

Instruments used in operative dentistry

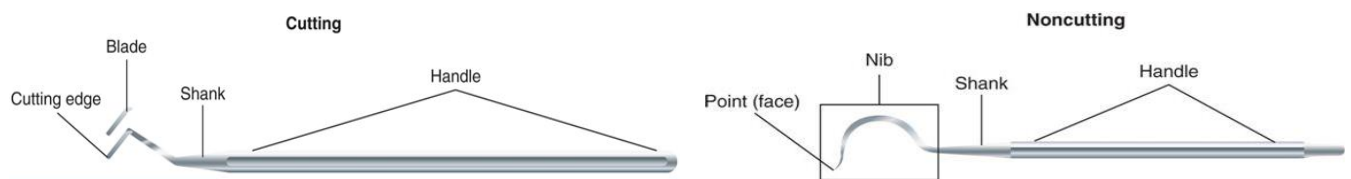
Instruments are used to examine, clean, cut, and help to restore teeth. The main types of cutting instruments are either hand-held or rotary instruments driven in a handpiece. Other equipment includes fiberoptic lights for illumination, light-curing systems used for polymerization of resin-based materials (such as; composite materials), new instruments for tooth-cutting/ caries removal, and ultrasonic scalers. These instruments may be reused after suitable decontamination and sterilization procedures, or else are disposable, single-use items.

1. Hand instruments:

Manufactured from medical grade stainless or carbon steel (sometimes with tungsten carbide brazed to the cutting edges for increased longevity of sharpness), carbon steel was harder and maintained sharpness better than stainless steel. On the other hand, stainless steel has improved by incorporating with chromium to provide corrosion resistance and with carbon to enhance hardness. Hand instruments used in the dental operatory may be categorized as:

(1) **Cutting** (excavators, chisels, hatchets, hoes, carvers and gingival margin trimmer).

(2) **Noncutting** (amalgam carrier, burnisher and condensers, mirrors, explorers, probes and tweezers).

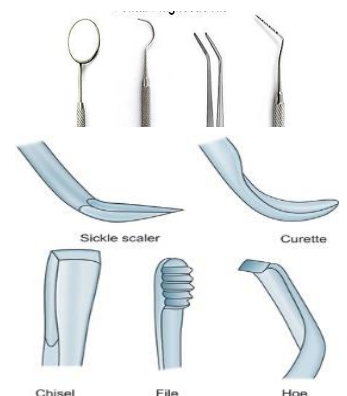


Hand instruments can be used for the following purposes:

1- **Oral examination** (mouth mirror, dental probes (straight, angled, and sickle), tweezers). Disposable examination instruments are now manufactured from plastic to allow single use only.

2- **Periodontal scaling:** (sickle scalers, curettes and chisels, *hoes*) used to remove supra- and sub-gingival calculus deposits.

3- **Caries removal** (*excavators, chisels/hatchets/hoes*):



-*Excavators*: instruments with a discoid/ovoid blade sharpened to a cutting edge are used to remove caries and soft temporary restorations.



- *Chisels, hatchets and hoes*: used to remove unsupported enamel/bevel cavity margins (especially where access for rotary instruments is limited).



4- Handling restorative materials (*flat plastics, condensers (pluggers), carvers*):

- *Flat plastic instruments*: used for placing and shaping plastic materials.

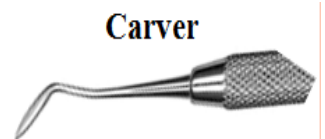
Usually made of stainless steel but for composite placement, Teflon-coated or titanium nitride-coated blades confer a useful non-stick property.



- *Condensers (pluggers)*: smooth surface instruments for packing restorative materials into cavities under pressure (eliminating voids).



- *Carving instruments*: sharp/semi-sharp blades carve the shape/contour of the final restoration by cutting/scraping action.



Design of hand instruments:

Most hand instruments, are composed of three parts: handle, shank, and blade.

- blade or nib*: The blade (in the cutting instruments) or nib (in noncutting instrument) is the working end of the instrument and is connected to the handle by the shank. Some instruments have a blade on both ends of the handle and are known as double-ended instruments.
- Handles*: is used to hold the instrument by clinician's hand.
- Shanks*: they connect the handles to the working ends of the instruments. They often have one or more bends to overcome the tendency of the instrument to twist while in use when force is applied.



Instruments formula:

J.V. Black classified all of the instruments by name (eg., excavators and carvers)

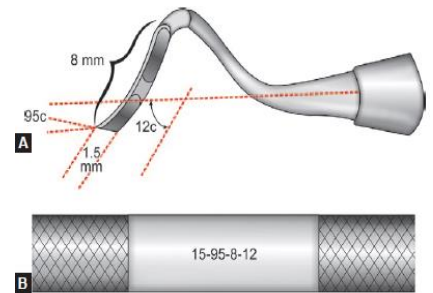
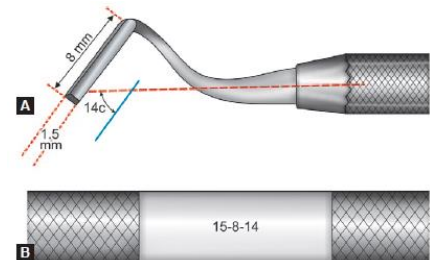
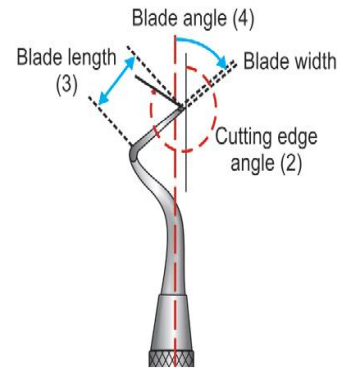
In addition, for hand-cutting instruments, he developed a numeric formula to characterize the dimensions and angles of the working end.

