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Conservative Dentistry

DENTAL HAND AND ROTARY INSTRUMENTS

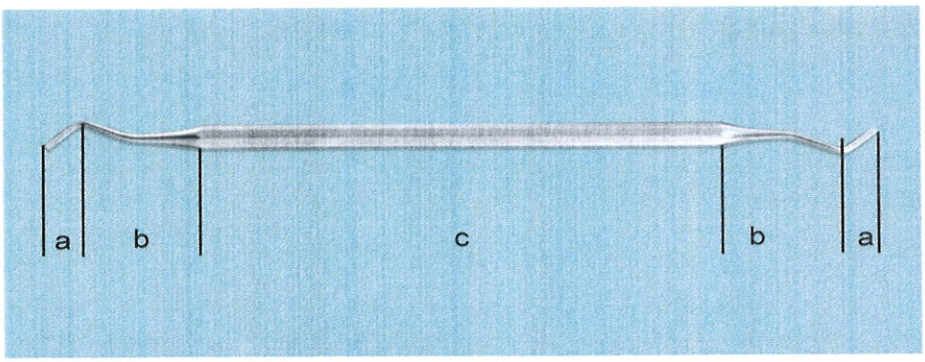
Removal and shaping of tooth structure are essential aspects of restorative dentistry. Initially, this was a difficult process accomplished entirely by the use of hand instruments. The introduction of rotary, powered cutting equipment was a truly major advance in dentistry.

Definition:
It is hand-powered dental instruments.

- G.V. Black gave the first acceptable nomenclature and classification of hand instruments. His classification system enabled both dentists and manufacturers to communicate more clearly and effectively in regard to instrument design and function.
- For many years, carbon steel was the primary material used in hand instruments because they were harder and maintained sharpness better than stainless steel.
- Stainless steel is now the preferred material because stainless steel instrument remains bright with steam or dry heat sterilization, and because the properties of stainless steel have improved by incorporating a significant amount of chromium imparts corrosion resistance and carbon imparts hardness.

Hand instruments used in operative dentistry may be categorized as:
1. Cutting instruments and,
2. Non cutting instruments.

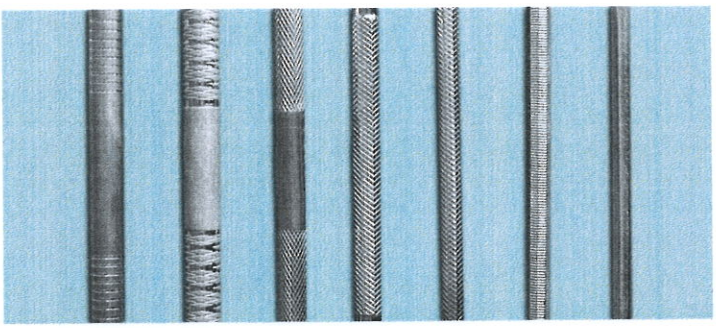
Cutting instruments
These instruments are used to cut hard or soft tissue of the mouth.
Hand cutting instruments are composed of three parts: handle, shank and blade



Parts of hand cutting instrument; a: Cutting edge/blade, b: shank, c: shaft/handle

A. Handle or Shaft:

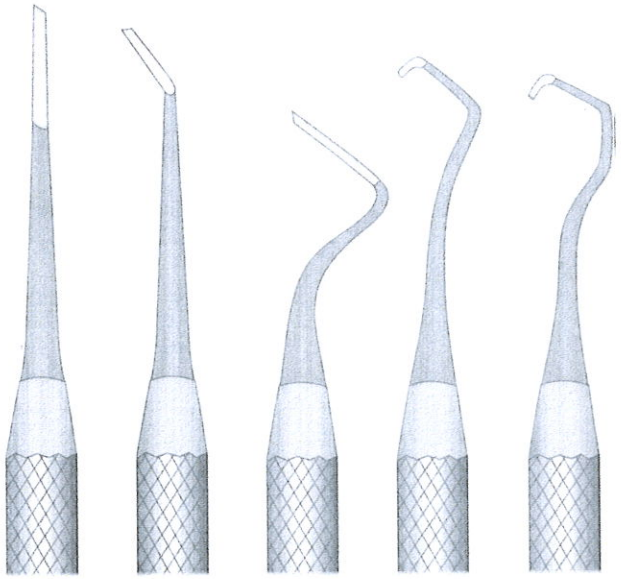
- Handle is used to hold the instrument.
- It can be small, medium or large, smooth or serrated for better grasping and developing pressure.
- Handles can be joined or separable from the shank. Separate type of handle is known as cone socket handle, this allows replacement of various working ends; for example, mouth mirrors.



