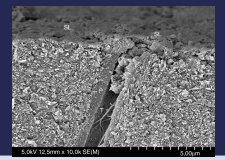
ROTARY POWERED EQUIPMENT AND INSTRUMENTS

POWERED CUTTING EOUIPMENT

* In hand instruments cutting is done by hand's forces.

1. Rotary power cutting equipment

* Produces smear plugs (Disadvantages in bonding)



* indicated for caries removal

The dental unit contains air compressor which activat rotary for cutting through burs

2. Laser Equipment

* mainly used to cut soft tissue (Gummy smile).
* new Lasers can cut hard tissue (Enamel and Dentin)

3. Air Abrasion Equipment

indicated for surface roughing (Enhances bonding)

Doesn't produces smear plug.

* Air itself cuts the tooth structure.

* Device provides alumina particles forced in high pressure → hits the tooth (Roughing the surface)

Rotary Power Cutting Equipment

Powered rotary cutting instruments, known as dental handpieces, are the most commonly used instruments in contemporary dentistry.

Evolutionary changes to handpieces

1. Changes in ergonomic design, weight, and balance have made handpieces more comfortable to use for longer periods. This improved design can minimize arm and shoulder fatigue in the clinician. Better visibility with incorporation of durable fiberoptics greatly improves the clinician's ability to see more detail with less eye strain.

* Also new handpieces came with water coolent (no need for external source)

2. Development of LED (light-emitting diode) technology has improved the quality of light to be more akin to daylight and has vastly enhanced bulb life.

3. Noise levels, which have a considerable impact on the long-term hearing health of clinicians and their staff, have been reduced. — New handpieces almost silent

4.The durability of the handpiece that undergoes frequent sterilization has been improved significantly over the years, thus avoiding material degradation. * You can sterilaize handpieces much times without being affected.

Technologies of using handpieces

Two technologies are used today for dental handpieces, and each has unique characteristics and benefits.

1. The air-driven handpiece
   - Dental unit comes with compressor.

2. The electric motor-driven handpiece
   - Slow speed handpiece used for training
   - Endodontic rotary (Niti files)

Rotary Speed Ranges for Different Cutting Applications

The rotational speed of an instrument is measured in revolutions per minute (rpm). Three speed ranges are generally recognized:

- Low speeds (<12,000 rpm),
- medium speeds (12,000–200,000 rpm), used in Labs work.
- High speeds (>200,000 rpm).

straight handpiece

At low speeds, cutting of tooth structure is a traumatic experience for the patient and the dentist. Low-speed cutting is ineffective, is time-consuming, and requires a relatively heavy force application; this results in heat production at the operating site and produces vibrations of low frequency and high amplitude. Heat and vibration are the main sources of patient discomfort.

*because of applied Pressure.

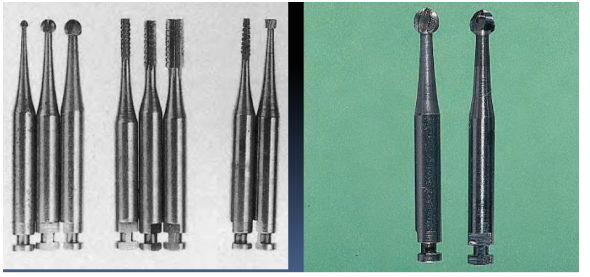
so heat may reaches the Pulp !!

Mostly low speed contra used in other uses than cutting tooth structure.

Indications:
* finishing and polishing of cavity/restoration
* Removing soft caries close to the pulp through large round bur.
  - you can use spoon excavator hand instrument for same this purpose

Mainly used

- for cleaning teeth,
- caries excavation, (especially in deep soft dentin)
- finishing and polishing procedure



At low speed

- tactile sensation is better
- cutting is ineffective
- time consuming,
- requires a relatively heavy force application

At high speed,

This speed is used for tooth preparation and removing old restorations. Other advantages are the following:

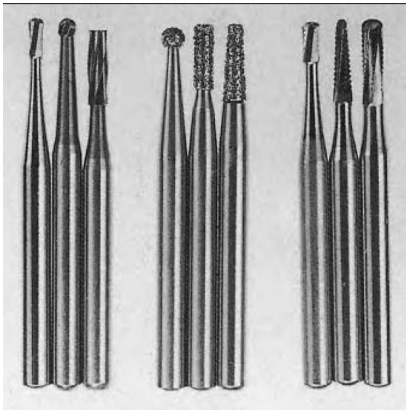
- Diamond and carbide cutting instruments remove tooth structure faster and with less pressure, vibration, and heat generation.
- The number of rotary cutting instruments needed is reduced because smaller sizes are more universal in application.

No need for large burs to remove intact tooth structure, so we usually uses few small burs that can remove caries without removing additional healthy tooth structure.

