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Rotary Instruments in Tooth Preparation-A Review

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ABSTRACT: Rotary instruments are essential tools in modern restorative dentistry, playing a pivotal role in tooth preparation for a wide range of procedures, including cavity restorations, crown and bridge placement, and veneer applications. These instruments, including dental burs, diamonds, and other rotary cutting devices, attach to high-speed or slow-speed hand pieces to efficiently remove, shape, and refine tooth structure. The versatility and precision of rotary instruments allow clinicians to effectively prepare the tooth while minimizing damage to surrounding healthy tissue. Burs, the most commonly used rotary instruments, are available in diverse shapes, sizes, and materials such as steel, tungsten carbide, and diamond, each designed for specific tasks. This article provides a comprehensive overview of rotary instruments used in tooth preparation. It highlights the importance of choosing the appropriate instrument for each step of the tooth preparation process to ensure optimal functional and aesthetic outcomes, while also considering factors like material properties, speed, and precision. The article aims to emphasize the critical role of rotary instruments in enhancing the quality, safety, and success of restorative dental procedures.

KEY WORDS: carbide burs, diamond points, grit size, colour coding

I. INTRODUCTION

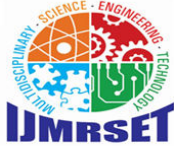
Primary rotary instruments are carbide burs which reduce the tooth structure or diamond points which reduce a tooth surface. Burs classified as cutting instrument; Diamond points are abrading instruments.

Generally, diamond Rotary instruments are preferred for preparing teeth for fixed prosthodontics. They are easier to control than burs because of increased tactile sense. However, for certain preparations a combination of diamonds and burs is needed to incorporate all the retentive and resistance features required for that restoration. An example would be a preparation required in pins and occasionally, grooves.¹

Diamond Rotary instruments are manufactured to produce three abrasive qualities coarse, medium and fine based on tinkered diamond particle grit size. The instrument with the largest diameter and the coarsest surface is intended to reduce the tooth structure most efficiently; a fine particle diamond point is designed for finishing prepared surfaces. The medium particle surface produces a prepared surface texture between the coarse and fine particles.²

Tinkered Diamond particle grit size is mainly categorized tooth preparation instruments with colour coding as one of the following. [Figure-1]

- Coarse- grit diamond bur (125-150 μ) Green.
- Medium- grit diamond bur (88-125 μ) Blue.
- Fine-grit diamond bur (60-74 μ) Red.
- Very fine - grit diamond bur (38-44 μ) Yellow.³



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Fig-1-colour coding of burs based on grit size

Cutting instruments are kept in motion to control the instrument and produce smoother reductions development of the tactile sense and light touch at high speed also provide greater control.¹

Parts of diamond bur [Fig-2]



Parts of diamond bur [Fig-2]

1-shank,2-neck,3-head [Fig-2]

Based on shank design burs are classified as

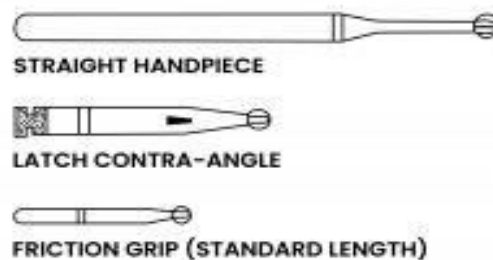


Fig-3



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The dentist should be familiar with the dimensions of diamond points and burs. Reduction of tooth structure is in proportion to the size of the cutting instrument so an efficient instrument should be used to save effort and energy during to preparation. ¹

DIMENSIONS OF NONDENTATE TAPERED FISSURE BURS

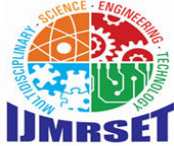
Bur	Tip diameter(mm)	Base diameter(mm)	Cutting length	Inclination per side
169	0.54	0.9	4.2	2.5
169L	0.50	0.9	5.2	2.0
170	0.56	1.0	4.2	3.0
170L	0.58	1.0	6.0	2.0
171	0.76	1.2	4.2	3.0
171L	0.78	1.2	6.0	2.0
172	1.14	1.6	4.4	3.0
172L	1.18	1.6	6.0	2.0
H375012	0.8	1.2	7.0	3.0
H375-014	0.8	1.4	8.0	2.0
7702-010	0.7	1.0	5.2	2.0
7713-012	0.8	1.2	5.2	2.0
7204-014	0.6	1.4	9.0	2.5
7205-016	0.7	1.6	9.0	3.0

