

Operative dentistry

Lec.1 (Definition, Classification, Principles)

دیشدی

DEFINITION OF TOOTH PREPARATION

Tooth preparation is defined as the mechanical alteration of a defective, injured, or diseased tooth to best receive a restorative material that will reestablish a healthy state for the tooth with normal form and function

OBJECTIVES OF TOOTH PREPARATION

In general terms, the objectives of tooth preparation are to:

- To remove diseased tissue as necessary
- To restore the integrity of the tooth surface
- To restore the function of the tooth so that under the force of mastication the tooth or the restoration or both will not fracture and the restoration will not be displaced
- To restore the appearance of the tooth

NOMENCLATURE: Nomenclature refers to a set of terms used in communication by persons in the same profession that enables them to better understand one another.

CARIES TERMINOLOGY:

Dental caries is an infectious microbiologic disease that results in localized dissolution and destruction of the calcified tissues of the teeth. Caries can be described according to location, extent, and rate.

❖ LOCATION OF CARIES:

PRIMARY CARIES

Primary caries is the original caries lesion of the tooth. Three morphologic types of primary caries are evident in clinical observation: (1) lesions originating in enamel pits and fissures, (2) lesions originating on enamel smooth surfaces, or (3) lesions originating on root surfaces.

1-Caries of Pit-and-Fissure Origin: Complete coalescence of the enamel developmental lobes results in enamel surface areas termed *grooves* and *fossae*. Usually, these areas are not susceptible to caries because they are cleansed by the rubbing of food during mastication. Caries may develop in a groove or fossa, however, in areas of no masticatory action in neglected mouths. Imperfect coalescence of the developmental enamel lobes will result in enamel surface pits and fissures. When such areas are exposed to oral conditions conducive to demineralization, caries may develop. The caries forms a small area of penetration in the enamel at the bottom of a pit or fissure and does not spread laterally to a great extent until the dentinoenamel junction (DEJ) is reached. Dentin caries initially spreads laterally along the DEJ and begins to penetrate the dentin toward the pulp via the dentinal tubules. This lateral and pulpal progression results in unsupported enamel. In diagrammatic terms, pit-and-fissure caries may be represented as two cones, base to base, with the apex of the enamel cone at the point of origin and the apex of the dentin cone directed toward the pulp. As caries progresses in these areas, sometimes little evidence is clinically noticeable until the forces of mastication fracture the increasing amount of unsupported enamel.



Figure1. Caries of Pit-and-Fissure Origin.

2-Caries of Enamel Smooth-Surface Origin: Smooth-surface caries does not begin in an enamel defect but, rather, in a smooth area of the enamel

surface that is habitually unclean and is continually, or usually, covered by plaque. The disintegration in the enamel in smooth-surface caries also may be pictured as a cone, but with its base on the enamel surface and the apex at, or directed to, the DEJ. The caries again spreads at this junction in the same manner as in pit-and-fissure caries. Thus, the apex of the cone of caries in the enamel contacts the base of the cone of caries in the dentin (Double inverted cone).

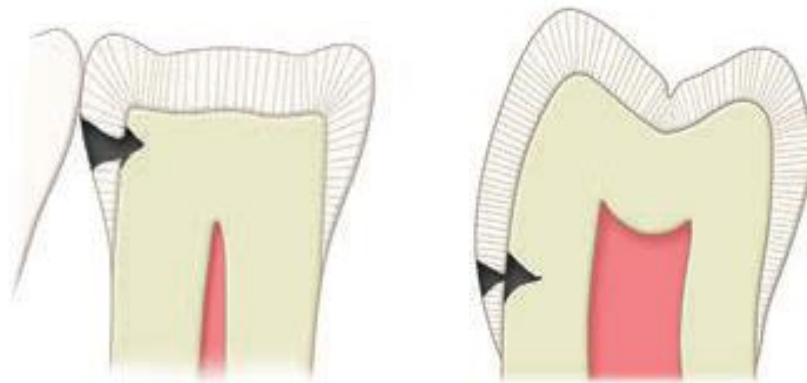


Figure2. Caries of Enamel Smooth-Surface Origin

3- Root-Surface Caries: Root-surface caries may occur on the tooth root that has been exposed to the oral environment and habitually covered with plaque. Root caries is usually more rapid than other forms of caries and should be detected and treated early. Root caries is becoming more prevalent because a greater number of older individuals are retaining more of their teeth and experiencing gingival recession, both of which increase the likelihood of root caries development.