- The operator has better control and greater ease of operation.
- Instruments last longer. Because of less heat generation -
- Patients are generally less apprehensive because annoying vibrations and operating time are decreased.
- Several teeth in the same arch can be treated at the same appointment.

Mainly Used For:

- **Tooth Preparation**
- **Removing Old Restorations**



Advantages :

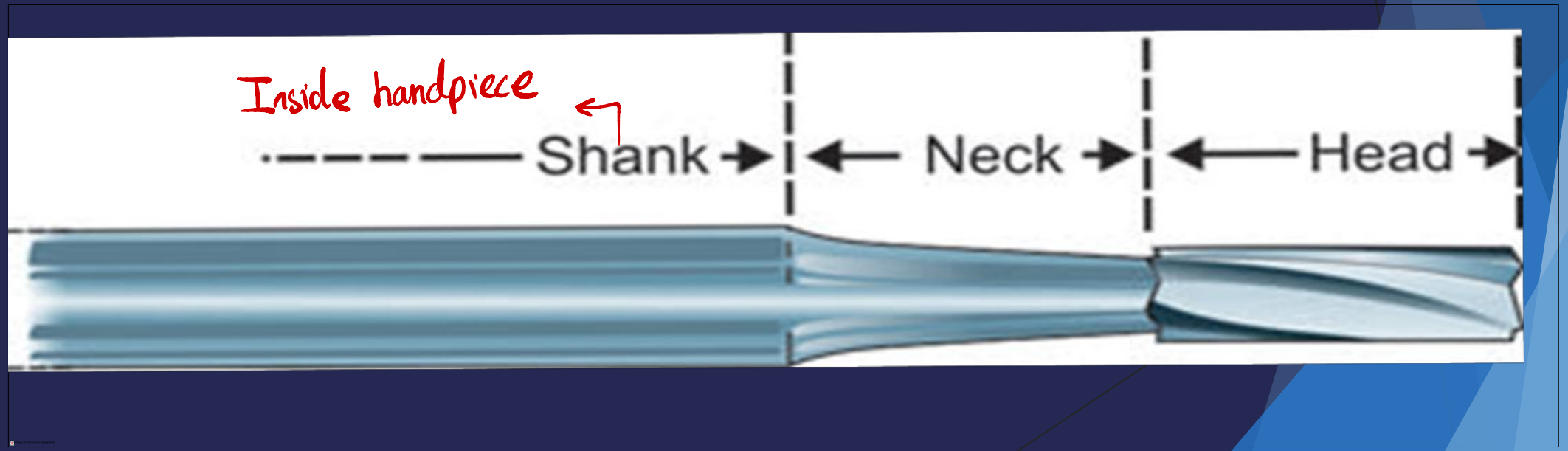
- **Efficient Cutting Can Be Attained**
- **Remove tooth structure faster with less pressure, vibration, and heat generation**
- **Operator has better control and greater ease of operation**
- **Patients are generally less apprehensive because annoying vibrations**
- **Operating time are decreased**
- **Several teeth in the same arch can be treated at the same appointment**

Rotary Cutting Instruments

Common Design Characteristics

Each instrument consists of three parts: **(1) shank, (2) neck**, and **(3) head**. Each has its own function, influencing its design and the materials used for its construction.

As there is handle in the hand instrument here the handle is the handpiece



High speed : smooth surface with rounded end. (Friction type)

Low speed : smooth with notched end (Latch type)

Shank Design

The shank is the part that fits into the handpiece, accepts the rotary motion from the handpiece, and provides a bearing surface to control the alignment and concentricity of the instrument.

Neck Design

The neck is the intermediate portion of an instrument that connects the head to the shank. The neck normally tapers from the shank diameter to a smaller size immediately adjacent to the head.

The main function of the neck is to transmit rotational and translational forces to the head. The neck dimensions represent a compromise between the need for a large cross-section to provide strength and a small cross-section to improve access and visibility.

Head Design

The head is the working part of the instrument, the cutting edges or points that perform the desired shaping of tooth structure.

