

# Operative Dentistry

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## Instruments and equipment for tooth preparation

The removal and shaping of tooth structures is an essential part of restorative dentistry. To achieve this, a wide variety of hand and rotary instruments are used. Other instruments are also needed for filling procedures.

### Hand instruments

#### Materials:

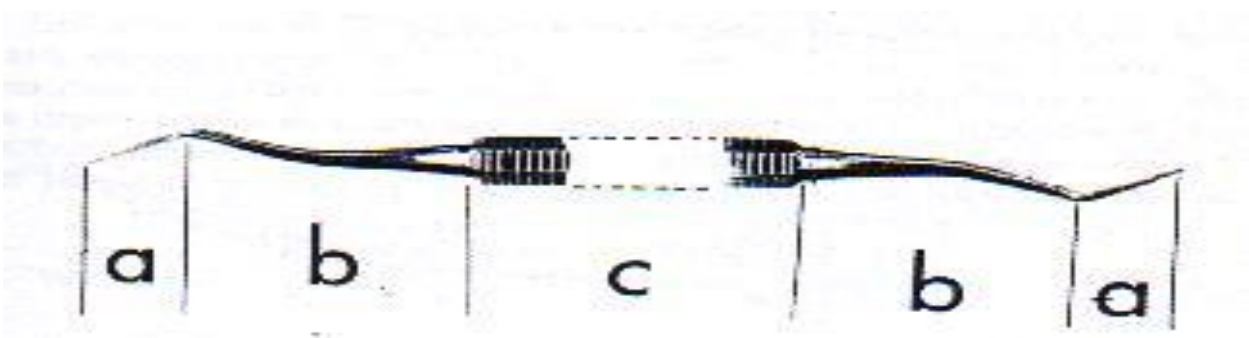
Hand cutting instruments are manufactured from two main materials: **Carbon steel** and **stainless steel**. In addition, some instruments are made from **carbide** to provide more durable cutting edges. Carbon steel is harder than stainless steel, but when unprotected, it will corrode. Stainless steel remains bright under most conditions but loses a sharp edge during use much more quickly than carbon steel. Carbide, while hard and wear resistant, is brittle and can not be used in all designs.

Other alloys of nickel, cobalt, or chromium are used in the manufacture of hand instruments, but they are usually restricted to instruments other than those used for the cutting of tooth surfaces.

#### Instrument design:

Most hand instruments, regardless of use composed of three parts:

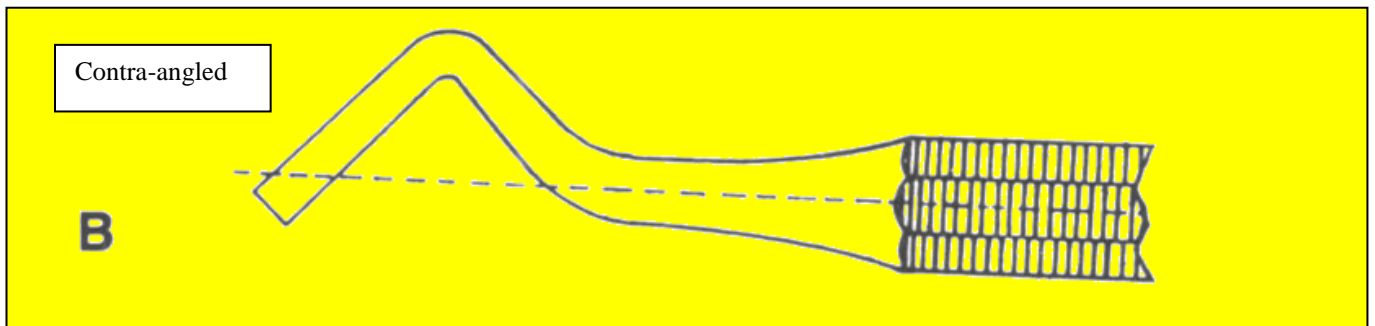
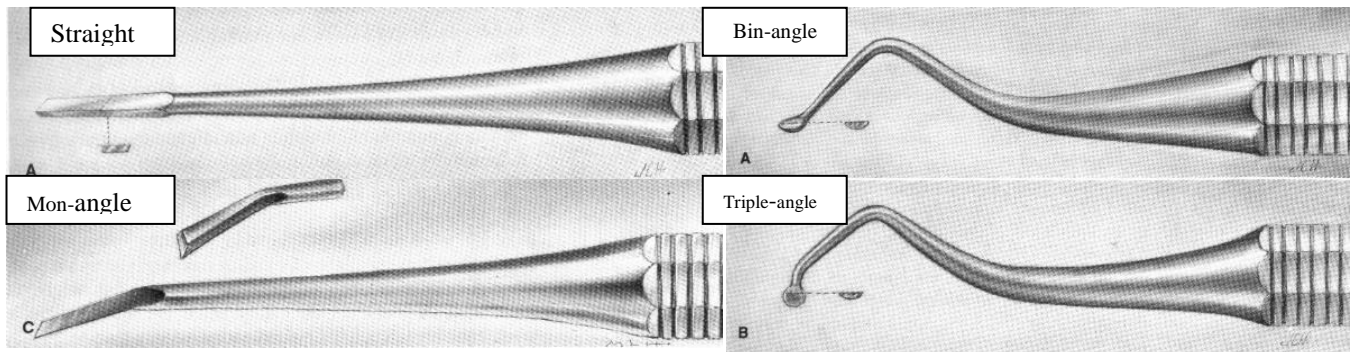
- 1- Handle or shaft:** various sizes and shapes, grasped by hand, eight-sided to facilitate control.
- 2- Shank:** connects the handle to the working end of the instrument, it is normally rounded, smooth and tapered; usually has one or more bends to avoid the instrument having a tendency to twist in use when force is applied.
- 3- Blade:** working end of the instrument, has many sizes and designs depending on the function, it is connected to the handle by the shank. For the non cutting instrument the part corresponding to the blade is called the **nib**. The end of the nib or working surface is termed as the **face**. Some instruments have a blade on both ends of the handle and are known as **double – ended instruments**.



