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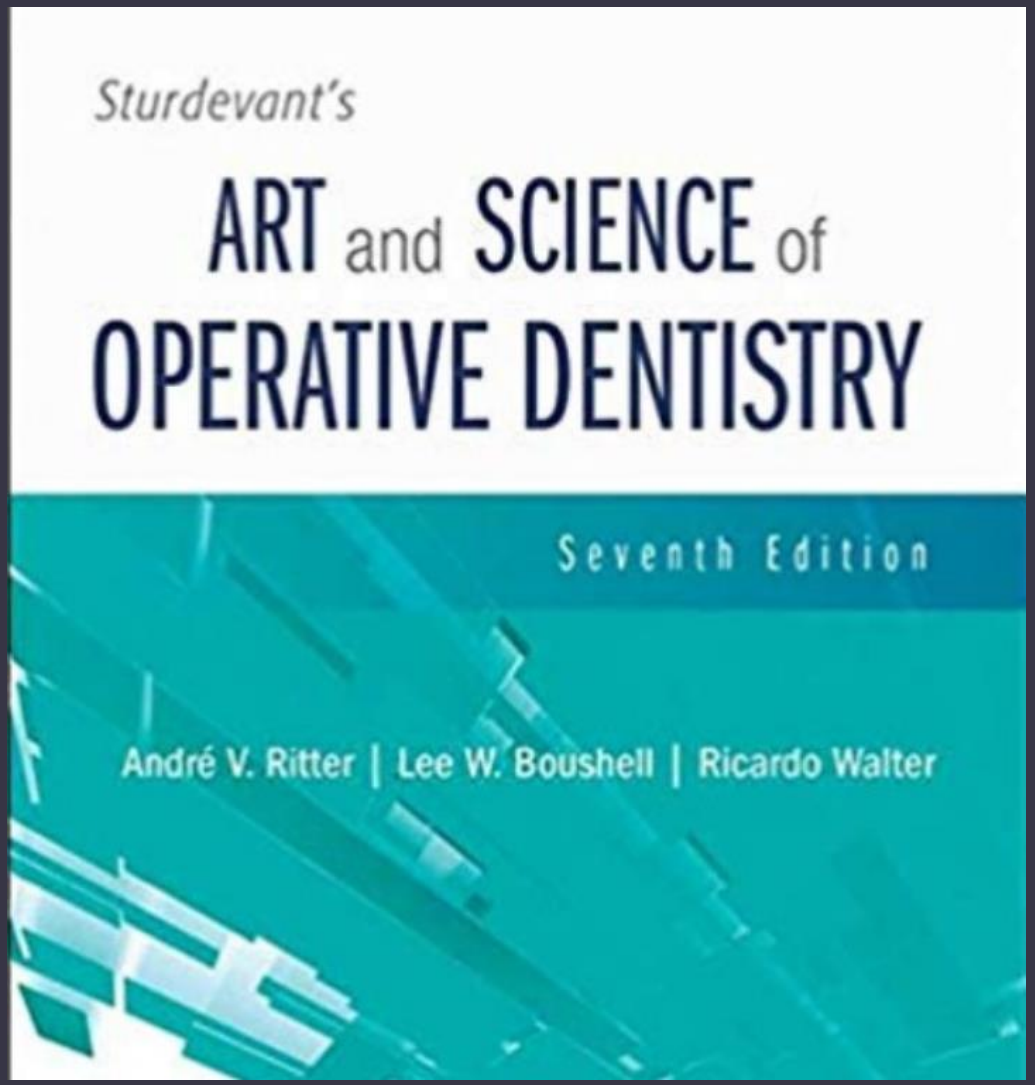


Your Text Book

What is Operative Dentisrty?

- It is the art and science of the diagnosis, treatment and prognosis of defects of teeth that do not require full coverage restorations for correction, only a partial replacement.

- The treatment should result in a tooth with a proper form, esthetics and function. While maintaining the physiological integrity of teeth with harmonious relationship with the adjacent soft and hard tissue.

Operative Dentistry

Operative dentistry is recognized as the foundation of dentistry and the base from which most other aspects have evolved.

Operative or Conservative Dentistry?

History

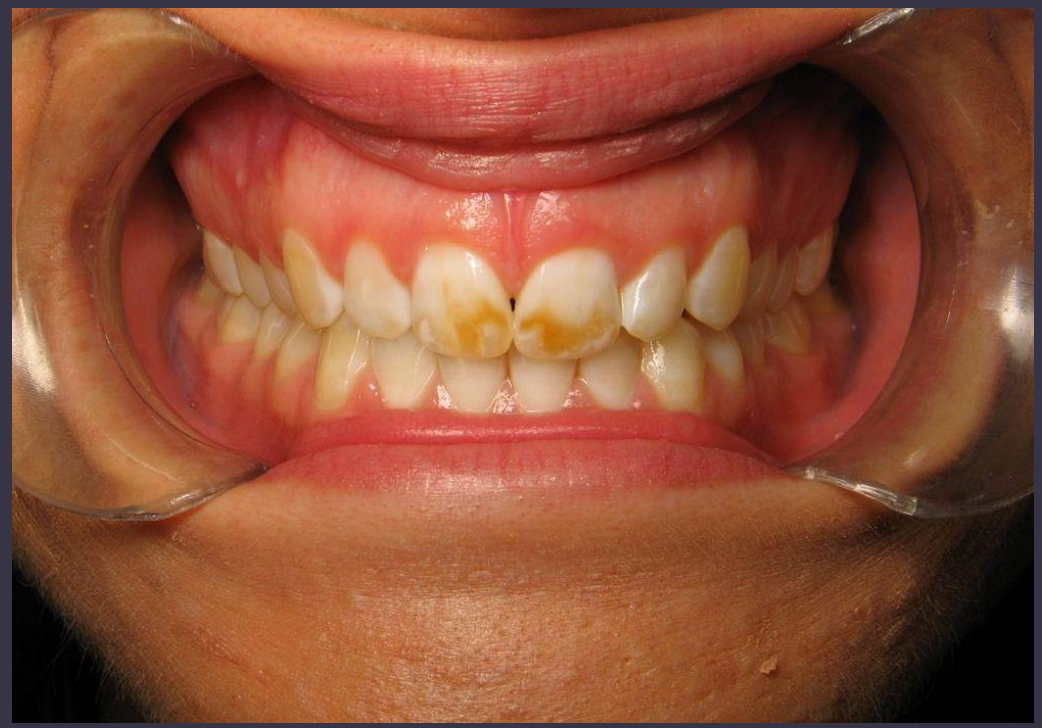
In 1867, Harvard University established the first dental program

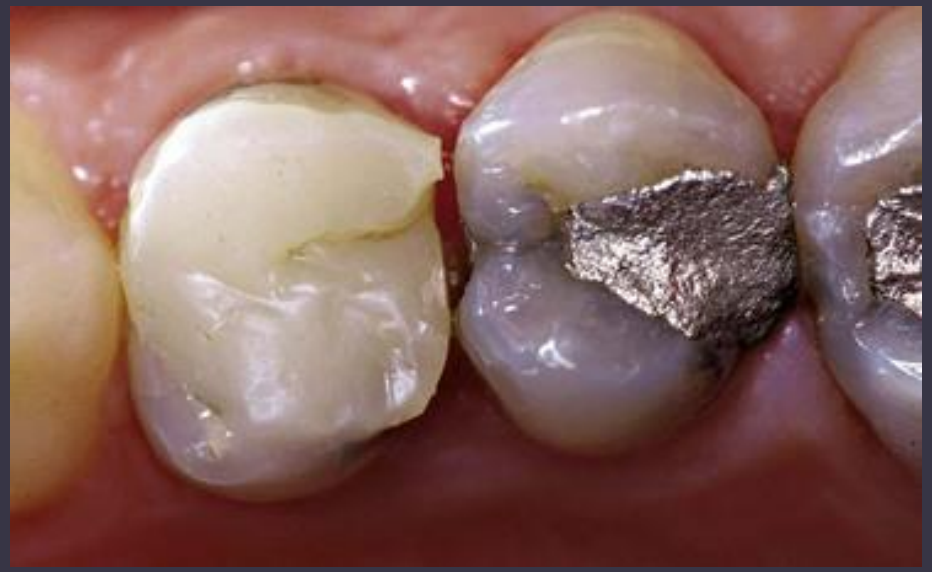
G. V. Black gave the foundation for the dental profession

The scope of operative dentistry has evolved from the treatment of carries/cavities with fillings to mechanically alter the tooth (tooth preparation) to receive a restoration (Filling)

Indications

1. Carries
2. Malformed, discolored or fractures teeth
3. Restoration replacement or repair

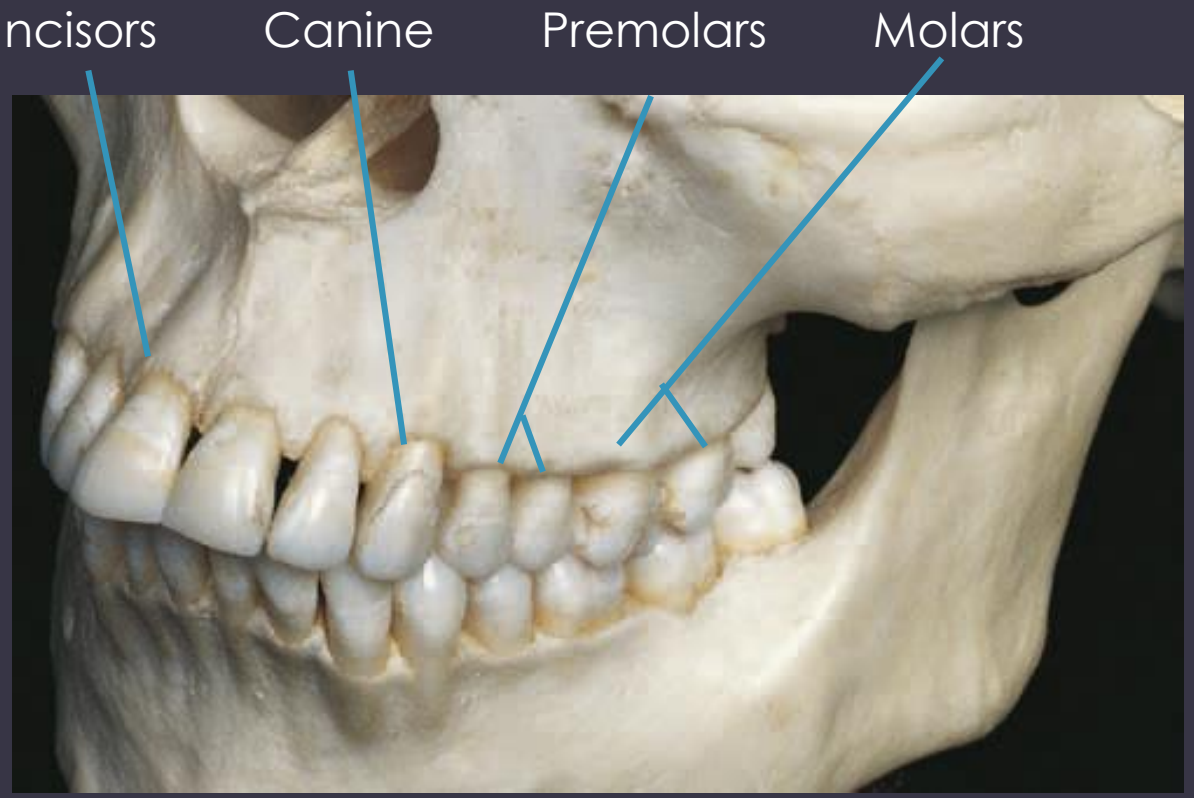


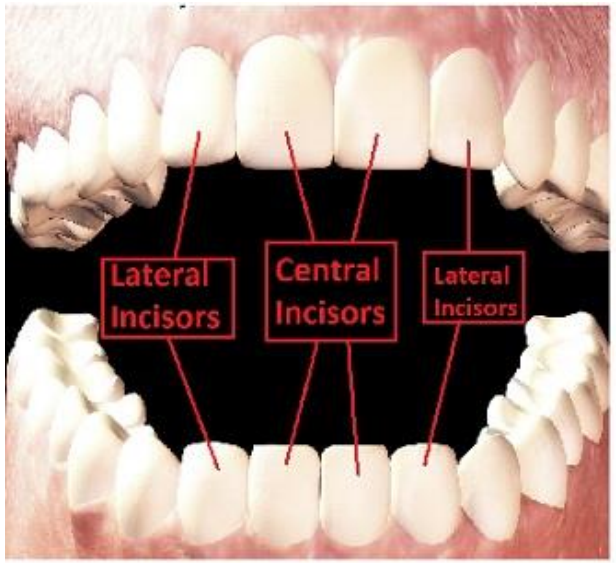


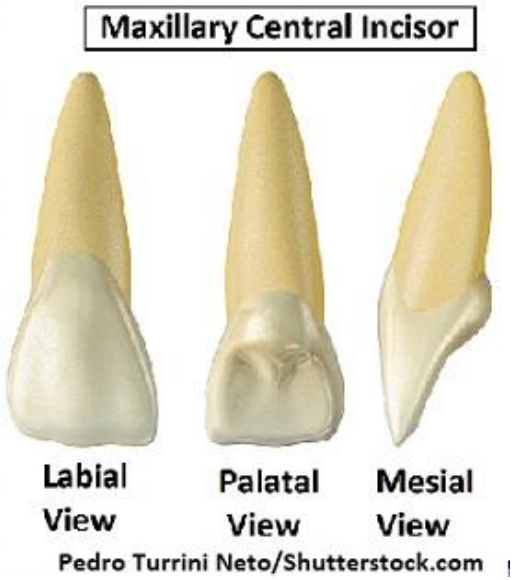
Dental Anatomy and Terminology

Human Teeth: Form and Function

- Incisors
- Canines
- Premolars
- Molars

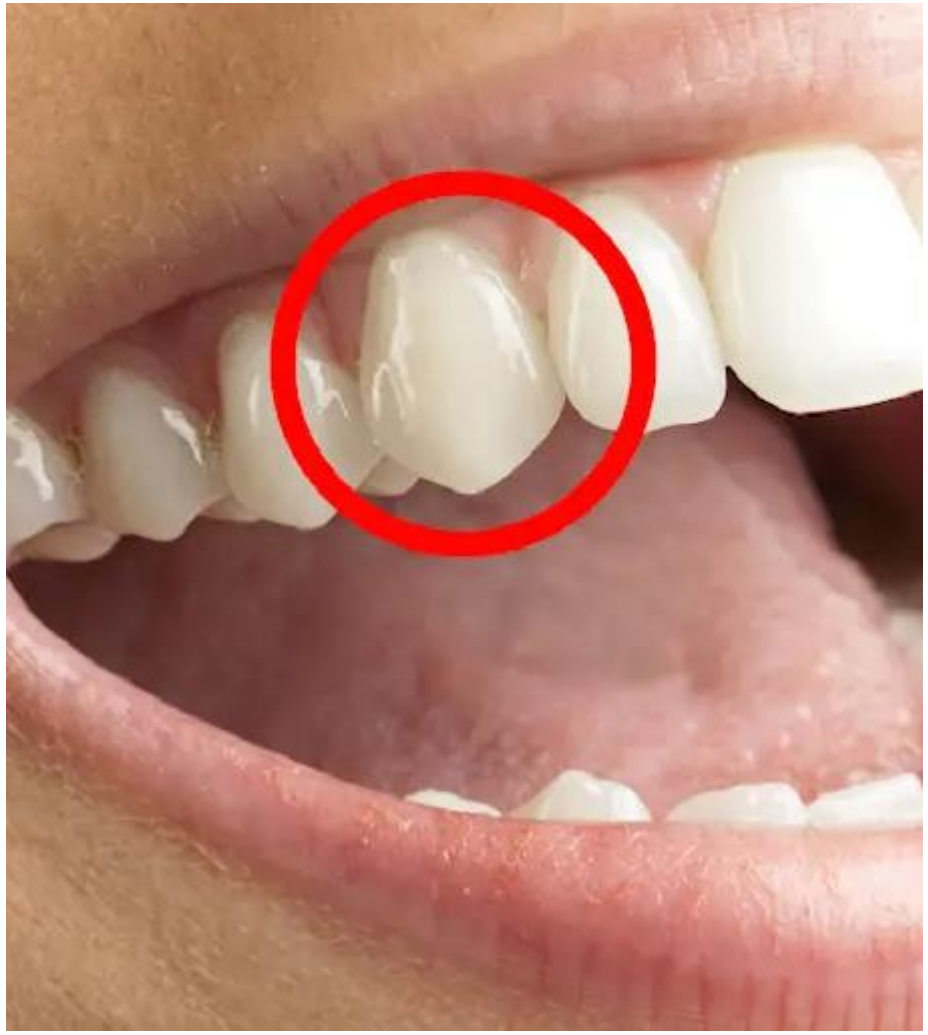






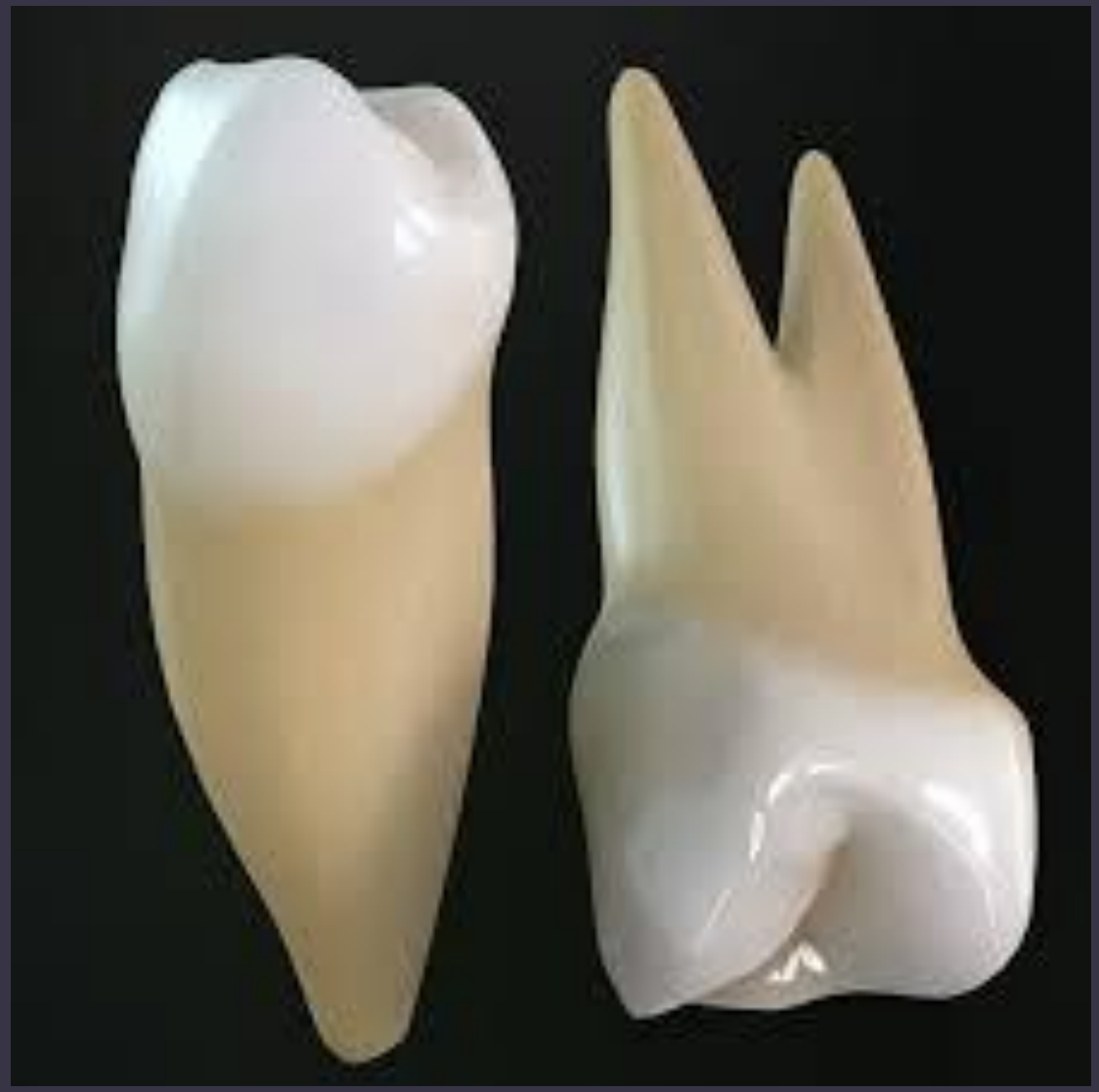
Incisors

- are essential for Incising (cutting) food, esthetics of the smile, facial soft tissue contours (lip support), and speech (phonetics).



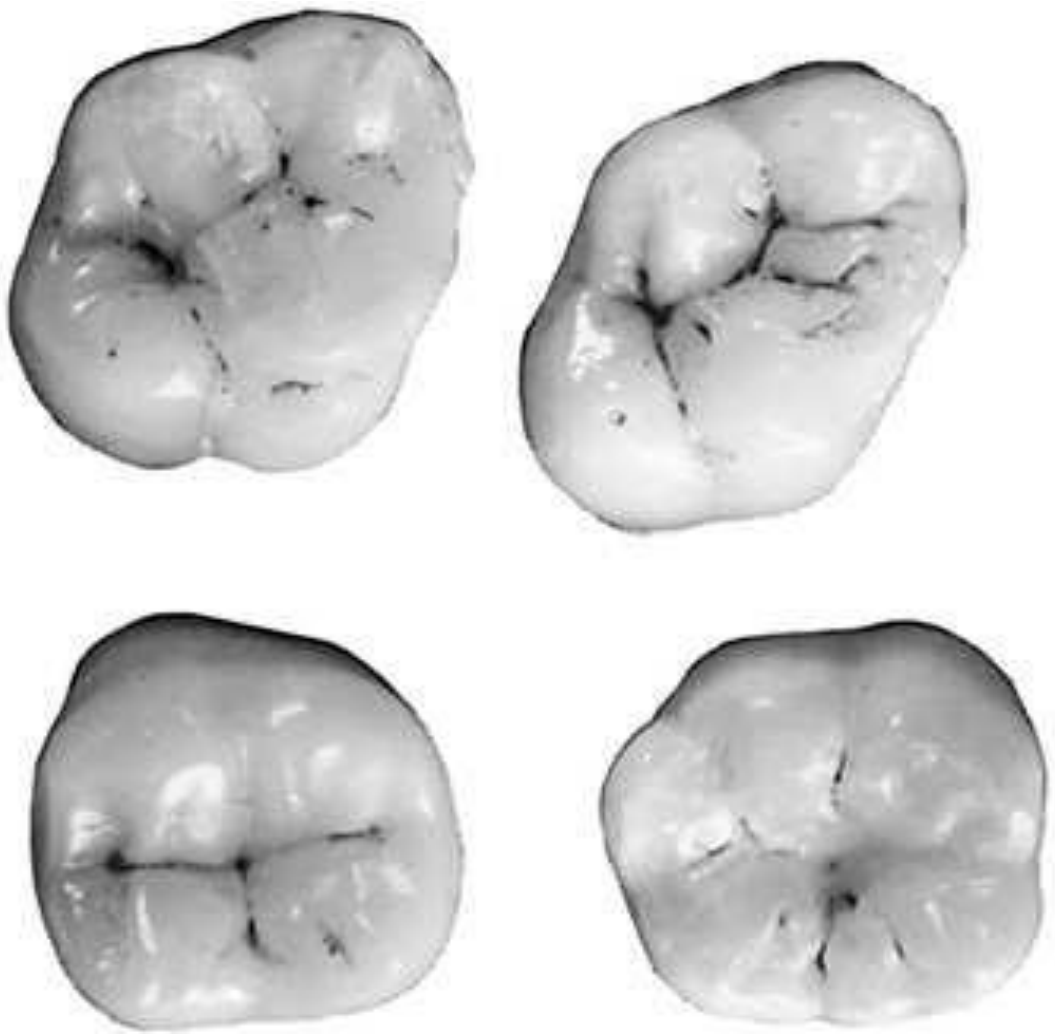
Canines

- Canines possess the longest roots of all teeth and are located at the corners of the dental arches. hey function in the piercing, tearing, and cutting of food.
- play a crucial role (along with the incisors) in the esthetics of the smile and lip support



Premolars

- Premolars serve a dual role: They are similar to canines in the tearing of food, and they are similar to molars in the grinding of food.

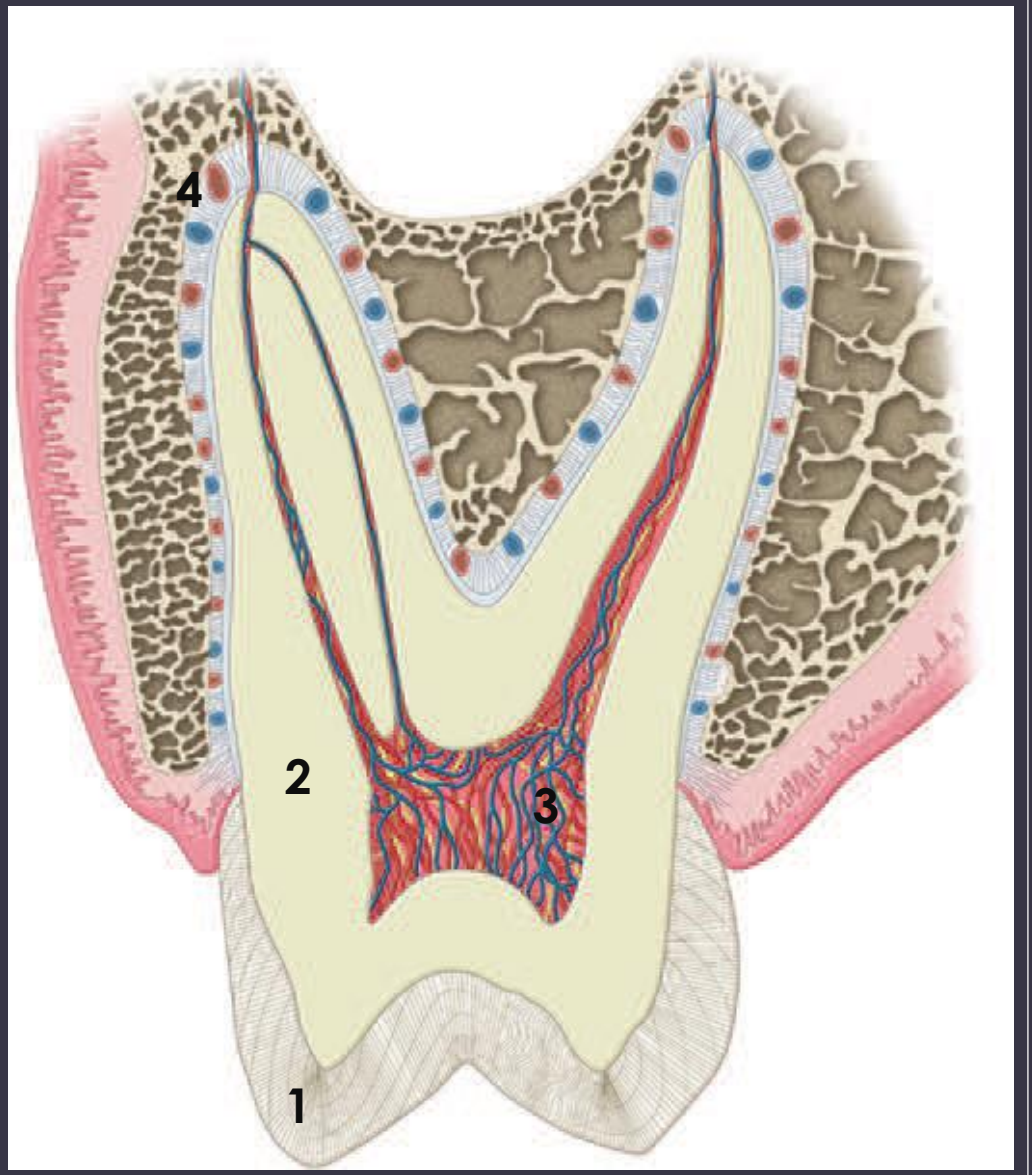


Molars

- Molars are large, multicusped, strongly anchored teeth located nearest the temporomandibular joint (TMJ), which serves as the fulcrum during function.
- hense teeth have a major role in the crushing, grinding, and chewing of food to dimensions suitable for swallowing.
- They are well suited for this task because they have broad occlusal surfaces.

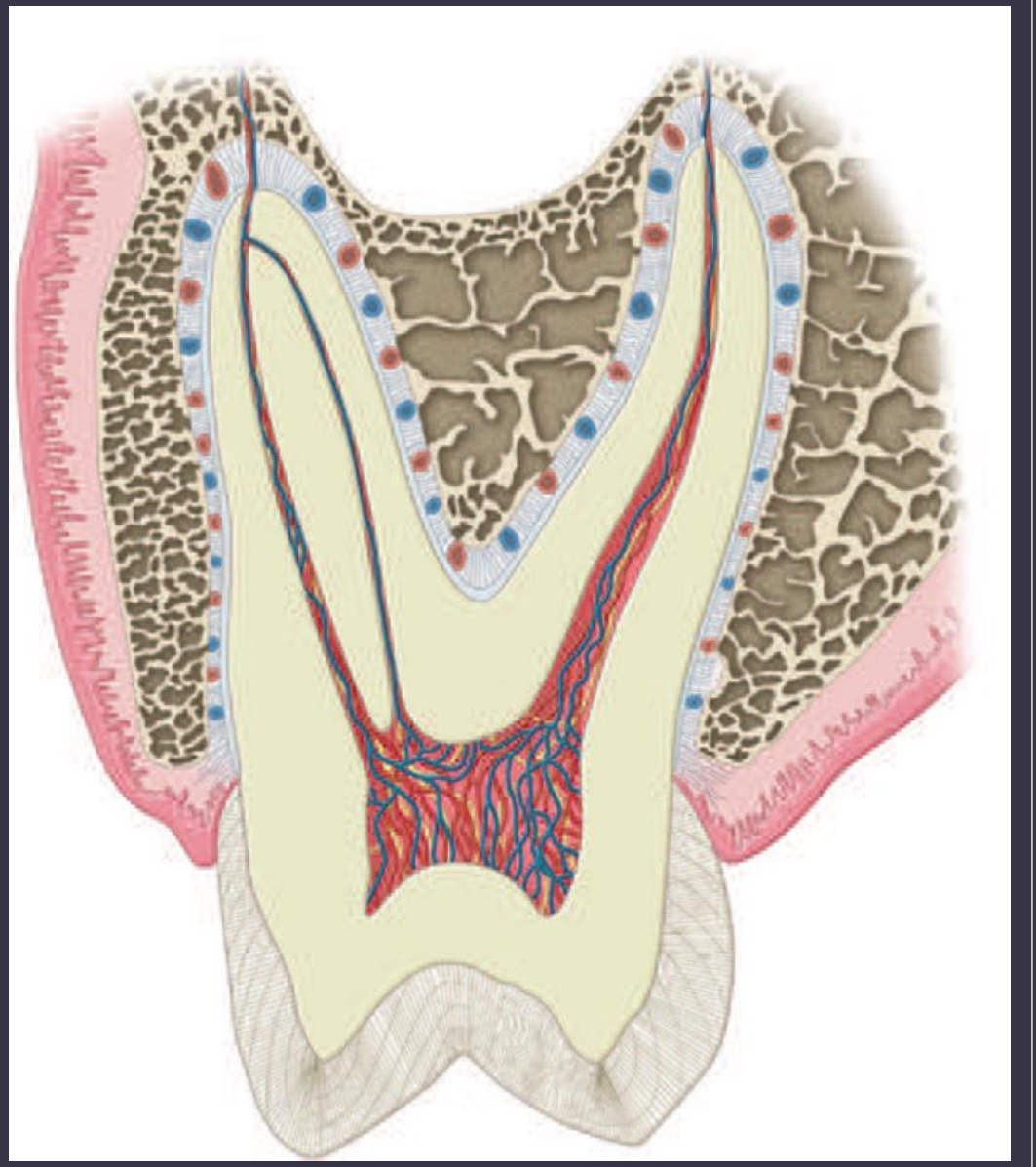
Structures of Teeth

1. Enamel
2. Dentine
3. Pulp
4. Cementum



Enamel

- Enamel formation, ***amelogenesis***, is accomplished by cells called ***ameloblasts***. These cells originate from the embryonic germ layer known as ectoderm.
- Enamel covers the anatomic crown of the tooth, varies in thickness in different areas.
- securely attached to the dentin by the dentino-enamel junction (DEJ)



Enamel

- It is thicker at the incisal and occlusal areas of the crown and becomes progressively thinner until it terminates at the cementoenamel junction (CEJ).

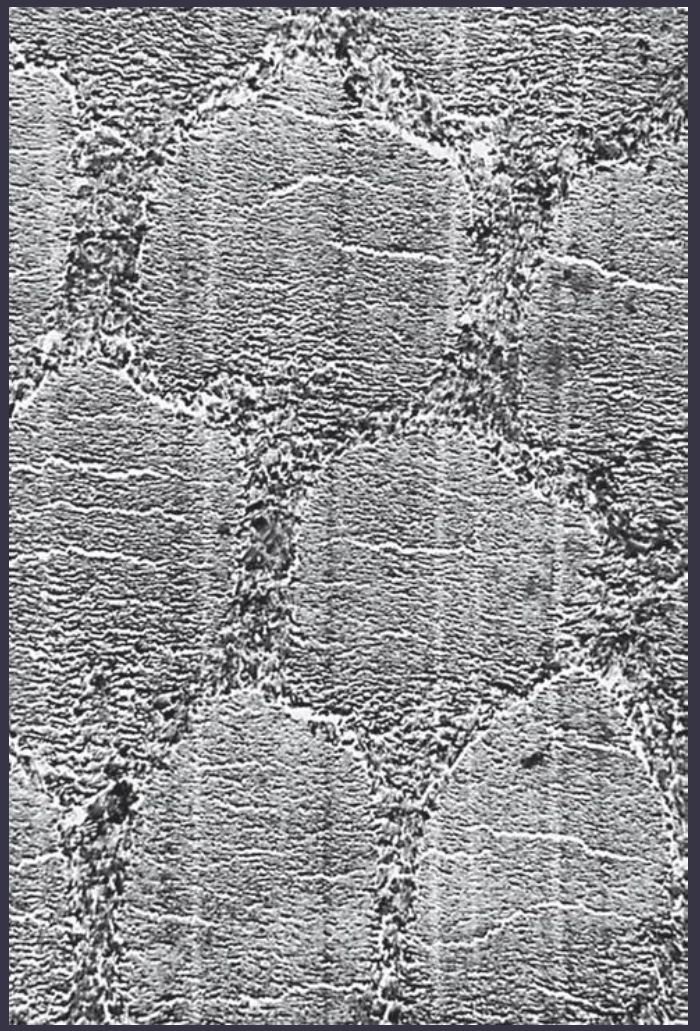
- The thickness also varies from one class of tooth to another, averaging:

1. 2 mm at the incisal ridges of incisors
2. 2.3 to 2.5 mm at the cusps of premolars
3. 2.5 to 3 mm at the cusps of molars

Enamel

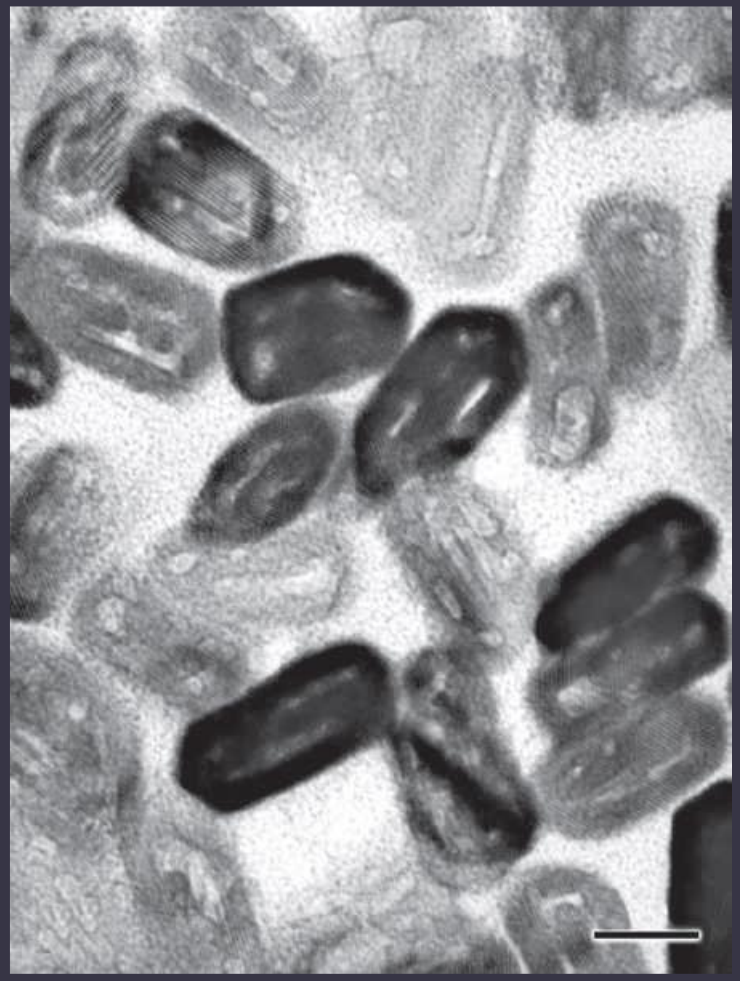
- Chemically, enamel is a highly mineralized crystalline structure.
- ***Hydroxyapatite***, in the form of a crystalline lattice, is the largest mineral constituent (90%–92% by volume).
- The remaining constituents of tooth enamel include organic matrix proteins (1%–2%) and water (4%–12%) by volume

Enamel Rods

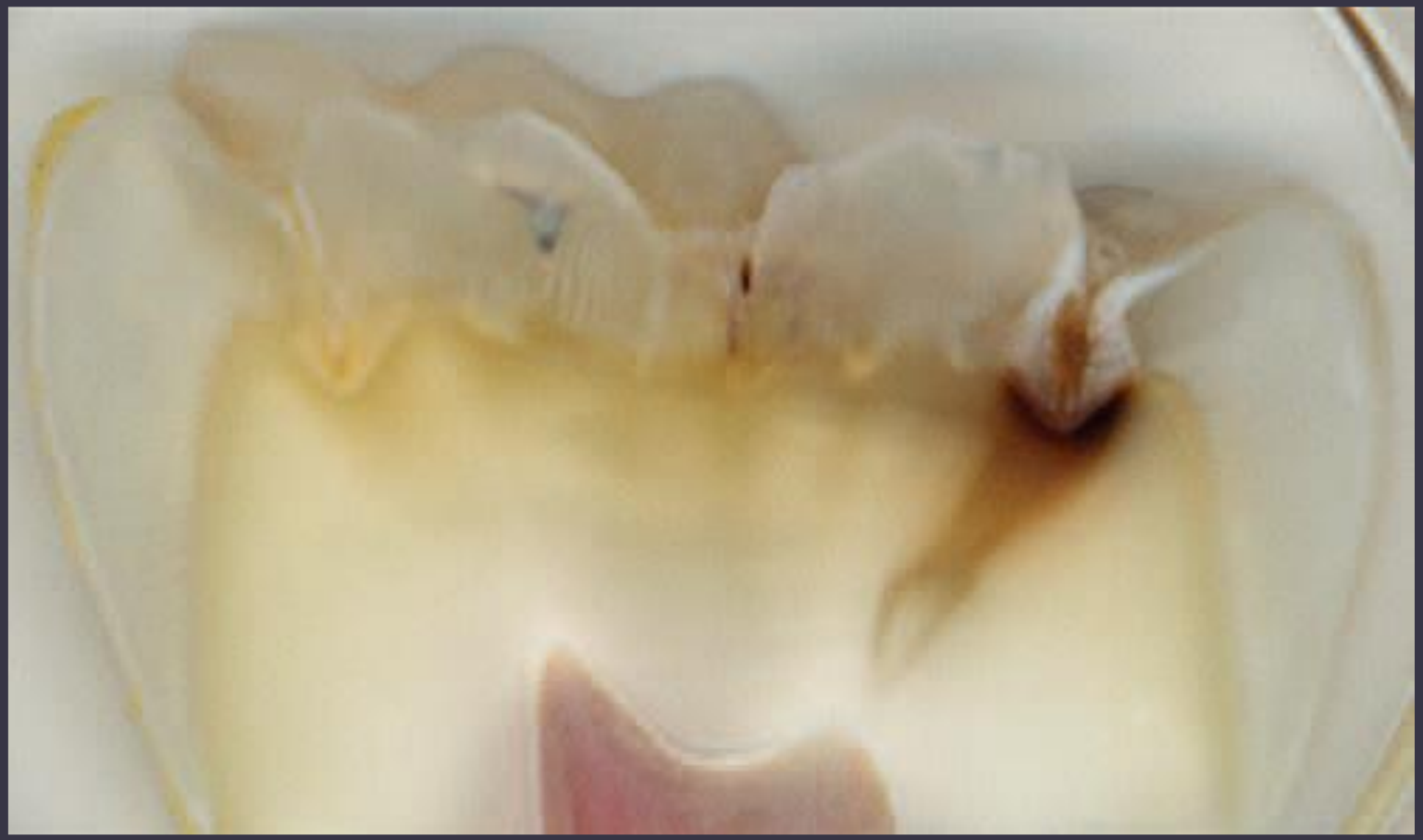


Hydroxyapetite Crystals

- Each enamel rod contains millions of small, elongated apatite crystallites that vary in size and shape.
- The crystallites are tightly packed in a distinct pattern of orientation that gives strength and structural identity to the enamel rod



Enamel Carries



Nasmyth Membrane

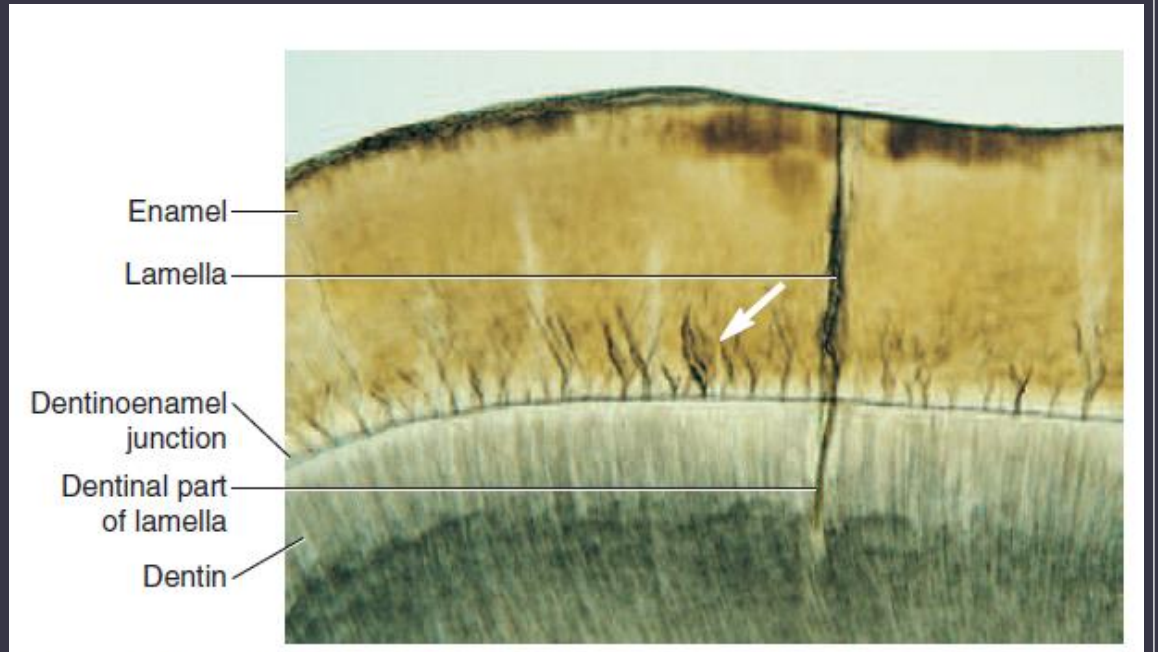
- The final act of the ameloblasts, upon the completion of enamel rod formation, is the secretion of a membrane layer that covers the ends of the enamel rods.
- This layer is referred to as ***Nasmyth membrane***, or primary enamel cuticle.
- Ameloblasts degenerate upon completion of Nasmyth membrane.
- It covers the newly erupted tooth and is worn away by mastication and cleaning

Enamel Permeability

- Although enamel is a hard, dense structure, it is permeable to certain ions and molecules.
- The route of passage may be through structural units such as rod sheaths, enamel cracks, and other defects that are hypomineralized and rich in organic content.
- Water plays an important role as a transporting medium through the small intercrystalline spaces.

Enamel Tufts and lamellae

- Enamel tufts are hypomineralized structures of interrod substance between adjacent groups of enamel rods that project from the DEJ.
- may play a role in the spread of dental caries
- Enamel lamellae are thin, leaflike faults between the enamel rod groups that extend from the enamel surface toward the DEJ, sometimes extending into dentin



• **Fig. 1.10** Microscopic view through lamella that goes from enamel surface into dentin. Note the enamel tufts *(arrow)*. (From Fehrenbach MJ,

Fluoride and Enamel

- Fluoride is able to affect the chemical and physical properties of the apatite mineral and inluence the hardness, chemical reactivity, and stability of enamel, while preserving the apatite structures.

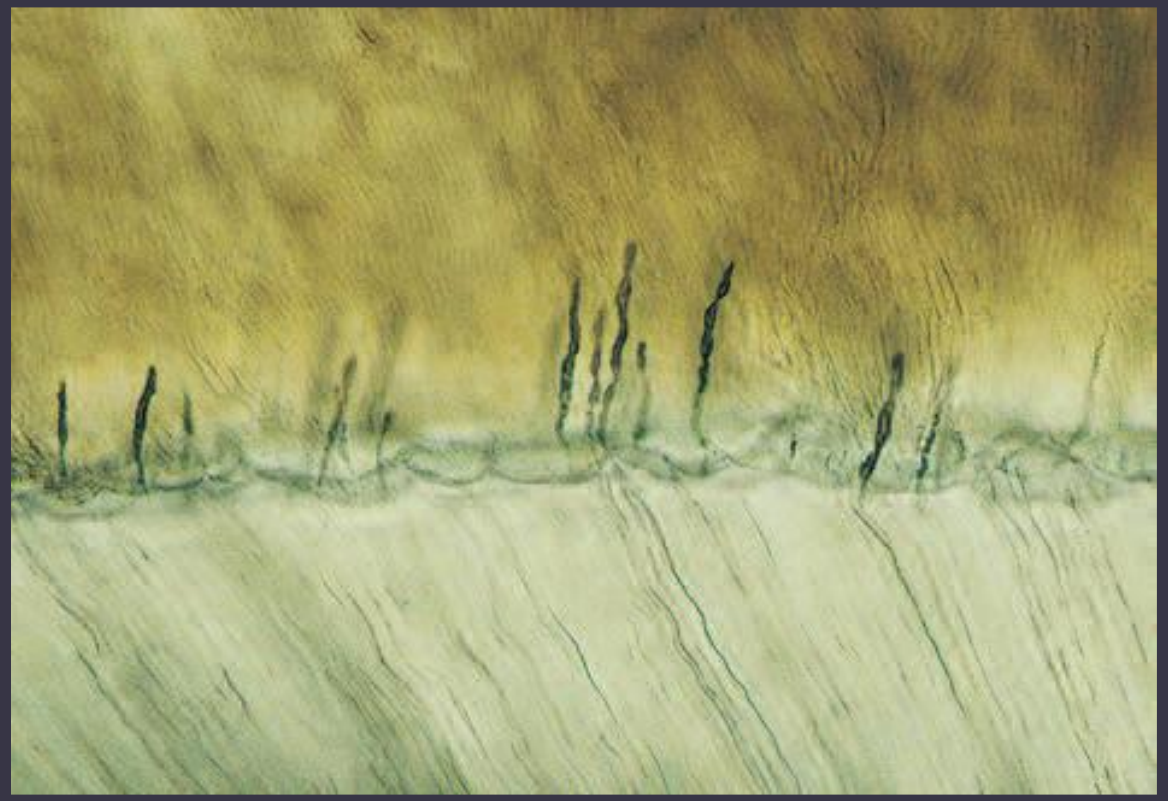
- When luoride ions are present during enamel formation or are topically applied to the enamel surface, the solubility of surface enamel is decreased

Enamel and Dentine

- Enamel is the hardest substance of the human body. Hardness may vary over the external tooth surface according to the location.
- Also, it decreases inward, with hardness lowest at the DEJ
- Enamel is a rigid structure that is both strong and brittle (high elastic modulus, high compressive strength, and low tensile strength).
- The ability of the enamel to withstand masticatory forces depends on a stable attachment to the dentin by means of the DEJ.
- Dentin is a more flexible substance that is strong and resilient (low elastic modulus, high compressive strength, and high tensile strength), which essentially increases the fracture toughness of the more supericial enamel.

