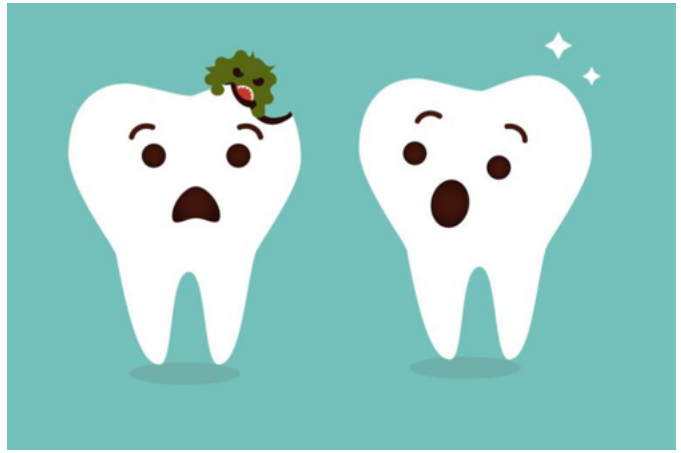
250 years of EXCELLENCE
in medical education,
research & innovation
and healthcare

Preparation techniques in conservative dentistry (and endodontics)

dr. Jelencsics Dávid

Department of General Dental Precilincal Practice

Caries



localised destruction of dental hard tissues by acidic by-products of special bacterias in saliva

In early stages: prevention (secunder)

- Incipient caries

REVERSIBLE

Therapy:
restoration → cavity preparation, filling

IRREVERSIBLE

Definition of tooth preparation

- Preparing the tooth for filling is called tooth (cavity) preparation

Instruments

Knownledge and rules:

Instruments for tooth preparation
(enamel, dentin and carious dentin)

Cavity preparation

- Removal of tooth structure for healing purposes
- Possibilities:
  - Manual (hand) instruments
  - Rotary instruments (gold standard)
  - Oscillating instruments
  - Laser
  - Air abrasion
  - Chemo-mechanical (ICON)

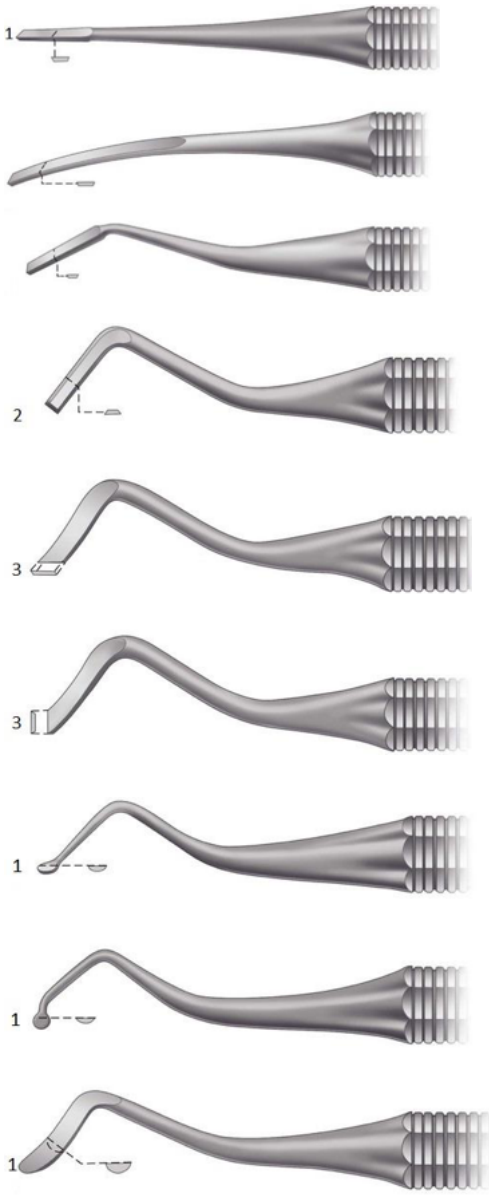
Hand instruments (G. V. Black)

Nowadays hand instruments are not used for primary preparation
Most of them are paired instruments

- Advantage: it is not caused iatrogen damage
- Disadventage: very low efficiency
- Instruments for enamel preparation:

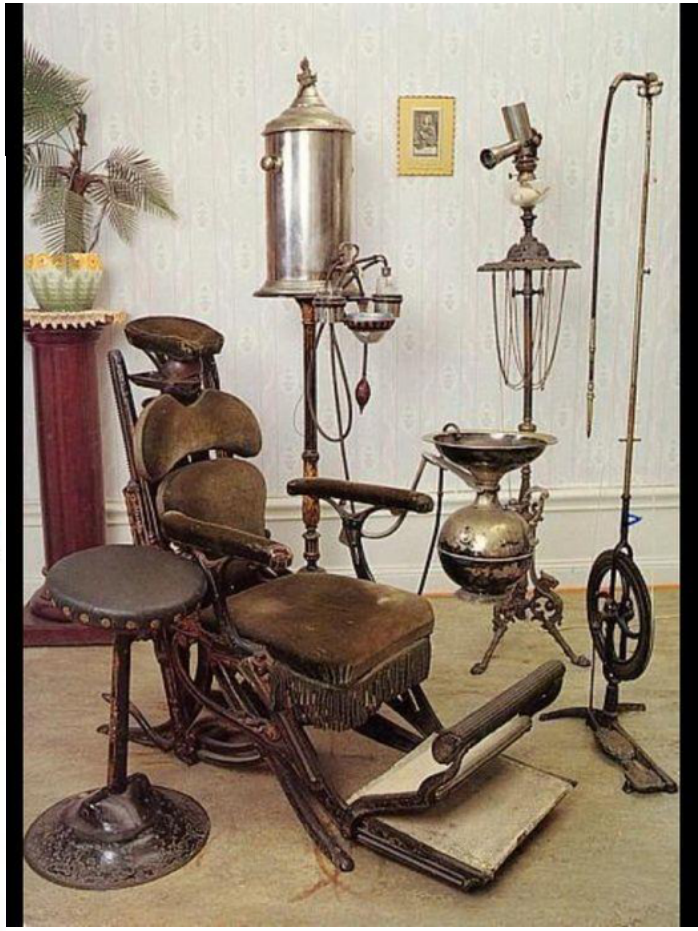
1. Chisel (Black)
2. Hatchet
3. Gingival margin trimmer* • Instruments for dentin preparation:

1. Excavator (hoes, **spoon**, hatchet)*



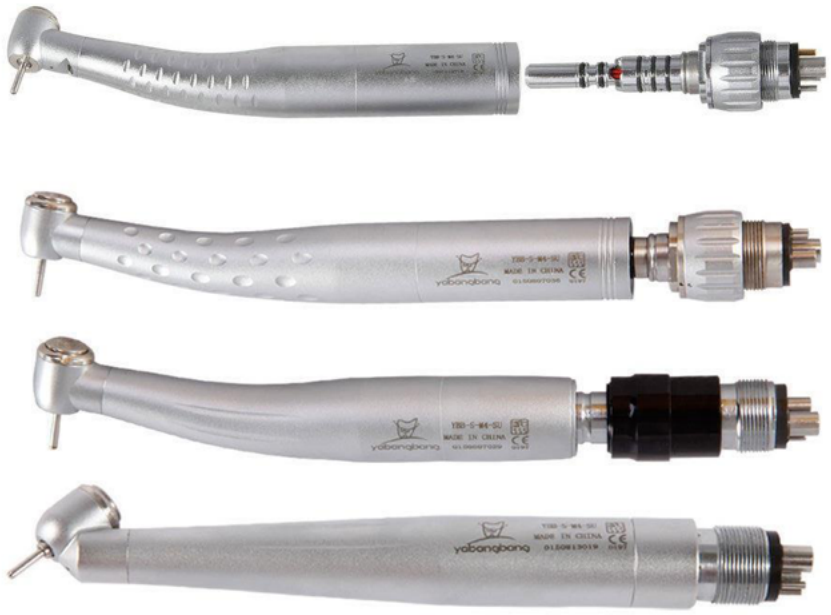
Rotary, powered instruments (foot, electric, air) drive

- Foot engine (mirellalummertz.files.wordpress.com)
- Modern dental unit (KaVo)



Turbine, air and micromotor

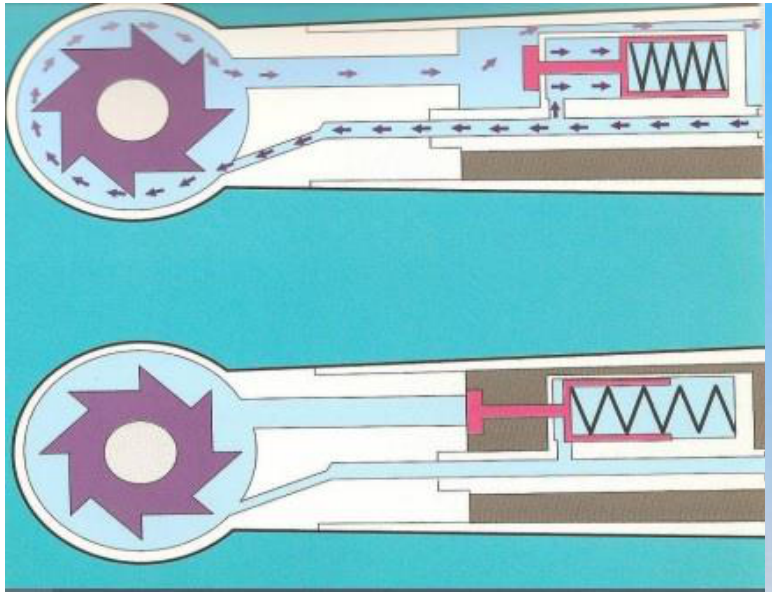
Only contra angled, by compressed air drive

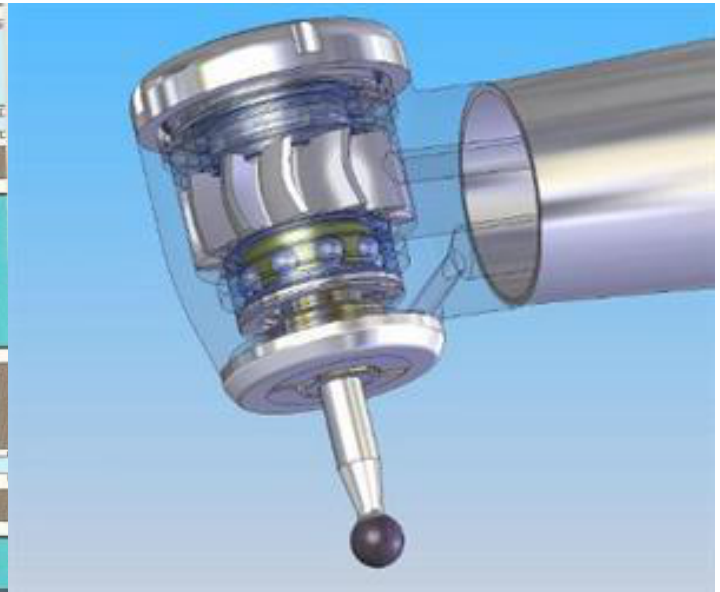


Contra angled and straight, direct current electric, or air drive

Tubine (highspeed handpiece)

