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4th Edition

Textbook of
Preclinical Conservative
Dentistry





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Forewords
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Contents

1. **Introduction to Preclinical Conservative Dentistry** 1
   - Definitions *1*
   - Need for Preclinical Conservative Dentistry *1*
   - Indications of Conservative Dentistry *1*
   - Objectives of Operative Dentistry *1*
   - Objectives of Preclinical Conservative Dentistry *3*
   - Armamentarium *3*
   - Preclinical Tooth Preparations *4*
   - Shortcomings of Preclinical Practice *5*
   - Scope of Operative Dentistry *5*

2. **Tooth Nomenclature, Morphology, Anatomy and Physiology** 7
   - The Crown and Root *7*
   - Elevations Present on a Crown *8*
   - Depressions Present on Teeth *9*
   - Other Important Terms *10*
   - Nomenclature of Teeth *11*
   - Histological Structures of Teeth *13*
   - Enamel *14*
   - Dentin *14*
   - Dental Pulp *16*
   - Periradicular Tissue *16*
   - Functions of Teeth *16*
   - Physiology Form of the Teeth *17*
   - Morphology of Individual Teeth *19*

3. **Carious and Noncarious Lesions of Teeth** 28
   - Definitions *28*
   - Etiology of Dental Caries *28*
   - Classification of Dental Caries *29*
   - Histopathology of Dental Caries *31*
   - Diagnosis of Dental Caries *32*
   - Recent Methods of Caries Detection *32*
   - Caries Risk Assessment *32*
   - Prevention of Dental Caries *32*
   - Noncarious Lesions of Teeth *33*
   - Attrition *33*
   - Abrasion *33*
   - Erosion *34*
   - Abfraction *34*

4. **Dental Materials** 38
   - Classification of Dental Materials *38*
   - Properties of Dental Materials to be Considered *38*
   - Dental Cements *39*
   - Zinc Oxide-Eugenol Cement *39*
   - Ethoxybenzoic Acid Reinforced Cement *40*
   - Polymer Reinforced Zinc Oxide-Eugenol Cement *40*
   - Zinc Phosphate Cement *41*
   - Zinc Silicophosphate Cements *42*
   - Calcium Hydroxide *42*
   - Zinc Polycarboxylate Cement/Zinc Polyacrylate Cement *42*
   - Glass Ionomer Cements *43*
   - Composition *44*
   - Setting Reaction of Glass Ionomer Cement *46*
   - Dental Amalgam *47*
   - Clinical Considerations *50*
   - Steps to Reduce Mercury Exposure in the Dental Clinic *50*
   - Adhesive Dentistry *51*
   - Definitions *52*
   - Enamel Bonding *52*
   - Dentin Bonding *53*
   - Evolution of Dentin-bonding Agents *53*
   - Composites *55*
   - Classification of Composites *55*
   - Cast Metal Alloys *57*
   - Components of Cast Gold Alloys *58*
   - Classification of Cast Gold Alloys *58*
   - Waxes *58*

5. **Instruments Used in Operative Dentistry** 63
   - Materials Used for Manufacturing Cutting Instruments *63*
   - Classification *63*
   - Nomenclature by GV Black *63*
   - Parts of Hand Cutting Instruments *64*
   - Instrument Formula *64*
   - Different Instrument Designs *65*
   - Description of Various Instruments *66*
   - Hand Cutting Instruments *67*
   - Restorative Instruments *69*
   - Instrument Grasps *71*
   - Finger Rests *72*
   - Methods of Use of Instruments *72*
   - Rotary Cutting Instruments *73*
   - Handpieces *73*
   - Dental Burs *73*
   - Diamond Abrasive Instruments *75*
   - Matricing *76*
   - Matrix *76*
   - Classification *76*
   - Tofflemire Universal Matrix Band Retainer (Designed by Dr BR Tofflemire) *77*
   - Separation of Teeth *80*
   - Methods of Tooth Separation *80*

6. Chair Position and Dental Operatory 89
- Operating Stool *89*
- Antisepsis in Clinics *90*

7. Principles of Tooth Preparation 93
- Definition *93*
- Purpose of Tooth Preparation *93*
- Indications of Restorative Intervention *93*
- Objectives of Tooth Preparation *93*
- Terminology *93*
- Number of Line and Point Angles *95*
- Stages of Cavity Preparation *97*
- Initial Cavity Preparation Stage *98*
- Final Stages of Tooth Preparation *101*

8. Tooth Preparation for Amalgam Restorations 115
- Class I Cavity Preparation for Silver Amalgam *115*
- Class II Cavity Preparation for Amalgam Restoration *117*
- Class III Cavity Preparation for Amalgam Restoration *123*
- Class V Cavity Preparation *124*
- Class Vi Cavity Preparation for Amalgam Restoration *125*

9. Tooth Preparation for Direct Composite Resin and Glass Ionomer Cements 129
- General Principles for Tooth Preparation for Composite Restorations *129*
- Steps of Composite Restoration on Teeth *129*
- Tooth Preparations for Anterior Composite Restorations *130*
- Tooth Preparation for Posterior Composite Restoration *133*
- Repair of Composite Restorations *135*
- Tooth Preparation for Glass Ionomer Restoration *135*
- Steps for Placement of Glass Ionomer Cement *137*

10. Cast Metal Restorations 141
- Definitions *141*
- Steps of Inlay Preparation *141*
- Cavity Preparation for Class II Gold Inlays *142*
- Steps for Fabrication of Cast Metal Restoration *143*
- Wax Pattern Fabrication *143*
- Spruing the Wax Pattern *144*
- Washing of Wax Pattern *145*
- Investing the Wax Pattern *145*
- Burnout of Wax Pattern/Wax Elimination and Heating *146*
- Casting Machines *146*
- Melting the Alloy *147*
- Trying in the Casting *149*
- Cementation of the Casting *149*

11. Basics of Endodontics 153
- Etiology of Pulpal Diseases *154*
- Progression of Pulpal Pathologies *154*
- Endodontic Instruments *154*
- Standardization of Instruments Given by Ingle and Levine *154*
- Access Cavity Preparation *157*
- Access Cavity of Anterior Teeth *157*
- Access Cavity Preparation for Premolars *157*
- Working Length Determination *157*
- Significance of Working Length *159*
- Irrigation of Root Canal System *159*
- Cleaning and Shaping *160*
- Basic Principles of Canal Instrumentation *160*
- Techniques of Root Canal Preparation *161*

12. Examination Spotters 164
- Instruments *164*
- Materials *173*

Glossary *181*

Index *187*

CHAPTER

7

Principles of Tooth Preparation

CHAPTER OUTLINE

- Definition
- Purpose of Tooth Preparation
- Indications of Restorative intervention
- Objectives of Tooth Preparation
- Terminology
- Number of Line and Point Angles
- Stages of Cavity Preparation
- Initial Cavity Preparation Stage
- Final Stages of Tooth Preparation

DEFINITION

Tooth preparation is the mechanical alteration of a defective, injured or diseased tooth in order to best receive a restorative material which will re-establish the healthy state of the tooth including aesthetics correction when indicated along with normal form and function. —**Sturdevant**

PURPOSE OF TOOTH PREPARATION

Restoration is required to repair a diseased, injured, or defective tooth structure. It helps maintain the proper form, function, and aesthetics of the tooth.

INDICATIONS OF RESTORATIVE INTERVENTION

- Restoration of carious tooth.
- Repair of fractured tooth.
- Restoration of teeth with congenital malformations.
- Repair or replacement of defective restoration.
- Replacement of missing teeth.
- Need for aesthetic improvement.

OBJECTIVES OF TOOTH PREPARATION

- Removal of all defects.
- Provide necessary pulp protection.
- Preservation of tooth structure.
- To allow for functional and aesthetic placement of restorative material.
- Prepare tooth such that under masticatory forces, the tooth and restoration do not fracture and restoration does not get displaced.

Factors Affecting Cavity Design for Restoration

1. Extent of the defect.
2. Properties of restorative material.
3. Occlusal relationship.
4. Aesthetic needs of the patient.
5. Assessment of pulpal and periodontal status.
6. Economic status of the patient.
7. Type of dentition, i.e., primary or permanent.
8. Quality of tooth (hypoplasia), location and type of tooth.

