



Indira Gandhi  
National Open University  
School of Health Sciences



Dental Council of India

## **MDT-002**

# **Clinical Endodontics I**

Block

# **2**

## **ACCESS CAVITY PREPARATION**

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## **BLOCK INTRODUCTION**

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So, Now you are all set for the take off

I am sure you must have gone through your previous books well before reaching here. Why do I say so? This because it is very common for a student/clinician to keep the 'basic books' back in the book rack and straight away pick up the 'Clinical Books', and here is the mistake. To understand what you are doing, it is important to realize as to why you are doing so.

This block is written to make us all understand the principles to be followed, roads to navigate and safety precautions in making our passage to reach the apex of the tooth.

Principles of access opening.....

A standard protocol needs to be followed repeatedly, every time to get the desired positive results. Many years of research and clinical assessment has brought in a set of laid principle which one needs to go through well, understand and execute them exactly (modifications, which I assure you are rarely needed.)

This unit will stress on to those principles.

To err is human! Access opening is the first procedural step towards root canal treatment. Here you start the journey inside the tooth. The dimensions inside the tooth are fixed; any violations you make while your navigation can cause one or the other complication. A good dentist is the one who can avoid these violations and if it is not possible then correct it by his/her knowledge and skill. We would like to beware you of the possible common errors encountered and their management through this unit.

The last unit gives you an idea and importance of working length...first landmark achieved during root canal preparation. Many methods are being practiced all over the world to determine it accurately. In earlier days when clinical acumen used to rest more on history, percussion and palpation, tactile sensation was used to determine this length. As the time passed by, more of technology filtered in the working length determination and apex locator came up. This is a very essential tool in determining working length.

Wishing you a happy reading, remember it is a complicated and a beautiful world inside the tooth, enjoy it and at the same time RESPECT IT.

## Access Cavity Preparation

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## UNIT 19 PRINCIPLES OF ACCESS OPENING

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Working Length  
Determination and Apex  
Locators

### Structure

- 19.0 Objectives
- 19.1 Introduction
- 19.2 Objectives of Access Cavity Preparation
- 19.3 Armamentarium for Access Cavity Preparation
- 19.4 Endodontic Coronal Cavity Preparation
  - 19.4.1 Principle I – Outline Form
  - 19.4.2 Principle II – Convenience Form
  - 19.4.3 Principle III – Removal of Remaining Carious Dentin and Defective Restorations
  - 19.4.4 Principle IV – Cleansing the Cavity
- 19.5 Basic Procedure for Access Cavity Preparation
- 19.6 Let Us Sum Up
- 19.7 Answers to Check Your Progress
- 19.8 Further Readings

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### 19.0 OBJECTIVES

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After reading this unit, you should be able to:

- describe the objectives of an access opening;
- list the principles of access opening;
- discuss the reasons for removing unsupported tooth structure and caries during access preparation; and
- elaborate the procedures in preparing an endodontic access opening.

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### 19.1 INTRODUCTION

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Once the diagnosis and treatment plan has been established, the first part of the endodontic treatment directly applied to the tooth is the access cavity preparation. You must understand that adequate access is essential for successful endodontic treatment. Knowledge of the pulp chamber morphology, along with an examination of pre-operative radiographs, should be integrated when designing the access cavity to a tooth for non-surgical root canal treatment. Preparation may be divided into two phases: Coronal phase and the Intra-radicular (within the root) phase. The coronal phase, which is the access cavity, must give direct access to the root canals and the apical foramina so that these areas may be properly cleaned and shaped by the intra-radicular phase. Hence, success of the treatment that follows rests on a carefully prepared access cavity. As you are aware, there is great variance in overall tooth size, morphology, and arch position. This therefore, means that no two access openings are identical, although common access guidelines have been established depending on the location of the tooth. There is an old cliché that “*Access is Success*”. Unlike other aspects of dentistry,

root canal treatment is carried out with little visual guidance; therefore, the difficulties that you are likely to encounter while preparing an access cavity need to be considered.

The access cavity must provide clear and unobstructed access to each and every orifice and must be designed in such a way so as not to interfere with the often difficult intracanal procedures to follow.

