Figure 8:** Comparison of traditional access cavity {black line}, Contracted access cavity {green line} and ninja access cavity {red line} [16].

**Guided access cavity:** Guided access cavity aims at combining CBCT and 3-D printer technology, a bur is specially designed according to the design of the tooth as seen by the CBCT image (Figure 9). A virtual bur is first made and then superimposed on the tooth, then the 3D printer is used to make the specific bur, which then helps in making the endodontic access [17].



**Figure 9:** Guided endodontic access cavity [17].

## Conclusion

Minimal invasive dentistry involves the use of natural tooth structure more than any artificial restoration for strength and esthetic functions. The conservative access cavity has a stepwise approach that aims at conserving the natural tooth structure. The advent of microscopes and CBCT imaging are the most important aids that help in the success of endodontic cavity. A good irrigation protocol should be followed if a minimal invasive cavity is used to satisfy the biological principle of the biomechanical preparation. With the help of a good irrigation system, CBCT imaging, and Microscopes, good prognosis following conservative access cavity can be achieved.

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