DEJ

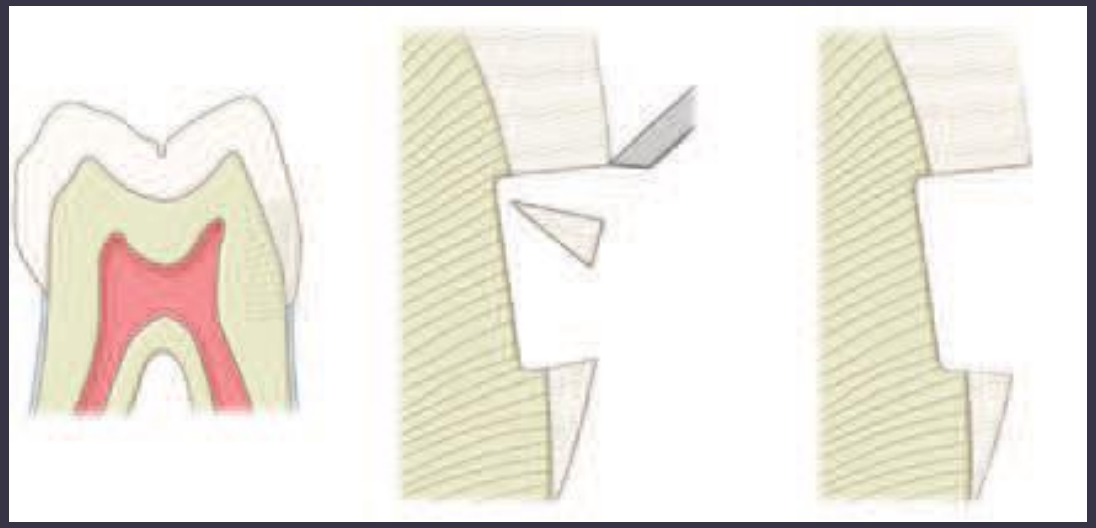
- The junction of enamel and dentin (DEJ) is scalloped or wavy in outline, with the crest of the waves penetrating toward enamel
- DEJ is approximately 2 μm wide and is comprised of a mineralized complex of interwoven dentin and enamel matrix proteins
- his matrix-modified interphase layer is considered to provide fracture propagation limiting properties to the interface between the enamel and the DEJ and thus overall structural stability of the enamel attachment to dentin



Undermined Enamel

- Enamel rods that lack a dentin base because of carries or improper preparation design are easily fractured away from neighboring rods.

- For optimal strength in tooth preparation, all enamel rods should be supported by dentin

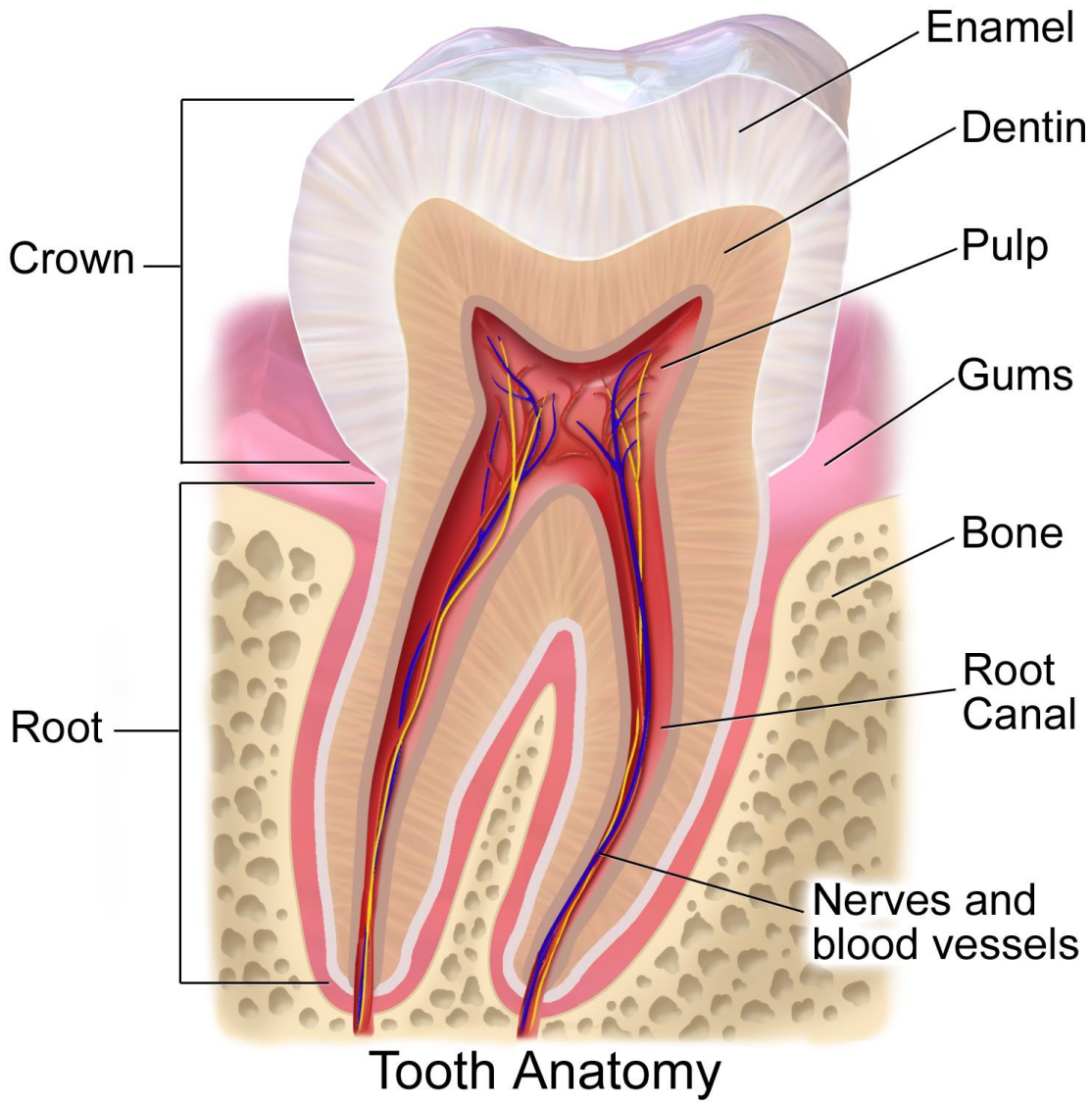


Dentino-Pulpal Complex

- Pulp and dentin tissues are specialized connective tissues of mesodermal origin.
- Dental pulp occupies the pulp cavity in the tooth and is a unique, specialized organ of the human body that serves four functions:
- (1) formative (developmental)
- (2) nutritive
- (3) sensory(protective)
- (4) defensive/reparative

Dentino-Pulpal Complex

- The formative function is the production of primary and secondary dentin by odontoblasts.
- The nutritive function supplies mineral ions, proteins, and water to dentin through the blood supply to odontoblasts and their processes.
- The sensory function is provided by nerve fibers within the pulp that mediate the sensation of pain.
- The defense/ reparative function?



Tooth Anatomy

The pulp

- Coronal pulp (including pulpal horns)
- Radicular Pulp
- The pulp contains nerves, arterioles, venules, capillaries, lymph channels, connective tissue cells, intercellular substance, odontoblasts, fibroblasts macrophages and collagen

Dentin

- Dentin formation, ***dentinogenesi***s, is accomplished by cells called ***odontoblasts.***
- Odontoblasts are considered part of pulp and dentin tissues because their cell bodies are in the pulp cavity, but their long, slender cytoplasmic cell processes (Tomes ibers) extend well (100–200 μm) into the tubules in the mineralized dentin

Dentinogenesis

- Dentin formation begins immediately before enamel formation.
- Odontoblasts generate an extracellular collagen matrix as they begin to move away from adjacent ameloblasts.
- The most recently formed layer of dentin is always on the pulpal surface.
- The unmineralized zone of dentin is immediately next to the cell bodies of odontoblasts and is called predentin

Dentin

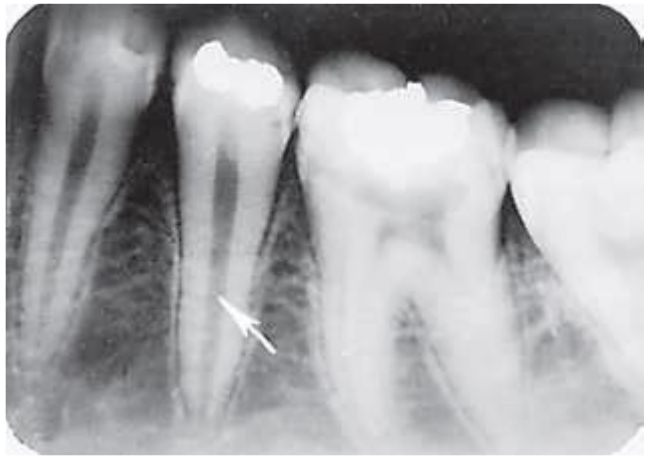
- In contrast to enamel formation, dentin formation continues after tooth eruption and throughout the life of the pulp.
- The dentin forming the initial shape of the tooth is called ***primary dentin*** and is usually completed 3 years after tooth eruption (in the case of permanent teeth).
- Human dentin is composed of approximately 50% inorganic material and 30% organic material by volume. The organic material is approximately 90% type I collagen and 10% noncollagenous proteins

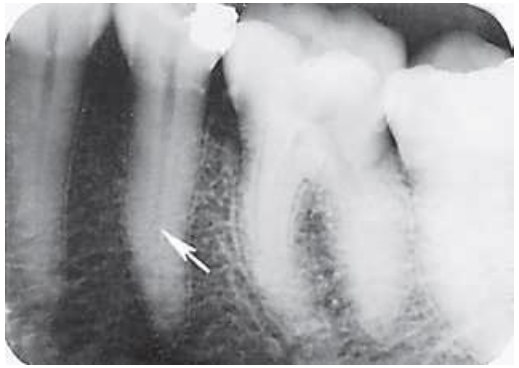
Dentin

- The hardness of dentin averages one fifth that of enamel, and its hardness near the DEJ is about three times greater than near the pulp.
- Although dentin is a hard, mineralized tissue, it is flexible, with a modulus of elasticity of approximately 18 gigapascals (GPa).
- This lexibility helps support the more brittle, less resilient enamel

Dentin

- During tooth preparation, dentin usually is distinguished from enamel by:
- (1) color and opacity, (2) reflectance, (3) hardness, and (4) sound.



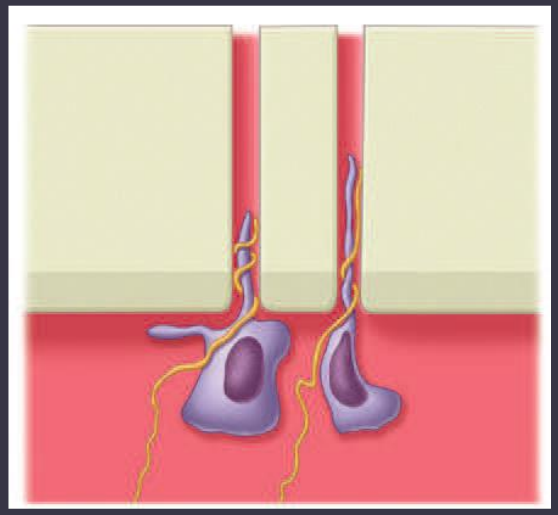


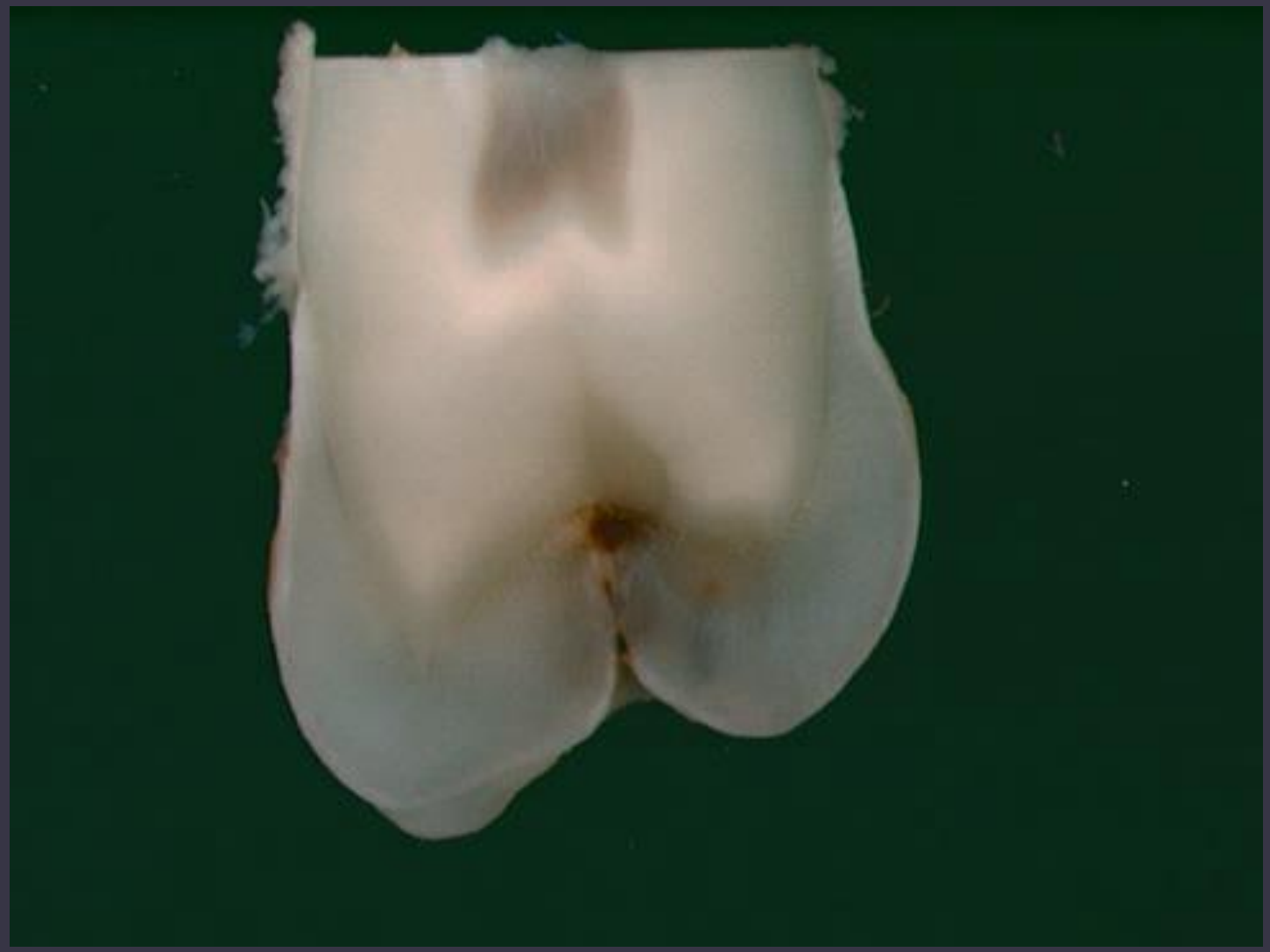
Dentin

- Pulp cavity size. A, Premolar radiograph of young person. B, Premolar radiograph of older person. Note the difference in the size of the pulp cavity

Odontoblasts and sensation

- Stimuli that induce rapid fluid movements in dentinal tubules distort odontoblasts and afferent nerves (arrow), leading to a sensation of pain. Many operative procedures such as cutting or air-drying induce rapid fluid movement.





Carries Rate in Dentin

- Tubules in superficial dentin close to the dentoenamel junction (DEJ) (A) are smaller and more sparsely distributed compared with deep dentin (B). The tubules in supericial root dentin (C) and deep root dentin (D) are smaller and less numerous than those in comparable depths of coronal dentin

Types of Dentin

- Primary Dentine
- Secondary dentin
- Tertiary (reactionary) dentin

- Chapter 1, page 23

Physiology of Tooth Form

- Function:

Teeth serve four main functions: (1) mastication, (2) esthetics, (3) speech, and (4) protection of supporting tissues

Contours

- Facial and lingual surfaces possess a degree of convexity that affords protection and stimulation of supporting tissues during mastication.

- The convexity generally is located at the cervical third of the crown on the facial surfaces of all teeth and the lingual surfaces of incisors and canines

Contours

- Contours. Arrows show pathways of food passing over facial surface of mandibular molar during mastication.
- A, Overcontour delects food from gingiva and results in understimulation of supporting tissues.
- B, Undercontour of tooth may result in irritation of soft tissue.
- C, Correct contour permits adequate stimulation and protection of supporting tissue

Contours

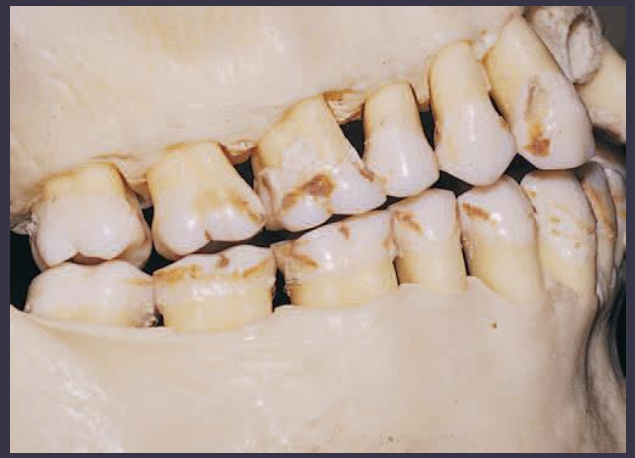
- Overcontouring is the worst ofender, usually resulting in increased plaque retention that leads to a chronic inlammatory state of the gingiva.

Proximal Surfaces

- Proper form of the proximal surfaces of teeth is just as important to the maintenance of periodontal tissue health as is the proper form of facial and lingual surfaces.
- The proximal height of contour serves to provide (1) contacts with the proximal surfaces of adjacent teeth, thus preventing food impaction, and (2) adequate embrasurespace (immediately apical to the contacts) for gingival tissue, supporting bone, blood vessels, and nerves that serve the supporting structures

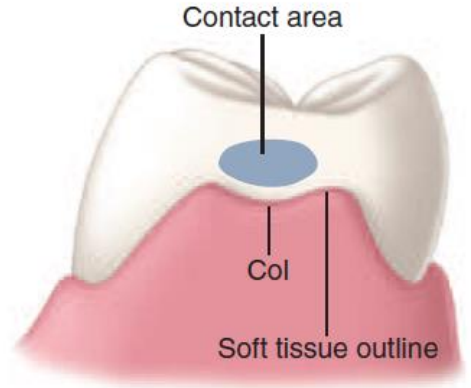
Contour

- Portion of the skull, showing triangular spaces beneath
- proximal contact areas. These spaces are occupied by soft tissue and
- bone for the support of teeth.



Proximal Contact Area

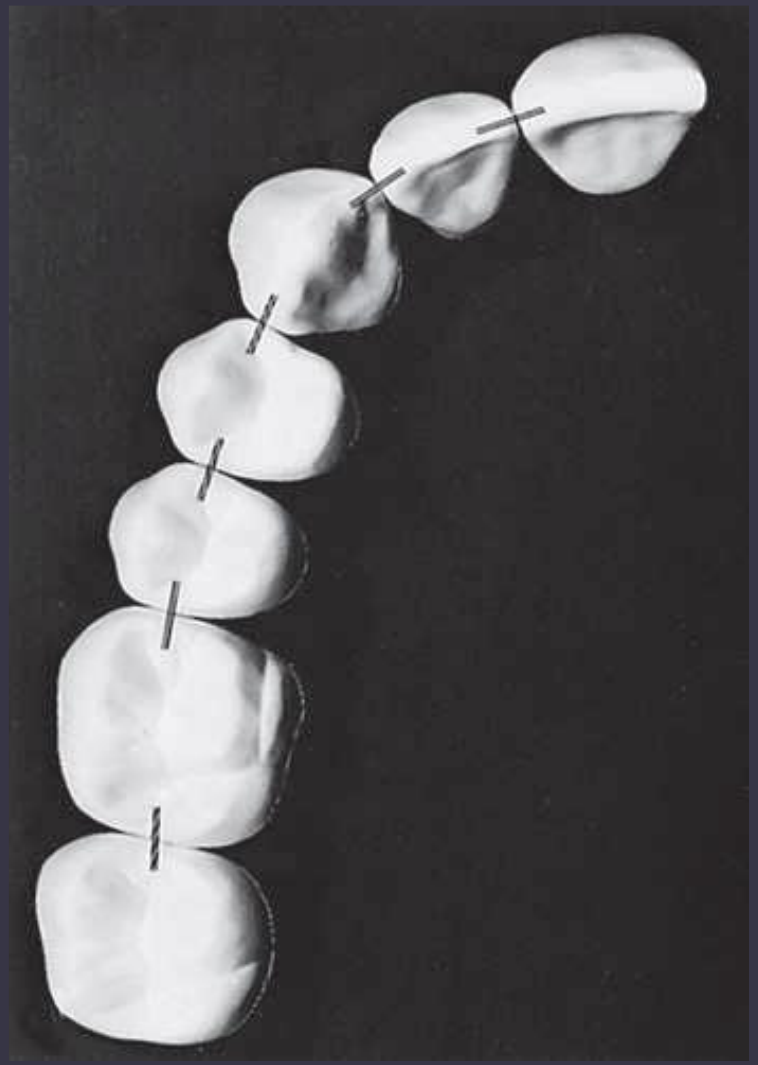
- When teeth initially erupt to make proximal contact with previously erupted teeth, a contact point is present.
- The contact point increases in size to become a proximal contact area as the two adjacent tooth surfaces abrade each other during physiologic tooth movement

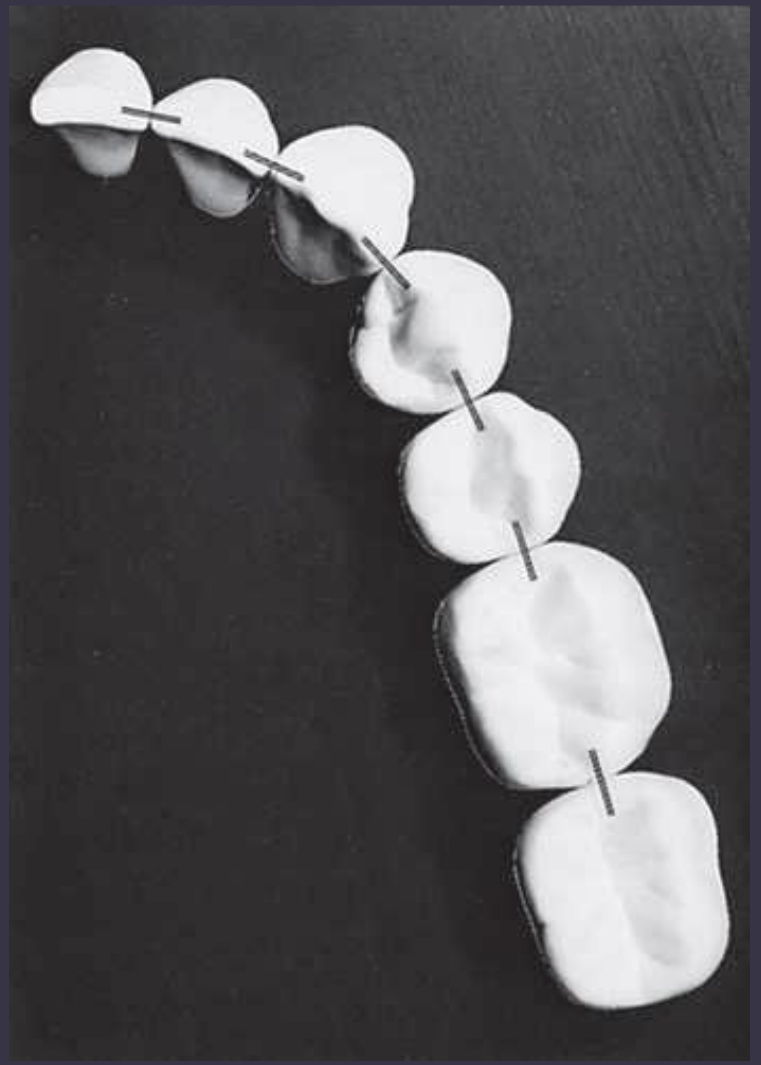


• **Fig. 1.34** Relationship of ideal interdental papilla to molar contact area.

Proximal Contacts

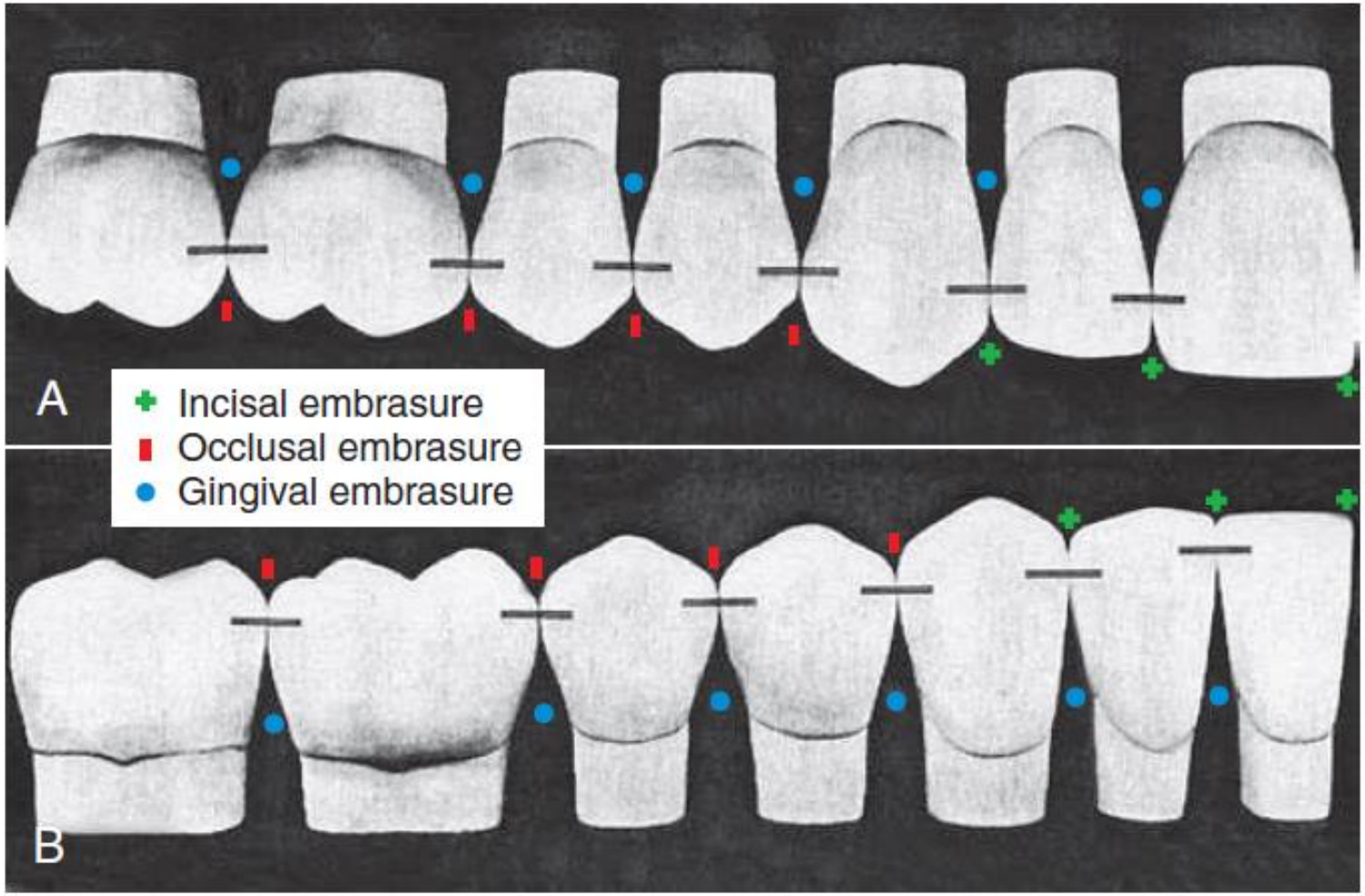
- The physiologic significance of properly formed and located proximal contacts cannot be overemphasized; they promote normal healthy interdental papillae filling the interproximal spaces. Improper contacts may result in food impaction between teeth, potentially increasing the risk of periodontal disease, caries, and tooth movement.
- In addition, retention of food is objectionable because of its physical presence and the halitosis that results from food decomposition.



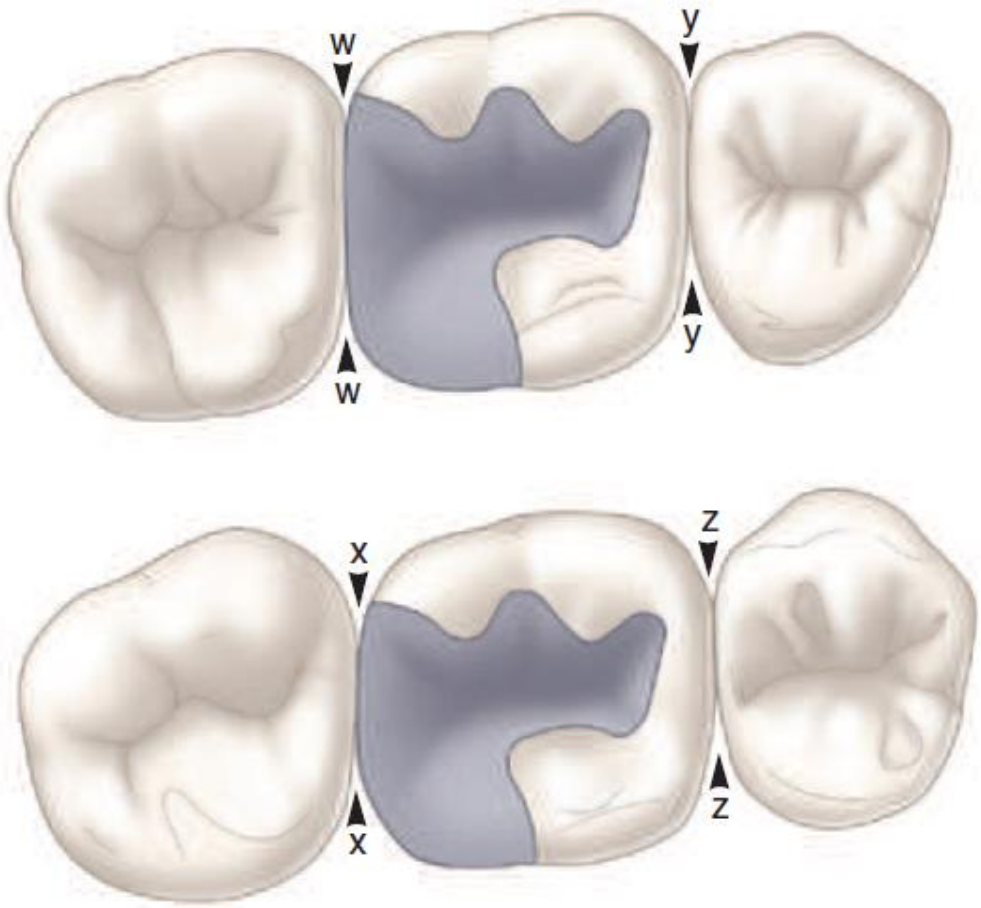


Embrasures

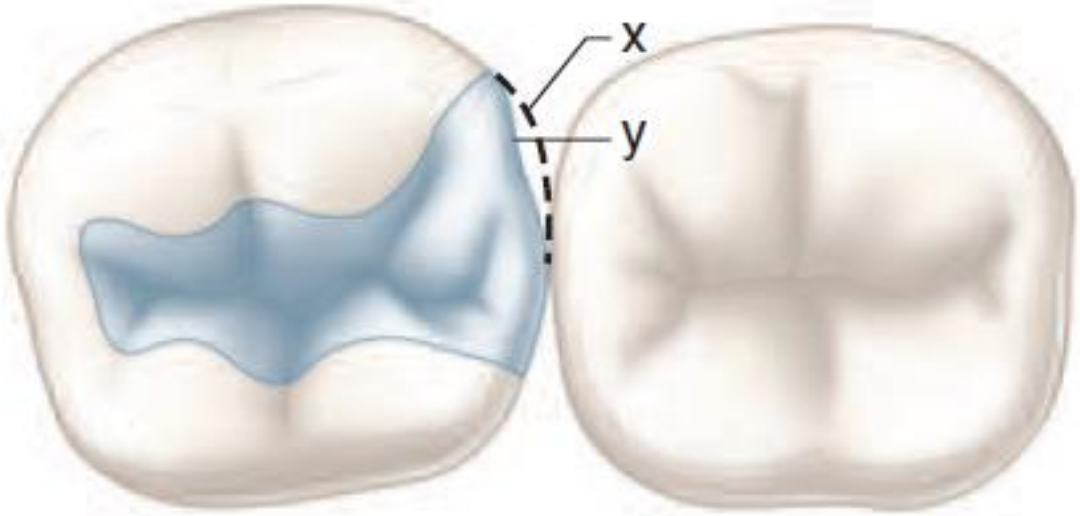
- Embrasures are V-shaped spaces that originate at the proximal contact areas between adjacent teeth and are named for the direction toward which they radiate.
- These embrasures are: (1) facial, (2) lingual, (3) incisal or occlusal, and (4) gingival



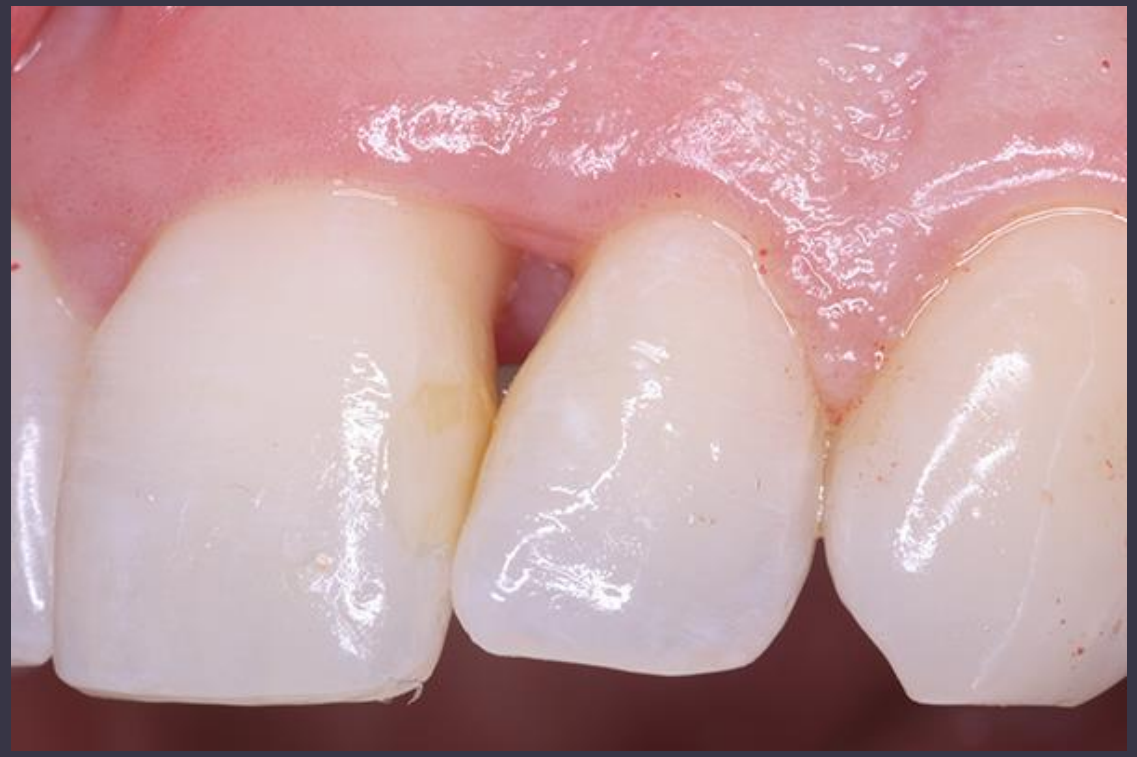
• **Fig. 1.33** Proximal contact areas. Black lines show positions of contact incisogingivally and occluso-gingivally. Incisal, occlusal, and gingival embrasures are indicated. A, Maxillary teeth. B, Mandibular teeth.



• **Fig. 1.35** Embrasure form. *w*, Improper embrasure form caused by overcontouring of restoration resulting in unhealthy gingiva from lack of stimulation. *x*, Good embrasure form. *y*, Frictional wear of contact area has resulted in decrease of embrasure dimension. *z*, When the embrasure form is good, supporting tissues receive adequate stimulation from foods during mastication.



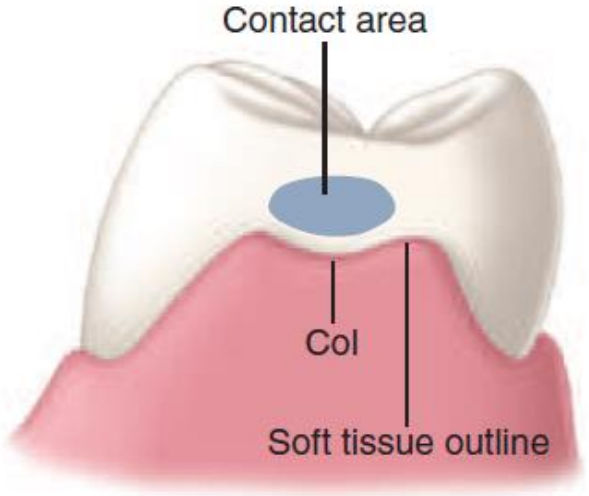
• **Fig. 1.36** Embrasure form. *x*, Portion of tooth that offers protection to underlying supporting tissue during mastication. *y*, Restoration fails to establish adequate contour for good embrasure form.



Papilla

- Initially, the interdental papilla ills the gingival embrasure.
- When the form and function of teeth are ideal and optimal oral health is maintained, the interdental papilla may continue in this position throughout life. When the gingival embrasure is filled by the papilla, trapping of food in this region is prevented.

- the papilla is seen to have a triangular
- shape between anterior teeth, whereas in posterior teeth, the papilla
- may be shaped like a mountain range, with facial and lingual peaks
- and the col (“valley”) lying beneath the contact area



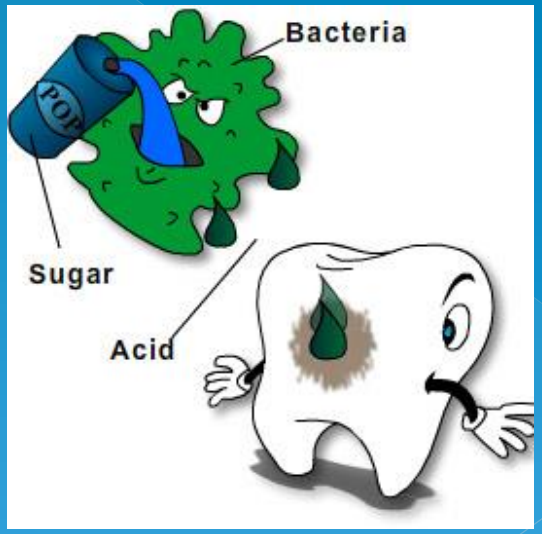
• **Fig. 1.34** Relationship of ideal interdental papilla to molar contact area.

THANK YOU

Dental caries

Dental Caries

- It is a multifactorial, transmissible, infectious oral disease caused primarily by the complex interaction of cariogenic oral flora with fermentable dietary carbohydrates on the tooth surface over time.



Caries can be defined as

- Dental caries can be defined as the chemical dissolution of calcium salts. First of the enamel then of the dentin by lactic acid.

G.V. Black

- Dental caries also can be defined as localized post eruptive pathological process of external origin involving softening of hard tooth tissue and proceeding to formation of cavity.

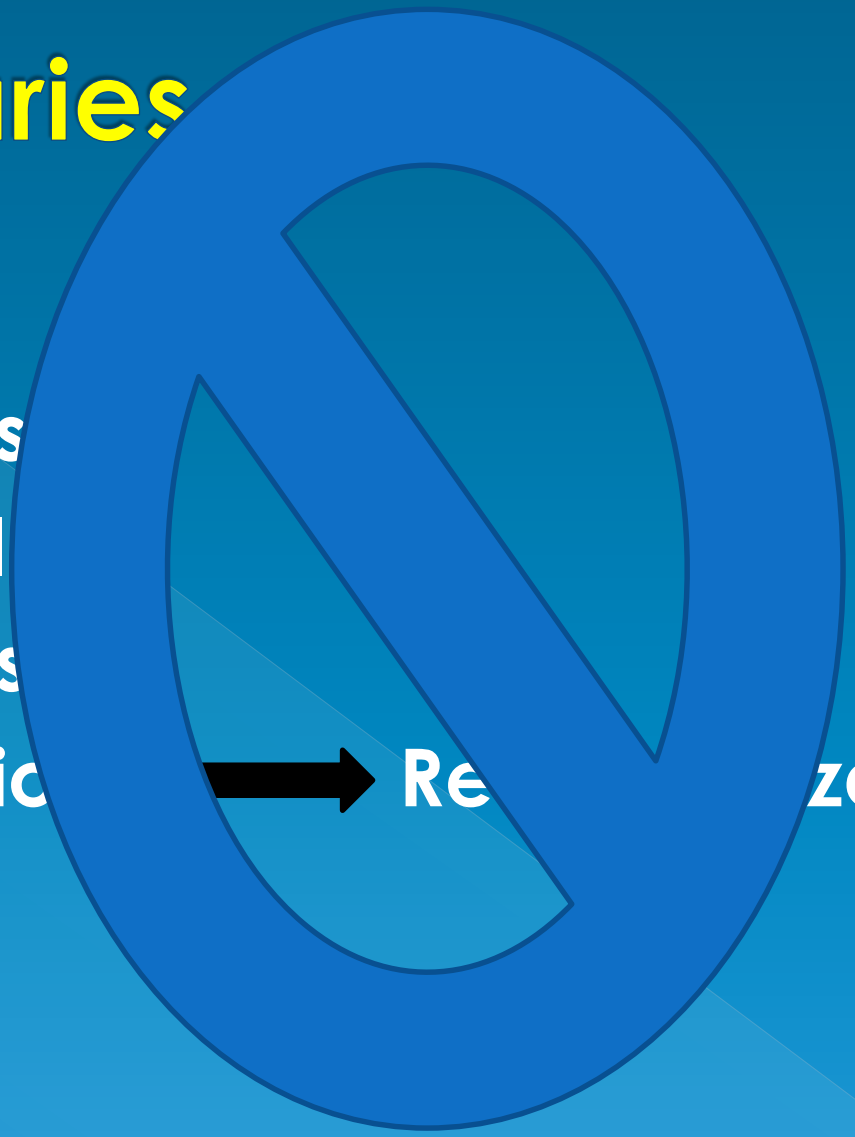
WHO

Dental caries

- At the tooth level → caries activity is characterized by local demineralization and loss of tooth structure.
- Cariogenic bacteria in biofilm metabolize refined carbohydrates for energy and produce acid as by-product (lactic acid)
- For extended periods of time, lactic acid can lower pH in biofilm to below critical level (5.5)

Dental Caries

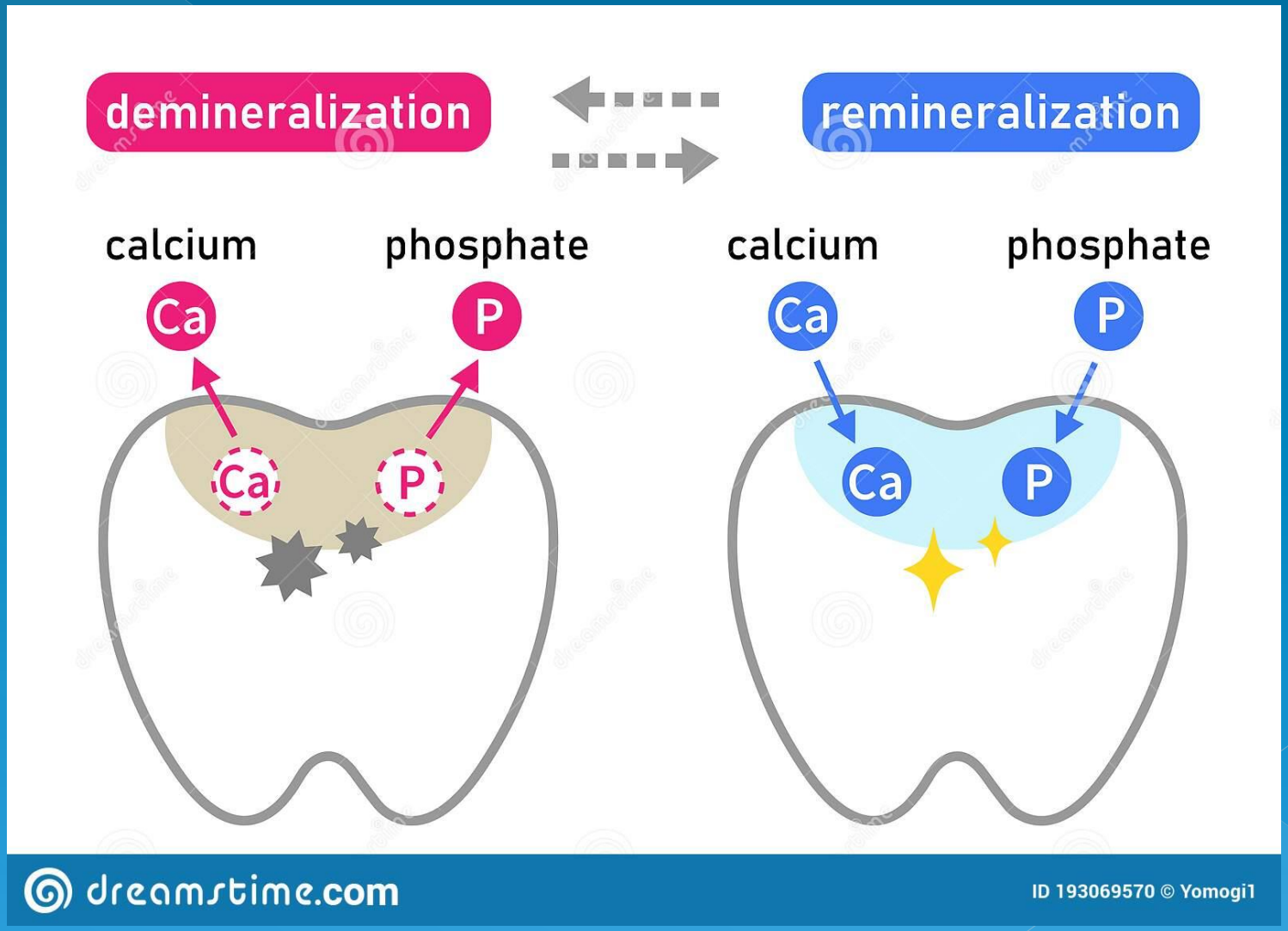
- Caries process
- Bacterial biofil
- pH fluctuations
- Demineralizatic → Re zation



Demineralization vs Remineralization

- **Demineralization** → loss of tooth minerals (Calcium & phosphate) due to low pH (below critical)
- **Remineralization** → when pH in biofilm returns to neutral and the conc of ca & Po4 is supersaturated (relative to that in tooth) → minerals are added back to the partially demineralized enamel

