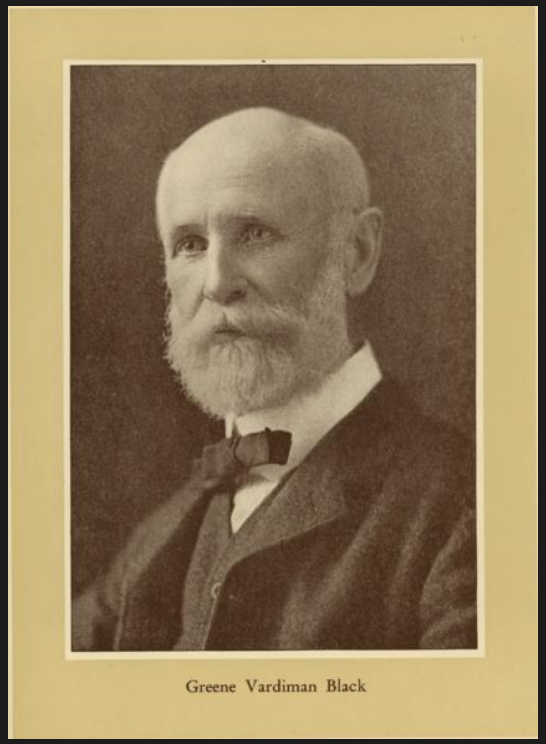
Tooth preparation for amalgam
Removal of amalgam fillings

Dr. Gergely Pataky

G. V. Black (1836-1915)

- Classification of caries lesions
- Principles of tooth preparation
- The predilection places of caries served as a base of the classification
- His principles were established for making silver amalgam and direct gold restorations
- Invented foot-driven dental drill


Greene Vardiman Black

Classification of caries lesions according to G. V. Black

- Class I.: Pits and fissures - premolars and molars; upper incisors
  - Occlusal surface of premolars and molars
  - Grooves on the facial or lingual surfaces of molars
  - Foramen coecum of upper incisors
- Class II.: Proximal surfaces - premolars and molars
  - Prepared cavity extend to the occlusal surface
- Class III.: Proximal surfaces - incisors and canines
  - Prepared cavity extend to the oral surface
- Class IV.: Proximal surfaces+incisal edges - incisors and canines
- Class V. - any tooth
  - Gingival third of the facial or lingual surfaces

- (Class VI.: Incisal edge, cusp)

Introduction

- Dental amalgam is a metal-like restorative material composed of a mixture of silver/tin/copper alloy and mercury

- The unset mixture is pressed (condensed) into a specifically prepared undercut tooth form and contoured to restore the tooth's form and function

History

- Amalgam is in use since the 1830s
- Dentist used to file silver coins and mixed them with mercury creating a putty-like mass

Restoration techniques

- Nonbonded
- Bonded
  - Was thought to provide significant benefits
  - These were not well achieved

Current status

- Today the popularity of amalgam has decreased

- Reasons:
  - Concerns about its safety and environmental effects
  - Poor esthetics
  - Weakening of the tooth structure
  - Benefits of using composite materials

Types of amalgam restorative materials

- Low-copper amalgam
  - Were prominent before the early 1960s
  - Material was subject to corrosion after setting because formation of gamma-two phase

- High-copper amalgam
  - Increased copper content to 12% or greater
  - Copper reacts with the tin and prohibits the formation of gamma-two phase → reduction of the corrosion products
  - In composition they can be:

  - Spherical amalgam
    - Small round alloy particles
    - Require little condensation pressure
    - High early strength – suitable for large restorations

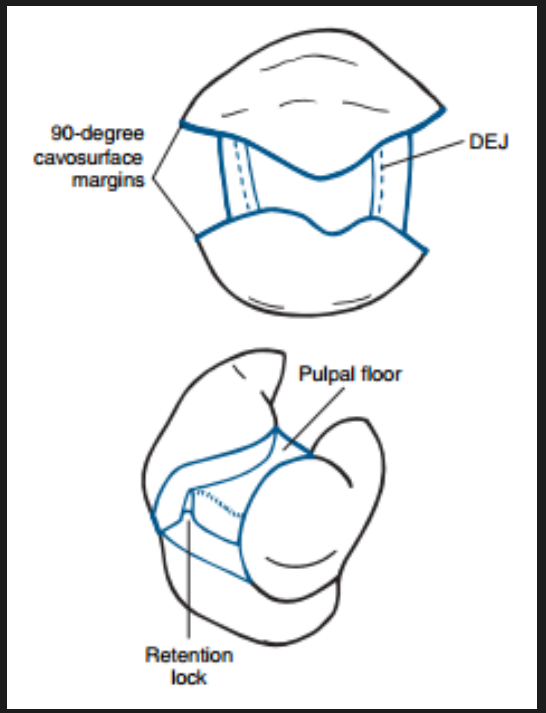
  - Admixed amalgam
    - Irregularly shaped and sized alloy particles
    - More condensation pressure is required

Important properties

- Linear coefficient of thermal expansion
  - 2.5 times greater than that of tooth structure
- Compressive strength
  - Similar to tooth structure
- Tensile strength
  - Lower than that of tooth structure → subject to fracture
- Creep and flow (deformation of material under load over time)
  - High-copper amalgams exhibit no clinically relevant creep or flow
- Thermal conductivity
  - Good – amalgam should not be placed in close proximity of pulp tissues

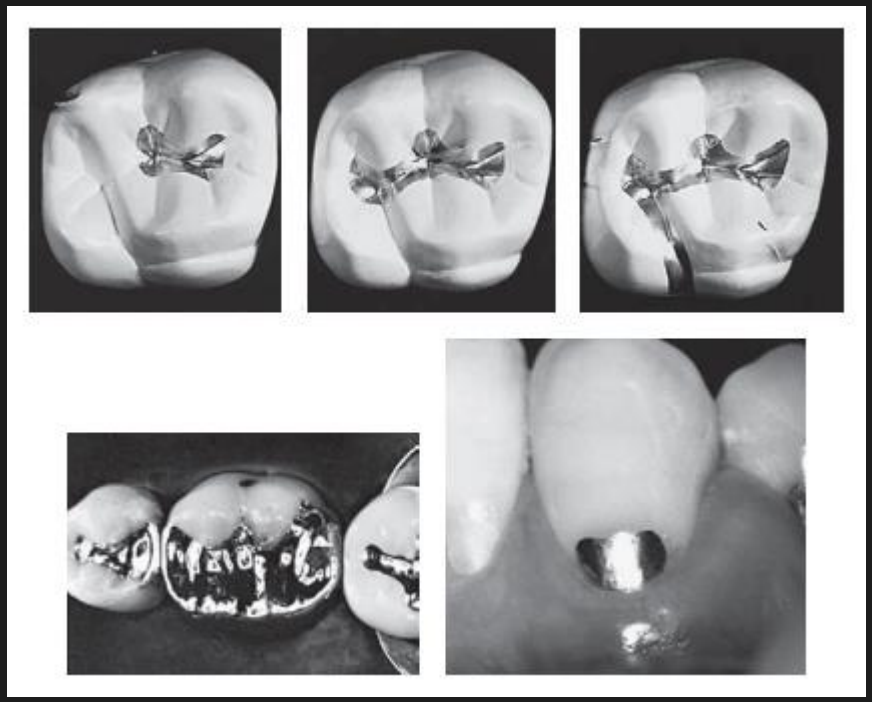
Required tooth preparation form

- 1. Possess a uniform specified minimum thickness for strength (1-2mm)
- 2. Produce a 90-degree amalgam angle (butt joint form) at the margin
- 3. Be mechanically retained in the tooth



Indications

- Class I, II, and V restorations
- Foundations



Contraindications

- The use of amalgam in more prominent esthetic areas of the mouth is usually avoided
  - Anterior teeth
  - Premolars
  - (Molars)

- Small to moderate defects in posterior teeth

  (use of composite results in conservation of tooth structure)

Advantages

- Ease of use
  - Isolation of the operating area is less critical
  - Insertion and finishing procedures are also much easier
- High compressive strength
- Excellent wear resistance
  - Especially when the restoration provide all of the occlusal contact for a tooth
- Favorable long-term clinical research results
- Lower cost than for composite restorations

Disadvantages

- Noninsulating
- Nonesthetic
- Less conservative (more removal of tooth structure during tooth preparation)
- Weakens tooth structure
- More technique sensitive if bonded
- More difficult tooth preparation
- Initial marginal leakage

Steps of tooth preparation

Steps of tooth preparation

- Initial stage of tooth preparation
  - Initial tooth preparation depth
  - Outline form
  - Primary retention form
  - Primary resistance form
  - Convenience form
- Final stage of tooth preparation
  - Removal of remaining fault and pulp protection
  - Secondary resistance and retention form
  - Final procedures

Preparation designs

- Chosen filling material/restoration type
- Location of the cavity

Preparation designs

- Conventional preparation
  - Macroretention – box form
  - Restoration type: amalgam filling, metal inlay/onlay
  - Cavity located on the root surface when making composite restoration
- Beveled conventional preparation
  - Conventional preparation + beveled enamel margins in 0,5-1mm width
  - Changing amalgam filling to composite filling
- Modified / adhesive / minimalinvasive preparation
  - Microretention
  - The extension of the cavity is dictated by the outspread of the caries

Preparation designs for amalgam

- Conventional tooth preparation
- Box-only preparation
- Tunnel preparation

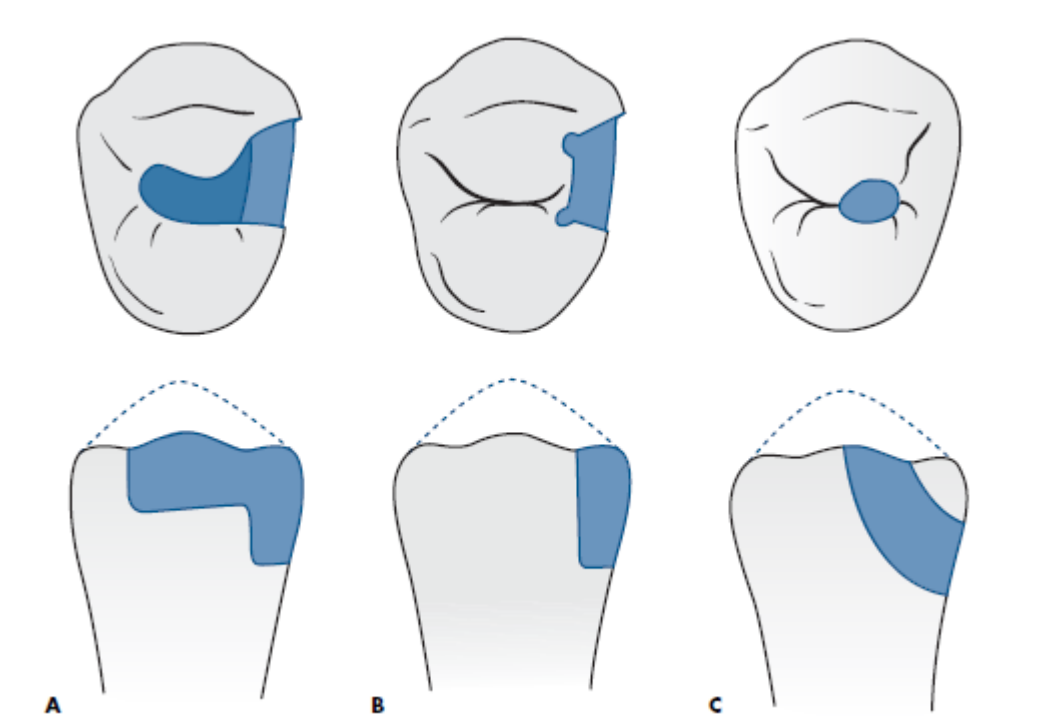


FIGURE 16-14 **Types of amalgam tooth preparations. A,** Conventional. **B,** Box-only. **C,** Tunnel.

Initial tooth preparation depth

- *Extending the depth (pulpally or axially or both) to a prescribed uniform dimension*

- 0.2mm inside the DEJ

Initial tooth preparation depth

- Pulpal floor depth
  - 0.2mm inside the DEJ
  - Exception: when the occlusal enamel has been significantly worn thinner → 1.5mm as measured from the depth of the central groove

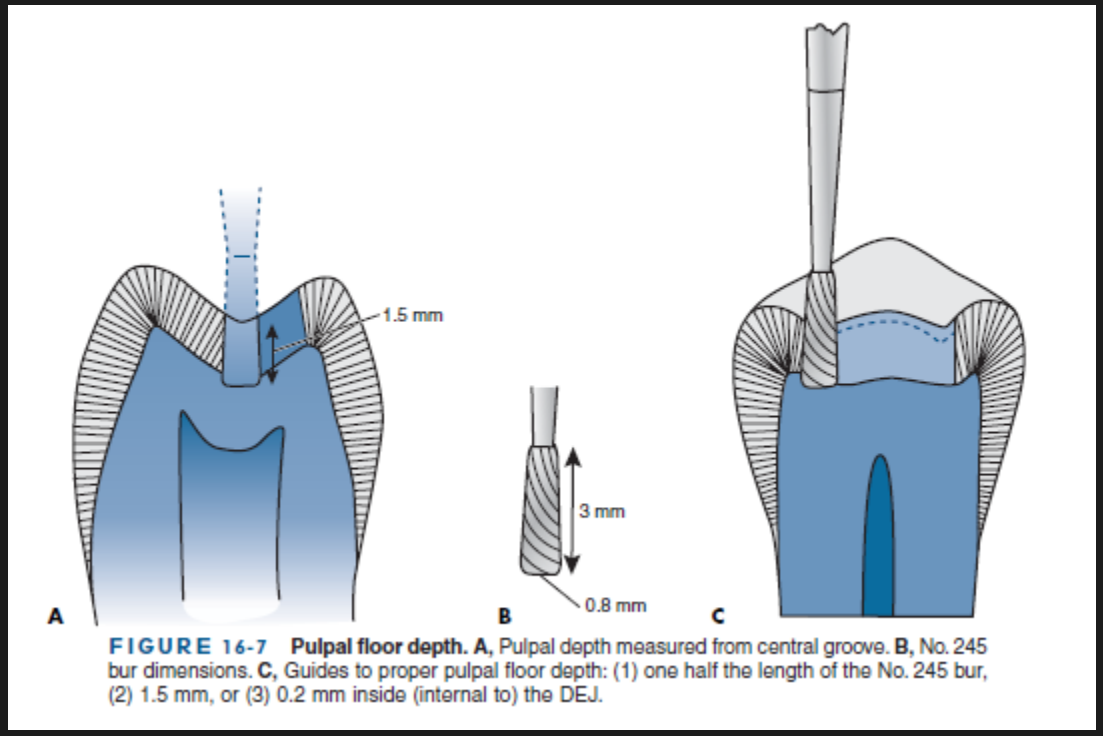


FIGURE 16-7 **Pulpal floor depth. A,** Pulpal depth measured from central groove. **B,** No. 245 bur dimensions. **C,** Guides to proper pulpal floor depth: (1) one half the length of the No. 245 bur, (2) 1.5 mm, or (3) 0.2 mm inside (internal to) the DEJ.