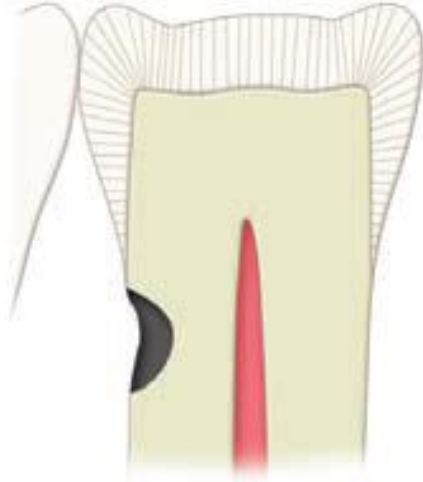


Figure3. Root surface caries

RESIDUAL CARIES

Residual caries is caries that remains in a completed tooth preparation, whether by operator intention or by accident. Such caries is not acceptable if it is present at the DEJ or on the prepared enamel tooth wall. It may be acceptable, however, when it exists as affected dentin, especially near the pulp (see the section Affected and Infected Dentin).

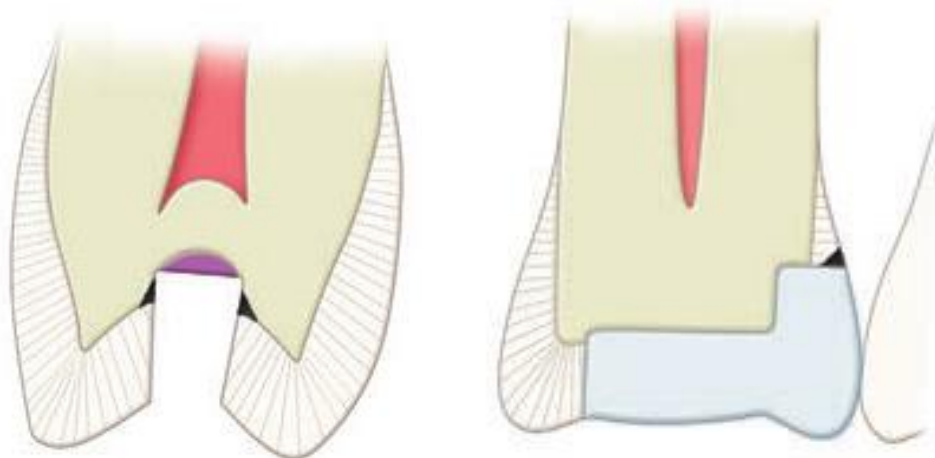


Figure4. residual caries.

SECONDARY (RECURRENT) CARIES

Secondary caries occurs at the junction of a restoration and the tooth and may progress under the restoration. It is often termed *recurrent caries*. This condition usually indicates that microleakage is present, along with other conditions conducive to caries development.