Demineralization vs Remineralization



Role of the Biofilm

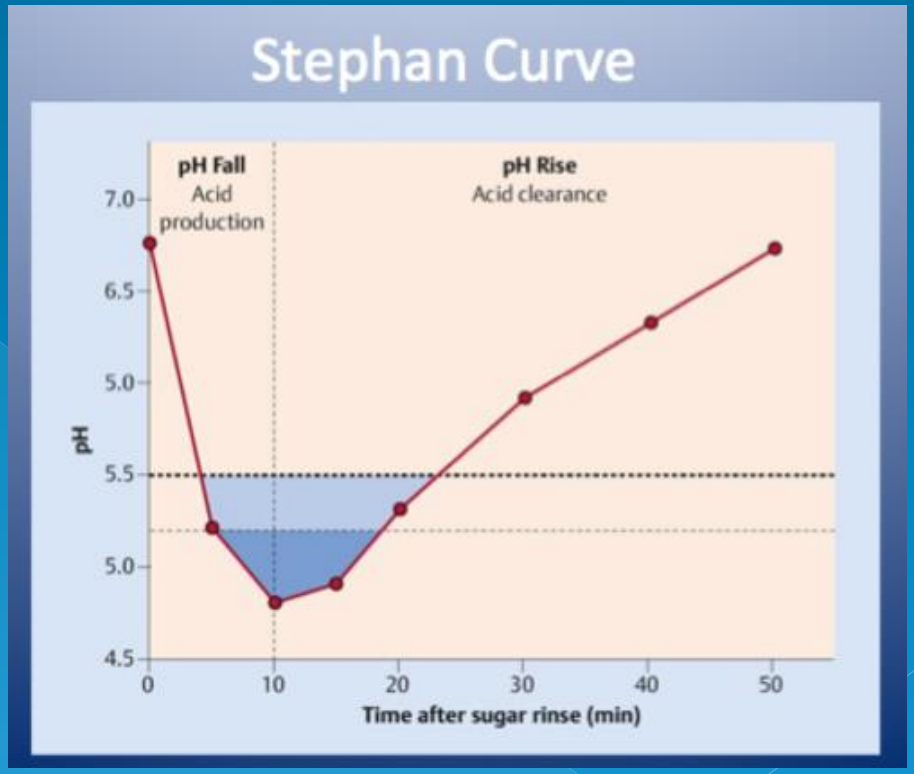
- Soft tenacious film accumulating on teeth surfaces
- Composed mostly of bacteria, their by-products, extracellular matrix and water
- It is not an adherent food debris
- Organized sequence of accumulation on teeth
- Mature plaque biofilm has large metabolic potential of any available carbohydrates

Role of the Biofilm …

- Communities of lactobacilli and Streptococcus mutans → dominant in mature plaque
- Professional teeth cleaning is intended to control biofilm and prevent caries
- After professional removal of all organic material coating and bacteria from tooth surface → a NEW coating of organic material begins to accumulate immediately (within 2 hours a cell-free structureless organic film covers the area)

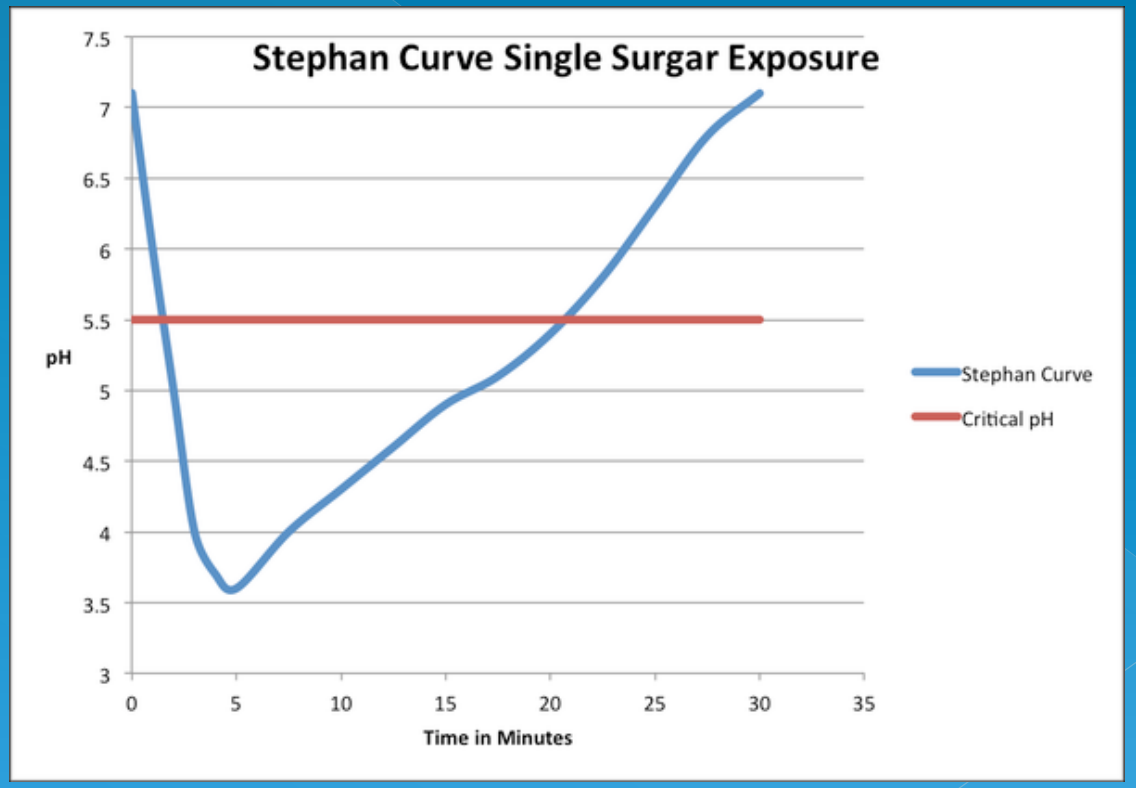
Critical pH

- Studies by Stephan shows metabolic potential of cariogenic bacteria → severe pH drop at the plaque-enamel interface after glucose rinse
- pH of 5.5 is the threshold for enamel demineralization



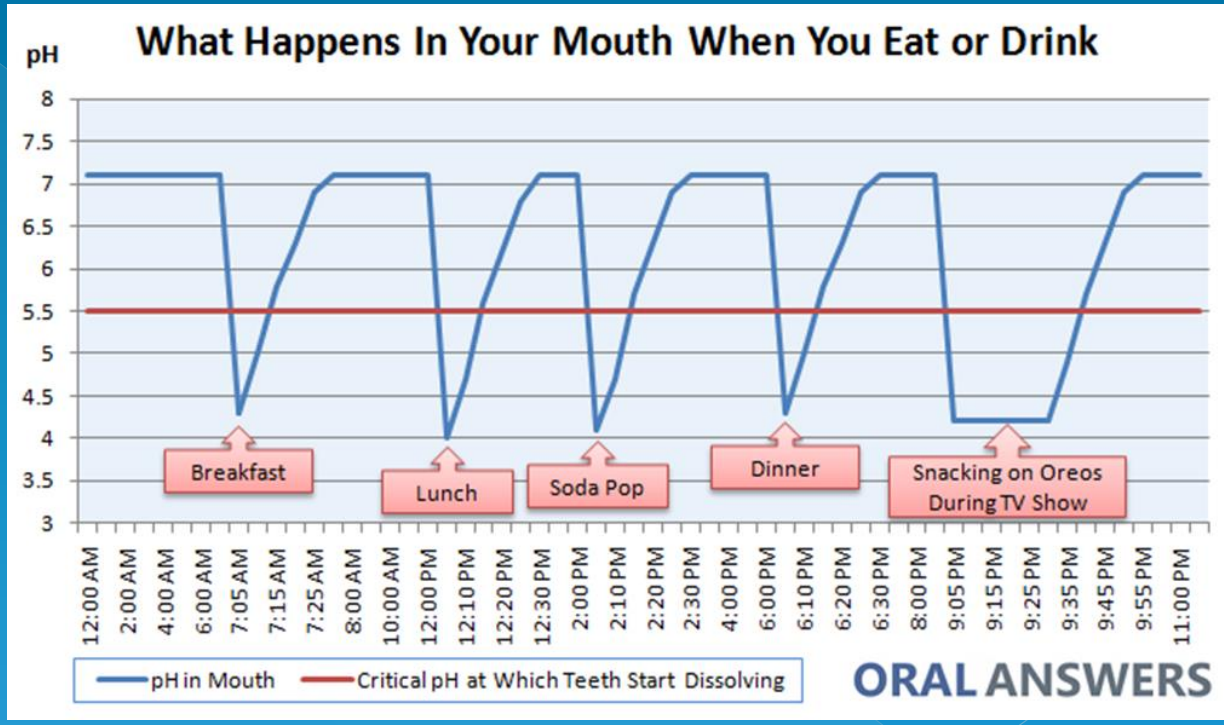
Critical pH

- Exposure to a glucose rinse for an extreme caries activity plaque results in a sustained period of demineralization



Frequency of sucrose exposure

- Frequency of sucrose exposure for cariogenic plaque → influence progress of tooth demineralization.
- For example, 3 meals per day results in 3 exposures of plaque acids
- Further snacks between meals → further exposure to acids especially if diet was based on refined carbohydrates



Pathophysiology

Microorganisms
(S.mutans & Lactobacilli)

↓

Sucrose or other substrate

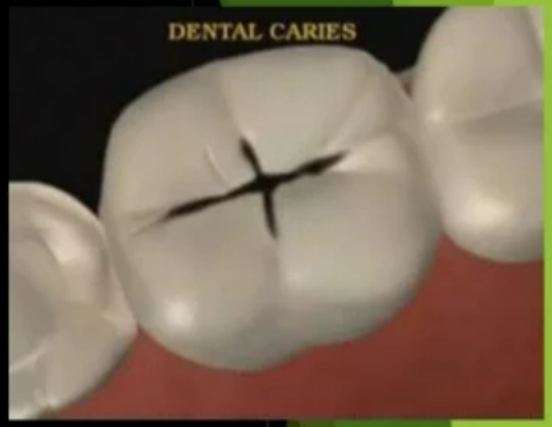
↓

Acid production, mainly lactic acid

↓

Acid from plaque overcomes buffering capacity of salivary bicarbonate

↓



pH is lowered

↓

pH< 5.5 (Critical pH) – remains at tooth surface for 20-50 mins

↓

Tooth mineral acts as buffer and loses calcium & phosphate ions into plaque

↓

Buffering capacity maintained till pH 5.0

↓

At pH 5.0, surface remains intact, subsurface mineral is lost Initial carious lesion (incipient caries)

↓

Incipient lesion may be reversed by remineralization

↓

When subsurface demineralization becomes extensive

↓

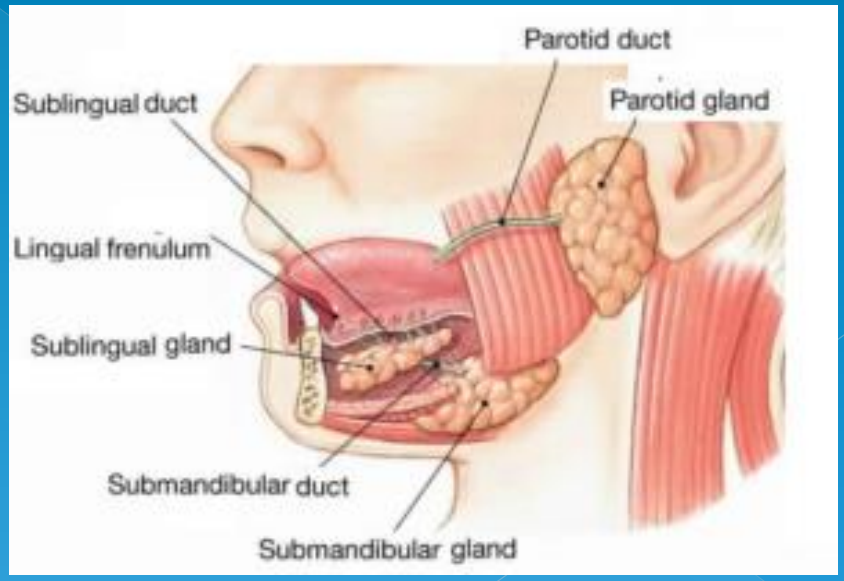
Tooth surface collapses

↓

Cavities (Caries)

Saliva: Anticaries Agent

- Bacterial clearance
- Antibacterial activity
- Buffer capacity
- Remineralization



Clinical Sites for Caries Initiation

- Pits and fissures
- Smooth enamel surfaces
- Root surfaces

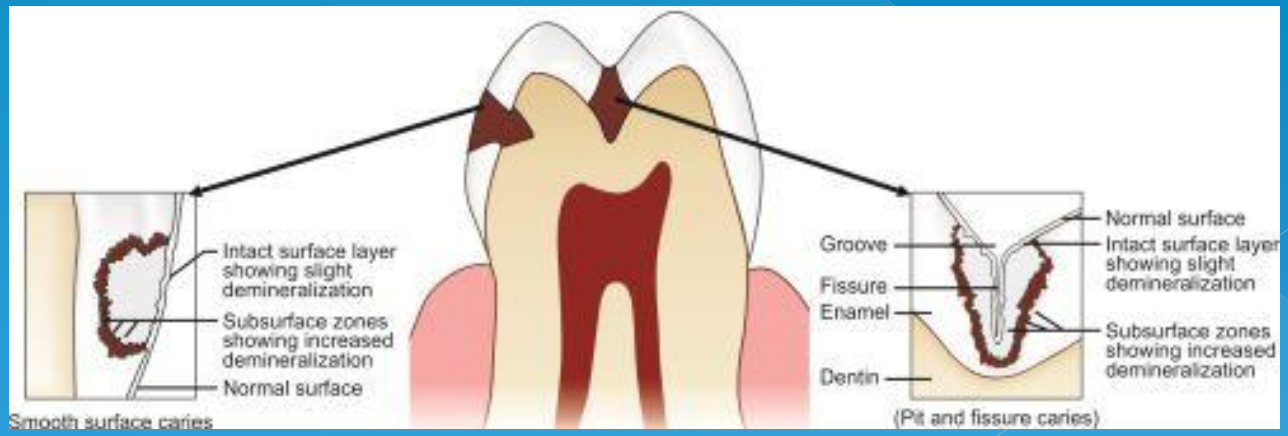
Pits and fissures

- Bacteria rapidly colonize the pits and fissures of newly erupted (e.g. gram +ve cocci)
- Large numbers of streptococcus mutans are usually found in carious pits & fissures
- Shape of pits & fissures contribute to their high susceptibility to caries (long narrow fissure prevent biofilm removal)

Pits and fissures

Pits and fissures

- In cross section, the gross appearance of a pit and fissure lesion is an inverted "V" with a narrow entrance and a progressively wider area of involvement closed to the dentinoenamel junction

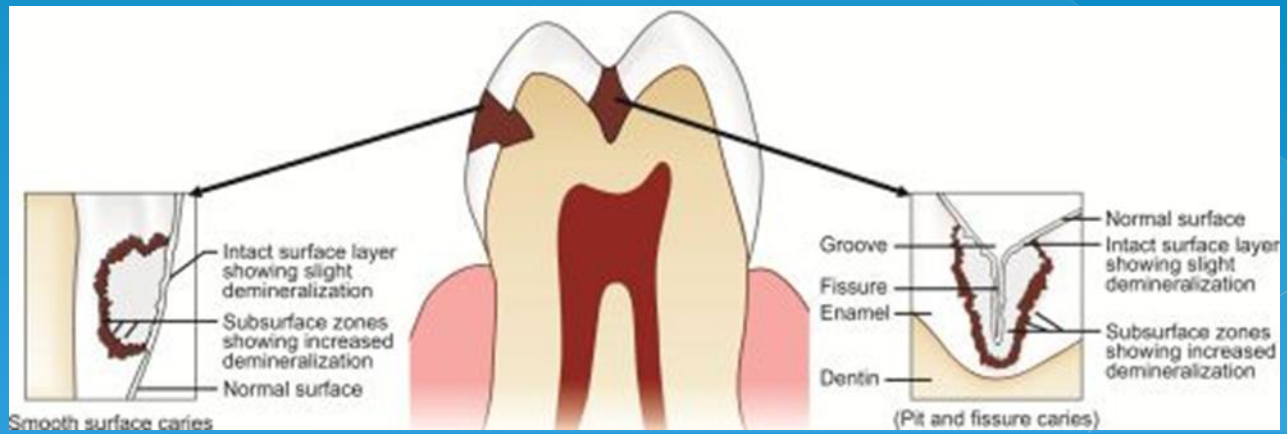


Smooth enamel surfaces

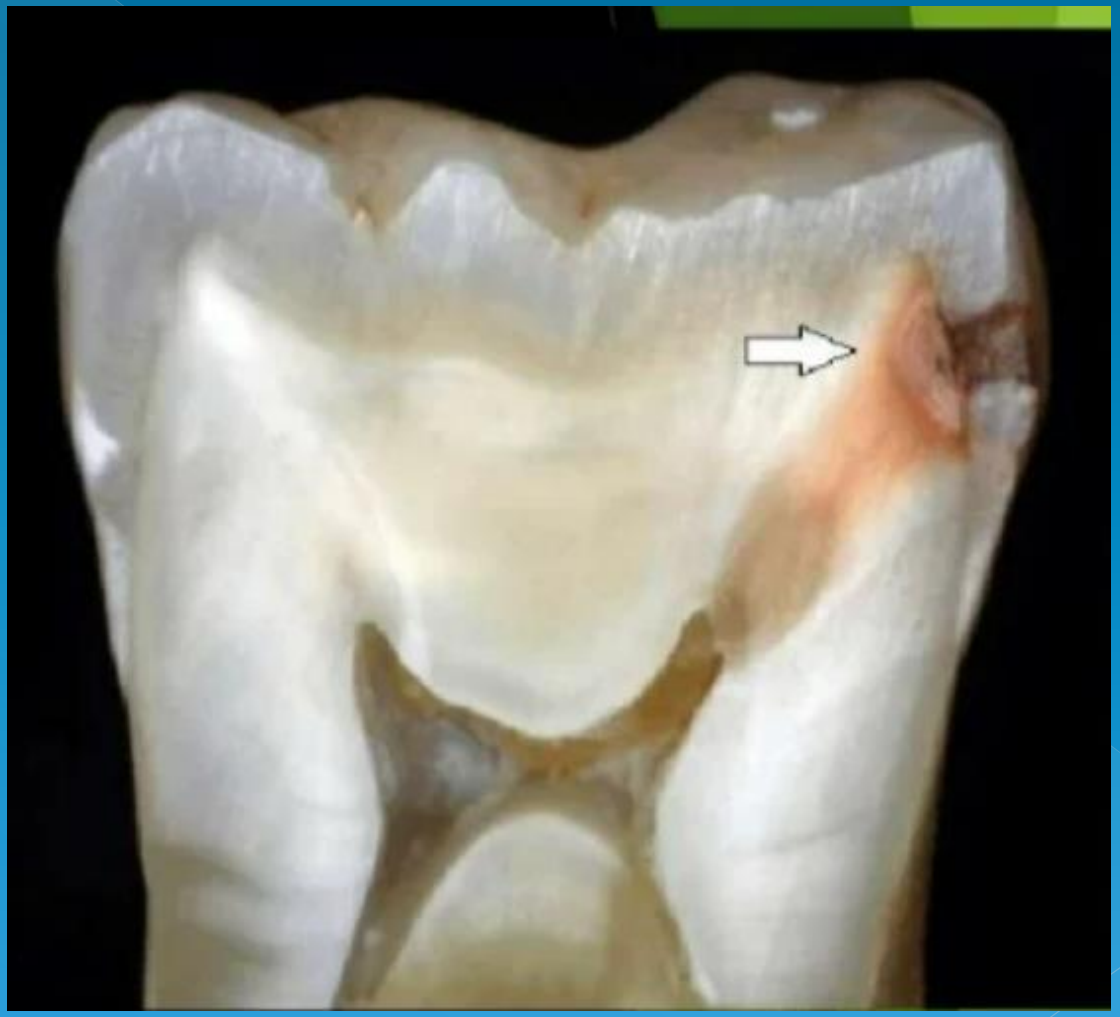
- Cariogenic biofilm usually develops only on the smooth surfaces that are near the gingiva or under proximal contacts.
- Proximal surfaces are susceptible to caries

Smooth enamel surfaces

- Lesions have a broad area of origin and a conical extension towards DEJ
- A cross section of the enamel portion of smooth surface lesion shows a V-shape with a wide area of origin and the apex of the V directed toward the DEJ

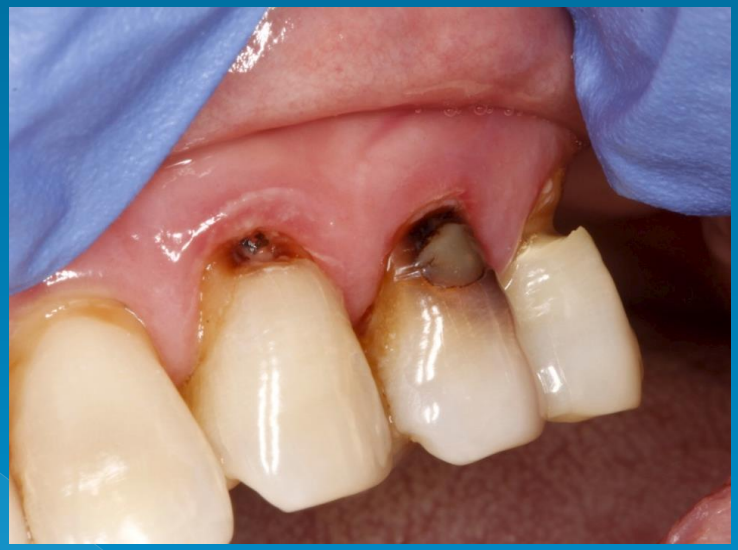


Smooth surface caries



Root surfaces

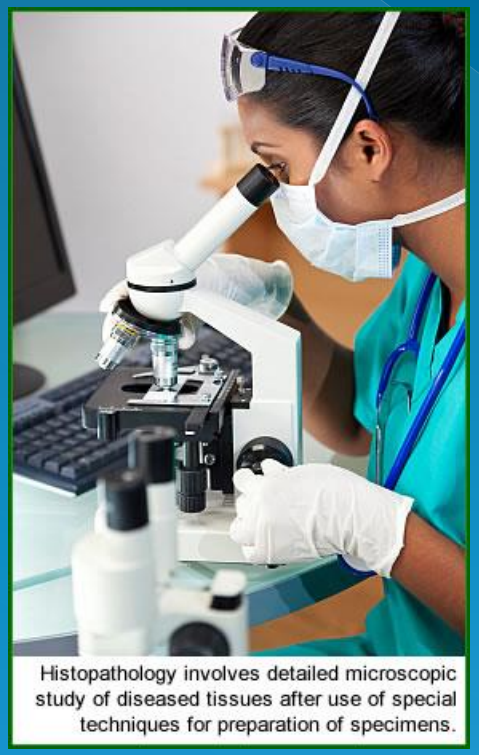
- Root surface rougher than enamel → readily allows cariogenic biofilm formation in the absence of good oral hygiene.
- Periodontal disease lead to gingival recession which cause root exposure
- Root lesions have less well-defined margins and progress rapidly because of the lack of protection from an enamel covering



Progression of Caries Lesions

- Enamel Caries
- Dentin Caries

Histopathological features of enamel



Histopathology involves detailed microscopic study of diseased tissues after use of special techniques for preparation of specimens.

- Fully mineralized enamel once tooth erupts
- Hydroxyapetite crystals tightly packed
- Crystals arranged in rods and interrod enamel
- Between crystals→ spaces filled with water & organic material
- Enamel is constantly modified by the demineralization – remineralization process

Structural changes in Enamel Experiment

- Experiments followed **development of initial lesion under undisturbed biofilm**
- Experiment included ortho bands were cemented on extracted teeth.
- No mechanical disturbance of plaque
- Teeth surfaces were examined, under electron microscope, after different periods of time (after 1 week, 2 weeks, 3-4 weeks)

Structural changes in Enamel

- **After one week** (undisturbed biofilm formation):
- →Clinically: no clinical changes in enamel even after air drying
- → Ultrastructually: signs of direct dissolution of outer enamel surface (partial dissolution of crystal peripheries).

Structural changes in Enamel

- **After two weeks** (undisturbed biofilm plaque):
- →Clinically: changes in enamel visible after air drying
- → White spot lesions were visible

Structural changes in Enamel

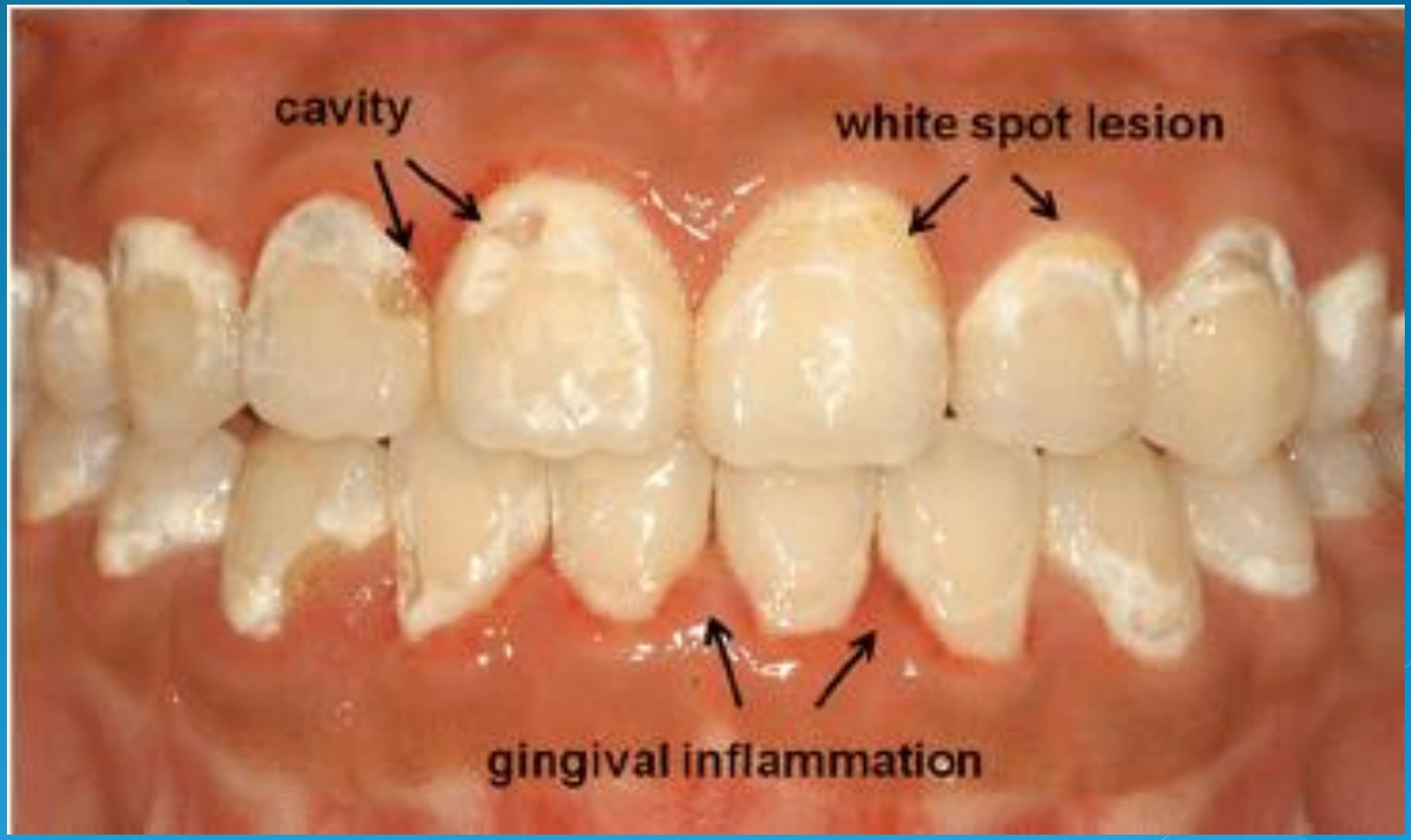
- **After 3-4 weeks** (undisturbed plaque):
- →Clinically: changes in enamel are seen without air drying
- → Ultrastructually: complete dissolution of enamel surface (continued enlargement of intercrystalline spaces).

Structural changes in Enamel

- Removal of ortho bands → disturbance of biofilm → diminishing white appearance & surface became hard and shiny again
- Regular disturbance of biofilm → arrest the lesion by removing the acid producing organisms

Enamel Caries

- White spot lesion: earliest evidence of caries on smooth enamel surface of a crown
- Termed as noncavitated enamel caries lesions
- White spot lesions can be remineralized
- Cavitated enamel lesions can be detected as breakdown of the enamel surface


cavity
white spot lesion
gingival inflammation

Diagnosis of enamel caries

- Goal: early diagnosis of active enamel caries at stage of white spot lesions.
- Diagnosis requires:
  1. good light
  2. Clean teeth
  3. 3 in 1 syringe
  4. Good sharp vision
  5. Bitewing radiograph

Diagnosis of Enamel Caries

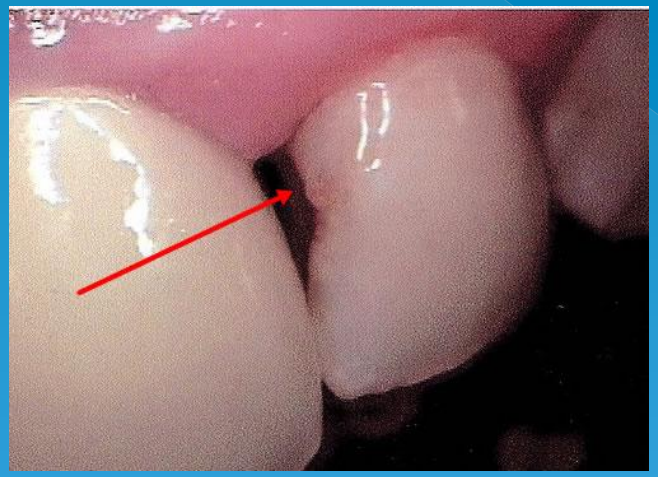
Occlusal surfaces

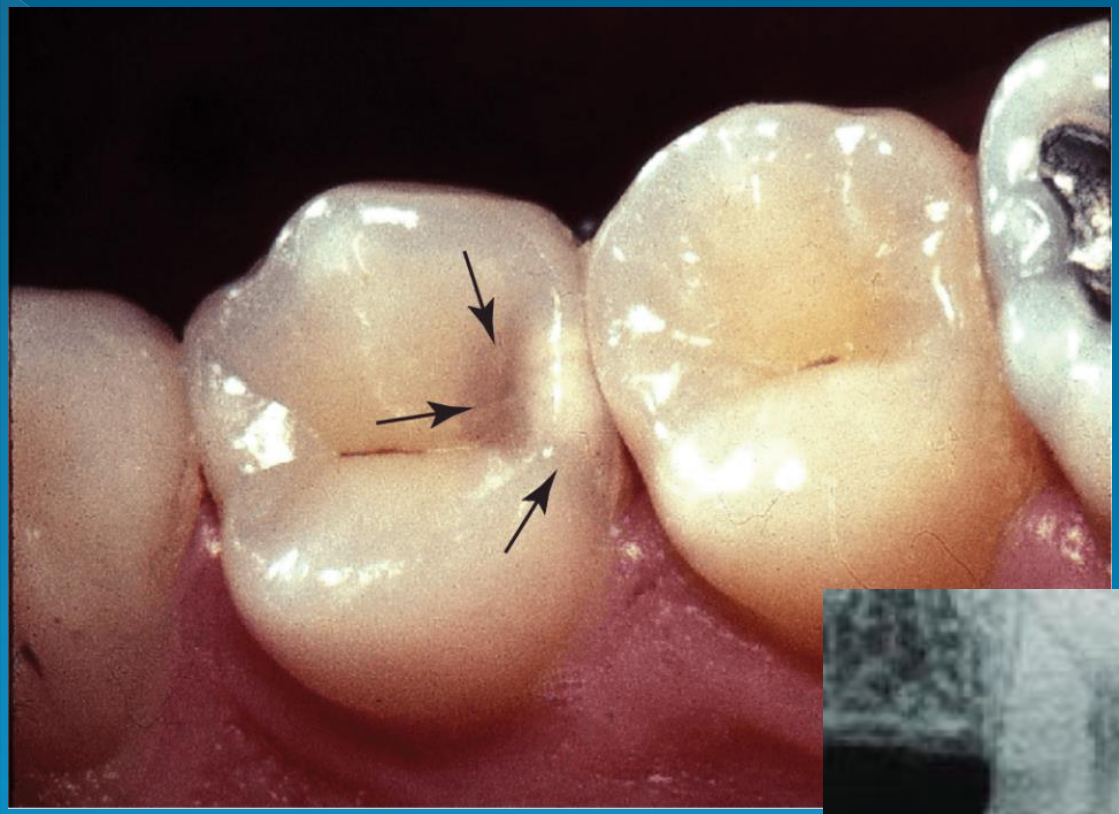
- Vision is very important
- Active, uncavitated: white non shiny
- Inactive: may be brown
- Not visible on radiograph
- Cavitated lesions: microcavities with or without greyish discoloration of enamel.
- Cavities in dentine → active

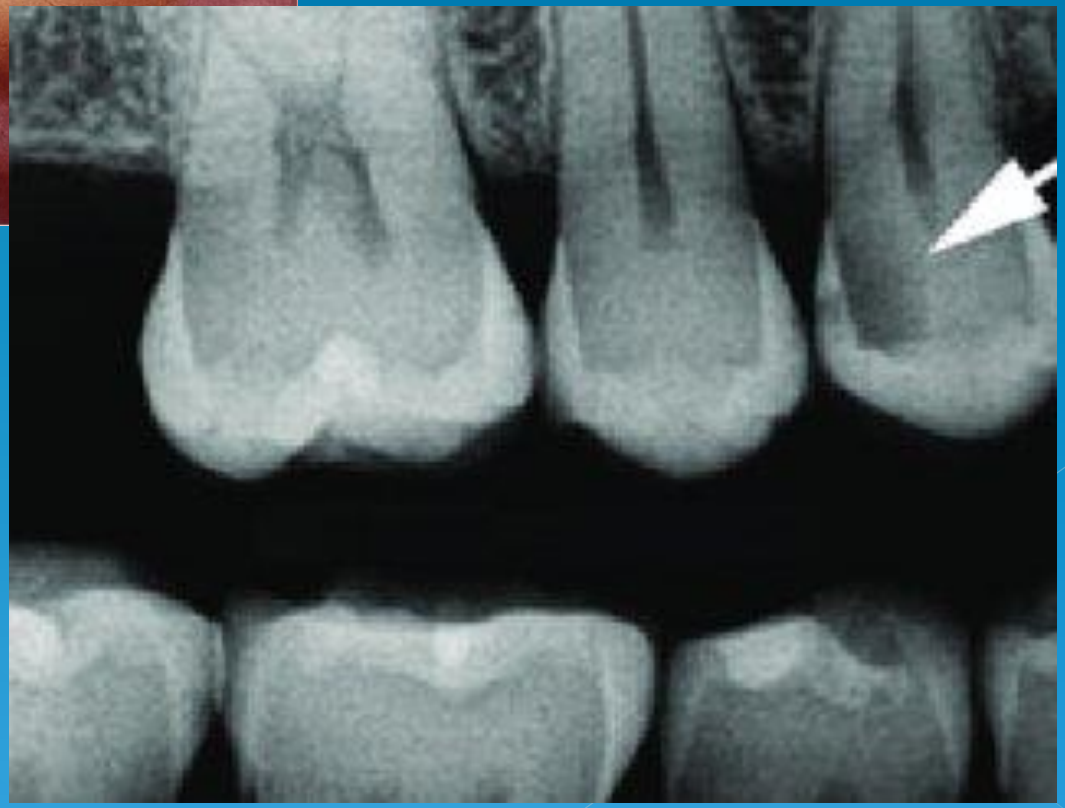
Diagnosis of Enamel Caries

Approximal surfaces

- Adjacent tooth → bitewing radiograph is the main diagnostic tool
- No adjacent tooth → caries is arrested → brown discoloration due to stains from mouth





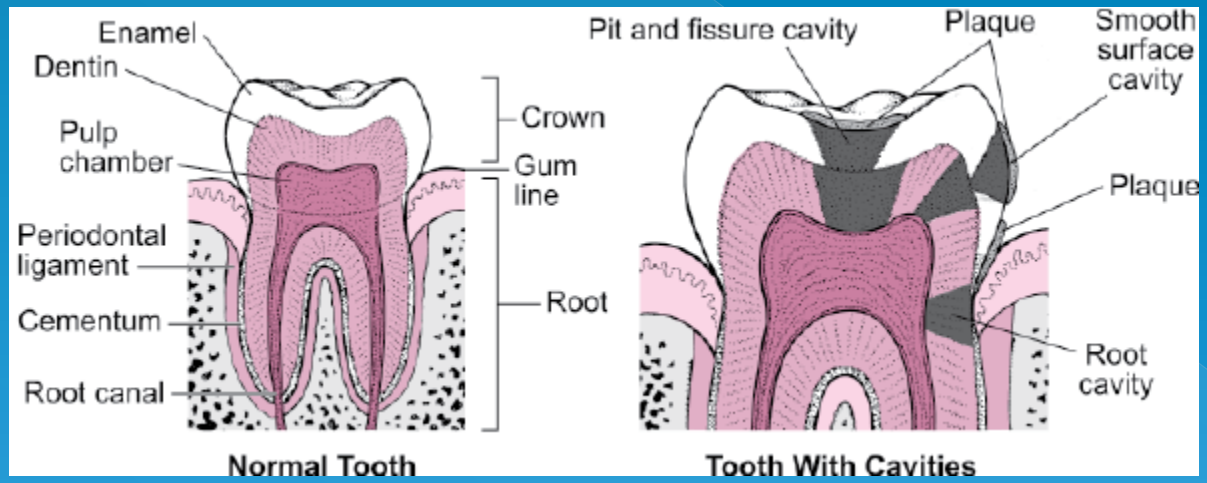


Dentin Caries

- Dentin contains less minerals (in comparison to enamel) & has microscopic tubules that provide pathway for the ingress of bacteria
- The DEJ has the least resistance to caries attack & allows rapid lateral spreading when caries penetrates enamel

Dentin Caries

- Dentin caries is V-shaped in cross section with a wide base at the DEJ and the apex directed pulpally



Dentin Caries

- Caries advances more rapidly in dentin (less mineralized)
- Episodes of short-duration pain may be felt occasionally during earlier stages of dentin caries.
- Pain is caused by stimulation of pulp tissue by the movement of fluid through the dentinal tubules that have been opened to the oral environment by cavitation.

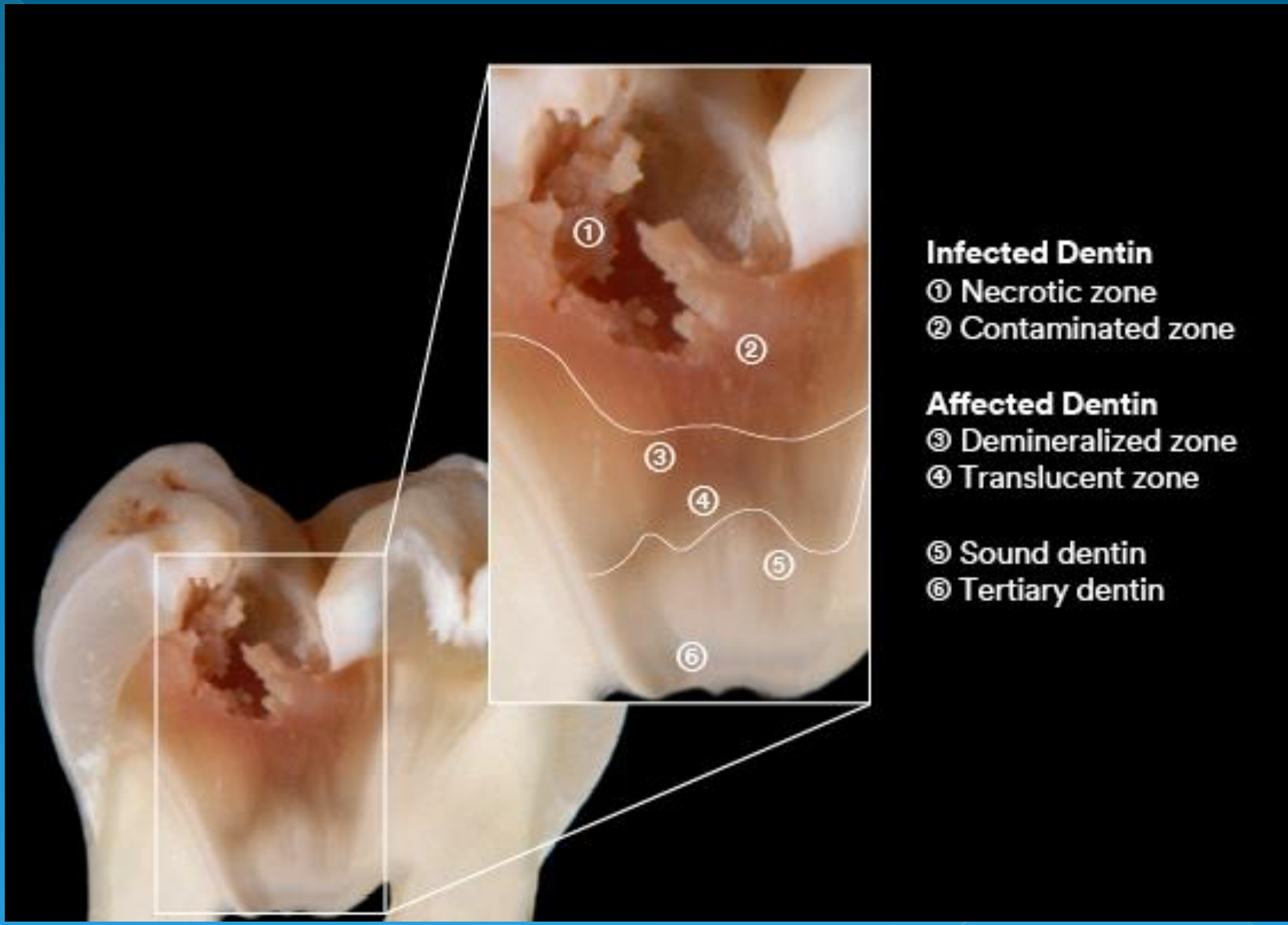
Dentin Caries

- The pulp-dentin complex reacts to caries attacks by attempting to initiate remineralization and blocking off the open dentinal tubules
- These reactions result from the odontoblasts and the physical process of dimeneralization and remineralization.

Zones of Dentin Caries

- Normal Dentin
- Affected Dentin
- Infected Dentin

Infected dentin	Affected dentin
1.Softened demineralized dentin teeming with bacteria	1.Softened deminerlized dentin not yet invaded by bacteria
2.Collagen is irreversibly denatured	2.Collagen cross linking remains
3.Cannot remineralize	3.Acts as a template for remineralization
4.Soft necrotic tissue, followed by dry leathery dentin – flakes away with an instrument	4.Softer than normal dentin, discoloured but does not flake easily
5.Dyes: 1% Acid red in propylene glycol stains only irreversibly denatured collagen	5.Does not stain


①
②
③
④
⑤
⑥
Infected Dentin
① Necrotic zone
② Contaminated zone
Affected Dentin
③ Demineralized zone
④ Translucent zone
⑤ Sound dentin
⑥ Tertiary dentin

Caries Risk Assessment

- To predict if new carious lesions will develop, or if early lesions will continue to grow.

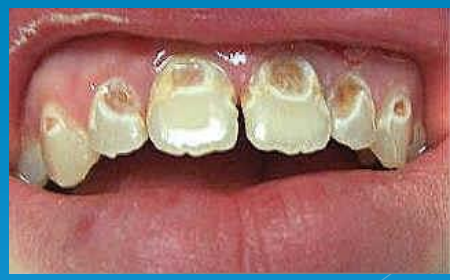
- Useful for screening individuals and populations by identifying caries prone children / individuals who need more intensive preventive care.

Caries Risk Assessment

- Caries risk does not remain constant throughout life and may be modified by preventive intervention by the patient and by the dentist.

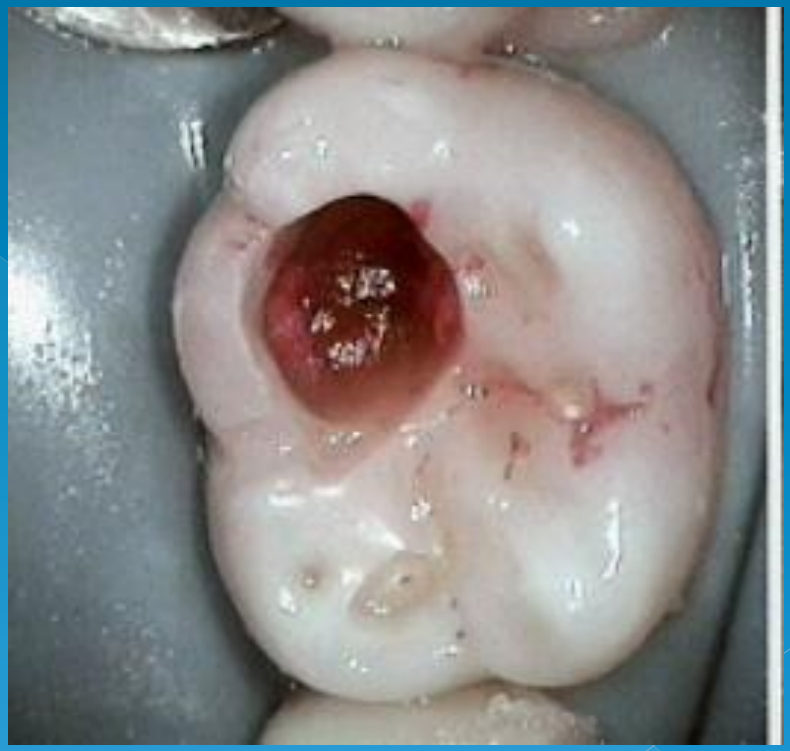
Caries Management by Risk Assessment (CAMBRA)

- Caries must be recorded where present on each surface as either initial lesion (reversible) or cavitated (irreversible).
- The activity of caries lesions is assessed to estimate the severity of the caries in a patient.
- It provides an estimate of **future caries activity**.