In this unit you will learn the rationale for a carefully prepared access opening and the principles that you should keep in mind while preparing the access opening. The armamentarium required and the basic procedure to be followed while preparing an access will be also dealt with, in the later part of this unit.

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## **19.2 OBJECTIVES OF ACCESS CAVITY PREPARATION**

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By now you have already understood that access is the most important phase of non-surgical root canal treatment. A well-designed access preparation is essential for an optimum endodontic result. Without adequate access, you will realise that instruments and materials become difficult to handle properly in the highly complex and variable root canal system.

It is therefore, suggested that you try to assess the following features by visual examination of the tooth, and a study of a pre-operative periapical radiographs:

- The external morphology of the tooth.
- The architecture of the tooth's root canal system.
- The number of canals present.
- The length, direction and degree of curvature of each canal.
- Any branching or division of the main canals.
- The relationship of the canal orifice(s) to the pulp chamber and to the external surface of the tooth.
- The presence and location of any lateral canals.
- The position and size of the pulp chamber and its distance from the occlusal surface.
- Any related pathology.

***The objectives of access cavity preparation consist of the following:***

- 1) Remove the entire roof of the pulp chamber so that the pulp chamber can be debrided.
- 2) Enable the root canals to be located and instrumented by providing direct straight line access to the apical third of the root canals.
- 3) Enable a temporary seal to be placed securely in order to withstand any displacing forces.
- 4) Conserve as much sound tooth tissue as possible and as is consistent with treatment objectives.

The ideal access cavity creates a smooth, straight-line path to the canal system and ultimately to the apex. During your practice you will find that when prepared correctly, the access cavity allows complete irrigation, shaping, cleaning, and quality obturation. Optimal access results in straight entry into the canal orifice, with the line angles forming a funnel that drops smoothly into the canal(s). Projection of the canal centre line to the occlusal surface of the tooth indicates the location of the cavosurface line angles. Connection of the line angles creates the outline form. The access cavity preparations for endodontic therapy are designed for efficiently uncovering the roof of the pulp chamber and providing direct access to the apical foramina by way of pulp canals.

It may be prudent to commence access cavity preparation before isolating the tooth with rubber dam in order that the anatomical landmarks, tooth inclination and other helpful features are not lost. You must understand that it is crucial that the root canal does not become contaminated during either access preparation or canal instrumentation, and the tooth should be isolated in an aseptic field as soon as possible. If there is a danger of fracture of the coronal tooth structure, the cuspal height should be reduced to prevent this. If the loss of coronal tissue is extensive, there may be a need to provisionally restore the tooth. The subsequent restoration of the tooth should always be considered first. If you find that the tooth is not heavily restored then only the amount of coronal tissue sufficient for the successful completion of the root canal treatment should be removed. However, if you discover that the tooth is already compromised and will require some form of cuspal coverage restoration, an onlay or a crown, then it may be practical to reduce the cusp height, particularly mesiobuccally in molars, to enable better visualisation of the pulp chamber.

**Check Your Progress 1**

What are the objectives of endodontic access preparation?

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## 19.3 ARMAMENTARIUM FOR ACCESS CAVITY PREPARATION

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You should familiarise your self with the instruments for access preparation. The instruments required for access preparation include:

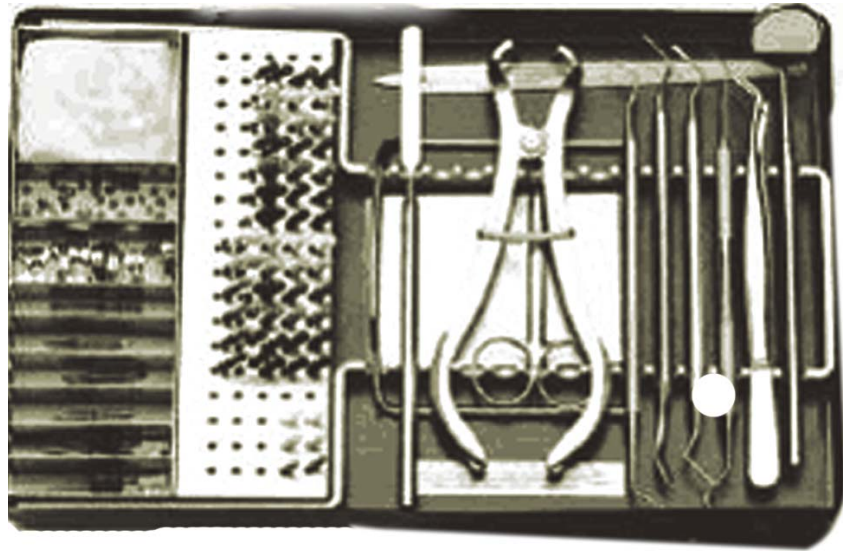


Fig.19.1: Armantarium box

- Front surface mirror
- Endodontic explorer (DG 16) – to aid in locating orifices
- Endodontic excavator
- Plastic instrument
- Amalgam plugger
- Spatula
- Cotton pliers
- Broaches
- Glass slab
- Cotton pellets – to hold medication and absorb blood
- High speed and slow speed handpiece
- High speed fissure bur and round bur
- Slow speed long-shank #2, #4, #6 bur
- Irrigating syringe and needle (bent at 45°)
- Sodium hypochlorite, and
- Rubber dam.

For initial entrance through the enamel surface or through a restoration, the ideal cutting instrument is the round end carbide fissure bur or a diamond stone mounted in a high speed contra-angle handpiece. As soon as the enamel or restorative penetration and minor surface extensions are complete, you require to use the slow speed handpiece with round burs to drill through the dentin and “drop” into the pulp chamber. The same bur is employed for removal of roof of the pulp chamber. The choice of size of the pulp chamber is made by estimating the canal width and chamber size apparent in the initial radiograph. As soon as



the bulk of the overhanging dentin is removed from the roof of the chamber, you need to use the high speed fissure bur to finish and slope the side walls in the visible portions of the preparation.

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## 19.4 ENDODONTIC CORONAL CAVITY PREPARATION

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As you have read before, endodontic preparations deal with both coronal and radicular access, each of which is achieved separately but ultimately flow together into a single preparation. The principles of endodontic coronal cavity preparation (access opening) can be enumerated as:

- 1) Outline form
- 2) Convenience form
- 3) Removal of the remaining carious dentin (and defective restorations), and
- 4) Cleansing of the cavity.

### 19.4.1 Principle I – Outline Form

The outline form of the access cavity should be shaped correctly and positioned accurately to establish complete access for instrumentation, from cavity margin to the apical foramen. The internal anatomy of the tooth established by the pulp dictates the external outline form. The endodontic cavity preparations are therefore done in a reverse manner; from the inside of the tooth to the outside. Thus, the external outline form is established by mechanically projecting the internal anatomy of the pulp onto the external surface. This can be executed by drilling into the pulp chamber and then working with the bur from the inside of the tooth to the outside, cutting away the dentin of the pulpal roof and walls overhanging the floor of the chamber.

The factors of the internal anatomy that regulate the outline form of endodontic coronal cavities are:

- i) Size of the pulp chamber.
- ii) Shape of the pulp chamber.
- iii) Number, position and curvature of the root canals.

#### *Size of the Pulp Chamber*

The size of the pulp chamber considerably affects the outline form of the access cavity. The preparation must be more extensive in a young patient unlike that in an old patient. The difference is so because with age the pulp recedes and the pulp chamber becomes smaller in all three dimensions. This becomes extremely important in preparing the anterior teeth for younger patients who have large root canals and thus require larger instruments and filling materials.

