

## INSTRUMENTS AND GENERAL INSTRUMENTATION FOR CAVITY PREPARATION FARHAD HADAVI, DMD, MS

It is very important that the dentist have a complete knowledge of the purpose and application of the many instruments required. The dentist must know what instruments are available, where they are applicable and the manner of their use.

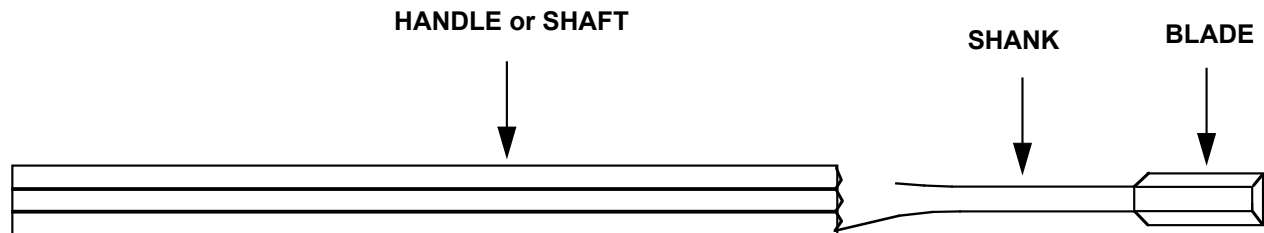
The term "Dental Instruments" refers to a wide variety of highly specific instruments held in hand and applied during the actual restoration sequence. Skillful application of sharp hand and rotary cutting instruments requires ability and coordination gained only by extensive training.

Hand cutting Instruments are used in 3 ways as:

- a- explorers
- b- gauges
- c- cutting and smoothing tools

### DESIGN CHARACTERISTICS OF HAND CUTTING INSTRUMENTS

A hand instrument **consists of three essential parts:**



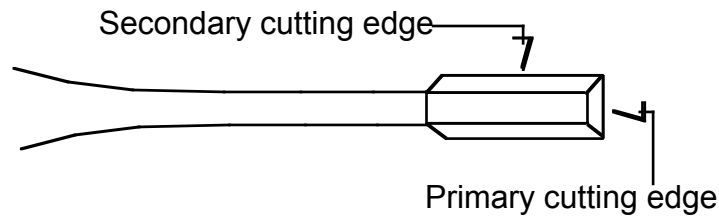
- a- **Handle or shaft\***: Hand cutting instruments are available with small, medium or large diameter handles which can be smooth, or serrated

\* NOTICE: Single-ended instruments are often referred to as long-handled (LH). Paired instruments such as the bin angle chisel are frequently called double-ended (DE).

- b- **Shank**: Connecting the shaft and blade (NIB). The shank may be straight or angled (single, double, or triple-angled).
- c- **Blade**: **This is the part that carries the functional end of the instrument.** It begins at the angle that terminates the shank (last angle if there is more than one).

**This is the part of the instrument that bears  
the cutting edge, condenser face, etc.**

Most hand instruments' blades have three bevels, one at the end of the blade that forms primary cutting edge and two along the length of the blade side forming the secondary cutting edges.



- d- **NIB** is the working end of the instrument used to:
- cutting
  - insert
  - condense
  - finish a restoration

### HAND CUTTING INSTRUMENTS

In establishing a nomenclature for hand instruments, Dr. Black prescribed four classes, similar to the biological classification:

- Order:** Purpose of the instrument (**excavator**)
- Suborder:** Manner of the use (**Push**)
- Class:** Form of the working end (**Hatchet**)
- Sub Class:** Shape of the shank (**Bin angle**)

Therefore, an instrument might be described as "**Bin angle Hatchet Push Excavator**"

In most cases the **working end** and the angle of **the shank** are sufficient to describe adequately the hand cutting instrument. e.g. "**Bin Angle Hatchet**" or "**Triple Angle Amalgam Condenser**".

#### **ORDER:**

In General Sense, **ALL CUTTING INSTRUMENTS ARE EXCAVATORS\***. The functions of excavators are to:

- a- remove caries
- b- shape walls, floors, line angles and point angles during cavity preparations by:
  - b1- cleaving
  - b2- planing
  - b3- lateral scraping

\*In the present-day application, however, **the term "excavator"** is frequently used to denote an instrument specifically designed to **remove carious tooth tissue**. Chisels, hatchets and hoes are considered specialized hand instruments that are used to **cleave the enamel or shape sound dentin**.