TERMINOLOGY

Simple Tooth Preparation

A tooth preparation involving only one tooth surface is termed simple preparation **(Fig. 7.1)**, for example, occlusal preparation.

Compound Tooth Preparation

A tooth preparation involving two surfaces is termed as compound tooth preparation **(Fig. 7.2)**, for example, mesio-occlusal or disto-occlusal preparation.



FIGURE 7.1: Simple tooth preparation involves only one tooth surface.

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FIGURE 7.2: Compound tooth preparation involves two surfaces.



FIGURE 7.3: Complex tooth preparation involves more than two surfaces.

Complex Tooth Preparation

A tooth preparation involving more than two surfaces is called as complex tooth preparation **(Fig. 7.3)**, for example, MOD preparation.

For communication and records purpose, the surface of tooth preparation is abbreviated by capitalizing the first letter. For example,

- Preparation on the occlusal surface as "O".
- Preparation on the distal and occlusal surfaces as "DO".
- Preparation on mesial, occlusal and distal surfaces as "MOD".

Walls

i. Internal Wall

The internal wall is the prepared surface that does not extend to the external tooth surface **(Fig. 7.4)**.

ii. External Wall (Fig. 7.4)

An external wall is a wall in the prepared tooth that extends to the external tooth surface. External wall takes the name of the tooth surface toward, which it is situated.

- **Enamel wall:** It is that portion of the prepared cavity wall consisting of enamel.
- **Dentinal wall:** It is that portion of the prepared cavity wall, consisting of dentin.

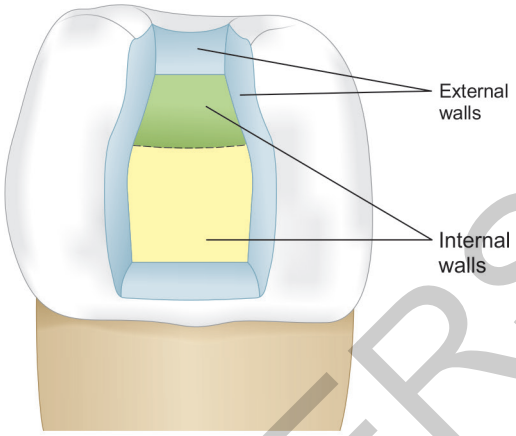

FIGURE 7.4: Schematic representation showing internal and external walls of tooth preparation.

iii. Pulpal Floor/Wall

The pulpal wall is the internal wall that is perpendicular to the long axis of the tooth and occlusal of the pulp **(Fig. 7.5)**.

iv. Axial Wall

The axial wall is the internal wall parallel to the long axis of the tooth **(Figs. 7.5 and 7.6)**.

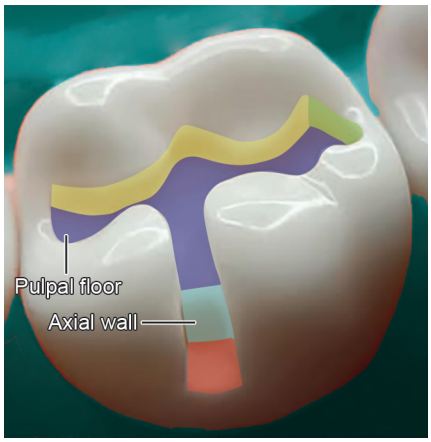

FIGURE 7.5: Schematic representation showing pulpal floor and axial wall.



FIGURE 7.6: Class III tooth preparation showing axial wall.

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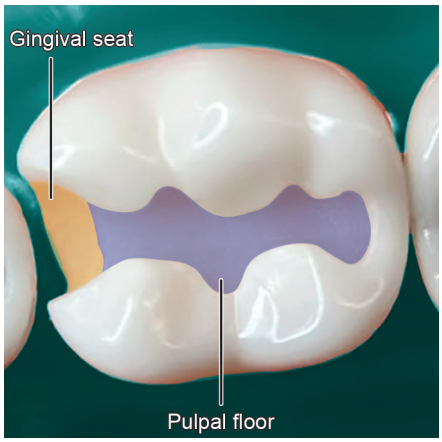


FIGURE 7.7: Schematic representation of gingival and pulpal floor.

Floor

The floor is the prepared wall that is horizontal and perpendicular to the occlusal forces that are directed occlusogingivally (parallel to the long axis of the tooth). Examples are pulpal and gingival floors **(Fig. 7.7)**.

These floors are prepared to provide stabilizing seats for the restoration, distributing the stresses in the tooth structure. Floor preparation increases the resistance form of the restored tooth against postrestorative fracture.

FACTS

When two or more surfaces are combined, the –al ending of the prefix word is changed to an –o. The angle formed by lingual and gingival wall is termed as "linguogingival" line angle. An MOD preparation is called mesio-occlusodistal preparation.

Cavosurface Angle

Cavosurface angle is formed by the junction of a prepared tooth surface wall and external surface of the tooth **(Figs. 7.8A and B)**.

Line Angle

It is a junction of two surfaces of different orientations along the line. Its name is derived from the involved surfaces forming the angle, e.g., buccopulpal, mesiopulpal, axiopulpal, gingivoaxial line angles.

Point Angle

It is a junction of three plane surfaces or three line angles of different orientations. Its name is derived from its involved surfaces or line angles.

NUMBER OF LINE AND POINT ANGLES

Number of line angles and point angles in different tooth preparations are enumerated in **Table 7.1**.

TABLE 7.1: Number of line angles and point angles in different tooth preparation designs.

Type of tooth preparation	Line angles	Point angles
Class I	8	4
Class II	11	6
Class III	6	3
Class IV	11	6
Class V	8	4

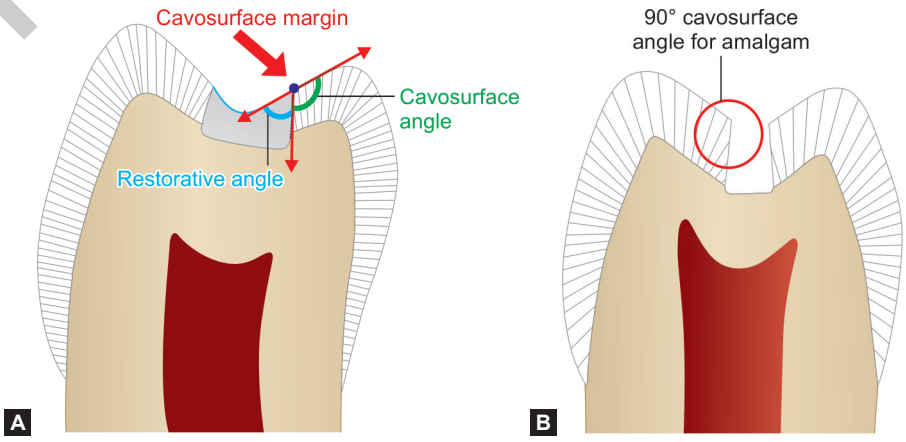
Line and point angles of class I to V tooth preparations are enlisted as following:

Class I Cavity Preparation

For simple class I tooth preparation involving only the occlusal surface of molars, eight line angles and four point angles are named as follows **(Fig. 7.9)**:

Line Angles

1. Mesiofacial line angle.
2. Mesiolingual line angle.
3. Mesiopulpal line angle.
4. Distofacial line angle.
5. Distolingual line angle.
6. Distopulpal line angle
7. Faciopulpal line angle.
8. Linguopulpal line angle.



FIGURES 7.8A AND B: Schematic representation showing the cavosurface angle.