Initial tooth preparation depth

- Axial wall depth
  - 0.2mm inside the DEJ
  - 0.5mm inside the DEJ when retention locks are used (allows placing retention locks without undermining marginal enamel)
  - 0.5 to 1mm on the root surface (provide room for retention groove or cove and provide for adequate thickness of the amalgam)

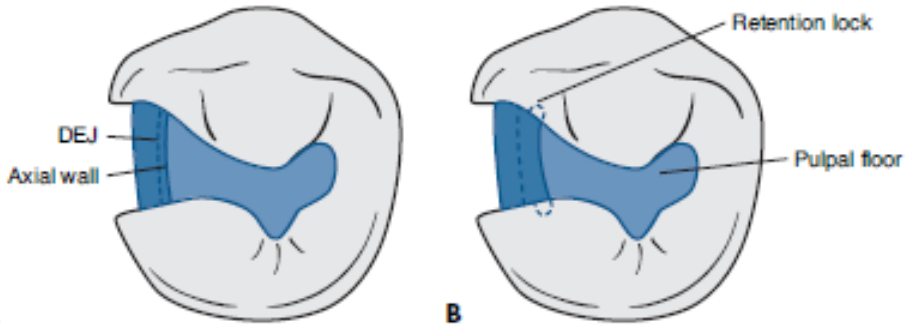


FIGURE 16-8 **Axial wall depth. A,** If no retention locks needed, axial depth 0.2 mm inside (internal to) DEJ. **B,** If retention locks needed, axial depth 0.5 mm inside (internal to) DEJ.

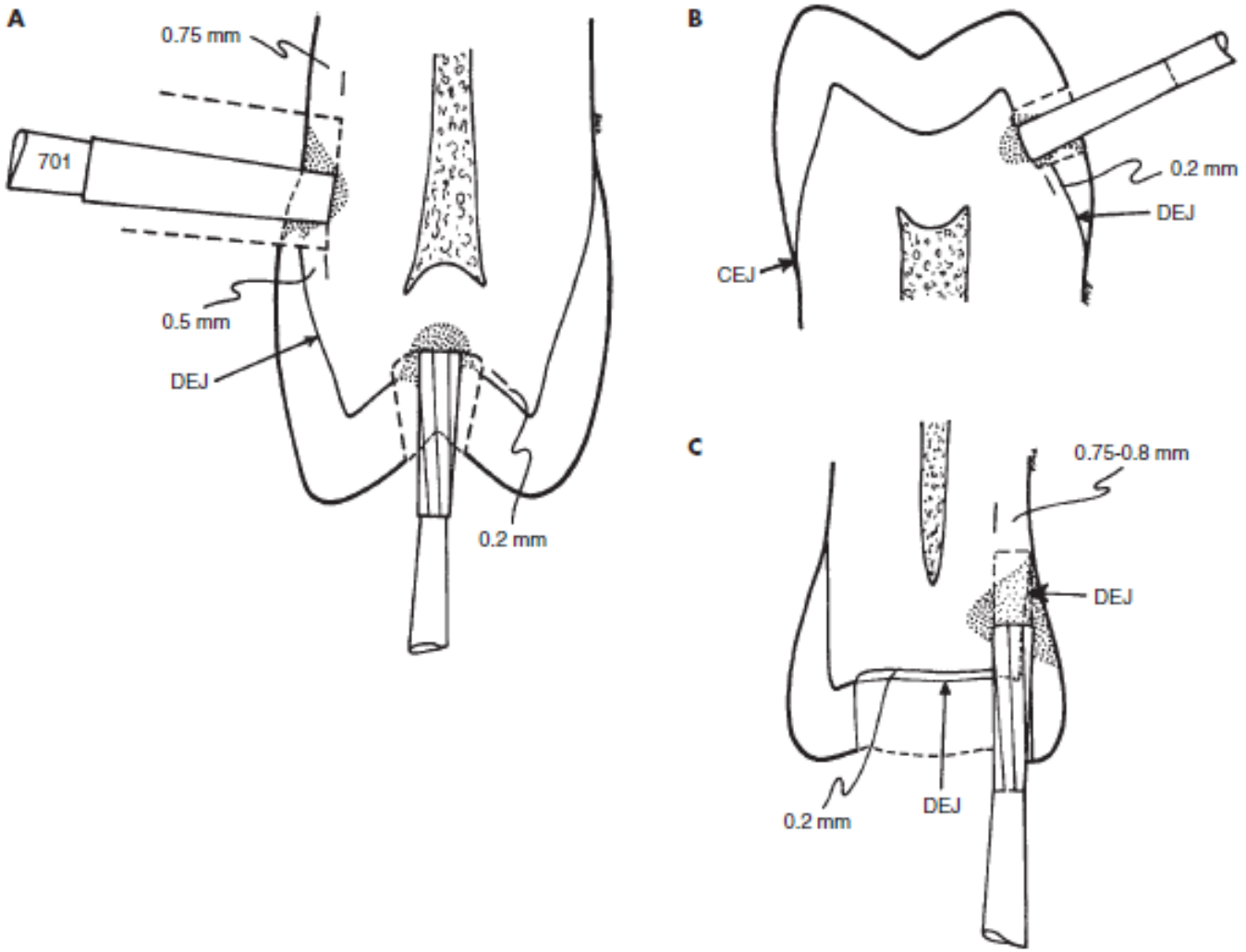


FIGURE 6-1 Initial tooth preparation stage for conventional preparations. A, B, and **C,** Extensions in all directions are to sound tooth structure, *while maintaining a specific limited pulpal or axial depth* regardless whether end (or side) of burr is in dentin, caries, old restorative material, or air. DEJ and CEJ are indicated in **B**. In **A,** initial depth is approximately two thirds of 3-mm bur head length, or 2 mm, as related to prepared facial and lingual walls, but is half the No. 245 bur head length, or 1.5 mm, as related to central fissure location.

Outline form

- *Placing the tooth preparation extension into sound tooth structure at the marginal areas (not pulpally or axially)*

- Extension is primarily dictated by the amount of caries, old restorative material, or defect present
- Also must be considered: provide access for the tooth preparation, caries removal, matrix placement, and amalgam insertion

- Requirements
  - For enamel strength: marginal enamel rods should be supported by sound dentin
  - Marginal requirements for amalgam: 90-degree butt-joint

Outline form

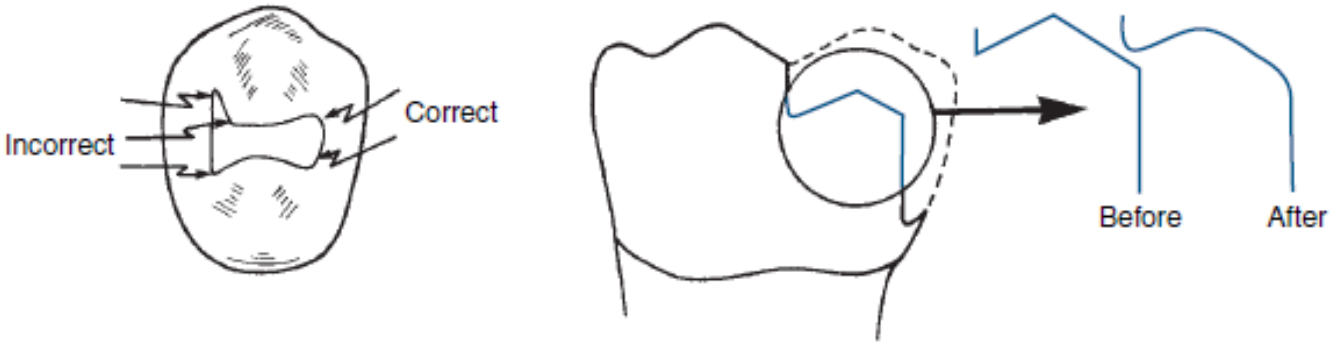


FIGURE 6-32 The junctions of enamel walls (and respective margins) should be slightly rounded, whether obtuse or acute.

Cavosurface margins

- Enamel and amalgam are both brittle structures
- Enamel must have a marginal configuration of 90 degrees or greater (a right or obtuse angle)
- Amalgam must have the same
- If they have marginal angles less than 90 degrees they are subject to fracture

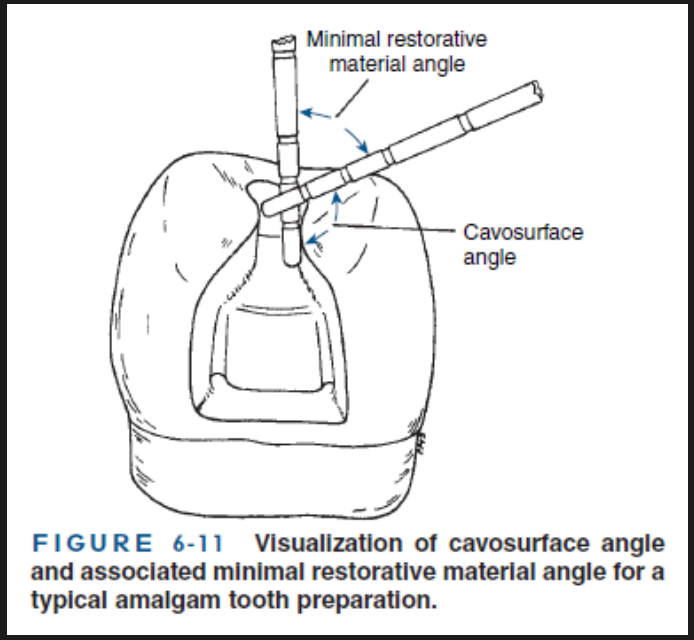


FIGURE 6-11 Visualization of cavosurface angle and associated minimal restorative material angle for a typical amalgam tooth preparation.

Proximal cavosurface margins

- Preparation walls on vertical parts of the tooth (facial, lingual, mesial, or distal) should result in 90-degree enamel walls

- When viewed from the occlusal, the facial and lingual cavosurface margins of a Class II preparation should be 90 degrees

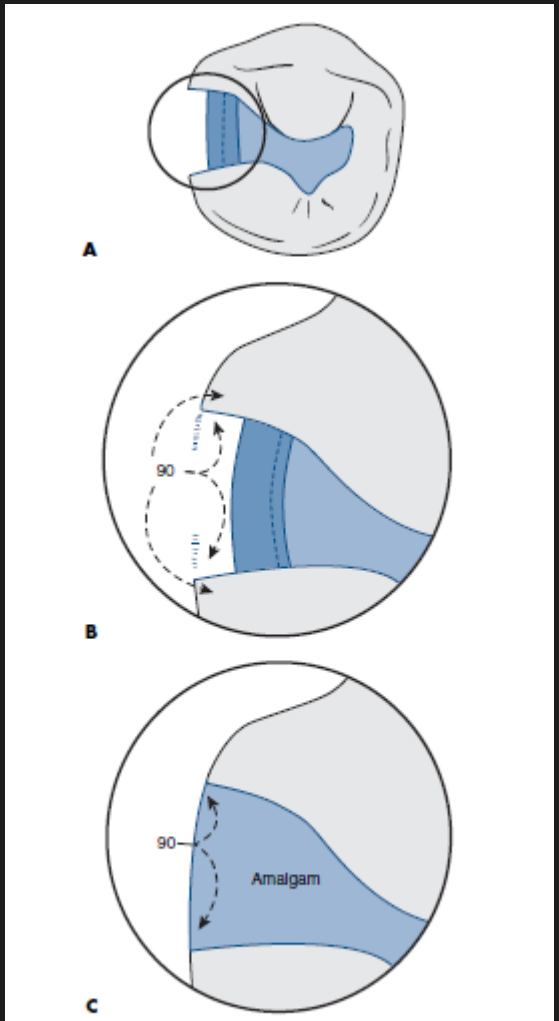


FIGURE 16-9 Proximal cavosurface margins. **A,** Facial and lingual proximal cavosurface margins prepared at a right angle (90 degrees) to a tangent drawn through the point on the external tooth surface. **B,** 90-degree proximal cavosurface margin produces 90-degree amalgam margin. **C,** 90-degree amalgam margins.

Occlusal cavosurface margins

- Preparation walls on the occlusal surface should provide 90-degree or greater amalgam margins and usually have obtuse enamel margins

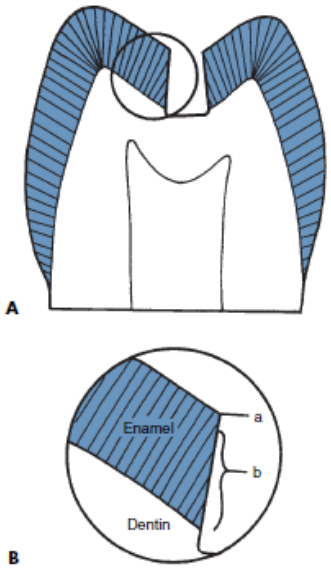


FIGURE 16-11 **Occlusal cavosurface margins.** **A,** Tooth preparation. **B,** Occlusal margin representing the strongest enamel margin. *a,* Full-length enamel rods. *b,* Shorter enamel rods.

