Hand Instruments (Part 1)

Learning Objectives

- To get to know different
- hand-powered dental instruments.
- details of parts of Hand operated instruments
- Means of use
- Classifications available for Hand Instruments

- **Introduction**
  - Definition
  - History
- **Classification**
  - Cutting instrument
  - Non cutting
- **Cutting instrument**
  - MATERIALS
  - Hardening and Tempering
  - Heat Treatments
  - Design
  - Shank angles
  - Nomenclature
  - Formula
  - Bevels
- **Cutting instrument applications**
  - Excavators
  - Chisels

Introduction

Definition :

It is hand-powered dental instruments.

History :

- The early hand-operated instruments characterized by:
- Large, heavy handles and inferior metal alloys in the blades.

cumbersome, difficult to use, and ineffective in many situations.

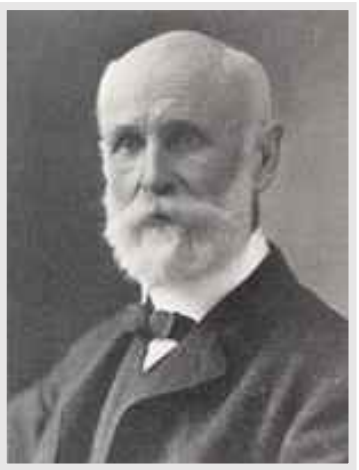
- there was no uniformity of manufacture or nomenclature, Many dentists made their own hand instruments in an effort to find a suitable instrument for a specific need.

- effective sterilization was a problem.

Designs of some early hand instruments

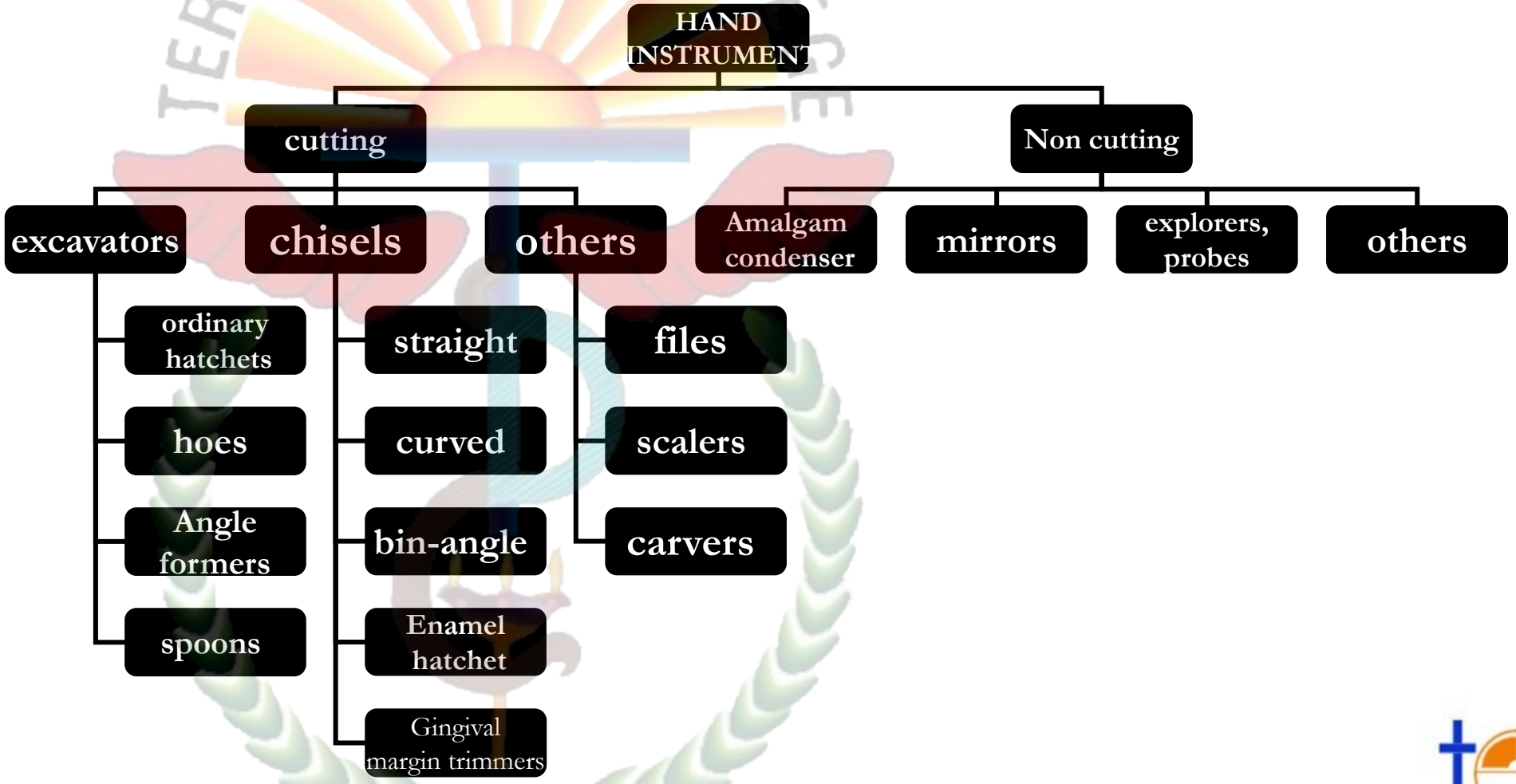
- G.V. Black is credited with the first acceptable nomenclature and classification of hand instruments.

- His classification system enabled both dentists and manufacturers to communicate more clearly and effectively in regard to instrument design and function.