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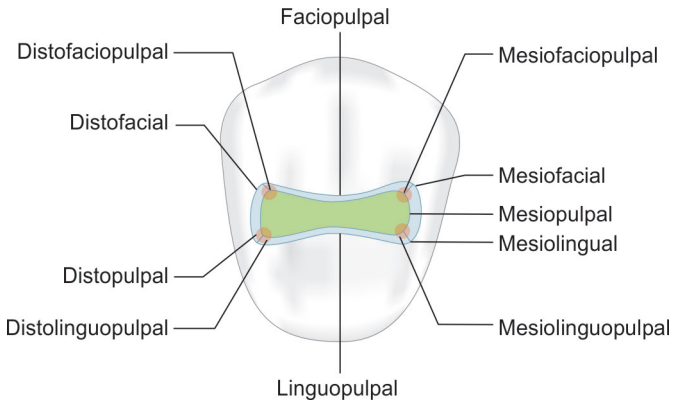

FIGURE 7.9: Class I tooth preparation showing line angles and point angles.

Point Angles

1. Mesiofaciopulpal point angle.
2. Mesiolinguopulpal point angle.
3. Distofaciopulpal point angle.
4. Distolinguopulpal point angle.

Class II Cavity Preparation

For class II preparation (mesio-occlusal or disto-occlusal) 11 line angles and 6 point angles are as follows **(Fig. 7.10)**: Following is the nomenclature for mesio-occlusal tooth preparation:

Line Angles

1. Distofacial
2. Distolingual
3. Distopulpal
4. Axiofacial
5. Axiolingual
6. Axiopulpal
7. Axiogingival
8. Faciopulpal
9. Faciogingival
10. Linguopulpal
11. Linguogingival.

Point Angles

1. Distofaciopulpal point angle.
2. Distolinguopulpal point angle
3. Axiofaciopulpal point angle.
4. Axiofaciogingival point angle.

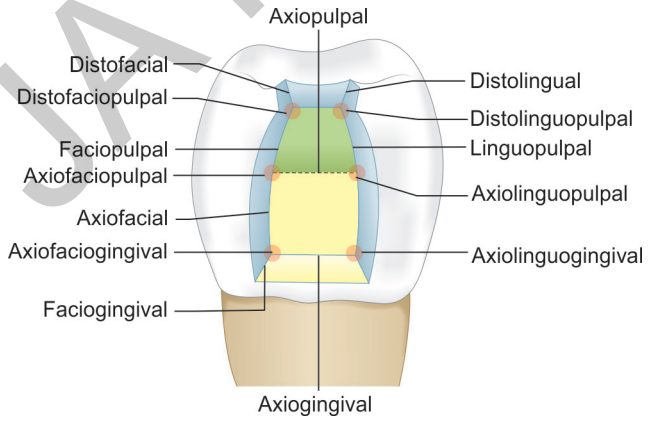

FIGURE 7.10: Class II tooth preparation showing line and point angles.

5. Axiolinguopulpal point angle
6. Axiolinguogingival point angle.

Class III Cavity Preparation

For class III preparation on anterior teeth, 6 line angles, and 3 point angles are as follows **(Fig. 7.11)**:

Line Angles

1. Faciogingival
2. Linguogingival
3. Axiofacial
4. Axiolingual
5. Incisal
6. Axiogingival.

Point Angles

1. Axiofaciogingival point angle.
2. Axiolinguogingival point angle.
3. Axioincisal point angle.

Class IV Cavity Preparation

For class IV tooth preparation on anterior teeth, 11 line angles, and 6 point angles are as follows **(Fig. 7.12)**:

Line Angles

1. Mesiofacial
2. Mesiolingual
3. Mesiopulpal
4. Axiofacial

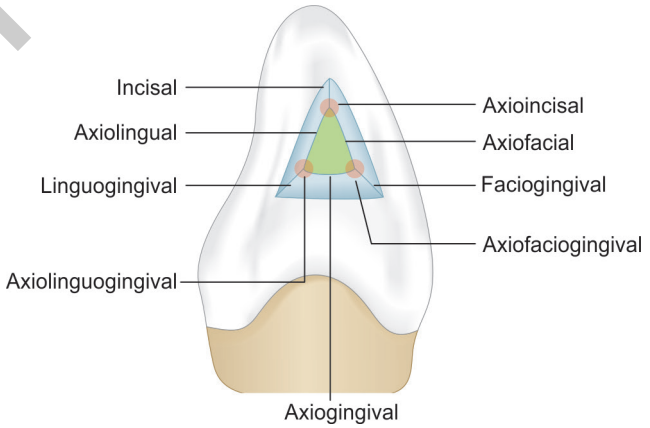

FIGURE 7.11: Class III tooth preparation showing line and point angles.

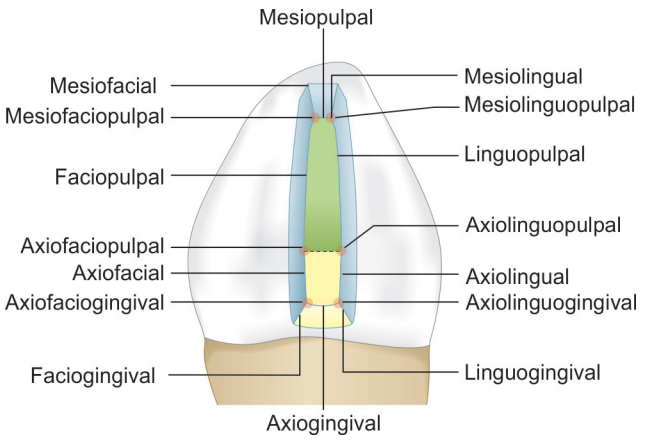

FIGURE 7.12: Class IV tooth preparation showing line and point angles.

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5. Axiolingual
6. Axiopulpal
7. Axiogingival
8. Faciopulpal
9. Faciogingival
10. Linguopulpal
11. Linguogingival.

Point Angles

1. Axiofaciopulpal point angle.
2. Axiolinguopulpal point angle.
3. Axiofaciogingival point angle.
4. Axiolinguogingival point angle.
5. Mesiofaciopulpal point angle.
6. Mesiolinguopulpal point angle.

Class V Cavity Preparation

For class V tooth preparation, 8 line angles, and 4 point angles are as follows **(Fig. 7.13)**:

Line Angles

1. Axiogingival
2. Axioincisal
3. Axiomesial
4. Axiodistal
5. Mesioincisal
6. Mesiogingival
7. Distoincisal
8. Distogingival.

Point Angles

1. Axiodistogingival point angle.
2. Axiodistoincisal point angle.
3. Axiomesiogingival point angle.
4. Axiomesioincisal point angle.

FACTS

Earlier when the affected tooth was prepared because of caries, cutting of the tooth was referred to as cavity preparation. But nowadays many indications other than caries lead to preparation of the tooth. Hence, the term cavity preparation has been replaced by tooth preparation.

Classification of Cavity Preparations

Following classification of cavity preparations according to the diseased anatomic areas involved was given by GV Black:

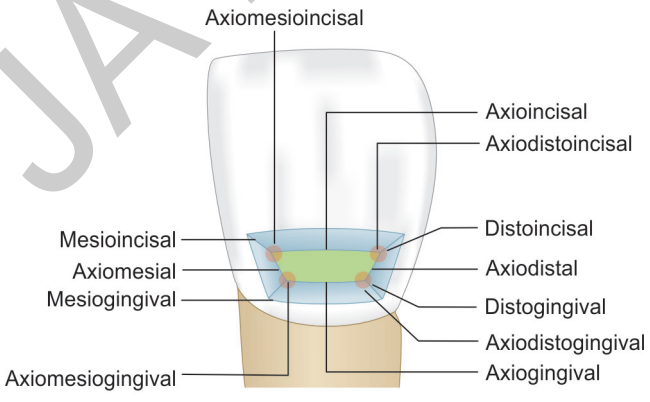

FIGURE 7.13: Class V tooth preparation showing line and point angles.

1. **Class I preparations:** All pit-and-fissure preparations are termed Class I. These include preparations on:
   i. Occlusal surfaces of premolars and molars,
   ii. Occlusal two-thirds of the facial and lingual surfaces of molars, and
   iii. The lingual surfaces of maxillary incisors.
2. **Class II preparations:** Preparations involving the proximal surfaces of posterior teeth are termed Class II.
3. **Class III preparations:** Preparations involving the proximal surfaces of anterior teeth that do not include the incisal angle are termed Class III.
4. **Class IV preparations:** Preparations involving the proximal surfaces of anterior teeth that include the incisal edge are termed Class IV.
5. **Class V preparations:** Preparations on the gingival third of the facial or lingual surfaces of all teeth are termed Class V.
   Since Black's original classification, an additional class has been added by Simon, Class VI.
6. **Class VI preparations:** Preparations on the incisal edges of anterior teeth or the occlusal cusp tips of posterior teeth are termed Class VI.