## Instrument shank angles

The functional orientation and length of the blade determines the number of angles necessary in the shank to balance the instrument. G.V. Black classified instruments used based on the number of shank angles, as: *mon-angle (one)*, *bin-angle (two)*, or *triple-angle (three)*.

Instruments with longer blades or more complex orientations may require two or three angles in the shank to bring the cutting edge near to the long axis of the handle. This allow for concentration of force onto the blade with out causing rotation of the instrument in grasp. Such shanks are termed *contra-angled*.



## Instrument name

Black classified all instruments by *name*. In addition, for hand cutting instruments, he developed a numeric *formula* to characterize the dimensions and angles of the working end. Black's classification system by instrument name categorized instruments by:

- 1- function (e.g., scaler, excavator)
- 2- manner of use (e.g., hand condenser)
- 3- design of the working end (e.g., spoon excavator, sickle scaler)
- 4- shape of the shank (e.g., mon-angle, bin-angle, contra-angle)

### Cutting operative instrument formulas:

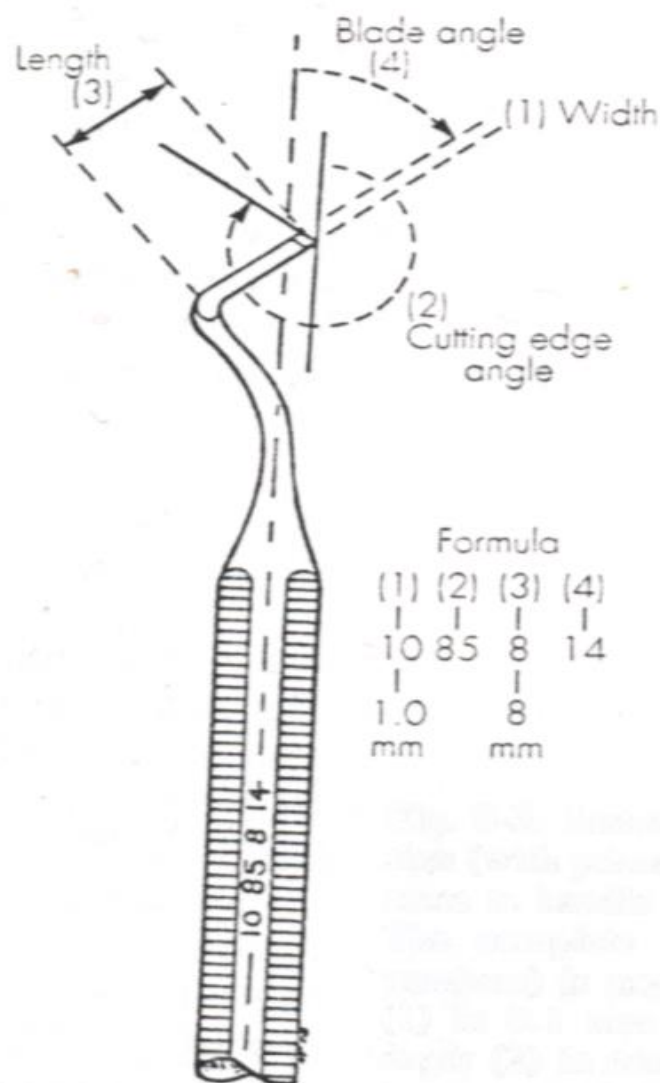
Cutting instruments have *formulas* describing the dimensions and angles of the working end. These are placed on a handle using a code of three or four numbers separated by dashes or spaces (e.g.: 10-85-8-14).

1- The *first number* indicates the **width of the blade or primary cutting edge** in tenths of mm.