- **3 Number instrument formula:** Cutting edge of the Instrument is at a right angle to the blade.

- First number- Width of the blade in tenths of a millimeter.
- Second number - Length of the blade in millimeter.
- Third number - Angle the blade forms with the axis of the handle in centigrade. Example: Enamel hatchet.

- **4 Number instrument formula:** Cutting edge of the Instrument is at an angle other than a right angle to the blade.

- First number - Width of the blade in tenths of a millimeter.
- Second number - Angle the cutting edge forms with the axis of the handle in centigrade.
- Third number - Length of the blade in millimeter.
- Fourth number - Angle the blade forms with the axis of the handle in centigrade. Example: Gingival marginal trimmer.



Hand Instrument Techniques:

a. *Pen grasp:* it is similar but not identical to that used in holding a pen. The pads of the thumb and of the index and middle fingers contact the instrument, while the tip of the ring finger (or tips of the ring and little fingers) is placed on a nearby tooth surface of the same arch as a rest. The palm of the hand generally is facing away from the operator.

b. *Inverted pen grasp:* the finger position are 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.

c. *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.



Instruments used for amalgam restorations:

1- Condensers.

2- Burnishers: They are available with different sizes and working end shapes which may be round, oval or rounded cone shapes.

Burnishers are used for smoothing and burnishing of the amalgam restorations.

They are also used for shaping metal matrix band to have more desirable contours for restoration.



3- Carvers.

4- Amalgam carriers: They are used to carry and place the amalgam into the prepared cavities.



Instruments used for plastic restorations (composites and glass ionomer materials):

- Plastic instruments: an instrument are used to carrying and shaping and backing plastic restorative materials (composite resin and glass ionomer), base and lining, and temporary filling materials in prepared teeth cavities, They were made of plastic, but now are available in either hard plastic or metal. These instruments are:

1. Dycal applicator: is a hand instrument with small round nib used for mixing and placing dycal lining material in the tooth cavity.
2. Cement spatula: is used for mixing of different restorative materials (such as cement or temporary filling material) on glass or on a paper pad.
3. Ash 6: it is similar to carver instrument except it has a non-sharp working end.
4. Ash 49: it is double ended instrument with rounded ends.



2. Rotary instruments:

Powered rotary cutting instruments, known as dental handpieces and burs, are the most commonly used instruments in contemporary dentistry. Dental burs, stones, cutting and polishing discs are small instruments gripped firmly by a chuck in a handpiece powered by compressed air as; air turbine (high-speed handpiece), or powered by a separate motor either air or electrically driven, such as low-speed handpieces.

Handpieces:

There are two types of dental handpieces; straight and contra angle handpieces. The straight one is used for laboratory work, while contra-angle used intra-orally. The contra-angle handpiece are classified into:

1. Air turbine (high-speed) handpieces:

Have a free running speed above 160,000 rpm and some have speed up to 500,000 rpm. It gets power from the compressed air supplied by the compressor. High speed techniques are generally preferred for cutting enamel and dentin. High speed generates considerable heat during cutting, and should be used with water coolant and high efficiency evacuation. Burs are held via a friction-grip shank, the tip shrouded in water spray and illuminated with an optional fibreoptic light.



2. Low-speed handpieces:

Two-piece system comprising an electric or air-driven motor coupled to a contra-angled or straight handpiece (rotating clockwise or anticlockwise), with water spray and fibreoptic light. It gets power from electric micro-motor or air-motor. It is used for excavating caries with round burs, refining cavity preparations, using sand paper disks, marginating gold restorations and polishing procedures. They have free running speed range from 500 to 15,000 rpm (revolution per minute).



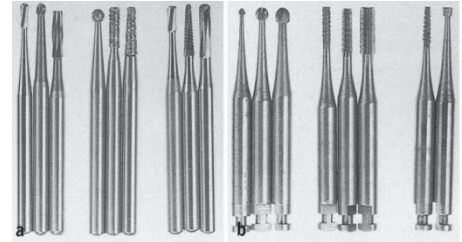
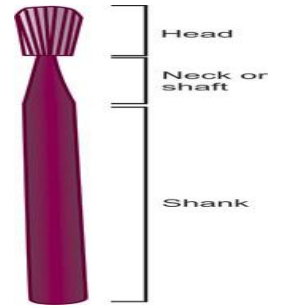
Dental burs:

The term bur is applied to all rotary cutting instruments that have bladed cutting heads. This includes instruments intended for finishing metal restorations, surgical removal of bone, and tooth preparation. Burs are made of different materials such as stainless steel,

diamond or tungsten carbide. Bur is consisting of head, neck and shank. 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.

The three commonly seen instrument shanks are:

- Straight handpiece shank.
- Friction grip handpiece shank.
- Latch type handpiece shank.



The most common used burs in operative dentistry are:

1. Round bur: it is used for initial entry into the tooth, preparation of retentive holes or for removal of caries dentin.
2. Inverted cone bur: This bur is used for flattening the floor of the cavity, increasing the depth of cavity or for providing undercuts in cavities preparation.
3. Fissure bur: - it is used for obtaining the outline form of the cavity and to cut walls, floor, or margins of the cavity.



Burs come with different coding colors. These colors represent the size of the diamond grit of the bur head. Green and black color produce roughness, blue one is standard and used for tooth and cavity preparation, while red, yellow and white one used for polishing and finishing process of the restoration.

