Instrumentation of (cavity) preparation in the dental hard tissues (enamel, dentin) and filling

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Definition of tooth preparation

- Preparing the tooth for filling is called tooth (cavity) preparation

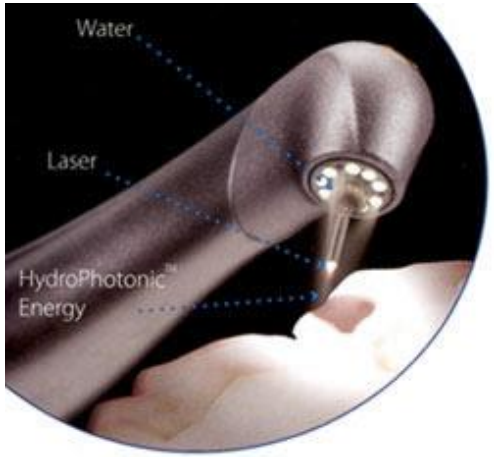
Instruments

Knownledge and rules:

Instruments for tooth preparation
(enamel, dentin and carious dentin)

Possibilities for preparation

- Hand instruments
- Rotary cutting instruments
- Oscillating instruments
- Air abrasion
- Chemical- mechanical caries removing
- Laser



Hand instruments (G. V. Black)

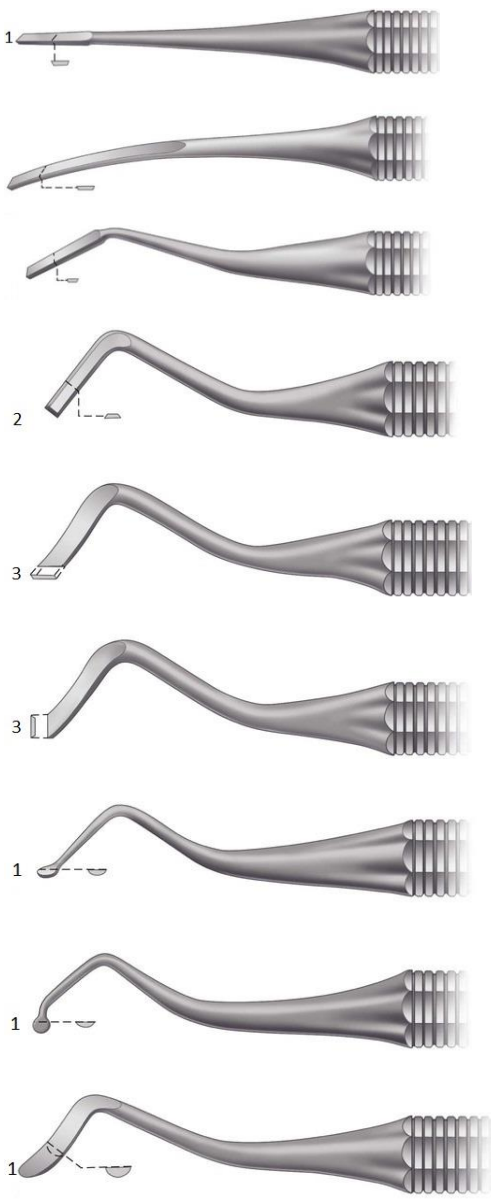
Novadays hand instruments are not used for primary preparation
Most of them are paired instruments

- Advantage: it is not caused iatrogen damage
- Disadventage: very low efficiency
- Instruments for enamel preparation:

1. Chisel (Black)
2. Hatchet
3. Gingival margin trimmer*

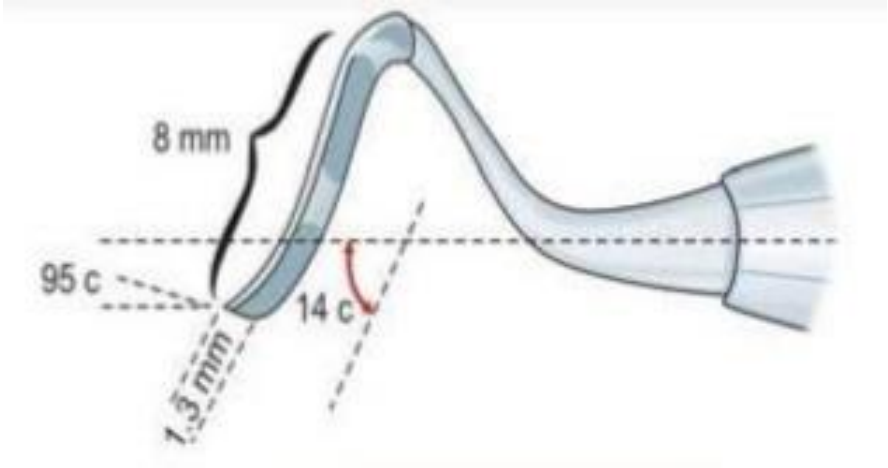
- Instruments for dentin preparation:

1. Excavator (hoes, spoon, hatchet)*



Characterisation of hand instruments(3, or 4* data)