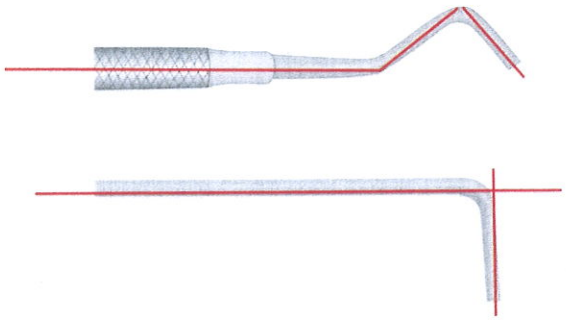
B. Shank

- Shank connects the handle to the blade.
- It tapers from the handle down to the blade and is normally smooth, round or tapered.
- The shank may be straight or angled. Angulation of instrument is provided for access and stability. Depending on number of angles, shank can be classified as *straight* (no angle), *monoangle* (one

angle), *bi-angle* (two angles), *triple-angle* (three angles), and *quadrangle* (four angles).



- Balancing of an instrument is achieved by designing the angles of shank so that cutting edge of blade lies within 2–3 mm of long axis of the handle. This principle of instrument design is also called as *contra-angling.*



C. Blade or Nib

- Blade is working part of the instrument which is connected to the handle by shank.
- The blades have many designs and sizes, depending on the function they are to perform.
- Some instruments have a blade on both ends of the handle and are known as double ended instrument.

INSTRUMENT FORMULA

GV Black established an instrument formula for describing dimensions of blade, nib or head of instrument, and angles present in shank of the instrument.

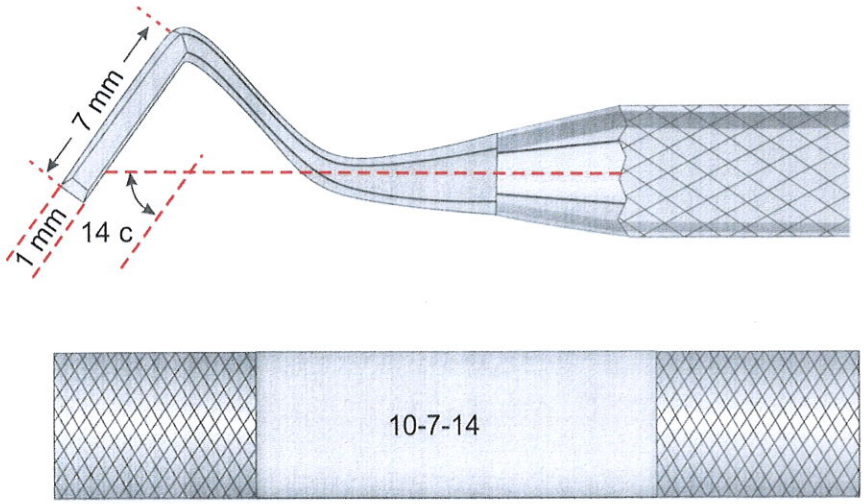
❖ **Three-Number Formula:**

It is used for the instruments in which cutting edge is at right angle to the long axis of the blade, e.g., enamel hatchet

a. First number- Width of the blade in tenths of a millimeter.

b. Second number - Length of the blade in millimeter.

c. Third number - Angle the blade forms with the axis of the handle in centigrade



❖ **Four-Number Formula:**

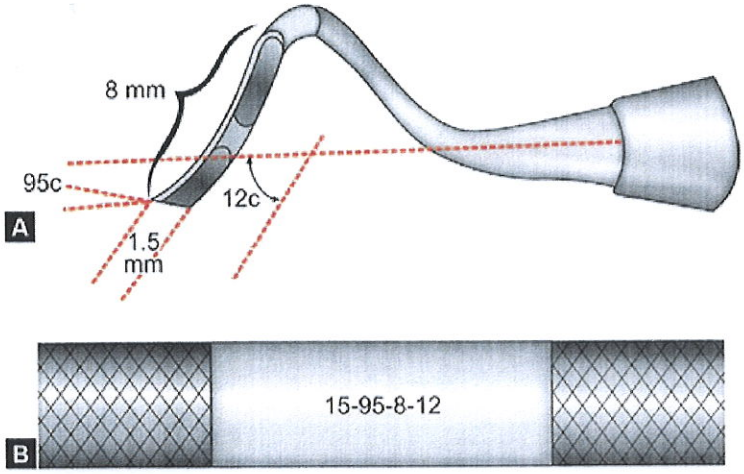
It is used for the instruments in which primary cutting edge is not at right angle to long axis of the blade, e.g. *gingival margin trimmer* and *angle former*.

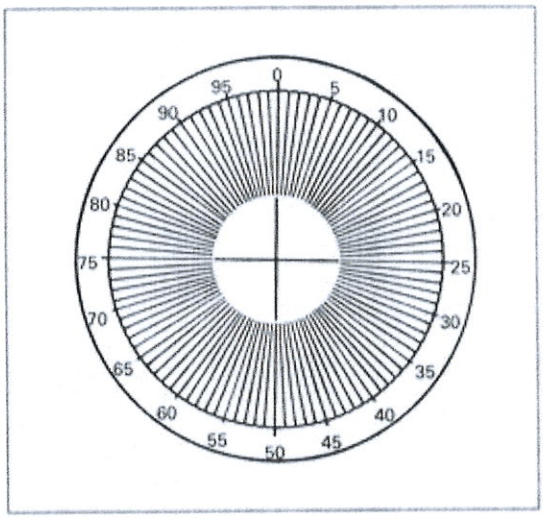
a. First number - Width of the blade in tenths of a millimeter.