- Wheels are in the head end of the contra angled handpiece
- When the turbine is in operation, some of the drive air flows into the wheels and then into the valve, opening the exhaust- air passage
- Immediatly the turbine is switched off, the valve seals the exhaust-air, preventing the aspiration of contamined aerosol





Turbine (1956)

- Free running speed: 300 000- 450 000 rpm max. (with load half of the free running speed)
- Direction of the running can’t be changed
- Ball bearing (ceramics 440 000 rpm / 3,5-4 bar)

Micromotor (1966)

- Air motor (air drive) 25 000 rpm max.
- Constant rotation speed for load
- Direction of rotation can be changed

- Electric micromotor 40 000 rpm max.
- Speed for load is constant
- Direction of rotation can be changed

The rotation speed can be changed with handpieces (accelerator, reductor)

Color of the ring	Electric powered motor	Air powered motor
Blue ring 1:1	4 000 40 000	5 000 20 000
Red ring 1:5	20 000 200 000	25 000 100 000
Green ring 5:1, 7.4:1, 2.8:1	800-8 000	1 000-4 000

Handpieces

- Functions of the handpieces:

1. Transfers the power for rotating instruments
2. Holds the rotating instruments

- Type:

1. Straight handpiece (HP)
2. Contra angled (RA, FG shanked accelerator)

Latch type, friction grip

Rotary cutting instruments (burs, diamonds, abresives)

Consistof:

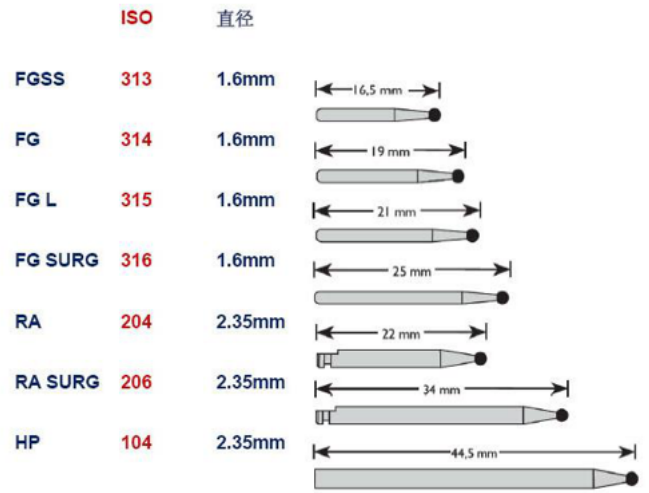
Head

Neck

Shank

Functions of head, neck and shank

- **Head** makes the preparation.
    1. Material depends on, the machined enamel, dentin, carious dentin.
    2. The shape depends of the work.
- **Neck** transmit the rotational and translational forces to head.
    1. It has tapered form, this taper can influence the visibility.
    2. Access and the strenght
- **Shank** fits into the chuck of the handpiece.
    1. Lenght, crossection and the end shape can be different.
    2. RA, FG, HP (latch type, friction grip, straight).



Head of the rotary instruments according to the materials

- Diamond, corundum
- Metal (hardmetal)
- Stones (Arcansas)
- Rubbers, polimers

Construction of the diamond bur

Metal blank that holds the diamond grits and the bonding material

- Size of the diamond grit
- Bonding material

affect the efficiency:

1. Coarse, medium for the preparation (ISO 544-ISO 524)
2. Fine for finishing (ISO 504)

Color code!

Color code:

Screw Bur

FG Color Code

Blue ring	Medium	106 - 125 µm	ISO 524	M	For removal of enamel
Black ring	Super coarse	180 µm	ISO 544	SC	For rapid gross reduction and removal of old filling
Green ring	Coarse	150 µm	ISO 534	C	For fast reduction of enamel
Green ring	Screw	150 µm	ISO 534	SC	For fast reduction of enamel
Red ring	Fine	40 µm	ISO 514	F	For finishing, crown preparations contouring and finishing composites
Yellow ring	Superfine	20 µm	ISO 504	SF	For fine polishing of composite materials

524	106 µm	60/80/90 µm*	Standard
544	150 µm	125 µm*	Super coarse
534	125 µm	106 µm*	Coarse
524	80 µm		Medium
524	60 µm		Medium
514	50 µm		Golden Burs GB
514	40 µm		Fine
514	25 µm		Fine
504	15 µm		Extra fine
494	8 µm		Ultra fine
484	4 µm		Ultra fine

Depending on the shape and size of the instruments, the grit size may differ from the specified value *
Sizes quoted within the site are based for guidance only on Std 106 µm

Head of the rotary cutting instruments

Metal bur has bladed cutting edges.

- Steel bur: at low rpm cut the dentin well, it is not good for enamel.
- Carbide bur (tungsten carbide): performs better at all speed, cut the dentin and enamel too.