- Width of the blade in tenths of a millimeter 1/10 (13)
- Blade lenght in millimeter (8)
- Blade angle in clockwise centigrades (14)
- Exception: gingival margin trimmer has 4 data: primary cutting edge angle in clockwise centigrades (95)

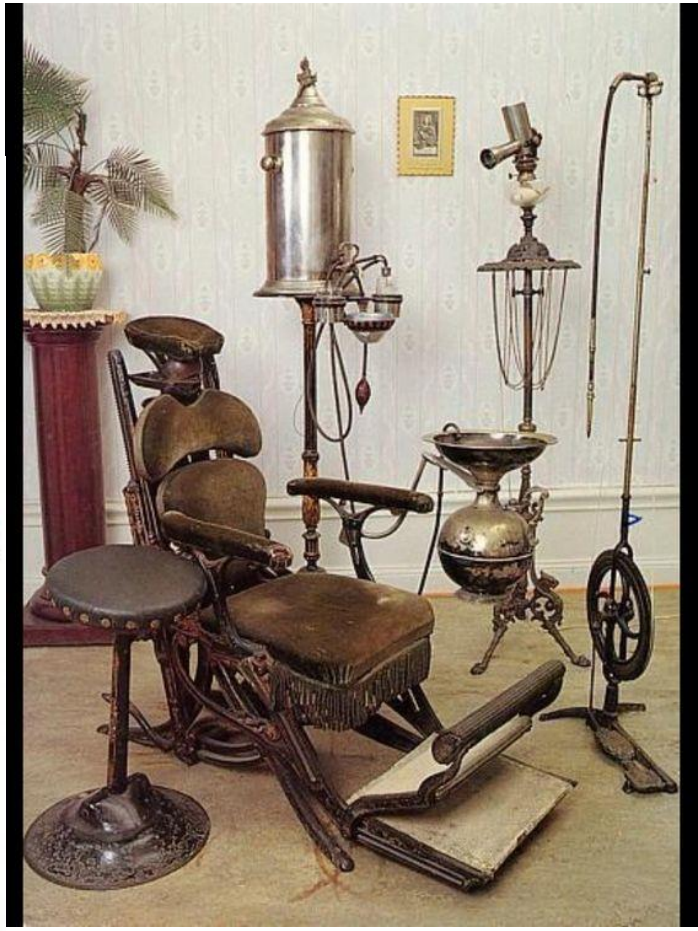


Gingival margin trimmer has 4 data:

- Width of the blade in tenths of a millimeter 1/10 (a)
- Primary cutting edge angle in clockwise centigrades (d)
- Blade lenght in millimeter (c)
- Blade angle in clockwise centigrades (b)

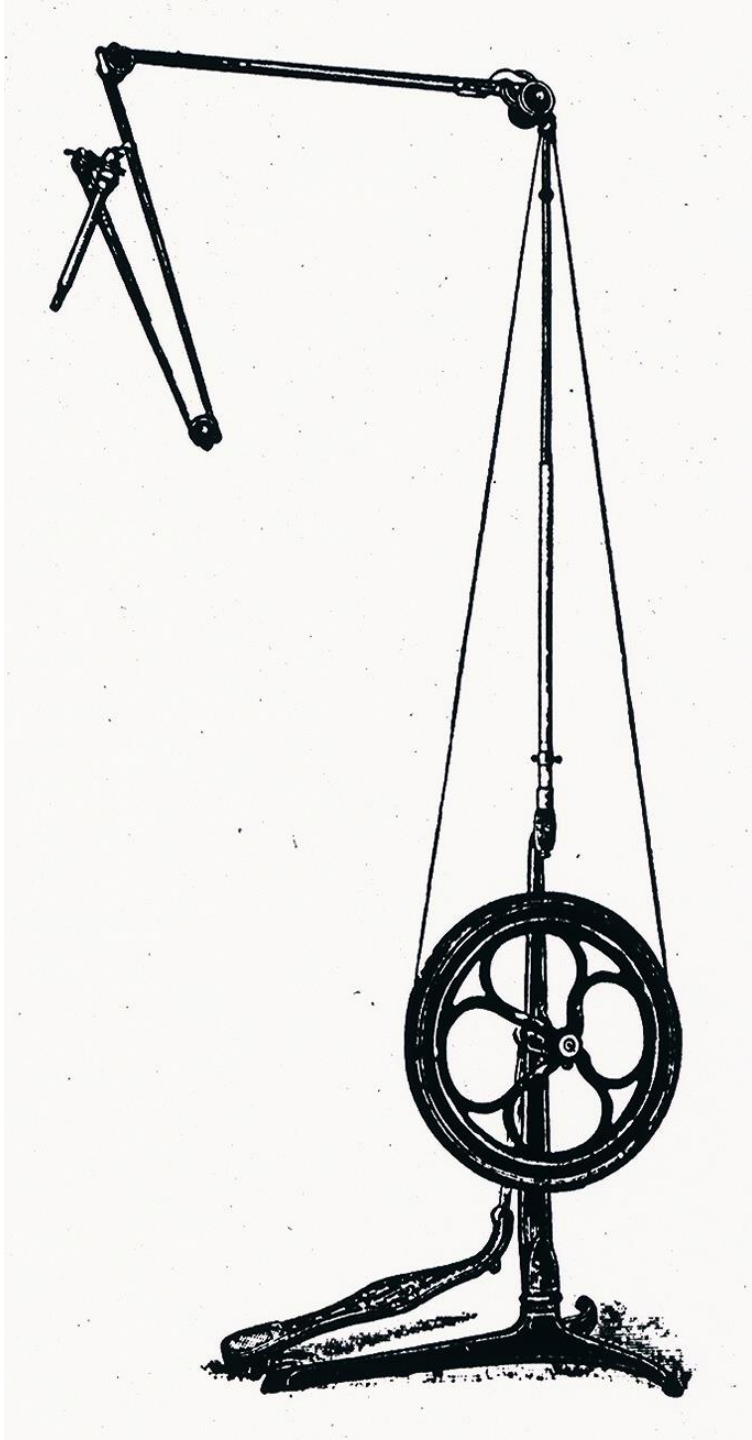
Rotary, powered instruments (foot, electric, air) drive