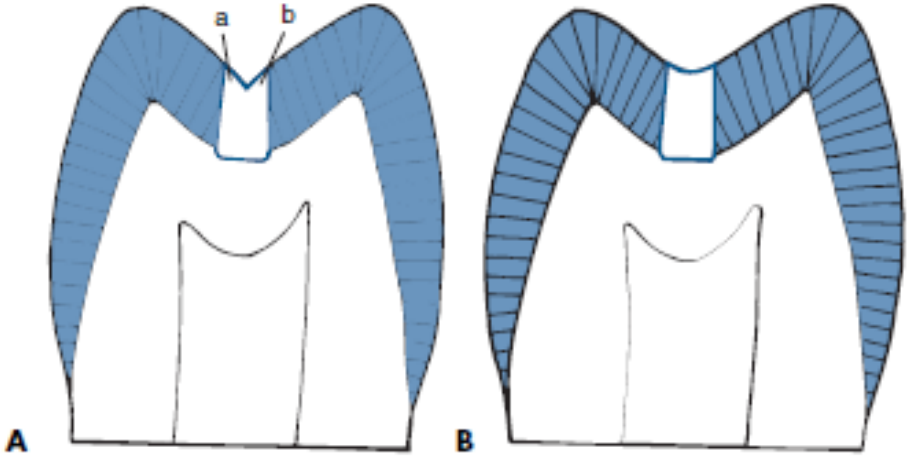


FIGURE 16-12 **Amalgam form at occlusal cavosurface margins. A,** Amalgam carved too deep resulting in acute angles *a* and *b* and stress concentrations within the amalgam, increasing the potential for fracture. **B,** Amalgam carved with appropriate anatomy, resulting in an amalgam margin close to 90 degrees, although the enamel cavosurface margin is obtuse.

Primary retention form

- *Providing an initial form that retains the amalgam in the tooth*
- Amalgam must be mechanically locked inside the tooth

- Retention form is provided by:
  - Mechanical locking of the inserted amalgam into surface irregularities of the preparation
  - Preparation of vertical walls (especially facial and lingual walls) that converge occlusally
  - Special retention features that are placed during the final stage of tooth preparation

    (locks, grooves, coves, slots, pins, steps or amalgampins)

Primary retention form

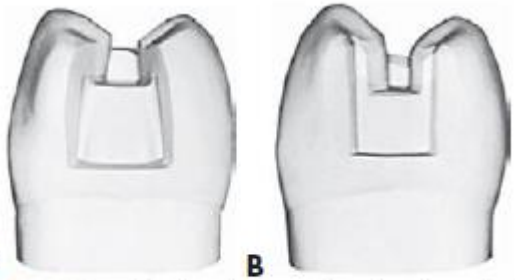


FIGURE 6-30 Basic primary retention form in Class II tooth preparations for amalgam **(A)** with vertical external walls of proximal and occlusal portions converging occlusally and for inlay **(B)** with similar walls slightly diverging occlusally.

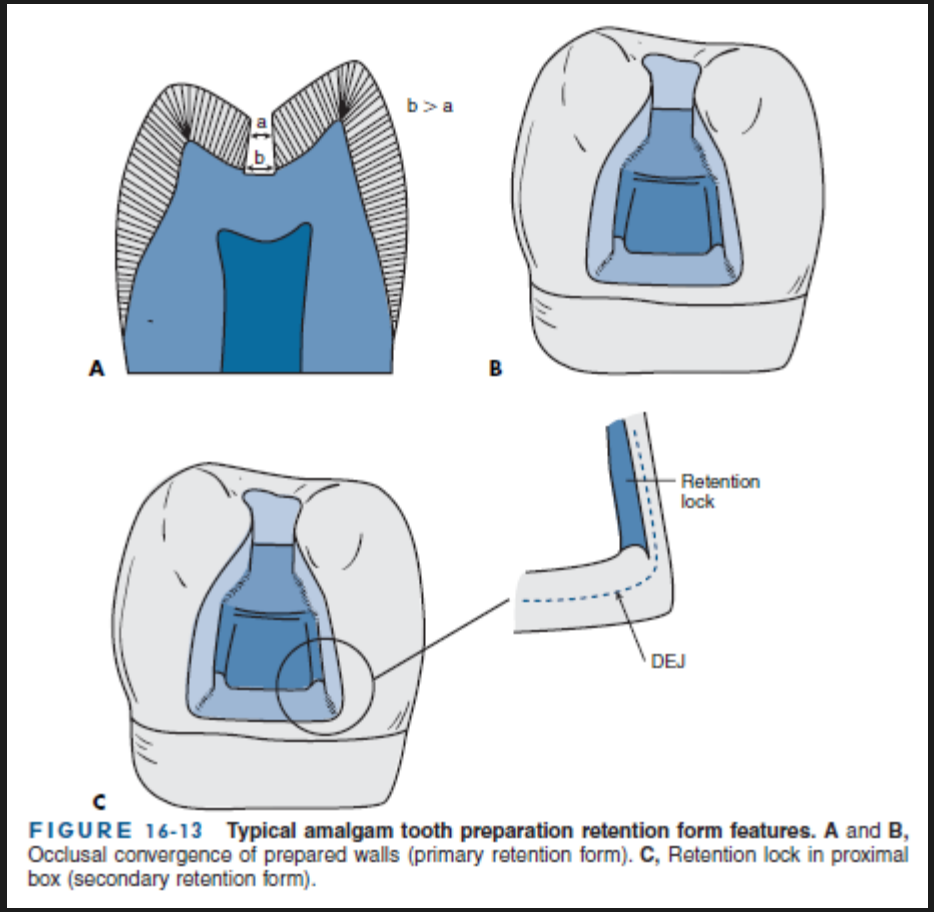


FIGURE 16-13 Typical amalgam tooth preparation retention form features. A and **B,** Occlusal convergence of prepared walls (primary retention form). **C,** Retention lock in proximal box (secondary retention form).

Primary resistance form

- *Resistance form preparation features help the restoration and tooth resist fracturing as a result of occlusal forces*

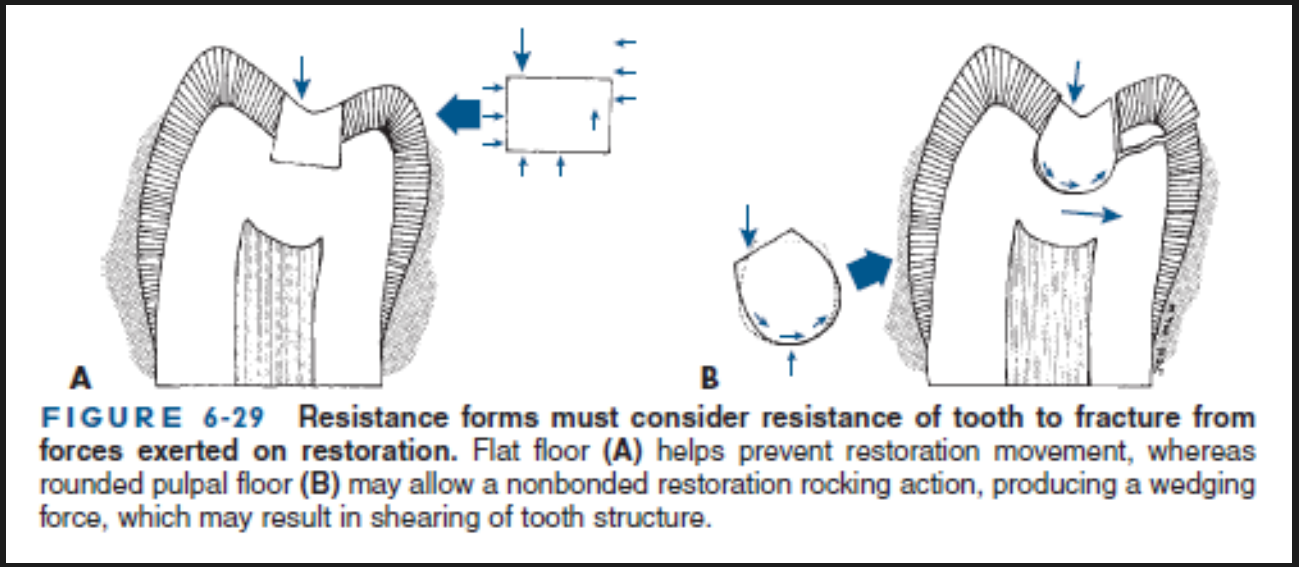


FIGURE 6-29 Resistance forms must consider resistance of tooth to fracture from forces exerted on restoration. Flat floor **(A)** helps prevent restoration movement, whereas rounded pulpal floor **(B)** may allow a nonbonded restoration rocking action, producing a wedging force, which may result in shearing of tooth structure.

Primary resistance form

- Preventing the tooth from fracturing:
  - Maintaining as much unprepared tooth structure as possible (preserving cusps and marginal ridges)
  - Having pulpal and gingival walls prepared perpendicular to occlusal forces, when possible
  - Having rounded internal preparation angles
  - Removing unsupported or weakened tooth structure
  - Placing pins into the tooth as part of the final stage of tooth preparation (secondary resistance form feature)

Primary resistance form

- Preventing the amalgam from fracturing:
  - Adequate thickness of amalgam
    - 1.5-2mm in areas of occlusal contact
    - 0.75mm in axial areas
  - Marginal amalgam of 90 degrees or greater
  - Boxlike preparation form, which provides uniform amalgam thickness
  - Rounded axiopulpal line angles in Class II tooth preparations

Convenience form

- *Convenience form features are features that make the procedure easier and the area more accessible*

- Extension of the outline form so that:
  - Marginal form can be established
  - Caries can be accessed for removal
  - Matrix can be placed
  - Amalgam can be inserted, carved, and finished
- Extension of the proximal margins:
  - To provide clearance from the adjacent tooth
- Extension of other walls to provide greater access for caries excavation

Convenience form

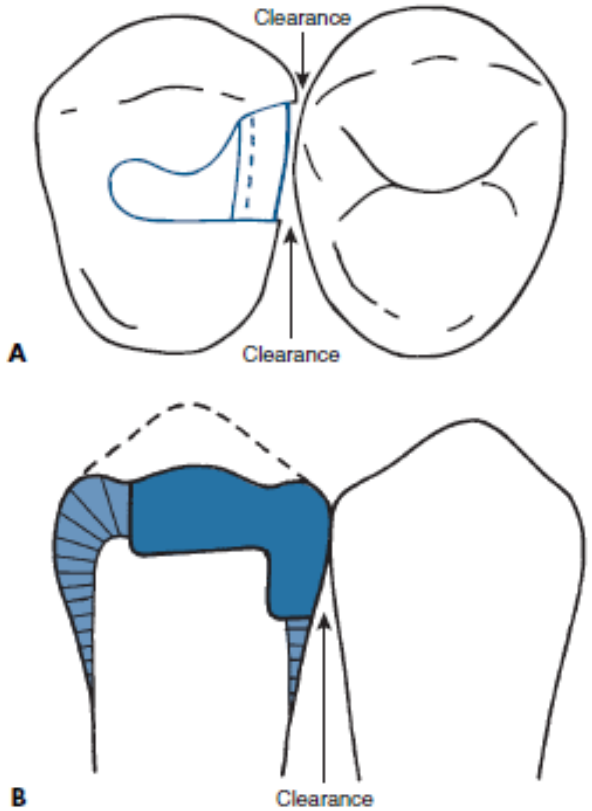


FIGURE 16-10 Proximal box preparation clearance of adjacent tooth. A, Occlusal view. **B,** Lingual view of a cross-section through the central groove.

Removal of remaining fault and pulp protection

- If caries or old restorative material remains after the initial preparation, it should be located only in the axial or pulpal walls

- For most nonbonded amalgam restorations, a sealer is placed on the prepared dentin before amalgam insertion to occlude the dentinal tubules

Secondary resistance and retention form

- If it is determined that insufficient retention or resistance forms are present in the tooth preparation, additional preparation is indicated
- Placement of locks, grooves, coves, slots, pins, or amalgampins
- Usually the larger the tooth preparation, the greater the need for secondary resistance and retention forms

Secondary resistance and retention form

- Secondary retention form for the occlusal and proximal portions of the preparation should be independent of each other
- When placing retention locks axial wall depth is 0.5mm inside the DEJ
- Retention locks should be placed 0.2mm inside the DEJ
- Care should be taken to prevent the removal of dentin that supports the proximal enamel

Secondary resistance and retention form

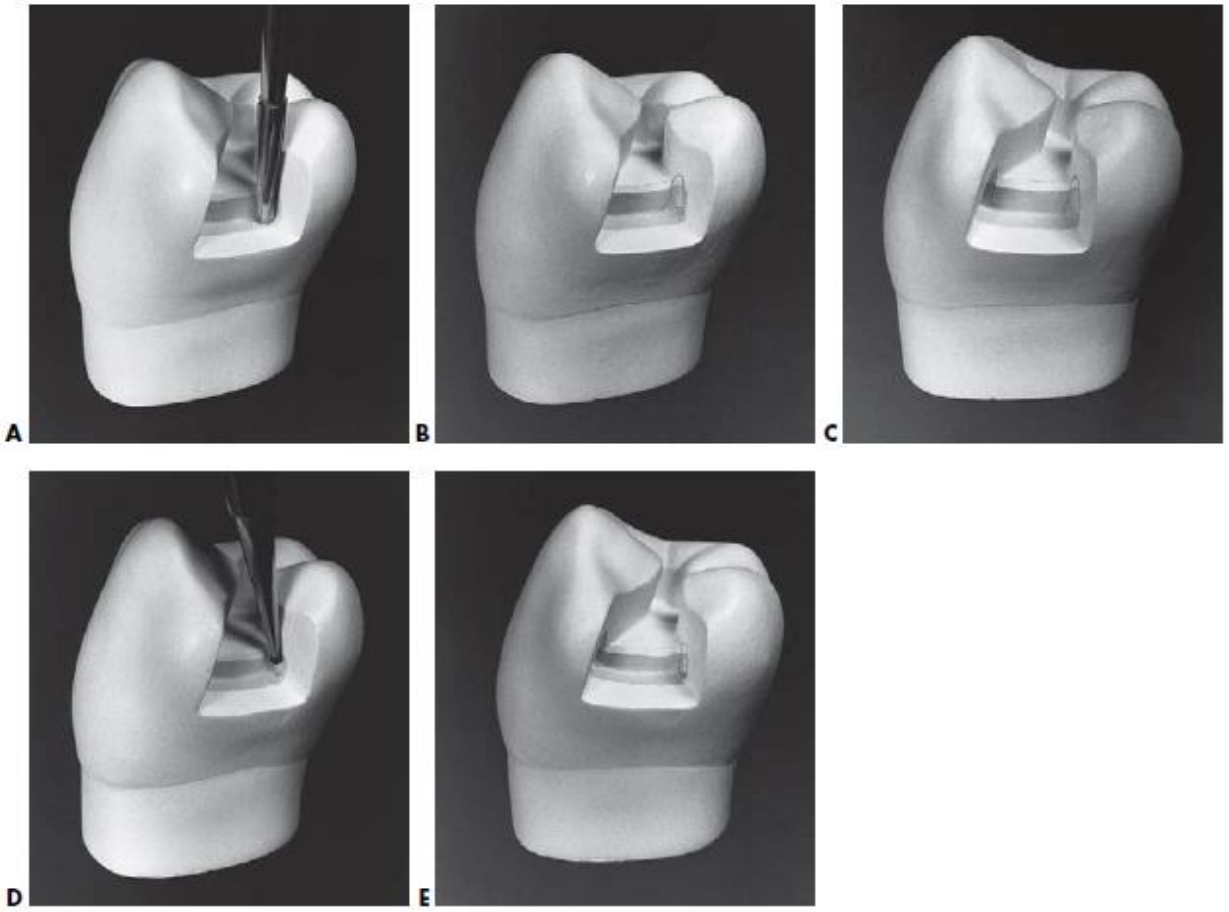


FIGURE 17-54 **Proximal retention locks. A,** Position of No. 169L bur to prepare retention lock as bur is moved lingually and pulpally. **B,** Lingual lock. Note dentin support of proximal enamel. **C,** Completed locks. **D,** Locks prepared with No. ¼ bur. **E,** Completed locks.