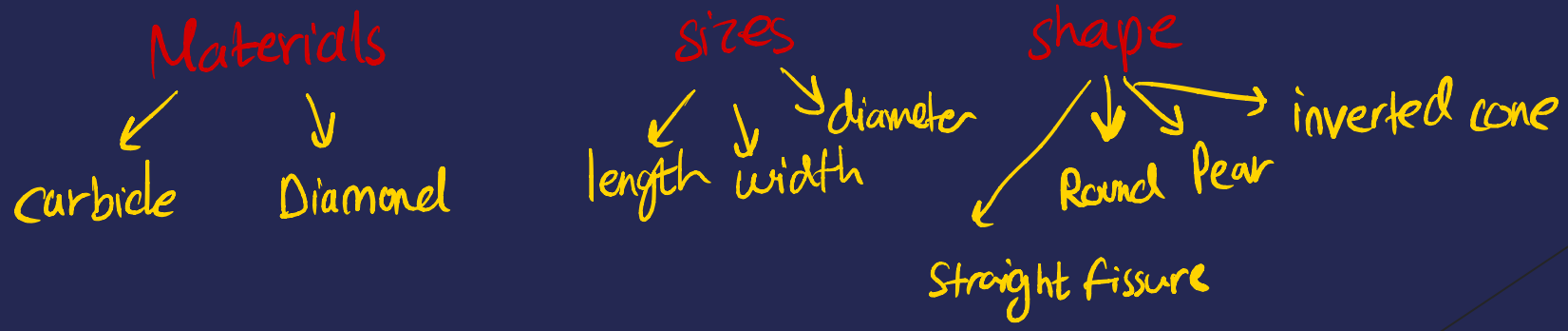
The shape of the head and the material used to construct it are closely related to its intended application and technique of use.

The heads of instruments show greater variation in design and construction than either of the other main portions.

Classification of rotary cutting instruments

Many characteristics of the heads of rotary instruments could be used for classification such as, material of construction, head size, and head shape are additional characteristics.

Most important among these is the division into **bladed instruments (dental burs) and abrasive instruments.**



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 and surgical removal of bone and instruments primarily intended for tooth preparation.

Types

Previously

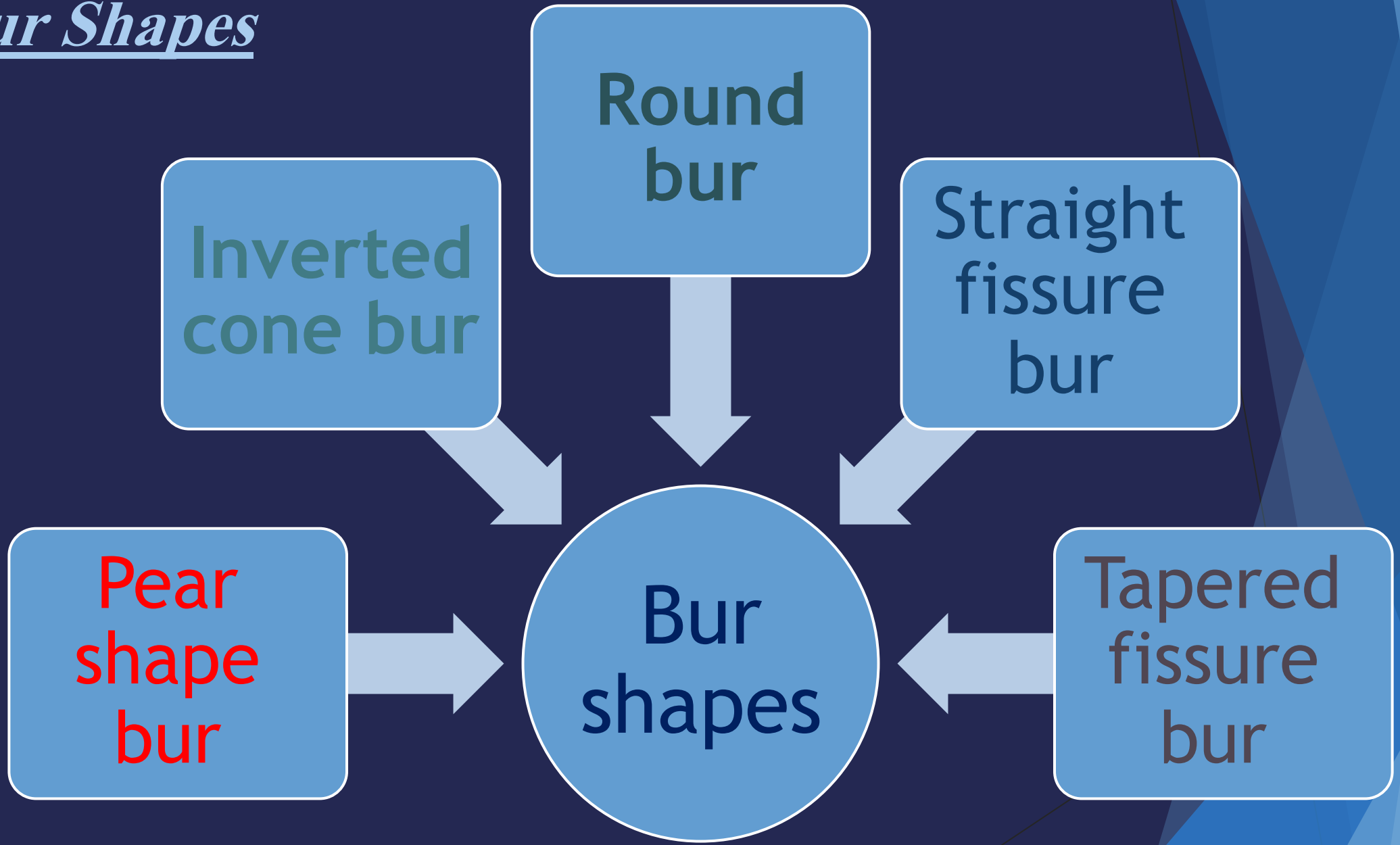
Steel burs

Carbide burs

Bur Classification Systems

Newer classification systems such as those developed by the International Dental Federation (Federation Dentaire Internationale, {FDI}) and International Standards Organization (ISO) tend to use separate designations for shape (usually a shape name) and size (usually a number giving the head diameter in tenths of a millimeter).