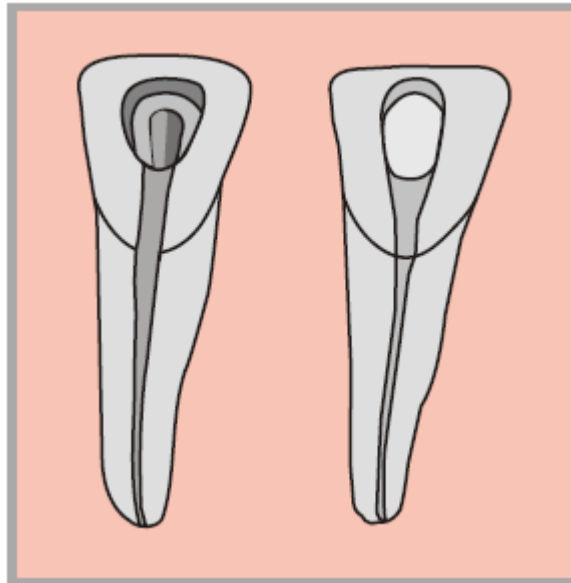


Fig. 19.2: Shape of pulp chamber of mandibular incisors

### *Shape of the Pulp Chamber*

The shape of the pulp chamber should be accurately reflected by the finished outline form. Let us consider an example of a mandibular molar tooth. In this tooth, the floor of the pulp chamber is usually triangular in shape, owing to the triangular position of the orifices of the canals. This triangular shape is extended upto the walls of the cavity and out onto the occlusal surface. Thus, the final cavity outline form is generally triangular. Likewise, if you consider maxillary first premolar, the outline form of the endodontic coronal cavity in this tooth is narrow, elongated oval in bucco-lingual projection. This reflects the size and shape of the broad, flat pulp chamber of this particular tooth.

### *Number, Position, and Curvature of Root Canals*

The cavity walls often have to be extended or modified to allow an unstrained instrument approach to the apical foramen, in order to instrument each canal efficiently without interference. This is particularly apparent in cases of curved canals. The outline form of the endodontic cavity is significantly affected when the cavity walls are extended to improve instrumentation. This change is for convenience in preparation, therefore, the convenience form regulates the outline form to some extent.

### **19.4.2 Principle II – Convenience Form**

The convenience form was conceived by G.V.Black as a modification of the cavity outline form, to establish greater convenience in the placement of intra-coronal restorations. In endodontic therapy, the convenience form makes the preparation and filling of the root canal more convenient as well as accurate. The convenience form modifications' offers four important benefits:

- i) Unobstructed access to the canal orifice.

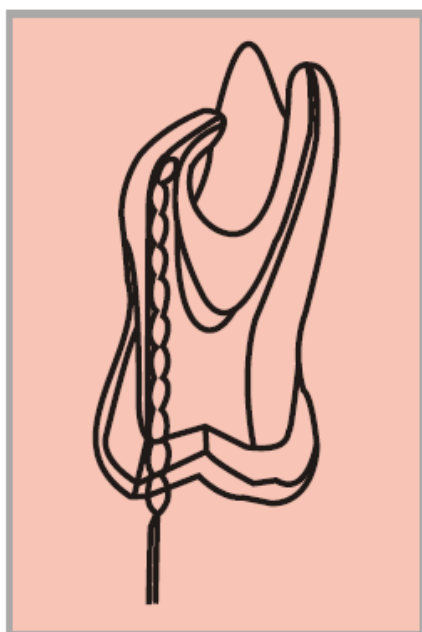
- ii) Direct access to the apical foramen.
- iii) Cavity expansion to accommodate filling techniques.
- iv) Complete authority over the enlarging instrument.

#### ***Unobstructed Access to the Canal Orifice***

For the instruments to be placed easily into the orifice of each canal without interference from the overhanging walls, enough tooth structure must be removed. You should be able to see each orifice and reach it easily with the instrument point. Additional canals present in some teeth should also be kept in mind. For example, there is a high incidence of a second separate canal in the mesiobuccal root of maxillary molars. The lower incisors often have additional canals. Also, a second canal is found often in the distal root of mandibular molars. You must keep in mind these variations while preparing the endodontic access cavity. Such variations often result in a modified outline form, to establish greater convenience for instrumentation.

#### ***Direct Access to the Apical Foramen***

Extensive removal of coronal tooth structure becomes necessary to provide a direct access to the apical foramen and to allow complete freedom of the endodontic instruments so that they can extend down the canal in an unstrained position. This is especially true when the root is severely curved or leaves the chamber in an obtuse angle Figure 19.3.



**Fig. 19.3: Direct access to apical foramen in severely curved root**

#### ***Cavity Expansion to Accommodate Filling Techniques***

Often it becomes necessary to expand the outline form of the endodontic cavity to make certain filling techniques more convenient. For instance, if a softened gutta percha technique is used to fill the canals, where the rigid pluggers are used in vertical thrust, then the outline form may have to be widely extended to accommodate these heavier instruments.