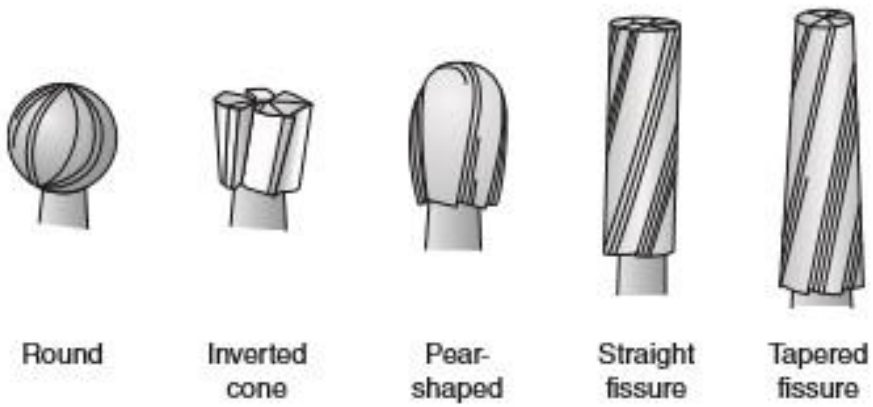


Fig. 6-19 Basic bur head shapes. *(From Finkbeiner BL, Johnson CS: Mosby's comprehensive dental assisting. St. Louis, 1995, Mosby.)*

Construction of the metal bur

- Number of the blades: the more cutting edges give the smoother surface.
    1. Excavating bur(6, 8, 10 blades)
    2. Finishing bur (12, 16, 18, 30 blades)
- Direction of blades:
    1. Straight or axial
    2. Spiral

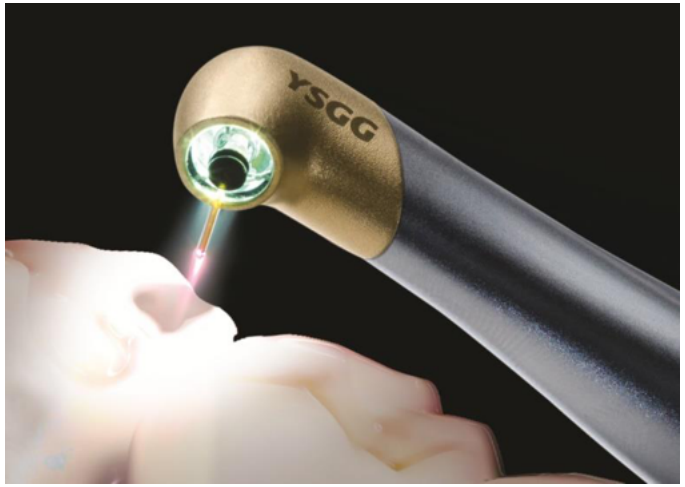
Both can be manufactured with or without crosscuts.

Shape of the burs and diamonds

- Round
- Fissure
- Tapered
- Pear
- Flame
- Inverted cone
- etc.

Oscillating, ultrasonic, abrasion, laser

- Alternative, minimal invasiv instruments



Preparation for direct restorations

- Primer preparation: turbine, micromotor (accelerator) 170 000- 250 000 rpm
  - Material: diamond ISO 806
  - Shank and lenght: FG ISO 314
  - Shape: fissure, round etc…. ISO 141, ISO 001, etc…
  - Grit: medium (blue) ISO 524
  - Size: depends on: ISO 008- ISO 016

- Removing of carious dentin: micromotor (blue ring, green ring) 1 000- 6 000 rpm
  - Material: steel, hard metal ISO 310, ISO 500
  - Shank: RA ISO 204
  - Shape: round ISO 001
  - Diameter/ size: different ISO 008- ISO 035

- Finishing: micromotor (accelerator) 10 000- 40 000 rpm
  - Material: diamond, hard metal ISO 806, ISO 500
  - Shank: FG ISO 314
  - Shape: lots
  - Grit: (diamond) fine- ultrafine ISO 514, ISO 504 ISO 494 (hard metal) 16-18 cutting edges

Removing of an old filling

- Composite: turbine, micromotor (accelerator) 170 000- 250 000 rpm
  - Material: diamond ISO 805
  - Shank: FG ISO 314
  - Shape: fissure, round etc…. ISO 141, ISO 001, etc…
  - Grit: medium (blue) ISO 524
  - Size: different: ISO 008- ISO 016
- Amalgam: turbine, micromotor (accelerator) 170 000- 250 000 rpm
  - Material: carbide bur ISO 500
  - Shank: SG ISO 314
  - Shape: fissure, round etc…. ISO 141, ISO 001, etc…
  - Size: different: ISO 008- ISO 016

Rubber dam, Exhaustor!!!!!!