STAGES OF CAVITY PREPARATION

Cavity preparation involves a systematic approach based on well-established mechanical and physical principles, which should be followed in an orderly sequence. The design of the cavity preparation, whether for a tooth with initial caries or for the replacement of an existing restoration, depends on factors, such as the location and extent of caries, the amount of lost tooth structure, and the type of restorative material to be used. Although, there are certain basic principles that must be followed during tooth preparation, modifications can be made depending on the clinical situation. Tooth preparation is generally divided into two stages, each consisting of several steps, and every step should be carried out precisely to achieve an ideal restoration.

Steps of Cavity Preparation

Stage I: Initial cavity preparation stage
1. Outline form and initial depth.
2. Primary resistance form.
3. Primary retention form.
4. Convenience form.

Stage II: Final cavity preparation stage
5. Removal of any remaining enamel pit or fissure, infected dentin and/or old restorative material, if indicated.
6. Pulp protection, if indicated.
7. Secondary resistance and retention form.
8. Procedures for finishing the external walls of the tooth preparation.
9. Final procedures: Cleaning, inspecting and sealing.

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INITIAL CAVITY PREPARATION STAGE

1. Outline Form and Initial Depth

Definition

Outline form is defined as ***"placing the preparation margins in the position they will occupy in the final tooth preparation except for finishing enamel walls and margins".*** It also includes preparing the initial depth of 0.2–0.8 mm into the dentin. It can be divided into **(Fig. 7.14)**:

- ***External outline form*** which refers to the marginal boundaries.
- ***Internal outline form*** which refers to the shape of internal form of the preparation.

During tooth preparation, the margins of the preparation not only extend into sound tooth tissue but also involve adjacent deep pits and fissures in preparation. This was referred to as "extension for prevention" by GV Black.

Factors Affecting the Outline and Initial Depth form of Tooth Preparation

- Extension of carious lesion.
- Proximity of the lesion to other deep structural surface defects.
- Relationship with adjacent and opposing teeth.
- Caries index of the patient.
- Need for aesthetics.
- Restorative material to be used.

Principles

- Removal of all weakened and friable tooth structure.
- Removal of all undermined enamel.
- Incorporate all faults in preparation.
- Place all margins of preparation in a position to afford good finishing of the restoration.

Features for Establishing a Proper Outline Form (Fig. 7.14)

- Preserving cuspal strength.
- Preserving strength of marginal ridge.
- Minimizing the buccolingual extensions.
- If distance between two faults is less than 0.5 mm, connect them.
- Limiting the depth of preparation 0.2–0.8 mm into dentin.
- Using enameloplasty wherever indicated.

Outline Form for Pit and Fissure Lesions

- Remove all defective portions, and extend the preparation margins to healthy tooth structure. Rather than being straight, the outline form should have smooth curves so as to preserve as many strong cusps as possible. This is called ***circumventing the cusps***.
- Remove all unsupported enamel rods or weakened enamel margins.
- Limit the depth of preparation to 0.2 mm into dentin, though the actual depth may vary from 1.5–2 mm depending on the steepness of cuspal slopes and enamel thickness **(Fig. 7.15)**.
- If the thickness of enamel between two preparation sites is less than 0.5 mm, connect them to make one preparation, otherwise prepare as separate cavity preparations.
- Avoid ending the preparation margins in high stress areas, such as cusp eminences.
- Extend the preparation margins to include all pits and fissures which cannot be managed by enameloplasty.
- Isthmus width should be 1/4th of the intercuspal distance **(Fig. 7.16)**.
- Extend the outline form to facilitate the convenience for preparation and restoration.

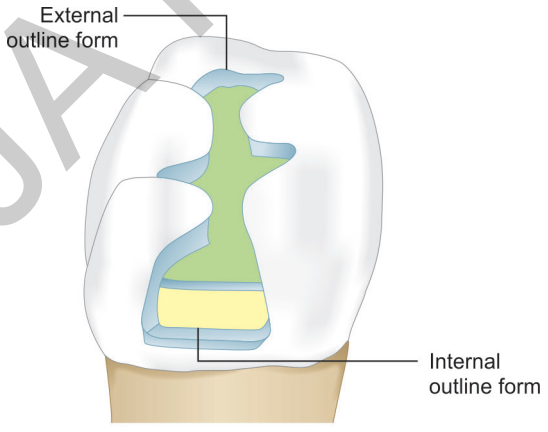

FIGURE 7.14: Schematic representation of external and internal outline form.

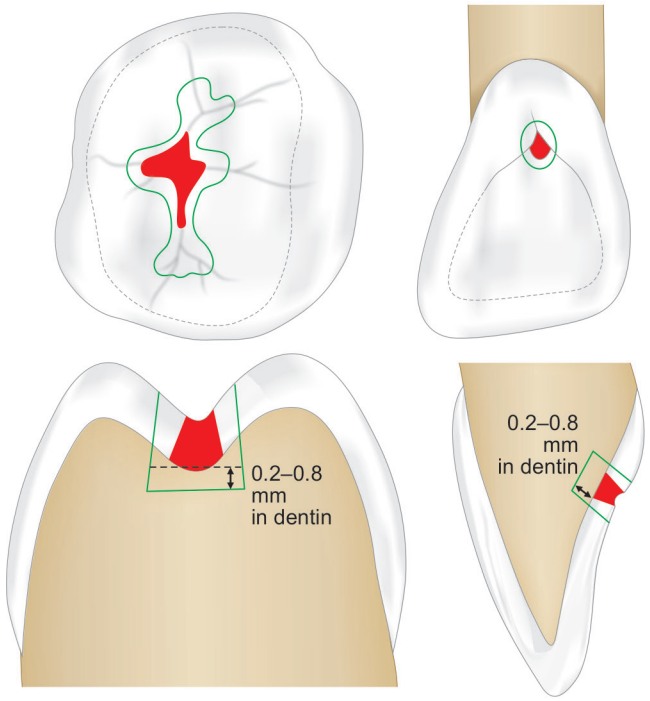

FIGURE 7.15: Outline form for pit and fissure lesions.

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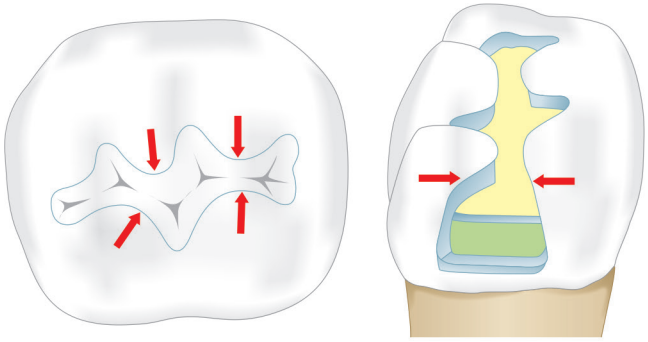


FIGURE 7.16: Isthmus width should be 1/4th of the intercuspal distance.

Outline Form for Smooth Surface Lesions—Outline Form of Proximal Caries (Class II, III and IV Lesions)

Factors affecting the outline form of proximal preparations:

- Extent of the caries on the proximal side.
- Dimensions of the contact area in the affected tooth.
- Contact relationship with adjacent tooth.
- Age of the patient.
- Position of gingiva.
- Alignment of teeth and masticatory forces likely to fall on restorative material **(Figs. 7.17A and B).**
- Aesthetic requirement of the patient.