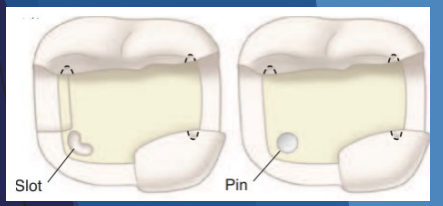
Bur Shapes


Round bur
Inverted cone bur
Straight fissure bur
Pear shape bur
Bur shapes
Tapered fissure bur

Round bur

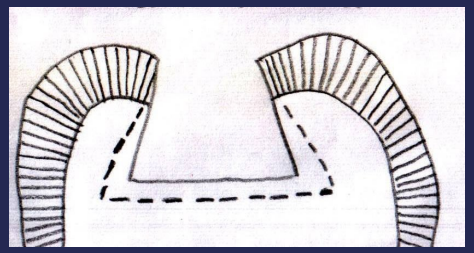
Varies in sizes and number of blades.

Retentive feature.



Is spherical. This shape customarily has been used for initial entry into the tooth, extension 2 of the preparation, preparation 3 of retention features, and caries removal. 4 Also in soft caries removal close to the pulp → Large slow speed.

Inverted cone bur



+ Straight fissure wouldn't give the conventional retentive design for Amalgam

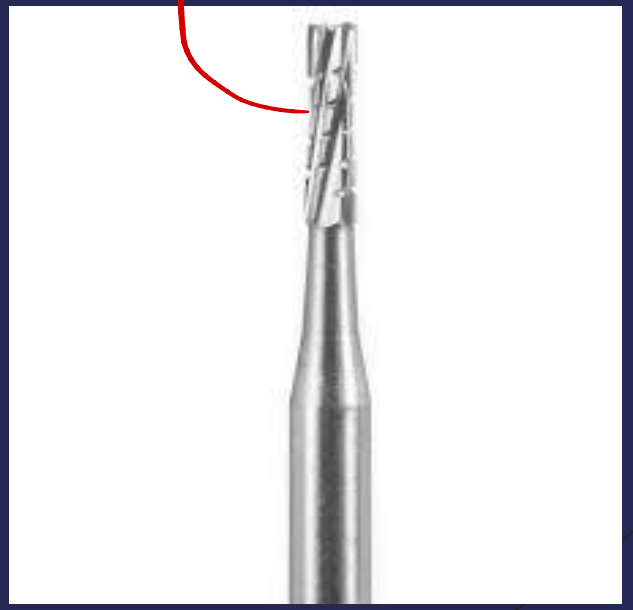
Is a portion of a rapidly tapered cone with the apex of the cone directed toward the shank of the bur. Head length is approximately the same as the diameter. This shape is particularly suitable for providing undercuts in tooth preparations.

Pear-shaped bur

Is a portion of a slightly tapered cone with the small end of the cone directed toward the shank of the bur. The end of the head either is continuously curved or is flat with rounded corners where the sides and flat end intersect. An elongated pear bur (length three times the width) is advocated for tooth preparations for amalgam.

Straight fissure bur

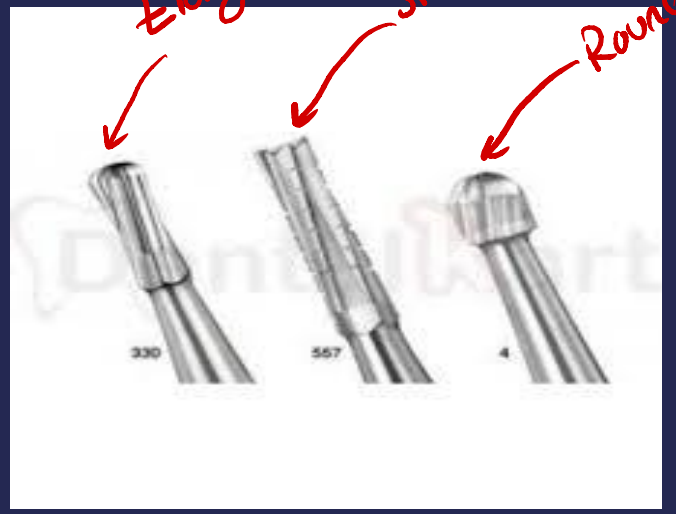
Is an elongated cylinder. Some dentists advocate this shape for amalgam tooth preparation.