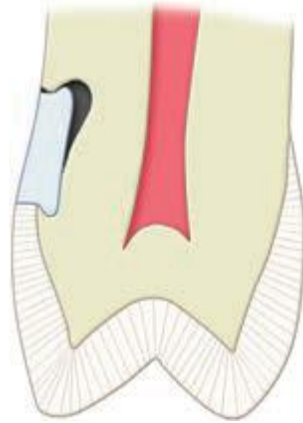


Figure5. Secondary (recurrent) caries

❖ EXTENT OF CARIES

1) INCIPIENT CARIES (REVERSIBLE)

Incipient caries is the first evidence of caries activity in enamel. On smooth-surface enamel, the lesion appears opaque white when air-dried and seems to disappear when wet. This lesion of demineralized enamel has not extended to the DEJ, and the enamel surface is fairly hard, intact, and smooth to the touch. The lesion can be re-mineralized if immediate corrective measures alter the oral environment, including plaque removal and control. This lesion may be characterized as reversible. A re-mineralized lesion usually is either opaque white or a shade of brown-to-black from extrinsic coloration, has a hard surface, and appears the same whether wet or dry.

2) CAVITATED CARIES (IRREVERSIBLE)

In cavitated caries, the enamel surface is broken (not intact), and usually the lesion has advanced into dentin. Usually, remineralization is not possible, and treatment that includes tooth preparation and restoration is indicated.

❖ RATE (SPEED) OF CARIES

1) ACUTE (RAMPANT) CARIES

Acute caries, often termed *rampant caries*, refers to disease that rapidly damages the tooth. It is usually in the form of numerous soft, light-colored lesions in a mouth and is infectious. Less time for extrinsic pigmentation explains the lighter coloration.

2) CHRONIC (SLOW) OR ARRESTED CARIES

Chronic caries is slow, or it may be arrested after several active phases. The slow rate results from periods when demineralized tooth structure is almost remineralized (the disease is episodic over time because of changes in the oral environment). The condition may be found in only a few locations in a mouth, and the lesion is discolored and fairly hard. The slow rate of caries allows time for extrinsic pigmentation. An arrested enamel lesion is brown-to-black in color and hard and as a result of fluoride may be more caries resistant than contiguous, unaffected enamel. An arrested, dentinal lesion typically is “open” (allowing debridement from toothbrushing), dark, and hard, and this dentin is termed *sclerotic or eburnated dentin*.

EXTENSION FOR PREVENTION

In tooth preparations for smooth-surface caries, the restoration should be extended to areas that are normally self-cleansing to prevent recurrence of caries. This principle was known as *extension for prevention* and was broadened to include the extension necessary to remove remaining enamel defects such as

pits and fissures. The practice of extension for the prevention on smooth surfaces virtually has been eliminated, however, because of the relative caries immunity provided by preventive measures such as fluoride application, improved oral hygiene, and a proper diet. This change has fostered a more conservative philosophy defining the factors that dictate extension on smooth surfaces to be (1) the extent of caries or injury and (2) the restorative material to be used. Likewise, extension for prevention to include the full length of enamel fissures has been reduced by treatments that conserve tooth structure. Tooth structure conservation ultimately leads to restored teeth that are stronger and more resistant to fracture. Such treatments are enameloplasty, application of pit-and-fissure sealant, and preventive resin or conservative composite restoration.

AFFECTED AND INFECTED DENTIN

Carious dentin consists of two distinct layers—an outer layer and an inner layer. The outer layer is *infected dentin* and the inner layer is *affected dentin*. In tooth preparation, it is desirable that only infected dentin be removed, leaving affected dentin, which may be remineralized in a vital tooth after the completion of restorative treatment. Infected dentin has bacteria present, and collagen is irreversibly denatured. It is not remineralizable and must be removed. Affected dentin has no bacteria, and the collagen matrix is intact, is remineralizable, and can be preserved. To clinically distinguish these two layers, the operator traditionally observes the degree of discoloration (extrinsic staining) and tests the area for hardness by the feel of an explorer tine or a slowly revolving bur.

TOOTH PREPARATION TERMINOLOGY:

A tooth preparation is termed;

- 1- Simple if only one tooth surface is involved.
- 2- Compound if two surfaces are involved.
- 3- Complex if a preparation involves three (or more) surfaces.