Factors Related to Caries Risk Assessment

- ✓ Social history
- ✓ Medical history
- ✓ Plaque control
- ✓ Diet
- ✓ Fluoride use
- ✓ Saliva

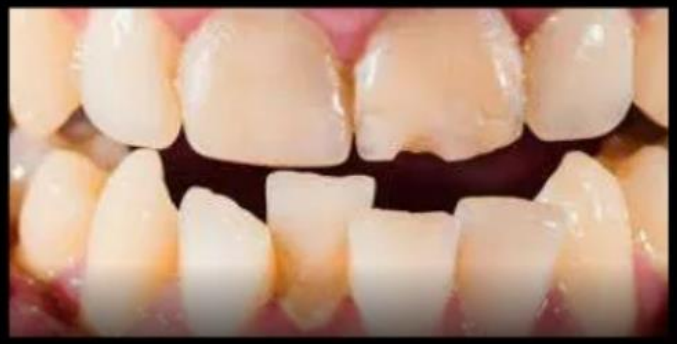


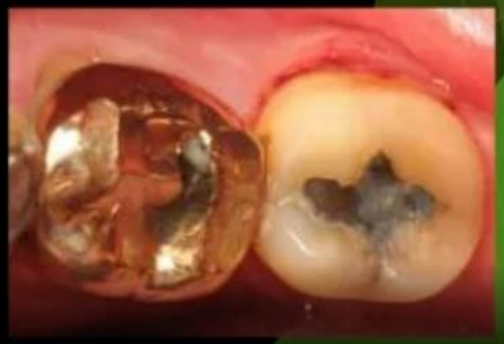
Factors influencing caries etiology:

Host factors	Components
Tooth	1. Composition 2. Morphologic characteristics 3. Position
Saliva	1. Composition a) Inorganic b) Organic 2. pH 3. Quantity 4. Viscosity 5. Antibacterial factors
Diet	1. Physical factors a) Quality of diet 2. Local factors a) Carbohydrate content b) Vitamin content c) Fluorine content
Systemic conditions	

- ✓ Susceptible sites of plaque retention:

  - Enamel pits and fissures – occlusal surface
  - Buccal pits, palatal pits, lingual pits
  - Proximal surfaces
  - Cervical regions of crown
  - Exposed root surfaces
  - Rough margins of restorations
  - Malaligned teeth – Out of position, Rotated





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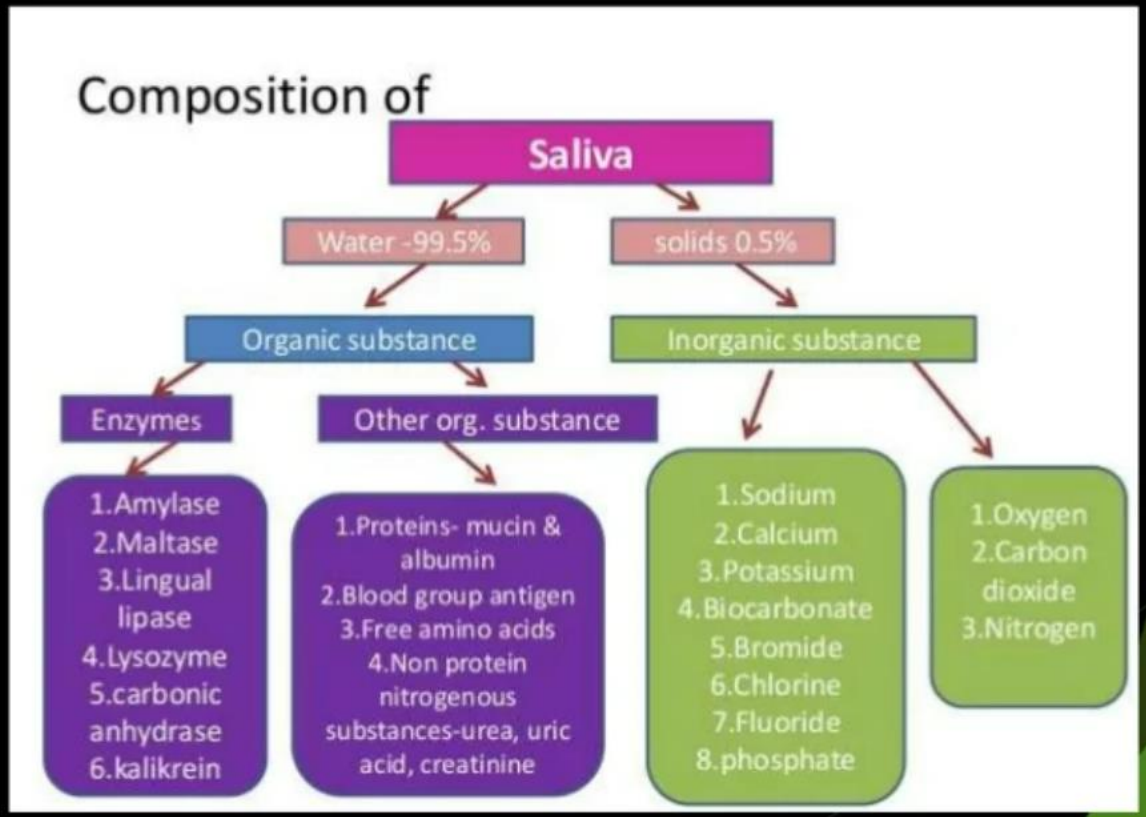
Saliva factors:

- ✓ Saliva is a major factor in caries progression as it is the medium in which plaque develops.



- ✓ Calcium & phosphate concentrations in saliva: they have a natural defense mechanism against dissolution of teeth.
- ✓ pH of saliva: Below critical pH i.e 5.5, inorganic material of tooth dissolves.
- ✓ Buffer capacity: major buffer systems are bicarbonate carbonic acid and phosphate.
- ✓ Antibacterial properties of saliva: Lysozymes, salivary peroxidases, immunoglobulins, lactoferrin, mucin.

Caries Risk Assessment Factors
Social History

- Socially deprived
- Caries high in peers and relatives
- Dental awareness
- Dental attendance
- Snacks frequency

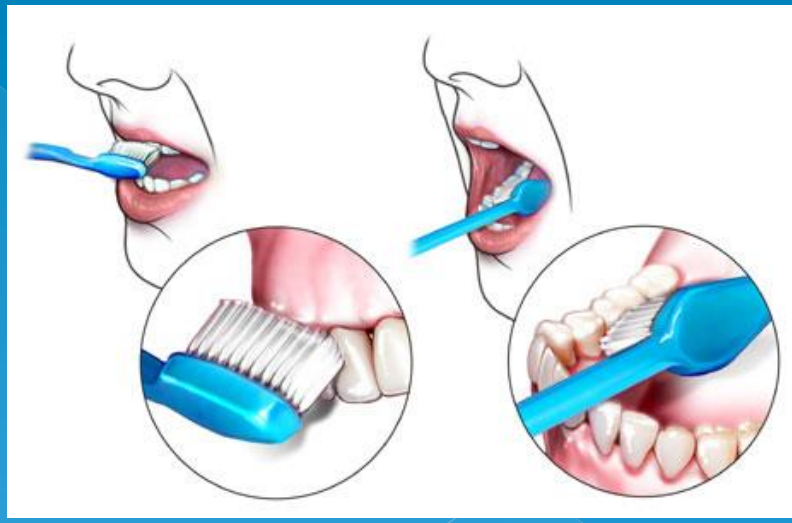
Caries Risk Assessment Factors

Medical History

- Medically compromised
- Sugars based medicines
- Xerostomia
  - ✓ Head & neck radiotherapy
  - ✓ Medications (diuretics, antihypertensives, antidepressants,..)
- Disabled patients

Caries Risk Assessment Factors
Plaque Control

- Effective cleaning
- Frequency of cleaning
- Manual Control



Caries Risk Assessment Factors
Dietary Habits

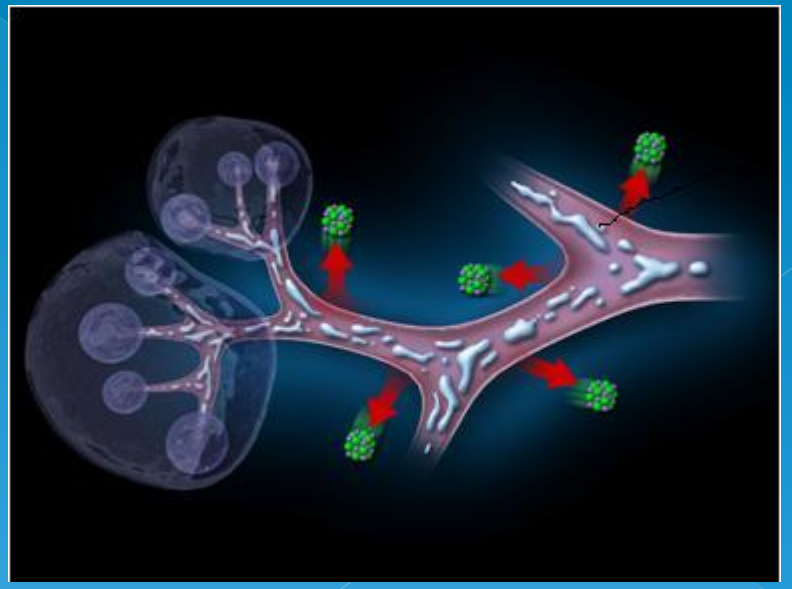
- Sugar intake frequency
- Can change with time (lifestyle change)

Caries Risk Assessment Factors
Fluoride use

- Lives Fluoridated area or not
- Fluoride supplements (child given or not)
- Fluoride toothpaste /mouth rinse (being used or not)

Caries Risk Assessment Factors
Saliva

- Flow rate (normal or not)



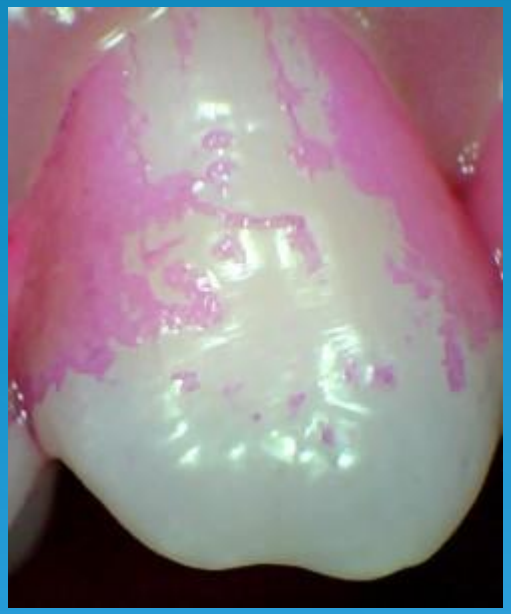
Caries Management

One of the major concerns is the ability of the patient to remove the biofilm.

Caries Management

Caries Control Checklist

- ✓ Plaque control: disclosing agents, mechanical control



Caries Management

Caries Control Checklist

- ✓ Diet Control
- ✓ Fluoride: water content, toothpaste, mouthwash
- ✓ Salivary flow

Professional prophylaxis

- Use of professionally applied Fluoride
- Diet advice by dentist
- Fissure sealant application esp in high caries risk patients

Thank you!

Instrumentation and Equipment for Tooth Preparation

DR. NADA NAJJAR

13/9/2022

DEPARTMENT OF PROSTHODONTICS AND OPERATIVE DENTISTRY

History

- Removal and shaping of tooth structures is an important aspect of operative dentistry
- Initially it was accomplished only by hand (manual instruments)
- Early hand-operated instrument had large heavy handles and were not helpful for the dentist
- Made from carbon steel or stainless steel

Instrument Categories

- Cutting

  (excavators, chisels or hatchets..)

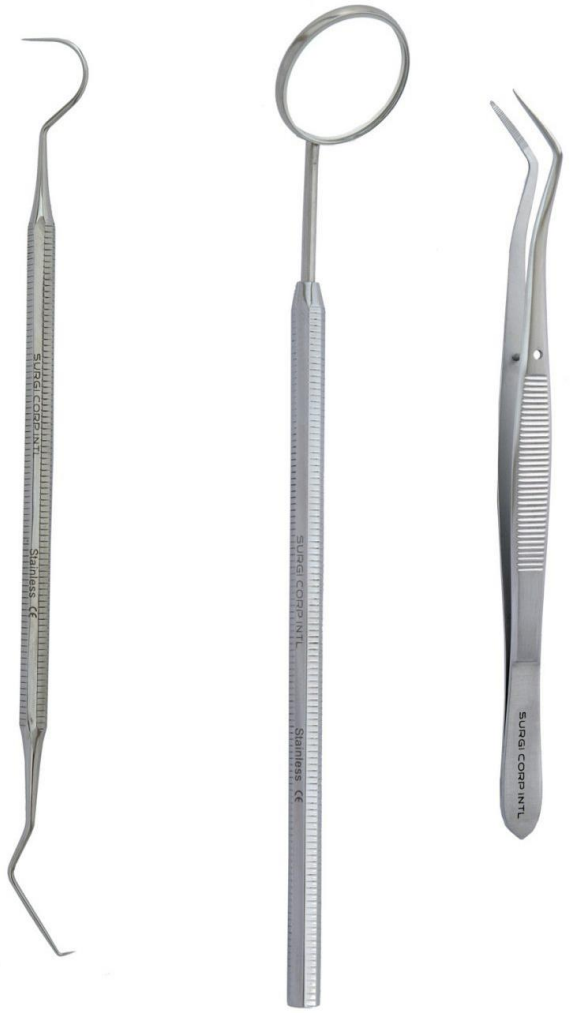
- Noncutting

  (Mirrors, Probes, amalgam condensers…)

Noncutting Instruments

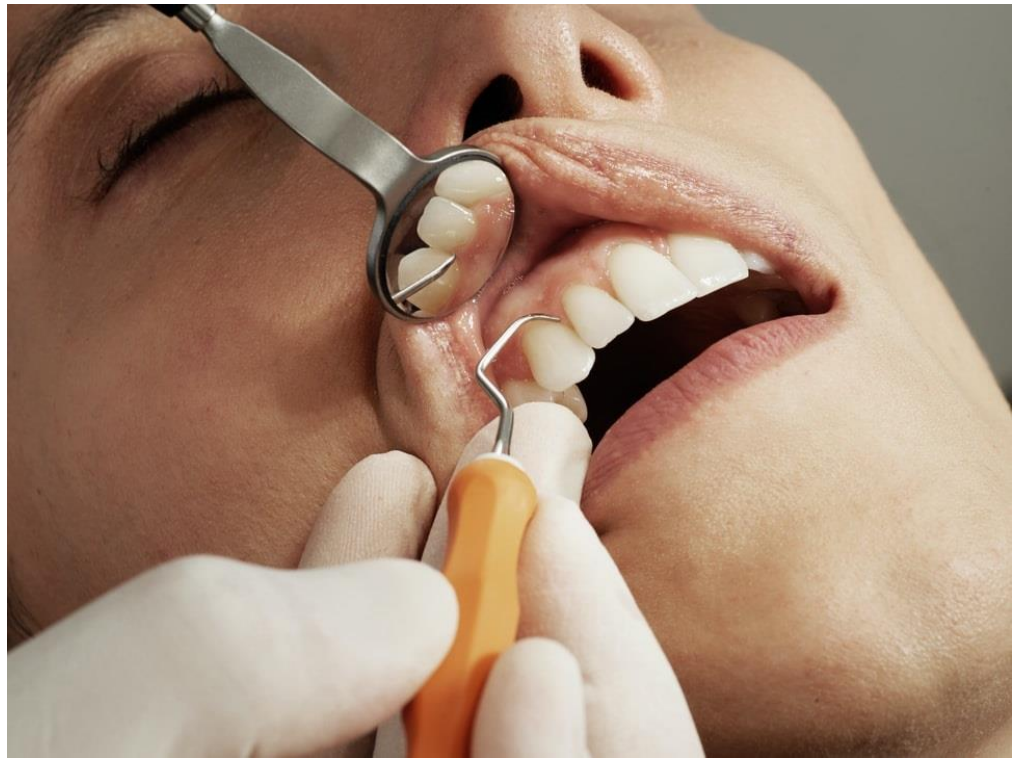
EXAMINATION KIT AND RESTORATION EQUIPMENT

Examination Kit



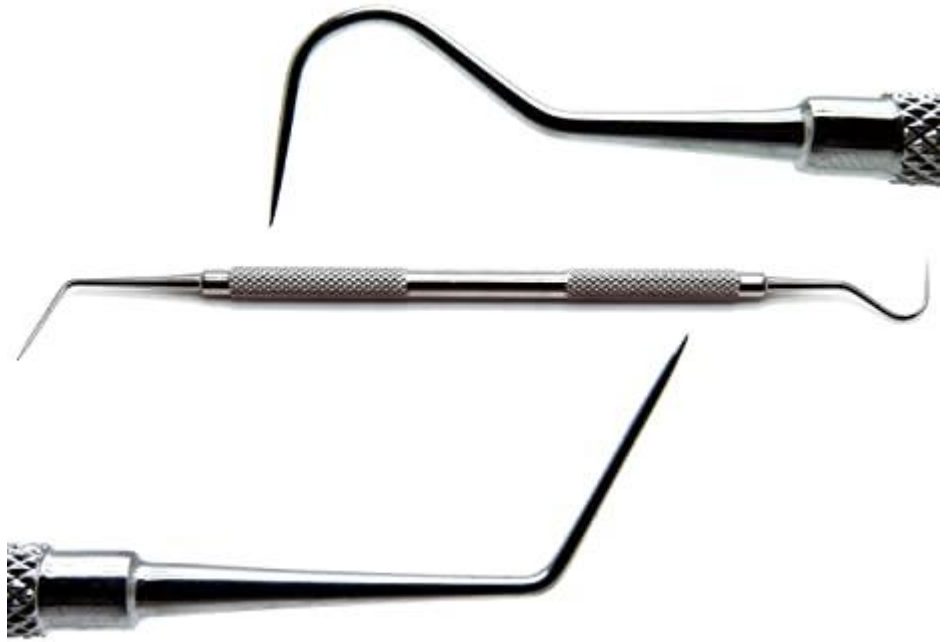
Dental Mirror

- dental mirrors allow dentists and hygienists to see different areas of the mouth and examine a patient's teeth and gums from a variety of angles. These mirrors should be small enough to maneuver within the patient's mouth and comfortable in the clinician's hand. Mirrors can be disposable or reusable.
- Also used for retraction



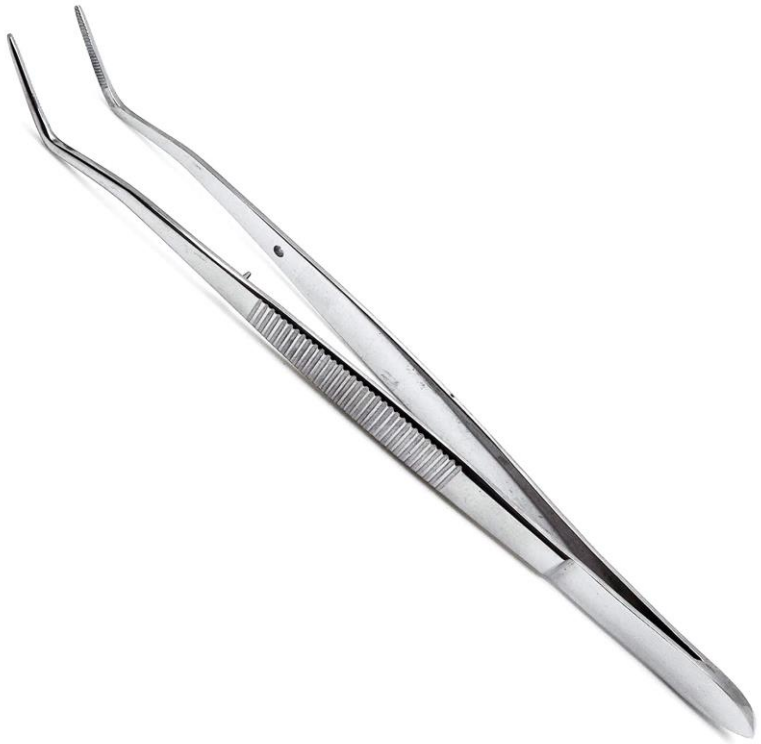
Probes or Explorers

- The dental explorer is used to check the occlusal surface of the tooth for hard tissue defects such as small fractures and pulp exposure.
- Checks the existence of a “catch” if a cavity exists



Dental Tweezers

- Tweezers have angled serrated tip, it provides an optimum angle to perform the procedure.
- Tweezers are most commonly used in dentistry to carry and place cotton rolls between cheek and gum



Restoration Equipment

Restoration Equpiment

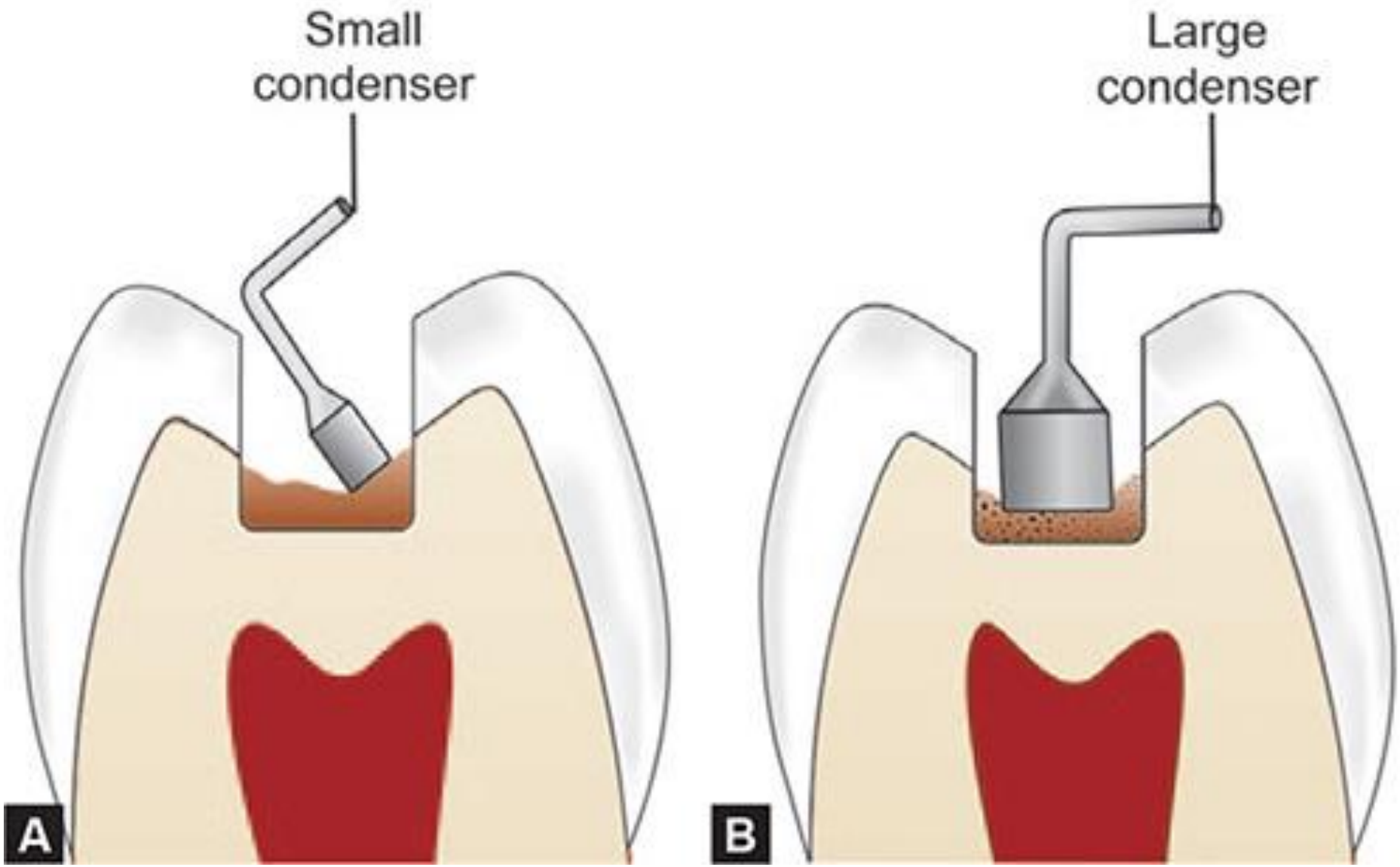
- Carriers
- Condensers
- Burnishers
- Carvers

Amalgam Carriers

- Amalgam carriers are instruments used to fill dental cavities with amalgam. These act like syringes, carrying in their tubular tip the amalgam that is inserted and pressed in the dental cavity by pressing on a lever, which activates the piston inside the tube or the back end of the amalgam carrier

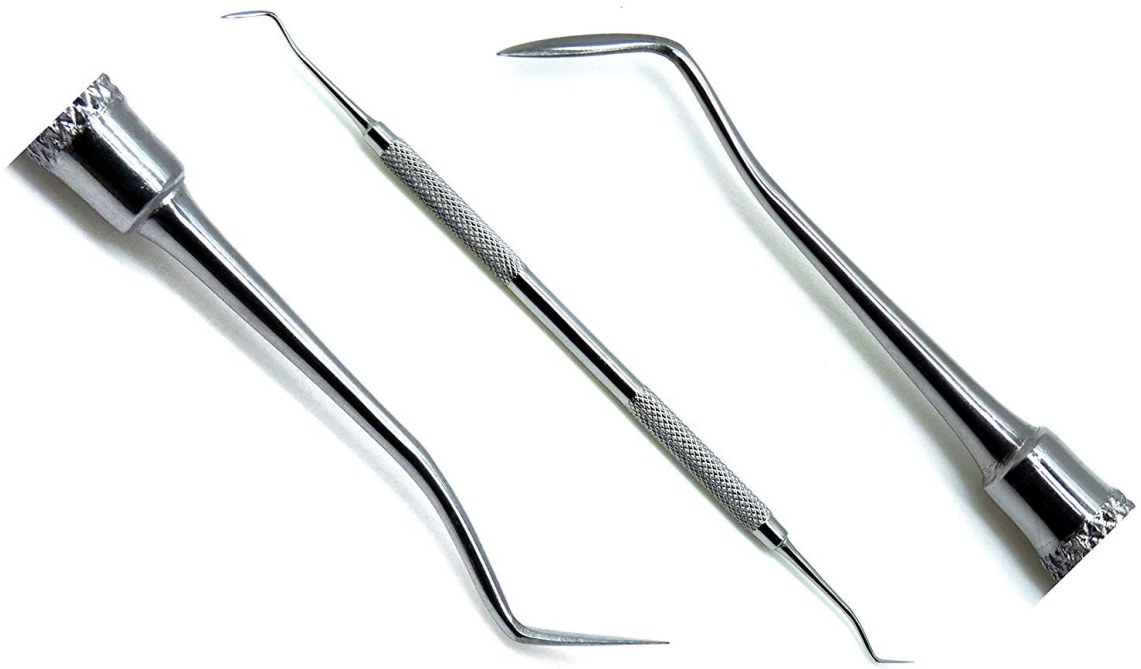
Condensers

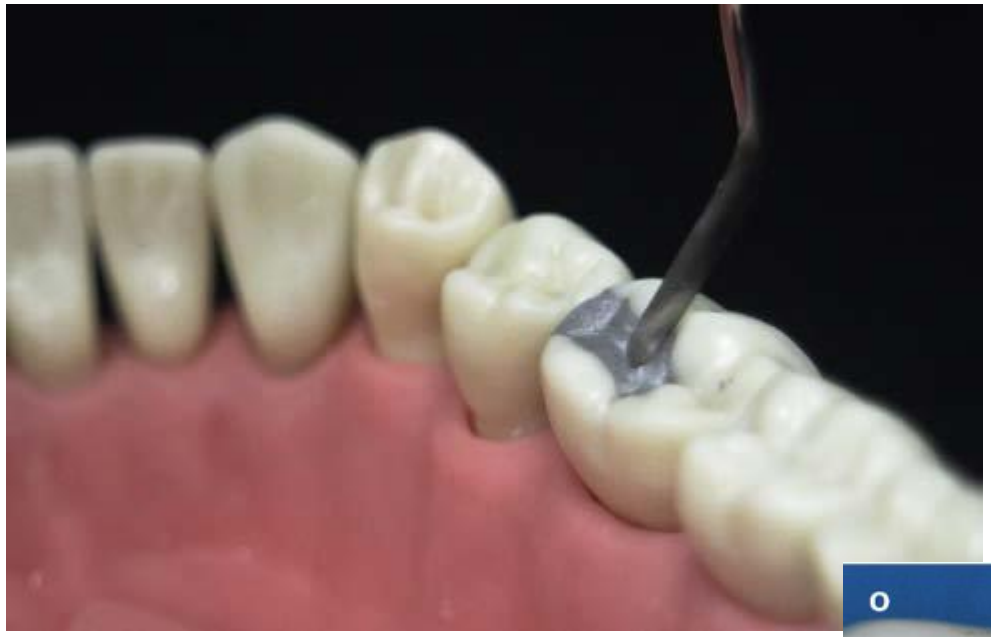
- Used to condense the amalgam or composite.
- They are used to deliver and condense the restoration to the tooth preparation
- Double-ended (one or two sizes)
- Small size diameter is usually 1.1-1.2 mm

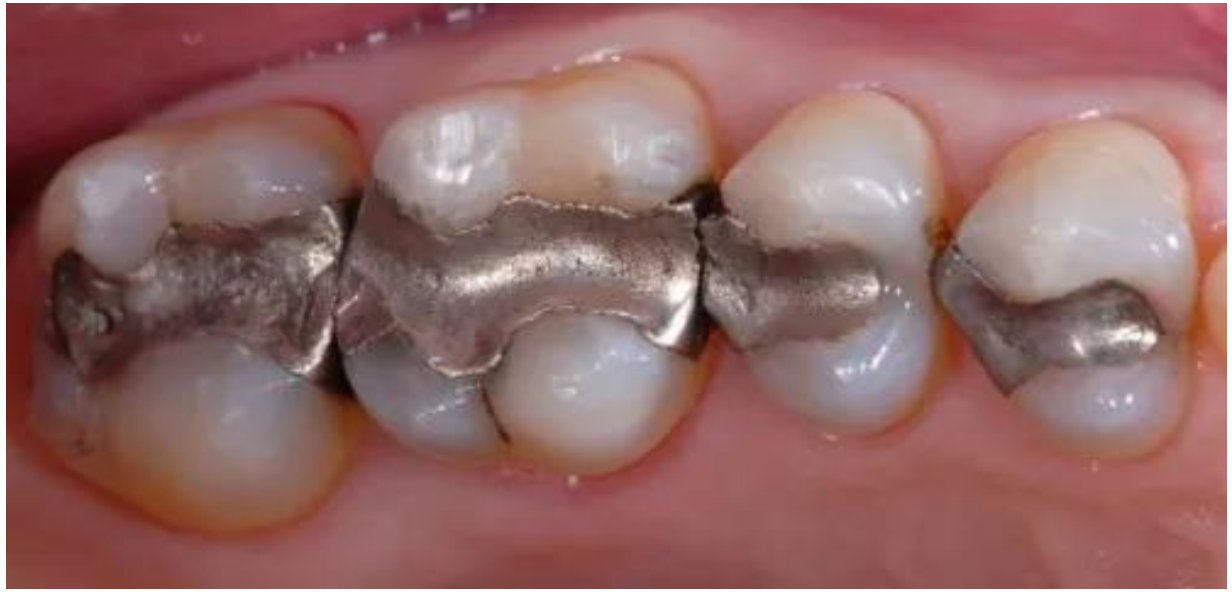

Small
condenser
Large
condenser
A
B

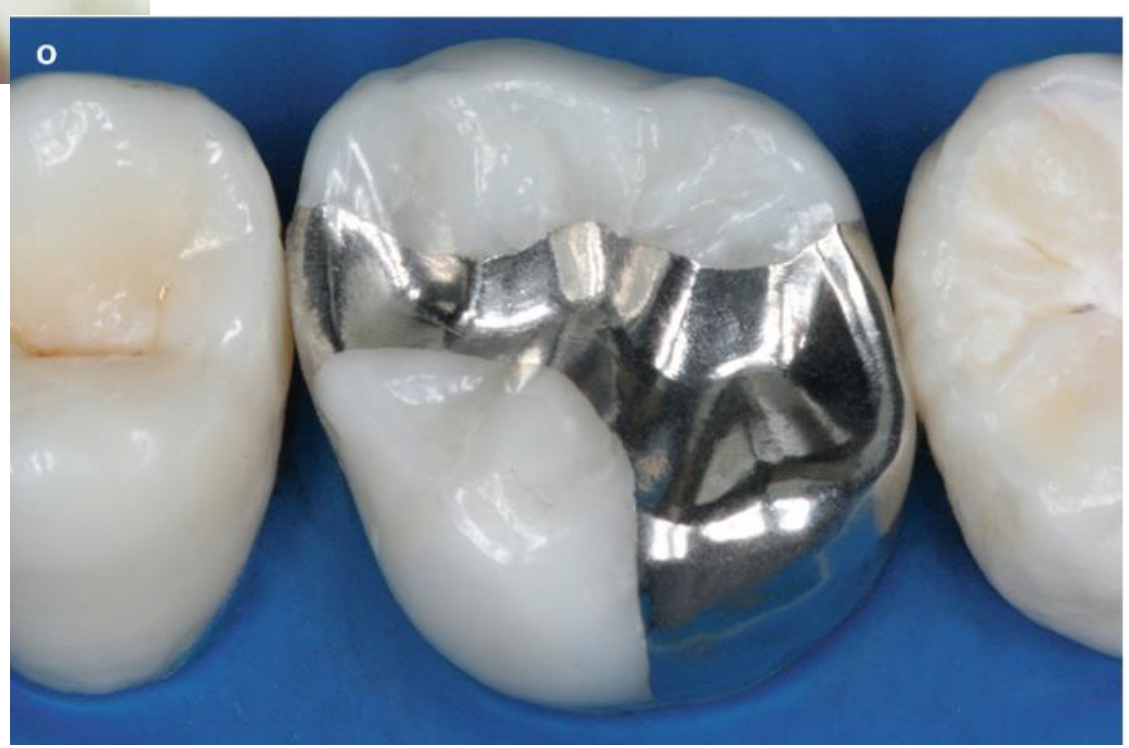
Hollenback Carvers

- Hollenback carver is a double ended, round handle dental instrument used for placing, carving and contouring amalgam and also composite.
- It shapes and restoration into the correct morphology of the tooth (draws pits and fissures back)





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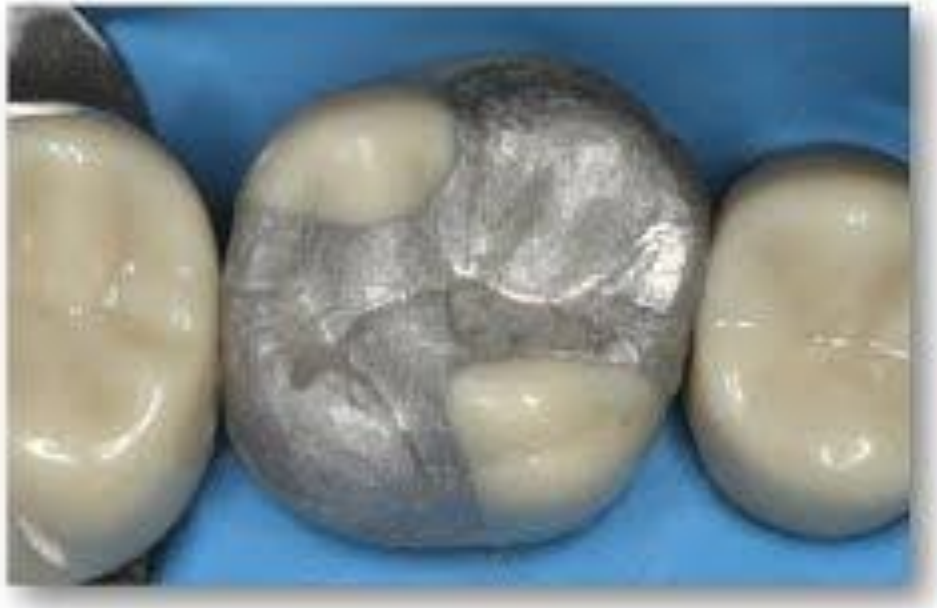
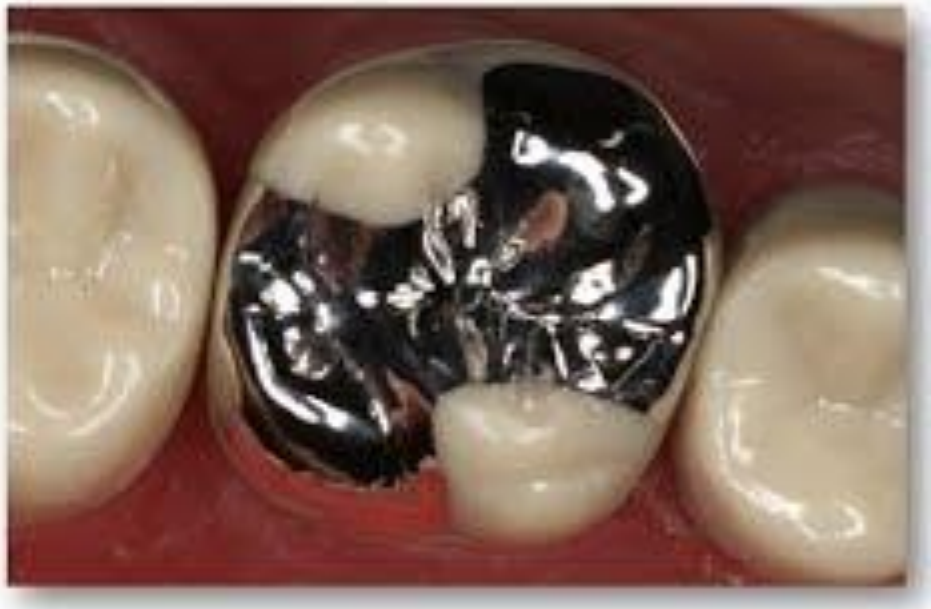
Burnishers

- Round burnishers
- Egg burnishers
- Anatomical Burnishers

COMPLEX AMALGAM





PART 3 - FINISH & POLISH

STEVENSON
DENTAL SOLUTIONS

Cutting Instruments

EXCAVATORS, HATCHETS, HANDPIECES AND BURS

Instrument Names

- Black classified the instruments by name:

1. according to function (scaler, excavator…)
2. Manner of use (condenser…)
3. Design of working end (spoon excavator…)
4. Shape of shank (contra angle, double sided…)

Manual Cutting instruments

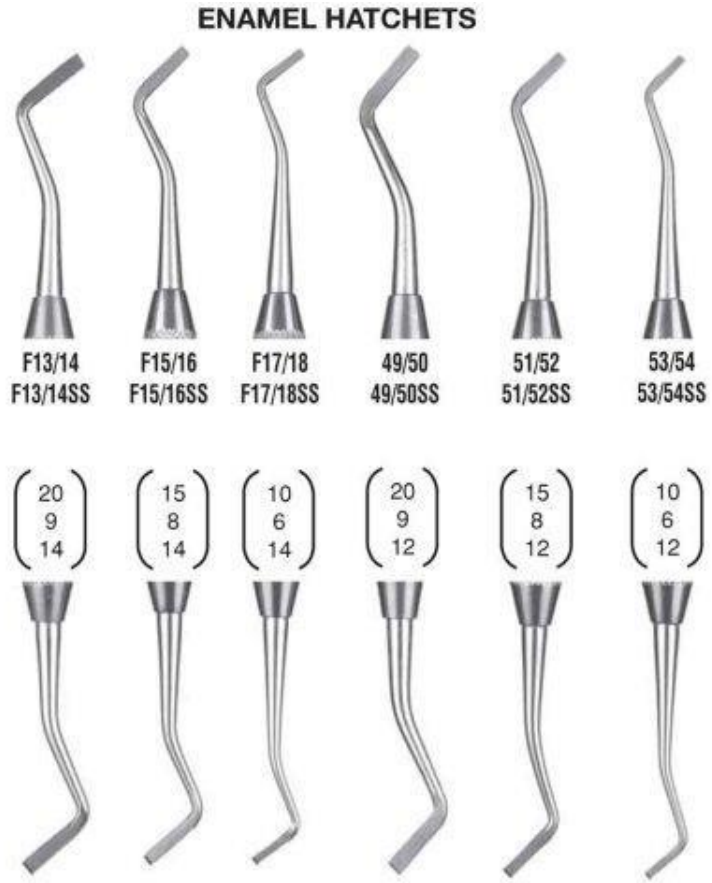
- Excavators
- Chisels

Excavators

- dental excavator is a hand instrument used in dentistry designed to remove carious tissue.
- It has the shape of a very small sharp spoon. Before a filling can be placed, the decayed dentin near the pulp must be removed with a dental excavator

Chisels or Hatchets

- It is a bi-beveled or single beveled cutting dental hand instrument having its cutting edge in line with the axis of its blade.
- It is used for breaking down tooth structure undermined by caries, smoothing cavity walls, removing unsupported enamel, and sharpening line and point angles



Powered Cutting Equipment

HANDPIECES (HIGH SPEED, LOW SPEED, AND DENTAL BURS)

Handpiece

- the part of a mechanized device designed to be held or manipulated by hand especially: the handheld part of an electrically powered dental apparatus that holds the revolving instruments (as a bur)
- An instrument for holding dental burs to remove tooth structure or to smooth and polish restorative materials

Conventional designs

- Straight
- Angled

Dental Handpieces

- Used for the following:
  - Remove dental decay
  - Prepare tooth for restoration
  - Polish
  - Polish and finish dental restorations
  - Cut, finish, and polish dental appliances
  - Trim models and trays

- **High Speed**

- **Low Speed**

High-Speed Handpiece

- Used to rapidly cut tooth structure and finish restorations
- Operate at up to 450,000 revolutions per minute (RPM) and higher
- A smooth, one-piece design, usually a contra-angle (attachment head) with the head slightly angled to the shank of the handpiece
- Does not hold any attachments
  - Holds burs and other rotary instruments with the head of the handpiece in a small, metal cylinder called a chuck
  - Holds burs with a friction-grip shank
- To tighten or loosen the chuck, either a bur tooth/wrench or a button/release lever on the back of the head of the handpiece is used
  - the manufacturer provides the specific tool used with the handpiece, so they are packaged TOGETHER

High-Speed Handpiece

- The power source for the dental handpiece comes from the dental unit
  - Compressed air drives the turbines in the handpiece
    - To activate and control the speed, a rheostat (foot control) is operated, (like the accelerator on a car)
- Available with fiber-optic light source
  - Improves visibility of the tx area for operator
  - The fiber-optic light is carried along optical bundles in the tubing of the handpiece

High-Speed handpiece

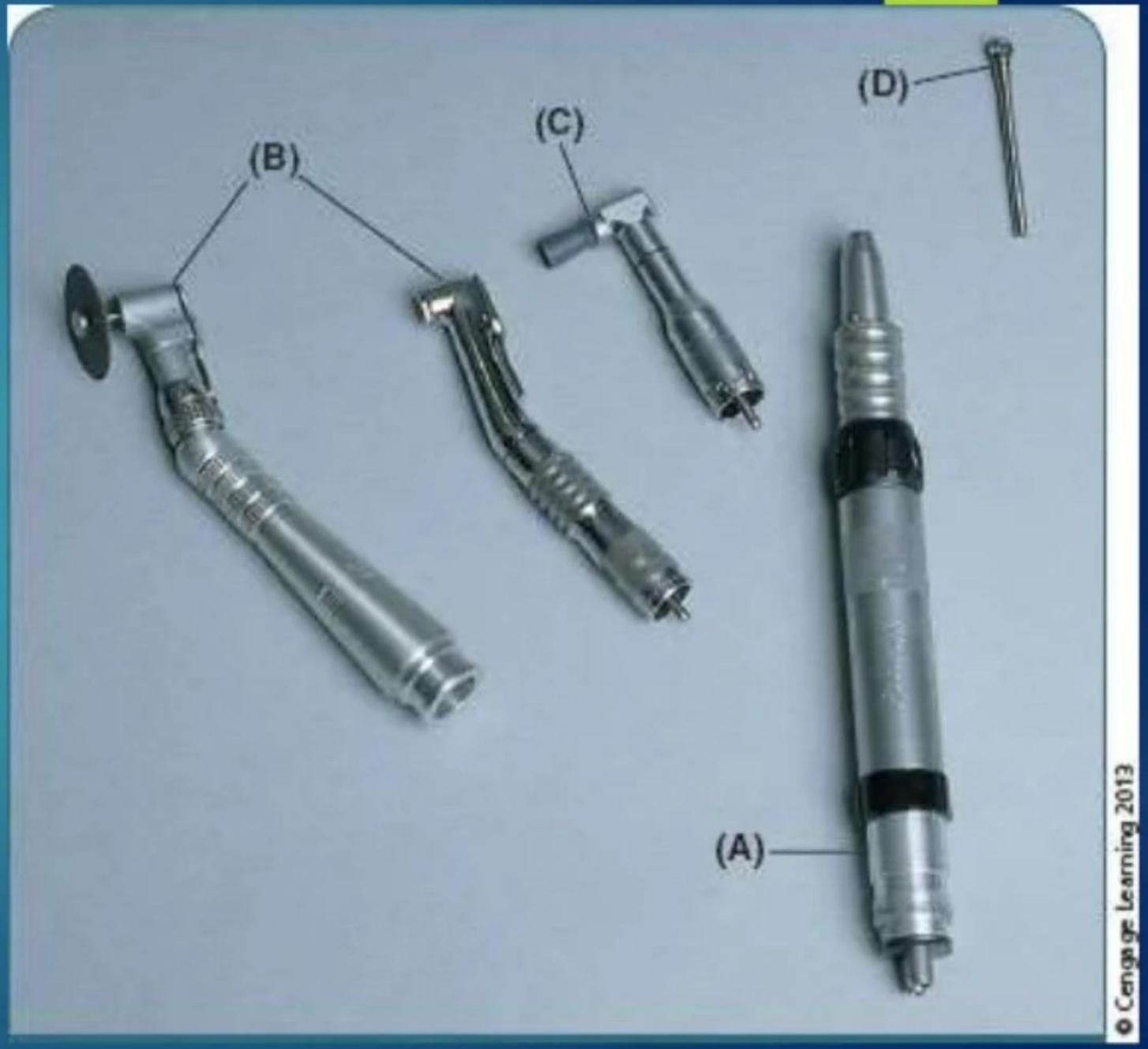
- High–speed handpieces can produce frictional heat, which can cause pulpal damage to the tooth.
- It is important to use a coolant, such as air, water, or and air-water spray to reduce the frictional heat.

Low-Speed Handpiece

- Low-speed handpieces are used in both the dental office and laboratory.
- Its uses in the dental office are to polish teeth and restorations, remove soft carious material, and define cavity margins and walls.
- Usually do not have water supply
- Operate at up to 30,000 RPM

Low-Speed

- A little bulkier than high-speed
- Used with long-shank (straight) rotary instruments, contra-angle attachments, and right-angle attachments



Evolution of Rotary Cutting Equipment in Dentistry

DATE	INSTRUMENT	SPEED (RPM)
1728	Hand-rotated instruments	300
1871	Foot engine	700
1874	Electric engine	1000
1914	Dental unit	5000
1942	Diamond cutting instruments	5000
1946	Old units converted to increase speed	10,000
1947	Tungsten carbide burs	12,000
1953	Ball bearings handpieces	25,000
1955	Water tubine angle handpiece	50,000
1955	Belt-driven angle handpiece (Page-Chayes)	150,000
1957	Air turbine angle handpiece	250,000
1961	Air turbine straight handpiece	25,000
1962	Experimental air bearing handpiece	(800,000)
1994	Contemporary air turbine handpiece	300,000

Dental Burs

COMMON DESIGN CHARACTERISTICS

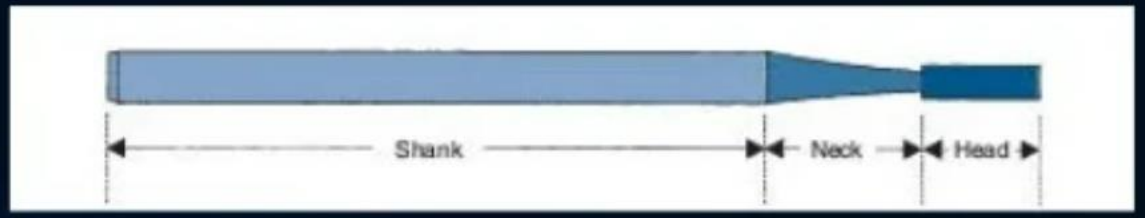
- Each instrument consists of 3 parts:
  - Head
  - Neck
  - Shank

SHANK DESIGN

- Part that fits into the hand piece, accepts the rotary motion from the handpiece
- Provides bearing surface to control the alignment and concentricity of the instrument.
- Shank design and dimensions vary with the hand piece for which it is intended for.
- ADA Specification No. 23 for dental excavating burs includes 5 classes

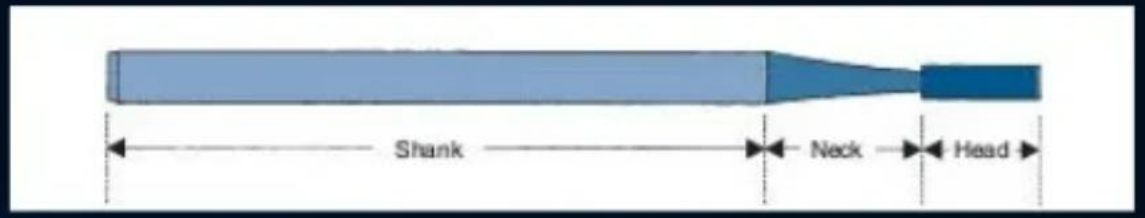
NECK DESIGN

- Portion that connects the head to the shank.
- Neck normally tapers from the shank to the head.
- Main function - transmit rotational and transitional force to head.
- Also provides visibility and ease of operation.
- For this reason neck diameter is a compromise between strength and improved access and visibility.