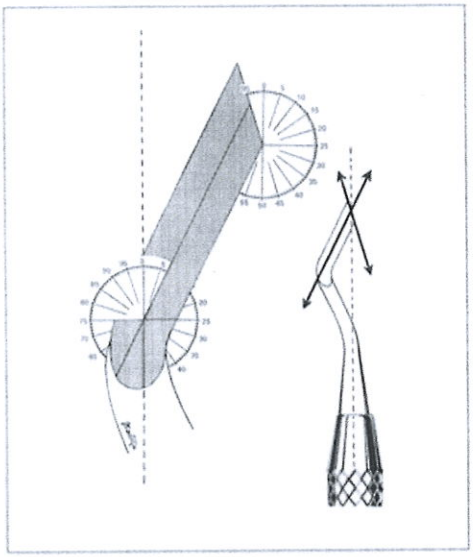
b. Second number - Angle the cutting-edge forms with the axis of the handle in centigrade.

c. Third number - Length of the blade in millimeter.

d. Fourth number - Angle the blade forms with the axis of the handle in centigrade.







Centigrade scale. The circle is divided into 100 units

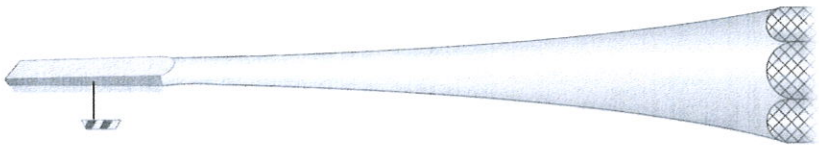
Instrument motions

A. Pulling: Instrument is moved toward operator's hand.
B. Scraping: Instrument is moved side to side or back and forth on the tooth surface.
C. Pushing: Instrument is moved away from operator's hand.
D. Cutting: Instrument is moved parallel to the long axis of handle

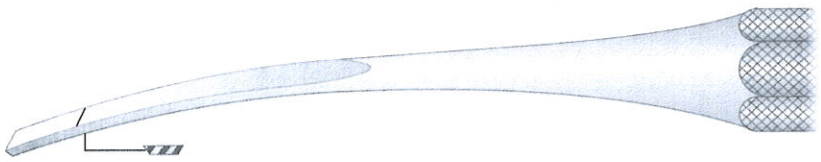
Gutting instruments:

1. Chisel: Chisels are used for cleaving, planing, and lateral scraping. In other words, they are used to split tooth enamel, to smoothen the preparation walls, and to sharpen the preparations. The cutting edge of chisel is perpendicular to the axis of handle. Chisels are used with a push motion. Chisels can be of following types:
   A. Straight Chisel: It has straight blade in line with shank and handle. It is used with straight thrust force in push motion for cutting enamel. It is used with a push or pull motion for smoothening proximal and gingival walls.

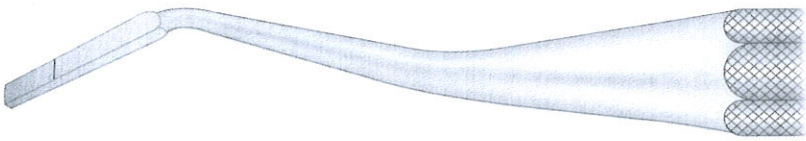
Straight Chisel (12-7-0).



   B. Curved/Wedelstaedt Chisel: This instrument is almost similar to straight chisel except for slight vertical curvature in its shank. It is mainly used for cleaving undermined enamel.

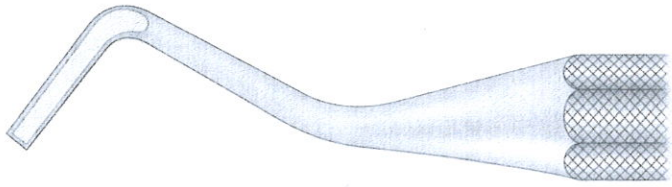


   C. Bin-angle Chisel: It has two different angles–one at the working end and other at the shank. It is used to cleave the undermined enamel

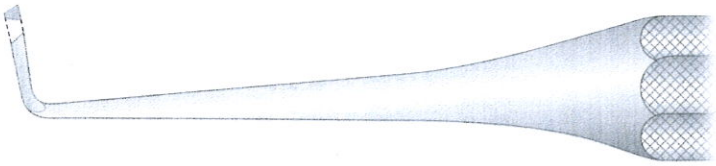


2. **Enamel Hatchet:** also called a Hatchet, the cutting edge of the instrument is parallel or close parallel to the long axis of the handle, Hatchet is a paired instrument in which blades makes 45-90° angle to the shank. In paired right and left hatchets, blades are beveled on