Secondary resistance and retention form

- There are four characteristics or determinants of proximal locks:
  - Position: refers to the axiofacial and axiolingual line angles of initial tooth preparation
  - Translation: refers to the direction of movement of the axis of the bur
  - Depth: refers to the extent of translation
  - Occlusogingival orientation: refers to the tilt of the bur, which dictates the occlusal height of the lock, given a constant depth

Secondary resistance and retention form

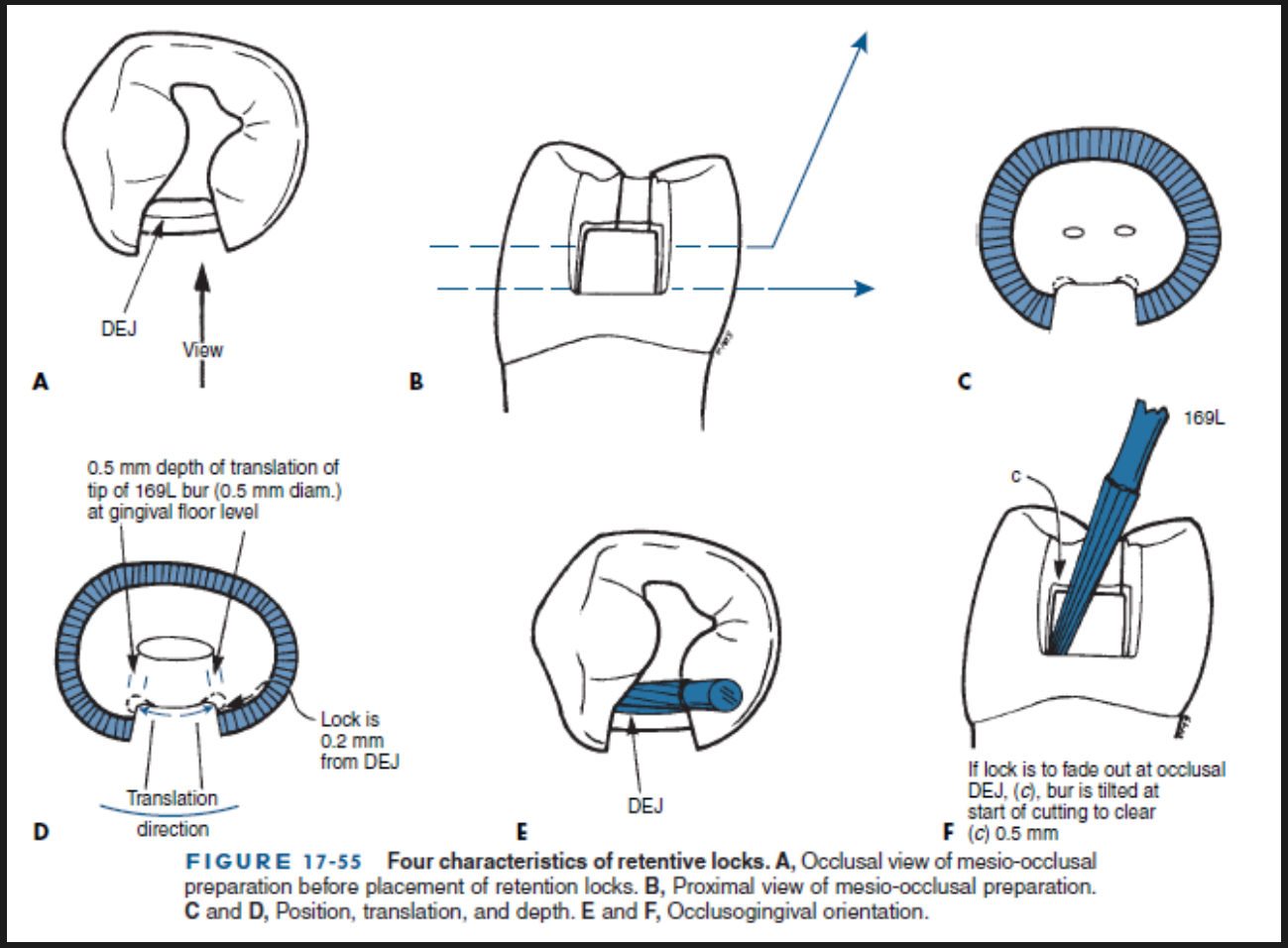


FIGURE 17-55 **Four characteristics of retentive locks. A,** Occlusal view of mesio-occlusal preparation before placement of retention locks. **B,** Proximal view of mesio-occlusal preparation. **C** and **D,** Position, translation, and depth. **E** and **F,** Occlusogingival orientation.

Final procedures

- Tooth preparation should be viewed from all angles

- Ensure:
  - All caries has been removed
  - Depths are proper
  - Margins provide for the correct amalgam and tooth preparation angles
  - Tooth is cleaned of any residual debris

Removal of amalgam fillings

Removal of amalgam fillings

- Technically:
  - Removing the undercuts around the margin of the restoration using carbide fissure bur with water cooling

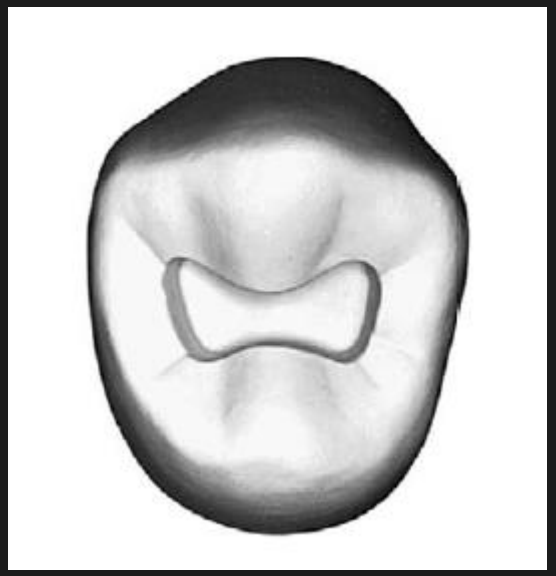
Removal of amalgam fillings

- Protection of the patient:
  - Placement of rubber dam isolation (mandatory in case of allergy to mercury!)
  - In some countries it is not adviced or forbidden to remove amalgam fillings during the period of pregnancy

Removal of amalgam fillings

- Environmental aspects:
  - Installing filtration system in dental offices
  - Treating waste separately that contaminated with mercury

Class I amalgam preparation



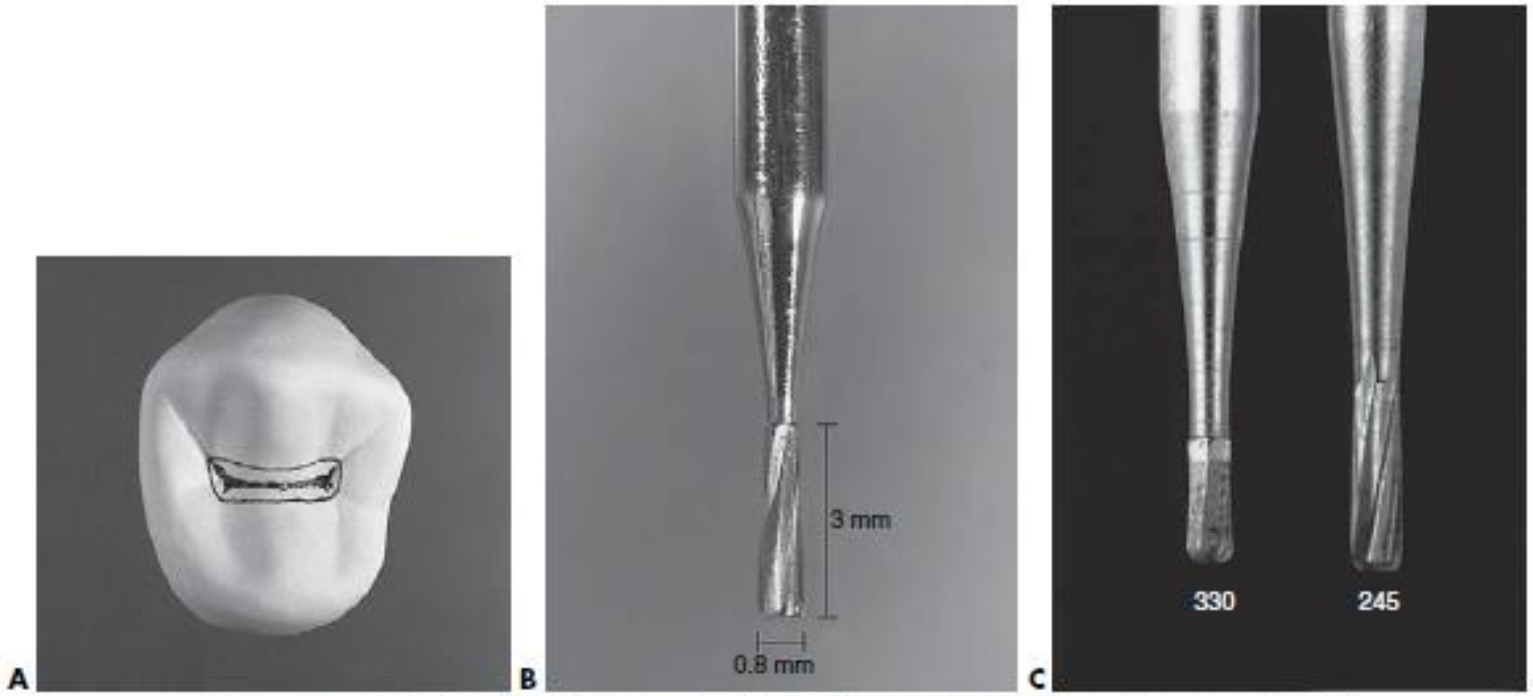


FIGURE 17-2 Outline and entry. A, Ideal outline includes all occlusal pits and fissures. **B,** Dimensions of head of a No. 245 bur. **C,** No. 330 and No. 245 burs compared.

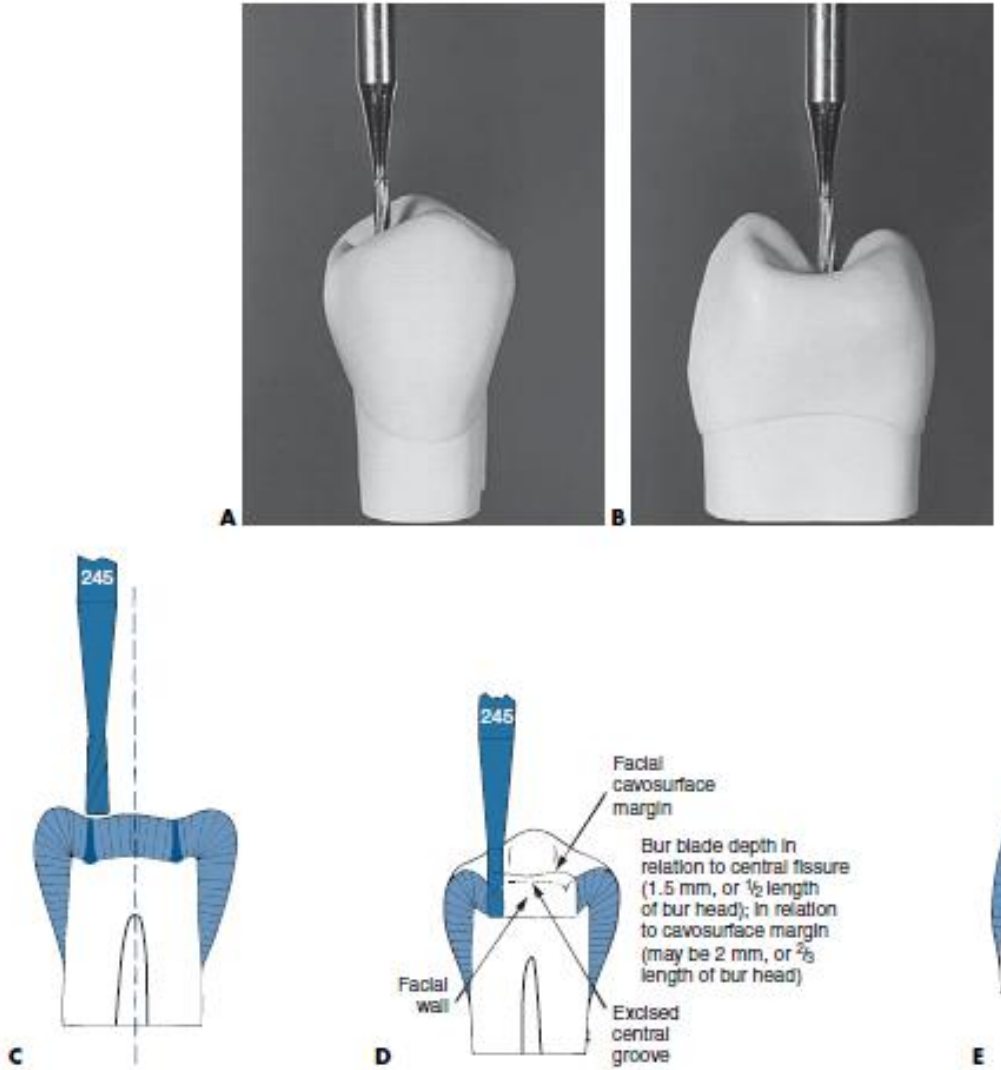
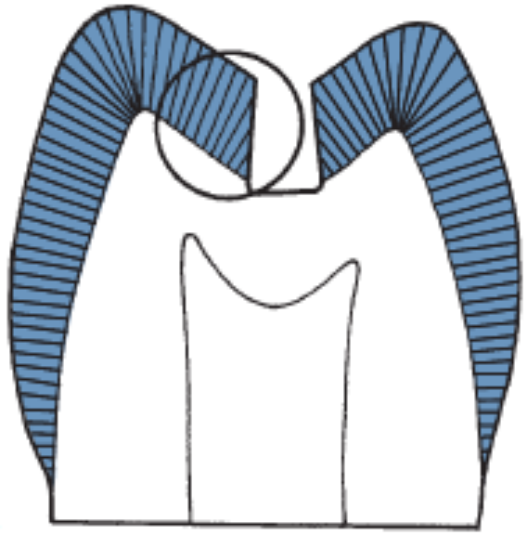
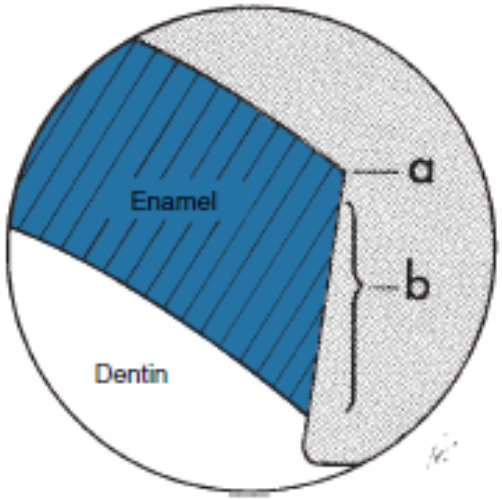