Abbreviated Descriptions of Tooth Preparations;

The description of a tooth preparation is abbreviated by using the first letter, capitalized, of each tooth surface involved. Examples are:

- (1) An occlusal tooth preparation is an O; (2) a preparation involving the mesial and occlusal surfaces is an MO; and (3) a preparation involving the mesial, occlusal, and distal surfaces is an MOD.

Tooth Preparation Walls:

Internal Wall: An internal wall is a prepared (cut) surface that does not extend to the external tooth surface.

Axial wall: An axial wall is an internal wall parallel with the long axis of the tooth.

Pulpal wall: A pulpal wall is an internal wall that is both perpendicular to the long axis of the tooth and occlusal of the pulp.

External Wall: An external wall is a prepared (cut) surface that extends to the external tooth surface, and such a wall takes the name of the tooth surface (or aspect) that the wall is toward.

Floor (or Seat): A floor (or seat) is a prepared (cut) *wall* that is reasonably flat and perpendicular to the long axis of the tooth. Examples are the pulpal and gingival walls.

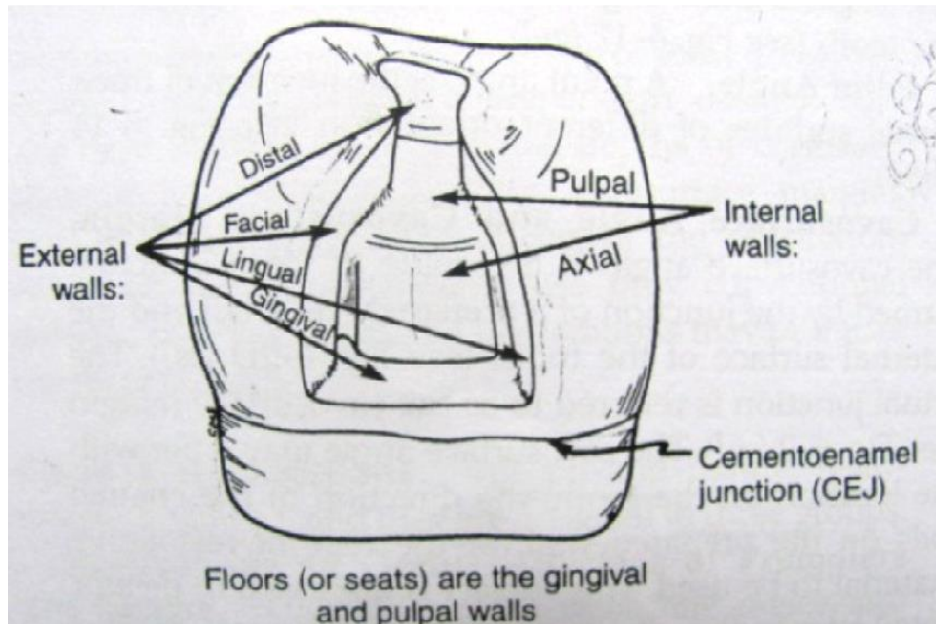


Figure 6. Tooth preparation walls.

Tooth Preparation Angles: the junction of two or more prepared (cut) surfaces is referred to as an angle.

Line Angle: A line angle is the junction of two planar surfaces of different orientation along a line. An internal line angle is a line angle whose apex points into the tooth. An external line angle is a line angle whose apex points away from the tooth

Point Angle: A point angle is the junction of three planar surfaces of different orientation.

Cavosurface Angle and Cavosurface Margin: The cavosurface angle is the angle of tooth structure formed by the junction of a prepared (cut) wall and the external surface of the tooth. The actual junction is referred to as the cavosurface margin.

Proximal surface: is the surface that face the adjacent tooth

Marginal ridge: border the lingual surface of anterior teeth and the occlusal surfaces of posterior teeth.