Presence of cross-cutting notches increases cutting efficiency but more aggressive

Tapered fissure bur

Is a portion of a slightly tapered cone with the small end of the cone directed away from the shank of the bur. This shape is used for tooth preparations for indirect restorations.



Bur Sizes

- The number designating bur has served as a code for head design.
- The original numbering system grouped burs by 9 shapes and 11 sizes.
- The¼ and ½ designations (both very small round burs) were added later.

- Number 500 is added to indicate cross cutting
- Number 900 is added to indicate end-cutting only
- □ So no. 57 ,557 and 957 are all had the same head size



Shapes & diameters of regular carbide burs used for tooth preparation

- ***Round***

Bur size: 1/16 1/8 ¼ ½ 1 2 3 4 5 6 7 8 9 11

Diameter: 0.30 0.40 .50 .60 .80 1.0 1.2 1.4 1.6 1.8 2.1 2.3 2.5 3.1

- ***Inverted cone***

Bur size: 33½ 34 35 36 37 39 40

Diameter (mm): .6 .8 1.0 1.2 1.4 1.8 2.1

- ***Straight Fissure*:**

Bur size: 55½ 56 57 58 59 60

Diameter (mm): .60 .80 1.0 1.2 1.4 1.6

- ***Tapered fissure:***

Bur size: 168 169 170 171

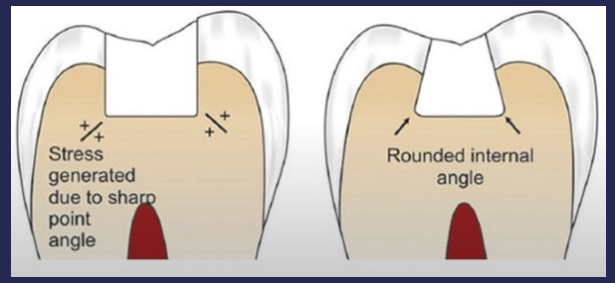
Diameter (mm): .80 .90 1.0 1.2

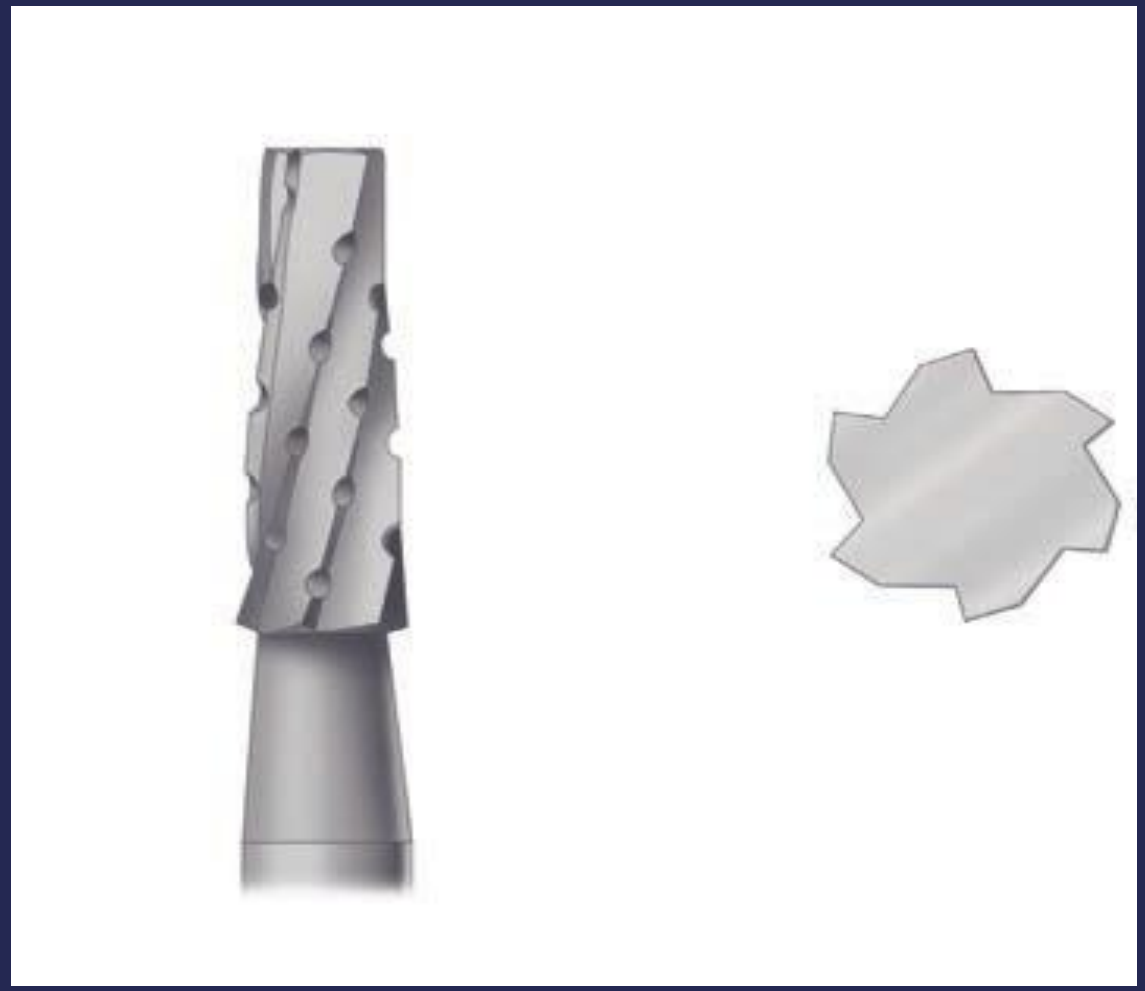
Modifications in Bur Design

Three other major trends in bur design are discernible:

- Reduced use of crosscuts → Less Agressive.
- Extended heads on fissure burs Elongated Head eg. elongated pear.
- Rounding of sharp tip angles

To free the cavity design from sharp line angles should be rounded all over the surface.