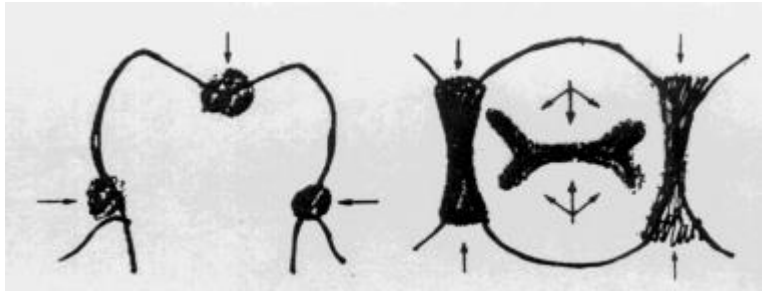
Predilection spots (areas)

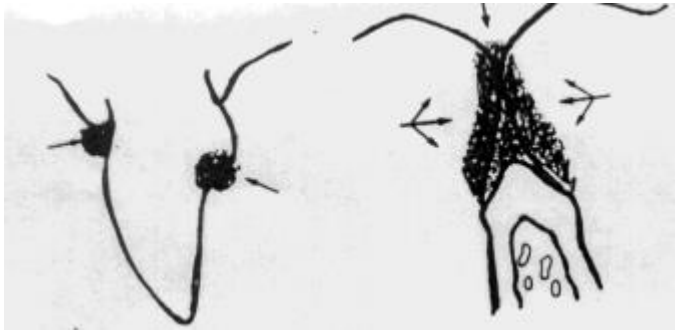
- Predilection spots are retention areas
  - these areas are not self-cleaning (debris)

➢Fissures ➢Pits

➢Approximal surfaces (under the contact point)

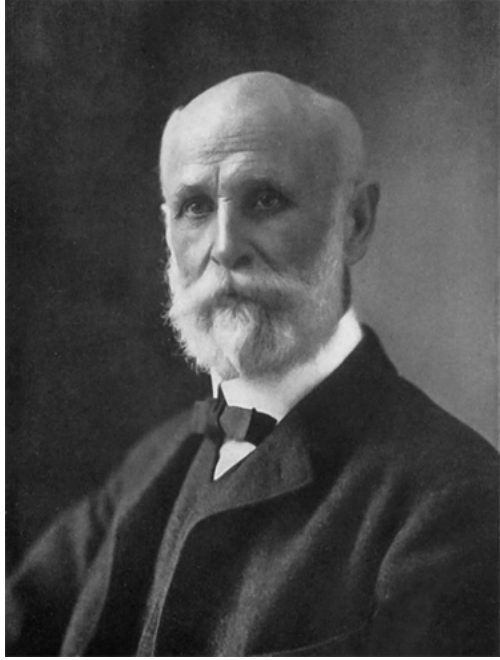
➢Smooth surfaces between the aquator of the tooth and the gingiva



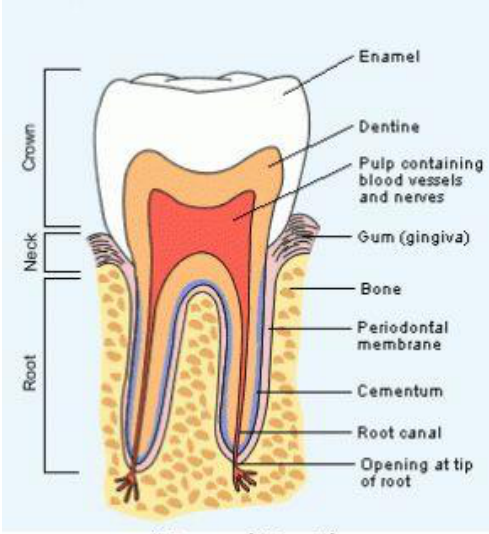


Classification of cavities

- Based on the **predilection spots** of caries on the anatomical crown (until the CEJ; clinical crown?)
  - Class I-V
- Later extra classes were added
  - Class VI: not predilection area (for example: top of the cusp)
  - Root surface caries: not on the anatomical crown; clinical crown!)



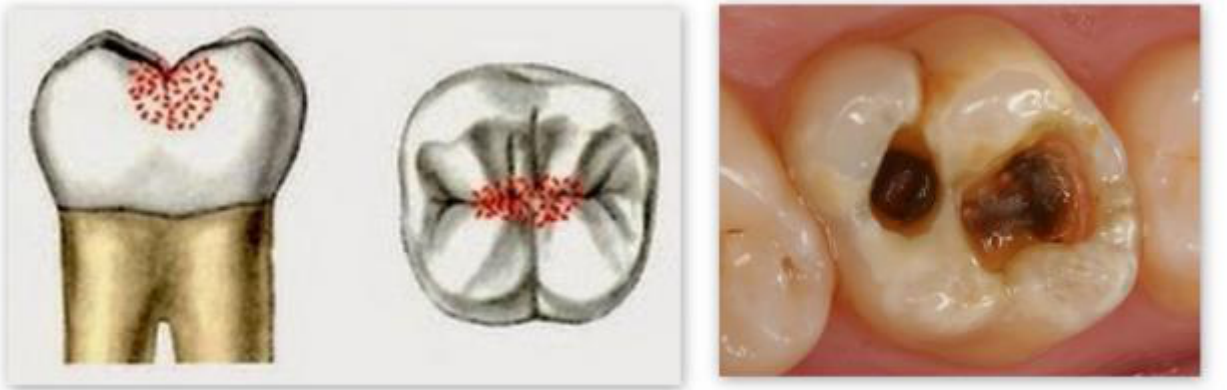
G.V. Black (1914)



Normal Tooth

Class I

Pits and fissure cavities



Class I Lesions

Class II

Cavities on the proximal surface of posterior (premolar and molar) teeth (MO, OD, MOD)