### ***Complete Authority Over the Enlarging Instrument***

It is important that you must have a complete control over the root canal instrument. If the instrument is impinged at the canal orifice by tooth structure that should have been removed, then you will lose control of the direction of the tip of the instrument and the intervening tooth structure will dictate control of the instrument. On the contrary, if you had removed the tooth structure around the orifice so that the instrument is free in this area of the canal, the instrument will then be controlled by two factors:

- a) Your fingers on the handle of the instrument, and
- b) The walls of the canal at the tip of the instrument.

If the access cavity outline is not properly modified by extending the convenience form, this can lead to failure by either root perforation, “ledge” or “shelf” formation within the canal, instrument breakage, or the incorrect shape of the completed canal preparation often termed “zipping” or apical transportation.

### **19.4.3 Principle III – Removal of Remaining Carious Dentin and Defective Restorations**

It is important to remove the caries and defective restorations in an endodontic cavity for three reasons:

- 1) To eliminate mechanically as many bacteria as possible from the interior of the tooth.
- 2) To eliminate the discolored tooth structure, that may ultimately lead to staining the crown.
- 3) To eliminate the possibility of any bacteria-laden saliva leaking into the prepared cavity (especially for proximal or buccal caries that extend into the prepared cavity).

After caries removal, if the carious perforation of the wall is allowing salivary leakage, the area must be repaired with cement, preferably from the inside of the cavity. If the caries is so extensive that the lateral walls are destroyed, or if the defective restoration is in place that is loose and leaking, then the entire wall or restoration should be removed and later restored. It is important that the restoration be postponed until the radicular preparation has been completed. It is much easier to complete the radicular preparation through an open cavity than through a restored crown. As long as a rubber dam can be placed on the tooth, it need not be built-up with amalgam, cement, or a copper band. If enough tooth does not remain above the gingiva to place a rubber dam clamp and seal against saliva, and if it is imperative that the tooth be retained, a simple gingivoplasty will establish the required “crown” length.

### **19.4.4 Principle IV – Cleansing the Cavity**

All of the caries, debris, and necrotic material must be removed from the chamber before the radicular preparation is begun. Leaving the calcified or metallic debris in the chamber can cause obstruction during canal enlargement. The soft debris from the chamber might increase the bacterial population in the canal.

The long-blade, endodontic spoon excavator is ideal for debris removal. Sodium hypochlorite (NaOCl) should also be used during the access preparation for its added benefits of disinfection, removal of hemorrhagic or purulent fluids, and flushing action of debris and dentin chips. The chamber can be finally wiped out with cotton and a careful flush of air will eliminate the remaining debris. You must be careful not to aim the air down the canals to prevent air embolism.

**Check Your Progress 2**

- 1) What are the principles of endodontic access preparation?  
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- 2) List the factors of internal anatomy that regulate the outline form of endodontic coronal cavities.  
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- 3) What role does the principle of convenience form have in endodontic access preparations?  
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- 4) What are the benefits of removing caries and defective restorations in an endodontic cavity?  
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## 19.5 BASIC PROCEDURE FOR ACCESS CAVITY PREPARATION

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Guidelines for cutting the access cavity are:

### 1) **Start Radiograph**

Begin with an X-ray of the unprepared tooth. This start with X-ray is important in making a diagnosis, as well as estimating the initial measurement of the canals. You must study the radiograph as a blueprint to establish the size, shape and location of the pulp canal(s) and their relative positions.

### 2) **Place Rubber Dam**

Rubber dam application is an essential prerequisite for providing non-surgical endodontic treatment. The benefits of using a rubber dam for an endodontic treatment include: It provides a dry, clean, and disinfected field; it protects the patient from the possible aspiration or swallowing of tooth and filling debris, bacteria, necrotic pulp remnants, and instruments or operating materials; it protects the patient from rotary and hand instruments, drugs, irrigating solutions, and the trauma of repeated manual manipulation of the oral soft tissues; and it is faster and more convenient than the repeated changing of cotton rolls and/or saliva ejectors.