Table-1[Source- Herbert T Shillingburg, Richard Jacob, Susan E Bracket. Fundamentals of tooth preparation for cast metal and porcelain restorations.]⁴

DIMENSIONS OF DIAMOND STONES AND DIAMOND/BUR COMBINATIONS

Bur	Tip diameter(mm)	Base diameter(mm)	Cutting length	Inclination per side	Convergence angle of tip
Round-end tapered diamond	1.0	1.6	8.0	2.0	-
Flat-end tapered diamond	1.0	1.6	8.0	2.0	-
Long needle diamond	0.5	1.2	9.0	3.0	-
Short needle diamond	0.5	1.2	6.0	3.5	-
Small wheel diamond	-	4.0	1.4	-	-
Torpedo diamond	-	1.0	6.0	-	60
Torpedo bur	-	1.0	6.0	-	60
Flame diamond	-	1.0	8.0	-	12
Flame bur	-	1.0	8.0	-	12


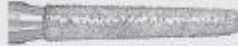

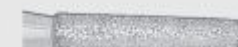



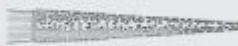

Table-2[Source- Herbert T Shillingburg, Richard Jacob, Susan E Bracket. Fundamentals of tooth preparation for cast metal and porcelain restorations.]⁴



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Rotary instruments for tooth preparations

Shape	ISO no.	Silhouette	Use
Round-end tapered diamond	6856- 016		Depth orientation grooves Occlusal reduction Functional cusp bevel
Round-end tapered finishing diamond	8856- 016		Occlusal finishing Functional cusp bevel finishing
Flat-end tapered diamond	6847- 016		Axial reduction (MCR, allceramic crown) Shoulder (MCR, allceramic crown)
flat end tapered finishing diamond	8847KR -0 6		Axial wall finishing (MCR,all -ceramic crown) Radial shoulder (MCR , all - ceramic crown)
Tapered torpedo diamond	6877K -014		Axial reduction Chamfer finish line
Tapered torpedo finishing diamond	8 8 7 7 K - 0 1 4		Axial wall finishing Chamfer finishing
Short needle diamond	8 5 2 - 0 1 2		Initial proximal reduction (posterior teeth)
Long needle diamond	8 5 0 - 0 1 2		Initial proximal reduction (anterior teeth)
Small foot ball shaped diamond	6 3 7 9 - 0 2 1		Lingual reduction (anterior teeth)



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Small foot ball shaped finishing diamond	8 3 7 9 - 0 2 1		Lingual reduction finishing (anterior teeth)
Flame diamond	8 6 2 - 0 1 0		Proximal flare Gingival bevel
Flame finishing diamond	8 8 6 2 - 0 1 0		Flare and bevel finishing
Tapered fissure bur	1 7 1 L - 0 1 2		Seating groove Proximal groove (posterior teeth) Offset Occlusal shoulder Isthmus Proximal box Smoothing and finishing Occlusal and incisal bevels
Tapered groove alignment fissure burs	1 7 0 L - 0 1 0 1 6 9 L - 0 0 9		Initial groove alignment Angle so proximal boxes Smoothing and finishing Occlusal and incisal bevels

Table-3 [Source: Shillingburg HT, Hobo S, Whittset LD, Jacobi R, Brakett SE. Fundamentals of fixed Prosthodontics. 3rd ed. Pg no 179-90.]²

Some commonly used instruments

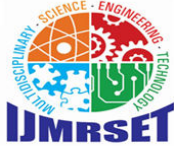
DIAMOND BURS

FLAT END TAPERED DIAMOND CYLINDER[SHOULDER BUR] [Fig- 4]

This is used for bulk axial and occlusal reduction and shoulder preparation on PJC and PFM tooth preparations. End cutting burs are also used to develop and lower shoulder preparation. They are kept perpendicular to the plane being reduced.