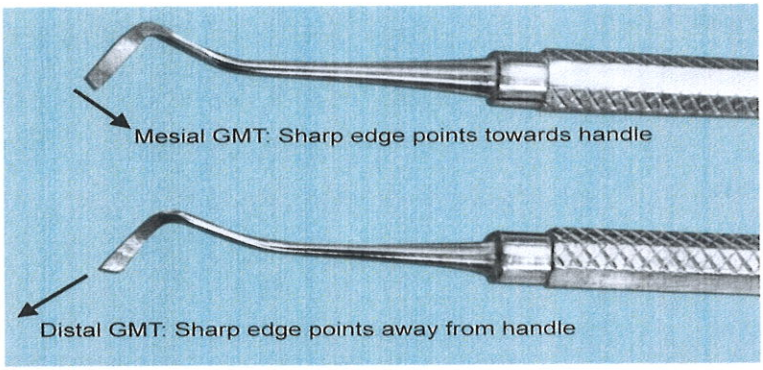
opposite sides to form their cutting edges. Hatchet is used for cleaving enamel and planing cavity dentinal walls so as to have sharp outline of the preparation.



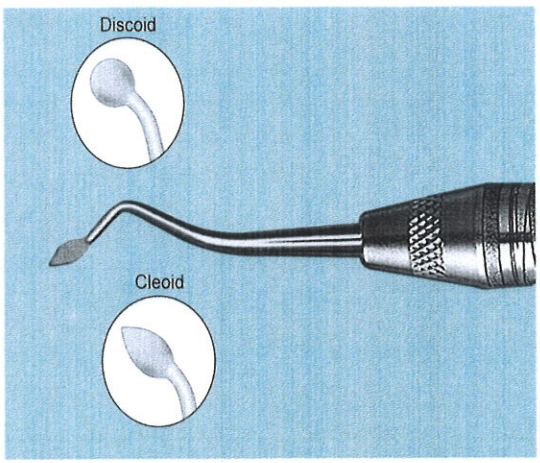
3. **Hoe Excavators:** Primary cutting edge of blade is perpendicular to the long axis of handle. It is a single-planed instrument which cuts in vertical, push and pull, right, and left motions. It is used to shape and plane the tooth preparation walls and to form line angles in class III and V restorations.

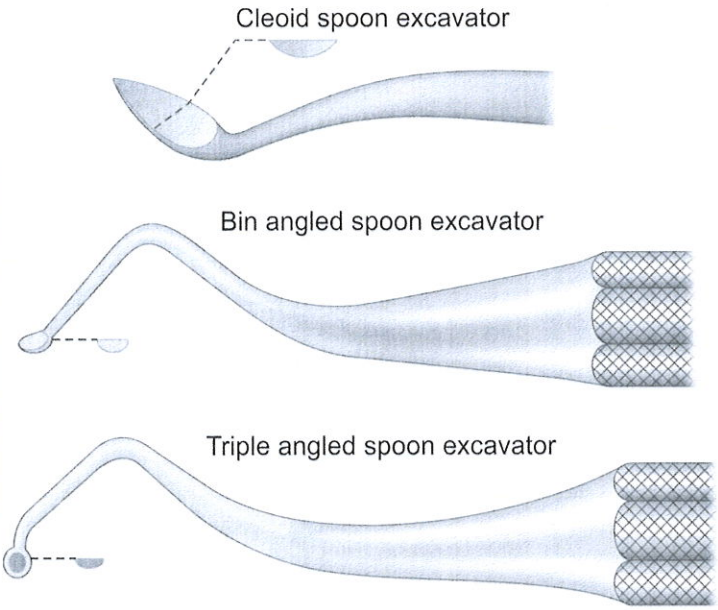


4. **Gingival Margin Trimmer:** This instrument is used for beveling of the gingival enamel margin of proximo-occlusal preparations. Also, it is used for beveling of axio-pulpal line angle of two surface preparation as in class II cavities. It is similar in design to the hatchet, except the blade is curved, and cutting edge is at an angle (other than parallel) to the long axis of the blade. It is made as right and left types. Also, it is made either a mesial pair or a distal pair.



5. **Spoon Excavator:** The blade is curved and the cutting edge at the end of the blade is in the form of a semicircle. This gives the instrument an outer convexity and inner concaving that makes it looks like a spoon. Like the hatchet the cutting edge at the end of the blade is parallel to the handle, therefore there are left cutting and right cutting spoons. The shank of some spoons holds a small circular (disk blade) or claw – like blade at its end. The disk blade is known as a discoid, where the claw - like blade is termed a cleoid. The uses of spoon excavator are:
   A. Remove caries and debris in the scooping motion from the carious teeth.
   B. For carving amalgam restorations and wax patterns.