Viva Voce

Axial wall should:

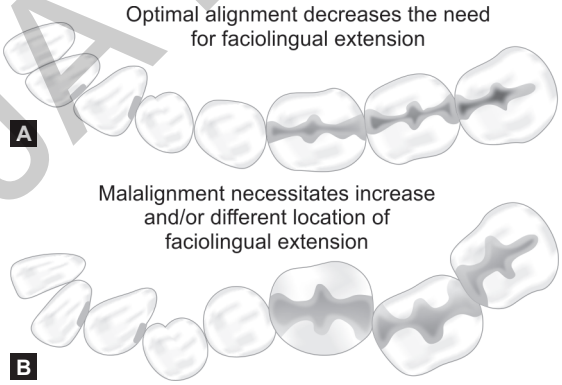
- Be placed into dentin 0.5–0.8 mm from dentinoenamel junction (DEJ).
- Follow curvature of DEJ buccolingually.
- Follow curvature of DEJ occlusogingivally.

A class II cavity preparation consists of:

- Occlusal segment.
- Proximal segment.

Rules for Making Outline Form for Proximal Preparation (Fig. 7.18)

- Extend the preparation margins until sound tooth structure is reached.



FIGURES 7.17A AND B: Proper alignment of teeth requires less faciolingual extensions as compared to malaligned teeth. It also offers better cleanliness of embrasure area.



FIGURE 7.18: Ideal class II cavity preparation of mandibular 1st molar.

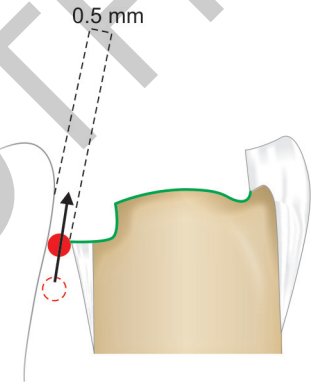


FIGURE 7.19: In proximal tooth preparation, gingival margin should clear adjacent tooth by 0.5 mm.

- Restrict the depth of axial wall 0.2–0.8 mm into dentin.
- Axial wall should be parallel to external surface of the tooth.
- In class II tooth preparation, place gingival seat apical to the contact but occlusal to gingival margin and have a clearance of 0.5 mm from the adjacent tooth. This clearance provides space for proper accessibility, visibility, instrumentation, and restoration **(Fig. 7.19)**.

Rules for Class V Cavities

- Outline form is limited by extent of the lesion.
- Extensions are made mesially, distally, occlusally and gingivally till sound tooth structure is reached.
- Axial depth is limited to 0.8–1.25 mm pulpally.

Enameloplasty

Enameloplasty is removal of sharp and irregular enamel margins of the enamel surface by "rounding" or "saucering" it and converting it into a smooth groove making it a self cleansable area **(Figs. 7.20A and B)**.

Indications

- It is done when caries is present in less than one-third thickness of the enamel.

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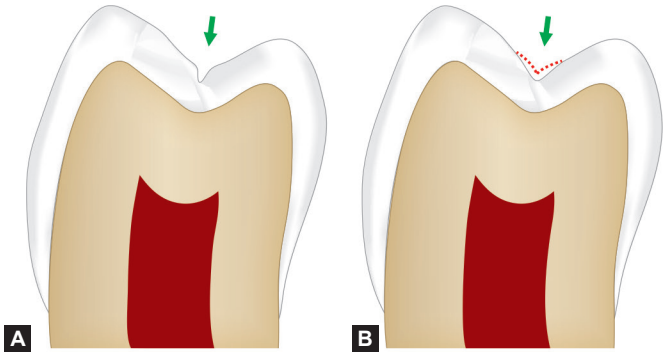
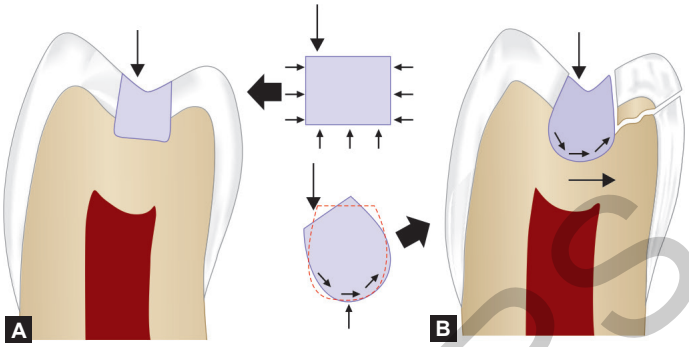


FIGURES 7.20A AND B: Enameloplasty: (A) Tooth with deep pit and fissure; (B) Removal of superficial enamel resulting in rounding of deep pit and fissure caries making it self-cleansable.



FIGURES 7.22A AND B: (A) Resistance form of tooth preparation provided by flat pulpal and gingival floor; (B) In case of rounded pulpal floor, the rocking motion of restoration results in wedging force which may result in failure of restoration.

- Presence of a shallow fissure crossing facial or lingual ridge.

Significance

Enameloplasty does not extend the outline form. This procedure should not be used unless a fissure can be made into saucer shaped area with mild removal of enamel.

2. Primary Resistance Form

Definition

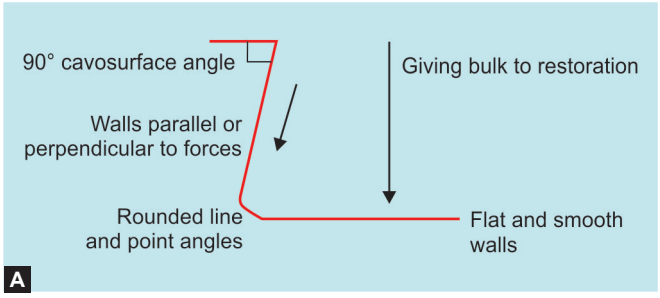
Primary resistance form is that shape and placement of preparation walls to best enable both the tooth and restoration to withstand, without fracture, the stresses of masticatory forces delivered principally along the long axis of the tooth.

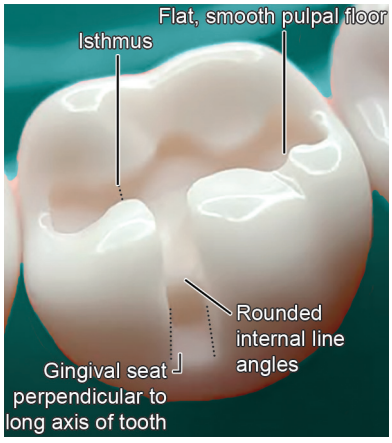
Factors Affecting Resistance Form

1. Amount of occlusal contact.
2. Type of restoration used.
3. Amount of remaining tooth structure.

Features of Resistance Form (Fig. 7.21)

1. ***Box-shape or mortise form of preparation*** with flat pulpal and gingival floor **(Fig. 7.21)**. Flat gingival and pulpal floors help in resisting masticatory forces directed along the long axis of the tooth, thereby prevent the tooth fracture from wedging forces resulting from opposing cusps **(Figs. 7.22A and B).**
2. ***Adequate thickness of restorative material*** depending on its respective compressive and tensile strengths to prevent the fracture of both the remaining tooth structure and the restoration **(Figs. 7.23A and B)**.
3. ***Restrict the extension of external walls*** to allow strong marginal ridge areas with sufficient dentin support.
4. ***Inclusion of weakened tooth structure*** to avoid fracture under masticatory forces.
5. ***Rounding of internal line angles*** to reduce the stress concentration points in tooth preparation.
6. Consideration to ***cusp capping*** depending upon the amount of remaining tooth structure.





FIGURES 7.23A AND B: Features of resistance and retention form for amalgam.

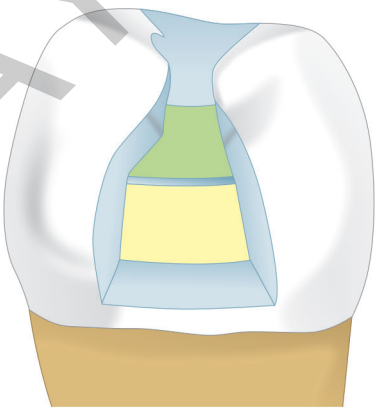


FIGURE 7.21: Box-shape or mortise form of preparation with flat pulpal and gingival floor.

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Viva Voce

Type of restoration	*Minimum occlusal thickness*
• Cast metal	1–2 mm
• Amalgam restorations	1.5 mm
• Ceramics	2 mm
• Composite	1–2 mm

3. Primary Retention Form

Definition

Primary retention form is that form, shape and configuration of the tooth preparation that resists the displacement or removal of restoration from the preparation under lifting and tipping masticatory forces.