G.V. Black

Classification



Cutting Instrument

MATERIALS

Hand cutting instruments are manufactured from two main materials.

carbon steel	stainless steel
Is harder than stainless steel.	remains bright under most conditions.
when unprotected, it will corrode.	loses a keen edge during use much more quickly than does carbon steel

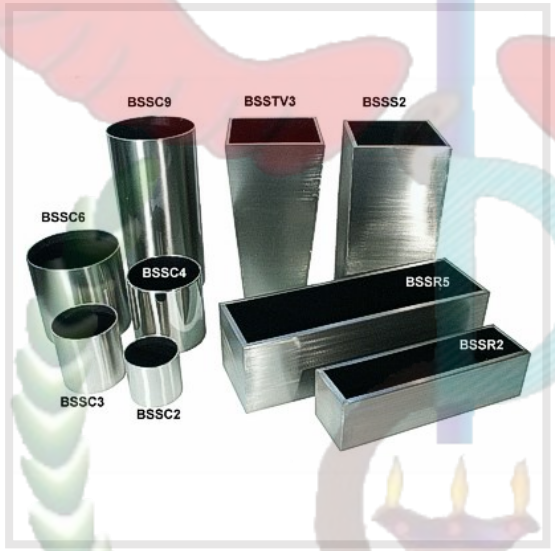
MATERIALS

- Tungsten carbide inserts or blades to provide more durable cutting edges (brittle). They may be soldered to steel handles.

- some instruments are made with carbide to
  provide more durable cutting edges.

MATERIALS

- **Other alloys of nickel, cobalt, or chromium are used in the manufacture of hand instruments.**



Stainless Steel

Carbon steel

MATERIALS

Hardening and Tempering Heat Treatments:

To gain maximal benefits from carbon steel or stainless steel, the manufacturer must submit them to two heat treatments: hardening and tempering .

Heat treatment Furnace

MATERIALS

- The hardening heat treatment hardens the alloy, but it also makes it brittle, especially when the carbon content is high.
- Heat treatment relieves strains and increases toughness. the tempering
- Heating or flaming of hand instruments during dental use can alter the original properties of the alloy and render it unserviceable.

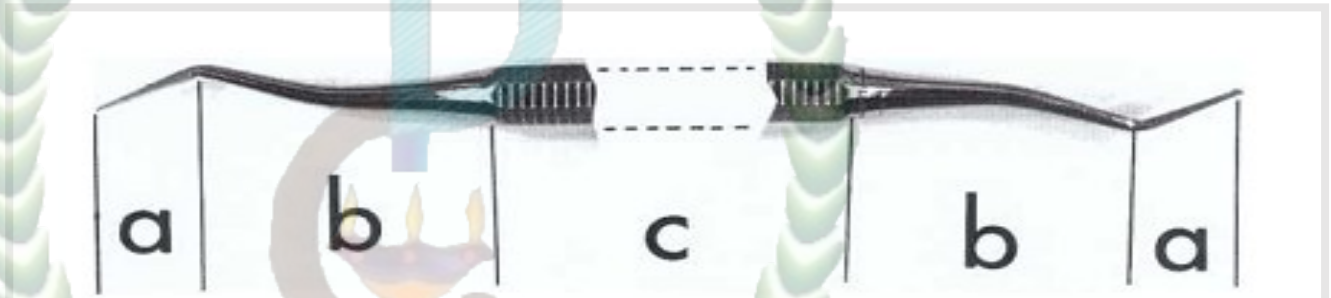
Design

- Most hand instruments composed of three parts :

a- Blade or nib

b-Shank

c-Handle



Design

a- blade

- This is the working part of the instrument.
- Begins at the point which terminates the shank.
- It is connected to the handle by the shank.
- Each blade has a cutting edge which is the working part of the instrument.
- It is usually in the form of a bevel (acute angle) that cuts into the tooth structure.
- On non cutting instruments e.g. condensers the part corresponding to the blade is called the nib or face.

Design

b-shank

- Connect the handle to the working end of the instrument.
- Normally smooth, round and tapered.
- Have one or more angles to avoid twisting of the instrument.
- Hand instruments must be balanced and sharp.
- Balance allows for the concentration of force onto the blade without causing rotation of the instrument.

Design

- Balance is accomplished by designing the angle of the shank so that the cutting edge of the blade must not be off axis by more than 1-2 mm.

- **Shank angles:**

Mon-angle, bin-angle, triple angle.

- Instruments with small short blades may be monangle

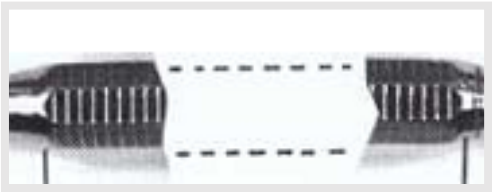
Design

- Instruments with long blades may required two or three angles in the shank to bring the cutting edge near to the long axis of the handle.

Such shanks are termed contra angled.

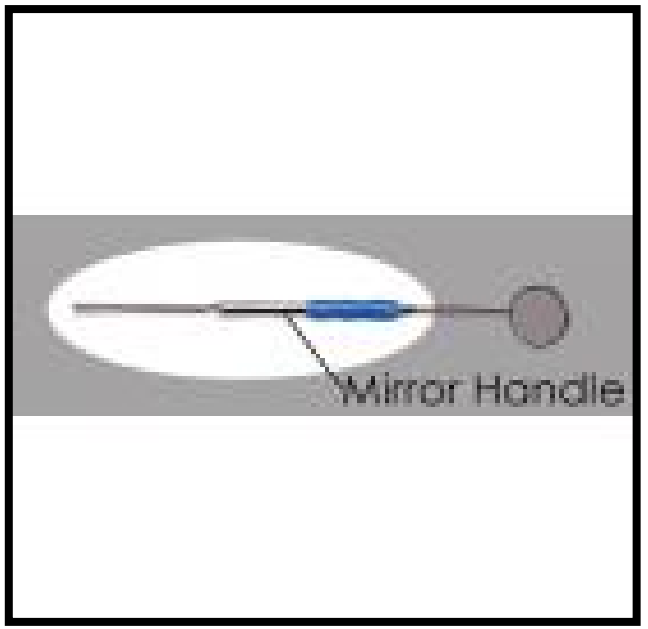
Design

c- handle(shaft)



- It is the part grasped in the operator's hand.
- Perfectly straight, smooth or eight sided.
- Serrated for better gripping and control of the instrument.
- Handles are in conjunction with the shank or it may be separable.
- Separate type is known as cone-socket handle and allows for replacement of several working ends e.g. mirrors and condensers.