Non-cutting instruments

In these instruments the blade is replaced by a nib or point. These are divided according to function into: -

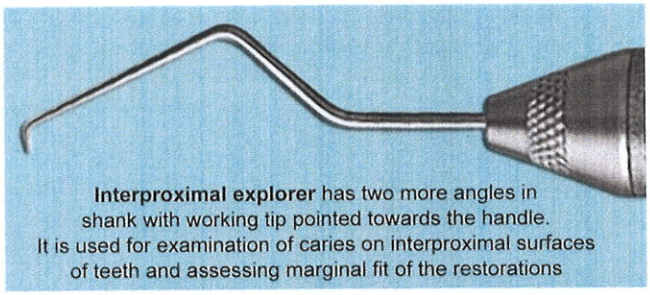
1- Diagnostic instruments
2- Plastic instruments
3- Amalgam instruments

Diagnostic instruments

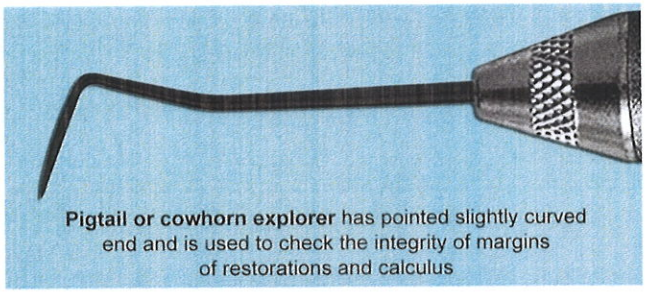
These are basic instruments that will be needed during each appointment for diagnosis and treatment.

1. **Mirror**: It has handle, shank and a mirror attached to a round metal disk at one end, used for:
   - Indirect visualization of any tooth surface that cannot be seen by the eye.
   - Illumination of operating area by reflecting light on to the tooth surface.
   - Retraction of soft tissues like the tongue, cheeks or lips for improved accessibility and visibility of the operating site.
2. **Explorer:** pointed instruments used:
   - As a diagnostic aid in evaluating condition of teeth especially pits and fissures.
   - To feel tooth surface for irregularities
   - To determine the hardness of exposed dentin and caries detection.

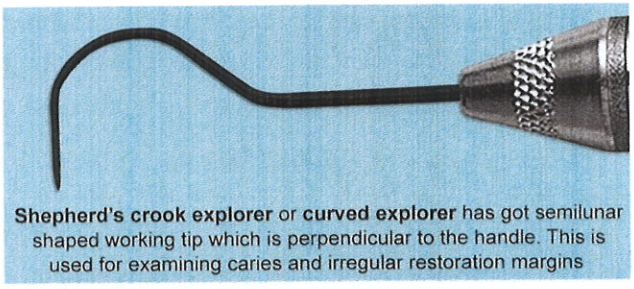
- Explorer have different shapes.



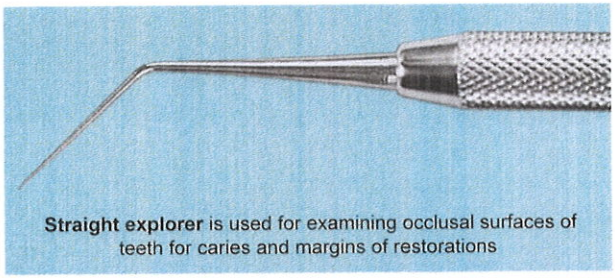
Interproximal explorer has two more angles in shank with working tip pointed towards the handle. It is used for examination of caries on interproximal surfaces of teeth and assessing marginal fit of the restorations



Pigtail or cowhorn explorer has pointed slightly curved end and is used to check the integrity of margins of restorations and calculus



Shepherd's crook explorer or **curved explorer** has got semilunar shaped working tip which is perpendicular to the handle. This is used for examining caries and irregular restoration margins



Straight explorer is used for examining occlusal surfaces of teeth for caries and margins of restorations

3- **Probe**: almost looks like straight explorers, but it has blunt end which is marked with graduations. Probe is used for measuring pocket depth but in operative dentistry, it is used to check dimensions of tooth preparation.



4. **Tweezer:** Tweezer has angled tip and is available in different sizes. It is used to place and remove cotton rolls and other small materials to and from the mouth.

Plastic instruments: Or plastic filling instrument are used to:

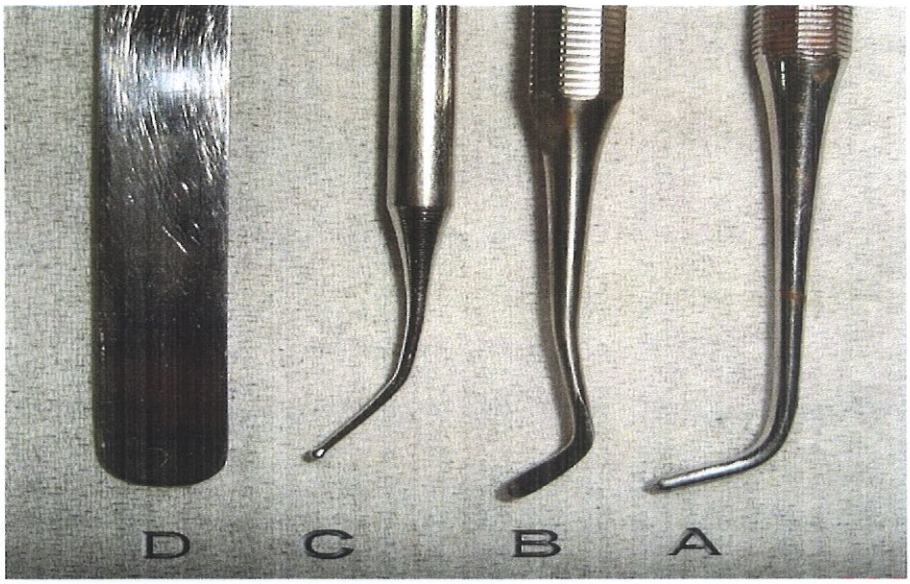
- Carry and shape tooth colored restorative material such as composite resin and glass ionomer.
- Packing temporary filling material inside unfilled cavities preparation.
- For placing of basing and lining material into the cavities. In past these instruments are made of plastic.