Retention Form for Different Restorations

1. **Amalgam:** Retention is increased in amalgam restoration by the following:
   - Providing ***occlusal convergence*** (about 2–5°) of the dentinal walls toward the tooth surface **(Figs. 7.23A and B)**.
   - Giving slight ***undercut in dentin*** near the pulpal wall.
   - Providing ***occlusal dovetail*** **(Figs. 7.24A and B)**.
2. **Cast metals:** Retention is increased in cast restorations by the following:
   - Close ***parallelism of the opposing walls*** with slight occlusal divergence of 2–5°.
   - Making ***occlusal dovetail*** to prevent tilting of restoration in class II preparations.
   - Use of ***secondary retention*** in the form of coves, skirts and dentin slot.
   - Give ***reverse bevel*** in class I compound, class II, and MOD preparations to prevent tipping movements.
3. **Composites:** In composites, retention is increased by:
   - ***Micromechanical bonding*** between the etched and primed prepared tooth structure and the composite resin.
   - Providing ***enamel bevels***.
4. **Direct filling gold:** Elastic compression of dentin and starting point in dentin provide retention in direct gold fillings by proper condensation.

4. Convenience Form

Definition

The convenience form is that form which facilitates and provides adequate visibility, accessibility, and ease of operation during preparation and restoration of the tooth.

Features of Convenience Form

1. To have adequate width and lateral extensions for restorative material.
2. To provide proximal clearance from the adjacent tooth during class II preparation.
3. Refining of line and point angles for starting points of direct filling gold.
4. To provide occlusal divergence for cast gold inlays.

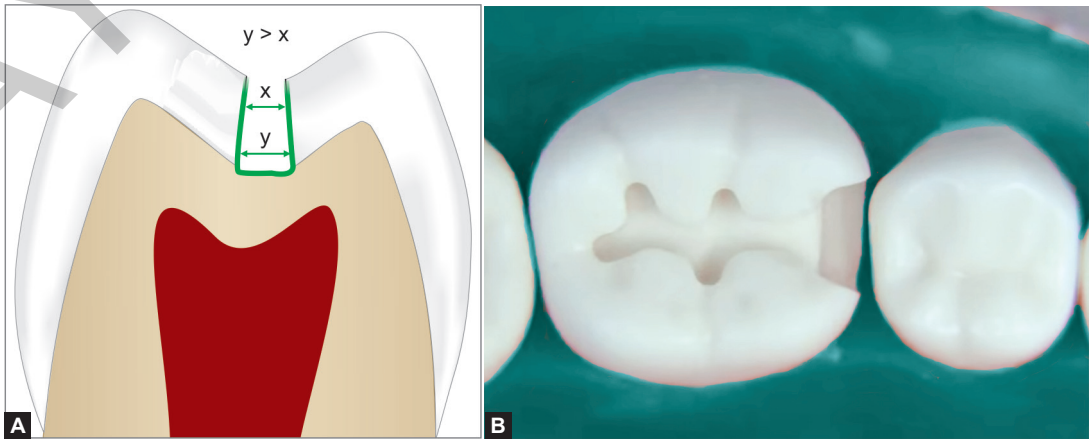
FINAL STAGES OF TOOTH PREPARATION

5. Removal of Any Remaining Enamel Pit or Fissure, Infected Dentin and/or Old Restorative Material, if Indicated

Definition

It is defined as removal of any infected carious tooth structure or faulty restorative material which is left in the tooth after initial preparation. While removing the carious dentin, one should remove only infected dentin not the affected dentin. This is done by using:

- **Large sized round steel bur at slow speed** with light force in wiping motion. Large sized instrument minimizes the force per square millimeter applied to affected area, reducing the chances of mechanical pulp exposure.
- **Large spoon excavator** in ***lateral wiping motion, forces*** for removal of infected dentin should be ***directed laterally and not towards the center of carious lesion***. Caries are



FIGURES 7.24A AND B: Retention to amalgam retention is provided by: (A) Convergence of walls; (B) Note dovetail, and convergent walls.

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removed in a spiraling fashion, beginning with the most superficial caries at the outer lateral wall. As hard dentin is reached laterally, it is followed to the central area.

- **Use of smart prep burs**: Smart burs are round burs used at a speed of 500–800 rpm. Their hardness is greater than infected dentin but lesser than normal enamel and dentin. So, while in use, these effectively remove the infected dentin without harming effect dentin.

Table 7.2 shows the difference between infected dentin and affected dentin.

TABLE 7.2: Difference between infected and affected dentin.

Infected dentin	*Affected dentin*
It is a superficial layer of demineralized dentin	It is a deeper layer
Cannot be remineralized	Can be remineralized
Lacks sensation	It is sensitive
In this, intertubular layer is demineralized with irregularly scattered crystals	In this, intertubular layer is only partly demineralized
Collagen fibers are broken down, appear as only indistinct cross bands	Distinct cross bands are present
It can be stained with: ■ 0.2% propylene glycol ■ 10% acid red solution ■ 0.5% basic fuchsin	It cannot be stained with any solution

Removal of Old Restorative Material is Indicated, if:

- It affects aesthetics of new restoration.
- Has secondary caries beneath (seen on radiograph).
- Tooth is symptomatic.
- It compromises new restoration.
- Marginal deterioration of old restoration.

6. Pulp Protection

When remaining dentin thickness is less, pulpal injury can occur because of heat production, high speed burs with less effective coolants, irritating restorative materials, galvanic currents due to restoration of dissimilar metals, excessive masticatory forces transmitted through restorative materials to the dentin and ingress of microorganisms and their noxious products through microleakage.

Pulp protection is achieved using liners, varnishes and bases depending upon:

- Amount of remaining dentin thickness.
- Type of restorative material used.

7. Secondary Resistance and Retention Forms

This step is needed in complex and compound tooth preparations where added preparation features are used to improve the resistance and retention form of the prepared tooth. These can be done by adding:

- Mechanical features.
- Conditioning procedures.



FIGURES 7.25: Complex tooth preparation with secondary retentive features.

Mechanical Features

Many mechanical features are added in the tooth preparation to provide additional retention and resistance form **(Fig. 7.25)**.

These can be:

1. **Retention grooves:** Retention grooves are ***placed on axiofacial and axiolingual line angles from gingival floor to occlusal surface***. These are prepared with the help of no. 1/4 round but just inside the dentin. **Table 7.3** enlists type of tooth preparation and location of retention grooves.

TABLE 7.3: Location of retention grooves for different tooth preparations.

Type of tooth preparation	*Location of retention grooves*
Class II preparation	Proximal wall, at the axiofacial and axiolingual line angles
Class III preparation	Axiogingival line angle or axiofaciogingival point angle and lingual dovetail
Class V preparation	Axioincisal and axiogingival line angle

2. **Coves:** Coves are small ***conical depressions*** prepared in the proximal walls of class II preparations ***at axiofacial and axiolingual line angles*** thus resisting the proximal displacement of restoration.
3. **Slots or internal boxes:** These are ***1.0–1.5 mm deep box-like grooves*** prepared in dentin to increase the surface area. These are ***prepared in occlusal box, buccoaxial, linguoaxial and gingival walls*** **(Fig. 7.26)**.
   For cast restorations, these are prepared by using tapered fissure bur to avoid undercuts and for amalgam, these are prepared by using inverted cone bur to create slight undercuts in dentin.
4. **Locks:** Locks are usually prepared for class II amalgam restorations for increasing resistance and retention form.
5. **Pins:** Different types of pins of various shapes and sizes are used to provide additional retention in amalgam, composite and cast restorations.