Design



mirror

cone-socket handle (mirror)

nomenclature

- Black classified all instruments by name according to:

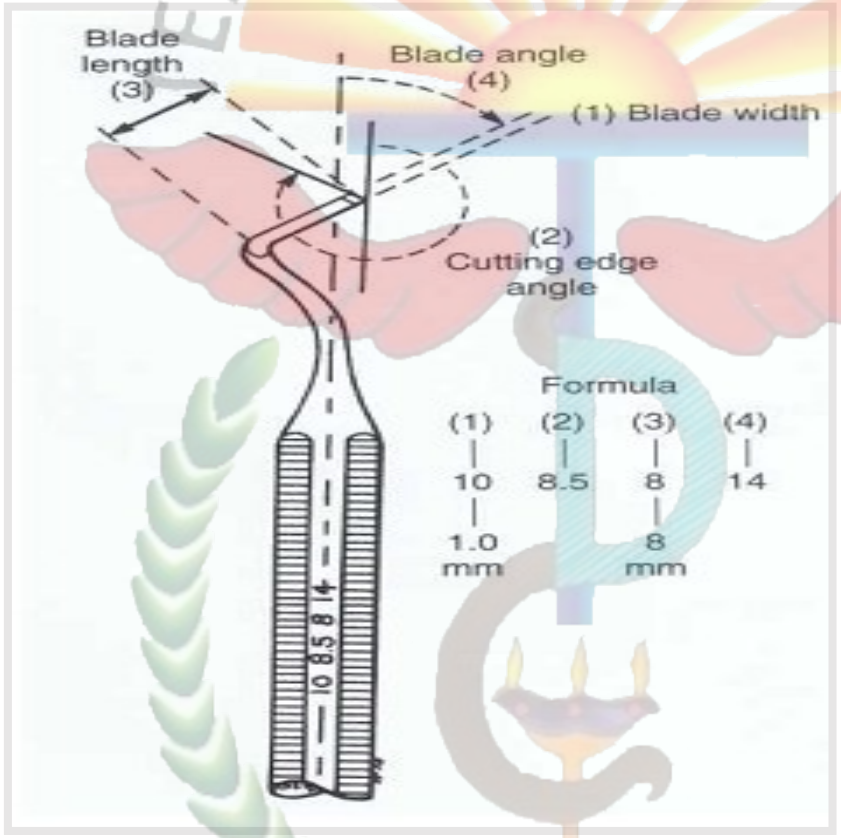
1. Function e.g. scaler, excavator.
2. Manner of use e.g. hand condenser.
3. Design of the working end e.g. spoon excavator, sickle scaler
4. Shape of the shank e.g. mono-angle, biangle, contra-angle.

•These names were combined to form the complete description of the instrument e.g. binangle spoon excavator.

formula

- Hand cutting instruments have formulas describing the dimensions and angle of the working end.
- These are placed on the handle using a code of three or four numbers separated by dashes or spaces (e.g. 10-85-8-14).
- The first number indicates the width of the blade in tenths of a mm (e.g. 10 = 1 mm).
- The second number primary cutting edge angle measured from a line parallel to the long axis of the handle in clockwise centigrade.

formula



Instrument shank and blade design with formula.

formula

- If the edge is perpendicular to the blade,
  this number is omitted resulting in a 3 numbers code.
- The third number indicates the blade length in mm (e.g. 8 = 8 mm).
- The fourth number indicates the blade angle relative to the
  long axis of the handle in clockwise centigrade e.g. (14)
  Additional number on the handle is the
- manufacturer's identification number.

formula

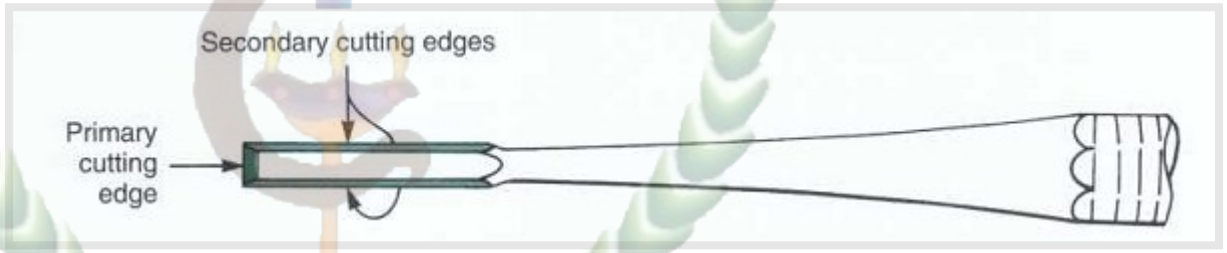
- Additional number should not be confused with the formula number.

Bevels

Most hand cutting instruments have on the end of the blade a single bevel that forms the primary cutting edge. Two additional edges,

Additional two secondary cutting edges that extend from the primary cutting edge for the length of the blade.

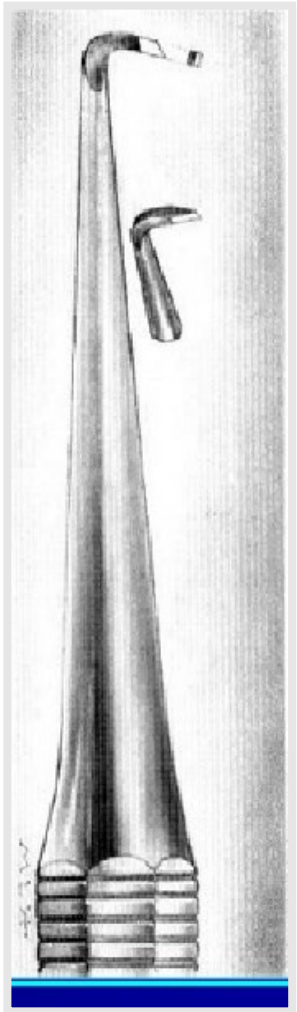
This allows cutting in 3 directions; facial and lingual walls of the proximal cavity.



Chisel blade design showing primary and secondary cutting edges.