Class II Lesions

Class III

Cavities on the proximal surface of anterior teeth, incisal edge is intact

Class III Lesions

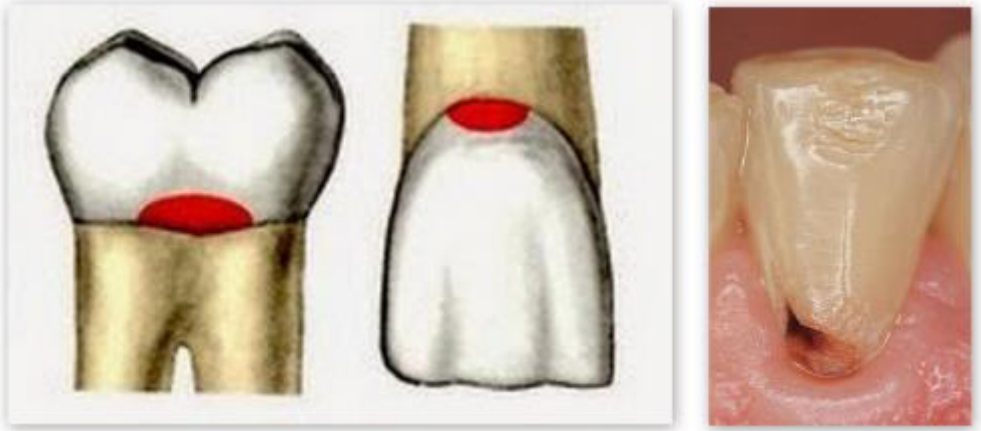
Class IV

Cavities on the proximal surfaces of anterior teeth that involves the incisal edge

Class IV Lesions

Class V

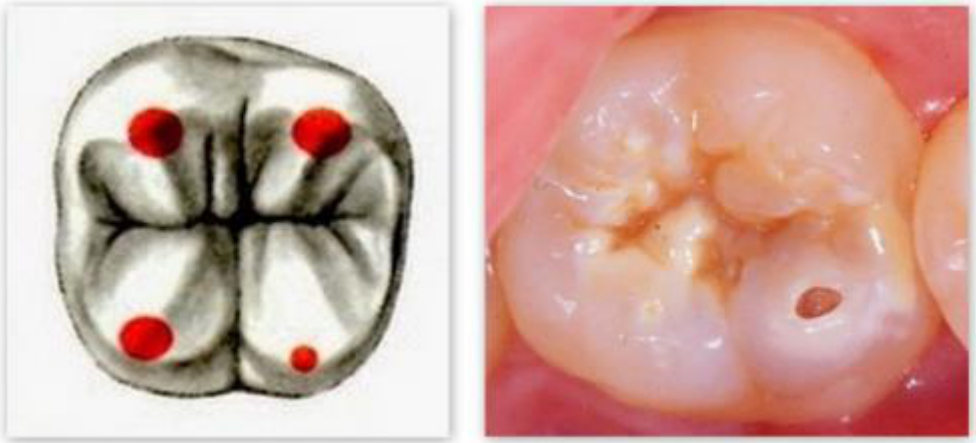
Cavities on the gingival third of the anatomical crown (bucal/oral)→ smooth surface caries



Class V Lesions

Class VI

Cavities on the incisal edge of anterior teeth, or on the occlusal cusp of posterior teeth→ not predilection spot



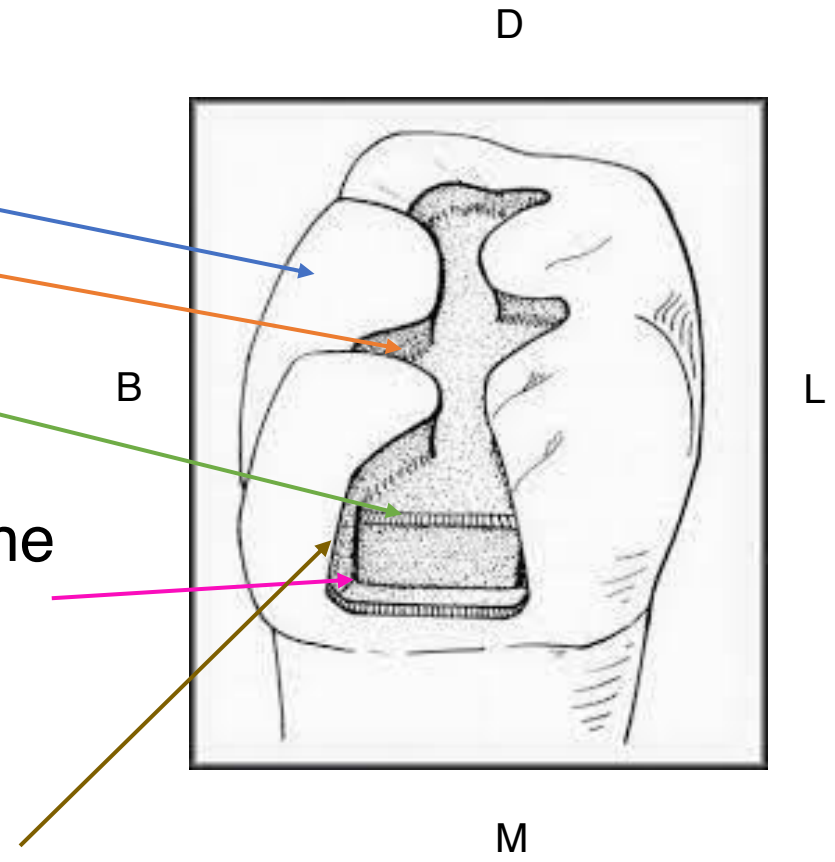
Class VI Lesions

Root surface caries

Caries develops on the root surface (cementum; clinical crown)