## **SUBORDER:**

The suborder describes the position or manner of use which is variable and nonspecific. For all practical purposes it can be usually omitted.

## **CLASS:**

The class describes the form or shape of the cutting edge:

- a-** Chisel
- b-** Hatchet
- c-** Hoe
- d-** Gingival margin trimmer
- e-** Angle former
- f-** Spoon
- g-** Cleoid
- h-** Discoid

## **SUBCLASS:**

The subclass delineates the angle or angles of the shank of the instrument:

- a-** Straight - no angle
- b-** Mono angle - one angle
- c-** Bin angle - two angles
- d-** Triple angle - three angles

\* The term "contra-angle" describes angling of the shank, particularly of long bladed instruments, in a manner designed to bring the cutting edge or working point into close proximity to the central axis of the instrument. There are either two (bin angle contra angle) or three angles needed in the shank (triple angle contra angle) to bring about this relationship.

## **"BLACK'S INSTRUMENT FORMULA"**

G.V. Black's established an Instrument Formula that describes:

- a-** the dimensions of an instrument (**dimension**) and
- b-** the angulation of the instrument (**angulation**)

This formula provides a practical method of expressing the dimensions of the blade as well as the angle or angles that exist in the shank that connects the working end to the handle or shaft.

The Basic Instrument Formula consists of three units whose measurements are based upon the metric system:

- a-** The first unit of formula describes the width of the blade in tenths of millimeters.

- b-** The second unit describes the length of the blade in millimeters.
- c-** The third unit describes the angle that the blade forms with the axis of the handle. This angle is expressed in "hundredths" of a circle or centigrade.

By this simple three-unit formula, an instrument such as the "bin angle hatchet" has a formula **15-8-12**.

- 15 = blade width 1.5 mm
- 8 = blade length 8 mm
- 12 = blade angled 12 centigrade from axis of handle or shaft

**FOURTH UNIT:**

When the cutting edge of an instrument is at an angle other than a right angle to the length of the blade, a fourth unit is added to the basic three-unit formula. This additional number, expressed in centigrade, represents the angle formed between cutting edge and central axis of the shaft. It is placed in the **Second Position** of the formula. For example, the distal gingival margin trimmer has a formula 12-**95**-10-12.

**TYPES OF HAND CUTTING INSTRUMENTS:**

<b>CHISEL FAMILY</b>	<b>HACHET FAMILY</b>
<ul style="list-style-type: none"> <li>- <b>Chisels</b></li> <li>- <b>Hoes</b></li> <li>- <b>Angle formers</b></li> <li>- <b>Discoïd &amp; Cleoid</b></li> </ul>	<ul style="list-style-type: none"> <li>- <b>Hatchets</b></li> <li>- <b>Gingival Margin Trimmers</b></li> <li>- <b>Excavators</b></li> </ul>

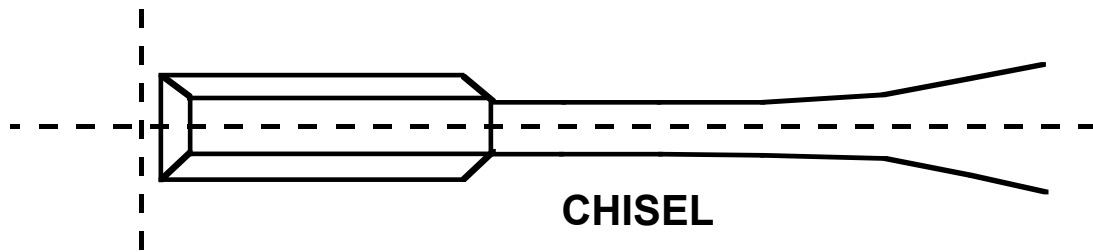
**CHISEL:**

This is an instrument used primarily for:

- a-** Planing
- b-** Cleaving enamel

This instrument is characterized by a blade that terminates in a cutting edge formed by a one-sided bevel .

The cutting edge of a chisel is at a right angle (close to the right angle) to the plane of the instrument.



A mono angle or bin angle chisel is frequently double-ended, having one cutting edge mesial, or nearer to the shaft and another cutting edge distal, or farther from the shaft.

When the cutting edge is distal to the shaft, it is termed a "CONTRA-BEVELED" OR "REVERSE BEVELED" chisel.