Fig-4



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STRAIGHT CYLINDER DIAMOND WITH A TAPERED POINT [Fig-5]

A suitable instrument for chamfer preparation is a tinker diamond ; a straight diamond with a tapered point this tapered point creates a chamfer with great control than round end tapered diamond. It is usually indicated for molars , not premolars and incisors.



Fig-5

ROUND END TAPERED DIAMOND CYLINDER [Fig-6]

Round end tapered cylinders are available in various sizes they are used for axial and occlusion reduction and developing chamfer margins. Less than half the diameter of the tip is used for Chamfer margins. cutting to a depth greater than half the diameter of the tip produces a shoulder margin. tapered cylindrical diamonds also have tendency to creep apically, this proclivity must be recognized and avoided



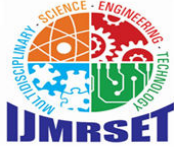
Fig-6

ROUND DIAMOND BUR [Fig-7]

Round diamond facilitate establishing depth grooves before reduction they vary in size and are measured to determine the cut depth. Round diamonds and burs are true and do not tend to toward apical migration. It is possible to delineate margins and preparations precisely and accurately using this technique. Round diamonds are also used to establish rest seats and reduce lingual surface of anterior teeth.



Fig-7



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ROUND DIAMOND WHEELS (Donut) [Fig-8]

Round wheels are gross reduction instruments and also used in anterior teeth lingual reductions.



Fig-8

OBLONG DIAMONDS (FOOTBALL) [Fig-9]

Variously shaped football diamonds are available for lingual reduction of anterior teeth they are available in sizes that uniformly reduce the fossae.



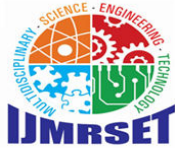
Fig-9

THIN TAPERED DIAMOND CONES (NEEDLE) [Fig-10]

Thin tapered cones are used for proximal slices to isolate teeth from adjacent teeth. They tend to lose their sharpness sooner than coarse diamonds and are replaced frequently.



Fig-10



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TAPERED OBLONG DIAMOND(FLAME) [Fig-11]

Small flame shaped diamonds are used in bevel placement there are many multifluted flame shaped carbides that have identical functions.



Fig-11

CARBIDE BURS

TWELVE FLUTED CARBIDE BUR [Fig-12]

Twelve fluted carbide burs are specifically matched with different sized Tinker diamonds and give a highly finished surface to a preparation. The greater the number of blades on a bur the smoother the cut. Also, blades in a spiral or diagonal to the shaft produce a smoother surface than blades parallel to the instrument shaft. The slightly spiral multilayered twelve fluted carbide bur is a smooth cutting instrument



Fig-12

CROSS CUT FISSURE BURS [Fig-13]

Cross cut fissure come in varying sizes both tapered and cylindrical the tapered burse are used for groove Placement in three quarter crowns, flutes and faciliating Grooves in complete gold crowns. They work efficiently in sectioning Gold restorations removed clinically.



Fig-13



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PLAIN FISSURE BURS [Fig-14]

Plain fissure burs cut smoothly and come in a variety of sizes both tapered and cylindrical. They may also be used for groove placement and finishing of preparations. The long tapered variety such as the 169L can be used in lieu of the narrow tapered diamonds in proximal slices on teeth.



Fig-14

II. CONCLUSION

Rotary instruments play a crucial role in modern tooth preparation, offering a variety of benefits that enhance both the efficiency and precision of dental procedures. Their ability to quickly remove tooth structure, shape cavities, and create smoother surfaces has revolutionized restorative dentistry. The selection of appropriate rotary instruments, including burs and handpieces, along with an understanding of their specific functions, allows for more controlled and predictable outcomes. Despite their advantages, it is essential for clinicians to be mindful of factors such as heat generation, vibration, and potential damage to surrounding tissues, ensuring the safety and comfort of patients. Ongoing advancements in rotary instrument technology continue to improve dental procedures, providing more effective and comfortable solutions for both dentists and patients.

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