- Foot engine (mirellalummertz.files.wordpress.com)
- Modern dental unit (KaVo)



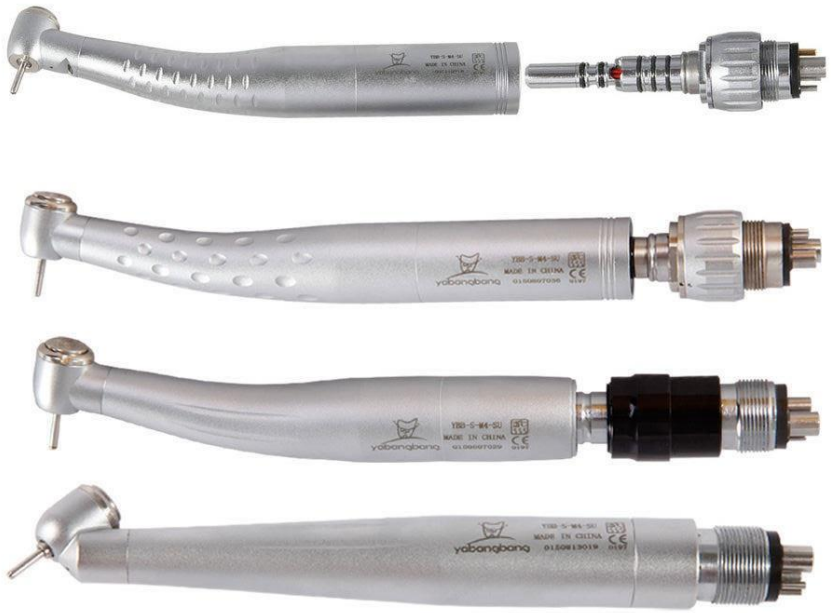
Development of rotary cutting instruments

- In driving
    1. Hand drive
    2. Foot drive (1971 Morrison)
    3. Electric drive (Doriot, micromotor)
    4. Air drive (air motor, turbina)
- In cutting instruments
    1. Stones (Arcansas)
    2. Metal (hardmetal, tungsten carbide)
    3. Diamond



Turbine, air and micromotor

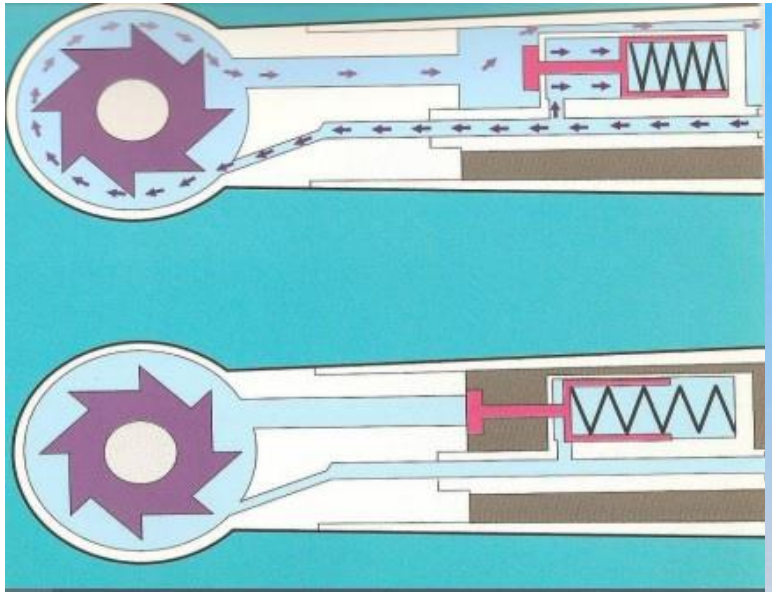
Only contra angled, by compressed air drive