**In this course Chisels are used for cavity preparations in the upper right quadrant of a patient if the dentist is right handed. If the dentist is left handed it is used on the upper left quadrant.**

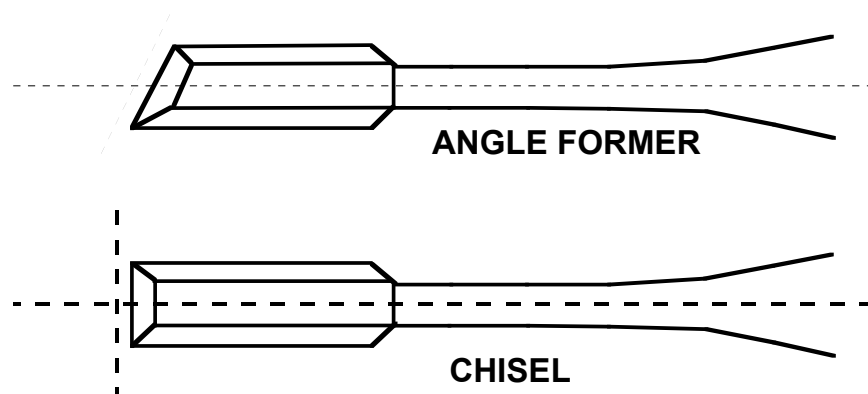
#### HOE:

A hoe is a descriptive term given to a form of the chisel in which the angle of the blade more nearly approaches a right angle (25 centigrade). The cutting edge would be at a right angle to the plane of the instrument.

While the chisel is normally used with a **push motion**, the hoe modification is frequently used with a **pull motion**.

#### ANGLE FORMER:

The cutting edge of the angle former is sharpened at an angle to the axis of the blade. The angled cutting edge as well as the sides of the blade of the angle former are beveled to form **THREE CUTTING EDGES**.



This instrument is very useful in:

- a- shaping
- b- refining.

**Fourth Unit:** Since the cutting edge of the angle former is not at a right angle to the blade axis, a fourth unit is incorporated into Black's instrument formula. This number, which again takes the 2nd position in the formula, indicates, in centigrade, the angle of the cutting edge to the axis of the shaft. The acute cutting angle being directed to the "RIGHT" or to the "LEFT" makes the angle former always a paired instrument. Its purpose is to accentuate line and point angles in the internal outline form.

The action of the instrument is essentially one of **LATERAL SCRAPING** motion. **In this course, Angle formers are used to plane gingival cavo surface margins in class 2 cavity preparations in the upper right quadrant if the dentist is right handed. If the dentist is left handed, it is used for the same purpose on the upper left quadrant.**

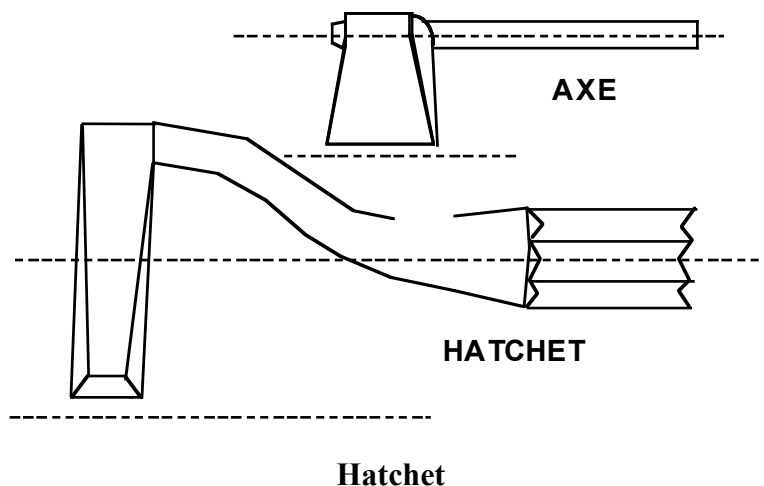
This instrument is historically used in cavity preparations for cohesive gold to establish retention form.