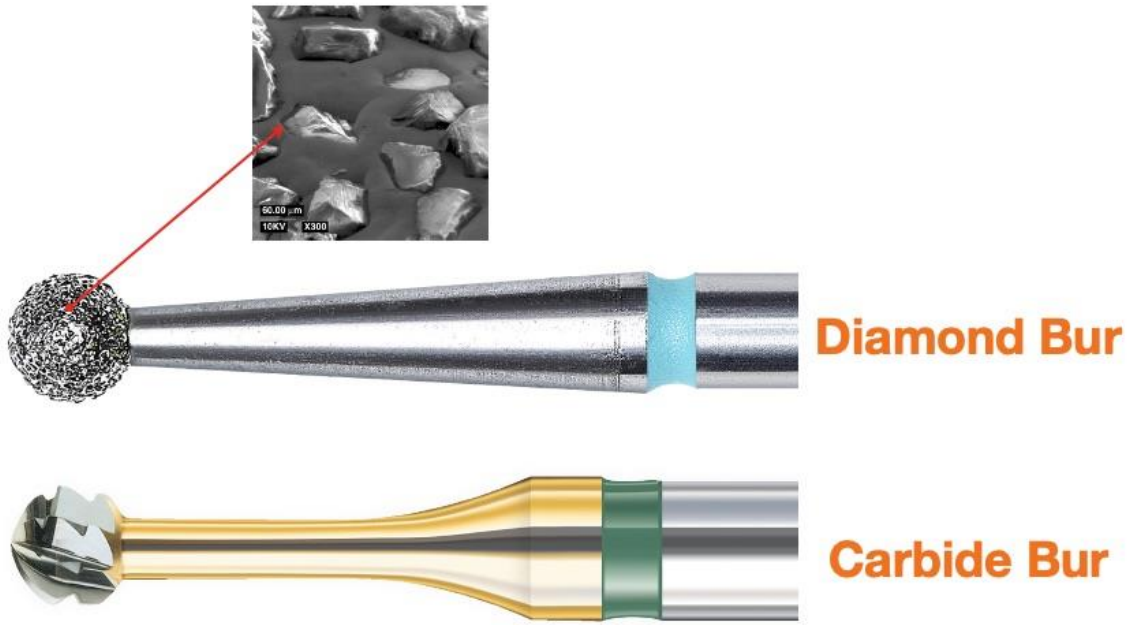
HEAD DESIGN

- It is the working part of the instrument - cutting edges or points.
- Shape and material used in manufacture are closely related to its intended application and technique of use.
- Head design forms the basis of instrument classification, such as; bladed instrument or abrasive instrument.



Types of burs

- Carbide burs
- Diamond burs

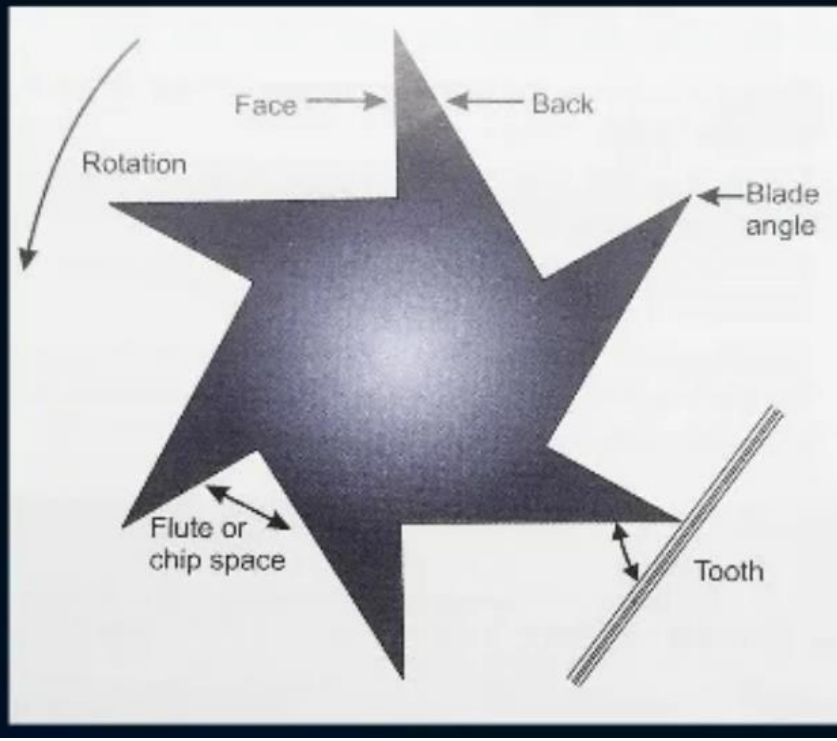


Carbide Burs

BUR DESIGN

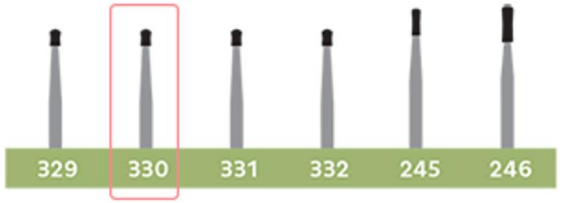
- Bur head consists of uniformly spaced blades with concave areas between them.
- Normally a cutting bur has 6, 8 or 10 blades and a finishing bur has 12-40 blades.
- Concave areas are called the chip/flute spaces.

- Actual cutting of the bur takes place at the edge of the blade.



330 Bur

- The burs head measure 1.8 mm
- Used for minimal caries in molars and premolars
- Used also for pedodontics

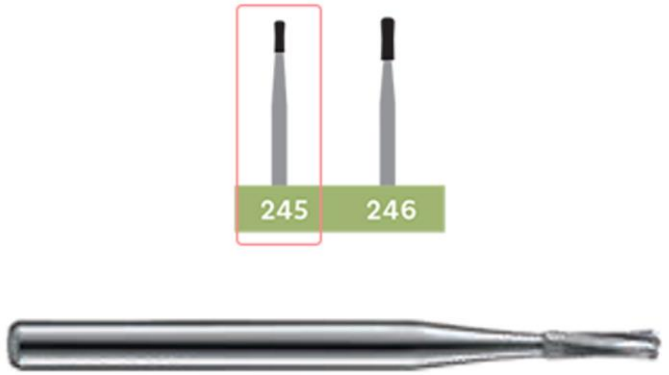


Pear

330

245 Bur

- Bur head measures 3 mm
- Used for minimal caries in proximal surfaces of molars and premolars
- Also used in Pedodontics



Amalgam Prep

245

Diamond Burs

Diamond Abrasive Instruments

- They have a greater clinical impact due to long life and effectiveness in cutting enamel and dentin.

- Introduced in United States in 1942 and was used popularly as grinding and finishing agents.

Terminology:

- Diamond instruments consists of 3 parts:
  - Metal blank
  - Powdered diamond abrasive
  - Metallic bonding material

- Metal blank resembles a bur without blades
  - 3 parts: Head, Neck & Shank

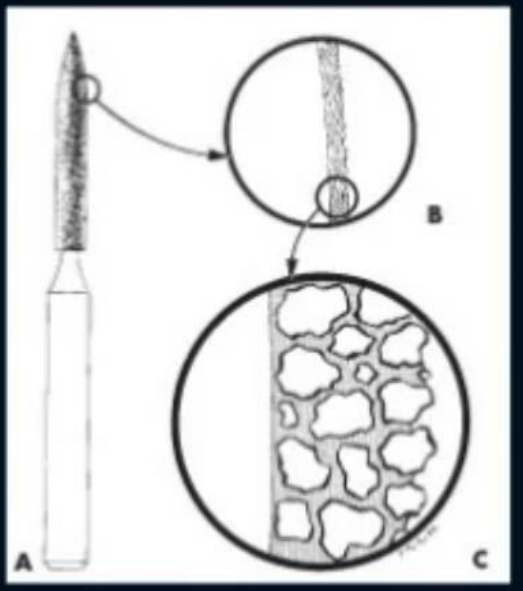
  - Head of blank is slightly smaller than the final dimension of the instrument head to accommodate for the thickness of abrasive layer.

  - Neck gradually tapers from the shank to the head.
    - For large disk/abrasives, it may not be reduced below the shank.

  - Diamonds maybe either natural or synthetic; that are crushed to a powder of desired particles in size and shape.

- These are held against the blank while it is being electroplated with a metal.

- Done in multiple layers to provide a continuous regeneration of cutting surface as wear occurs.



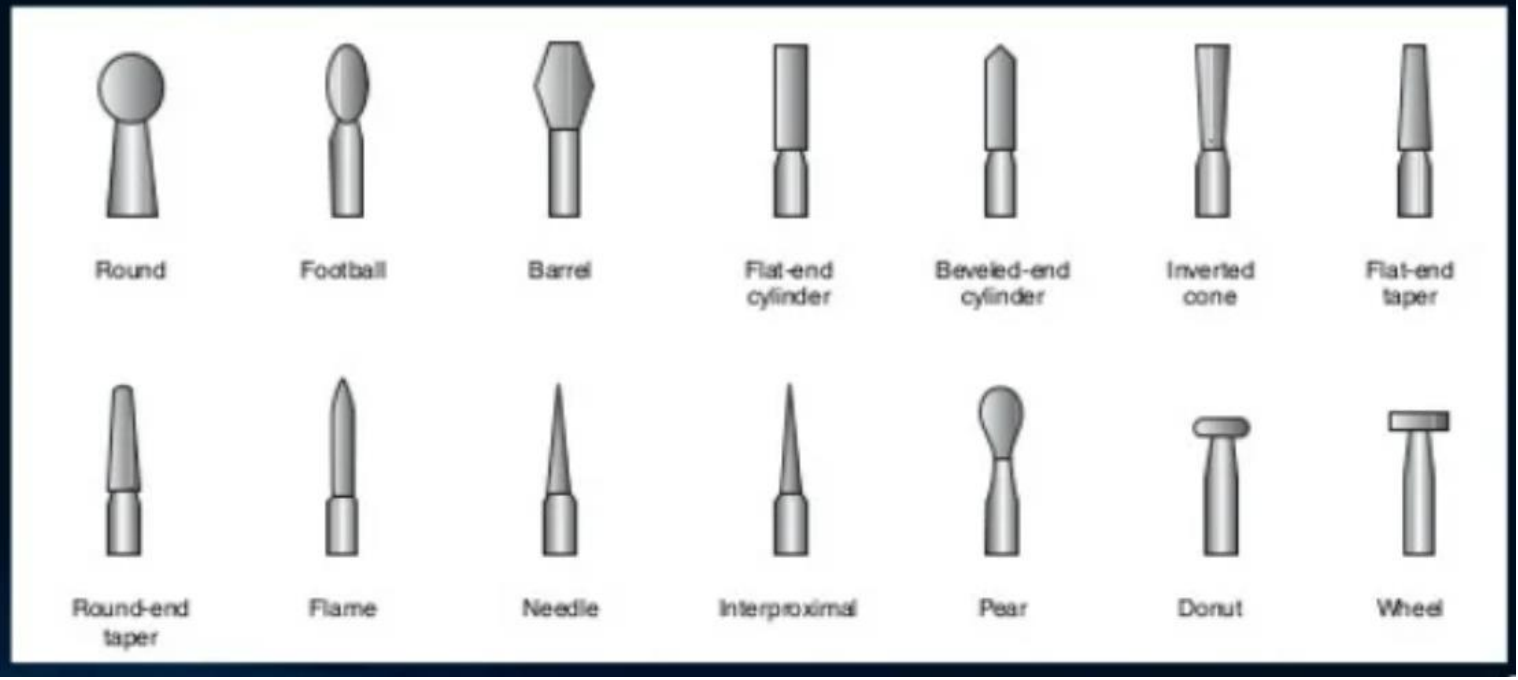
Classification

Classified based on average particle size of the abrasive:

- Coarse grit : 125 – 150 µm
- Medium grit : 88 – 125 µm
- Fine grit : 60 – 74 µm
- Very fine : 38 – 44 µm

Head shapes and sizes

- Available in wide variety of shapes and sizes.
- Because of their design which an abrasive layer over an underlying blank, the smallest diamond instrument cannot be as small in diameter as the smallest of burs, but a wide range of sizes are available for each shape.



Shapes of Dental Burs

Ball

Spear

Conical

Double Cone

Flame

Upside-down Cone

Football

Veneers

Pear

Cylinder

Wheel

Torpedo

FACTORS INFLUENCING THE ABRASIVE EFFECIENCY AND EFFECTIVENESS

1. **Size of the abrasive particle**

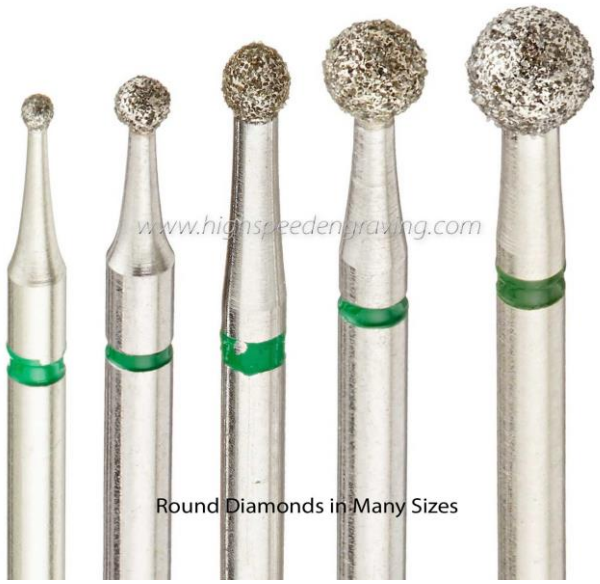
   - Larger the particle size, more deeper is the penetration on the surface of the work, hence rapid removal of the material occurs.

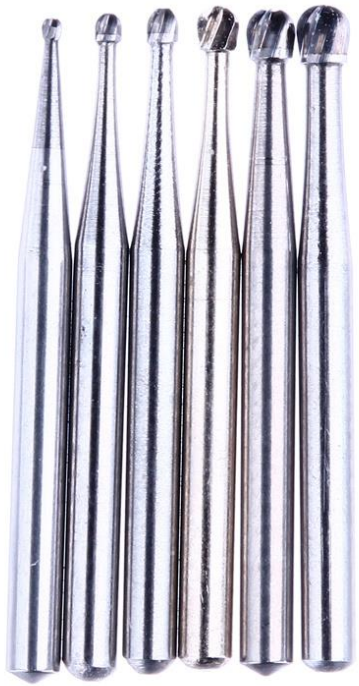
2. **Shape of the particle**

   - Should be irregular in shape for greater efficiency.
   - Irregular particles – sharp edge
   - So cuts better than round smooth or cuboidal particles which have a flat edge.

Round Bur

- Round burs are used for cavity preparation and creating access points
- Referred to as A bur





Inverted Cone bur

- To adjust the cavity shape (convergence form and a flat floor)
- Referred to as B bur

Finishing and Polishing Burs

Amalgam Polishing Burs

Composite Finishing and Polsihing Burs

Composite Finishing Diamonds

Grit	Color Band	Microns
Compo Ultra Fine	Violet	17-23
Compo Fine	Yellow	34-40

Thank you

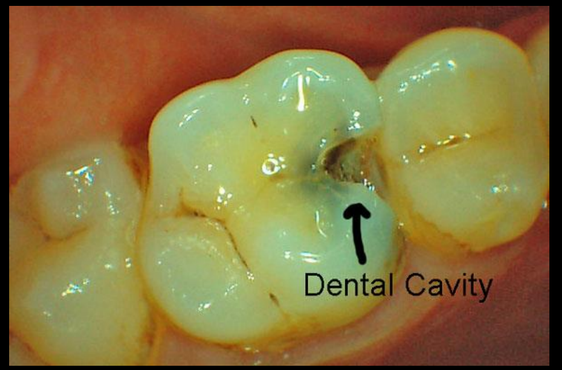
Principles of Cavity Preparation

Dr. Nada Najjar

14/9/2022

What is a Cavity?

Defect in the hard tooth structure resulting from carries or trauma



What is Cavity Preparation?

Mechanical alteration of a tooth to receive restorative material. Which will return the tooth to proper form, function and esthetics

Cavity Preparation

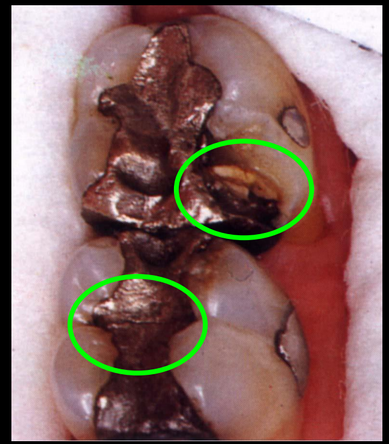
Indications:

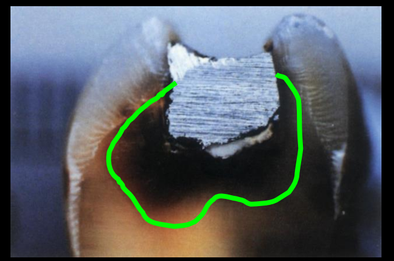
1- Carious lesion

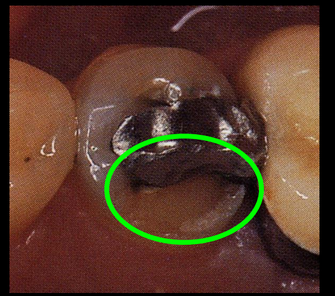
2- Fractures

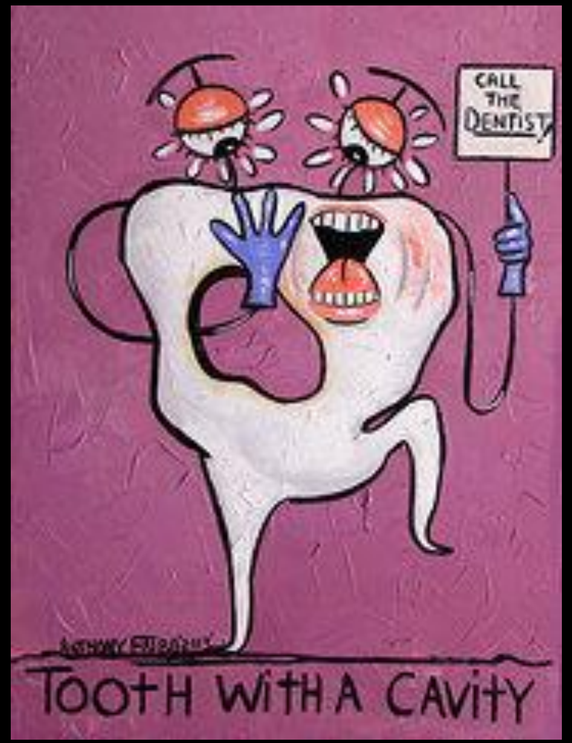
3- Restoring the form and function if absent congenitally

4- Esthetic demand of the patient









Why Do We Prepare Carious Cavities?

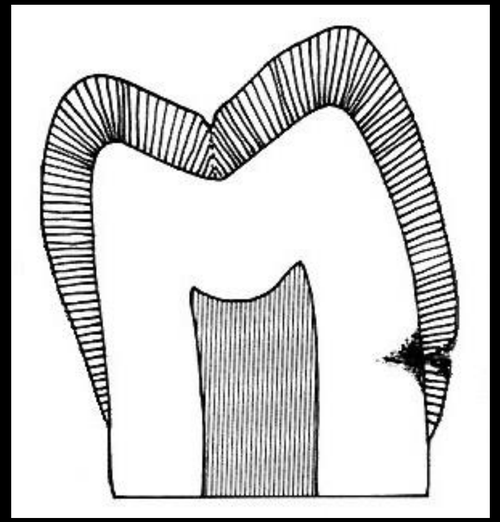
To remove carries and create a compatible foundation from the restoration

Objectives of Cavity Preparations

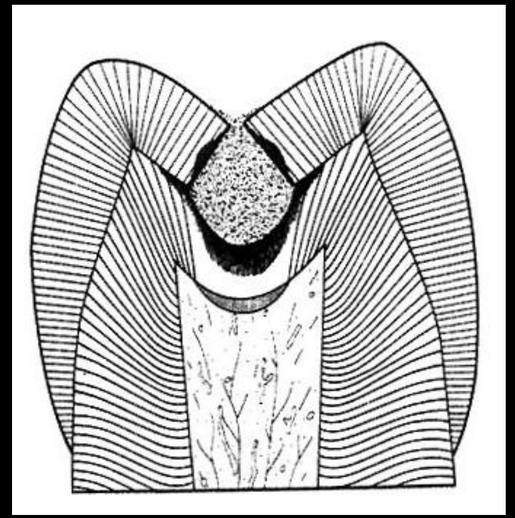
1. Remove diseased tissues (protect the pulp)
2. Retain filling material
3. Resist forces of mastication
4. Restore function and/or esthetics of teeth

Carries Could Start In…

Smooth Surfaces



Pits and Fissures

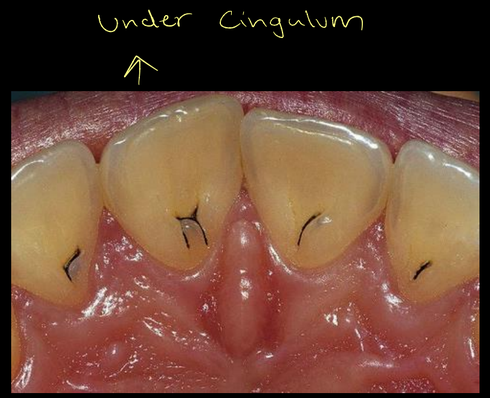


Cavity classification

Occlusal surface

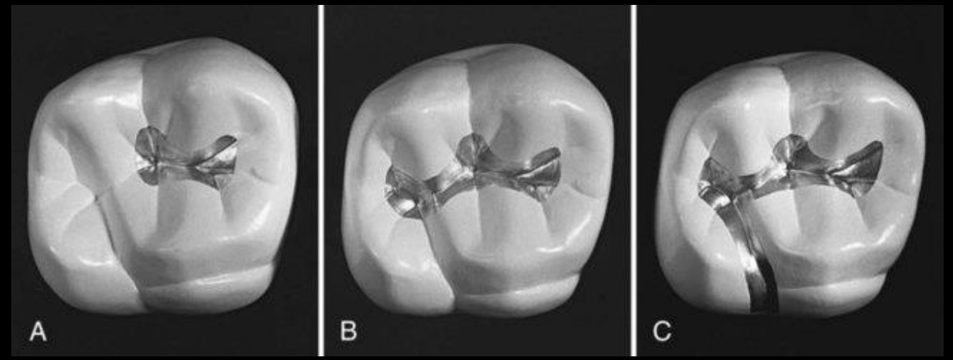
- Class I → Starts from B surface

  All pit and fissure cavities/restorations



- Could be on:

1. Occlusal surfaces of molars and premolars
2. Facial and lingual surfaces of molars
3. Lingual surfaces of maxillary incisors



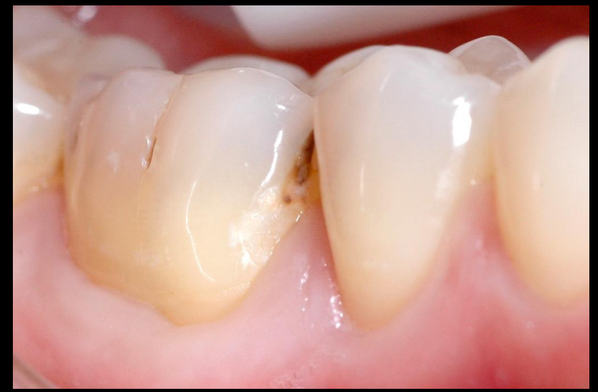
Cavity classification

for molars + premolers

- Class II — Mesial or Distal

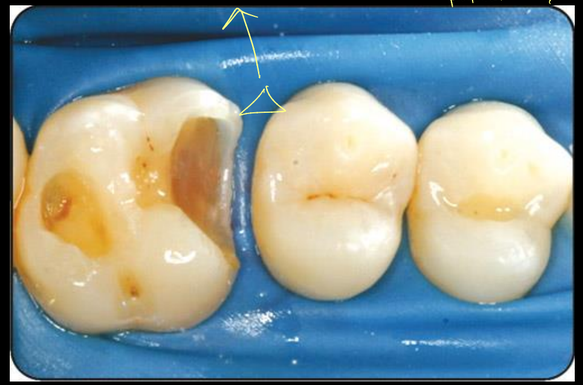
  Proximal surfaces of posterior teeth

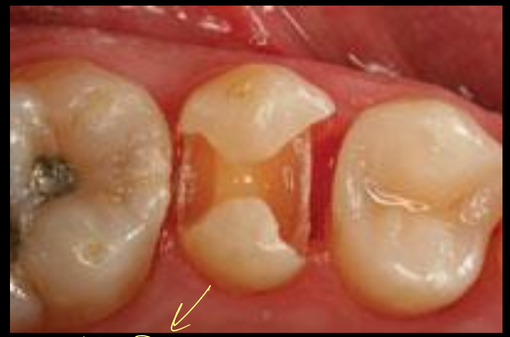
  Proximal and Occlusal surfaces of posterior teeth



Proximal area تنظيف الاسنان هل *

Big impresser → Big % for Carries

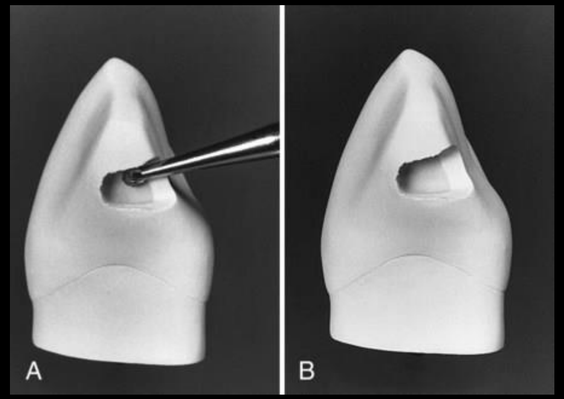


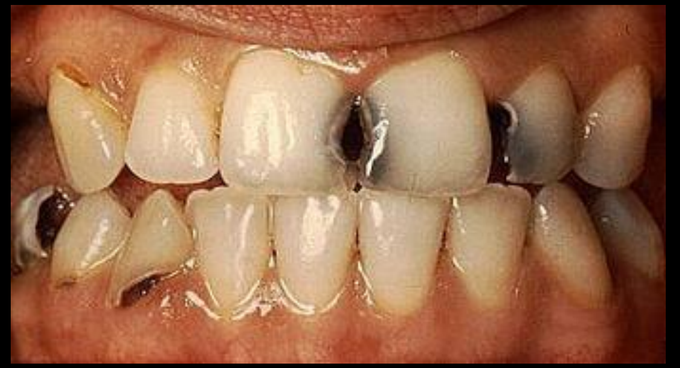


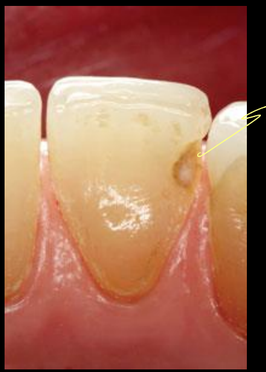
Cavity classification

- Class III

  Proximal surfaces of anterior teeth (do not involve the incisal angle)



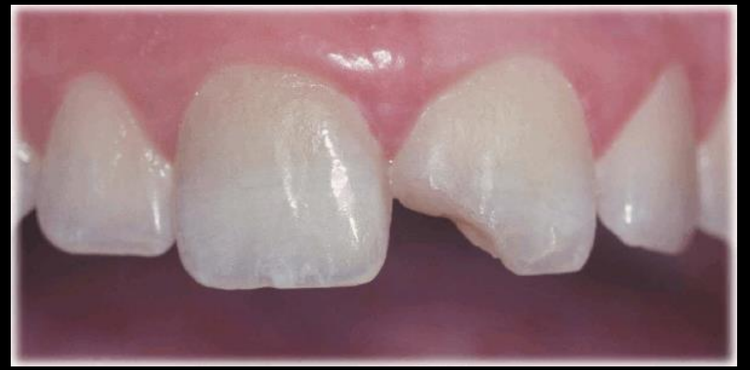


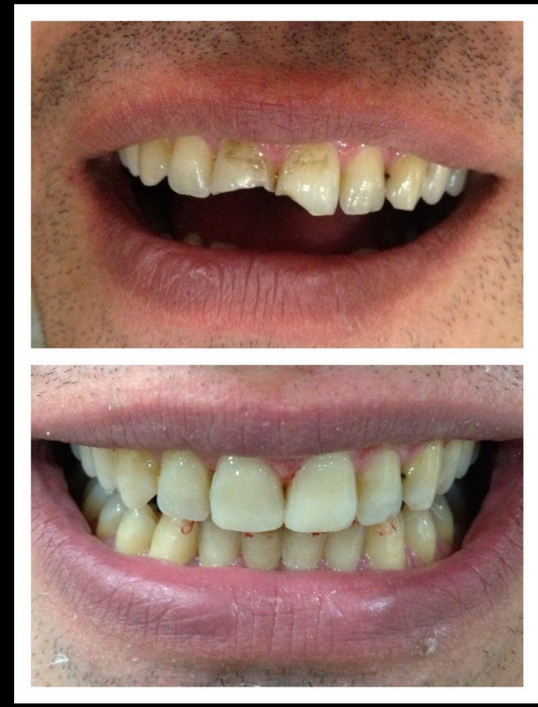


Cavity classification

- Class IV

  Proximal surfaces of anterior teeth that do involve the incisal angle



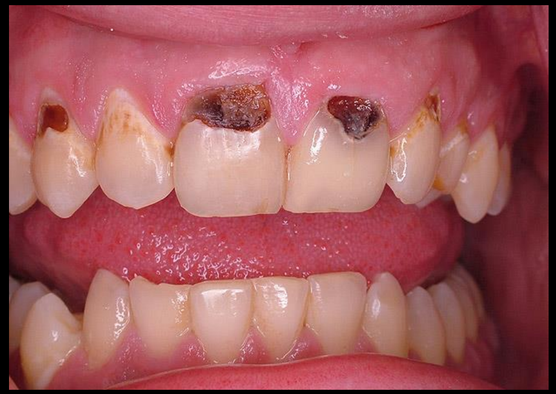


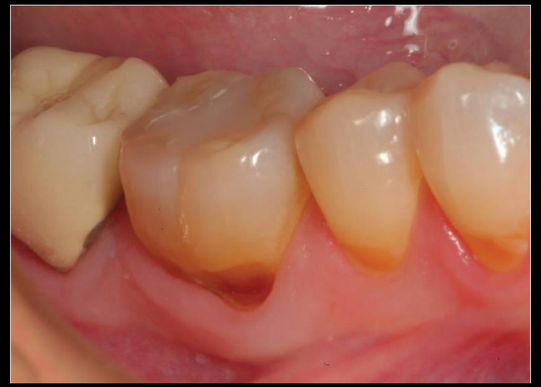
Cavity classification

- Class V

Posterior And Anterior

On the gingival third of the facial or lingual surfaces of all teeth (not pit and fissure)





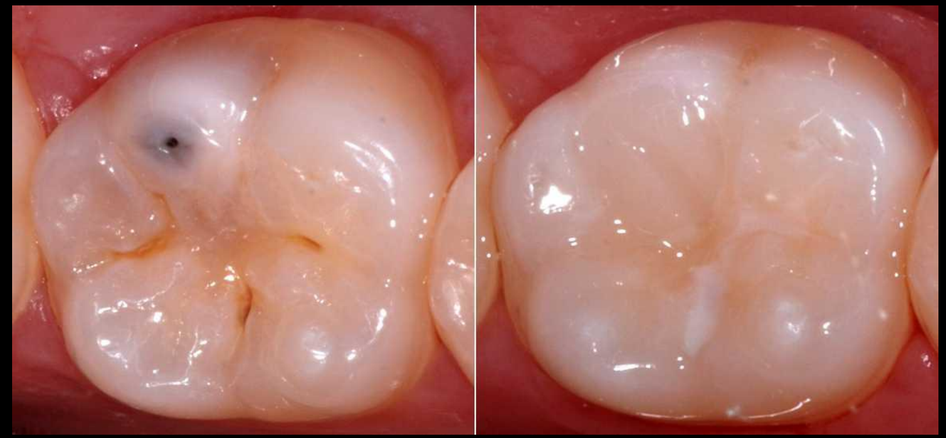
Cavity classification

So rare

- Class VI

  On the incisal edge of anterior teeth of the occlusal cusp heights of posterior teeth

3mm Enamel



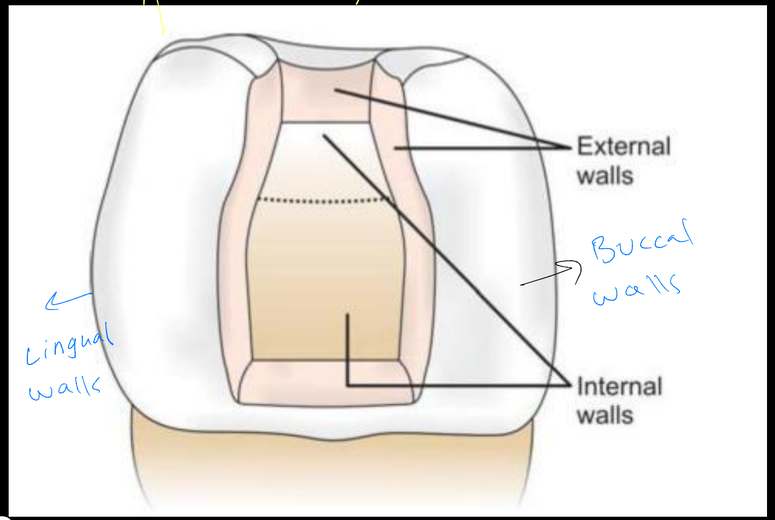
Anatomy of the Tooth Cavity

- Internal walls:

  Prepared wall that does not extend to the external tooth surface

- External walls:

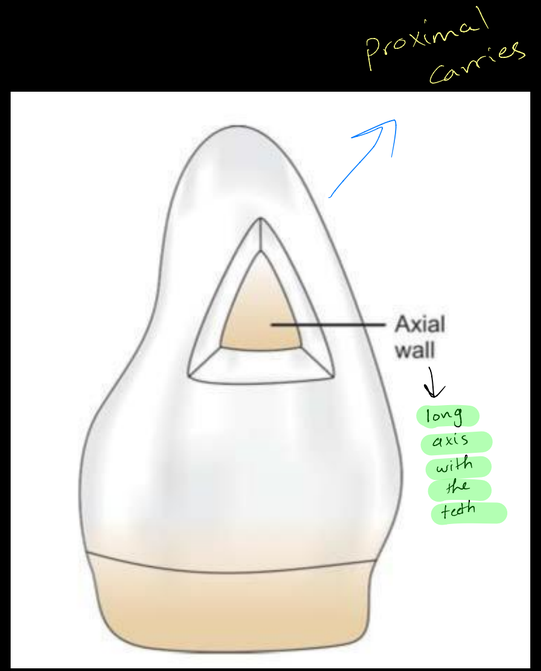
  Prepared walls that extend to the external tooth structure



Anatomy of the Tooth Cavity

- **Axial Wall:**

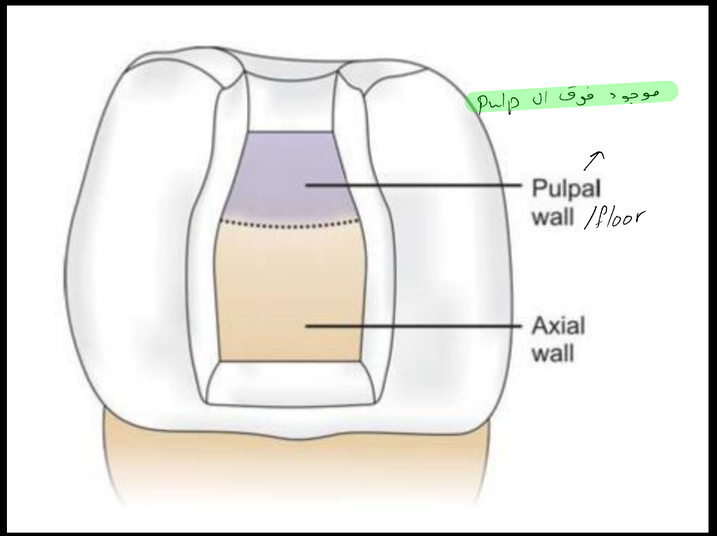
  Internal wall that is parallel to the long axis of the tooth



Anatomy of the Tooth Cavity

- **Pulpal Wall:**

  Internal wall that is perpendicular to the long axis of the tooth and is occlusal to the pulp



Anatomy of the Tooth Cavity

- Gingival Floor/wall:
  - ➢External wall that is perpendicular to the long axis of the tooth and parallel to the occlusal plane
  - ➢It is located above the gingiva and not the pulp of the tooth

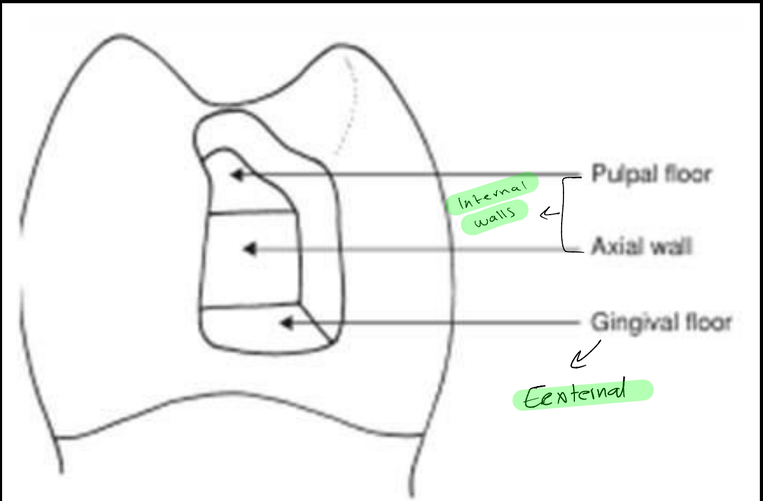
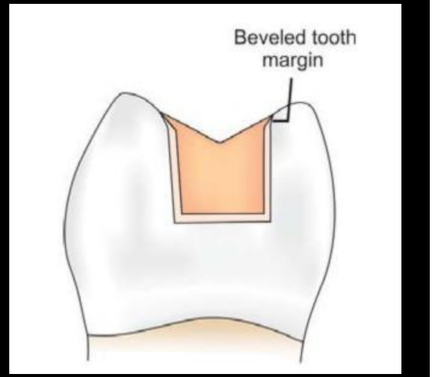


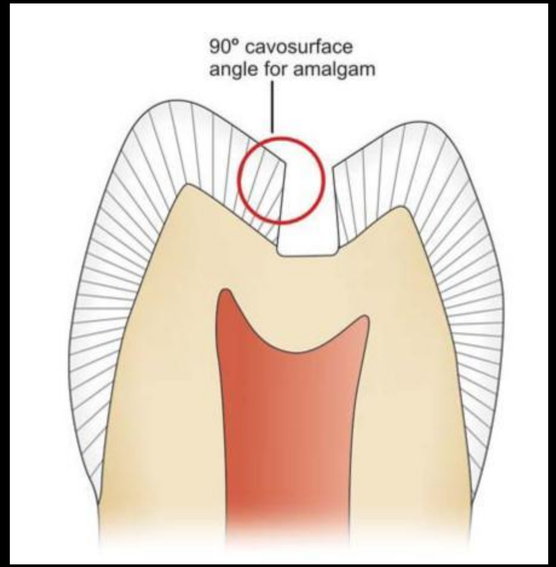
Figure 13.14 Posterior proximal cavity.

Anatomy of the Tooth Cavity

- **Cavo-surface line angle:**

  Angle formed by the junction of prepared cavity wall and the external surface of the tooth



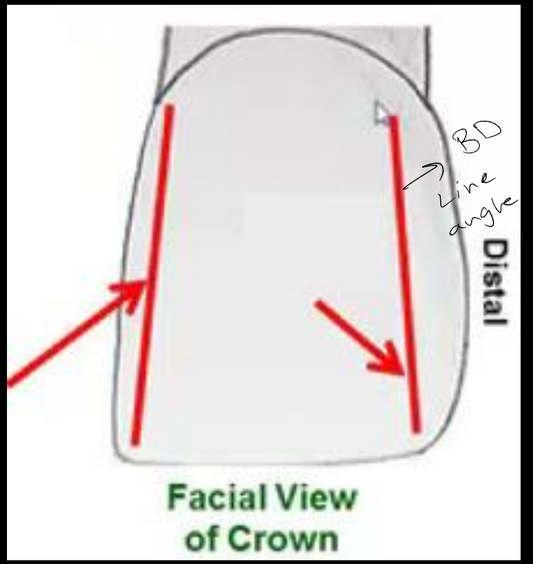


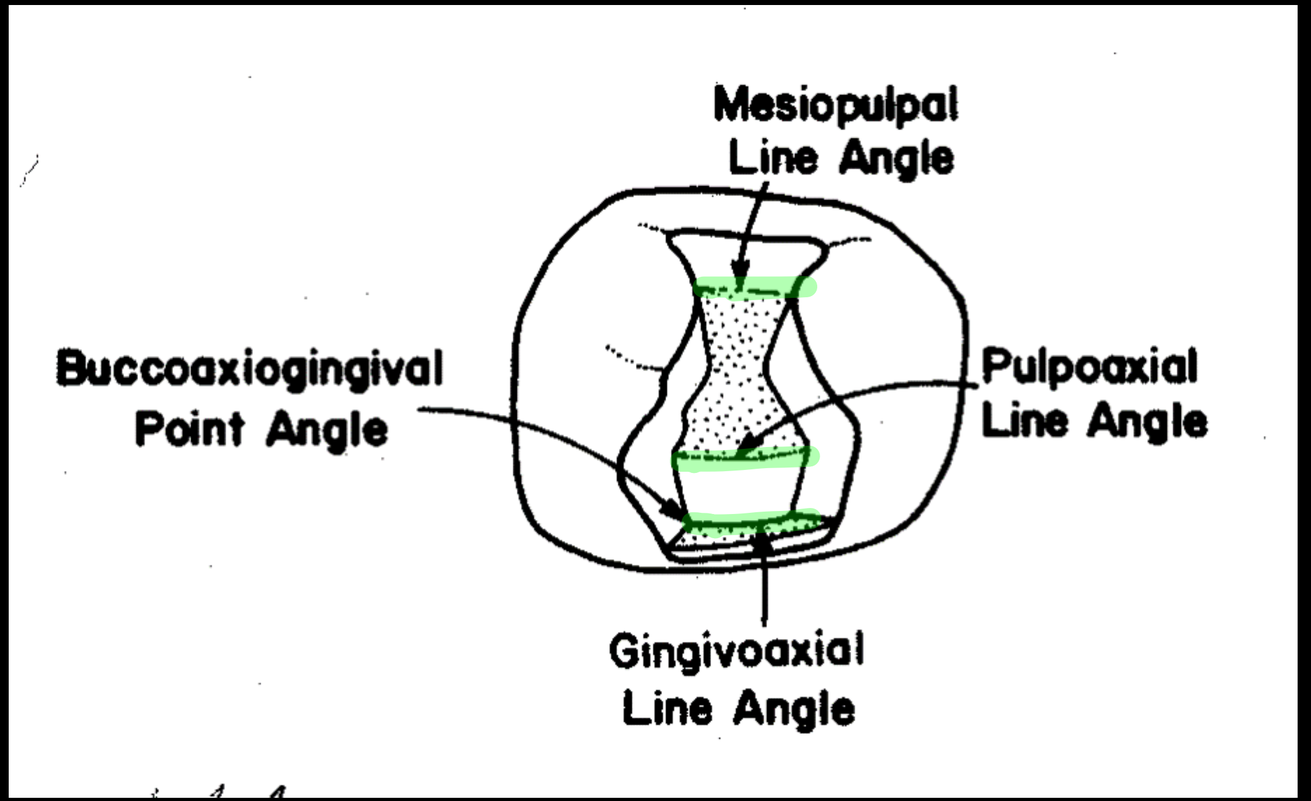
Anatomy of the Tooth Cavity

- Line Angles:

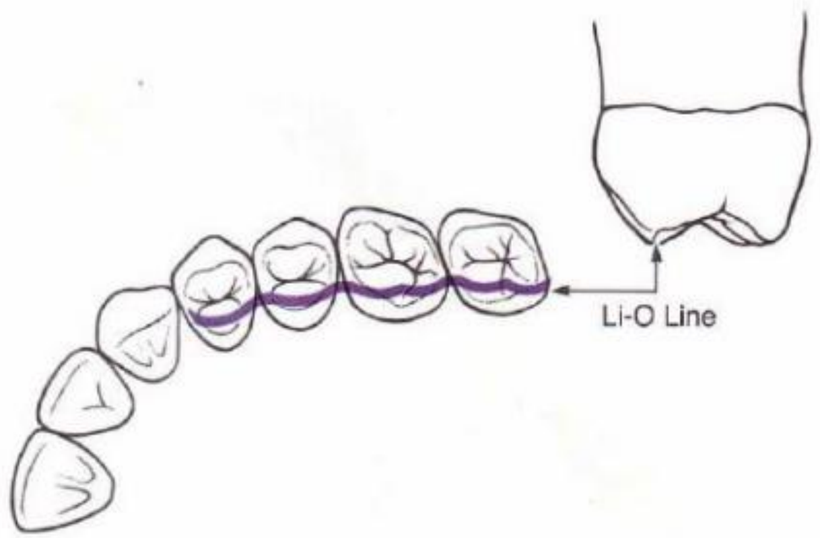
  Junction of two planes/surfaces of different orientation along a line

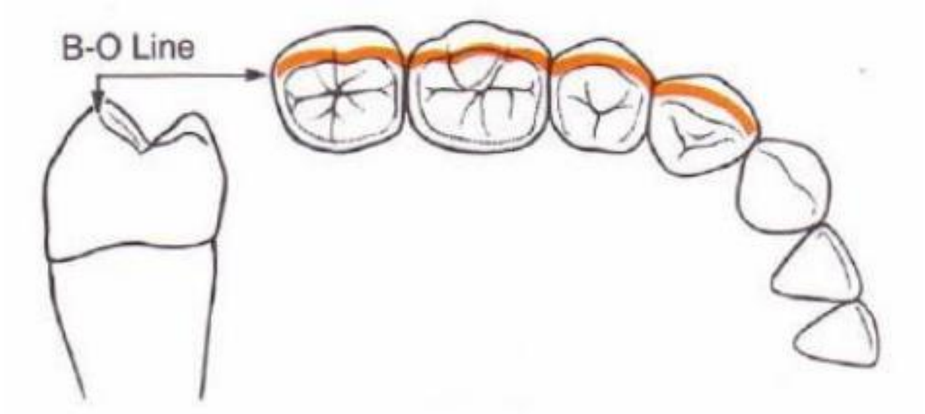

Fig. 4




Mesiopulpal
Line Angle
Buccoaxiogingival
Point Angle
Pulpoaxial
Line Angle
Gingivoaxial
Line Angle

BOLA & LOLA





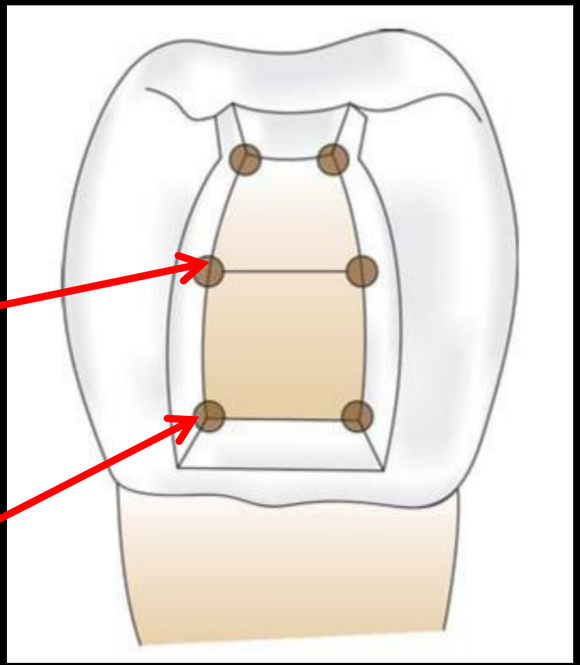
Anatomy of the Tooth Cavity

- Point Angles: → مكان التقاء 3 Surfaces

  Junction of 3 surfaces of different orientation

(abp):
Axio-Buccual-Pulpal point angle

(abg):
Axio-Buccual-Gingival point angle



Steps of Cavity Preparation

Steps of Cavity Preparation According to G.V.Black

Initial Cavity Preparation:

1. Outline and initial depth
2. Primary resistance form
3. Primary retention form
4. Convenience form

Final Cavity Preparation:

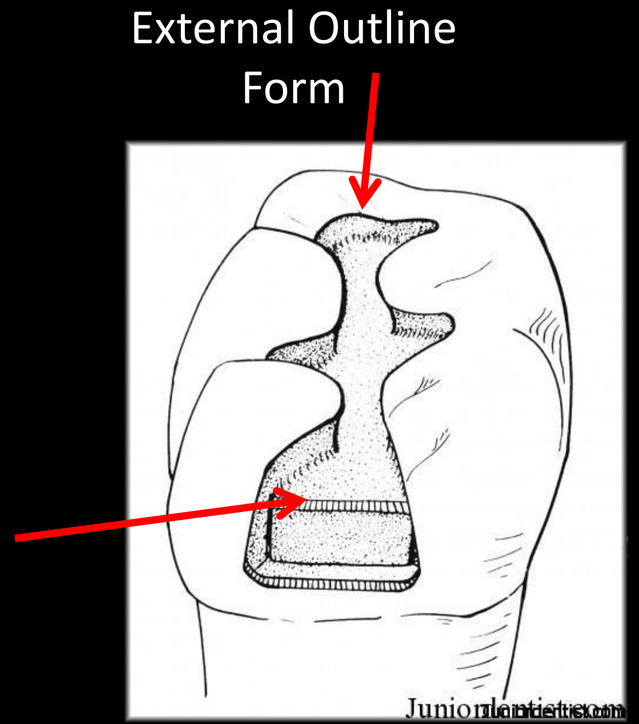
1. Removal of remaining carries
2. Finishing the cavity walls and floor
3. Cleaning, inspecting and varnishing

Initial Cavity Preparation

1. Out line Form:

Is the shape of the boundaries of a completed cavity

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



Initial Cavity Preparation

different from one to another بتختلف عن

Rules of Out line Form:

A. Extent of carious lesion/faulty old restoration

B. Preparation has to extend to sound tooth structure:(Enamel supported by non-carious dentin)

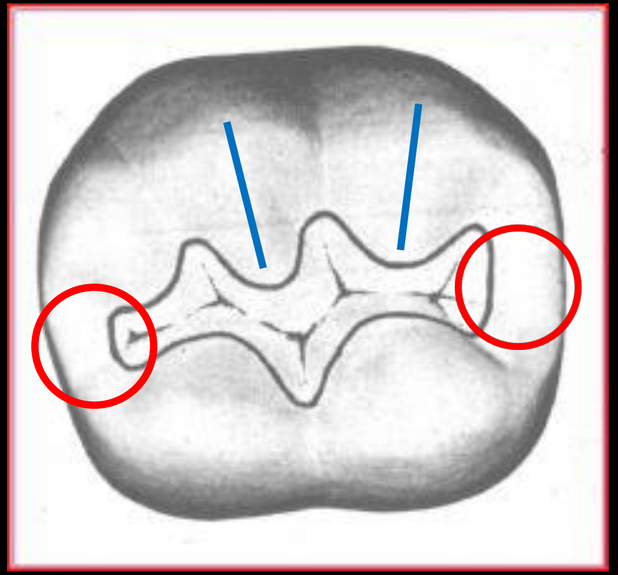
اقوى اشي في السن بعد ال cusp

C. Avoid terminating the margins (marginal ridge, cusp heights)

D. Extend the preparation margins to the MAIN carious fissures

main fissure gives accessories fissure

they are shallow



Initial Cavity Preparation

lower Six

Rules of Out line Form:

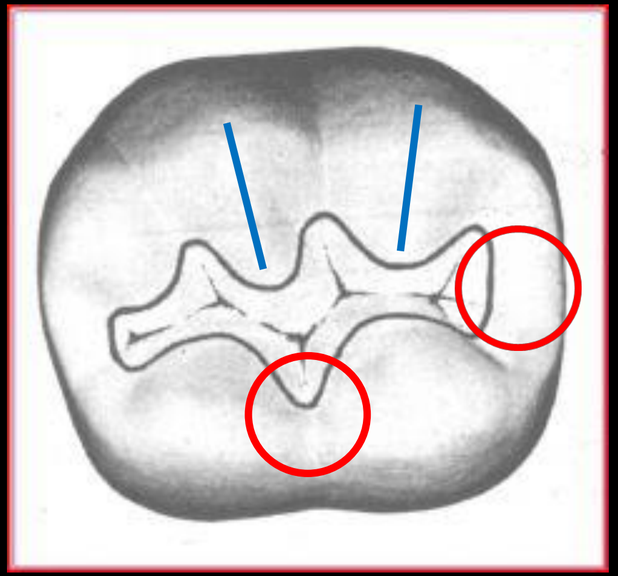
E. Minimize facio-lingual extension

F. Removal of carries

minimal carries

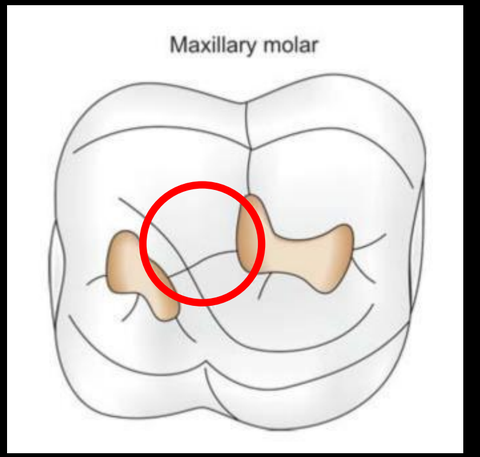
G. Restrict the depth of the cavity to:
Minimum of 0.2-0.5 in dentine (beyond DEJ) = total 1.7-2mm

H. Leave 2/3s of the cusps intact



Masticatory عشان ما تنكسر وتتقادم ← Amalgam need More than 2 mm

Initial Cavity Preparation



Rules of Out line Form:

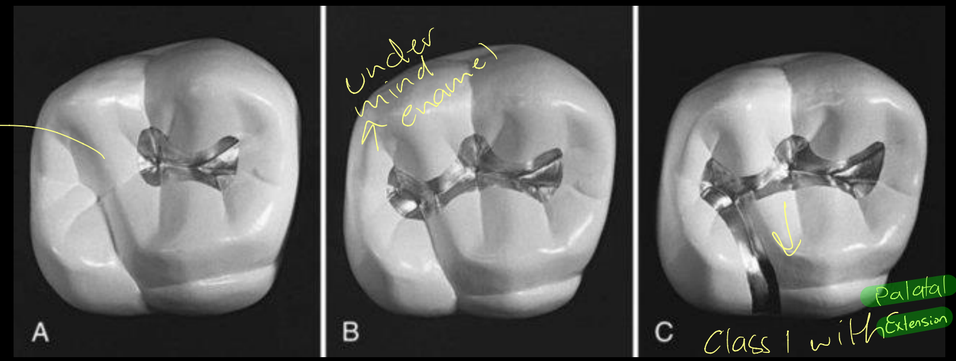
F. In case of 2 separate cavities/carious lesions (in upper molars especially):

The cavities are joined to one cavity when:

- Weak (less than 5 mm in width)
- Carious
- Undermined?