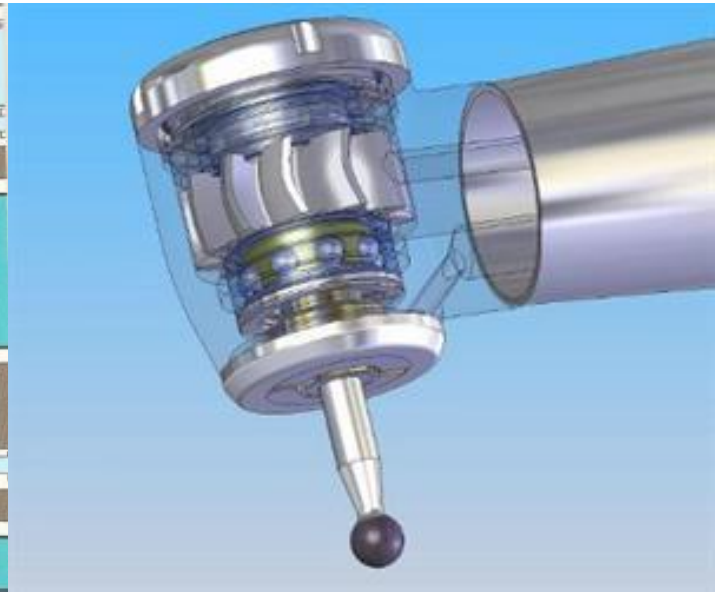


Contra angled and straight, direct current electric, or air drive

Tubine (highspeed handpiece)

- Wheels are in the head end of the contra angled handpiece
- When the turbine is in operation, some of the drive air flows into the wheels and then into the valve, opening the exhaust- air passage
- Immediatly the turbine is switched off, the valve seals the exhaust-air, preventing the aspiration of contamined aerosol





Turbine (1956)

- Free running speed: 300 000- 450 000 rpm max. (with load half of the free running speed)
- Direction of the running can’t be changed
- Low torque (speed is changing to load)
- Ball bearing (ceramics 440 000 rpm / 3,5-4 bar)

Micromotor (1966)

- Air motor (air drive) 25 000 rpm max.
- Constant rotation speed for load
- Direction of rotation can be changed

- Electric micromotor 40 000 rpm max.
- Speed for load is constant
- Direction of rotation can be changed

The rotation speed can be changed with handpieces (accelerator, reductor)

Color of the ring	Electric powered motor	Air powered motor
Blue ring 1:1	4 000- 40 000	5 000- 20 000
Red ring 1:5	20 000- 200 000	25 000- 100 000
Green ring 5:1, 7.4:1, 2.8:1	800-8 000	1 000-4 000

Handpieces

- Functions of the handpieces:

1. Transfers the power for rotating instruments
2. Holds the rotating instruments

- Type:

1. Straight handpiece (HP)
2. Contra angled (RA, FG shanked accelerator)

   Latch type, friction grip

Rotary cutting instruments (burs, diamonds, abresives)

Consist of:

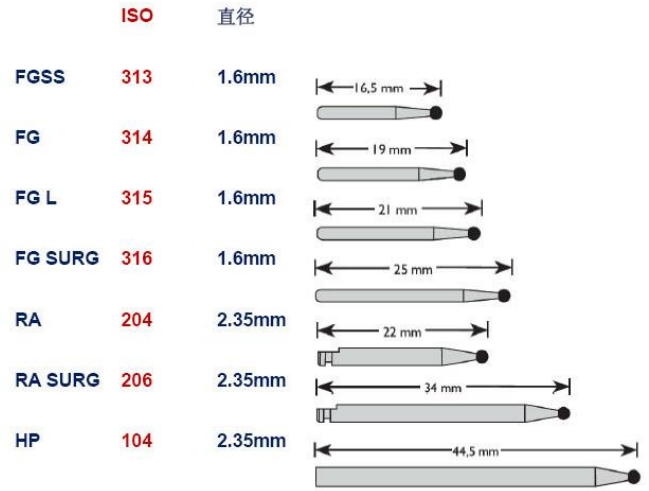
Head

Neck

Shank

Functions of head, neck and shank

- **Head** makes the preparation.
  1. Material depends on, the machined enamel, dentin, carious dentin.
  2. The shape depends of the work.
- **Neck** transmit the rotational and translational forces to head.
  1. It has tapered form, this taper can influence the visibility.
  2. Access and the strenght
- **Shank** fits into the chuck of the handpiece.
  1. Lenght, crossection and the end shape can be different.
  2. RA, FG, HP (latch type, friction grip, straight).



Head of the rotary instruments according to the materials

- Diamond, corundum
- Metal (hardmetal)
- Stones (Arcansas)
- Rubbers, polimers

Construction of the diamond bur

Metal blank that holds the diamond grits and the bonding material

- Size of the diamond grit
- Bonding material

affect the efficiency:

1. Coarse, medium for the preparation (ISO 544-ISO 524)
2. Fine for finishing (ISO 504)

Color code!