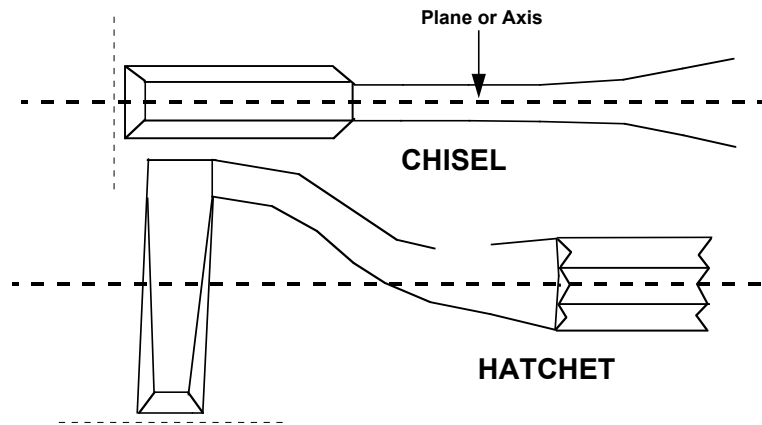
**CLEOID - DISCOID:**

The "cleoid" ,or clawlike, and the "discoïd", or disk-like, hand cutting instruments are modified double ended chisels. The cleoid and discoïd blades provide sharp cutting edges similar in design to the spoon, but with the blade-to-shaft relationship similar to that of the chisel. With both blades, the cutting edge is ground so as to be thin and sharp. The instrument was used at one time for caries removal. It is used presently as a **carving instrument** for amalgam and wax.

**HATCHET:**

An instrument with the cutting edge in the plane of the instrument is termed a hatchet. e.g. - if the blade of a hatchet is at right angles to the shaft, the cutting edge would be parallel to the shaft.





### CHISEL VS HATCHET

The paired, or "RIGHT" and "LEFT" hatchets, as they are frequently called, have their blades beveled on opposite sides to form their cutting edges, when viewing the instrument from its working end.

Hatchets, such as the 10-6-12 or 15-8-12 are used for planing and cleaving enamel walls during cavity preparation.

**In this course hatches are used in cavity preparations in the upper left, lower left and lower right quadrants of a patient if the dentist is right handed. If the dentist is left handed it is used in the upper right, lower left and lower right quadrants.**

### GINGIVAL MARGIN TRIMMER (GMT):

While the angle former previously discussed is a modified CHISEL, the gingival margin trimmer is a modified hatchet.

Two distinct modifications of the basic hatchet design are noted:

- a- The cutting edge of a gingival margin trimmer is at an angle other than right angle to the axis of blade, the same as hatchet.
- b- While the hatchet has a straight blade, the blade of the gingival margin trimmer is curved. The curved blade **accentuates the lateral scraping ability** of the instrument.

**NOTICE:** All curved bladed (Double-Plane) Instruments are Lateral-Cutting Instruments.

Like the hatchet, the gingival margin trimmers are paired instruments and are referred to as "LEFT" and "RIGHT". In addition, since this lateral-cutting instrument is used essentially for **PLANING GINGIVAL CAVOSURFACE MARGINS, DISTAL AND MESIAL TRIMMERS** are necessary.

A typical distal gingival margin trimmer is **15-95-8-14**, which is used to plane distal gingival margins.

A typical mesial gingival margin trimmer is **15-80-8-14**, which is used to plane mesial gingival margins.

Gingival margin trimmers are used with a lateral scraping motion.

### **SPOON EXCAVATORS:**

The spoon excavators are also double-planed instruments (curved blade) that are **modified hatchets**.

Unlike the straight cutting edge of the hatchet, however, the cutting edge of the spoon excavator is rounded. The shape of the tip and, to some degree, the spooning or scooping action of the instrument in caries removal provides an appropriate name.

Like all double-planed instruments, the spoon is designed for lateral scraping. It is always a paired instrument, with the curve of one blade directed from right to left and that of the other from left to right.

The circular cutting edges of this instrument are ground to a thin sharpness. The spoon excavator is frequently the **instrument of choice for the removal of carious dentin**.

### **INSTRUMENT STROKES:**

Dental hoes, hatchets, and chisels may be used to refine a cavity preparation in two ways:

- a- CLEAVING STROKE:** To split off large irregular areas of enamel. Enamel tends to break or separate along a defined plane.
- b- SCRAPING STROKE:** A dental instrument may be dragged across the tooth surface at right angles to the blade, thus removing small irregularities in the tooth structure and smoothing the surface.
- c-** A combination of these movements will be used when refining a cavity preparation.