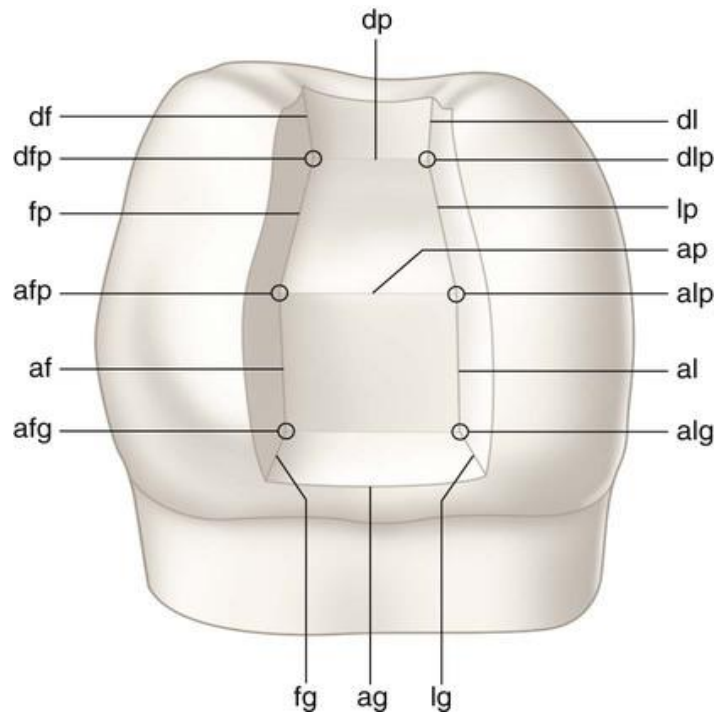


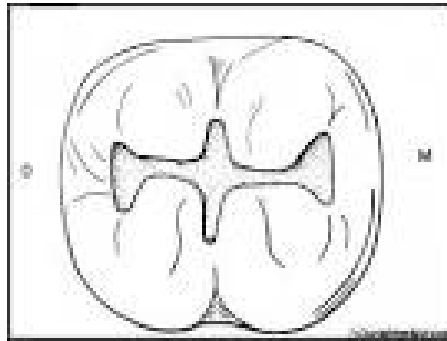
Figure 7: Schematic representation (for descriptive purpose) illustrating tooth preparation line angles and point angles. Line angles are distofacial (df), faciopulpal (fp), axiofacial (af), faciogingival (fg), axiogingival (ag), linguogingival (lg), axiolingual (al), axiopulpal (ap), linguopulpal (lp), distolingual (dl), and distopulpal (dp). Point angles are distofaciopulpal (dfp), axiofaciopulpal (afp), axiofacingival (afg), axiolinguogingival (alg), axiolinguopulpal (alp), and distolinguopulpal (dlp).

CLASSIFICATION OF TOOTH PREPARATIONS

Classification of tooth preparations according to the anatomic areas involved as well as by the associated type of treatment was presented by Black and is designated as Class I, Class II, Class III, Class IV, and Class V. Since Black's original classification, an additional class has been added, Class VI. Class I refers to pit-and-fissure lesions, whereas the remaining classes are smooth surface lesions. Classification was originally based on the observed frequency of carious lesions on certain aspects of the tooth.

- **Class I Restorations:** All pit-and-fissure restorations are *Class I*, and they are assigned to three groups, as follows.

1- Restorations on Occlusal Surface of Premolars and Molars; The names of the walls, line angles, and point angles of an occlusal conventional tooth preparation take the name of the tooth surface (or aspect) that the wall is toward.



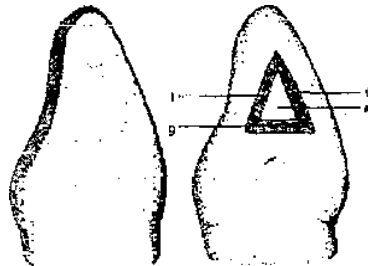
2- Restorations on Occlusal Two Thirds of the Facial and Lingual Surfaces of Molars. The names of the walls, line angles, and point angles of these tooth preparations are the same as those depicted for the preparations for Class V restorations

3- Restorations on Lingual Surface of Maxillary Incisors. The names of the walls, line angles, and point angles of these tooth preparations also are the same as those depicted for the preparations for Class V restorations.