### 3) **Cut through the Centre**

First, remove all caries and fillings that obstruct the view or that can cause leakage. Undermined enamel should also be removed together with any parts of the crown that may cause accessibility to the canal(s) difficult. Using a high-speed fissure bur or round bur held perpendicular to the lingual surface in case of anterior teeth and occlusal surface for posterior teeth, cut just through the enamel in the centre of the pencil-marked area. A common error is to begin cavity too far gingivally. Do not force the bur.

### 4) **Extend Access**

Extend the opening laterally to the designated outline by maintaining the point of the bur in the central cavity and rotating the handpiece toward the incisal so that the bur continues to parallel the long axis of the tooth. If there is pulp exposure, it should be widened with the handpiece in order to properly determine the extension of the pulp chamber.

### 5) **Cut through Dentin**

With a low-speed long-shank #4 or #6 bur (depending on the size of the pulp chamber), make a cut with the long axis of the tooth and cut directly through the dentin into the large pulp horn, or the largest area of the pulp chamber. The bur should be used with a pull stroke from the chamber and out.

### 6) **Explore Access**

Use the endodontic explorer (DG 16) to check for the canal. If the explorer meets constant resistance, the pulp chamber has not yet been reached.

### 7) **Cut into the Pulp Chamber**

Continue drilling apically through the dentin. You will feel a slight drop as the bur breaks through the roof and drops into the pulp chamber.

### 8) **Explore Access**

When the pulp chamber has been penetrated, probing with the explorer will often produce a “catch” along the ledges, or overhangs, created by the lingual walls or roof of the pulp chamber. The location of the orifice can often be determined by the colour of the dentin, sometimes referred to by the term *dentinal mapping*. The orifice may appear as a whitish spot in a general field of yellowish dentin.

### 9) **Remove Undercuts**

Expand the coronal cavity access slightly. Avoid perforating the floor of the pulp chamber. Penetrate the pulp chamber using a slow-speed long-shank round bur (No. 4 or No. 6, depending on size of chamber). Working from inside the chamber to outside in a sweeping motion, remove undercuts, or lingual and labial walls of pulp chamber.

Additional bevelling of the incisal wall is also completed by working from inside to outside to remove the lingual “shoulder” of the canal, thus allowing for the continuous access from the coronal cavity into the canal. The ideal access consists of smooth walls without ledges. The use of fissure burs very often creates ledges in the floor and walls of the cavity access preparation, which can make canal instrumentation more difficult. Moreover, ledges in the dentin can diminish the tensile strength of the tooth. In general, the No. 2 is used for working within the canals, while Nos. 4 and 6 are for working within the chamber, using a sweeping motion to avoid gouging the floor of the pulp chamber and creating the illusion of a canal which may lead to perforation. Remove debris from the chamber as you proceed, using a No. 2, No. 4 or No. 6 bur to eliminate pulpal horn debris and bacteria. If the canal or chamber is calcified, remove dentin with the slow speed hand piece and appropriate bur.

### 10) **Irrigate**

Irrigate periodically to flush out debris. Fill an irrigating syringe with “sodium hypochlorite” and attach an irrigating needle, the tip of which should be bent at approximately a 45 degree angle to the long axis of the needle. The distance from the bend to the tip of the needle should equal 20 mm. Use this needle to gently flush fillings and debris from the chamber. The needle should fit in the canal very loosely, and the solution should be introduced very slowly, so that it can run back out of the access opening and is not forced through the apex.

### 11) **Straight-line Access**

The resulting cavity should be smooth and continuous, flowing from cavity margin to canal orifice; this is referred to as straight-line access. Verify that you have achieved straight-line access by rotating a file within the canal. The file should have direct and unimpeded access to the canal, achieving 360 degrees of unrestrained motion; you should be able to rotate the file 360 degrees about the cavity outline without encountering resistance within the pulp chamber due to ledges or ridges.



**Check Your Progress 3**

Enumerate the steps involved in preparing an access cavity.