2- The *second number* indicates the **primary cutting edge angle** measured from a line parallel to the long axis of the instrument handle in clockwise centigrades (The centigrade circle contain 100 centigrade with 25, 50 and 75 centigrade equal to 90, 180, 270 degrees in the 360- degree circle). The instrument positioned so that this number is above 50. If edge is totally perpendicular to the blade, so this number is omitted resulting in a three number code.

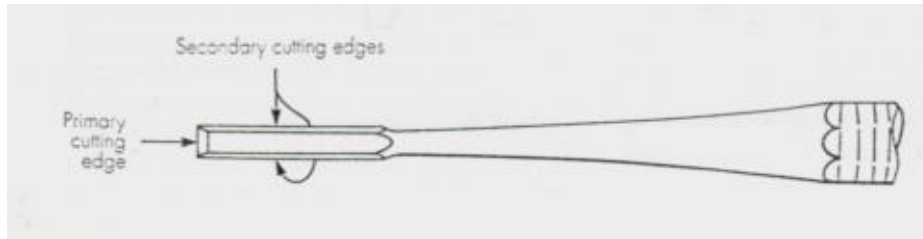
3- The *third number* indicates the **blade length** in mm .

4- The *fourth number* indicates the **blade angle relative to the long axis of the handle** in clockwise centigrade; this number is 50 or less.



## Cutting instrument bevel

Most hand cutting instruments have on the end of the blade a *single bevel* that forms the *primary cutting edge*. Two additional edges, called *secondary cutting edges*, extend from the primary edge to the length of the blade. *Bi-beveled* instruments, such as ordinary hatchets, have two bevels that form the cutting edge.



## Cutting instruments:

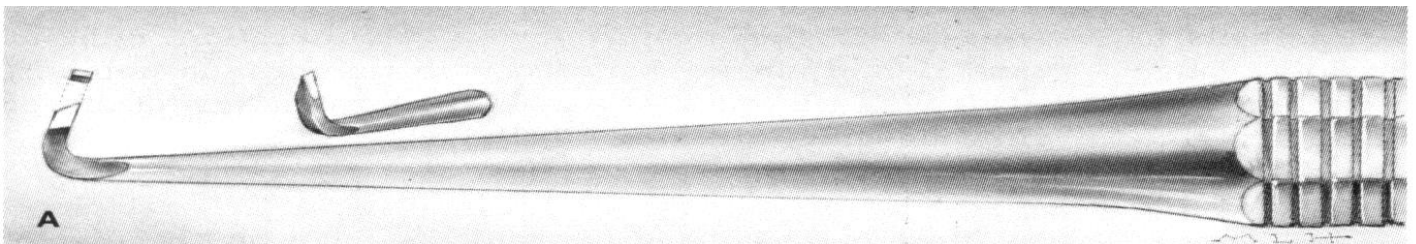
Instruments that are used to cut hard or soft tissues of the mouth, they include:

### 1- Excavators:

Excavators are used for removal of caries and refinement of the internal parts of the cavity. They are subdivided into the following:

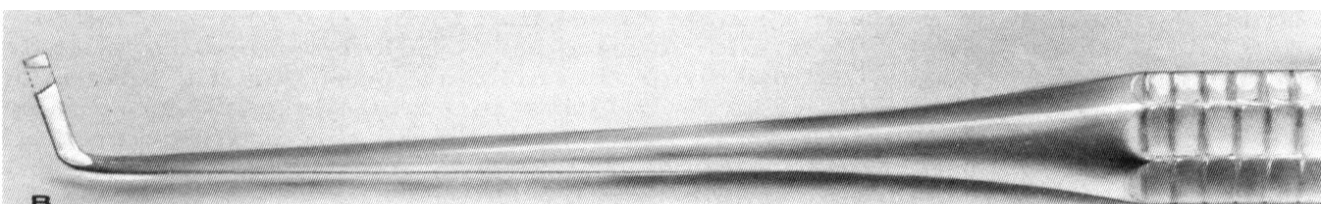
#### **(A)- Ordinary hatchet excavator:**

It has the cutting edge of the blade directed in the same plane as that of the long axis of the handle and is bibeveled. This instrument is used primarily on anterior teeth for preparing retentive areas and sharpening internal line angles, particularly in preparations for direct gold restorations.



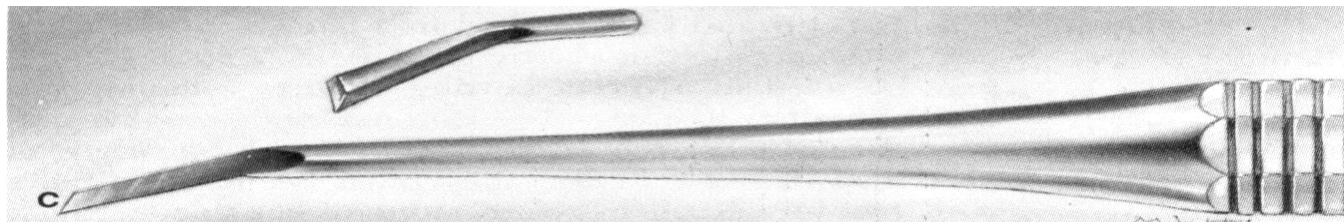
#### **(B)- Hoe excavator:**

It has the primary cutting edge of the blade perpendicular to the axis of the handle. This type of instrument is used for planing cavity preparation walls and forming line angles. It is commonly used in Class III and V preparations for direct gold restorations. Some hoes may have longer and heavier blades with the shanks contra-angled; these are intended for use on posterior teeth. It is usually used with pull motion.