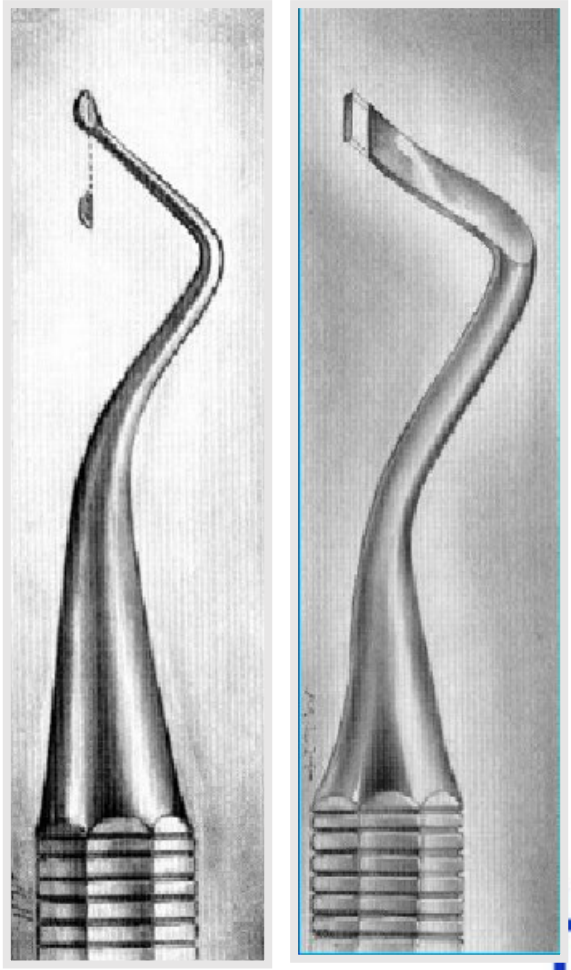
Bevels

- **Bibeveled instrument have two bevels that form the cutting edge,**
  e.g. hatched excavator.



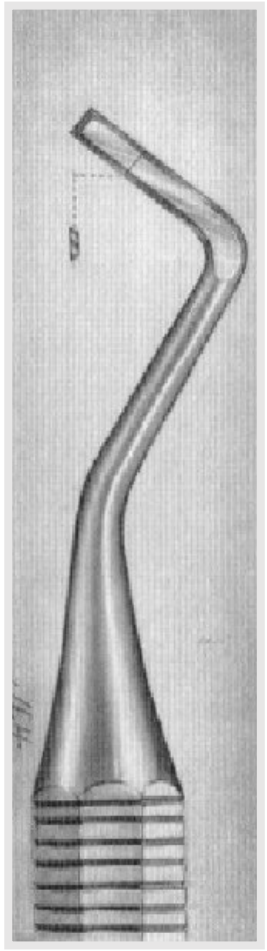
Bevels

- Single beveled instrument such as spoon excavator and gingival margin trimmer are used with lateral cutting movement.



Bevels

- **Enamel hatchet also as a single beveled instrument used with direct cutting motion, a planning or lateral cutting designated for right and left to the instrument formula.**



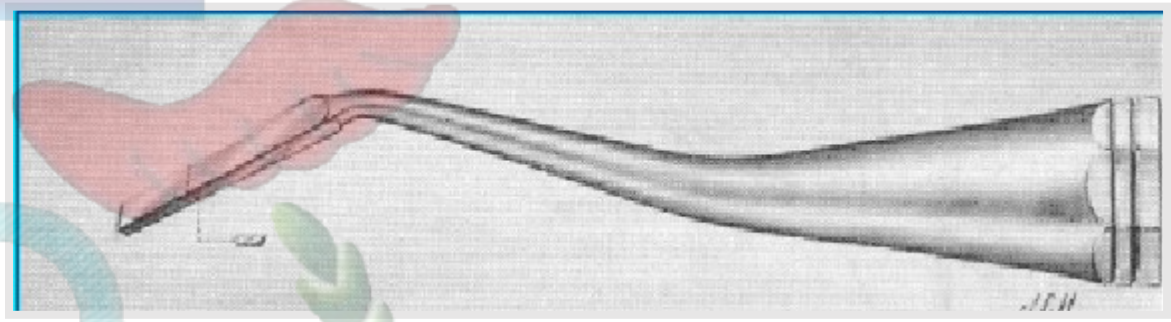
Bevels

Right and left bevels

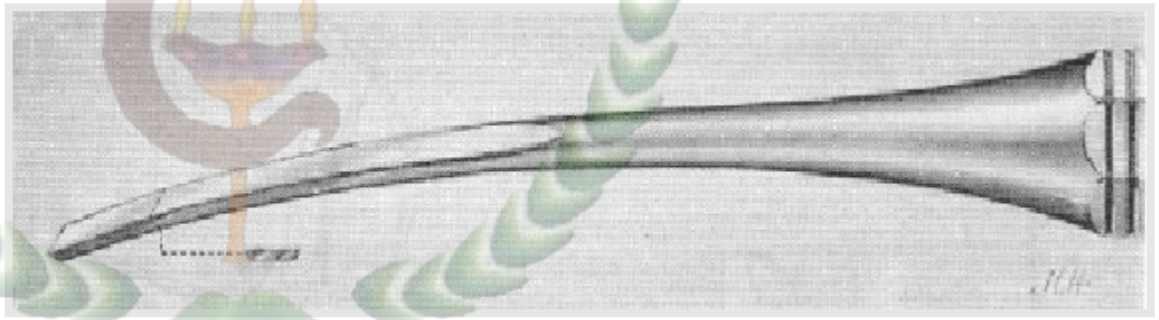
- To determine this, the primary cutting edge is held down and pointing away.
- If the bevel appears on the right, it is in the right instrument of the pair, when used it is moved from right to left.
- The opposite is true for the left instrument of the pair.
- One instrument is used for work on one side of the preparation and the other for the opposite side of the preparation.

Bevels

- The cutting edge is perpendicular to the axis of the handle
  e.g. binangle chisel.