A. **Ash 49:** - is double ended instrument with cylindrical nibs and rounded ends.

B. **Ash 6:** - is one of plastic instrument similar to carver but the margin of its working end is not sharp.

C. **Dycal applicator:** - is small hand instrument with small round nib used for mixing and placing dycal lining material in the cavity.

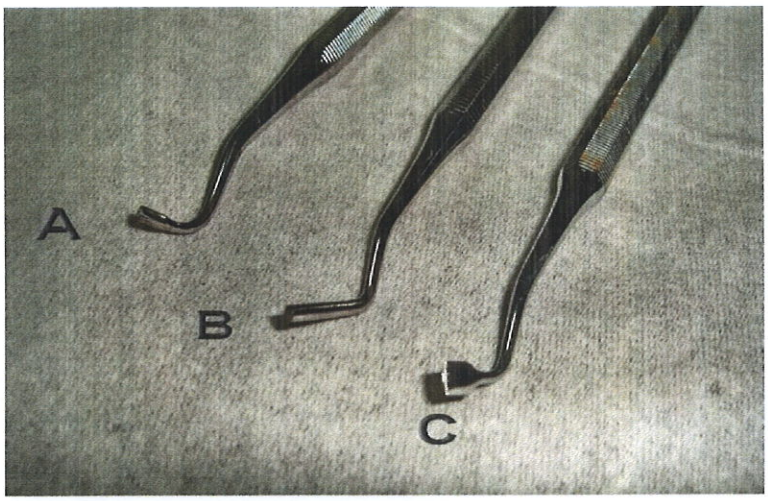
D. **Cement spatula:** - it is used for mixing variety of material which required mixing (such as cement or temporary filling material) on glass or on a paper pad.



Amalgam instruments

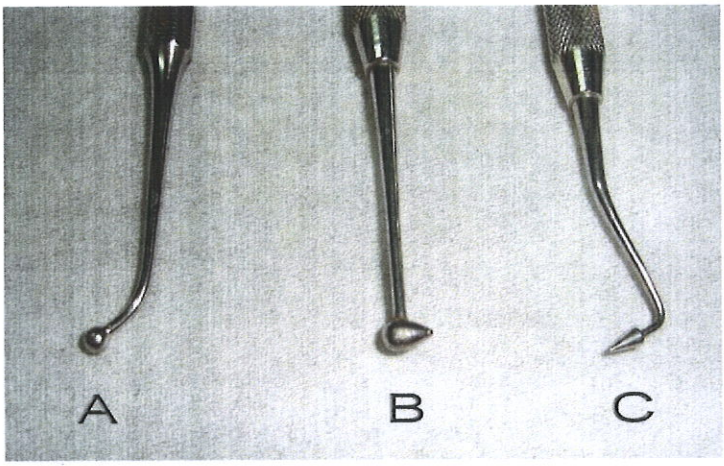
Those instruments used to place dental amalgam, and to a certain extent, resin composite restorative material.

Condensers: - condensers are used to compress the amalgam into all areas of the prepared cavity. The working end or nib of the condenser is usually round with flat end (face). The nibs have different shapes triangular, rectangular or diamond shape ends. Depending upon serrations they can be serrated and non-serrated.

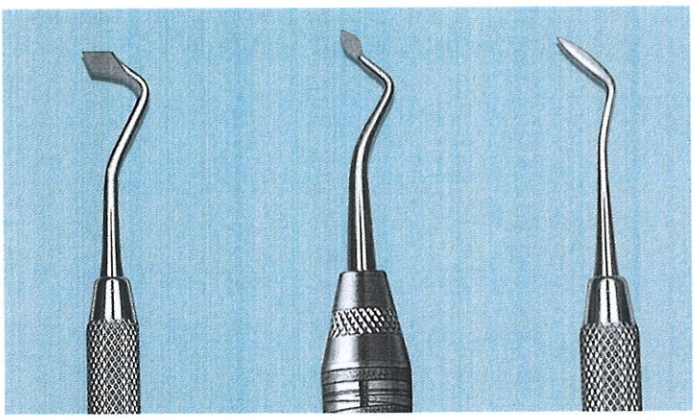


Burnisher: It have different nib shapes: round, oval or rounded cone shapes, also with different sizes, used for several functions such as;

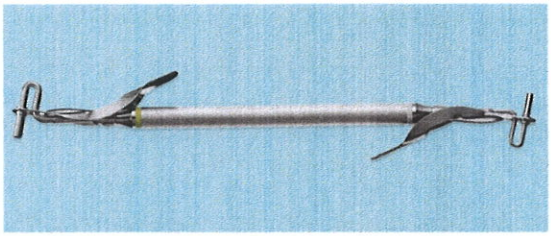
- Final condensation or burnishing of amalgam on the margins of the cavity.
- Initial shaping of occlusal anatomy of amalgam
- Shaping of metal matrix bands
- Shaping of occlusal anatomy in posterior resin composite before polymerization of resin
- To bend cast gold near the margins to burnish it to tooth surface (beaver tail).