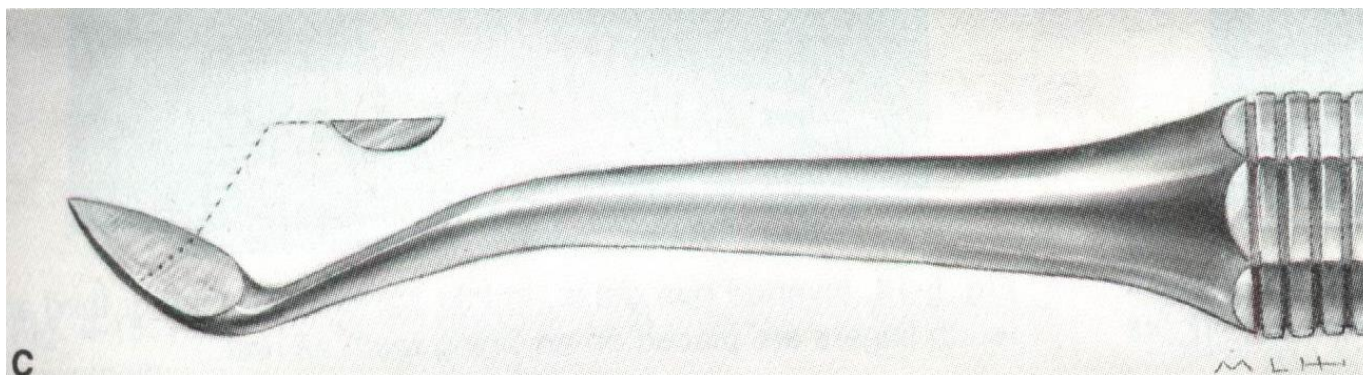
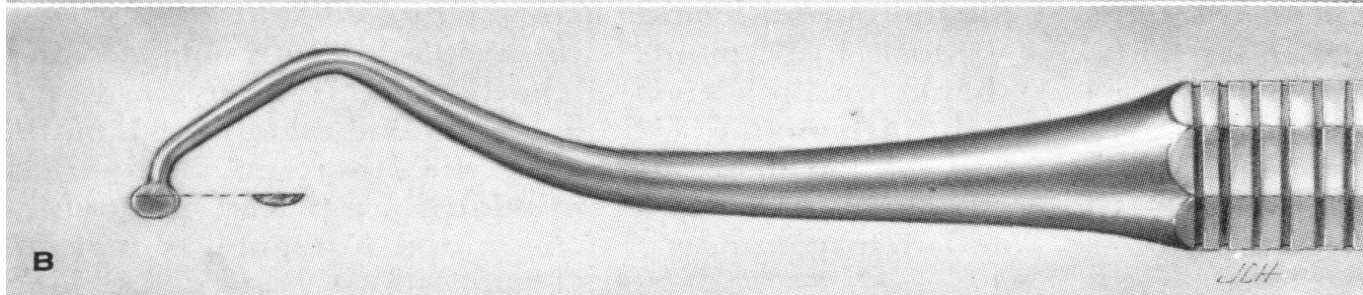
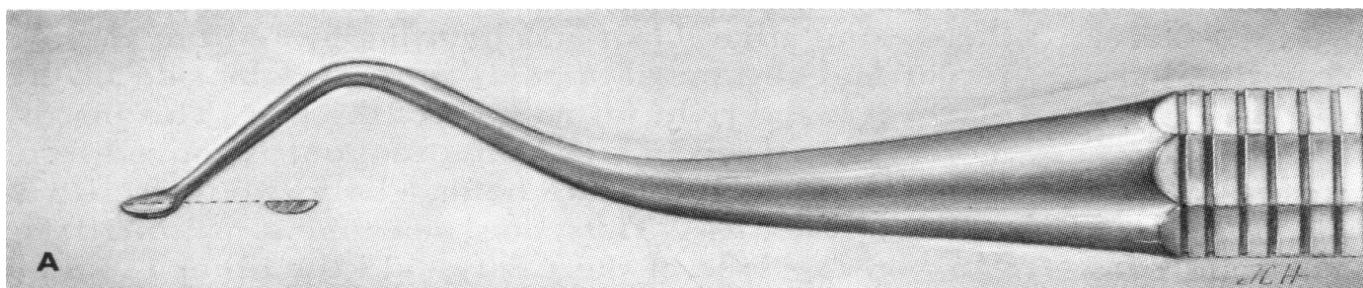


**(C)- Angle former:**

It is mon-angled and has the primary cutting edge at an angle (other than 90 degrees) to the blade. It may be described as a combination of a chisel and gingival margin trimmer. It is available in pairs (right and left). It is used primarily for sharpening line angles and creating retention features in dentin in preparations for gold restorations. It may also be used to in placing a bevel on enamel margins.