Color code:

Screw Bur

FG Color Code

Blue ring	Medium	106 - 125 µm	ISO 524	M	For removal of enamel
Black ring	Super coarse	180 µm	ISO 544	SC	For rapid gross reduction and removal of old filling
Green ring	Coarse	150 µm	ISO 534	C	For fast reduction of enamel
Green ring	Screw	150 µm	ISO 534	SC	For fast reduction of enamel
Red ring	Fine	40 µm	ISO 514	F	For finishing, crown preparations contouring and finishing composites
Yellow ring	Superfine	20 µm	ISO 504	SF	For fine polishing of composite materials

524	106 µm	60/80/90 µm*	Standard
544	150 µm	125 µm*	Super coarse
534	125 µm	106 µm*	Coarse
524	80 µm		Medium
524	60 µm		Medium
514	50 µm		Golden Burs GB
514	40 µm		Fine
514	25 µm		Fine
504	15 µm		Extra fine
494	8 µm		Ultra fine
484	4 µm		Ultra fine

Depending on the shape and size of the instruments, the grit size may differ from the specified value *
Sizes quoted within the site are based for guidance only on Std 106 µm

Head of the rotary cutting instruments

Metal bur has bladed cutting edges.

- Steel bur: at low rpm cut the dentin well, it is not good for enamel.
- Carbide bur (tungsten carbide): performs better at all speed, cut dentin and enamel too.

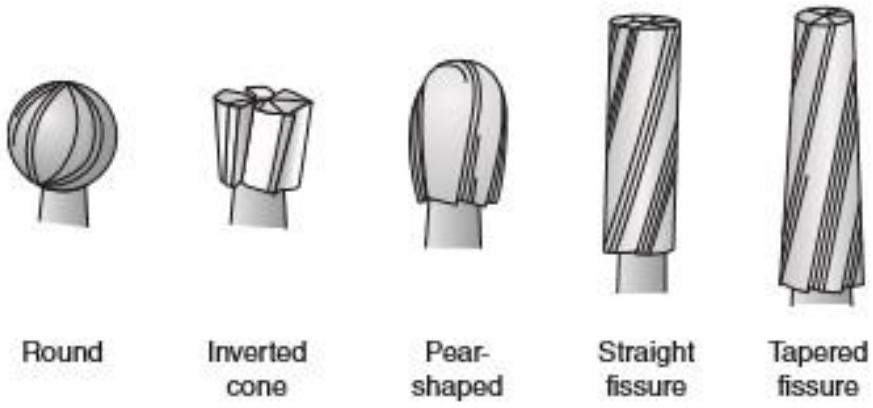


Fig. 6-19 Basic bur head shapes. *(From Finkbeiner BL, Johnson CS: Mosby's comprehensive dental assisting. St. Louis, 1995, Mosby.)*

Construction of the metal bur

- Number of the blades: the more cutting edges give the smoother surface.
    1. Excavating bur(6, 8, 10 blades)
    2. Finishing bur (12, 16, 18, 30 blades)
- Direction of blades:
    1. Straight or axial
    2. Spiral

Both can be manufactured with or without crosscuts.

Shape of the burs and diamonds

- Round
- Fissure
- Tapered
- Pear
- Flame
- Inverted cone
- etc.

Size of the bur

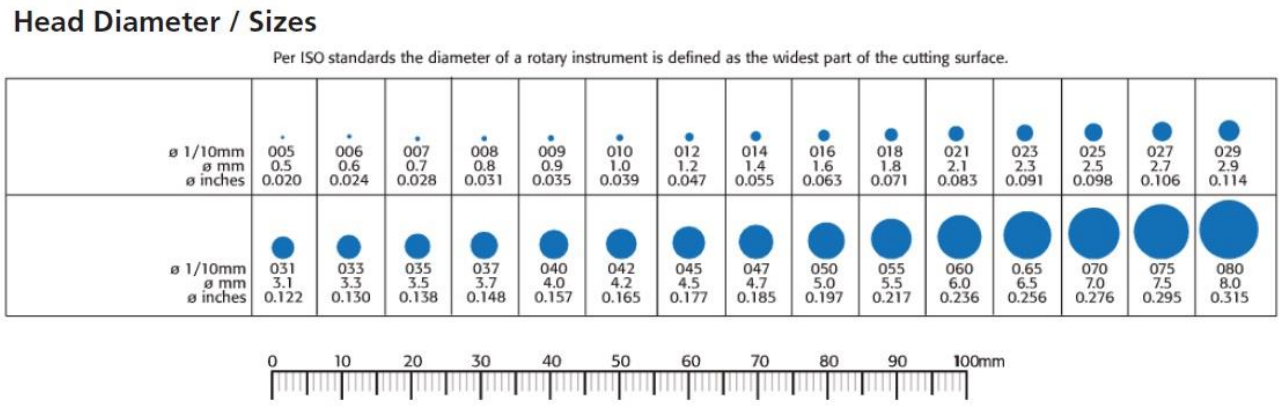
- The largest diameter of the head in 1/10 mm.