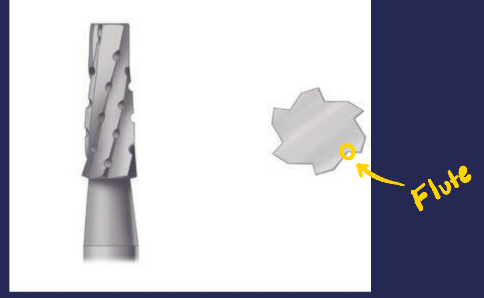




Additional Features in Head Design

Numerous factors other than head size and shape are involved in determining the clinical effectiveness of a bur design.

1. Neck diameter
2. Head diameter
3. Head length
4. Taper angle
5. Blade spiral angle
6. Crosscut size

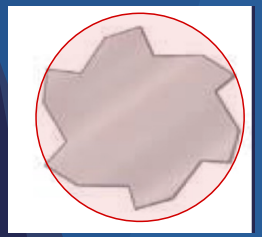


Bur Blade

The bur has blades uniformly spaced with depressed areas between them. These depressed areas are properly known as flutes.

The number of blades on an excavating bur may vary from 6 to 8 to 10. Burs intended mainly for finishing procedures usually have 12 to 40 blades. The greater the number of blades, the smoother is the cutting action at low speeds.

It is important that the bur head be as symmetrical as possible. Two terms are in common use to measure this characteristic of bur heads:

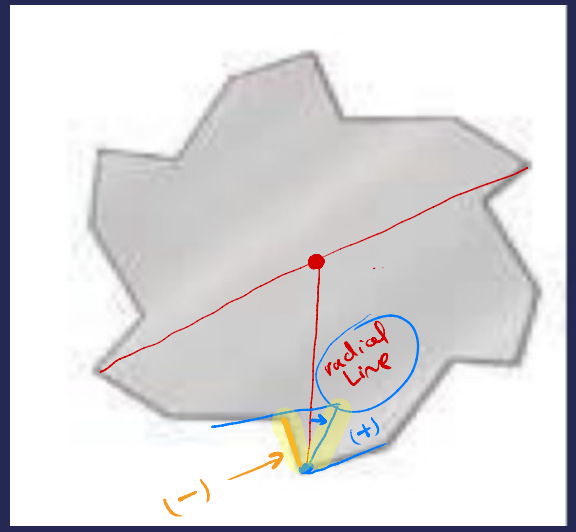


Concentricity is a direct measurement of the symmetry of the bur head itself. It measures how closely a single circle can be passed through the tips of all of the blades. It is a static measurement not directly related to function.

Runout is a dynamic test measuring the accuracy with which all blade tips pass through a single point when the instrument is rotated.

Bur Blade Design

Each blade has two sides—the rake face (toward the direction of cutting) and the clearance face—and three important angles—the rake angle, the edge angle, and the clearance angle.