FIGURE 17-3 **A,** No. 245 bur oriented parallel to long axis of tooth crown for entry as viewed from lingual aspect. **B,** Bur positioned for entry as viewed from distal aspect. **C,** Bur positioned over more carious pit (distal) for entry. Distal aspect of bur is positioned over distal pit. **D,** Mesiodistal longitudinal section. Relationship of head of No. 245 bur to excised central fissure and cavosurface margin at ideal pulpal floor depth. **E,** Faciolingual longitudinal section. *Dotted line* indicates long axis of tooth and direction of bur.



A



B

FIGURE 17-6 **A** and **B,** Ideal and strongest enamel margin is formed by full-length enamel rods *(a)* resting on sound dentin supported on preparation side by shorter rods, also resting on sound dentin *(b)*.

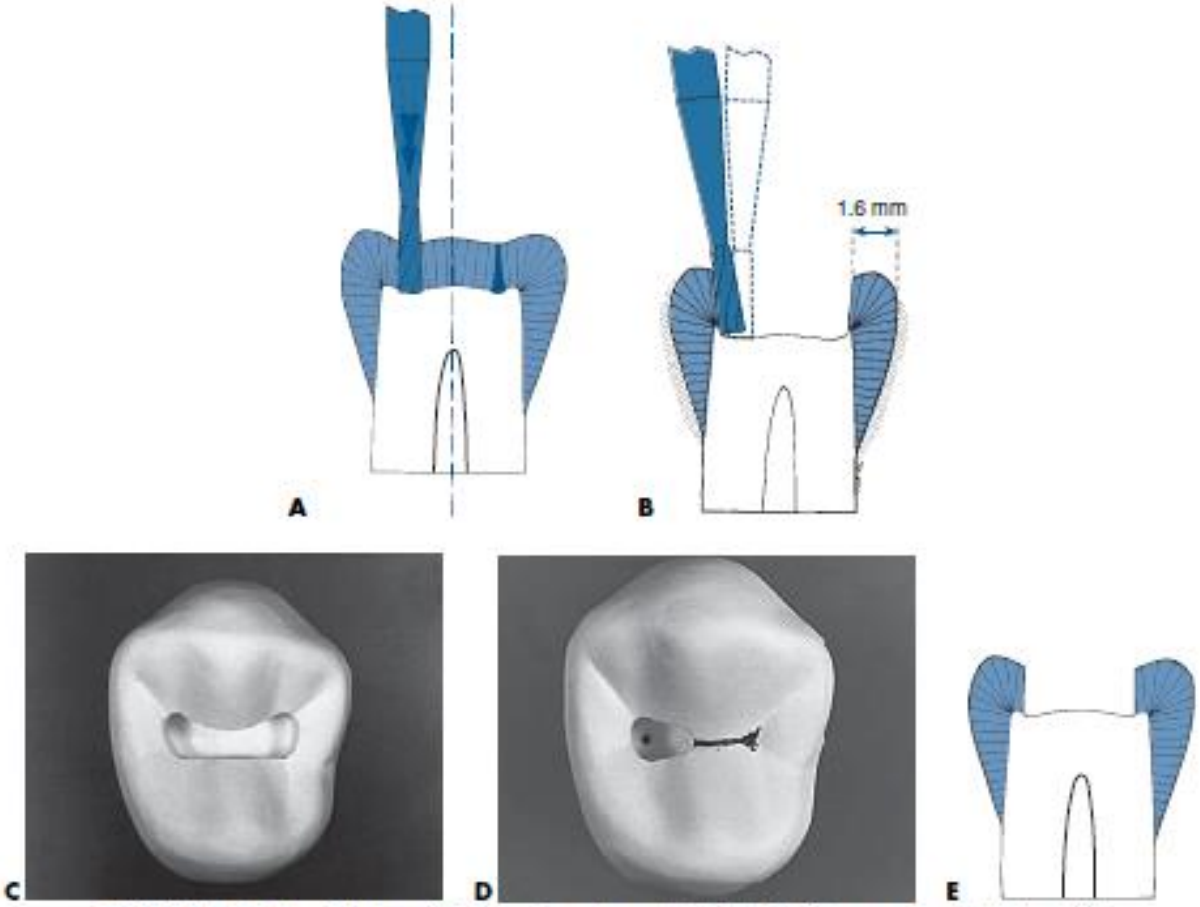


FIGURE 17-4 **A,** Enter pit with punch cut to a depth of 1.5 to 2 mm or one half to two thirds the head length of bur. (The 1.5-mm depth is measured at central fissure; the measurement of same entry cut [but of prepared external wall] is 2 mm.) **B,** Incline bur distally to establish proper occlusal divergence to distal wall to prevent removal of dentin supporting marginal ridge enamel when pulpal floor is in dentin, and distal extension is necessary to include a fissure or caries. For such an extension on premolars, the distance from margin to proximal surface (i.e., imaginary projection) must not be less than 1.6 mm (i.e., two diameters of end of bur). **C,** Occlusal view of initial tooth preparation that has mesial and distal walls that diverge occlusally. **D,** Distofacial and distolingual fissures that radiate from pit are included before extending along central fissure. **E,** Mesiodistal longitudinal section. Pulpal floors are generally flat, but may follow the rise and fall of occlusal surface.

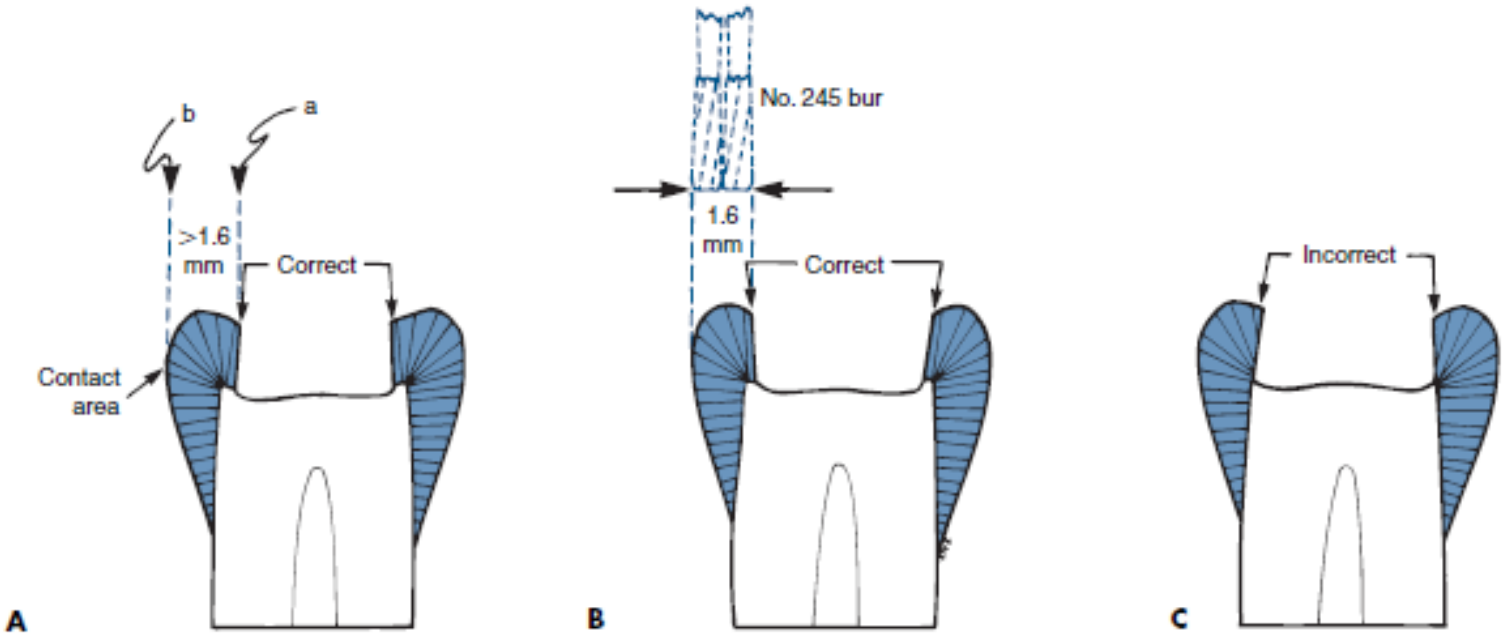


FIGURE 17-5 Direction of mesial and distal walls is influenced by remaining thickness of marginal ridge as measured from mesial or distal margin *(a)* to proximal surface (i.e., imaginary projection of proximal surface) *(b)*. **A,** Mesial and distal walls should converge occlusally when distance from *a* to *b* is greater than 1.6 mm. **B,** When operator judges that extension will leave only 1.6-mm thickness (two diameters of No. 245 bur) of marginal ridge (i.e., premolars) as illustrated here and in Fig. 17-4B and C, the mesial and distal walls must diverge occlusally to conserve ridge-supporting dentin. **C,** Extending mesial or distal wall to two-diameter limit without diverging wall occlusally undermines marginal-ridge enamel.

FIGURE 17-7 Mesiodistal longitudinal section showing example when pulpal floor is in dentin and caries is exposed after initial tooth preparation. The carious lesion is surrounded by sound dentin on the pulpal floor for resistance form.

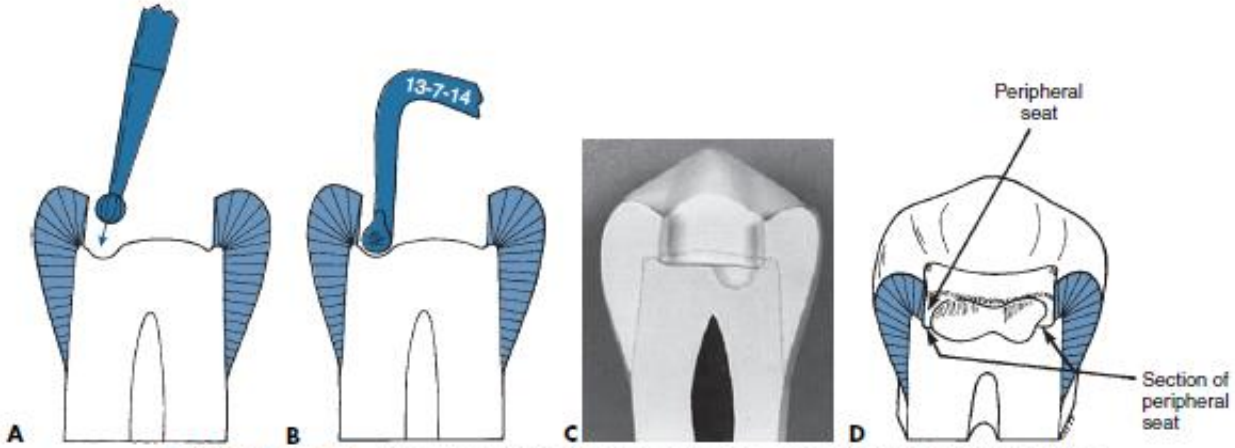
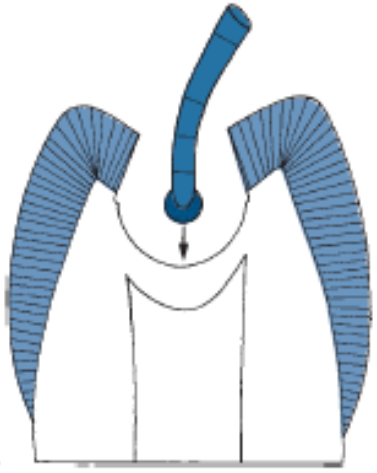
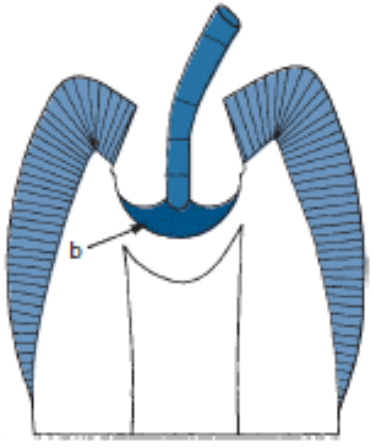


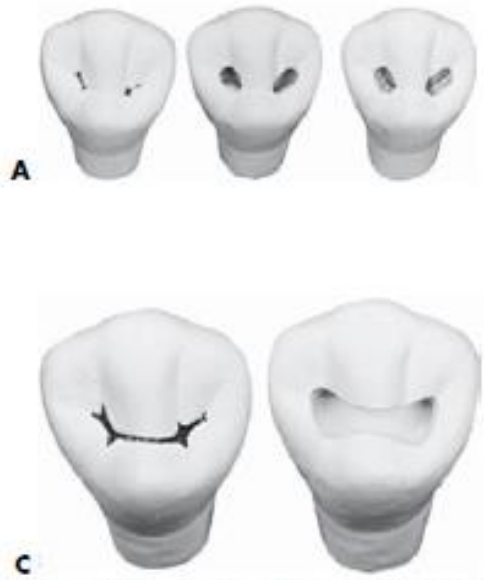
FIGURE 17-12 **A** and **B,** Removal of dentinal caries is accomplished with round burs **(A)** or spoon excavators **(B)**. **C** and **D,** Resistance form may be improved with flat floor peripheral to excavated area or areas.