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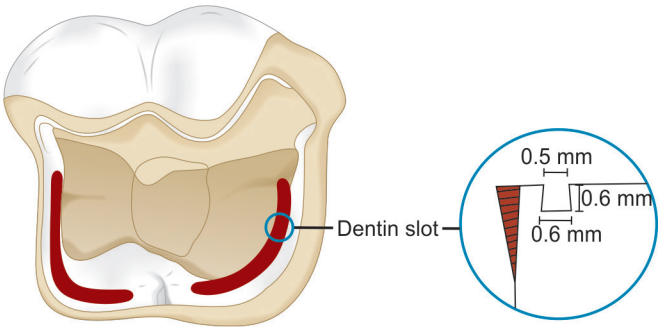

FIGURE 7.26: Slot or internal box is given in cast restoration which helps in retention of amalgam.

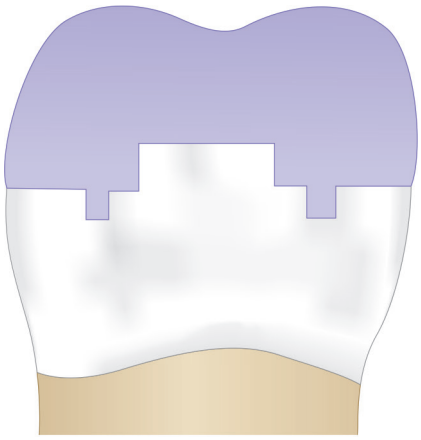

FIGURE 7.27: Secondary retention in the form of amalgam pins to increase the retention of the restoration.

6. **Skirts:** Skirts are prepared for providing additional retention in cast restorations by increasing the total surface area of preparation. Skirts can be prepared on one or all four sides of the preparation using flame shaped bur.
7. **Amalgam pins:** Amalgam pins are vertical posts of amalgam anchored in dentin. Dentin chamber is prepared by using inverted cone bur on the gingival floor 0.5 mm into dentin with 1–2 mm depth and 0.5–1 mm width **(Fig. 7.27)**.

Conditioning Procedures

Treatment of the preparation walls by conditioning procedures, etching, and bonding increases the adhesive property of tooth preparation. These procedures are done for glass ionomer cements, composites or ceramic restorations.

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

Definition

Finishing of tooth preparation walls is further development of a specific cavosurface design and degree of smoothness which produces maximum effectiveness of the restorative material being used.

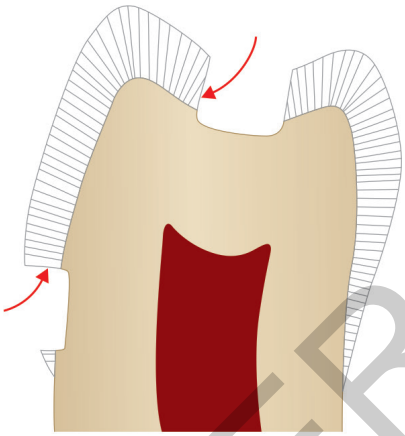

FIGURE 7.28: At the margins, all the enamel walls should have full length rods supported by dentin.

Objectives

1. To have smooth marginal junction between restoration and tooth surface.
2. To provide maximum strength for both tooth and restorative material at and near the margins.
3. To have smooth blending of restoration and tooth surface at the margins.

Factors Affecting Type of Finishing Necessary for External Walls

- Direction of enamel rods.
- Choice of restorative material.
- Location of the margins.

To avoid fracture of the tooth structure at the margins, all enamel walls should have full length of enamel rods supported by sound dentin **(Fig. 7.28)**.

Features

1. **Degree of smoothness or roughness of the walls:** This varies according to type of restorative material used. Smooth surface is indicated for cast metal restorations whereas roughness of the walls can be given in case of amalgam, direct filling gold, and composite resin restorations.
2. **Design of cavosurface angle:** This also varies according to type of restorative material used. For amalgam, 90° cavosurface angle or butt joint is recommended due to low edge strength of the material. For composite and cast metal restorations, bevel is indicated for better marginal sealing and better bonding.

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FACTS

Noy's structural requirements of finished tooth preparation:

- Tooth preparation should rest on sound dentin.
- Enamel rods of cavosurface angle should have their inner ends resting on sound dentin.
- Outer ends of enamel rods of cavosurface angle should rest on sound dentin with their outer ends to be covered with restorative material.
- Cavosurface angle should be properly trimmed or beveled so as to prevent harm to the tooth structure or restoration.

9. Final Procedures: Cleaning, Inspecting and Sealing

Final step in tooth preparation is cleansing of the preparation. This includes the removal of debris, drying of the preparation, and final inspection before placing restorative materials.

- Cleaning of tooth preparation using warm water.
- Drying the tooth preparation using air, dry cotton pellets.
- Sterilization of preparation walls using very mild alcohol free disinfectant: Use of mild disinfectant in tooth preparation serves the purpose of disinfection.

CONCLUSION

While preparing the cavity, one should keep in mind all the principles like outline form, resistance, and retention form features according to type of cavity, properties of the tooth tissue and type of restorative material to be used. To have success in restorative procedure, one should have fundamental knowledge of all the principles of cavity preparation.

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VIVA QUESTIONS

Q.1 What is tooth preparation?

Ans. It is a mechanical alteration of a defective, injured or diseased tooth in order to best receive a restorative material which will re-establish the healthy state of the tooth including esthetic correction when indicated along with normal form and function.

Q.2 What are different causes of loss of tooth structure?

Ans. Most common cause is dental caries. Other causes can be trauma resulting in tooth fracture, attrition, abrasion, erosion, tooth malformation, hypoplasia, tooth resorption, etc.

Q.3 What is simple, compound and complex tooth preparations?

Ans. A tooth preparation involving only one tooth surface is termed as simple preparation. For example, mesial, distal, occlusal, buccal, lingual tooth preparation.

A tooth preparation involving two surfaces is termed as compound tooth preparation. For example, mesio-occlusal (MO), disto-occlusal (DO), mesiolingual (ML), or distobuccal (DB) tooth preparation.

A tooth preparation involving more than two surfaces is called as complex tooth preparation. For example, mesio-occlusodistal (MOD), facio-occlusolingual (FOL) or mesioincisodistal (MID) tooth preparation.

Q.4 Define class I tooth preparation.

Ans. Class I preparations occur on the occlusal surfaces of premolars and molars, the occlusal two-third of buccal and lingual surface of molars and lingual surface of incisors.

Q.5 Define class II tooth preparation.

Ans. Preparations on the proximal surface of premolars and molars are class II.

Q.6 Define class III tooth preparation.

Ans. Preparations on the proximal surface of anterior teeth and not involving the incisal angles are class III.

Q.7 Define class IV tooth preparation.

Ans. Preparations on the proximal surface of anterior teeth also involving the incisal angle falls under class IV.

Q.8 Define class V tooth preparation.

Ans. Preparations on gingival third of facial and lingual or palatal surfaces of all teeth came under class V.

Q.9 Define class VI tooth preparation.

Ans. Preparations on incisal edges of anterior and cusp tips of posterior teeth without involving any other surface come under Class VI.

Q.10 What are different walls and floors of a tooth preparation?

Ans.
- Buccal
- Lingual/palatal
- Mesial
- Distal
- Axial wall
- Occlusal/incisal
- Pupal floor
- Gingival seat.

Q.11 Who is father of modern operative dentistry?

Ans. GV Black.

Q.12 What is floor of the cavity?

Ans. Floor is the flat surface of prepared cavity which is perpendicular to the occlusal forces which are directed occlusogingivally.
For example, pulpal and gingival floors.

Q.13 Define a line angle.

Ans. It is a junction of two surfaces of different orientations along the line. Its name is derived from the involved surfaces.

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Q.14 What is a point angle?

Ans. It is a junction of three plane surfaces or three line angles of different orientations. Its name is derived from its involved surfaces or line angles.

Q.15 Do we have line angle at cavosurface margin?

Ans. No, because line angle is the junction between two prepared parts of tooth preparation. Cavosurface margin is the junction of prepared tooth with unprepared tooth surface.

Q.16 If class II tooth preparation involves only proximal surface, why do we make occlusal preparation also?

Ans. Occlusal preparation is done for convenience form. Since directly reaching the affected area with bur is difficult because of close proximity of the adjacent tooth therefore an occlusal preparation is made through which proximal surface is reached.

Q.17 Why is class VI added to Black's classification?