### **Control of Hand Instruments:**

In general, control of hand instrument is gained with:

- a-** a large blade
- b-** a minimum number of bends
- c-** a cutting edge in direct axial alignment with the blade. To prevent instrument rotation and to achieve stability, the blade edge should not be off from the long axis more than 2 mm.

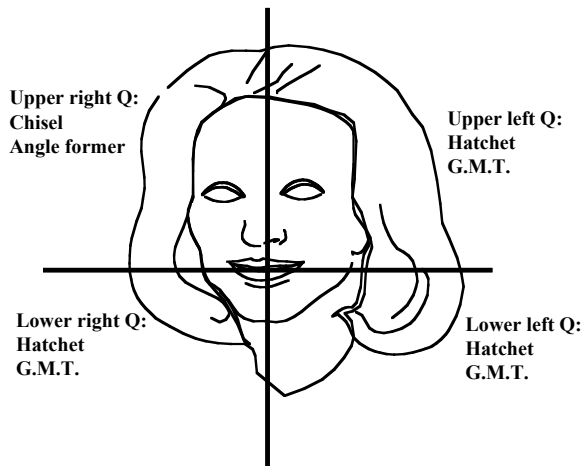
### **ADVANTAGES OF HAND CUTTING INSTRUMENTS:**



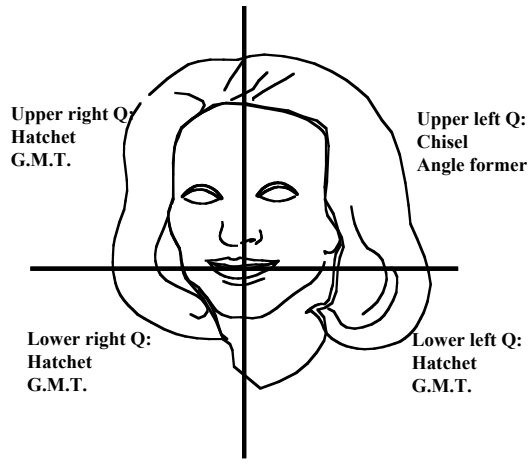
- a-** They are self-limited in cutting enamel.
- b-** They will not cut sound enamel, but will cut only enamel undermined by loss of dentin.
- c-** They can remove large pieces of undermined enamel quickly, thus saving time and effort.
- d-** No vibration or heat accompanies the cutting, making it painless and with no adverse effects on the tooth tissues.
- e-** They are the most efficient means for precise cutting, especially when cutting is needed adjacent to important anatomy.
- f-** They can create the smoothest surface of all cutting instruments.
- g-** They have the longest life span.

**OPERATING TIPS:**

1- Where to use different hand instruments:

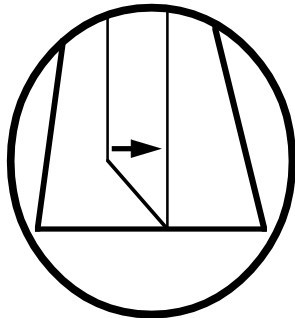


**RIGHT HANDED OPERATOR**

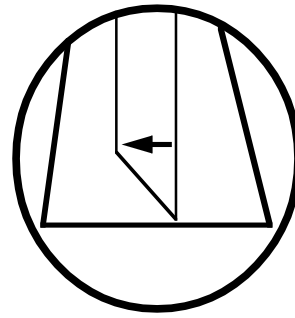


**LEFT HANDED OPERATOR**

2- For lateral cutting always move instruments from the beveled side to the non-beveled side of the blade

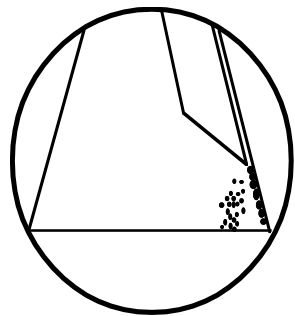


**CORRECT**

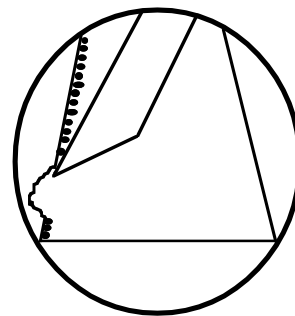


**WRONG**

3- The blade of the instrument must be always kept parallel to the cavity wall to remove unsupported enamel rods or roughness.



**CORRECT**



**WRONG**

4- Make sure to use the correct blade (cutting edge) of a double ended (paired)

instrument to make the cavity walls smooth.