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**19.6 LET US SUM UP**

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A preliminary step in root canal treatment is the preparation of access cavity, the opening in the dental crown that permits localisation, cleaning, shaping, disinfection, and three-dimensional obturation of the root canal system. The success of the endodontic treatment depends entirely on the precise, proper execution of this step. An access cavity that has been prepared improperly in terms of position, depth, or extent will hamper the achievement of optimal results. The objectives of access cavity preparation are to achieve straight-line access to the apical foramen or to the initial curvature of the canal, to locate all root canal orifices and to conserve sound tooth structure. The outline form of the endodontic cavity must be correctly shaped and positioned to establish complete access for instrumentation, from cavosurface margin to apical foramen.

Convenience form is a modification of the cavity outline form to establish greater convenience in the placement of intracoronar restorations and provide a more convenient and accurate preparation and filling of the root canal. Important benefits gained through convenience form modifications are unobstructed access to the canal orifice, direct access to the apical foramen, cavity expansion to accommodate filling techniques, and complete authority over the enlarging instrument. Caries and defective restorations remaining in an endodontic cavity preparation must be removed to mechanically eliminate as many bacteria as possible from the interior of the tooth, to eliminate the discolored tooth structure that may ultimately lead to staining of the crown, to reduce the risk of bacterial contamination of the prepared cavity.

All of the caries, debris, and necrotic material must be removed from the chamber before the radicular instrumentation is begun. This should be done without the use of an air syringe due to the possibility of an air embolism. Sodium hypochlorite (NaOCl) should also be used during the access preparation for its added benefits of disinfection, removal of hemorrhagic or purulent fluids, and flushing action of debris and dentin chips.

Adequate access is essential for successful non-surgical endodontic treatment. A straight line to the canal system that ultimately leads to the apex may achieve optimal results when it is based on knowledge of the internal morphology and observance of the principles of cavity preparation.



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## 19.7 ANSWERS TO CHECK YOUR PROGRESS

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### Check Your Progress 1

The objectives of access cavity preparation consist of the following:

- 1) Remove the entire roof of the pulp chamber so that the pulp chamber can be debrided.
- 2) Enable the root canals to be located and instrumented by providing direct straight line access to the apical third of the root canals.
- 3) Enable a temporary seal to be placed securely in order to withstand any displacing forces.
- 4) Conserve as much sound tooth tissue as possible and as is consistent with treatment objectives.

The ideal access cavity creates a smooth, straight-line path to the canal system and ultimately to the apex.

### Check Your Progress 2

- 1) The principles of endodontic coronal cavity preparation (access opening) are Outline form, Convenience form, Removal of the remaining carious dentin (and defective restorations) and Cleansing of the cavity.
- 2) The factors of the internal anatomy that regulate the outline form of endodontic coronal cavities are:
  - a) Size of the pulp chamber.
  - b) Shape of the pulp chamber.
  - c) Number, position and curvature of the root canals.
- 3) In endodontic therapy, the convenience form makes the preparation and filling of the root canal more convenient as well as accurate. The convenience form modifications' offers four important benefits:
  - a) Unobstructed access to the canal orifice.
  - b) Direct access to the apical foramen.
  - c) Cavity expansion to accommodate filling techniques.
  - d) Complete authority over the enlarging instrument.
- 4) It is important to remove the caries and defective restorations in an endodontic cavity for three reasons:
  - a) To eliminate mechanically as many bacteria as possible from the interior of the tooth.
  - b) To eliminate the discolored tooth structure, that may ultimately lead to staining the crown.
  - c) To eliminate the possibility of any bacteria-laden saliva leaking into the prepared cavity (especially for proximal or buccal caries that extend into the prepared cavity).

**Check Your Progress 3**

- 1) The steps involved in preparing an access cavity include:
  - a) Start radiograph
  - b) Place Rubber Dam
  - c) Cut through the centre
  - d) Extend Access
  - e) Cut through Dentin
  - f) Explore Access
  - g) Cut into the pulp chamber
  - h) Explore Access
  - i) Remove Undercuts
  - j) Irrigate.

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**19.8 FURTHER READINGS**

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*Endodontics; Fifth Edition; Ingle and Bakland.*

*Endodontic Therapy; Franklin S. Weine.*

*Pathways of the Pulp; Cohen S, Hargreaves KM*