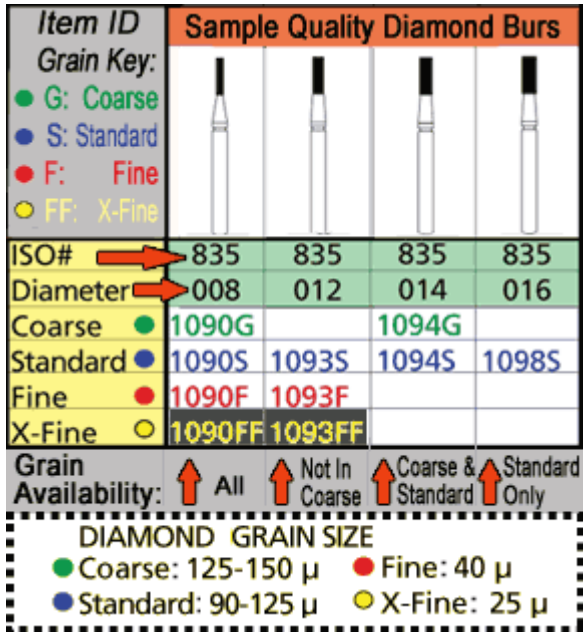
  005 diameter- 0.5 mm

  010 diameter- 1 mm

  016 diameter- 1.6 mm

  023 diameter- 2.3 mm





The bigger is the diameter of the bur, the lower speed can we use, to achieve the suitable effect (output)

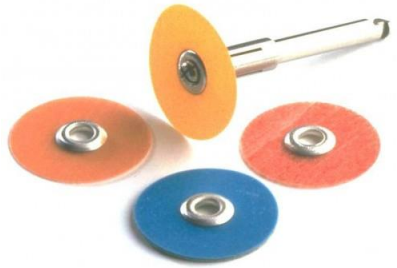
Recommendation for device selection

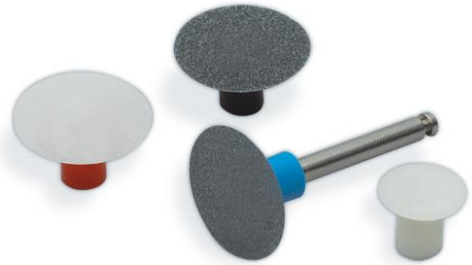
- Speed
- Burs
  - Material
  - Shape
  - Size

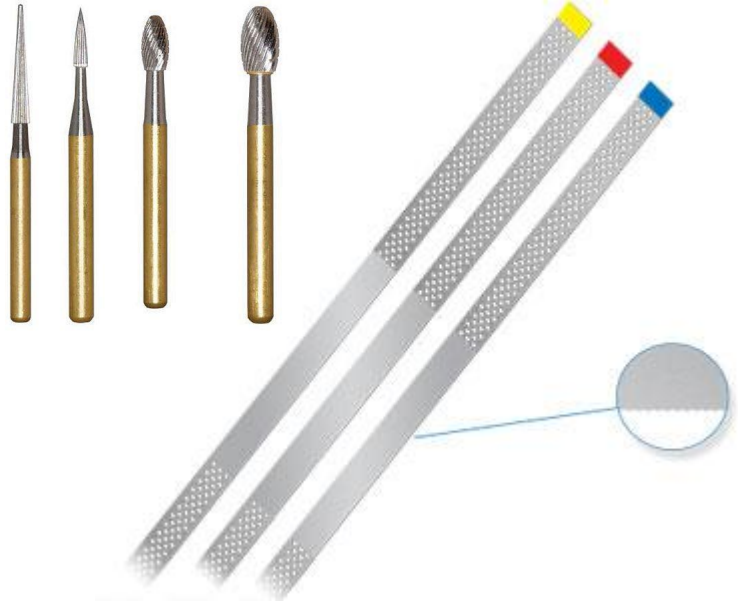
  for preparation (enamel, dentin)

  for finishing, polishing

Finishing, polishing (the composite and amalgam filling)



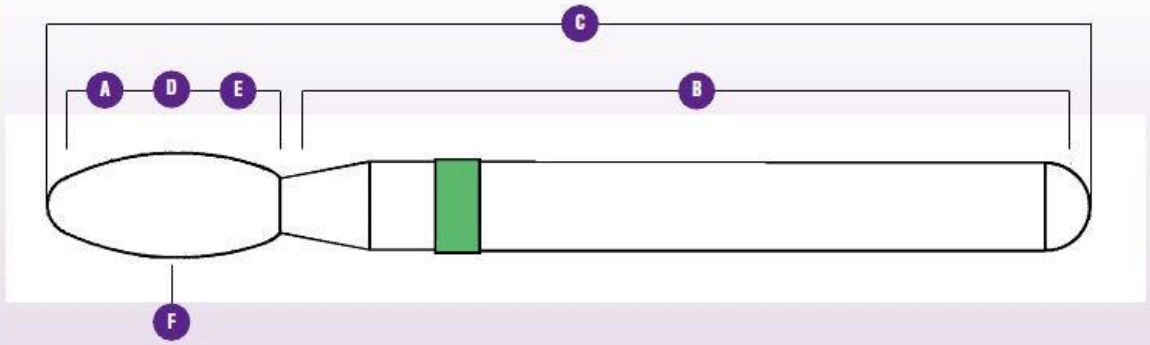




International standard for selection of burs (ISO 6360)