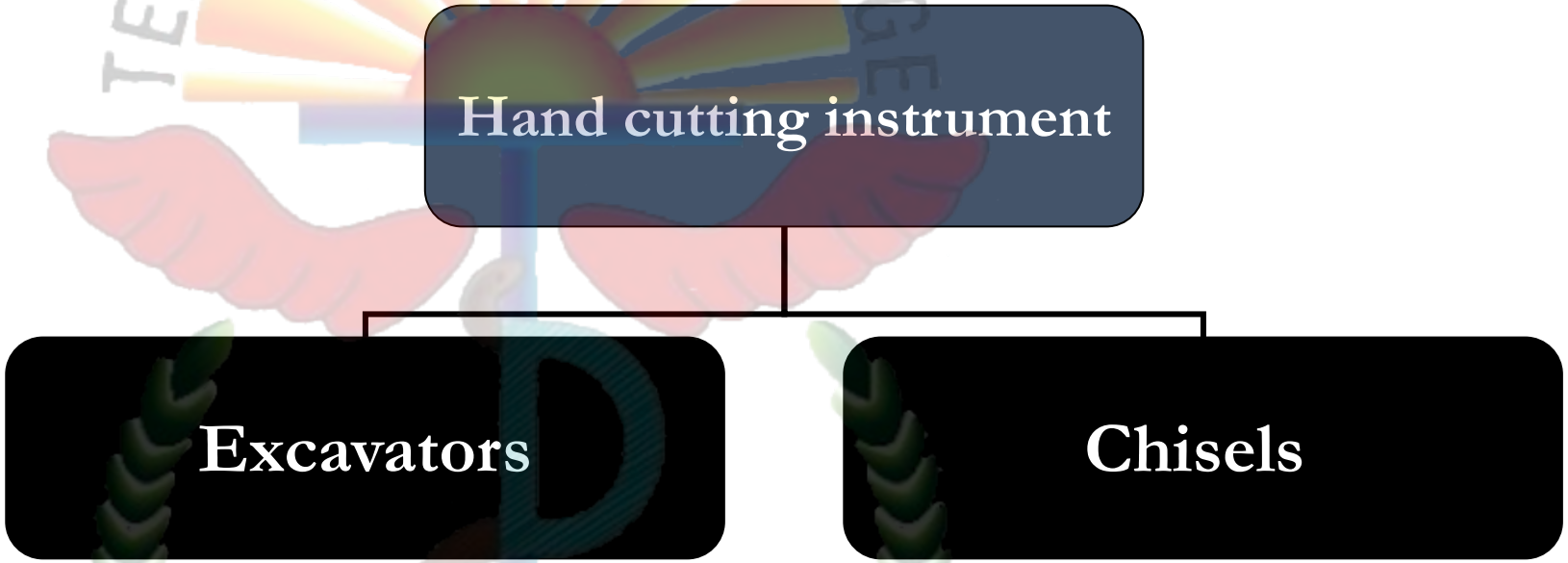


- Instrument with slight blade curvature
  e.g.Wedelstaedt chisel.



Cutting instrument applications

Applications can be classified into:



-Removal of caries and refinement of the internal parts of the preparation.

-Used primarily for cutting enamel.

CUTTING INSTRUMENT APPLICATIONS

(1)Excavators

- hatchets
- hoes
- angle formers
- spoons

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 .

Hatchet excavator

These instruments are used primarily on anterior teeth for preparing retentive areas and sharpening internal line angles, particularly in preparations for direct gold restorations .

Hoe excavator

IT has the primary cutting edge of the blade perpendicular to the axis of the handle

Hoe excavator

This type of instrument is used for planing tooth preparation walls and forming line angles. It is commonly used in Classes III and V preparations for direct gold restorations.

Hoe excavator

Some sets of cutting instruments contain hoes with longer and heavier blades, with the shanks contra-angled. These are intended for use on enamel or posterior teeth.

Angle former excavator

It is mon-angled and has the primary cutting edge at an angle (other than 90 degrees) to the blade. It is available in pairs (right and left)

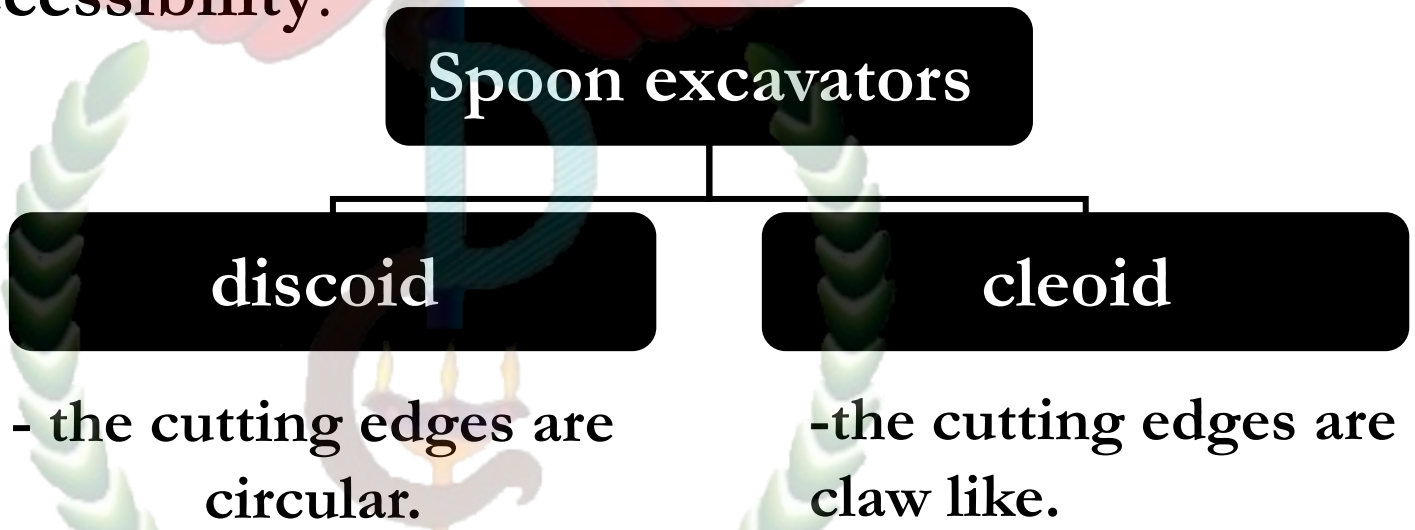
Angle former excavator

It is used primarily for sharpening line angles and creating retentive features in dentin in preparation for gold restorations.

It also may be used in placing a bevel on enamel margins

Spoon excavator

Its blades are slightly curved, the shanks may be bin-angled or triple-angled to facilitate accessibility.