**(D)- Spoon excavator:**

The blades are slightly curved and the cutting edges are either circular or claw-like. The circular edge is known as a *discoïd*, where as the claw-like blade is termed a *cleoid*. The shanks may be bin-angled or triple-angled to facilitate accessibility. They are used for removing caries and carving amalgam or direct wax patterns.

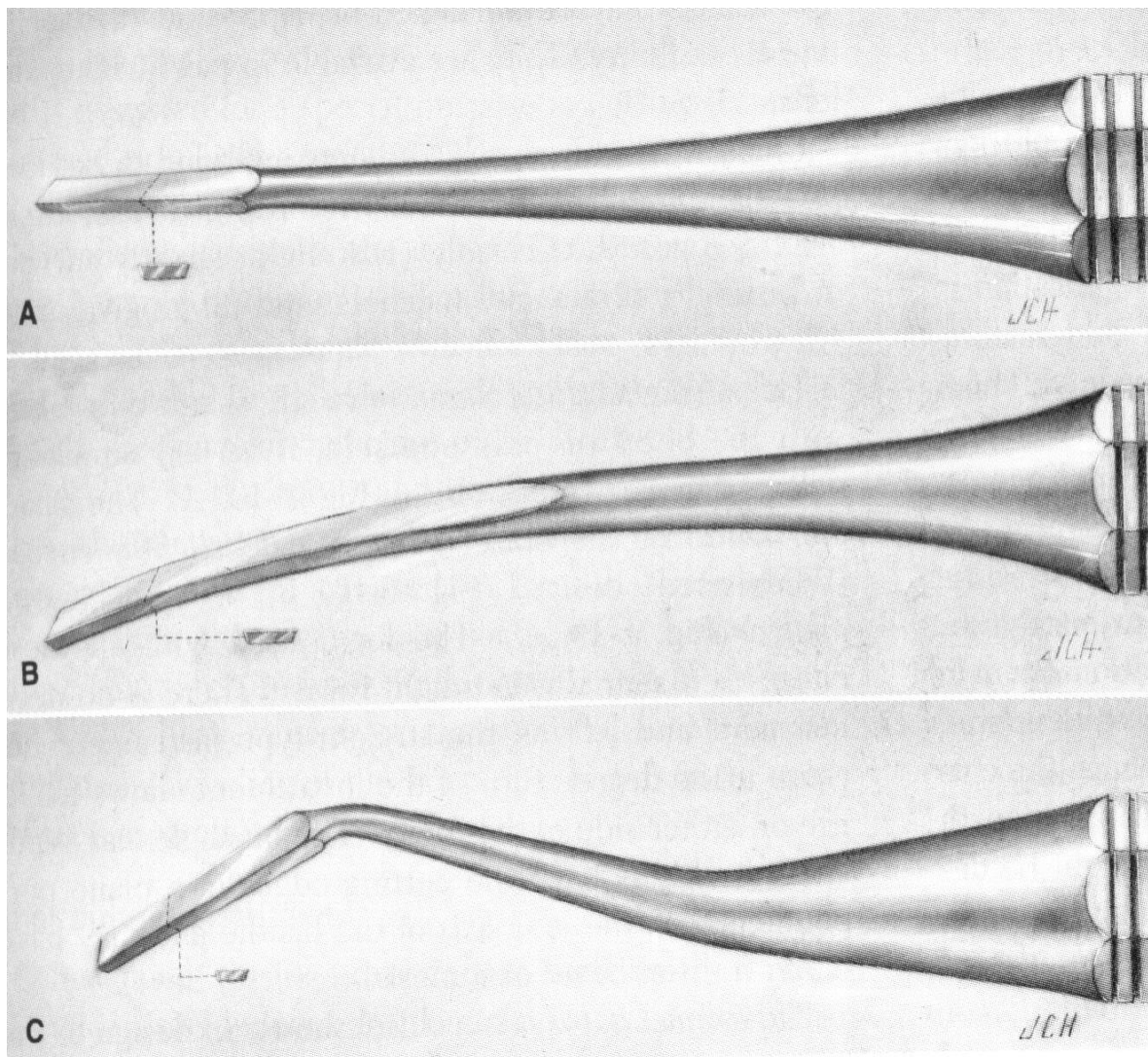


## 2- Chisels:

Chisels are intended primarily for cutting enamel and may be grouped as follows:

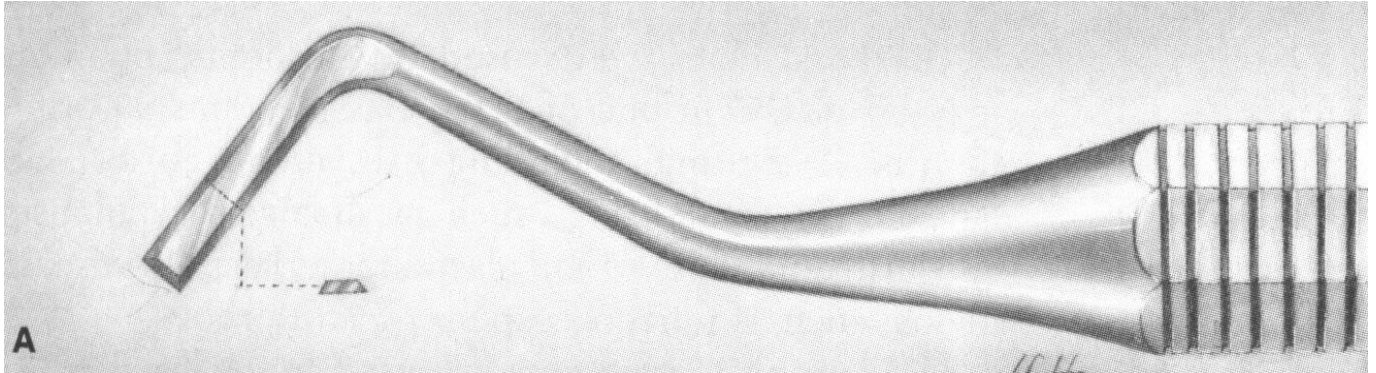
### (A)- *Straight, slightly curved, or bin-angle:*

A *straight chisel* has a straight shank and blade with the bevel on only one side. Its primary edge is perpendicular to the axis of the handle. It is similar in design to a carpenter's chisel. The shank and blade of the chisel also may be slightly curved (*Wedelstaedt design*), or may have two angles in the shank (*bin – angled*). There is no need for a right and left type in the straight chisel, since a 180-degree turn of the instrument allows for its use on either side of the cavity. In the bin-angled and Wedelstaedt chisels, the blade may have either a distal bevel or a mesial bevel. The blade with a distal bevel is designed to plane a wall that faces the blade's inside surface, while the blade with a mesial bevel is designed to plane a wall that faces blade's outside surface. The force used with all these chisels is essentially a straight push.