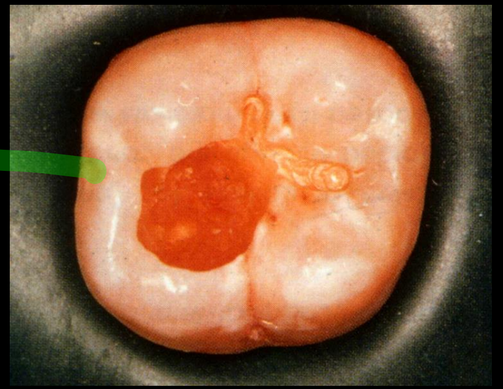
Upper Six

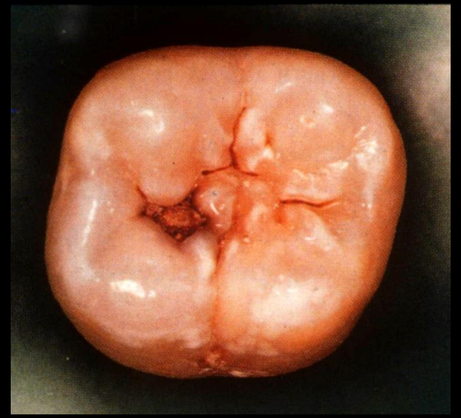
oblique ridge



Undermined Enamel

Carious Dentine





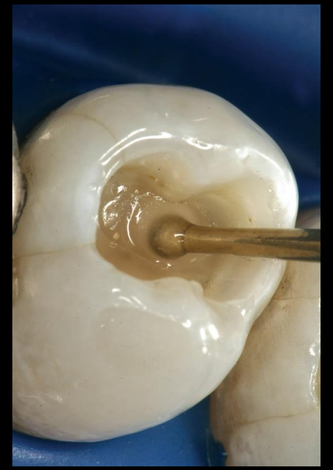
Initial Cavity Preparation

- Primary Resistance Form:

  The shape of the cavity walls enables both the tooth and the restoration to withstand mastication forces without fracture

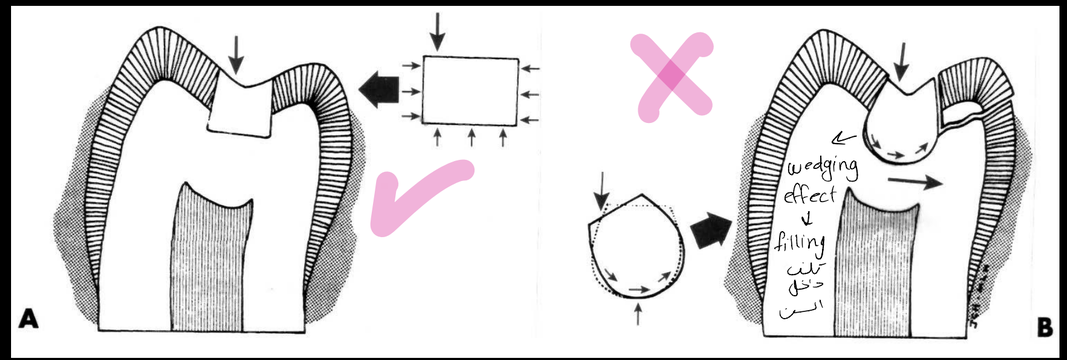
Composite have no minimun thikness.

Initial Cavity Preparation

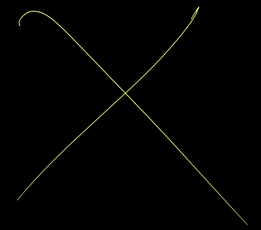


Features of resistance form:

1. Relatively flat floor → in cavity
2. Round internal line angles → داخل السن تكون دائرية (Rounded)
3. Relatively defined angles of the cavity (not too round) for the restoration not move around in the cavity under occlusal forces→ cusp fracture (wedging effect)



Resistance form in a Prepared Tooth



- Resistance form preparation features help the tooth and the restoration
- resist fractures caused by occlusal forces. Resistance features
- that assist in preventing the tooth from fracturing include (1)
- maintaining as much tooth structure as possible (preserving the
- dentin supporting cusps and marginal ridges); (2) having pulpal
- and gingival walls prepared perpendicular to occlusal forces, when
- possible; (3) having rounded internal preparation angles; (4) removing
- unsupported or weakened tooth structure;

Resistance Form in the Amalgam

- Resistance
- form features that assist in preventing the amalgam from fracturing
- include (1) adequate thickness of amalgam (at least 1.5–2 mm in
- areas of occlusal contact and 0.75 mm in axial areas); (2) amalgam
- margin of 90 degrees; (3) boxlike preparation form, which provides
- uniform amalgam thickness; and (4) rounded axiopulpal line angles
- in Class II tooth preparations. Many of these resistance form features
- may be achieved using the No. 330 or No. 245 bur.

Initial Cavity Preparation

Features of resistance form:

4. Marginal ridges should be preserved: 1.5 mm at least

(also buccal and lingual margins)

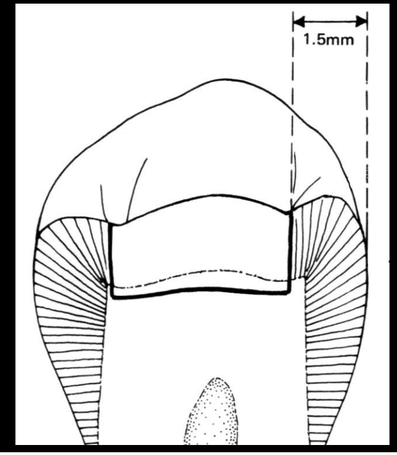
4. The depth and width of the cavity should be minimum of (for amalgam):

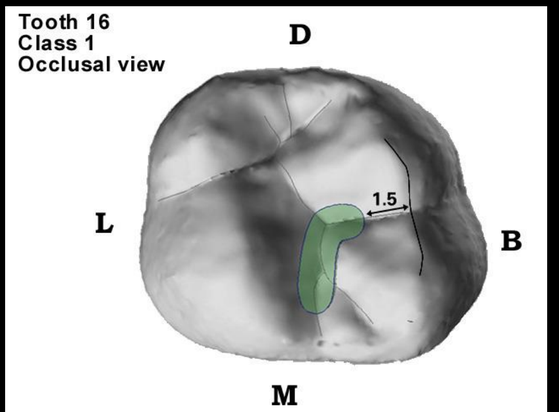
1.7 - 2 mm in depth

1.3 – 1.6 in width → idiol (1.5)

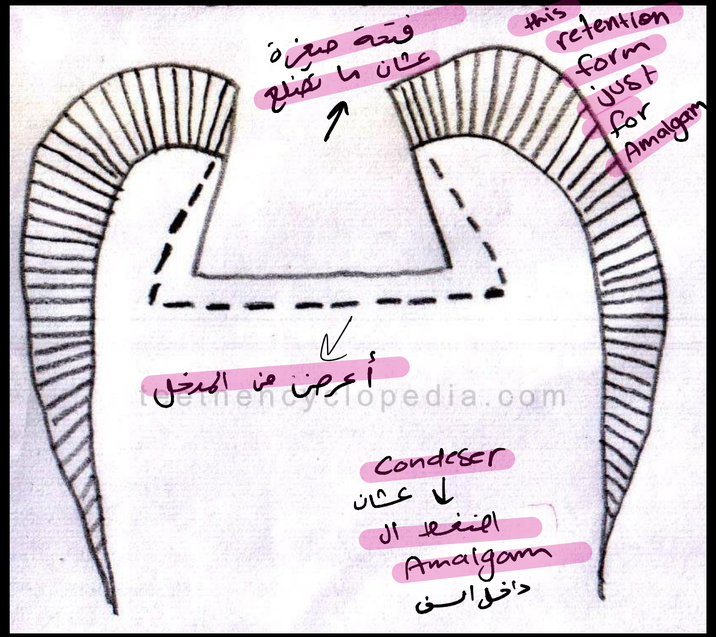
- For other material:

Porcelain: 2 mm / cast metal (gold): 1 mm





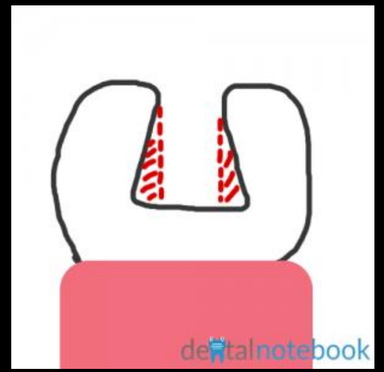
Retention Form



- The base of the cavity should be larger than the opening
- Internal outline form > External outline form

Retention Form

Composite do not need retention form + dove tail



- Primary retention form:

  The shape of the cavity should resist displacement of the restoration

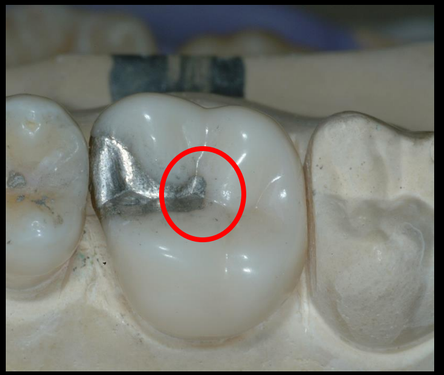
- For Amalgam:
  1. Walls should converge occlusaly (3°-5°till 10 degrees)
  2. Lateral retention (buccal/lingual extension): dove tail

(1) or (2)

Like hock

Used for

Class 2



for retention الطريقة (2)

معلومة مهمة

حتى لو ما في Occlusal Caries بعمل ال dove tail عشان تمسك

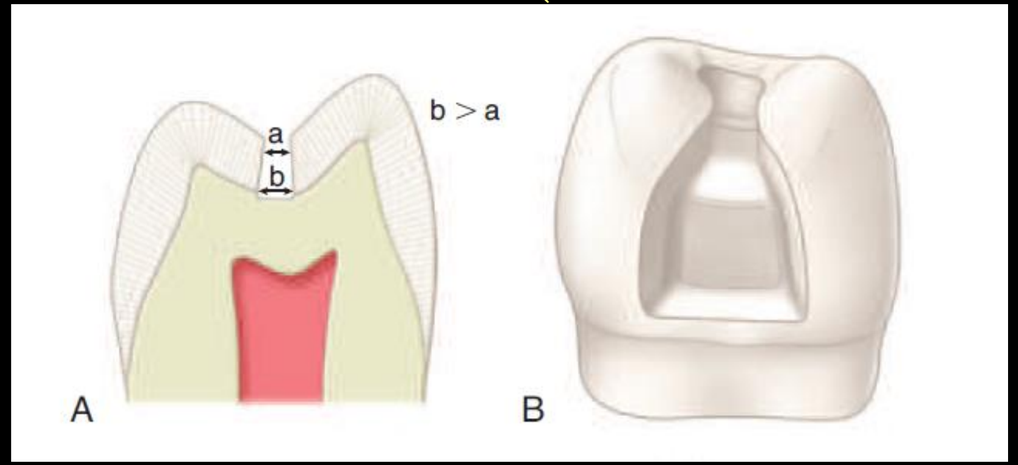
Retention Form

- Amalgam retention form is provided by:

(1) preparation of the vertical walls (especially facial and lingual walls) that converge occlusally (primary retention)

(2) retention features such as grooves, coves, slots, and pins that are placed during the final stage of tooth preparation (secondary retention)

(3) Engagement of the inserted amalgam into any surface irregularities in the preparation that may exist.



Convenience Form

The shape of the cavity should allow adequate observation, accessibility and ease of operation

Convenience form = visibility & accessibility

Convenience Form

- Convenience form includes features that allow adequate access and visibility of the operating site to facilitate tooth preparation and restoration.
- Convenience form includes extension of the outline form so that:

(1) the caries lesion may be accessed for removal

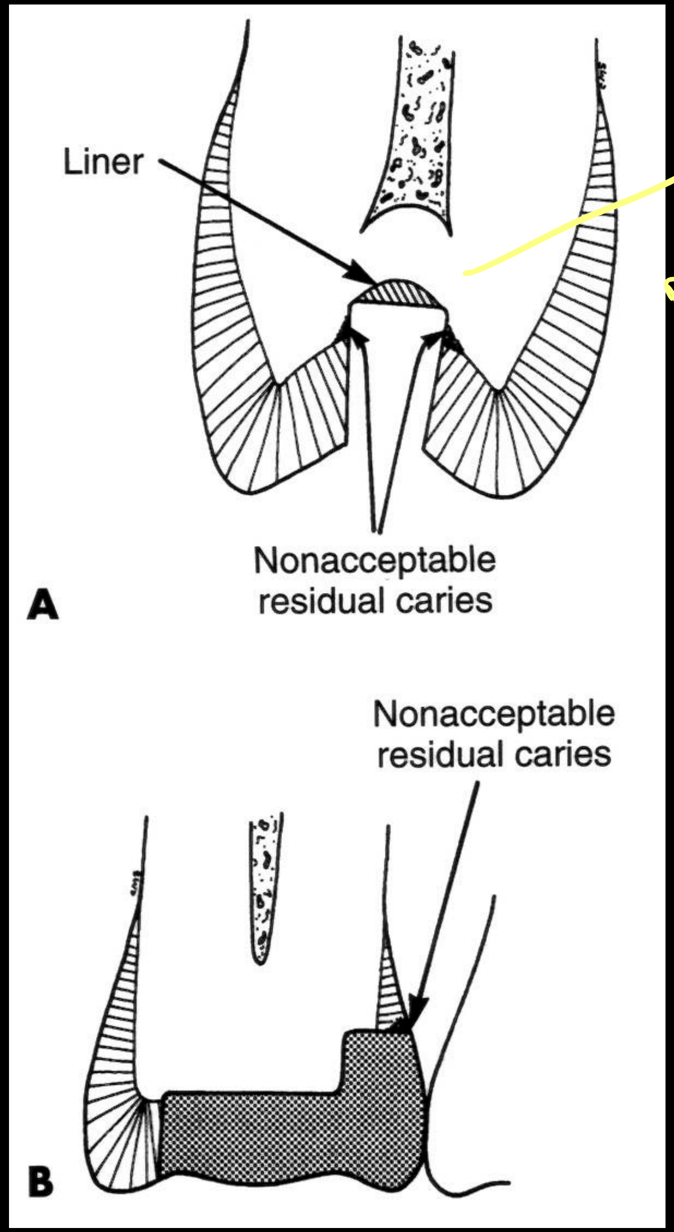
(2) the matrix may be placed

(3) amalgam may be inserted, carved, and finished—all while maintaining resistance form

Steps of Cavity Preparation

Final Cavity Preparation:

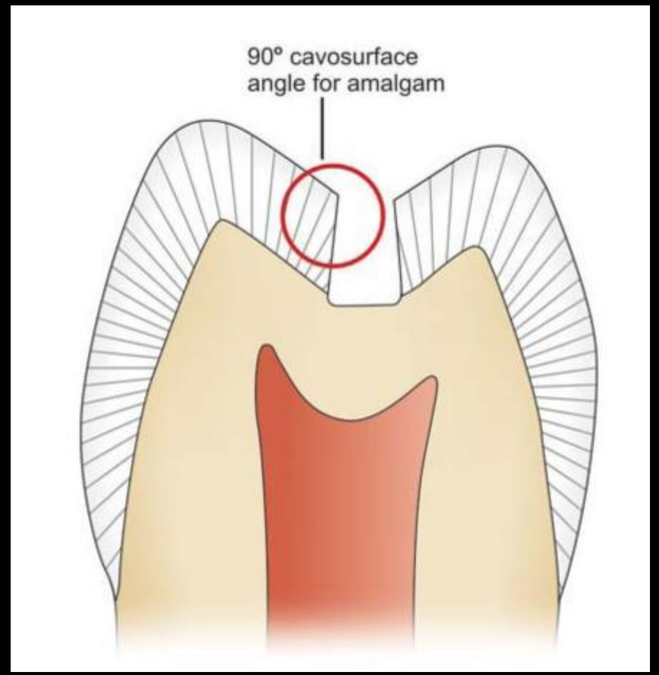
1. Removal or remaining infected dentine/old restoration material
2. Pulp protection
3. Finishing external walls
4. Cleaning, inspecting, varnishing /conditioning



Removal of Remaining Carries

- Sometimes after the initial preparation carries can be found in the floor or walls of the cavity
- Local removal of the carries leaves round holes in the floor of the cavity
- Sometimes hard discolored dentin may be found in the cavity (affected dentin)
- Placing a base or a liner to restore a flat floor?

Finishing Cavity Form



- Smooth walls and floor without any steps
- Cavo sarface angel should be 90° for amalgam
- CSA ‹ 90° = unsupported

(Enamel should always rest on sound dentin)

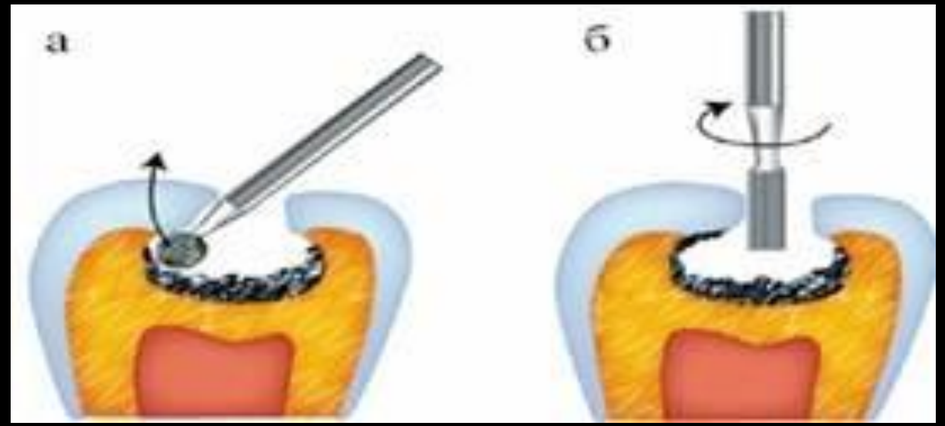
- CSA › 90° = bevel

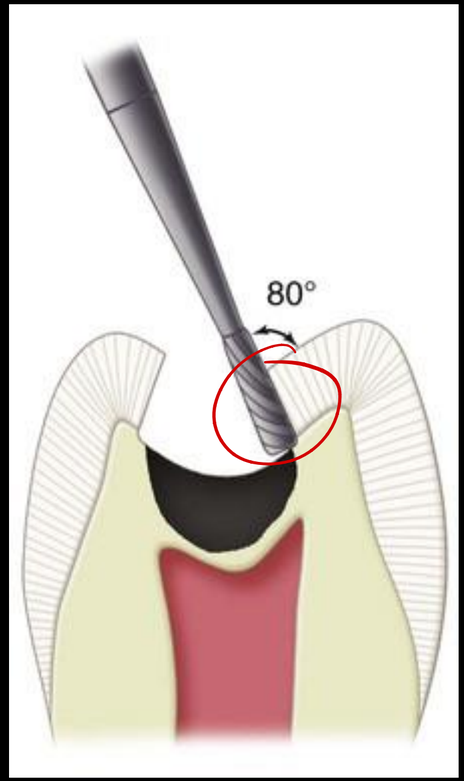
امحي جميع الزوايا

Amalgam X bevel

Composition ✓ bevel (rounded)

Undermined Enamel

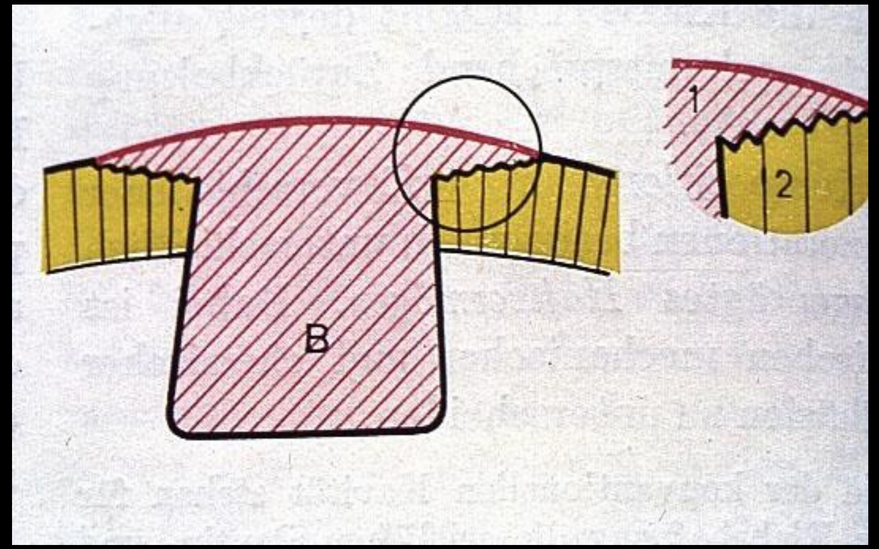




ميلان الـ walls
و توسيعها باتجاه
pulp الـ
تحمي
⇓
diversion
pulpy
Conversion
form occultly
↙
تميل bur مثل بصورة

Finishing Cavity Form

Bevel?



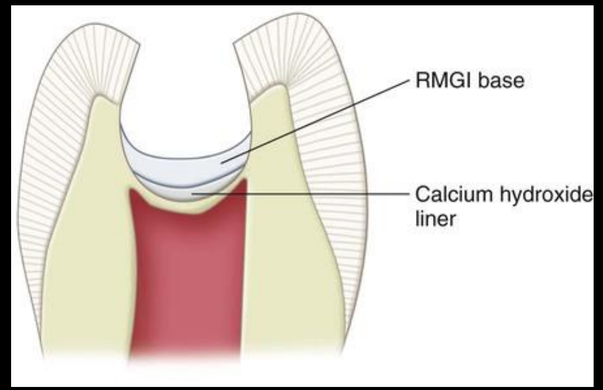
Pulp Protection

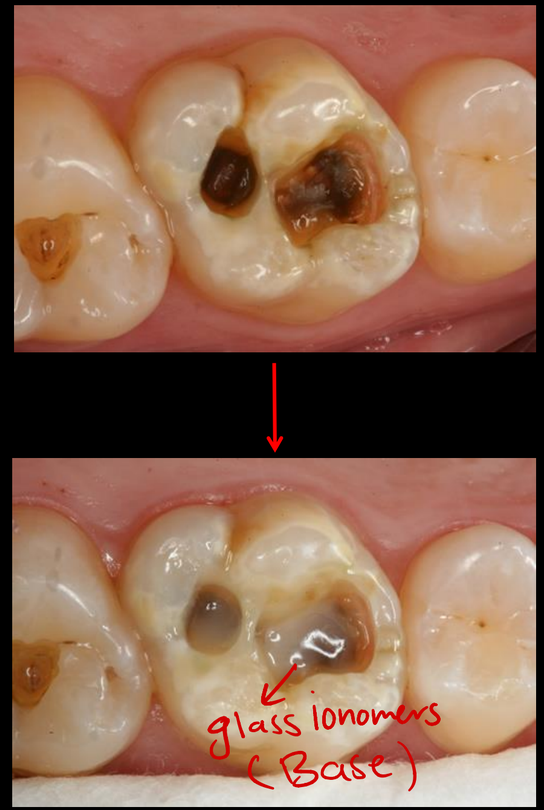
- The pulp may be affected by:
  1. Thermal changes → Ex: Amalgam
  2. Ingredients of restoration material
  3. Galvanic shock? → Metal الي اختلاف → 2 Amalgam one up, one down
  4. Micro-leakage of bacteria

Pulp Protection

- The Pulp can be protected by:
  1. Bases → floor & walls of Cavity
  2. Liners → Same as base but thinner (> 1 mm)
     - Ex: calcium hydroxide
- Reason for using them is:

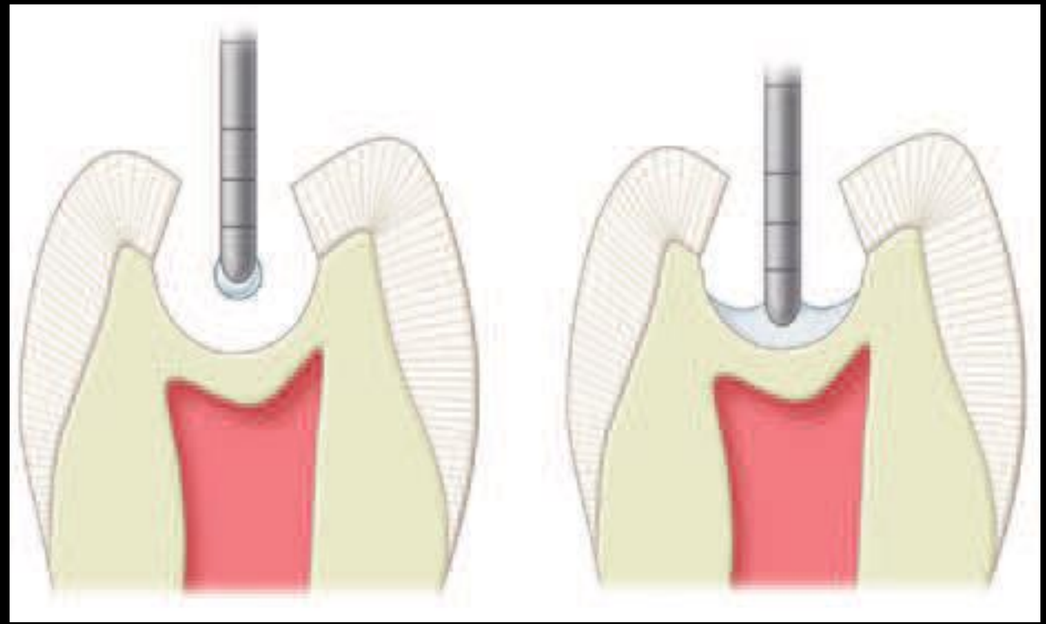
Protect the pulp or aid in the pulpal recovery or both





Liners and Bases

- Liner/Base application.
- A, Inserting resin-modified glass ionomer (RMGI) with periodontal probe.
- B, In moderately deep caries removal, a base thickness of 0.5 to 0.75 mm is indicated.



Liner & Bases

- If the tooth preparation is of ideal or shallow depth, no liner or base is indicated. In deeper caries removal (where the remaining dentin thickness is judged to be 1–1.5 mm), a layer (0.5–0.75 mm) of a resin-modified glass ionomer (RMGI) material should be placed
- The RMGI insulates the pulp from thermal changes, bonds to dentin, releases fluoride, is strong enough to resist the forces of condensation, and reduces microleakage.
- The RMGI is applied only over the deepest portion of the caries removal. It should be placed in small increments and should flow when it is touched to the dentin surface.
- The entire dentin surface should not be covered. Dentin peripheral to the liner should be available for support of the restoration

Liner & Bases

- For pulpal protection in very deep caries removal (where the remaining dentin thickness is judged to be <0.5 mm and suspicion of potential microscopic pulpal exposure is increased), a thin layer (0.5–0.75 mm) of a calcium hydroxide liner may be placed.
- The calcium hydroxide liner may elicit tertiary dentin formation if the original odontoblasts are no longer vital. If the calcium hydroxide liner is used, it is placed by using the same instrument and the same technique as described for the RMGI liner.
- The calcium hydroxide liner should be placed only over the deepest portion of the caries removal (nearest the pulp). A layer of RMGI liner should be used to cover the calcium hydroxide.

Pulp Protection

Liners

- Applied to the cavity floor in thin film
- Affects pulpal response
- A barrier that provides electrical and thermal protection to the pulp
- Example: Calcium Hydroxide (stimulates reparative dentin)

Bases

- Used in thicker dimensions
- Provides chemical, thermal protection of the pulp
- Example: Zinc Oxide Eugenol (sedative pulpal response)

Cleaning of the Cavity

- Use triple syringe to remove debris
- Dry the tooth out of water or saliva
- Do not dehydrate the tooth
- Amalgam Varnish (seals dentin tubules)

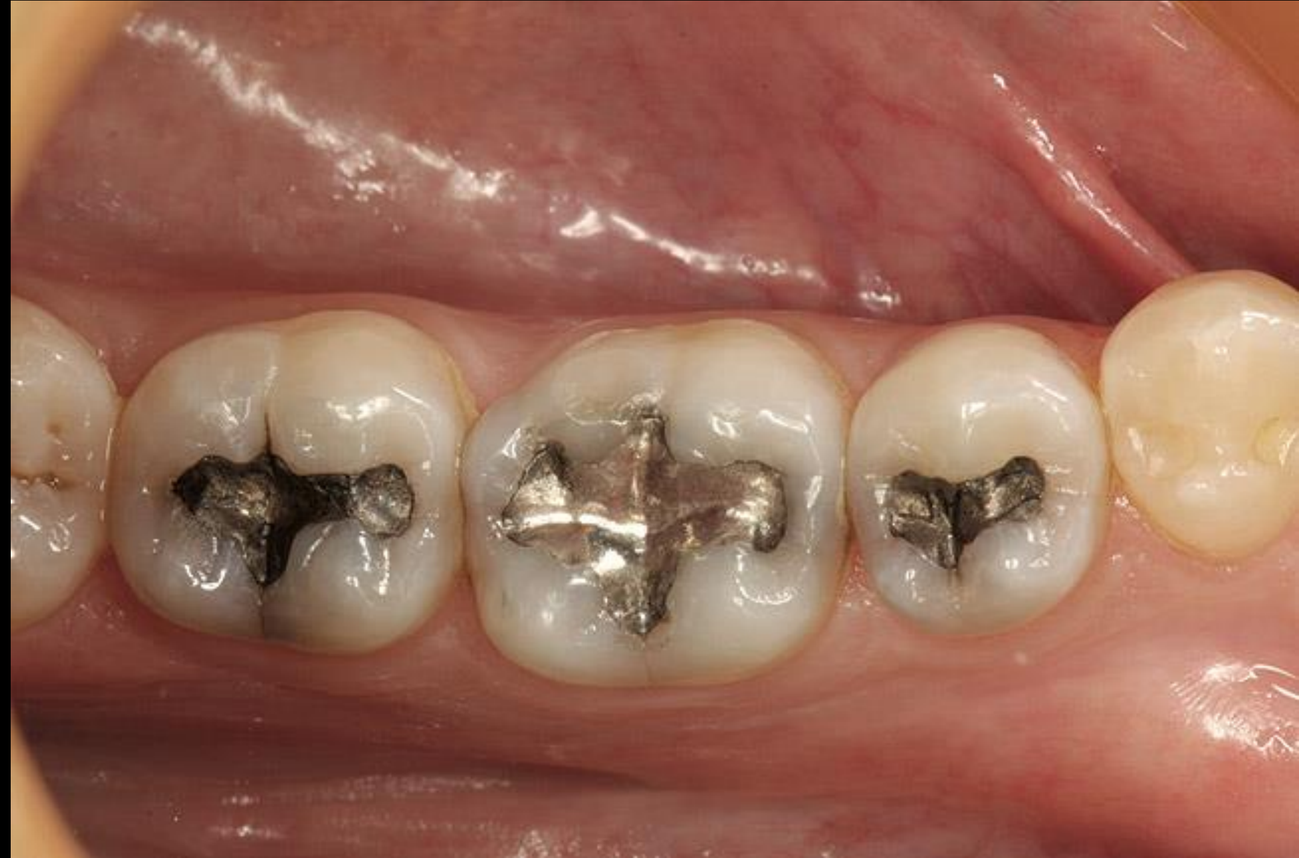
Thank You

Cavity Class I Preparation

Dr. Nada Najjar

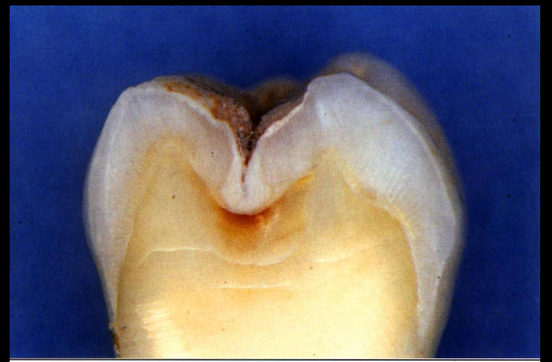
18/9/2022

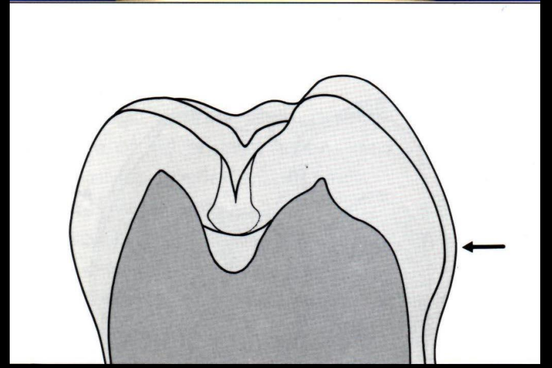
Amalgam Class I Restoration



Class I Carries

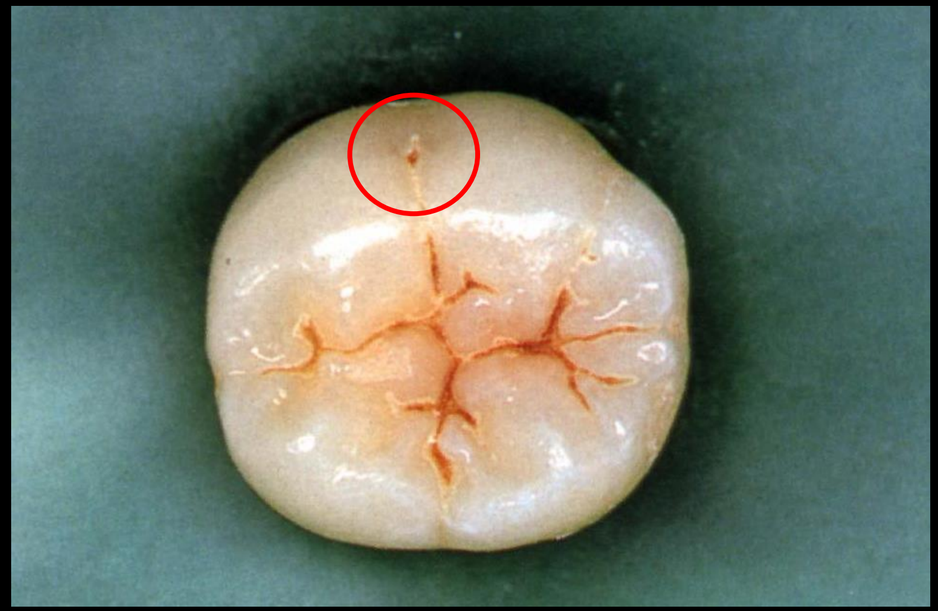
In the pits and fissures of Occlusal surfaces of posterior teeth





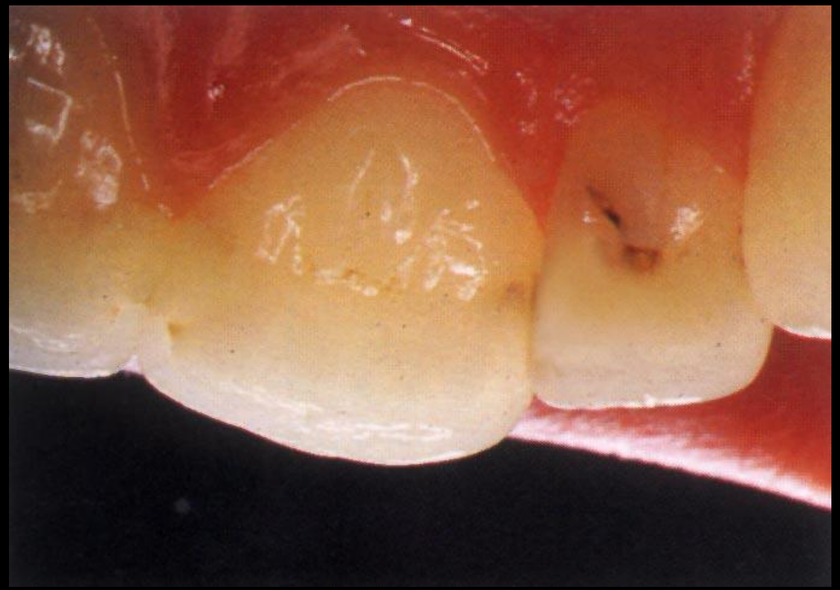
Class I Carries

BUCCAL PIT

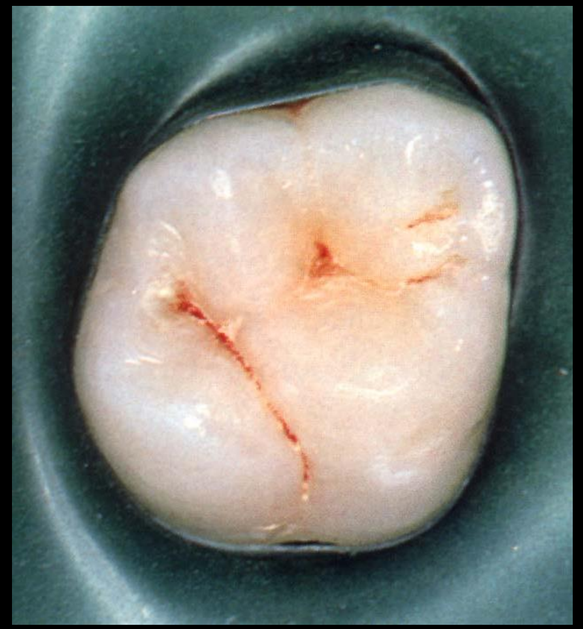


Class I Carries

Pits of lingual surfaces of anterior teeth



Class I Carries

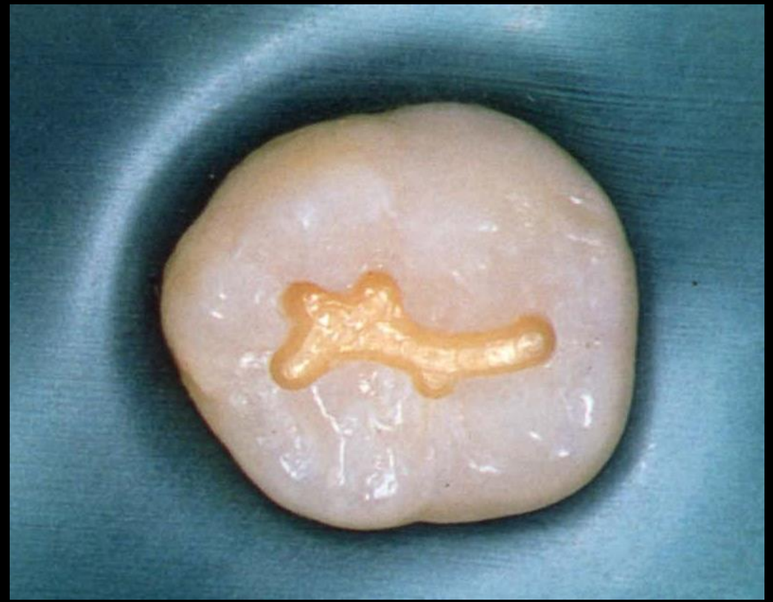


Palatal or Lingual extension in molars

Class I Carries

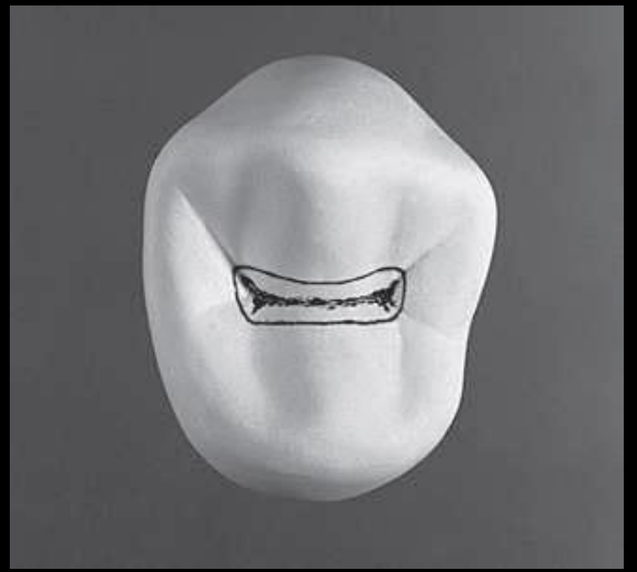
- Preparation of cavity class I should:

1. Include all the main fissures (extension for prevention)
2. Sharp angles should be avoided (round cavity)
3. Avoid destruction of the cusps
4. Eliminate weak walls of the enamel/remove undermined enamel
5. Preserve the marginal ridge (at least 1.5 - 2 mm)
6. Establish optimal conservative depth of pulpal wall



Initial Tooth Preparation for Class I

- Initial tooth preparation is defined as establishing the outline form by extension of the external walls to sound tooth structure while maintaining a specified, limited depth (usually just inside the DEJ) and providing resistance and retention forms.
- The outline form for the Class I occlusal amalgam tooth preparation should include only the defective occlusal pits and fissures.