Carver: - carvers are used to shape amalgam or resin composites (tooth colored) material after they have been placed in the tooth preparations. Carvers have many shapes but usually the nibs are flat with sharp margins for carving.



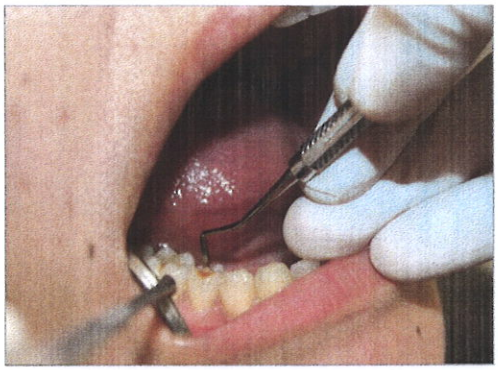
Amalgam carrier: used to carry the amalgam and place into the prepared cavities.



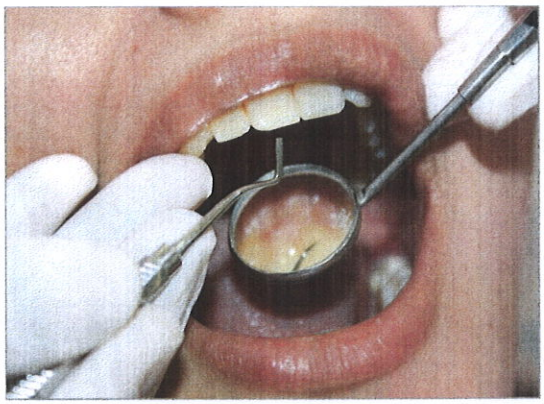


Hand instrument grasping

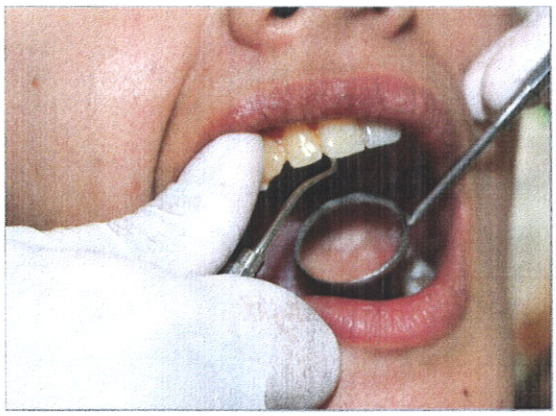
1. **Pen grasp**: - It is similar to that used in holding a pen. Pads of the thumb, index and middle fingers hold the instrument, while the tip of the ring finger, or tips of ring and little fingers, is placed on a nearby tooth surface of the same arch as arrest. The palm of the hand generally is facing away from the operator



2. **Inverted pen grasp: -** The finger position is the same as of pen grasp, but the hand is rotated so that the palm more toward the operator. This grasping is used mostly for preparing of upper teeth with indirect viewing technique.



3. **Palm and thumb grasp:** - The handle of the instrument is placed in the palm of the hand and grasped by all fingers, while the thumb is free of the instrument and used for resting on a nearby tooth of the same arch.

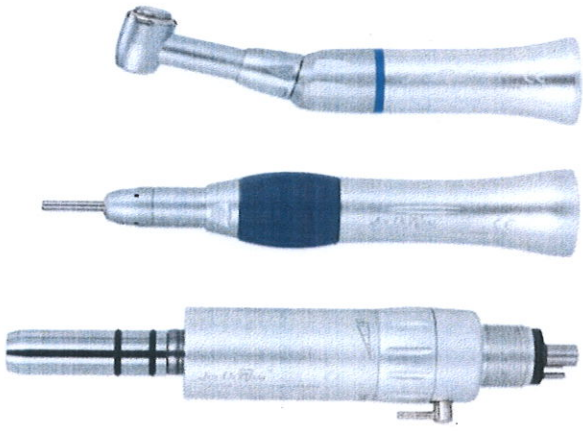


Rotary instruments:

Handpieces:

Two basic types of handpieces:

- ✓ **Straight handpiece:** used for laboratory work
- ✓ **contra angle handpiece:** used in the mouth



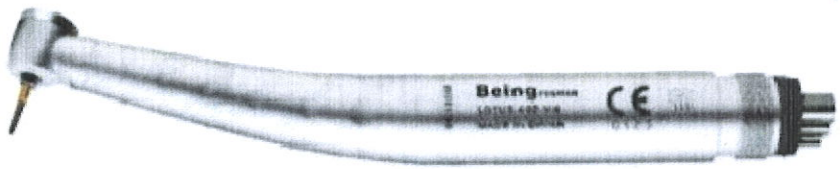
The contra – angle handpiece are classified according to their speed of rotation into:

Low speed handpiece: have a free running speed range from 500 to 15,000 rpm (revolution per minute), used for:

- Removal of carious dentin with round bur rotating slowly.
- Used with different bur shapes to finish the prepared cavity (e.g. rounding of sharp edges, or flatting of the floor).
- Finishing and polishing of restorations

High speed handpiece: - have a free running speed above 160,000 rpm and some have speed up to 500,000 rpm.