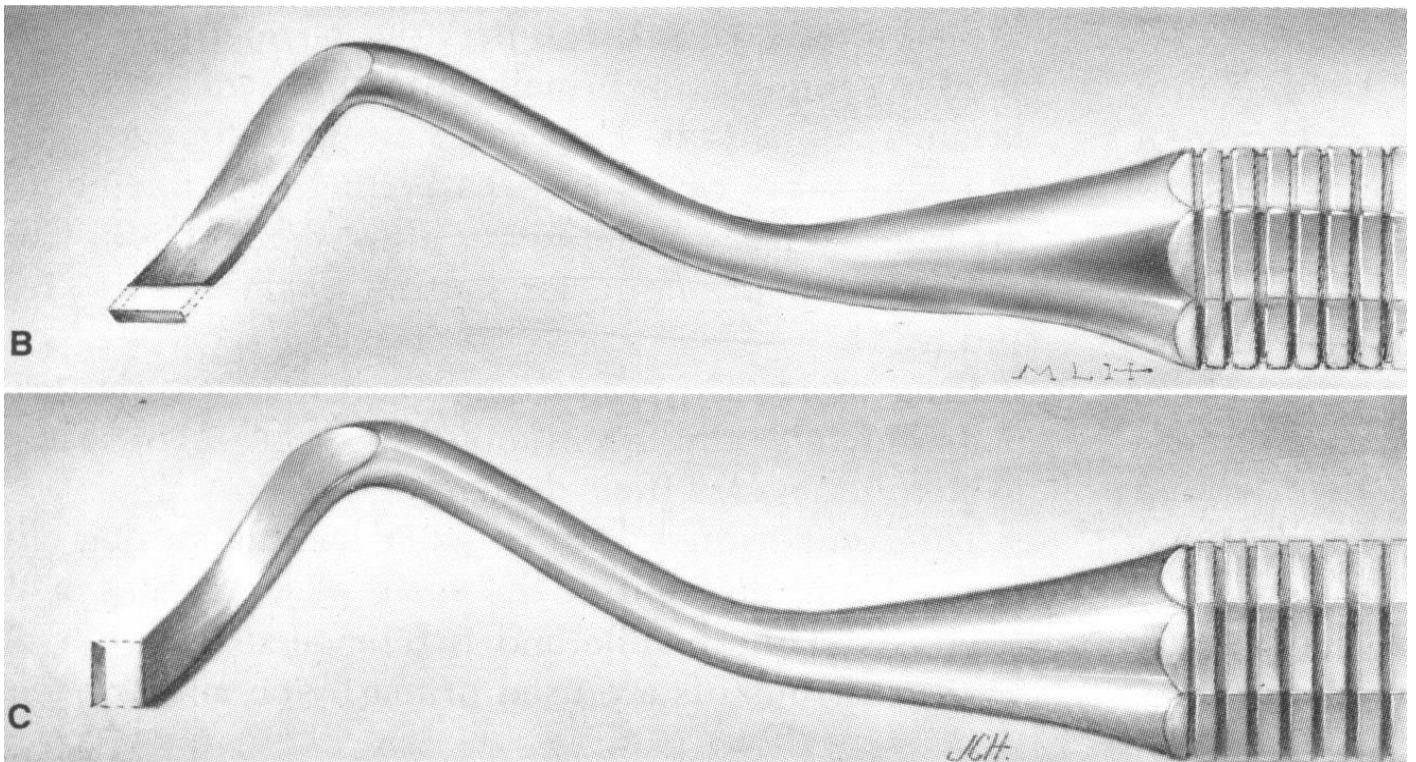
**(B)- Enamel hatchet :**

It is a chisel similar in design to the ordinary hatchet except that the blade is larger, heavier, and is beveled on only one side. It has its cutting edges in a plane that is parallel with the axis of the handle. It is used for cutting enamel and comes as right or left types for use on opposite sides of the cavity.



**(C)- Gingival margin trimmer**

It is similar in design to the enamel hatchet, except the blade is curved (similar a spoon excavator), and the primary cutting edge is at an angle (other than perpendicular) to the axis of the blade. It is made as right and left types (either a mesial pair or a distal pair). It is so designed to produce a proper level on gingival margins of proximoocclusal preparations.



### **3- Other cutting instruments:**

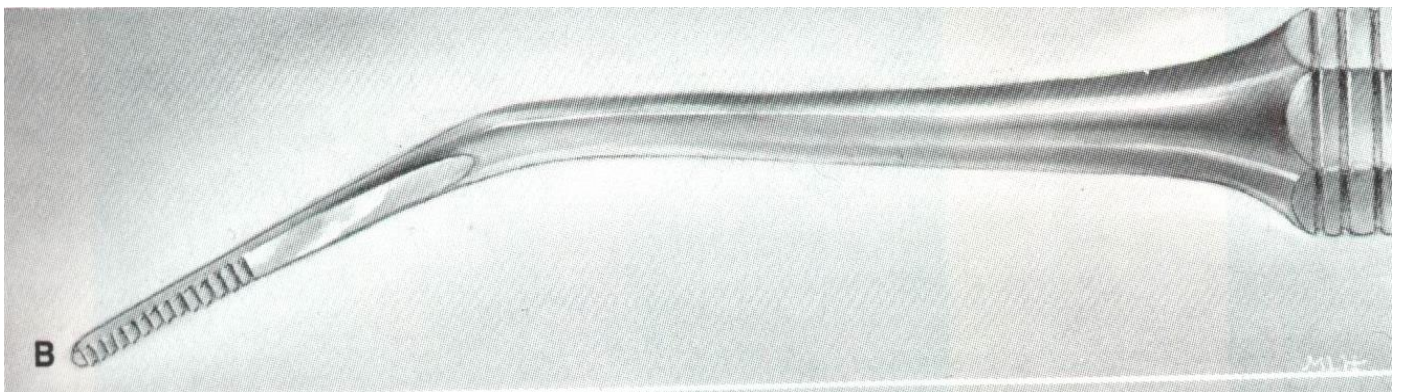
Other hand cutting instruments, such as knife, file, and discoid-cleoid instrument are used for trimming restorative material rather than for cutting tooth structure.

#### **(A)- Knives:**

They are known as finishing knives, amalgam knives, or gold knives. They are designed with a thin, knife-like blade that is made in various sizes and shapes. They are used for trimming excess filling material on the gingival, facial, or lingual margins of a proximal restoration or trimming and contouring the surface of Class V restoration.

#### **(B)- Files:**

The blades of files are very thin, and the teeth on the cutting surfaces are short. The teeth of the instrument are designed to make the file either a *push* or a *pull* instrument. Files can be used to trim excess filling material, and they are particularly useful at gingival margins. They are manufactured in various shapes and angles to allow access to restoration.



#### **(C)- Discoid-Cleoid instrument:**

The working ends of this instrument are larger than the discoid or cleoid end of an excavator. It is used mainly for carving occlusal anatomy in amalgam restorations. It also may be used to trim or burnish inlay-onlay margins.