Ans. Black classified the cavities according to some order and pattern of caries in affected teeth. But he did not include the areas which he assumed might not be attacked by caries, though in reality they might be affected. Simon later modified Black's classification and added class VI. The class VI are the tooth preparations which occur in the areas not covered by any of the other five classes like cusp tips, incisal two-third of anterior teeth, etc.

Q.18 What is enamel and dentinal wall?

Ans. Enamel wall is portion of prepared external wall consisting of enamel.
Dentinal wall is portion of prepared external wall consisting of dentin.

Q.19 What will be the treatment if caries involve proximal surface of anterior tooth without involving incisal edge and caries at palatal pit?

Ans. If lesions are not interconnected they are treated as separate preparations.
But if they are connected, the preparation is class III with lingual extension.

Q.20 What is treatment for caries present on buccal surface and proximal surface of a molar?

Ans. If lesions are not interconnected and small, they are treated as separate class II and class I preparations. But if lesions are large and interconnected, it is treated as proximo-occlusobuccal preparation.

Q.21 What is similarity between class II, III, IV and V preparations?

Ans. All occur on smooth surfaces.

Q.22 What is common between class II, III, IV preparations?

Ans. All these occur on proximal surfaces.

Q.23 How is tooth preparation done?

Ans. It is done by use of hand and rotary instruments.

Q.24 What are different steps of tooth preparation?

Ans.
- Stage I—Initial tooth preparation steps:
  - Outline form and initial depth.
  - Primary resistance form.
  - Primary retention form.
  - Convenience form.
- Stage II—Final tooth preparation steps:
  - Removal of any remaining caries, infected dentin and/or old restorative material, if indicated.
  - Pulp protection, if indicated.
  - Secondary resistance and retention form.
  - Procedures for finishing the external walls of the tooth preparation.
  - Cleaning, inspecting and sealing.

Q.25 Define outline form. List the factors influencing the outline form.

Ans. ***The outline form means:***
- Placing the preparation margins to the place they will occupy in the final tooth preparation except for finishing enamel walls and margins
- Maintaining the initial depth of 0.2–0.8 mm into the dentin.

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Factors affecting outline form:

- Extension of carious lesion
- Proximity of the lesion to other deep structural surface defects
- Relationship with adjacent and opposing teeth
- Caries index of the patient
- Need for esthetics
- Restorative material to be used.

Q.26 What is extension for prevention?

Ans. This concept was given by GV Black which advocated involvement of all pits and fissures even if they are unaffected by caries.

Q.27 What do you mean by breaking the contact?

Ans. In case of class II, III and IV caries, there is always a contact with the adjacent tooth. In these cases, whether caries are below or above the contact, the contact has to be broken so as to bring preparation margins into the embrasures for easy cleansability. If preparation margins end in non-cleansable areas, food stagnation in those areas may result in secondary caries.

Q.28 What should be ideal depth of the preparation?

Ans. Ideal depth should be 0.5 mm below DEJ, especially for non-adhesive materials. Since enamel is inelastic, it cannot be used for providing retentive and resistance form. So depth of preparation should be increased till elastic dentin is reached. Preparation should not end at dentinoenamel junction. This area is sensitive because of lateral branching of dentinal tubules and cytoplasmic extensions of odontoblasts.

Q.29 How does convenience form affects outline from?

Ans. This is specially seen in case of class II, III and IV preparations where adjacent tooth is present. In these cases it is impossible to reach the proximal area without cutting occlusal surface, otherwise adjacent tooth is cut.

But if adjacent tooth is missing, one can gain entry to proximal box without cutting the occlusal surface.

Q.30 What is meant by cuspal contour?

Ans. Cuspal contour means making preparation at uniform depth providing equal dentin thickness between pulp and the preparation. Since cusps are conical in shape, if pulpal floor is made straight it may result in uneven dentin thickness. The areas where less of dentin is present, preparation will be closer to pulp, resulting in its damage.

Q.31 Why should not preparation have sharp angles?

Ans. If preparation has sharp angles, it leads to concentration of stresses at those areas which may fracture the restoration. So to avoid stress concentration, preparation should have gentle curves and smooth walls.

Q.32 What is significance of stress bearing areas?

Ans. When opposing teeth come in contact, they contact only some areas of occlusal surfaces. These areas where they contact are stress bearing areas.

Significance: Preparation margins should not end at stress bearing areas otherwise stresses are met partially by the tooth and partially by restoration resulting in separation between the two. This can fracture the restoration or may result in marginal leakage. So preparation margin should be avoided at stress bearing areas. They should be kept entirely either on tooth surface or on restorative material.

Q.33 How is outline form affected by direction of enamel rods?

Ans. Enamel rods extend perpendicular from DEJ to enamel in a slightly wavy course. In vertical direction, they appear to converge towards a pit from DEJ, whereas they diverge as they move towards cusp tip from the DEJ.

In horizontal section, enamel rods flare out from DEJ towards outer surface.

Because of the direction of enamel rods, following walls are flared externally:

- Buccal and lingual walls of proximal box.
- Mesial and distal walls of buccal and lingual boxes of class I extensions.
- All walls of class V preparation.

If these walls are made to converge towards each other, this will result in unsupported enamel rods which may fracture later on.

Q.34 How does esthetics affect outline form?

Ans.

- For class III preparation, labial enamel is kept intact
- Preparation margins should be kept into embrasures for better esthetics
- Reverse curve is given in maxillary premolars.

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COLOR PLATE 1



Class I tooth preparation in mandibular first molar.



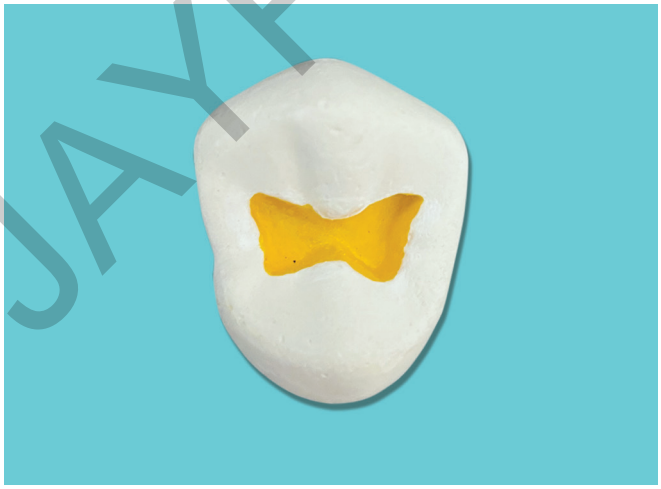
Conservative class I cavity preparation in mandibular premolar.



Conservative class I cavity preparation in maxillary first molar.



Conservative class I cavity (buccal pit) preparation in mandibular first molar.



Class I cavity preparation in maxillary premolar.



Palatal extension (class I cavity) preparation in maxillary first molar.

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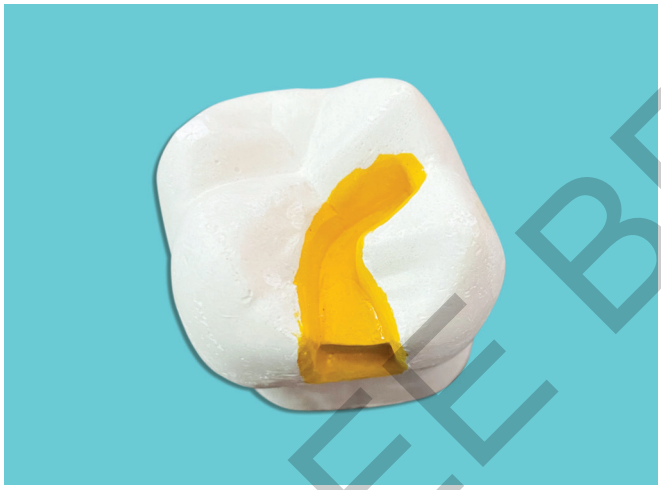
COLOR PLATE 2



Palatal extension and mesial pit preparation in maxillary first molar.



Class II cavity preparation in mandibular first molar.



Class II cavity preparation in maxillary first molar.



Class III cavity preparation in maxillary incisor.



Class III cavity preparation with dovetail in maxillary incisor.

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