A B

FIGURE 17-13 Base application. A, Inserting RMGI with Williams periodontal probe. **B,** In moderately deep excavations, a base *(b)* thickness of 0.5 to 0.75 mm is indicated.



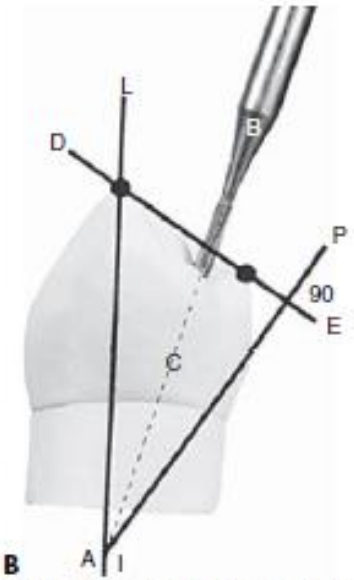


FIGURE 17-17 **A,** Preparation design and restoration of carious (or at risk for caries) occlusal pits on mandibular first premolar. **B,** Bur tilt for entry. Cutting instrument is held so that its long axis *(broken line, CI)* is parallel with bisector *(B)* of angle formed by long axis of tooth *(LA)* and line *(P)* that is perpendicular to plane *(DE)* drawn through facial and lingual cusp points. This dotted line *(CI)* is bur position for entry. **C,** Conventional outline, including occlusal pits and central fissure.

Extensive Class I amalgam preparation

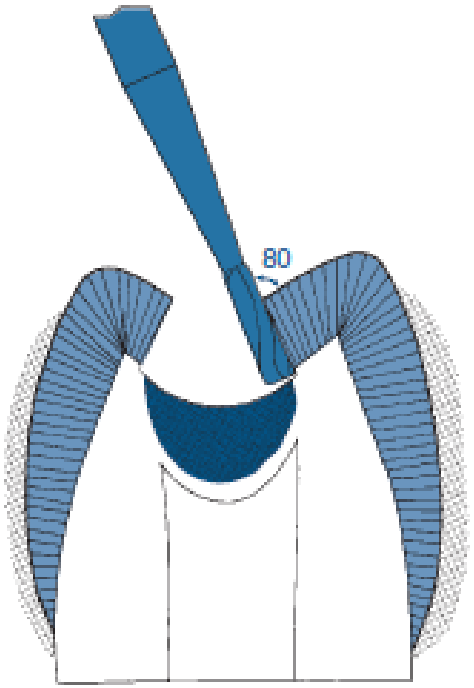


FIGURE 17-26 Initial tooth preparation with extensive caries. When extending laterally to remove enamel undermined by caries, alter the bur's long axis to prepare a 90- to 100-degree cavosurface angle. A 100-degree cavosurface angle on the cuspal incline results in an 80-degree marginal amalgam angle.

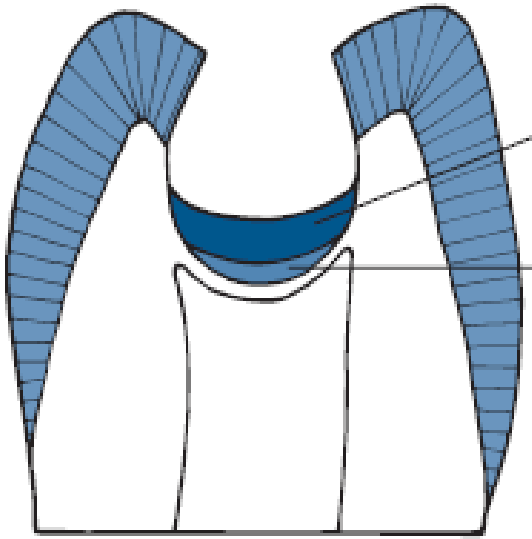
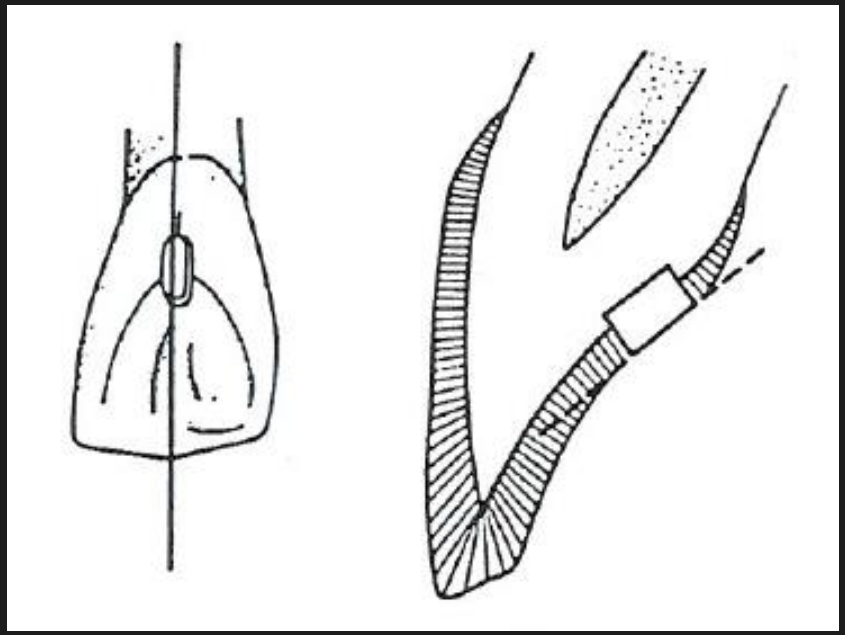


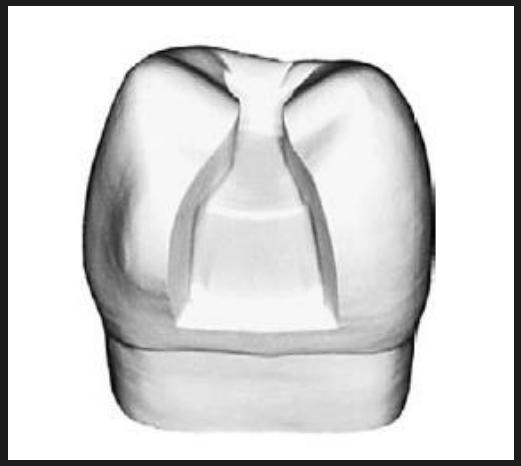
FIGURE 17-28 Placement of calcium hydroxide liner and RMGI base.

Foramen coecum laesions of upper incisors

- Axial wall depth is 0.2mm inside the DEJ
- Axiopulpal wall is parallel to the external enamel surface



Class II amalgam preparation



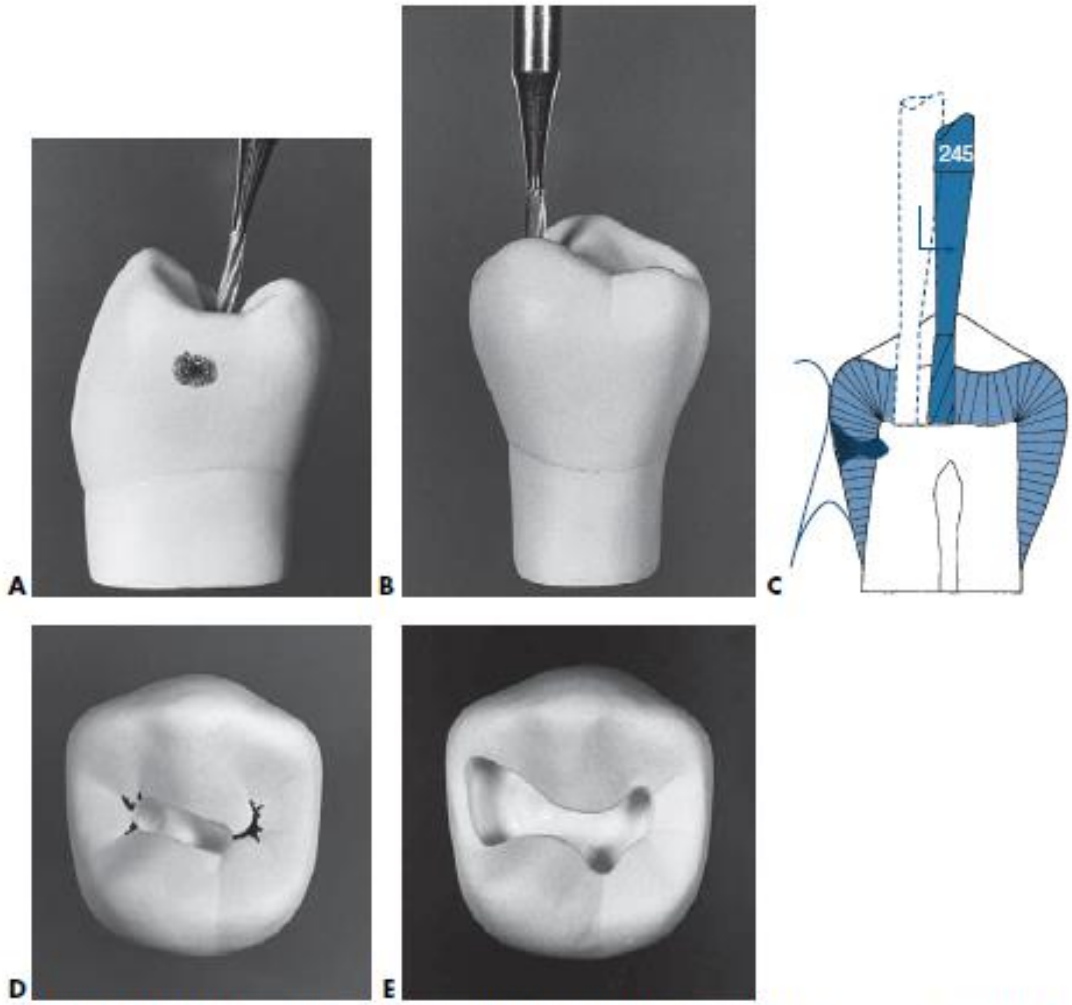


FIGURE 17-41 Entry and occlusal step. A, Bur position for entry, as viewed proximally. Note slight lingual tilt of bur. **B,** Bur position as viewed lingually. **C,** Enter tooth with punch cut and extend distally along central fissure at uniform depth of 1.5 to 2 mm (1.5 mm at fissure; because of inclination of unprepared tooth surface, corresponding measurement on prepared wall is greater). **D,** Occlusal view of **C**. **E,** Completed occlusal step.

FIGURE 17-42 **Visualize final location of proximo-occlusal margins *(dotted lines)* before preparing proximal box.**

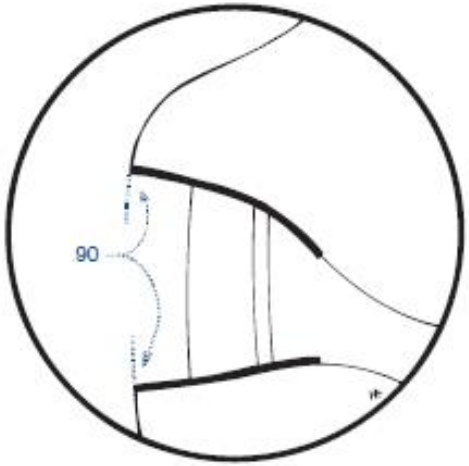


FIGURE 17-43 **Reverse curve in occlusal outline usually is created when mesiofacial enamel wall is parallel to enamel rod direction.** Lingually, reverse curve is very slight, often unnecessary.