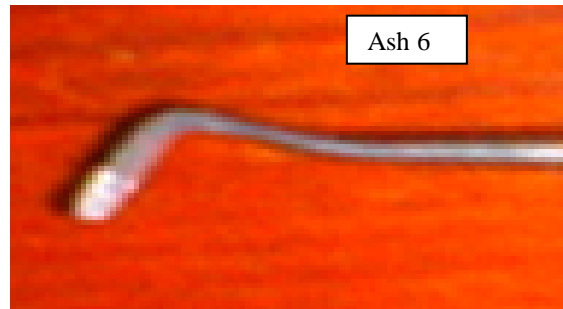
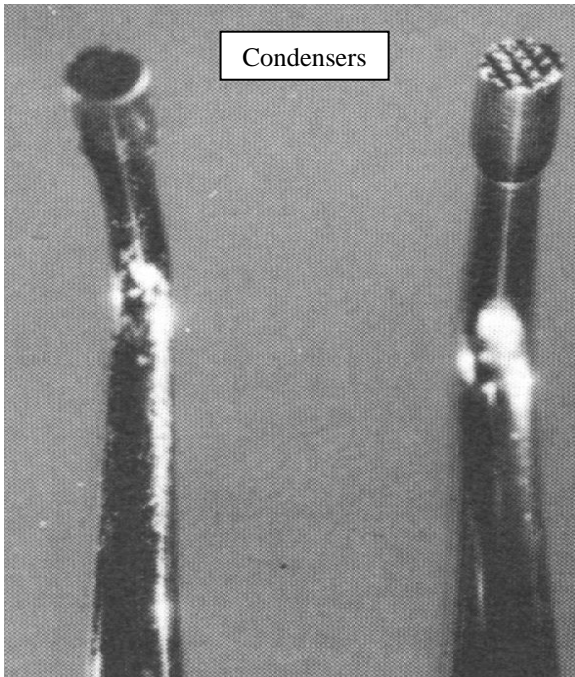




## Non cutting hand instruments

### 1- Condensing instruments

Used to condense amalgam in the prepared cavity. So they called condensers or pluggers. The head has different sizes and shapes, and could be either smooth or serrated.



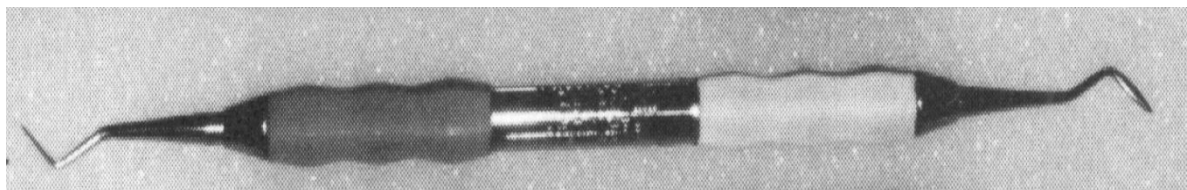
### 2- Plastic instruments

Used to manipulate plastic restorative material.

Examples: Ash 6 : adaptation of cement against the axial wall and finish carving of amalgam. Ash 49: adapt the cement in the cavity and finish carving of amalgam, sometimes used to condense some of the filling materials.

### 3- carving instruments

Used to carve amalgam to proper shape after condensation and also carve the wax pattern to the proper shape.



**4- Burnishing instrument**

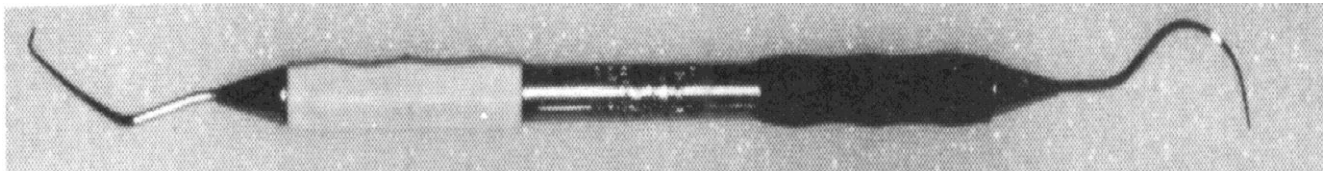
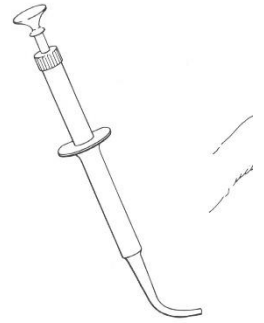
Has a round heads. Usually double ended, with different sizes. Usually used to polish and burnish the surfaces of the restoration, contour the matrix band in class II cavity preparation and stretch the margin of cast gold restoration.

**5- Amalgam carrier**

Used to carry amalgam from the container to the prepared cavity.

**6- Exploring instruments**

Such as dental probe used to explore tissue defects like caries detection. Either sickle ,straight, angle in shape. They are circular in cross section.



**7- Dental mirror**

Used for examination during diagnosis and treatment.

**8- Dycal applicator**

Has a very small round head, used to carry ca(OH)<sub>2</sub> subliner to the prepared cavity.

**9- Isolation instruments**

Rubber dam and saliva ejector.