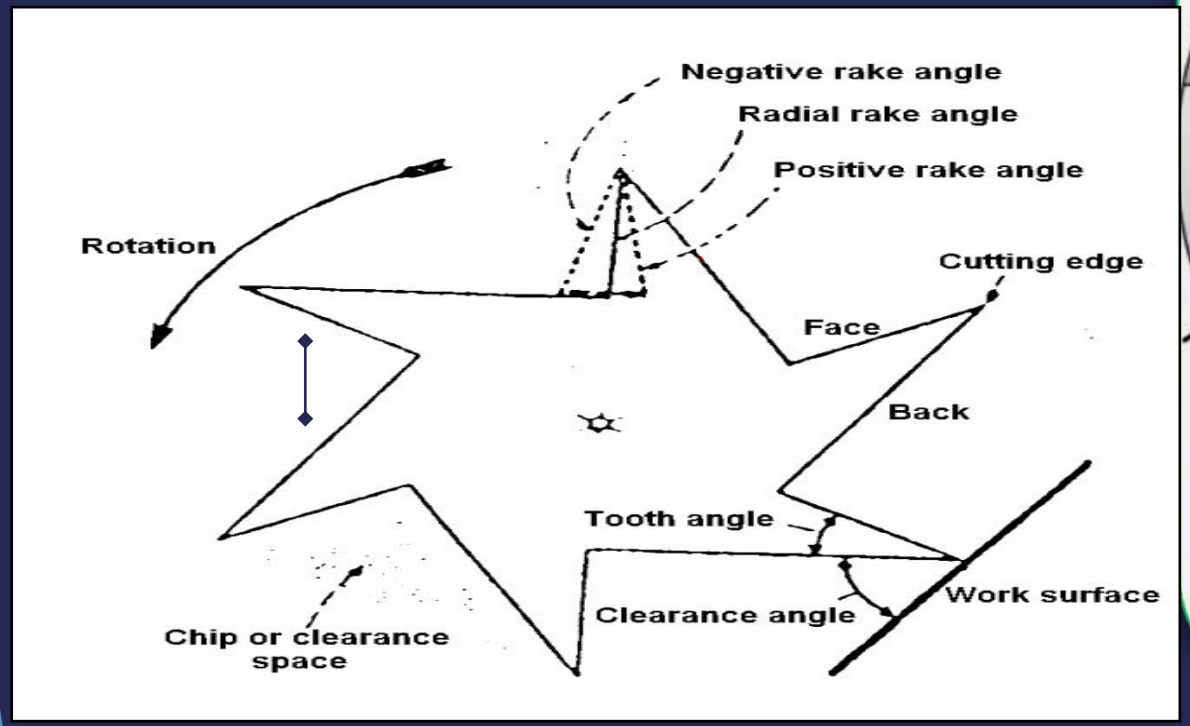
The rake angle is the most important design characteristic of a bur blade. For cutting hard, brittle materials, a negative rake angle minimizes fractures of the cutting edge, increasing the tool life.