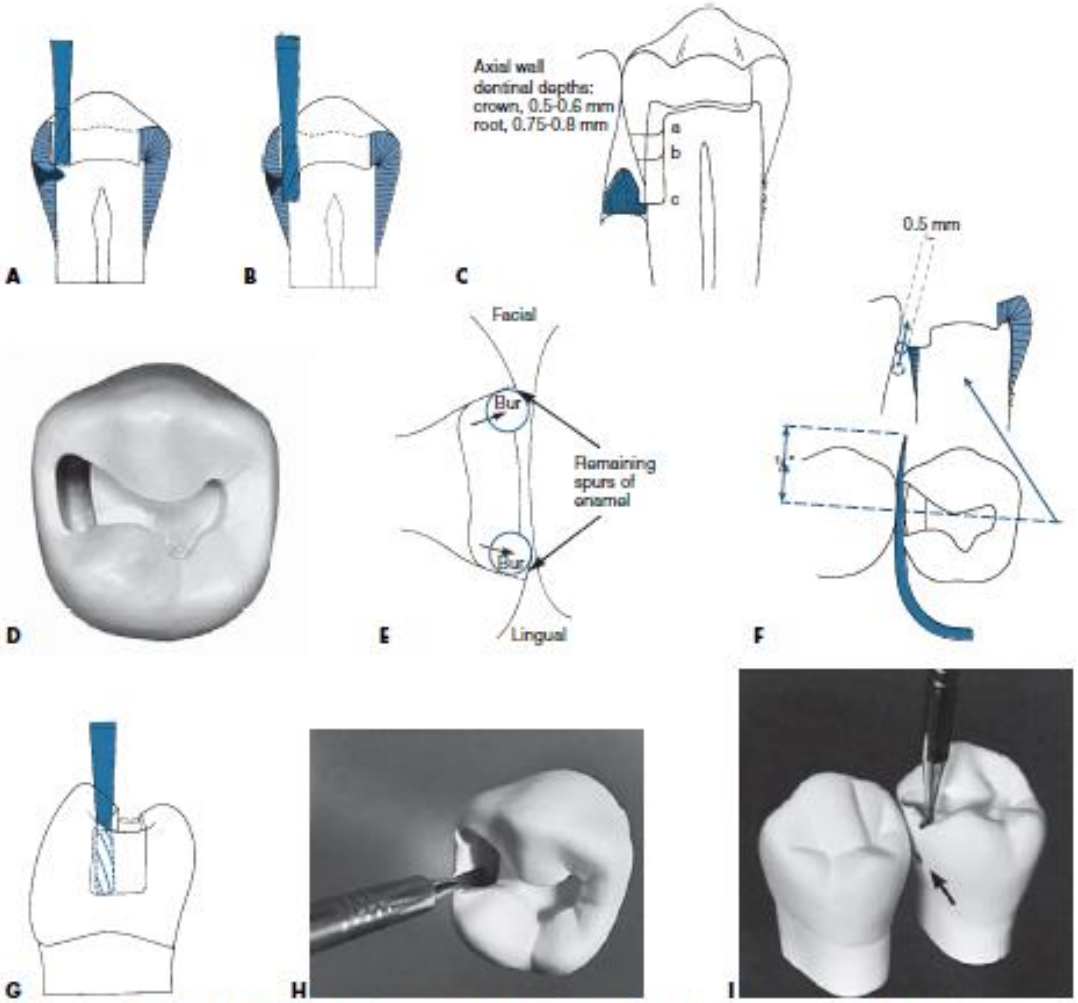


FIGURE 17-44 **Isolation of proximal enamel. A,** Bur position to begin proximal ditch cut. **B,** Proximal ditch is extended gingivally to desired level of gingival wall (i.e., floor). **C,** Variance in pulpal depth of axiogingival line angle as extension of gingival wall varies: *a,* at minimal gingival extension; *b,* at moderate extension; *c,* at extension that places gingival margin in cementum, whereupon pulpal depth is 0.75 to 0.8 mm and bur may shave side of wedge. **D,** Proximal ditch cut results in axial wall that follows outside contour of proximal surface. **E,** Position of proximal walls (i.e., facial, lingual, gingival) should not be overextended with No. 245 bur, considering additional extension provided by hand instruments when remaining spurs of enamel are removed. **F,** When small lesion is prepared, gingival margin should clear adjacent tooth by only 0.5 mm. This clearance may be measured with side of explorer. The diameter of the tine of a No. 23 explorer is 0.5 mm, $\frac{1}{4}$ inch (6.3 mm) from its tip. **G,** Faciolingual dimension of proximal ditch is greater at gingival than at occlusal level. **H,** To isolate and weaken proximal enamel further, bur is moved toward and perpendicular to proximal surface (parallel to direction of enamel rods). **I,** Side of bur may emerge slightly through proximal surface at level of gingival floor *(arrow)*.

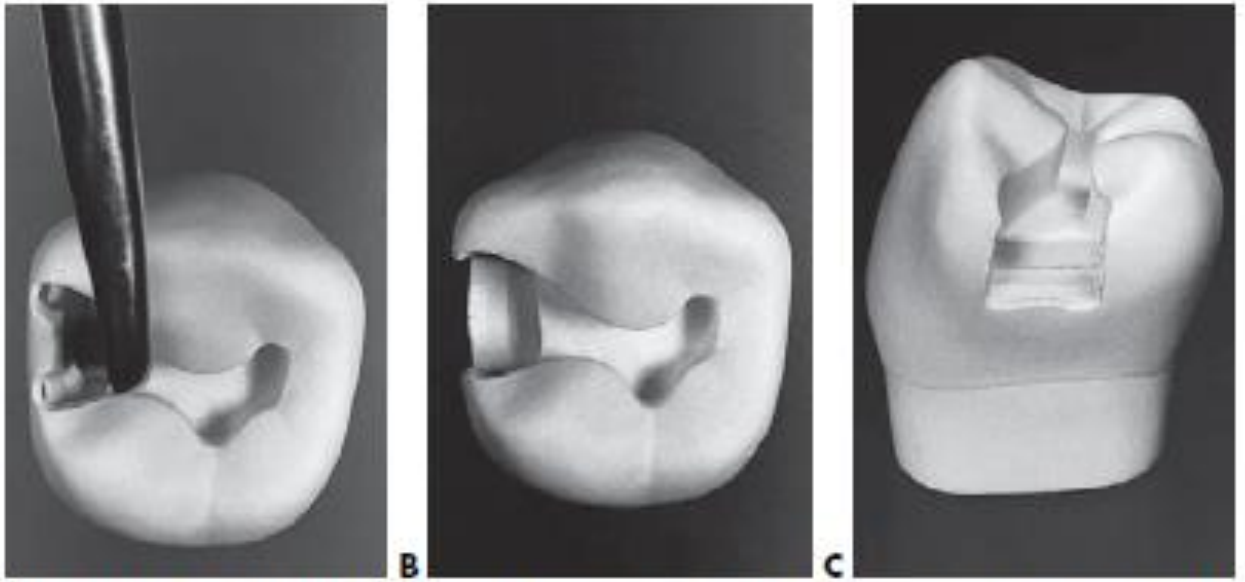


FIGURE 17-45 Removing isolated enamel. A, Using spoon excavator to fracture out weakened proximal enamel. **B,** Occlusal view with proximal enamel removed. **C,** Proximal view with proximal enamel removed.

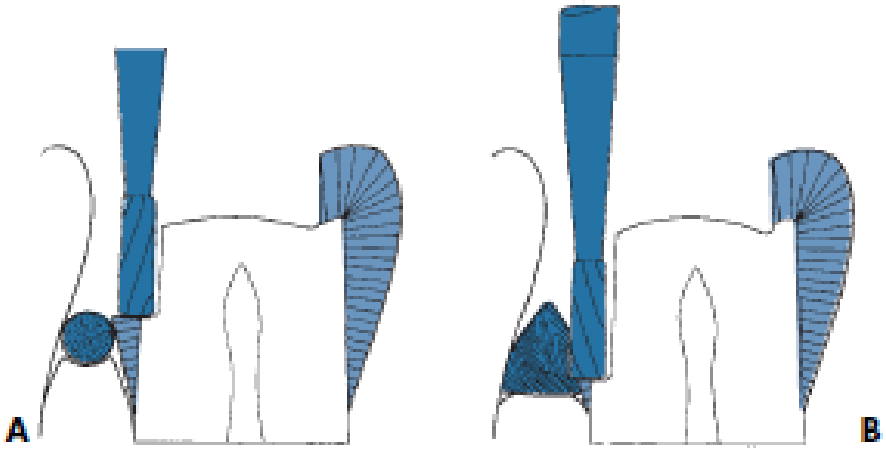


FIGURE 17-46 Wedging. A, Round toothpick wedge placed in gingival embrasure protects gingiva and rubber dam during preparation of proximal box. **B,** Triangular wedge is indicated when deep gingival extension of proximal box is anticipated because wedge's greatest cross-sectional dimension is at its base. Consequently, it more readily engages the remaining clinical tooth surface.

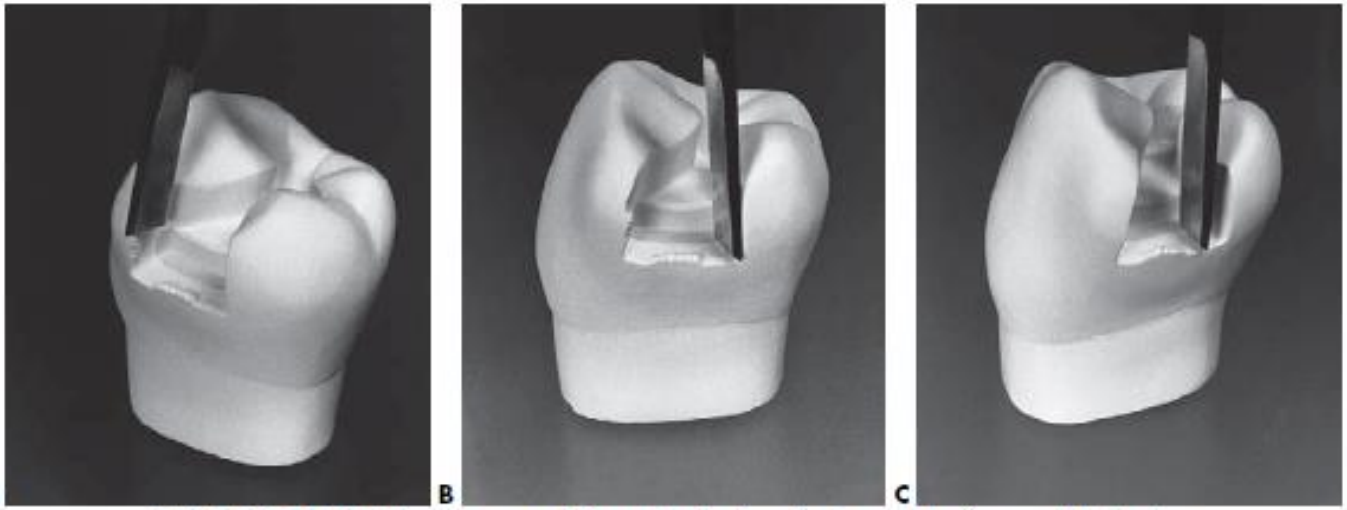


FIGURE 17-47 Removing remaining undermined proximal enamel with enamel hatchet on facial proximal wall **(A)**, lingual proximal wall **(B)**, and gingival wall **(C)**.

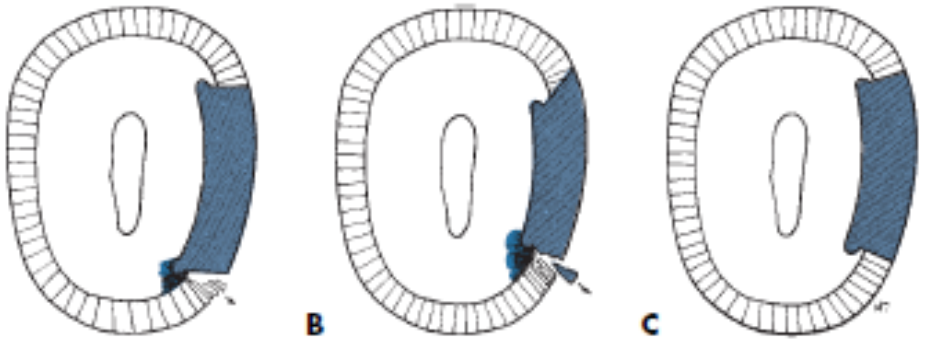


FIGURE 17-48 Direction of mesiofacial and mesiolingual walls. A, Failure caused by weak enamel margin. **B,** Failure caused by weak amalgam margin. **C,** Proper direction to proximal walls results in full-length enamel rods and 90-degree amalgam at preparation margin. Retention locks have been cut 0.2 mm inside DEJ, and their direction of depth is parallel to DEJ.

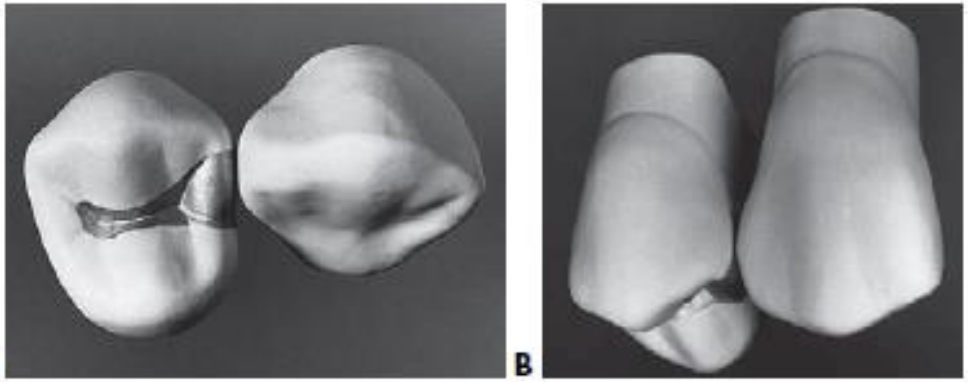


FIGURE 17-60 To produce inconspicuous margin on maxillary first premolar, mesiofacial wall does not diverge gingivally, and facial extension with a No. 245 bur should be minimal so that mesiofacial proximal margin of preparation minimally clears the contact as margin is finished. **A,** Occlusal view. **B,** Facial view.

FIGURE 17-53 Beveling axiopulpal line angle.

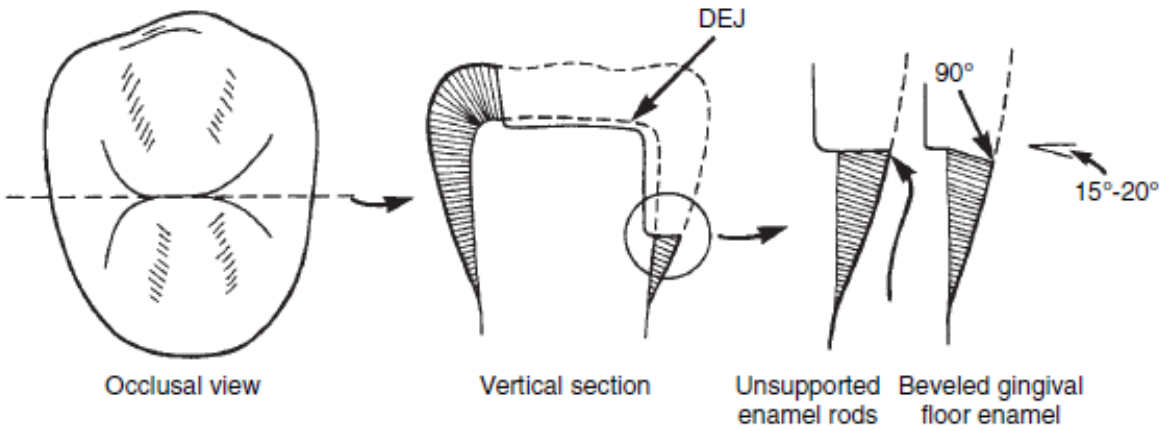


FIGURE 6-33 Vertical section of Class II tooth preparation. Gingival floor enamel (and margin) is unsupported on dentin and friable unless removed.