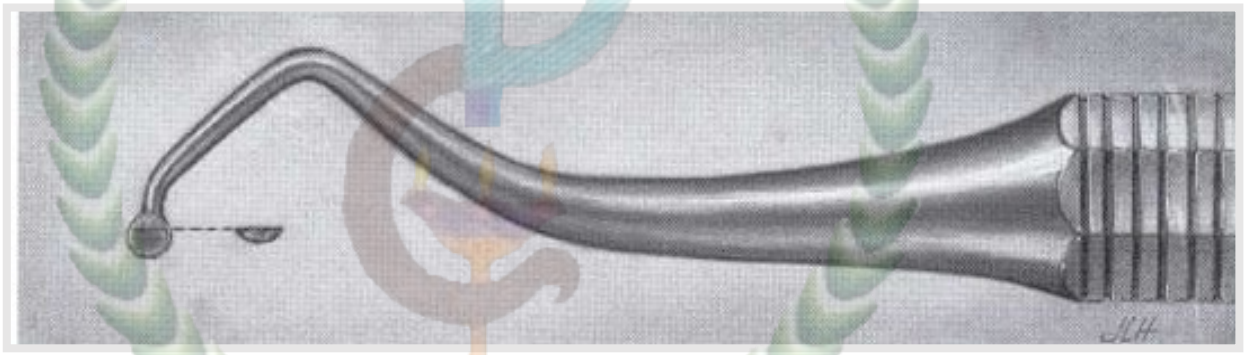


- the cutting edges are circular.

-the cutting edges are claw like.

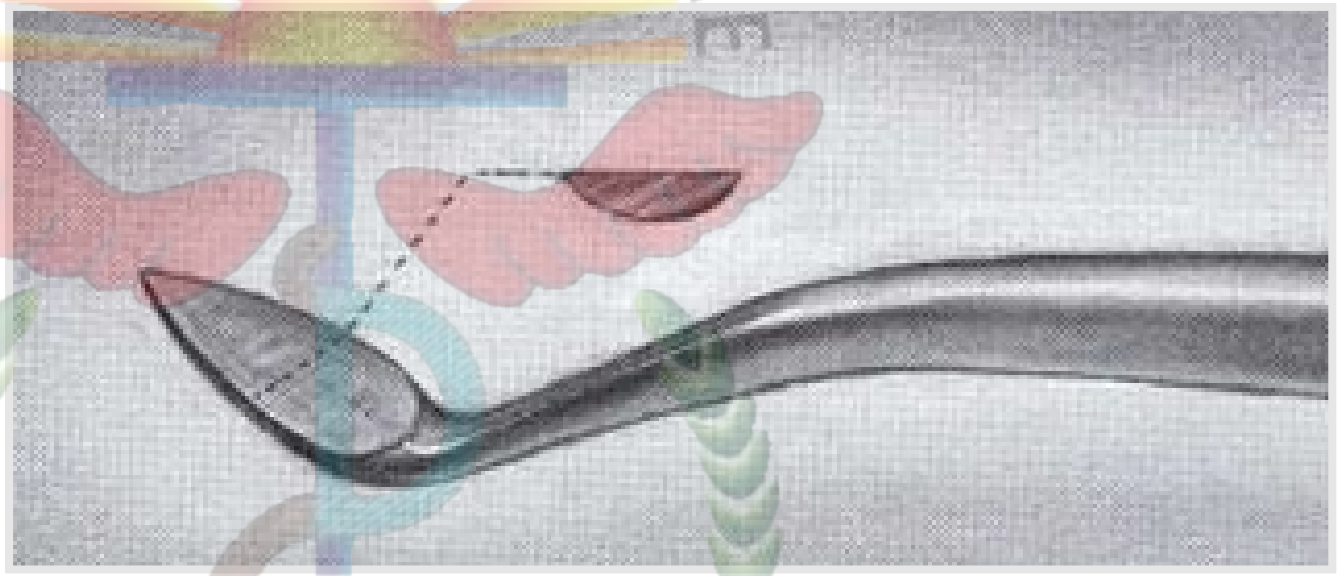
CUTTING INSTRUMENT APPLICATIONS

bin-angled spoon



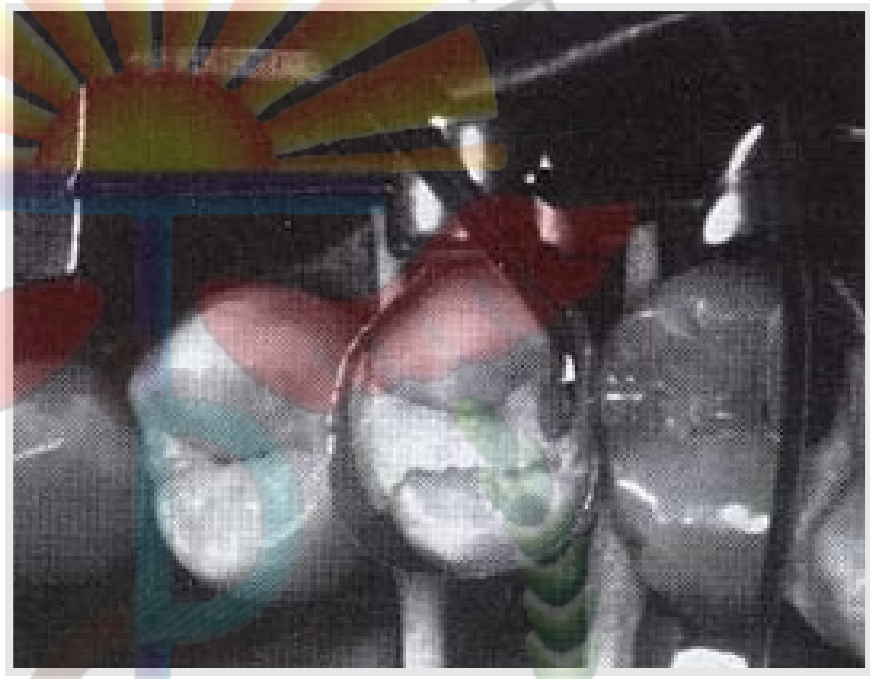
triple-angled spoon

CUTTING INSTRUMENT APPLICATIONS



Cleoid spoon

CUTTING INSTRUMENT APPLICATIONS



Discoid spoon

(2)Chisels

- straight, slightly curved, or bin-angle
- enamel hatchets
- gingival margin trimmers

CUTTING INSTRUMENT APPLICATIONS

straight, slightly curved, or bin-angle

The 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.