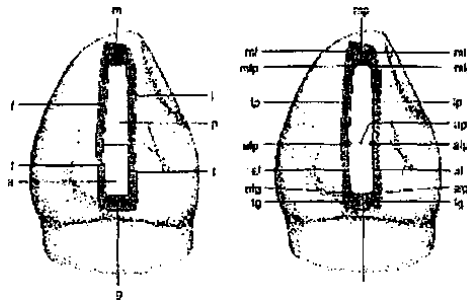
- **Class II Restorations:** Restorations on the proximal surfaces of posterior teeth are Class II.



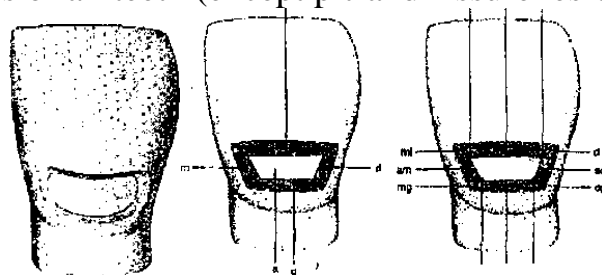
- **Class III Restorations:** Restorations on the proximal surfaces of anterior teeth that do not involve the incisal angle are Class III.



- **Class IV Restorations:** Restorations on the proximal surfaces of anterior teeth that do involve the incisal edge are Class IV.



- **Class V Restorations:** Restorations on the gingival third of the facial or lingual surfaces of all teeth (except pit-and-fissure lesions) are Class V



- **Class VI Restorations:** Restorations on the incisal edge of anterior teeth or the occlusal cusp heights of posterior teeth are Class VI.

Cavity preparation according G.V.Black principles:

Steps of Tooth Preparation:

- **Initial tooth preparation stage:**

Step 1. Outline form: Establishing the outline form means (1) placing the preparation margins in the positions they will occupy in the final preparation except for finishing enamel walls and margins and (2) preparing an initial depth of 0.2 to 0.5 mm pulpally of the DEJ position or 0.8 mm pulpally to normal root-surface position.

Step 2. Primary Resistance Form : *Primary resistance form* may be defined as the shape and placement of the preparation walls that best enable the remaining tooth structure and the restoration to withstand, without fracture, masticatory forces delivered principally in the long axis of the tooth. The relatively horizontal pulpal and gingival floors prepared perpendicular to the tooth's long axis help resist forces in the long axis of the tooth and prevent tooth fracture from wedging effects caused by opposing cusps.

Step 3. Primary Retention Form: *Primary retention form* is the shape or form of the conventional preparation that prevents displacement or removal of the restoration by tipping or lifting forces for non-bonded restorations. In many respects, retention form and resistance form are accomplished at the same time.

Step 4. Convenience Form: *Convenience form* is the shape or form of the preparation that Provides adequate observation, accessibility, and ease of operation in preparing and restoring the tooth. Occasionally, obtaining this form may necessitate the extension of distal, mesial, facial, or lingual walls to gain adequate access to the deeper portion of the preparation. The arbitrary extension of facial margins on anterior teeth usually is contraindicated, however, for esthetic reasons.

- **Final Tooth Preparation Stage**

Step 5. Removal of Any Remaining Enamel Pit or Fissure, Infected Dentin, or Old Restorative Material, if indicated.

Step 6. Pulp Protection, If Indicated: Although the placement of liners and bases is not a step in tooth preparation, in the strict sense of the term, it is a step in adapting the preparation for receiving the final restorative material.

Step 7: Secondary Resistance and Retention Forms: Like; Retention Grooves and Coves, Pins, Slots, Steps, and Amalgam Pins.

Step 8: Procedures for Finishing the External Walls of the Tooth Preparation.

Step 9: Final Procedures: Cleaning, Inspecting, and Desensitizing.