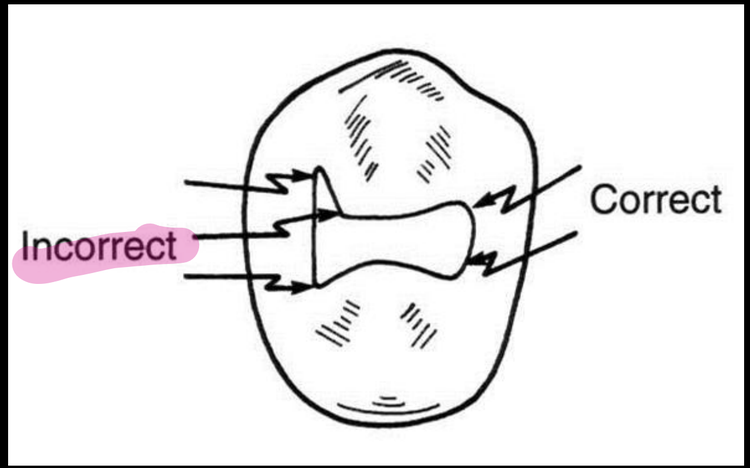


330 bur 245 bur

Class I Cavity

- External out line form:

Rounded with no sharp edges or angles



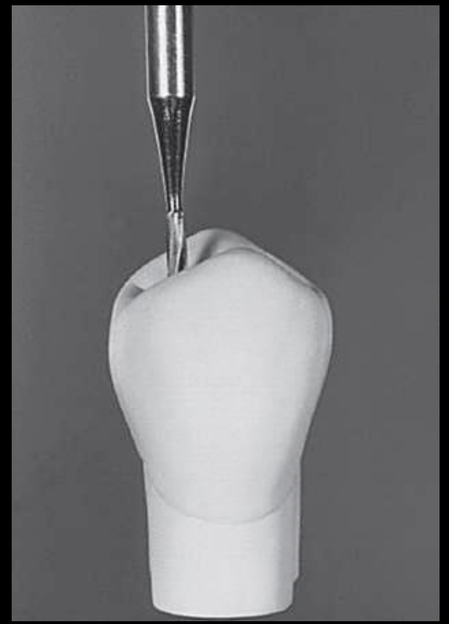
Burs to Use

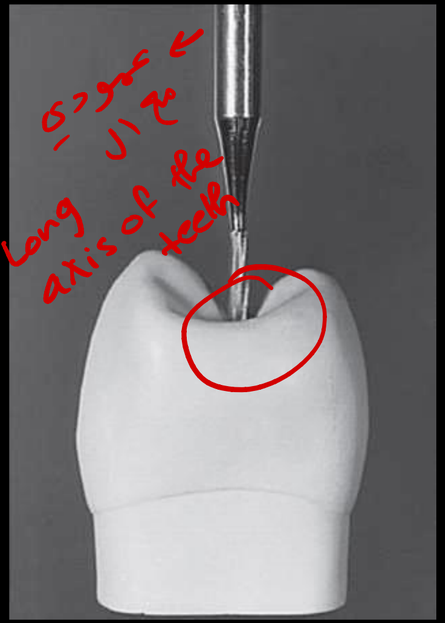
- The slightly rounded corners of the end of the No. 245 bur produce slightly rounded internal line angles that render the tooth more resistant to fracture from occlusal force.

- The No. 330 bur is a smaller and pear-shaped version of the No. 245 bur and is also indicated for amalgam preparations

330 bur 245 bur

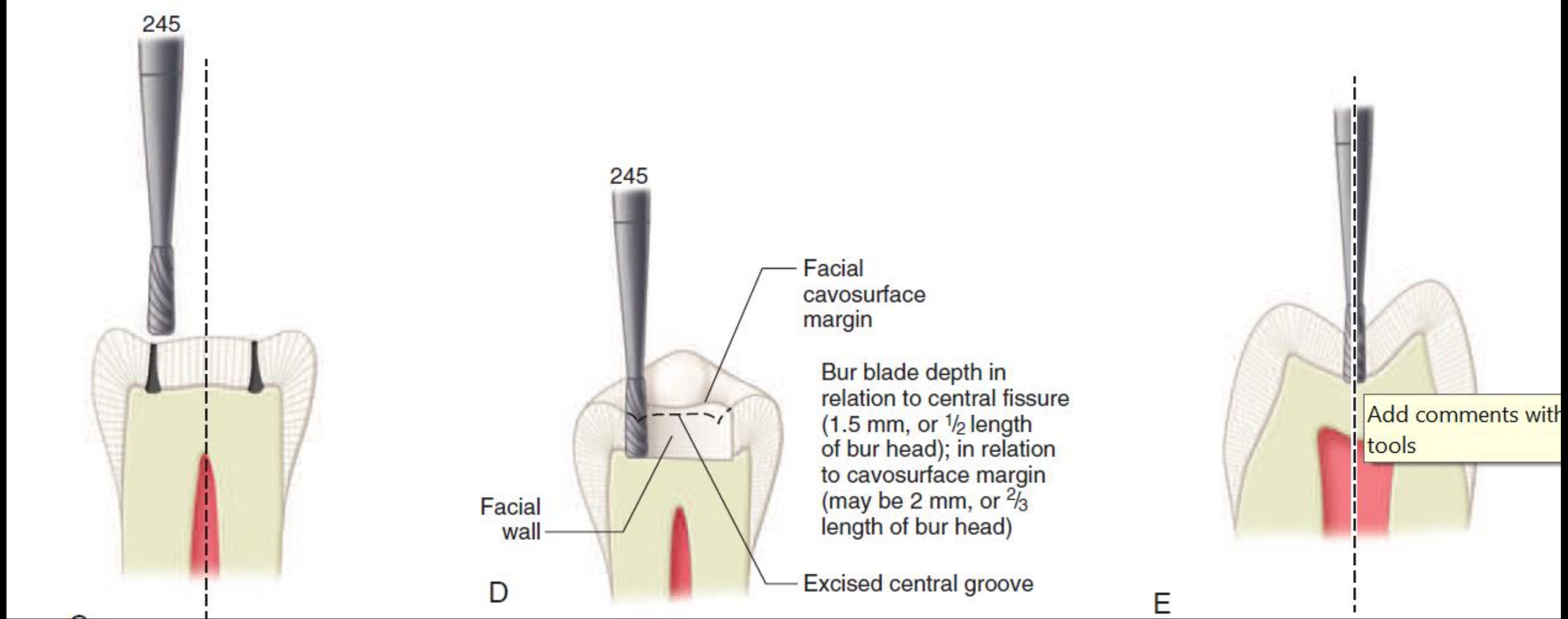
Class I Beginning



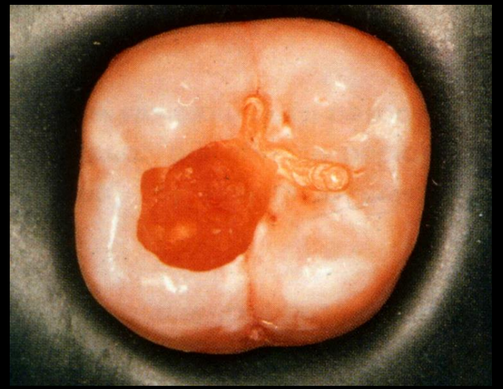


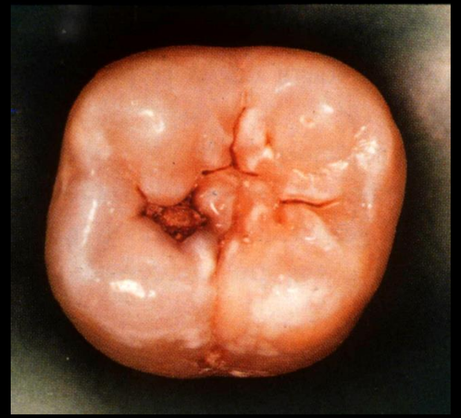
- Class I occlusal tooth preparation is begun by entering the deepest or most carious pit with a “punch cut” using the No. 245 carbide bur at high speed with air-water spray.
- A punch cut is performed by orienting the bur such that its long axis parallels the long axis of the tooth crown

bunch cut → to reach the depth that I need.

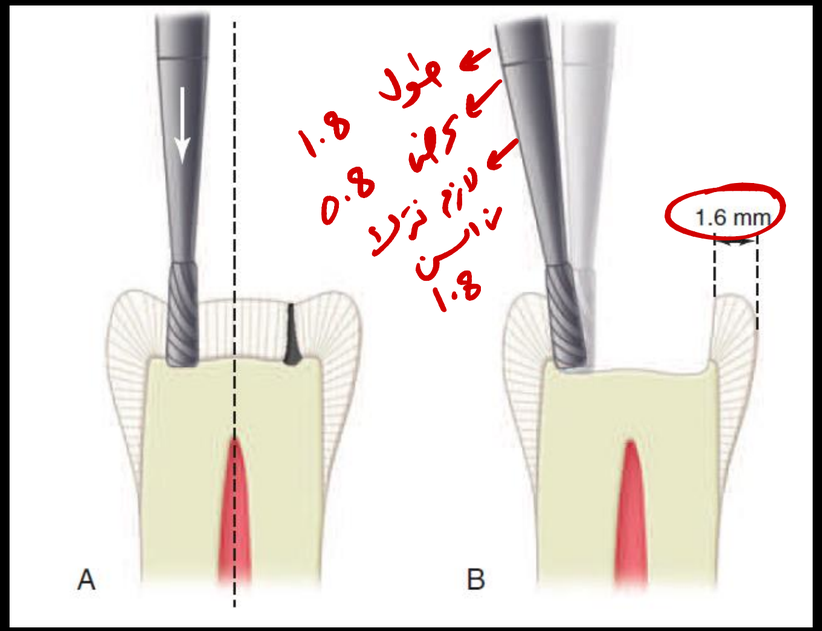

245
245
Facial
cavosurface
margin
Bur blade depth in
relation to central fissure
(1.5 mm, or ½ length
of bur head); in relation
to cavosurface margin
(may be 2 mm, or ⅔
length of bur head)
Facial
wall
Excised central groove
D
E
Add comments with
tools

Undermined Enamel

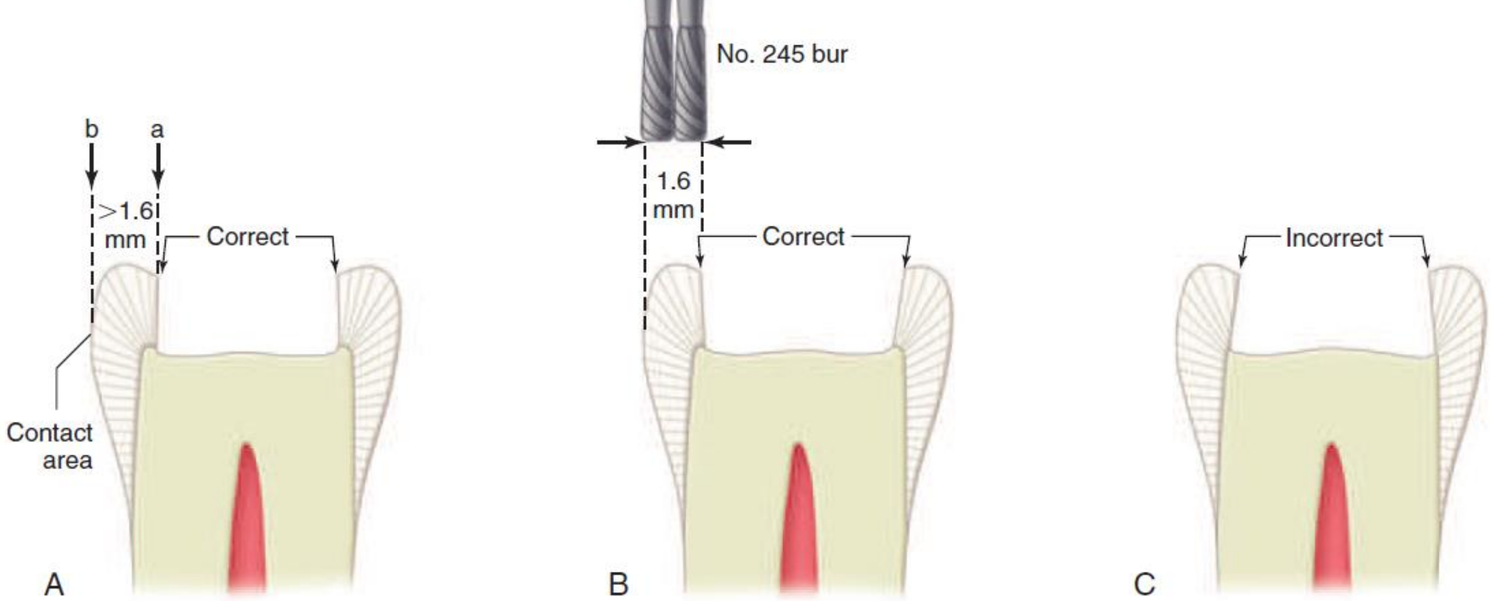




Mesial & Distal Walls

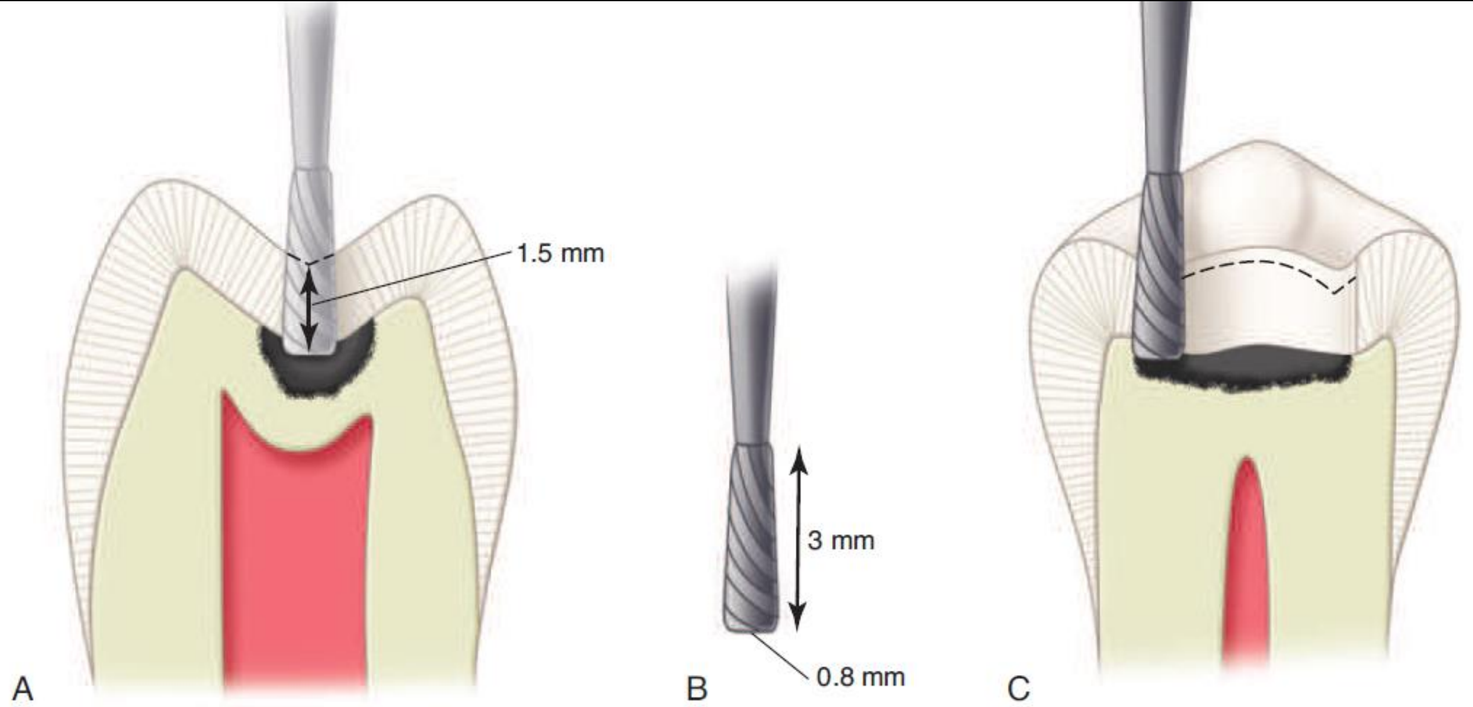


- Distal extension into the distal marginal ridge to include a fissure or caries occasionally requires a slight tilting of the bur distally (10 degrees).
- This creates a slight occlusal divergence to the distal wall to prevent undermining the marginal ridge of its dentin support.
- Because the facial and lingual prepared walls converge, this slight divergence does not compromise the overall retention form



• **Fig. 10.30** The direction of the mesial and distal walls is influenced by the remaining thickness of the marginal ridge as measured from the mesial or distal margin *(a)* to the proximal surface (i.e., imaginary projection of proximal surface) *(b)*. A, Mesial and distal walls should converge occlusally when the distance from *a* to *b* is greater than 1.6 mm. B, When the operator judges that the extension will leave only 1.6-mm thickness (two diameters of No. 245 bur) of marginal ridge (i.e., premolars), the mesial and distal walls must diverge occlusally to conserve ridge-supporting dentin. C, Extending the mesial or distal walls to a two-diameter limit without diverging the wall occlusally undermines the marginal ridge enamel.

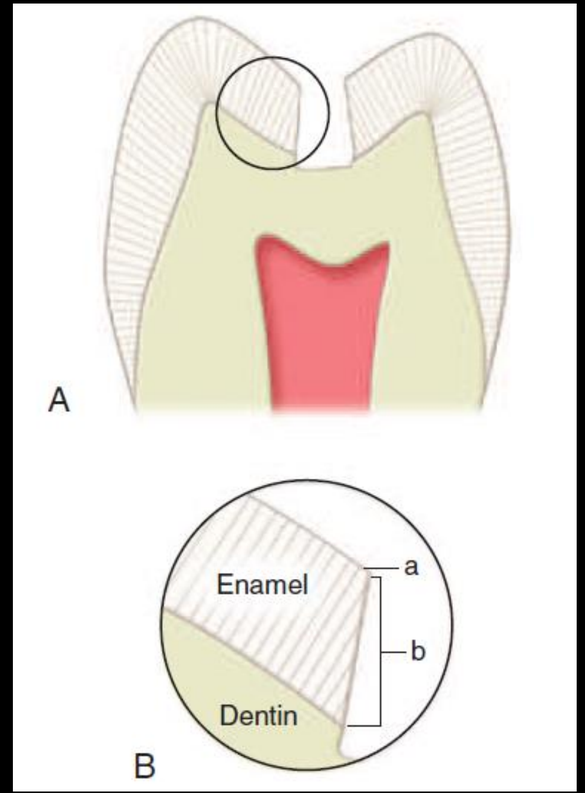
- The preparation must allow a minimum thickness of 1.5 to 2 mm so that the amalgam will not flex and fracture when under occlusal load (most amalgams fail by bulk fracture).



• **Fig. 10.7** 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 dentinoenamel junction (DEJ).

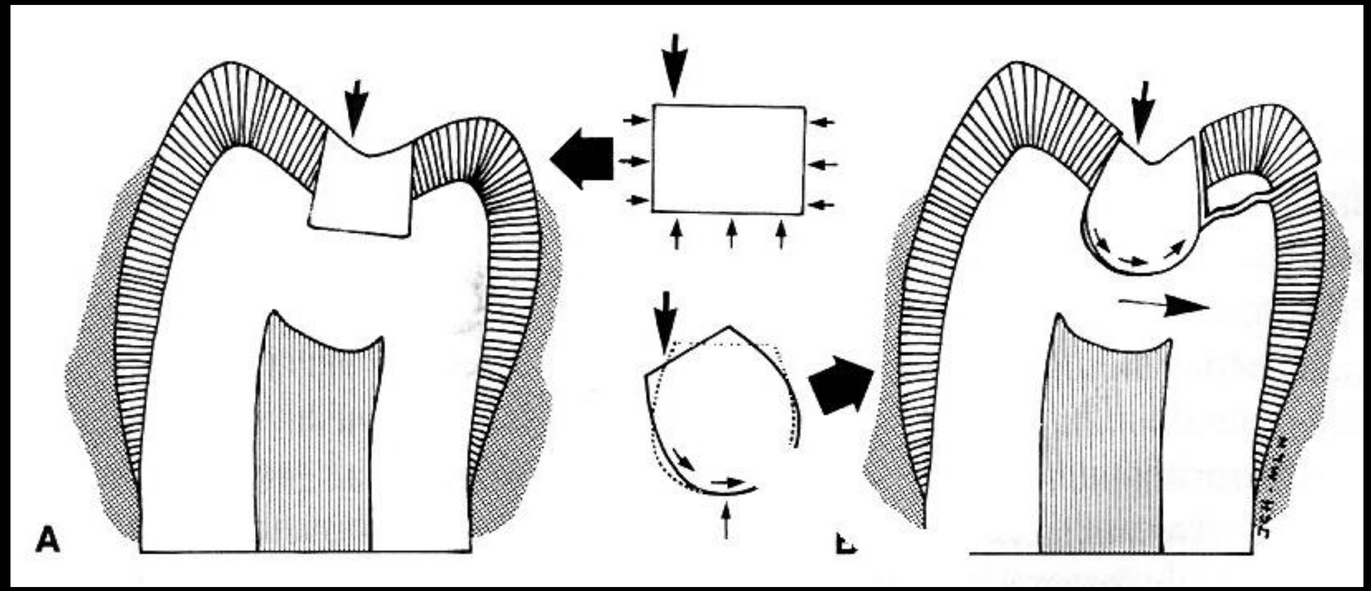
Cavo Surface Line Angle

- Called Cavosurface Line Angle or Margin
- Enamel must have a marginal configuration of approximately 90 degrees or greater, and amalgam must have a marginal configuration of approximately 90 degrees.
- Marginal wall configurations with angles less than 90 degrees in enamel or amalgam are subject to fracture, as both of these materials are brittle



Class I Cavity (Flat Floor)

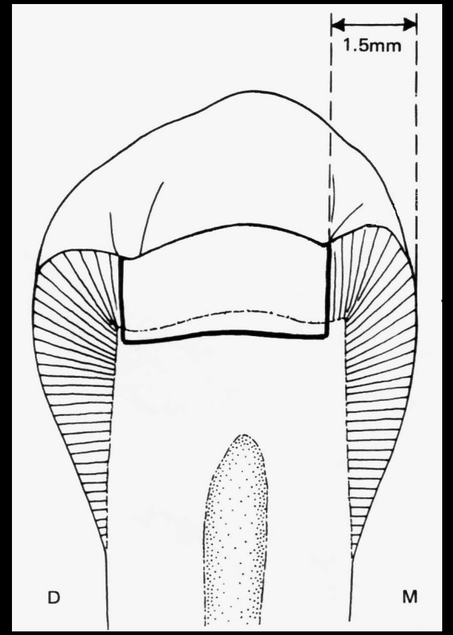
WEDGING EFFECT



Class I Cavity

- Primary Resistance form:

1. Sufficient area of relatively flat pulpal floor in sound tooth structure to resist forces directed in the long axis of the tooth and to provide a horizontal area for the restoration
2. Minimal extension of external walls (to conserve tooth strength)
3. Strong, ideal enamel margins
4. Sufficient depth (1.5 mm – 2mm) for adequate thickness of the restoration, providing resistance to fracture



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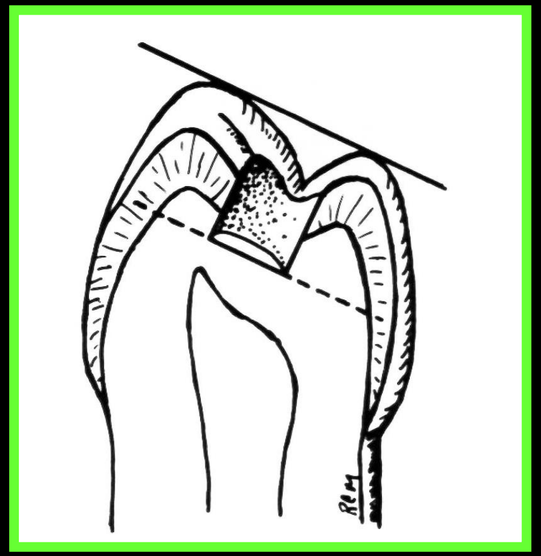
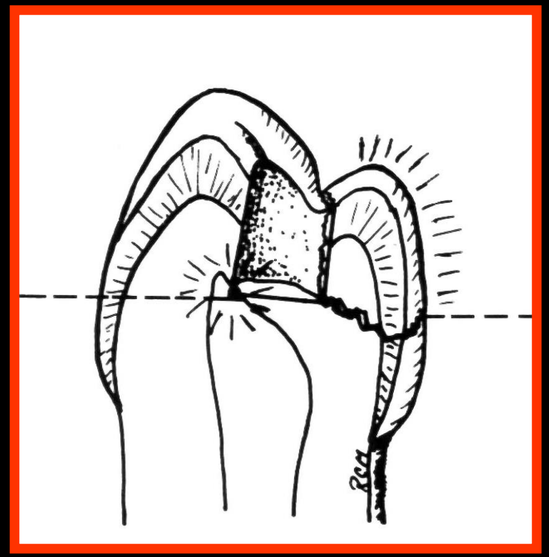
Class I Cavity in Lower First Premolar



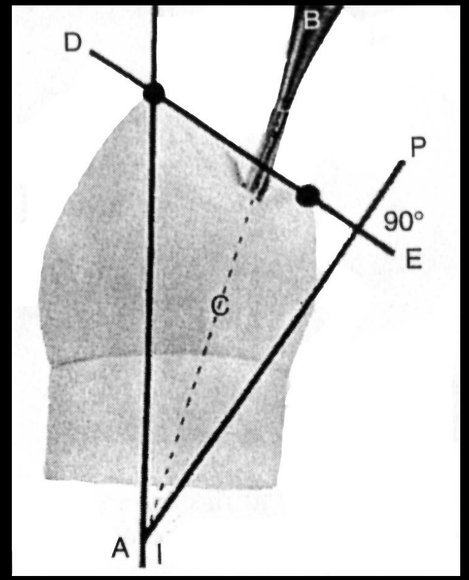


- **In lower first premolars:**

✓The cavity floor should be prepared angulated towards the lingual side

✓Preparing it straight could cause pulp exposure

Class I Cavity in Lower First Premolar



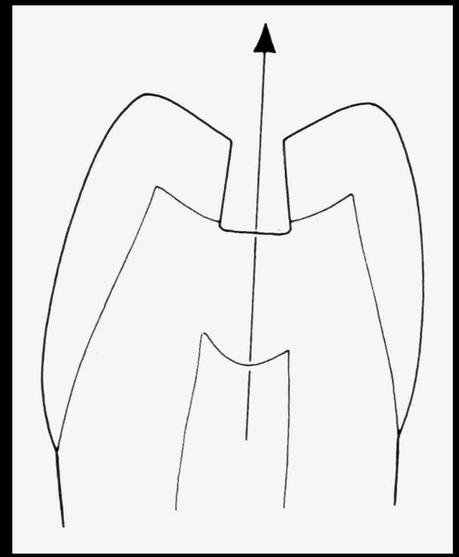
The axis of the bur should be angulated between the long axis of the tooth and the angle of the lingual cusp

Retention Form in Class I

- Retention form:

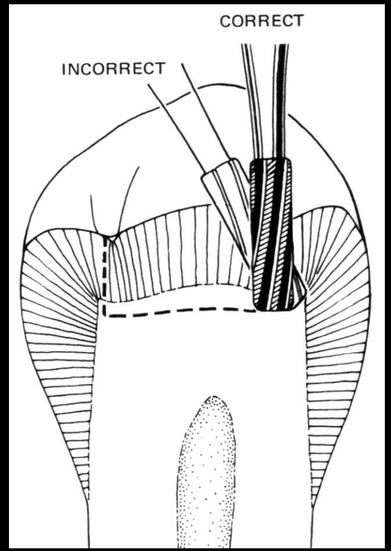
✓Convergence form 5-10 degrees in the buccal and lingual walls

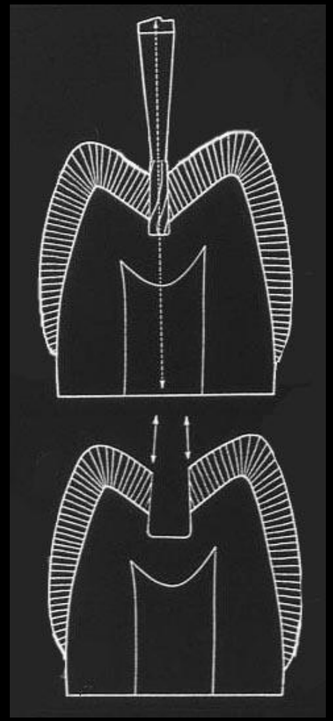
The slight occlusal convergence of two or more opposing, external walls provides the primary retention form

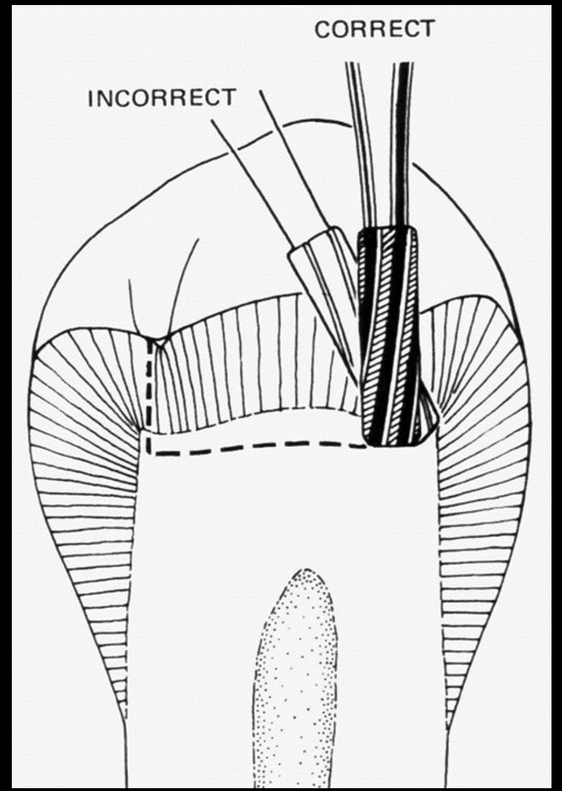


Class I Cavity Preparation

- Angulate 330 bur or a pear shaped bur
- Access the cavity with round bur and then use an Inverted cone bur
- Or use 330 bur from start to finish



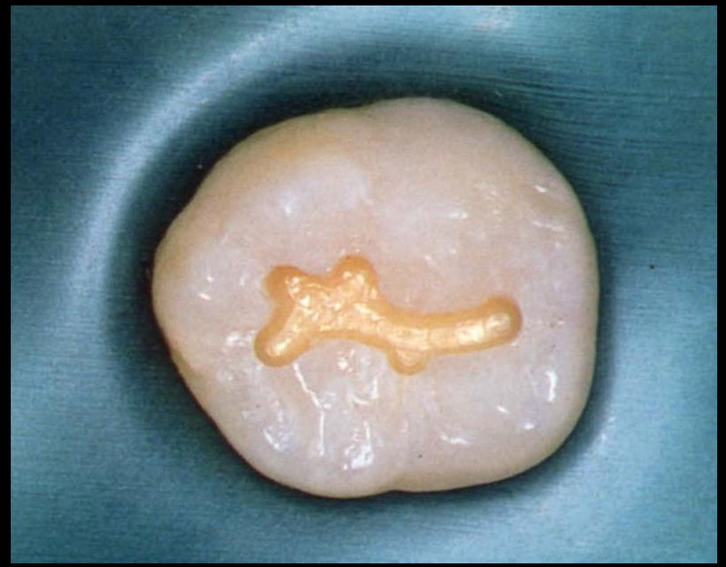




Retention Form (Mechanical)

- must be placed into a prepared undercut form in the tooth so as to be mechanically retained (amalgam does not bond to tooth structure).

Class I Cavity

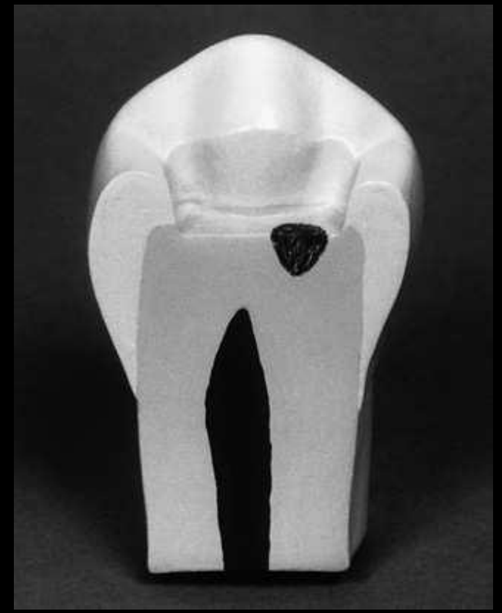


- Convenience form:

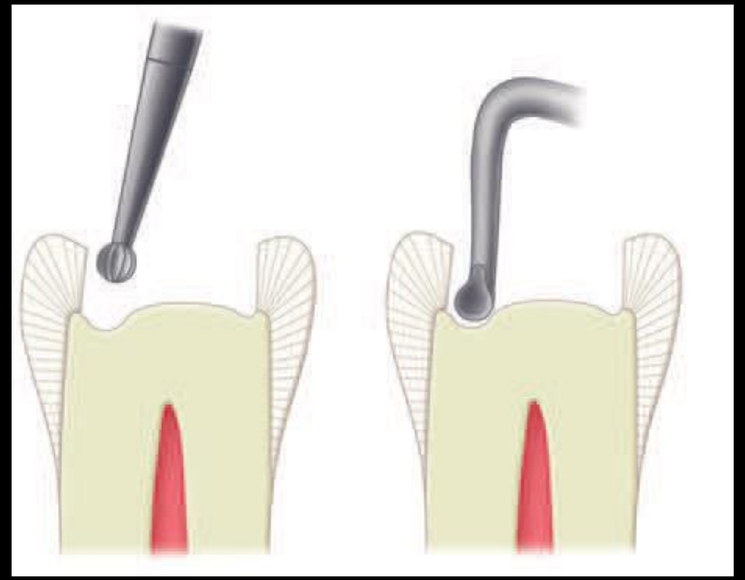
The cavity should be wide enough for the visibility

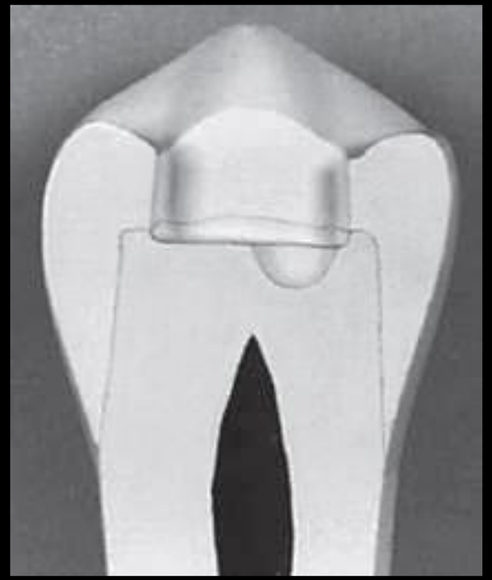
Final Tooth Preparation

- Mesiodistal longitudinal section showing example of the pulpal floor in dentin and the caries lesion that is exposed after the initial tooth preparation. The caries lesion is surrounded by sound dentin on the pulpal floor for the resistance form
- Remaining caries(and, if present, old restorative material) is removed during the final tooth preparation.



Final Cavity Preparation





Removal of the remaining dentinal carries by:

1. Low speed round bur
2. Spoon excavator

Affected vs. infected dentin?

Final Tooth Preparation

The final tooth preparation includes:

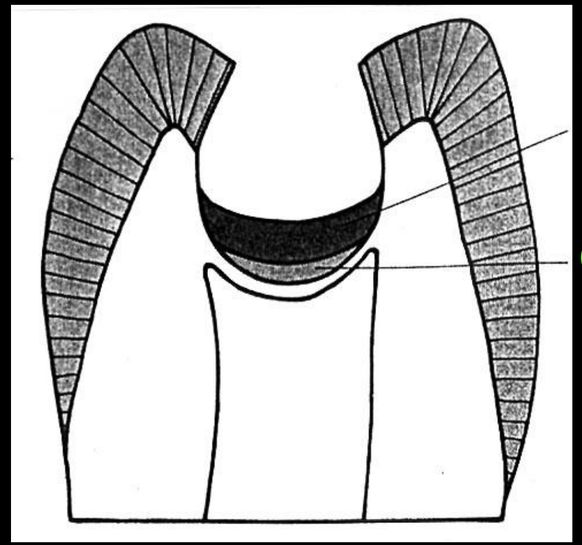
(1) removal of remaining defective enamel and soft dentin on the pulpal floor as indicated

(2) pulp protection, where indicated (liners or bases)

(3) procedures for finishing the external walls

(4) final procedures of debridement (cleaning) and inspecting the preparation.

Liners and Bases



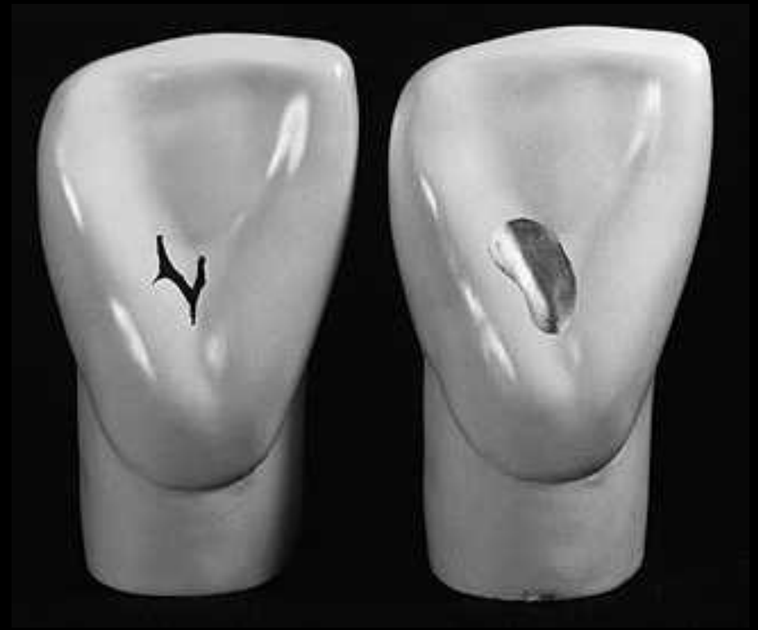
GIC Glass Ionomer Cement

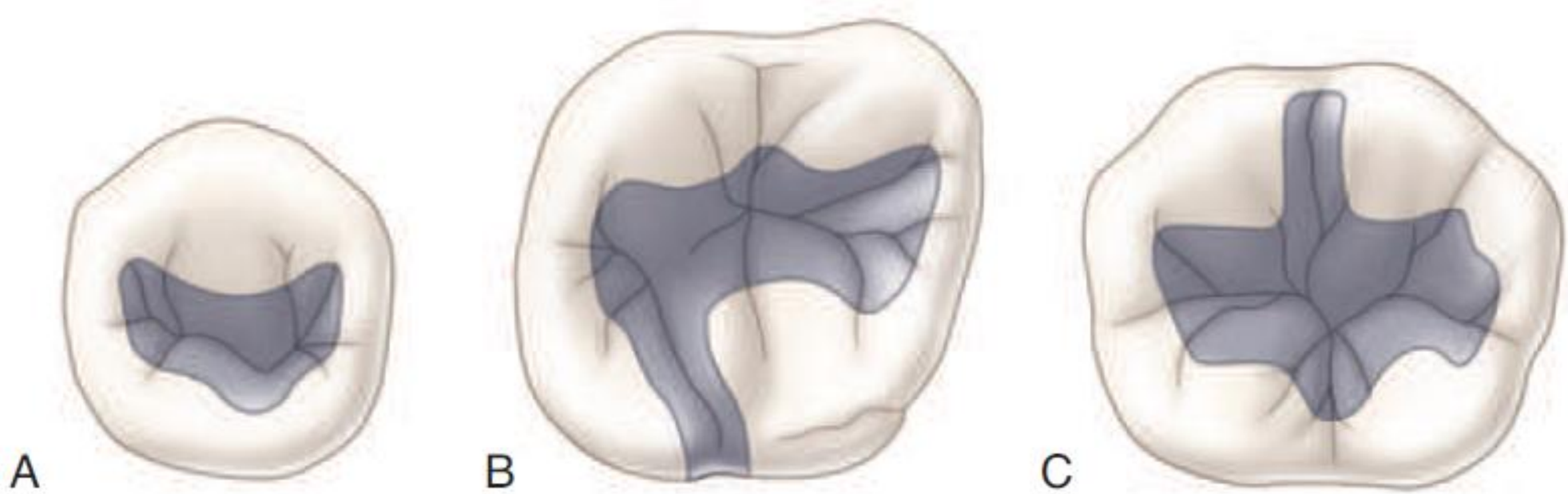
$Ca(OH)_2$

- Shallow cavity: Nothing or varnish (super seal)
- Deep cavity near the pulp: Calcium hydroxide liner + GIC (Sandwich technique)
- Moderate cavity depth: GIC without $Ca(OH)_2$

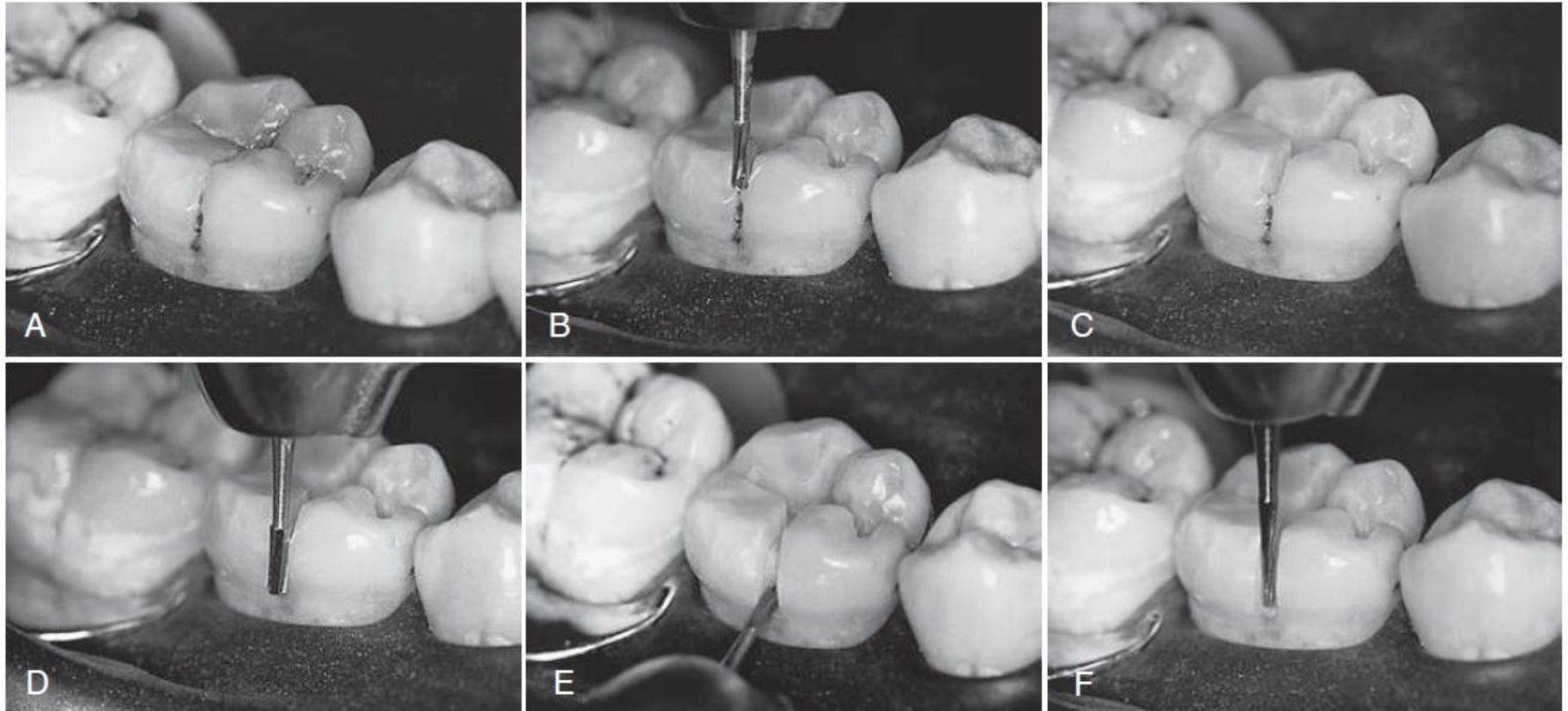
Other Class I Amalgam Preparations

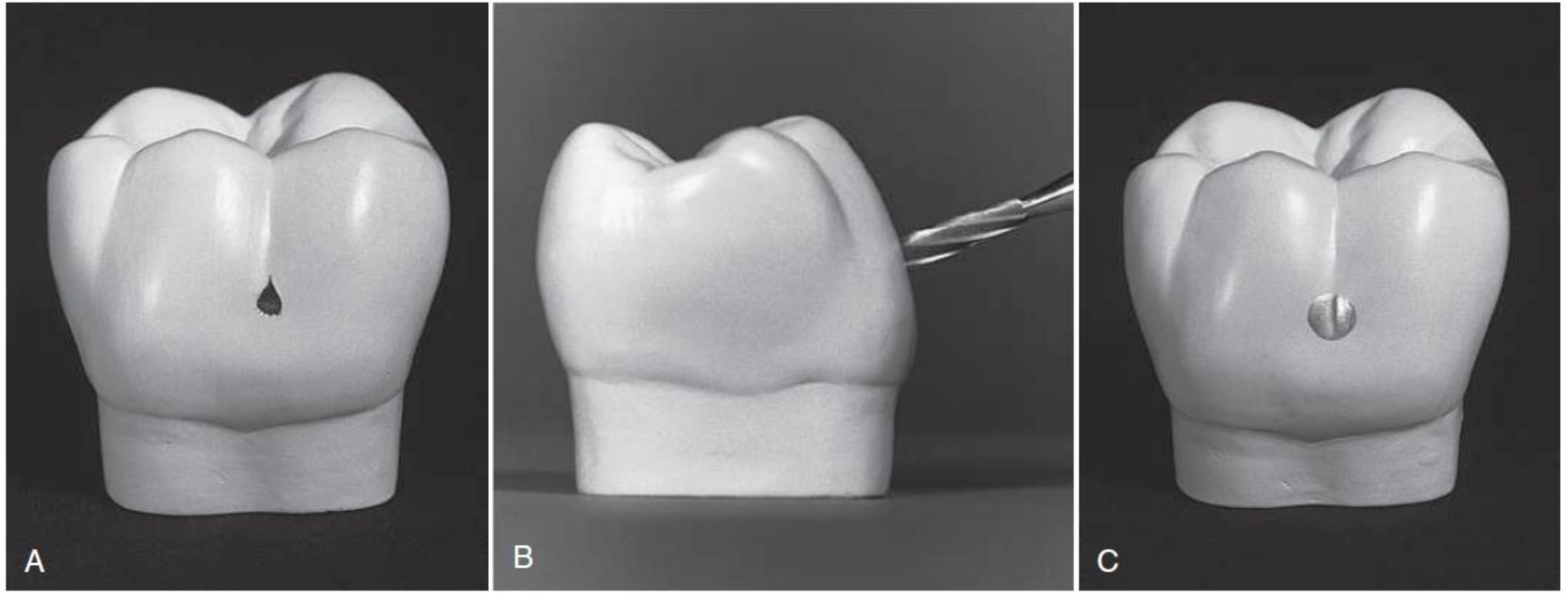
1. Facial pit of the mandibular molar.
2. Lingual pit of the maxillary lateral incisor.
3. Occlusal pits of the mandibular first premolar.
4. Occlusal pits and fissures of the maxillary first molar.
5. Occlusal pits and fissures of the mandibular second premolar





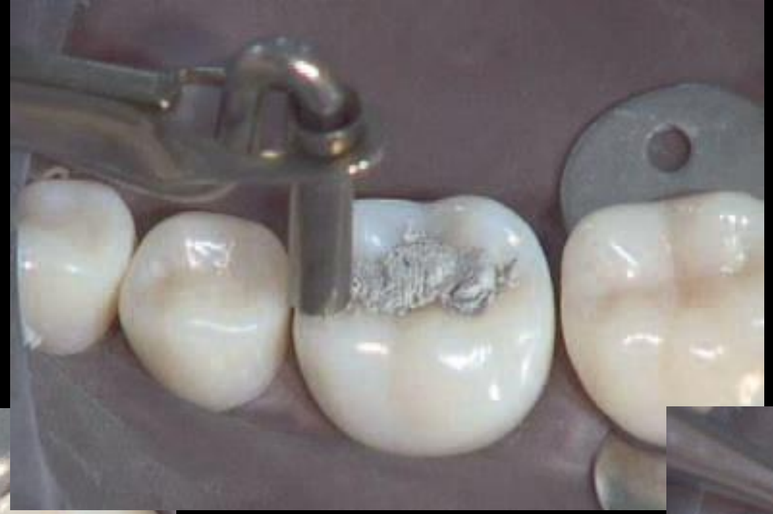
• **Fig. 10.36** Examples of more extensive Class I amalgam tooth preparation outline forms. A, Occlusal outline form in the mandibular second premolar. B, Occlusolingual outline form in the maxillary first molar. C, Occlusofacial outline form in the mandibular first molar.