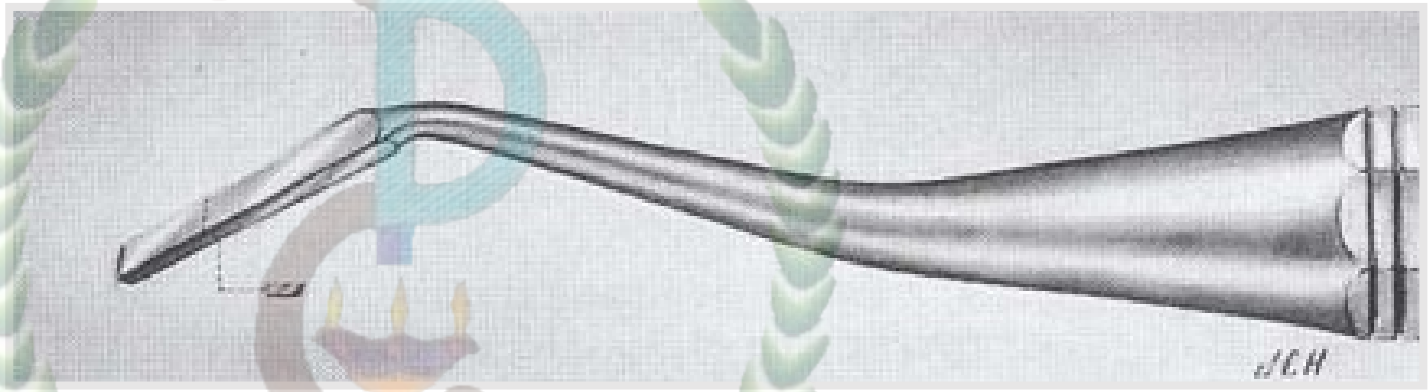
CUTTING INSTRUMENT APPLICATIONS

straight, slightly curved, or bin-angle

➡ The shank and blade of the chisel also may be slightly curved (Wedelstaedt design)

straight, slightly
curved, or bin-angle

➡ The shank and blade of the chisel also may be bin-angled .



straight, slightly
curved, or bin-angle

- The force used with all these chisels is essentially a straight thrust.
- There is no need for a right and left type in a straight chisel, since a 180-degree turn of the instrument allows for its use on either side of the preparation.

CUTTING INSTRUMENT APPLICATIONS

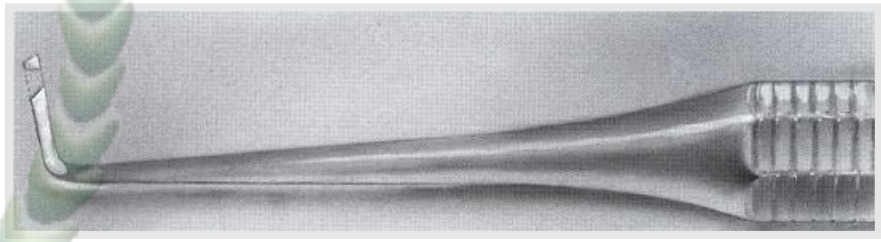
straight, slightly curved, or bin-angle

- The bin-angle and Wedelstaedt chisels have the primary cutting edges in a plane perpendicular to the axis of the handle and may have either a distal bevel or a mesial (reverse) bevel.

CUTTING INSTRUMENT APPLICATIONS

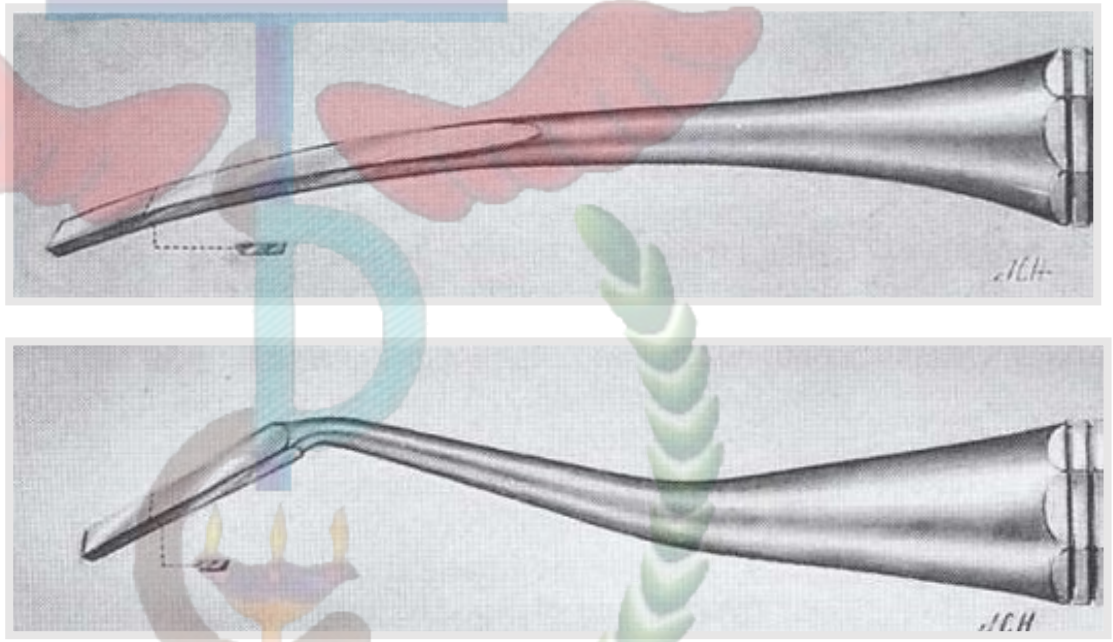
straight, slightly curved, or bin-angle

- The blade with a distal bevel is designed to plane a wall that faces the blade's inside surface



CUTTING INSTRUMENT APPLICATIONS

- The blade with a mesial bevel is designed to plane a wall that faces the blade's outside surface