A. Material of the head (3 digits)
B. Shank type (2 digits)
C. Overall lenght (1 digit)
D. Shape (3 figures)
E. Grit (3 figure)
F. Largest head diameter (3 digits)

Guide to ISO 6360 numbering system for diamond instruments in this catalog

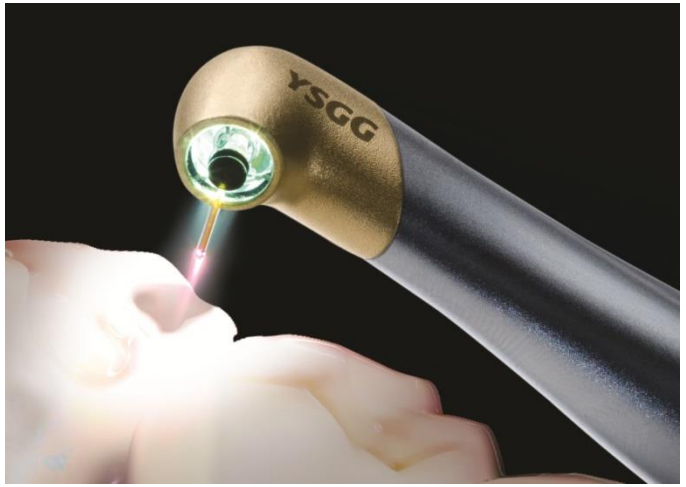


806 314 277 534 023

A Material of Working Part	B Shank Type	C Overall Length	D Shape	E Grit	F Nominal Size (ISO 2157), Largest head diameter in 1/10 mm
Example: 80 = Diamond 6 = Plated Metal Binding	**Example:** 31 = FG	**Example:** 4 = Standard	**Example:** 277 = Football	**Example:** 534 = Coarse	**Example:** 023 = 2.3 mm
Other Examples:	20 = CA or RA	2 = Miniature 3 = Short 5 = Long 6 = Extra Long	001 = Miniature 010 = Inverted Cone 108 = Cylinder 170 = Cone	544 = Super Coarse 524 = Medium 514 = Fine 504 = Very Fine 494 = Ultra Fine	008 = 0.8 mm 010 = 1.0 mm 014 = 1.4 mm 035 = 3.5 mm

Oscillating, ultrasonic, abrasion, laser

- Alternative, minimal invasiv instruments



Preparation for direct restorations

- Primer preparation: turbine, micromotor (accelerator) 170 000- 250 000 rpm
  - Material: diamond ISO 806
  - Shank and lenght: FG ISO 314
  - Shape: fissure, round etc…. ISO 141, ISO 001, etc…
  - Grit: medium (blue) ISO 524
  - Size: depends on: ISO 008- ISO 016

- Removing of carious dentin: micromotor (blue ring, green ring) 1 000- 6 000 rpm
  - Material: steel, hard metal ISO 310, ISO 500
  - Shank: RA ISO 204
  - Shape: round ISO 001
  - Diameter/ size: different ISO 008- ISO 035

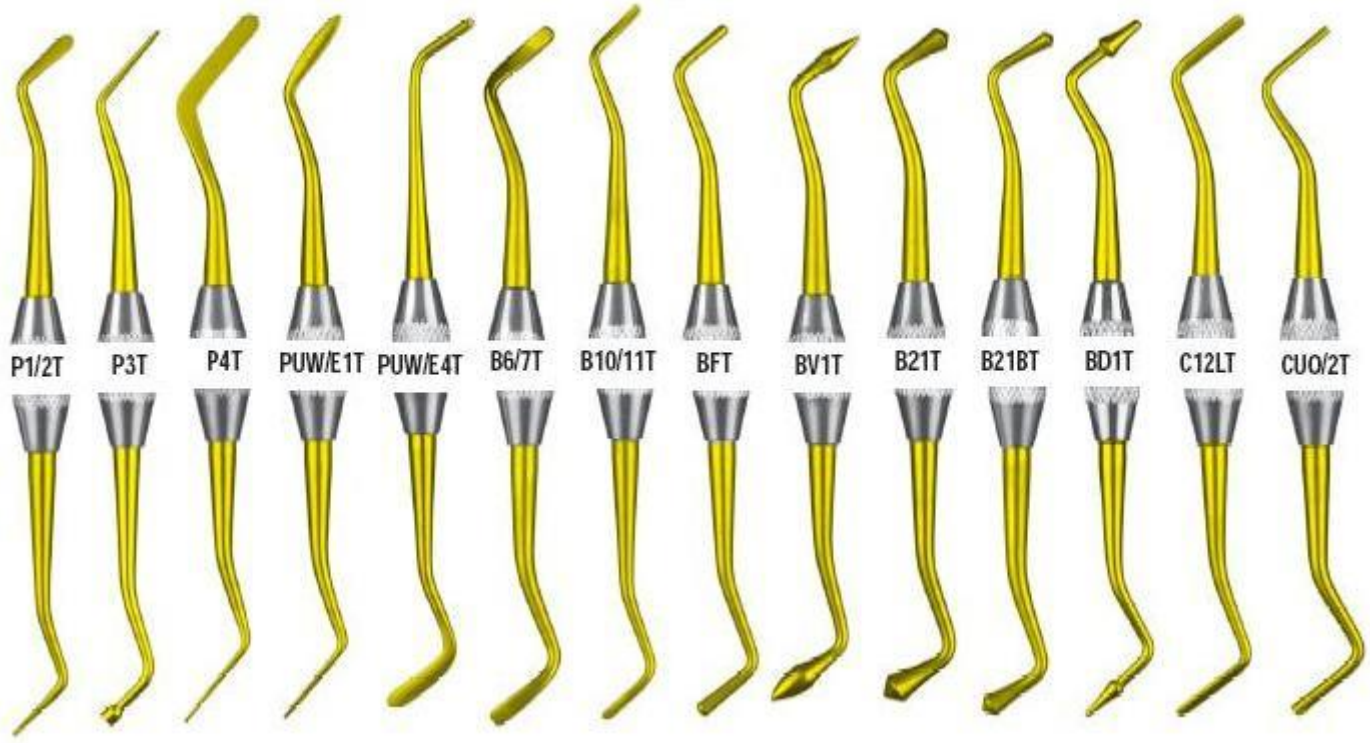
- Finishing: micromotor (accelerator) 10 000- 40 000 rpm
  - Material: diamond, hard metal ISO 806, ISO 500
  - Shank: FG ISO 314
  - Shape: lots
  - Grit: (diamond) fine- ultrafine ISO 514, ISO 504 ISO 494 (hard metal) 16-18 cutting edges