- Preferred for cutting enamel and dentin.
- Penetration through enamel and extension of the cavities outline are more efficient at high speed.
- Small diameter burs should be used in the high speed handpiece. High speed generates considerable heat during cutting, even with small diameter burs and should be used with water coolant and high efficiency evacuation.



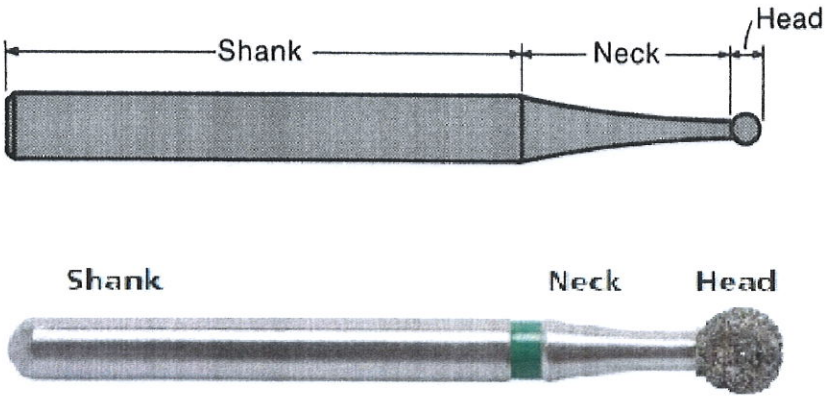
Burs:

A group of instruments that can turn on an axis with different speed of rotation to perform different types of work.

Parts of bur:

A. **Shank:** is the part that fit into the handpiece, accepts the rotation motion from handpiece, and which the bur is locked inside the handpiece head.

B. **Neck:** is the part of the bur that connects the head to the shank.
C. **Head:** is the working part of the bur which contains the cutting edges or points.

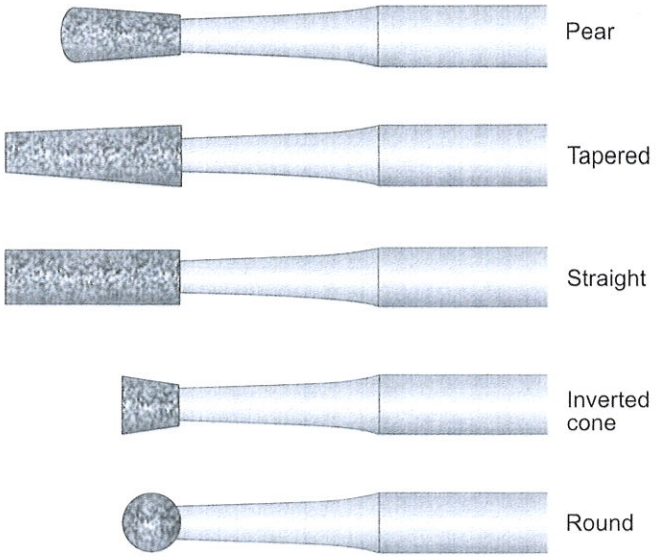


- Burs used for cutting are manufactured from different materials, which may be stainless steel, tungsten carbide or diamond.
- Its work is either cutting, abrasive, finishing or polishing.
- According to the length of their head, burs can be divided into long, short or regular
- Burs are classified according to the shapes of their heads.

The basic *bur shapes* are:

- ✓ **Round bur**: the head is spherical so it is used for initial entry into the tooth, preparation of retentive holes or for removal of carious dentin.
- ✓ **Inverted cone bur**: the head is a cone – shape with the apex of cone directed toward the bur shank. This bur is used for flatting the floor of the cavity, increasing the depth of cavity or for providing undercuts in cavities preparation.
- ✓ **Fissure bur**: is an elongated cylindrical head bur used for obtaining the outline form of the cavity and to cut walls, floor, or margins of the cavity, its either straight or tapered.
- ✓ **Tapering-fissure Bur:** It is tapered-sided cylindrical but sides tapering toward tip and is used for inlay and crown preparations.

✓ **End-cutting bur:** It is used for carrying the preparation apically without axial reduction.



- Classification of diamond burs according to abrasive particle size:
  - ✓ **Green:** Coarse grit diamond burs (125–150µ particle size)
  - ✓ **Blue**: Medium grit diamond burs (88–125µ particle size).
  - ✓ **Red**: Fine grit diamond burs (60–80µ particle size)
  - ✓ **Yellow**: Very or super fine grit diamond burs (30-40 µ particle size)