Nomenclature of cavity preparation

- Surface: unprepared part
- Wall: prepared part→ named after the surface
- Line angle: junction of two walls→named after the walls
- Point angle: junction of three walls: →named after the walls
- Cavosurface angle or cavosurface margin: junction of wall and surface

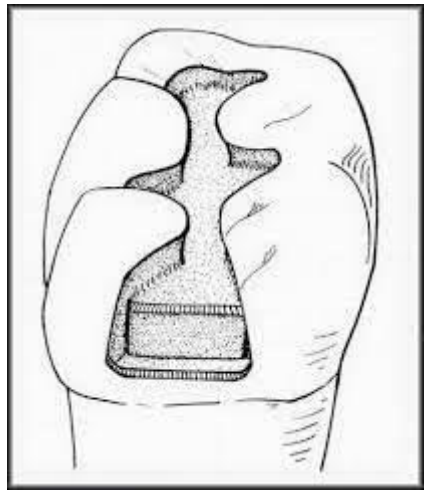


General rules of cavity preparation

- Black: EXTENSION FOR PREVENTION → aim was to prevent the secunder caries
  - the border of the cavity should be extended to areas that are normally self cleaning, or cleanable, therefore healty tooth structure can be removed
- During the years the rules were modified many times → principles nowadays:
  - Healthy tooth structure should be preserved
  - All fracturable enamel should be removed
  - All caries/faults should be involved
  - Good polishable position
  - The outline of the filling should be shortened

Preparation techniques

- **Conventional** form:
  - For amalgam, inlay/onlay, root surface caries
  - Macroretention
  - Box-like cavity
  - Special enamel margin
  - Secondary retention are used very often



Preparation techniques

- **BEVELED CONVENTIONAL** form:
  - Old amalgam filling is changed to composite
  - Macro- and microretention
  - Box form, but enamel margins are beveled for higher microretention

- **MODIFIED** form (ADHESIVE or MINIMALINVASIV):
  - No special form
  - Only decayed tooth structure will be removed
  - cavosurface margin will be beveled
  - Composite → Microretention

Tooth preparation–amalgam Vs composites

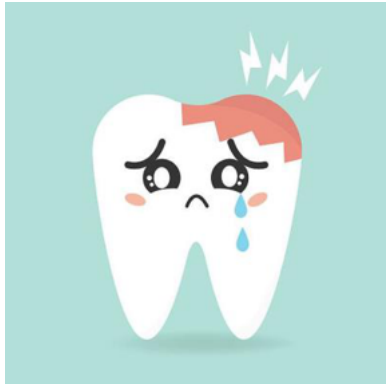
Features	*Amalgam*	*Composite*
Outline form	a. Include all pits and fissures **(Figs 18.42A and B)** and adjacent suspicious areas. b. For class II tooth preparation, proximal contact has to be broken	a. Include faults but need not to be extended to adjacent pits and fissures. b. For class II tooth preparations, proximal contact need not to be broken in all the cases
Pulpal depth	• Should be maintained uniform **(Figs 18.43A and B)** • Depth–1.5 mm (Minimum)	• Need not to be uniform • Depth–1–2 mm (usually)
Axial depth	• Should be uniform • Depth–0.2-0.5 mm inside DEJ	• Not necessarily uniform • Depth–to extent of the defect
Cavosurface margin	90° at margin	Equal to and greater than 90° at margin
Nature of prepared walls	Smoother	Rough
Primary retention form	Occlusal convergence	Etching, priming and bonding
Bevels	Not indicated in large preparations	
Resistance form	Box shaped preparation **(Figs 18.44A and B)** Flat pulpal and gingival floor	Not indicated For small to moderate preparations
Secondary retention	Grooves, Coves, slots, pins, locks and bonding	Indicated only for extensive preparations
Pulp protection and base	By use of varnish, liner Base: GIC, calcium hydroxide liner	Varnish not indicated

Phases of cavity preparation

- Primary phase
  - opening of the cavity
  - outline form, initial depth: prepared together, high speed, watercooling, diamond burs
  - primary retention form:
    - Preparation resists displacement or removal of the restoration from tipping or lifting forces
    - Retention is influenced by the contact between the restorative material and tooth
      - mechanical contact: macromechanical: amalgam micromechanical: composite
      - chemical: rare, glassionomer
      - electrical: weak
  - primary resistance form ~ convinience form:
    - Both the tooth and restoration can withstand without fracture the masticatory forces
    - Primary retention and resistance form are prepared together
    - Principles: box shape, flat floor, slightly rounded line angles, thickness of restorative material, walls: parallel, divergent or convergent

Phases of cavity preparation

- Secondary phase:
  - removal of infected dentin and old filling:
    - infected dentin always has to be removed
    - old restoration should be removed, if:
      - negatively affect the new one
      - compromise in retention
      - caries is under the filling
      - the pulp was sympthomatic preoperatively
      - the periphery of remaining filling is not intact