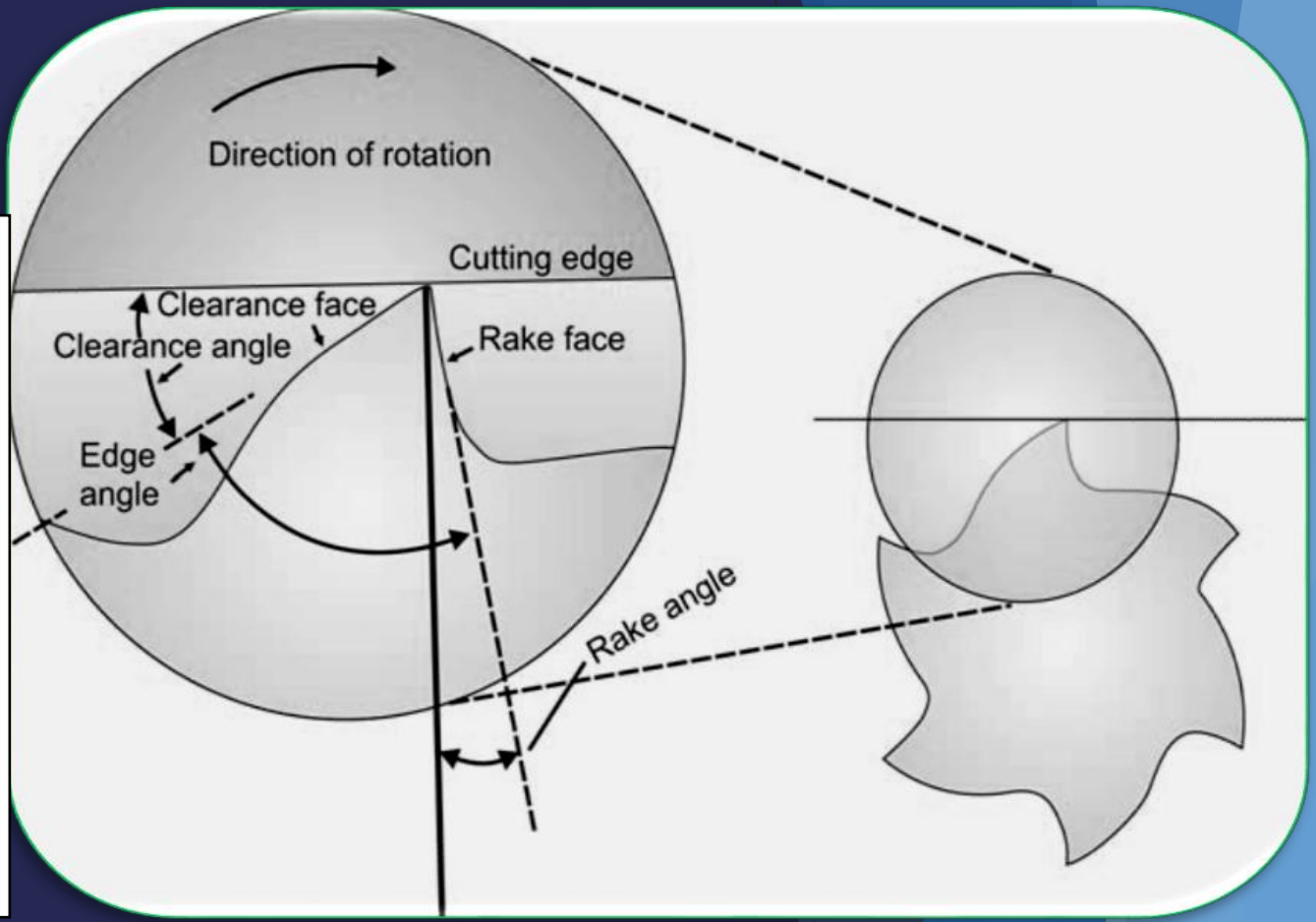
(−) minimal cutting efficiency

(+) maximum cutting efficiency

A rake angle is said to be negative when the rake face is ahead of the radius (from cutting edge to axis of bur).

Carbide burs normally have blades with slight negative rake angles and edge angles of approximately 90 degrees.


Negative rake angle
Radial rake angle
Positive rake angle
Rotation
Cutting edge
Face
Back
Tooth angle
Clearance angle
Work surface
Chip or clearance space


Direction of rotation
Cutting edge
Clearance face
Clearance angle
Rake face
Edge angle
Rake angle

DIAMOND ABRASIVE INSTRUMENTS

Terminology

- Diamond instruments consist of three parts:
- (1) A metal blank.
- (2) The powdered diamond abrasive.
- (3) A metallic bonding material that holds the diamond powder onto the blank.

Diamond burs used for

cutting

* high cutting efficiency
* coarse burs "black, green"

Finishing composite

* In order maner

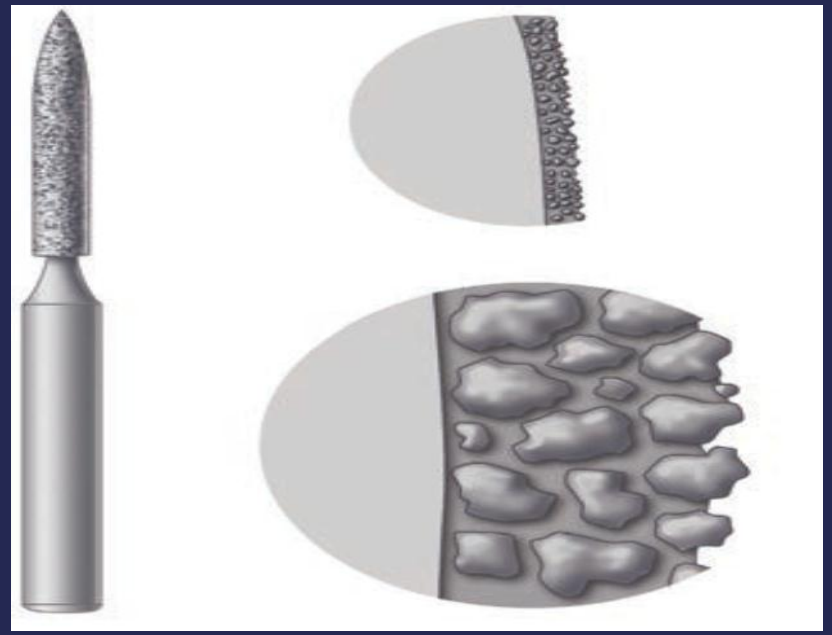
coarse → medium → Fine → very fine.

Head Shapes and Sizes

- Because of the lack of uniform nomenclature for diamond instruments, it is often necessary to select them by inspection to obtain the desired size and shape. It is essential to indicate the manufacturer when attempting to describe diamond instruments by catalogue number.

Diamond Particle Factors

Diamond particle size is commonly categorized as coarse (125–150 µm), medium (88–125 µm), fine (60–74 µm), and very fine (38–44 µm) for diamond preparation instruments. When using large particle sizes, the number of abrasive particles that can be placed on a given area of the head is decreased.



* Finishing of composite restoration by diamonds is very important as it is make it smooth. not rough

which colonize food, bacteria and Late staining.