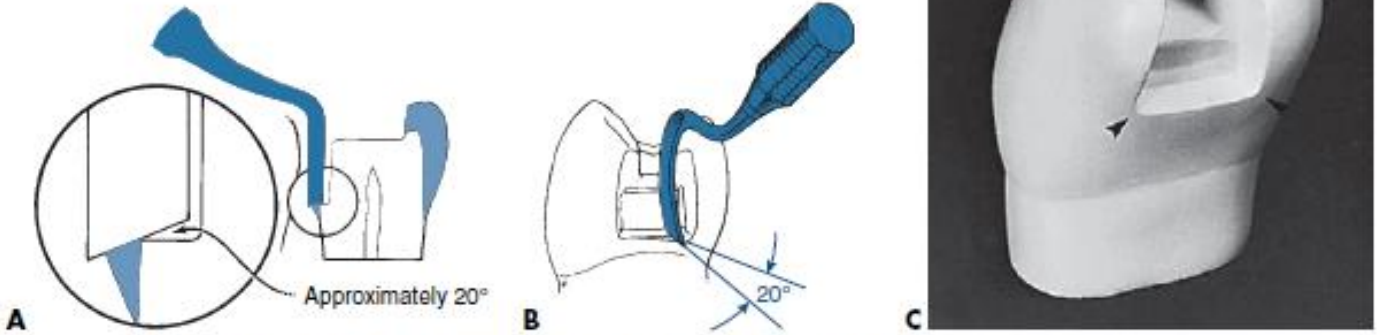


FIGURE 17-56 **A,** Bevel of enamel portion of gingival wall is established with gingival margin trimmer to ensure full-length enamel rods forming gingival margin. **B** and **C,** Sharp angles at linguogingival and faciogingival corners are rounded by rotational sweep with gingival margin trimmer.

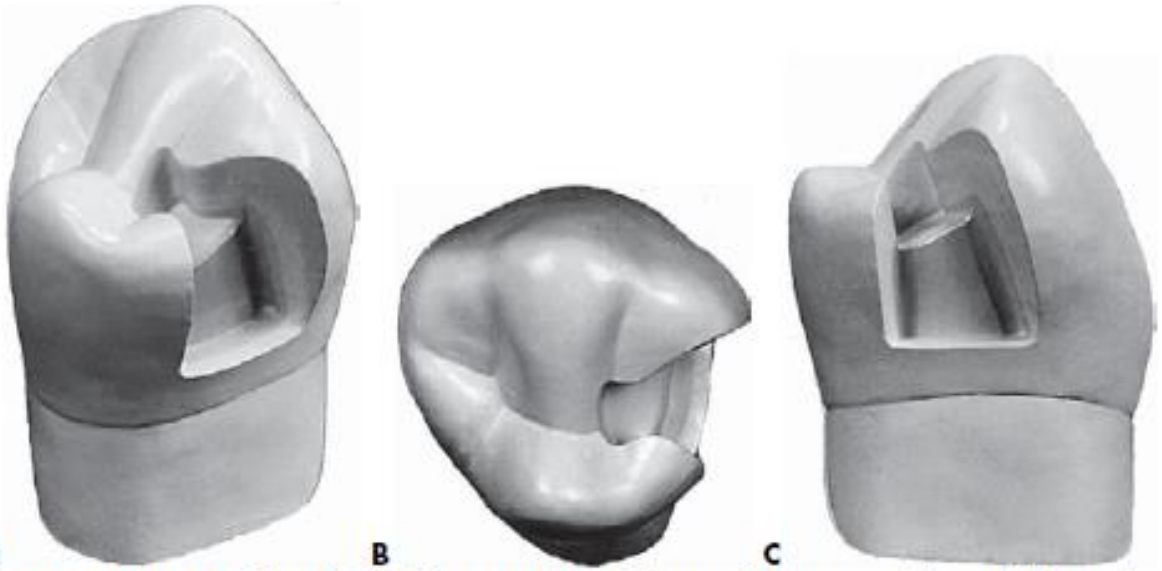


FIGURE 17-58 Mandibular first premolar with sound transverse ridge. A, Two-surface tooth preparation that does not include opposite pit. **B,** Occlusal outline form. **C,** Proximal view of completed preparation.

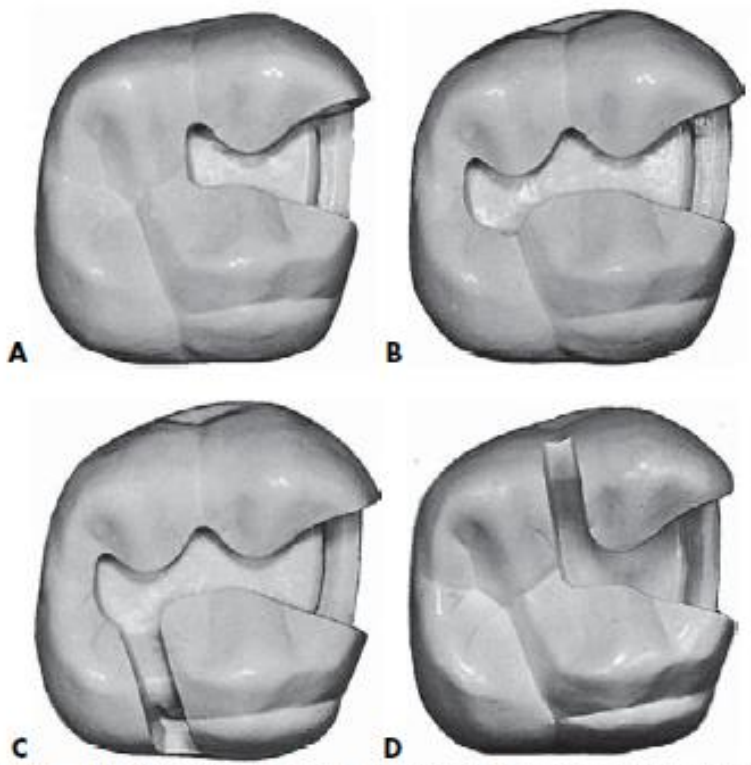
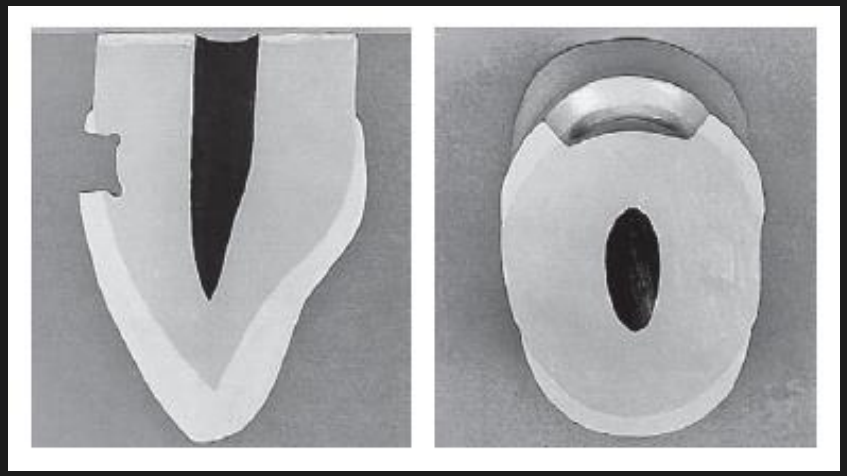


FIGURE 17-59 Maxillary first molar. A, Conventional mesio-occlusal preparation. **B,** Mesio-occlusal preparation extended to include distal pit. **C,** Mesio-occlusolingual preparation, including distal pit and distal oblique and lingual fissures. **D,** Mesio-occlusal preparation with facial fissure extension.

Class V amalgam preparation

- Axial wall depth is 0.2mm inside the DEJ
- Axial wall depth is 0.5mm inside the DEJ when secondary retention features are placed
- Axiopulpal wall follows the curvature of the tooth surface
- Retention is provided by the pulpal divergency of the occlusal (incisal) and gingival walls



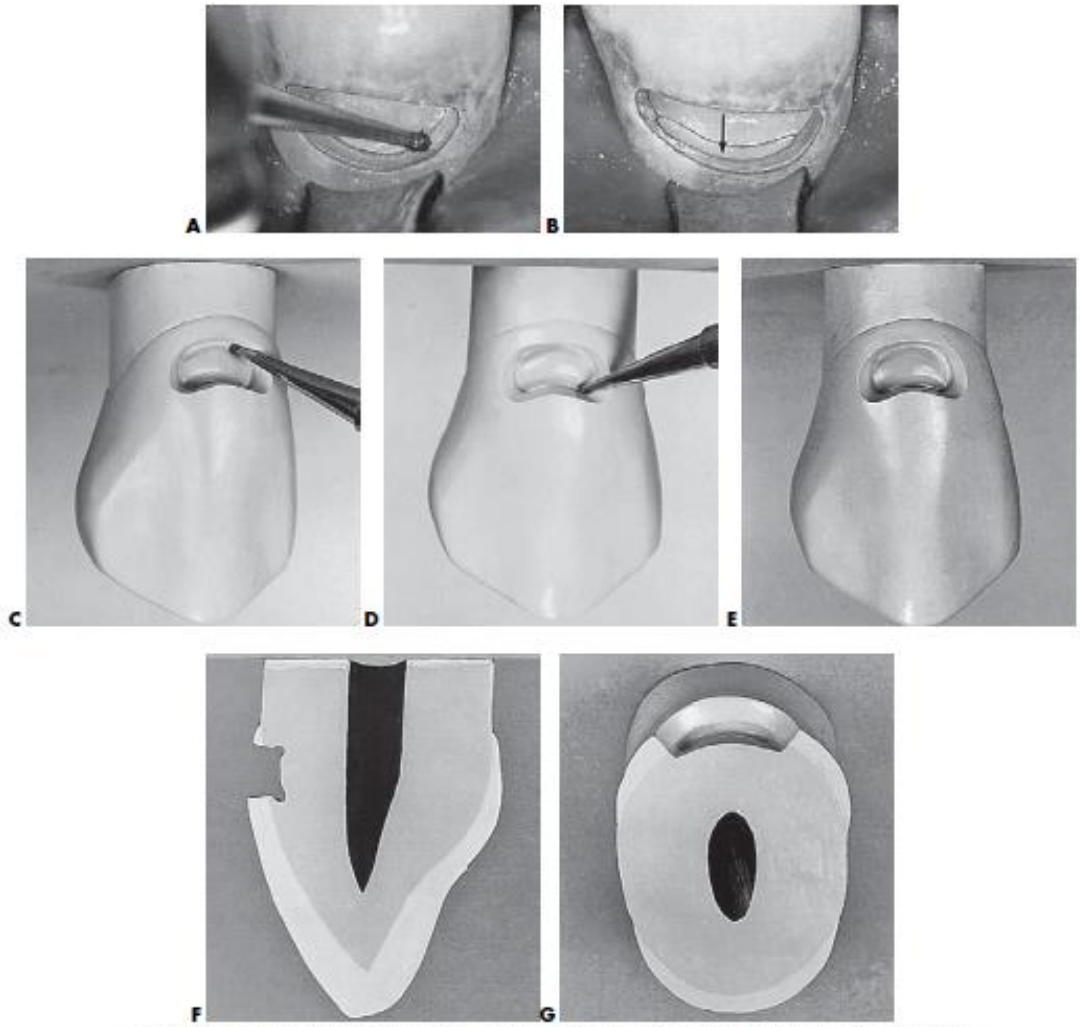


FIGURE 18-31 Retention form. A, A No. ¼ bur positioned to prepare gingival retention groove. **B,** Gingival retention groove *(arrow)* prepared along gingivoaxial line angle generally to bisect the angle formed by the gingival and axial walls. Ideally, the direction of preparation is slightly more gingival than pulpal. An incisal retention groove is prepared along incisoaxial line angle and directed similarly. **C** and **D,** Groove is placed with No. ¼ bur along gingivoaxial and incisoaxial line angles 0.2 mm inside DEJ and 0.25 mm deep. Note slight pulpal inclination of shank of No. ¼ bur. **E,** Facial view. **F,** Incisogingival section. Grooves depthwise are directed mostly incisally (gingivally) and slightly pulpally. **G,** Mesiodistal section.

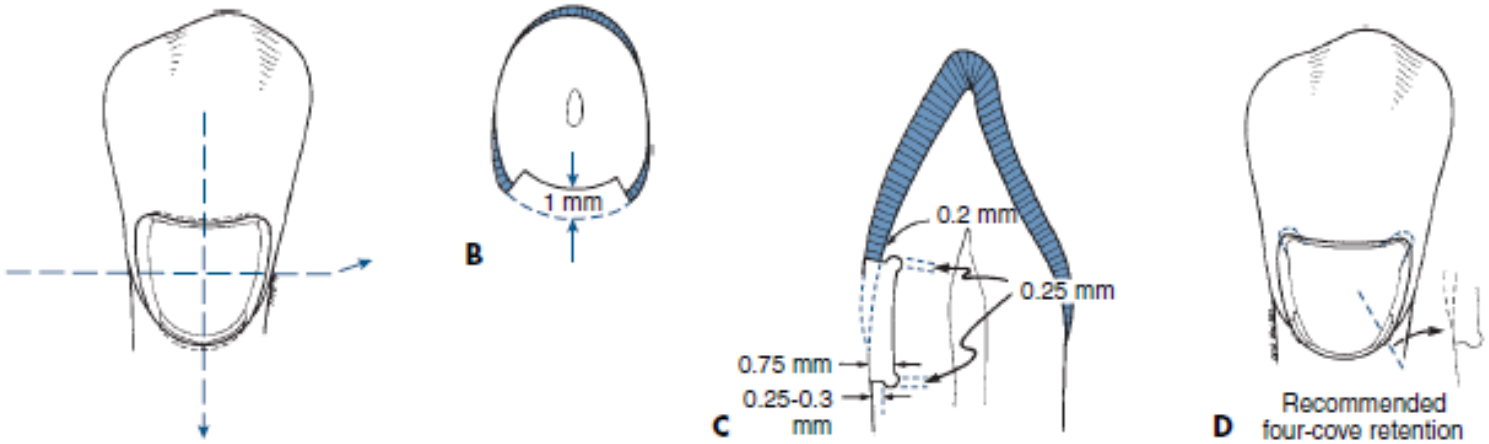


FIGURE 18-32 **A-C,** Extended Class V tooth preparation **(A)** with axial wall after DEJ contour mesiodistally **(B)** and incisogingivally **(C)**. Axial wall pulpal depth is 1 mm in crown and 0.75 mm in root. In addition, note location and direction depth (0.25 mm) of retention grooves and dimension of gingival wall (0.25 mm) from root surface to retention groove. **D,** Large Class V preparation with retention coves prepared in the four axial point angles.

Thank you for your kind attention!