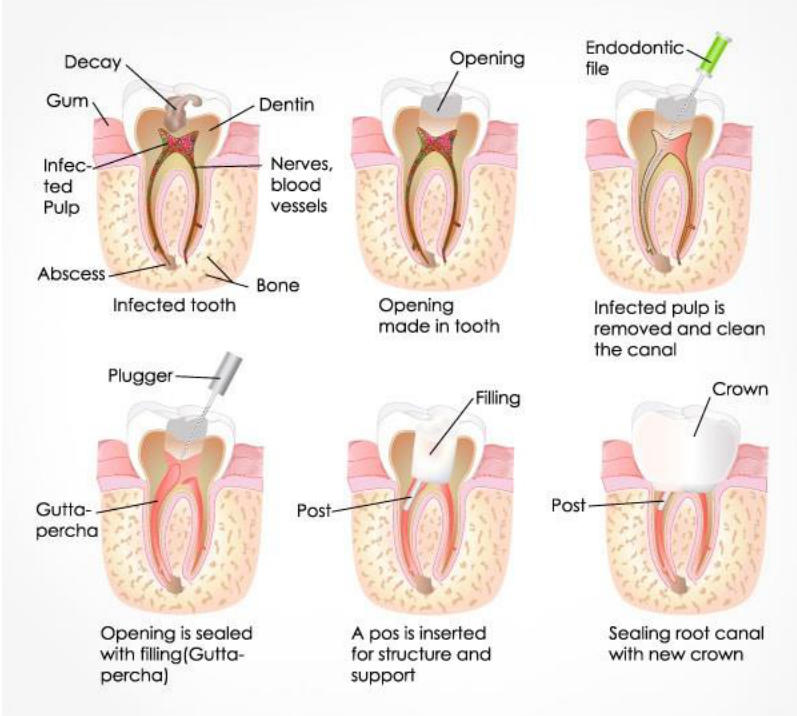
  - pulp protection
  - secondary resistance and retention form
  - finishing the prepared walls:
    - aim of finishing is to create the best marginal seal between the the restorative material and tooth; smooth marginal junction; provide maximum strength of both the tooth and filling near the margin
  - cleaning, inspecting

Endodontics

- What is endodontic treatment?
  - treatment sequence for the infected pulp of a tooth which results in the elimination of infection and the protection of the decontaminated tooth from future microbial invasion
  - – **chemo-mechanical shaping**: root canal should be suitable for the root canal filling (elimination of debris, disinfection and shaping)

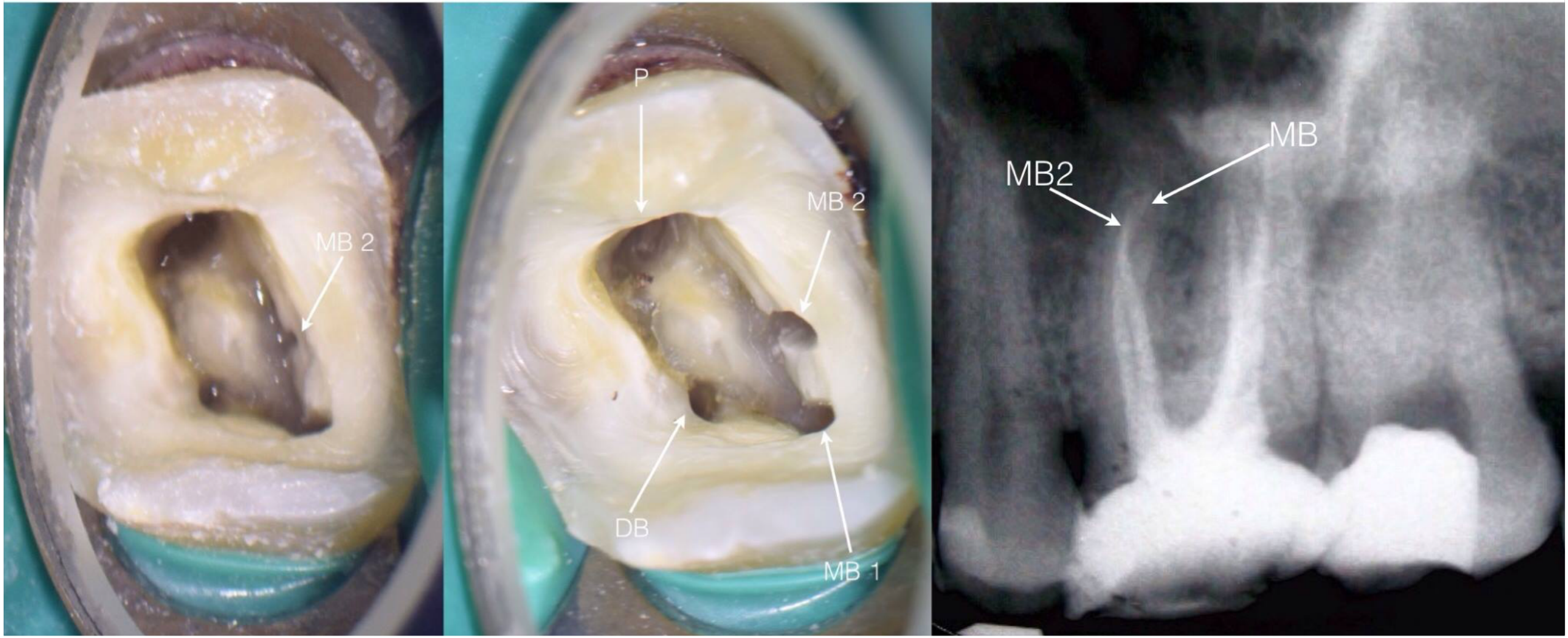
  Chemo: by disinfectants (f.e: Sodium hypochlorite, chlorhexidine)

  Mechanical: coronal part: special burs (Gates-gliden); root part: endo files



Intra-op

Post-op



Thank you for your kind attention!