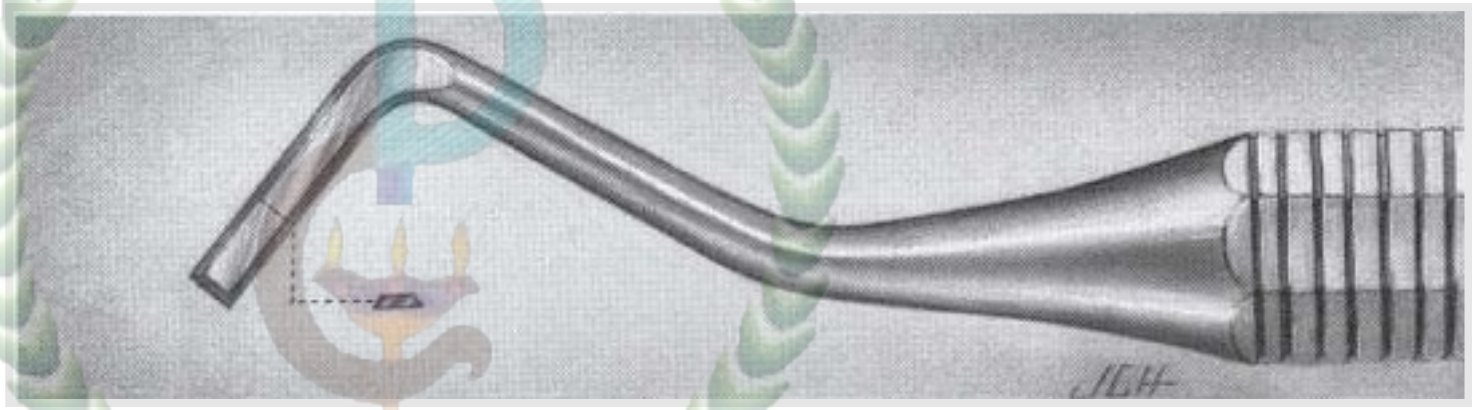
enamel hatchet

- It is a chisel similar in design to the ordinary hatchet excavator 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.

enamel hatchet

- It is used for cutting enamel and comes as right or left types for use on opposite sides of the preparation.



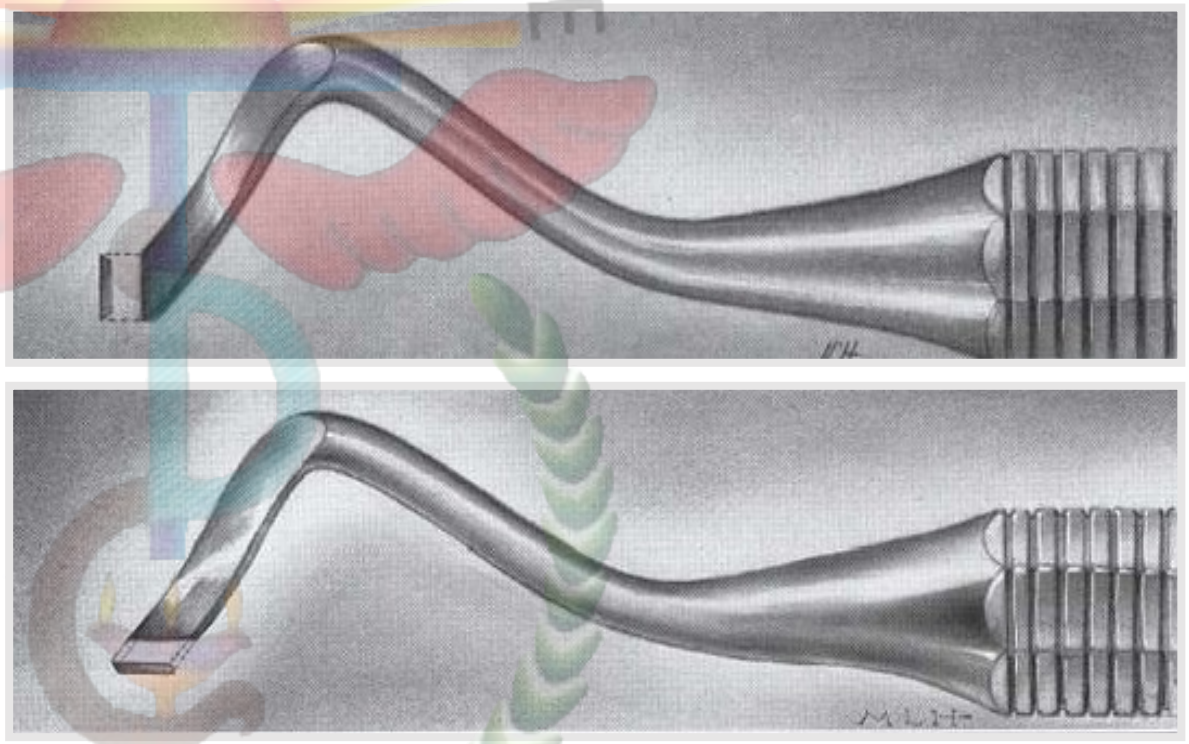
gingival margin trimmer

- Similar in design to enamel hatchet except the blade is curved.
- Right and left types:

Right pair is for either a mesial or distal gingival margins.

Left pair is for a mesial or distal margins

gingival margin trimmer



gingival margin trimmer

- When the second number in the formula is 90-100, it is used for distal gingival margins.
- When this number is 75-85, the pair is used to bevel the mesial margins.
- 100 and 75 pairs for steep margins for inlay preparation while 90-85 for slight bevel in amalgam preparations.

gingival margin trimmer

Uses of GMT :

1. Beveling of the gingival margins of proximoocclusal preparations.

2. Beveling of the axiopulpal line angle.

gingival margin trimmer

3. **Performing a gingival lock (reverse bevel), placed on the gingival seat.**

e.g. GMT 100 for the distal and GMT 75 for the mesial.

Conclusion

- The removal and shaping of tooth structure are important aspects of restorative dentistry.
- Modern high speed instruments have eliminated the need for many hand instruments for tooth preparation.
- But hand cuting instruments are still important for finishing many tooth preparations.

Take home message

- The removal and shaping of tooth structure are important aspects of restorative dentistry.
- **The cutting edge of the hand instrument should always be kept sharp**
- **proper instrument grasp must include a firm rest (support) to steady the hand during operative procedures**

Probable SAQs LAQs

- Classify Hand Cutting Instruments
- Instrument Formula
- Sharpening of Hand cutting instruments used in dentistry

Thanks for attention