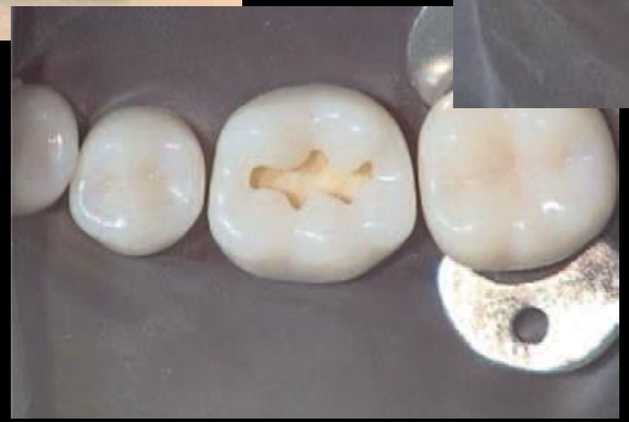

A
B
C
D
E
F

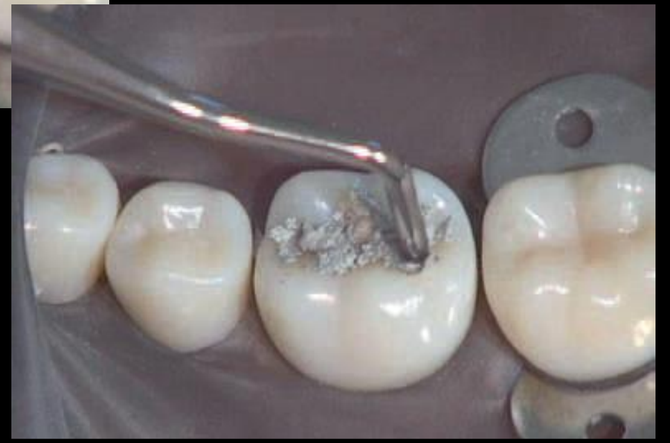


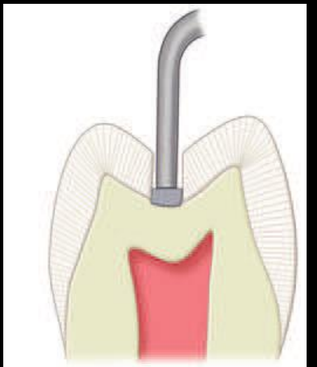
• **Fig. 10.40** Mandibular molar. A, Facial pit with a caries lesion. B, The bur positioned perpendicular to the tooth surface for entry. C, Outline of restoration.

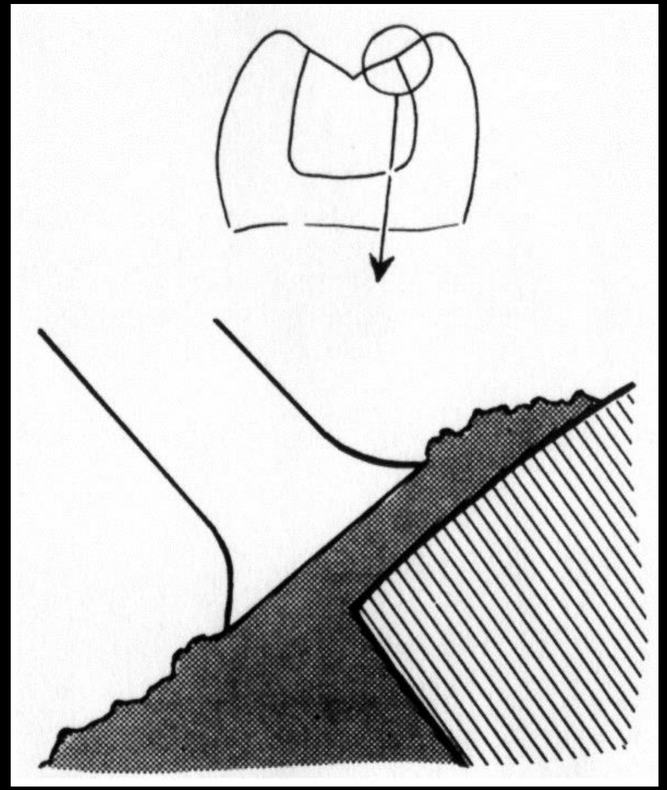
Restorative Technique for Class I Amalgam











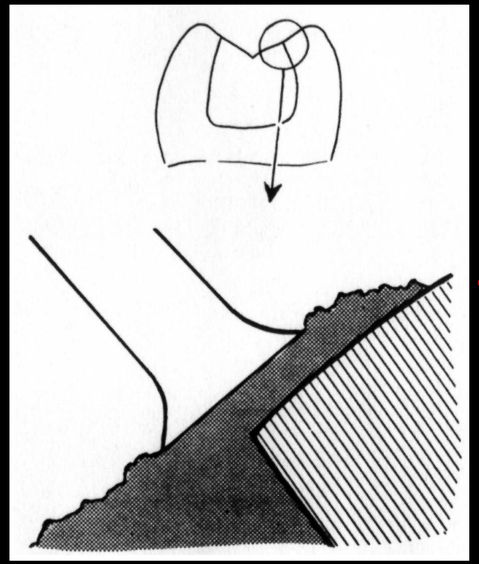
Carving the Amalgam

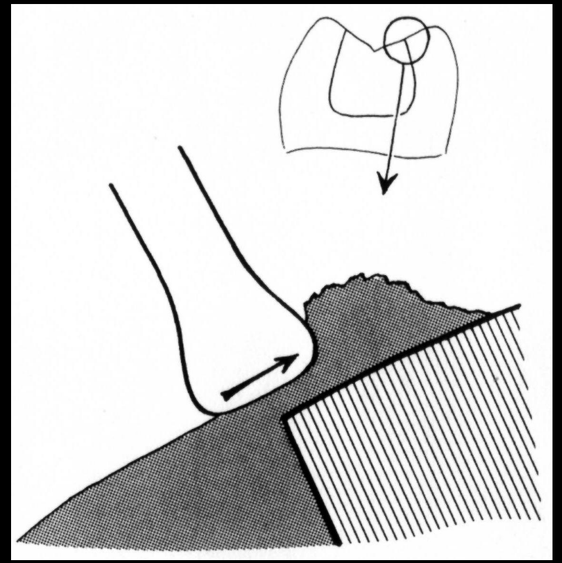
Final condensation over cavosurface margins should be done perpendicular to the external enamel surface adjacent to the margins. The overpacked amalgam should then be carved and burnished.

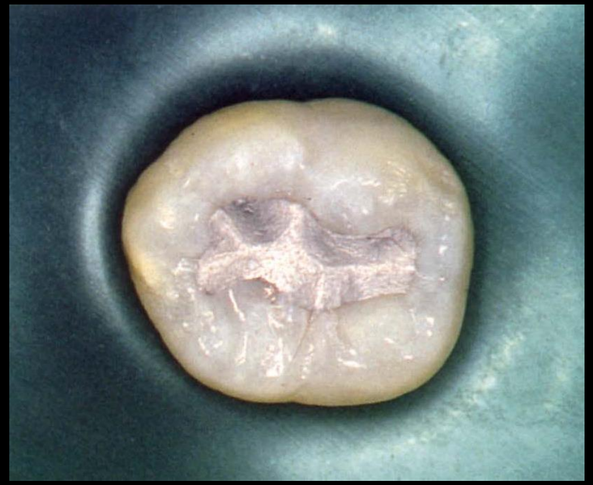
Class I Cavity

1. Amalgam Condensation
2. Amalgam carving

   (morphology)

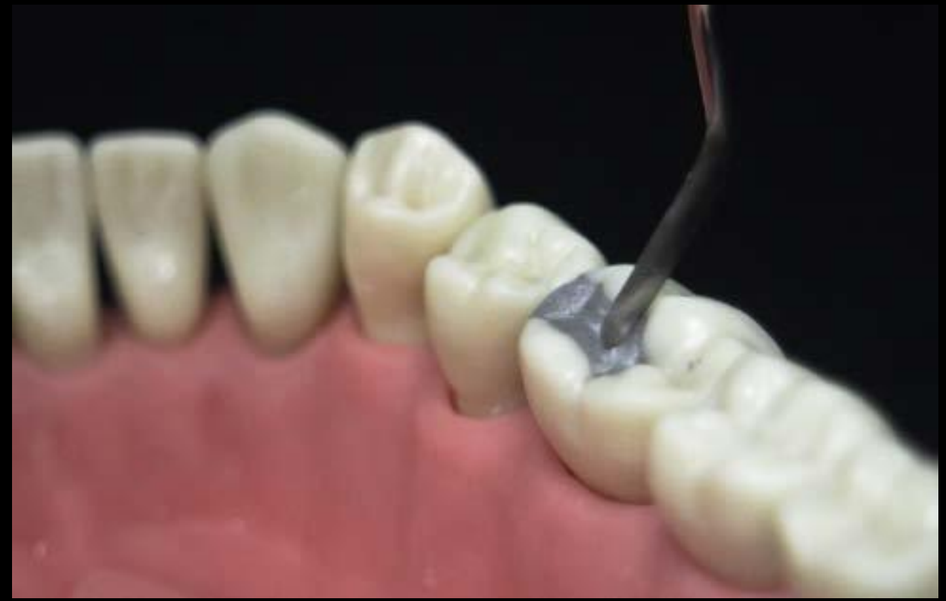


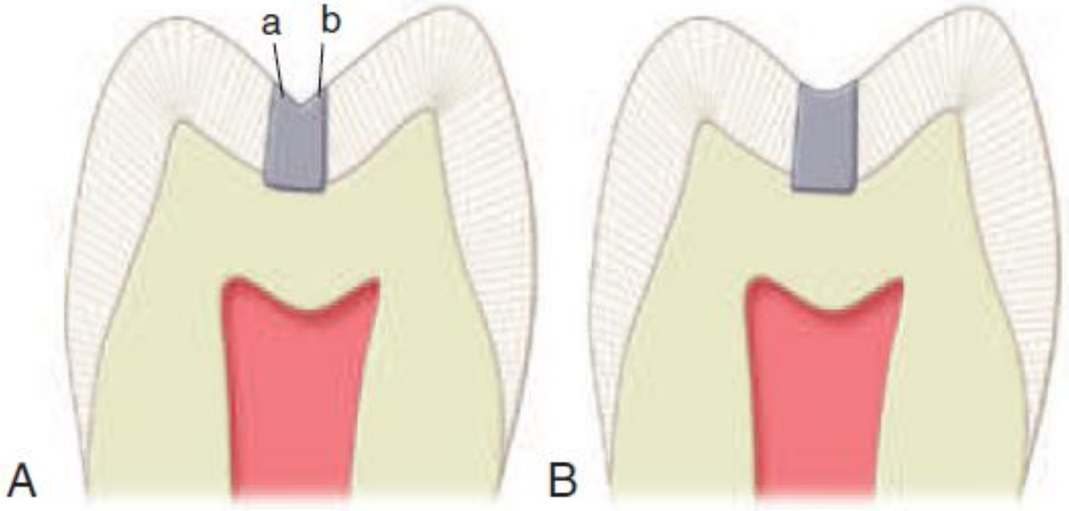




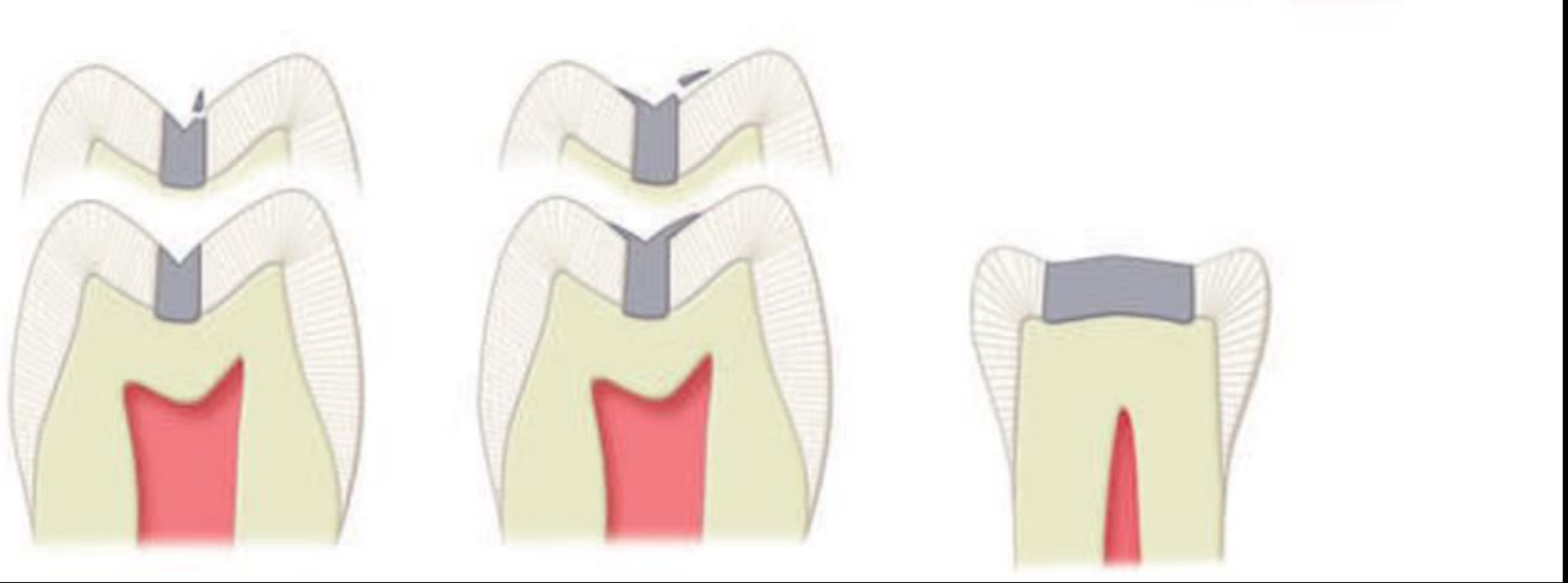
Carving the Amalgam

- All carving should be done with the edge of the blade perpendicular to the margins as the instrument is moved parallel to the margins.
- Part of the edge of the carving blade should rest on the unprepared tooth surface adjacent to the preparation margin





• **Fig. 10.12** 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.

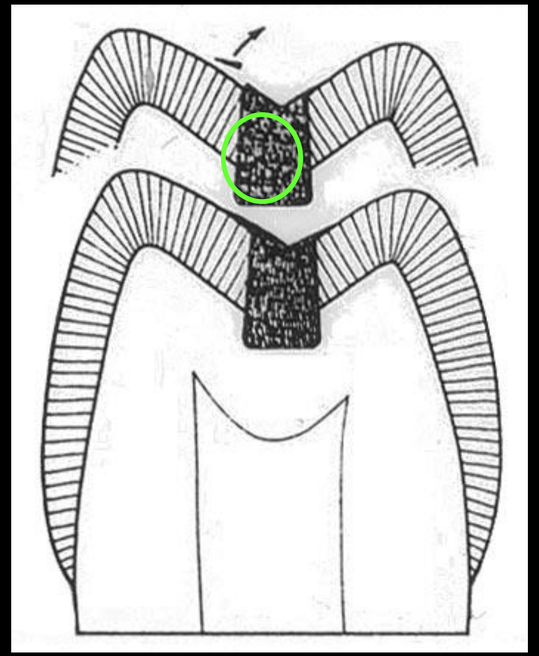


Carving of Amalgam

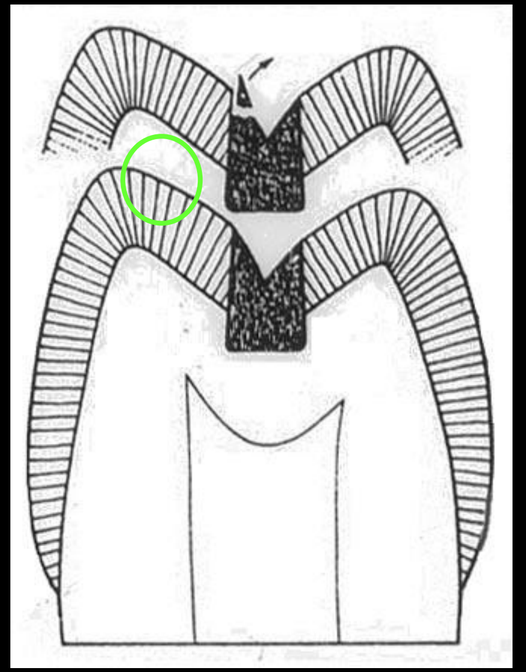
- Thin amalgam left in these areas may fracture because of its low edge strength.
- Deep occlusal anatomy should not be carved into the restoration because these may thin the amalgam at the margins and weaken the restoration.
- Under carving leaves thin portions of amalgam (subject to fracture) on the unprepared tooth surface.
- The thin portion of amalgam extending beyond the margin is referred to as Flash

UNDER CARVING

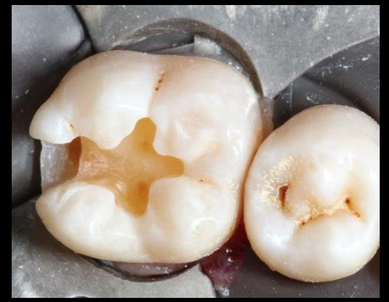
FLASH

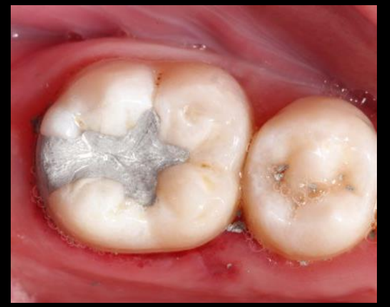


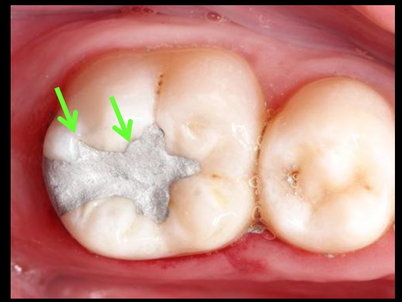
OVER CARVING



Flash

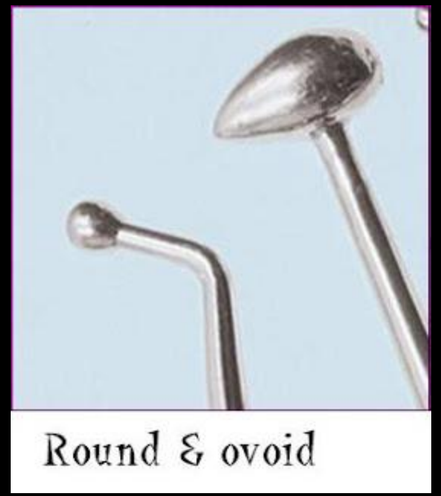


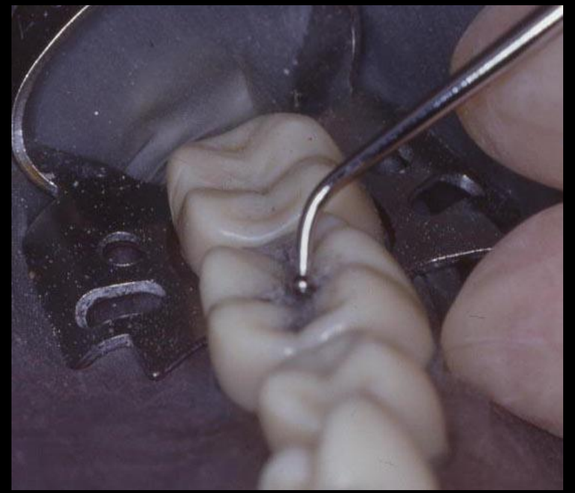




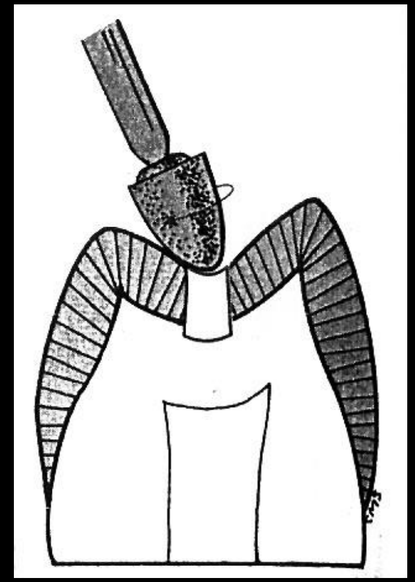
Class I Cavity

- Amalgam Burnishing

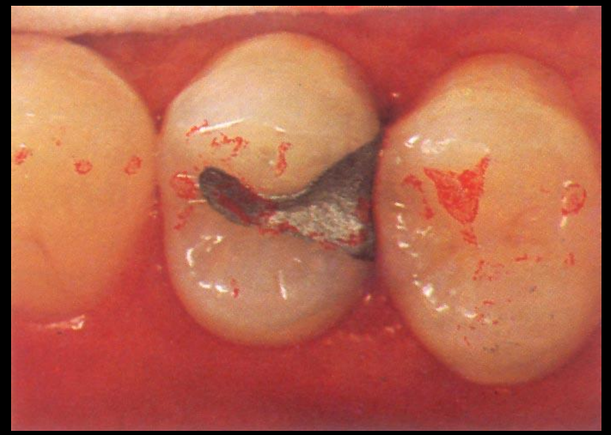


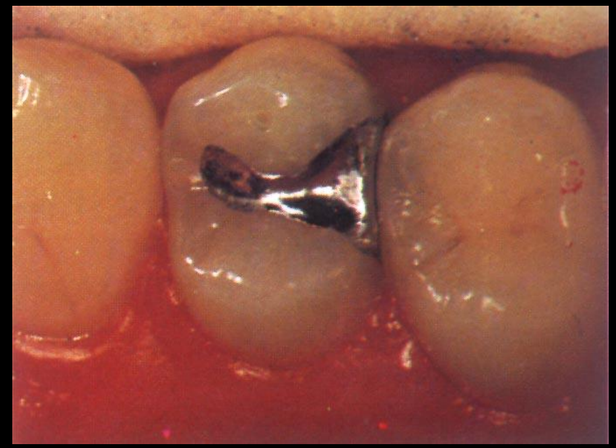


- Amalgam Finishing (after 24 hours)

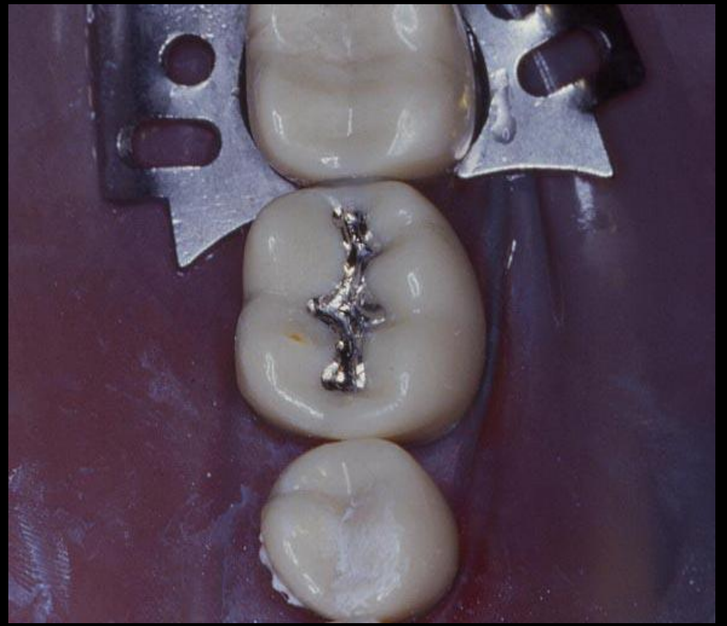


Amalgam Finishing after 24 hours



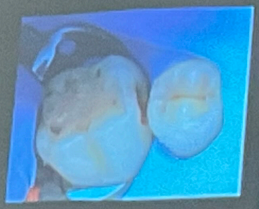


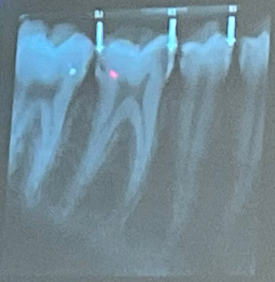
Finished Amalgam Restoration



Thank You

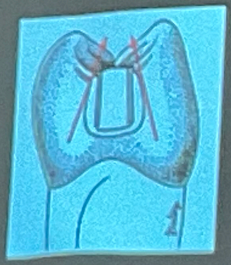
Class II Caries





- Caries lesion found in the proximal surfaces of molars and premolars

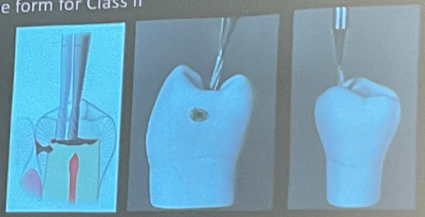
Class II Cavity Preparation



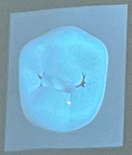
- Out line form
- Resistance form
- Retention form (convergence in the box + dove tail)
- Convenience form

Outline form for Class II

- Punch cut through the long axis of the tooth
- the long axis of the bur and the long axis of the tooth crown should remain parallel during the cutting procedures.

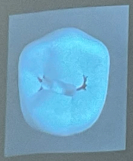


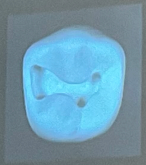
Outline Form for Class II



Extending into the involved proximal marginal ridge

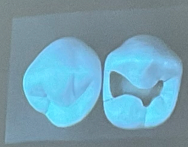
Outline Form for Class II





Extending into the involved proximal marginal ridge

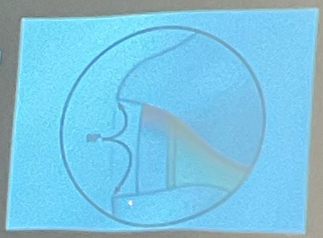
Outline form for Class II



- The final locations of the facial and lingual walls of the proximal box are estimated visually.
- Visual assessment prevents overextension of the occlusal outline form (occlusal step) where it joins the proximal outline form (proximal box)

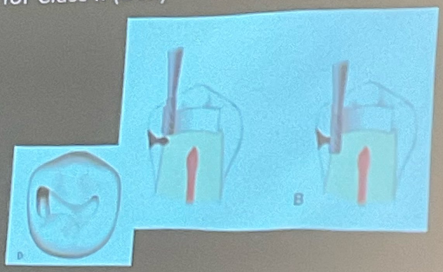
Outline form for Class II (The S shape)

- A reverse curve (S shape) in the occlusal outline of a Class II preparation results when developing the mesiofacial wall perpendicular to the enamel rod direction.
- At the same time, conserving as much of the facial cusp structure as possible.
- The extension into the mesiofacial cusp is limited to that amount required to permit a 90-degree mesiofacial margin.



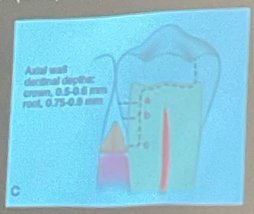
Proximal Outline form for Class II (Box)

- The initial procedure in preparing the outline form of the proximal box is the isolation of the proximal (in this case, mesial) enamel by the proximal ditch cut.
- While maintaining the same orientation of the bur, it is positioned over the DEJ in the pulpal floor next to the remaining mesial marginal ridge
- The end of the bur is allowed to cut a ditch gingivally along the exposed proximal DEJ, two thirds at the expense of enamel and one third at the expense of dentin



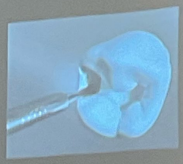
Proximal Outline form for Class II (Box)

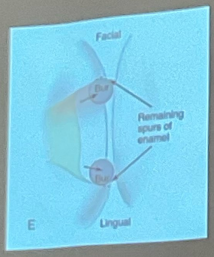
- Pressure is directed gingivally and lightly toward the mesial surface to keep the bur against the proximal enamel, while the bur is moved facially and lingually along the DEJ.
- The ditch is extended gingivally just beyond the caries lesion or the proximal contact, whichever is greater

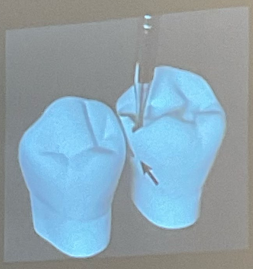


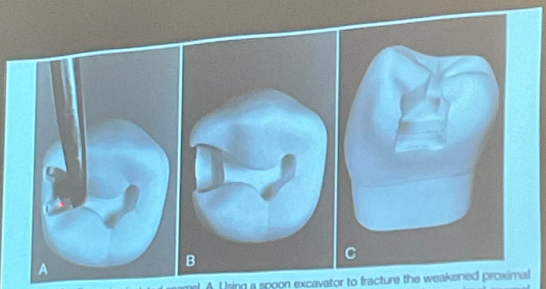
Proximal Outline form for Class II (Box)

- The faciolingual dimension of the proximal ditch is greater at the gingival level than at the occlusal level to provide occlusal convergence of the facial and lingual proximal box walls
- To isolate and weaken the proximal enamel further, the bur is moved toward and perpendicular to the proximal surface

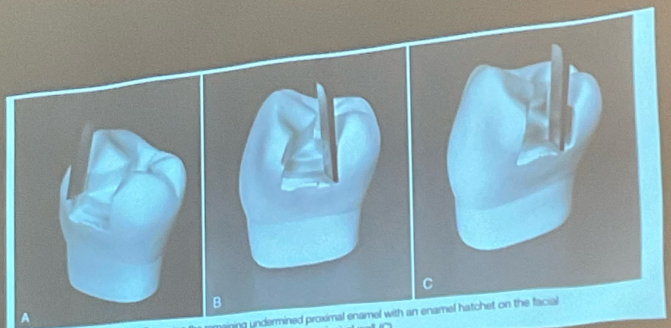



Facial
Remaining spurs of enamel
Lingual
E

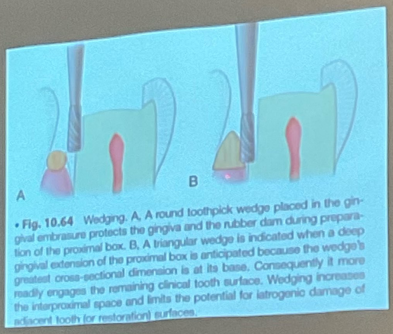




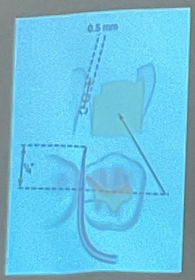
• **Fig. 10.63** Removing isolated enamel. A, Using a spoon excavator to fracture the weakened proximal enamel. B, Occlusal view with the proximal enamel removed. C, Proximal view with the proximal enamel removed.



• **Fig. 10.65** Removing the remaining undermined proximal enamel with an enamel hatchet on the facial proximal wall (A), the lingual proximal wall (B), and the gingival wall (C).



• **Fig. 10.64** Wedging. A, A round toothpick wedge placed in the gingival embrasure protects the gingiva and the rubber dam during preparation of the proximal box. B, A triangular wedge is indicated when a deep gingival extension of the proximal box is anticipated because the wedge's greatest cross-sectional dimension is at its base. Consequently it more readily engages the remaining clinical tooth surface. Wedging increases the interproximal space and limits the potential for iatrogenic damage of adjacent tooth (or restoration) surfaces.

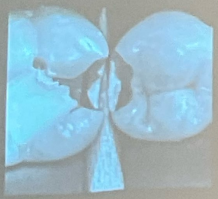


Clearance of the Box

- When preparing a tooth with a small lesion, these margins may clear the adjacent tooth by only 0.2 to 0.3 mm.
- A guide for the gingival extension is the visualization that the finished gingival margin will be only slightly gingival to the gingival limit of the ditch. his gingival margin will likely clear the adjacent tooth by only 0.5 mm when treating an early cavitated proximal lesion

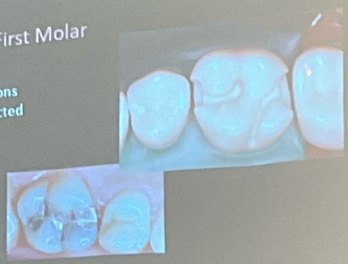
Final Preparation of Class II

Remnant of caries lesion bordering the enamel margin after insufficient gingival extension. Such a lesion indicates extending part or all of the gingival floor to place it in sound tooth structure



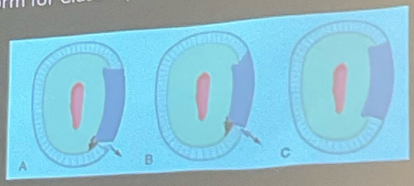
Class II in Maxillary First Molar

- When mesial and distal proximal surface amalgam restorations are indicated on the maxillary first molar that has an unaffected oblique ridge, separate two-surface tooth preparations are indicated (rather than a mesioocclusodistal preparation).



Proximal Outline form for Class II (Box)

- Proximal walls that result in cavosurface angles of 90 degrees are desired.
- Cavosurface angles of 90 degrees ensure that no undermined enamel rods remain on the proximal margins and that the maximal edge strength of amalgam is maintained



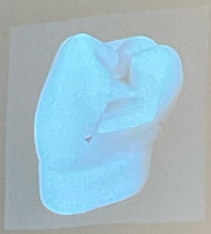
Resistance Form in Class II

- The primary resistance form in a class II cavity is provided by:

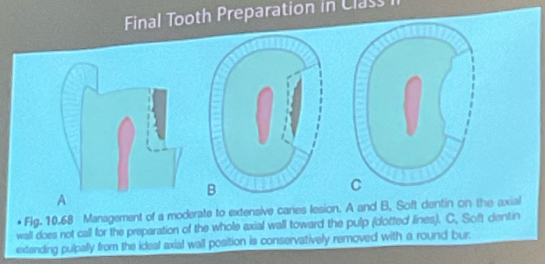
(1) the pulpal and gingival walls being relatively level (perpendicular to force directed along the long axis of the tooth)

(2) restricting the extension of the walls to allow sufficient dentin support to remain (and therefore strong cusps and ridge areas) while at the same time establishing the peripheral seat

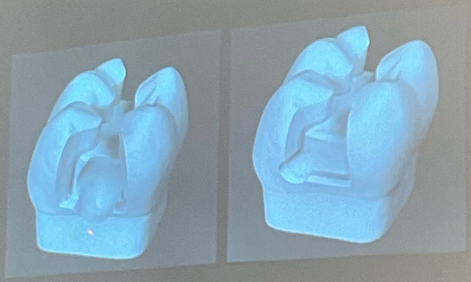
(3) restricting the occlusal outline form (where possible) to areas receiving minimal occlusal contact



Final Tooth Preparation in Class II

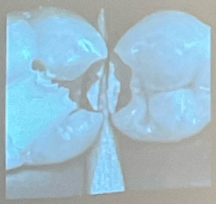


• **Fig. 10.68** Management of a moderate to extensive caries lesion. A and B, Soft dentin on the axial wall does not call for the preparation of the whole axial wall toward the pulp *(dotted lines)*. C, Soft dentin extending pulpally from the ideal axial wall position is conservatively removed with a round bur.



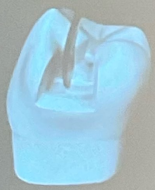
Final Preparation of Class II

Remnant of caries lesion bordering the enamel margin after insufficient gingival extension. Such a lesion indicates extending part or all of the gingival floor to place it in sound tooth structure



Final Preparation of Class II

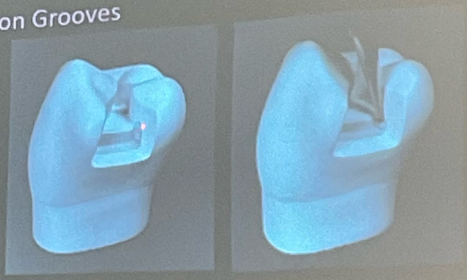
- Roundation of the pulpo-axial line angle (P.A.L.A)
- helps to increase the bulk of restorative material and decrease the stress concentration within the restorative material
- Overall it increases the resistance form for the amalgam



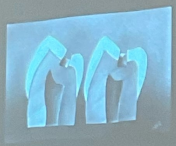
Proximal Retention Grooves

The depth of retention grooves in extensively wide proximal boxes may need to be 0.5 mm or greater at the gingival aspect.

Retention grooves, when used, always should be placed at least 0.2 mm inside the DEJ of the facial and lingual proximal walls regardless of the depth of the axial wall and associated line angles.



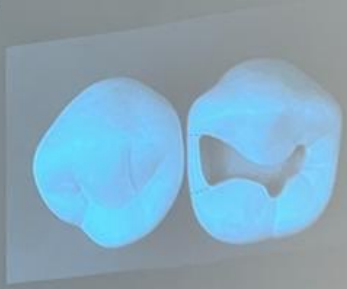
Variation of Proximal Surface Tooth Preparation



- Mandibular First Premolar
- The mandibular first and second premolars are compared in the picture
- Note differences in the sizes of the pulp chambers, lingual cusps, and direction of pulpal walls.

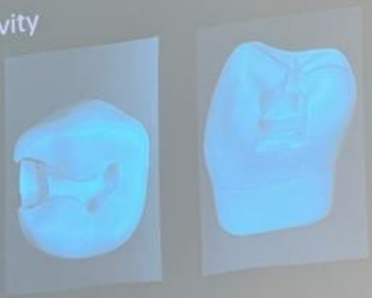
Outline form for Class II

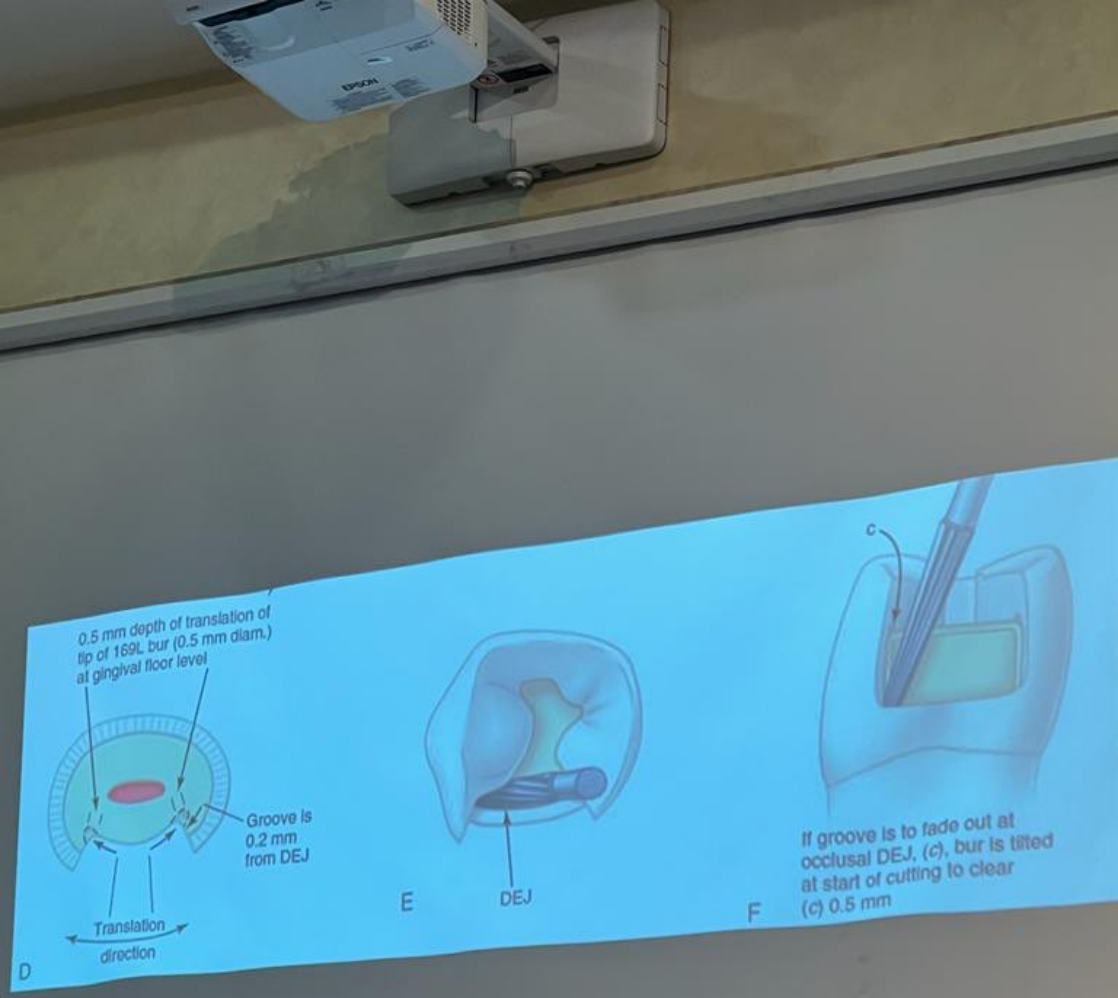
- The preparation is extended mesially, stopping approximately 0.8 mm short of cutting through the marginal ridge into the contact area.
- The occlusal step in this region is made slightly wider faciolingually than in the Class I preparation because additional width is necessary for the proximal box.



Retention Form in Class II Cavity

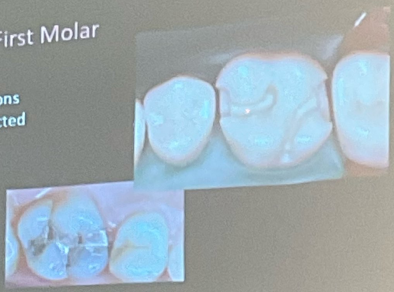
- The primary retention form is provided by the occlusal convergence of the facial and lingual walls and by the dovetail design of the occlusal step, if present.



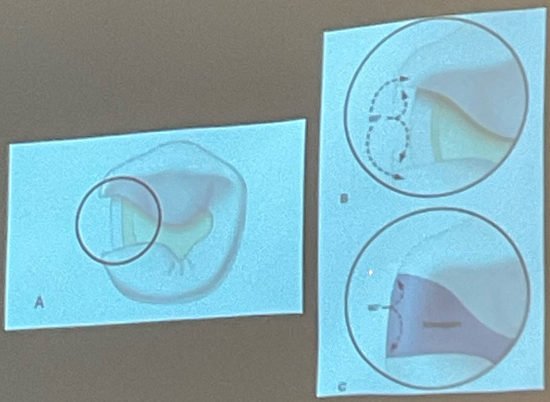

0.5 mm depth of translation of tip of 169L bur (0.5 mm diam.) at gingival floor level
Groove is 0.2 mm from DEJ
Translation direction
D
DEJ
E
C
If groove is to fade out at occlusal DEJ, (c), bur is tilted at start of cutting to clear (c) 0.5 mm
F

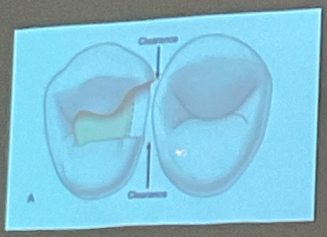
Class II in Maxillary First Molar

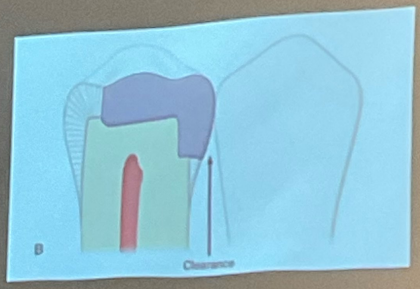
- When mesial and distal proximal surface amalgam restorations are indicated on the maxillary first molar that has an unaffected oblique ridge, separate two-surface tooth preparations are indicated (rather than a mesioocclusodistal preparation).



- Enamel cavosurface margins must be left at 90 degrees or greater to limit the potential for enamel fracture. For enamel strength, the marginal enamel rods should be supported by sound dentin.
- These requirements for enamel strength must be combined with marginal requirements for amalgam (90-degree butt joint) when establishing the periphery of the tooth preparation

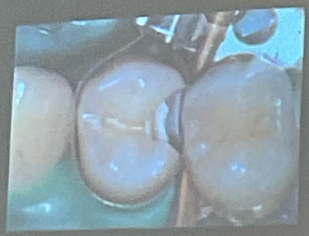


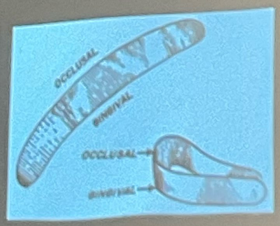

Clearance
A
Clearance


B
Clearance

Class II Cavity Preparation

Using Matrix Band



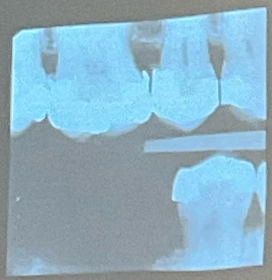


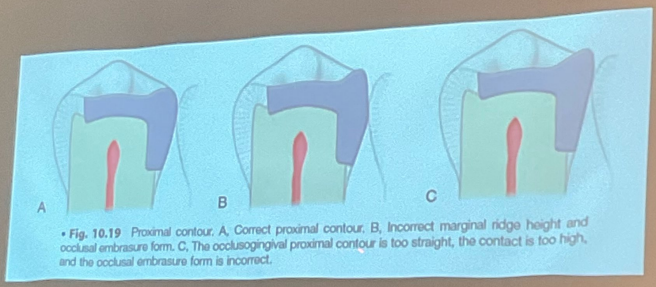
Class II Amalgam

- Establishing the contact area is important
- Not regaining the contact area can lead to:

✓Food impaction

✓Gingival inflammation

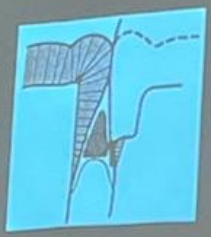


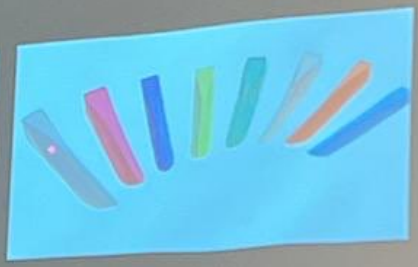


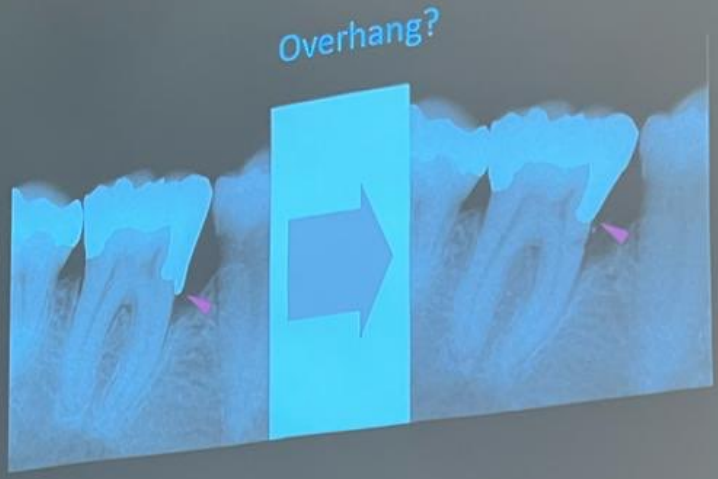
• **Fig. 10.19** Proximal contour. A, Correct proximal contour. B, Incorrect marginal ridge height and occlusal embrasure form. C, The occlusogingival proximal contour is too straight, the contact is too high, and the occlusal embrasure form is incorrect.

Class II Cavity Preparation

Using Wedges






Overhang?

Amalgam Finishing after 24 hours

Amalgam Finishing after 24 hours