Removing of an old filling

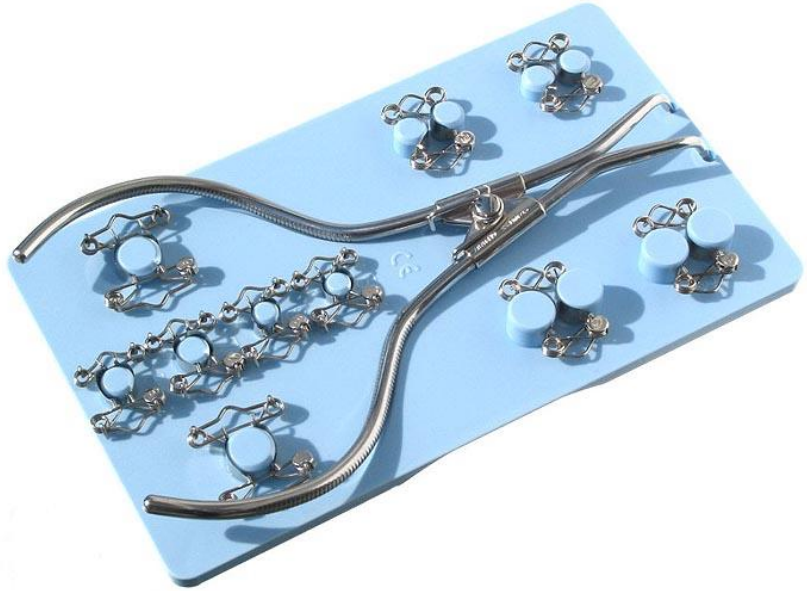
- Composite: turbine, micromotor (accelerator) 170 000- 250 000 rpm
  - Material: diamond ISO 805
  - Shank: FG ISO 314
  - Shape: fissure, round etc…. ISO 141, ISO 001, etc…
  - Grit: medium (blue) ISO 524
  - Size: different: ISO 008- ISO 016
- Amalgam: turbine, micromotor (accelerator) 170 000- 250 000 rpm
  - Material: carbide bur ISO 500
  - Shank: SG ISO 314
  - Shape: fissure, round etc…. ISO 141, ISO 001, etc…
  - Size: different: ISO 008- ISO 016

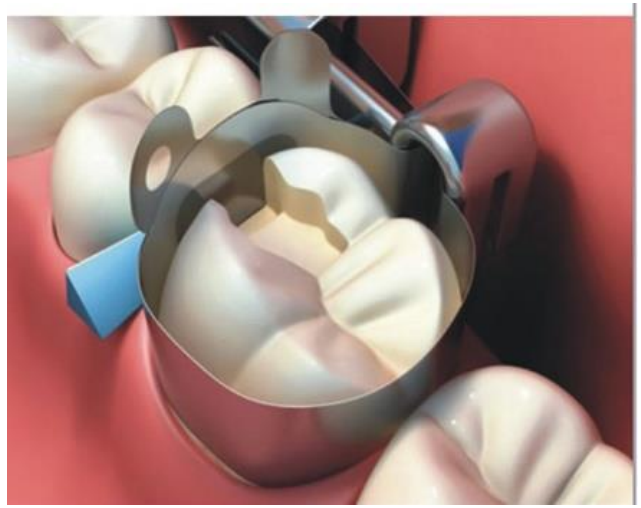
Rubber dam, Exhaustor!!!!!!

Hand instruments for anatomical shaping



Matrix systems





Matrix systems

Thank you!