



Endodontic Ultrasonic Tips: A Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This review highlights the endodontic ultrasonic tips. Ultrasounds (US) were discovered within the 18th century thanks to their employment within the kingdom Animalia. Richman was the primary to supply this approach to endodontics in 1957. Endodontics now uses ultrasound to irrigate root canals, remove posts, damaged tools, and other obstacles from the foundation canal, distribute sealant across the root canal walls, condense gutta-percha root fillings, and improve dentin permeability during bleaching. Ultrasonics have progressed from primary instrumentation to a passive ultrasonic cleaning approach in root canals. Modern ultrasonic units must be capable of high power and precision cutting, further because of the ability to manage not only the frequency but also the amplitude of the vibrations. Ultrasonic tip designs range from basic curves to multiangled bends and are available in varying form of shapes and sizes. Over the previous 65 years, the evolution of ultrasound in dentistry has been examined.

Keywords: *Ultrasonic tips; ultrasound; multiangled bends; root canals.*

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1. INTRODUCTION

Ultrasonics (US) were discovered within the 18th century thanks to their employment within the kingdom Animalia, but they weren't created until the 19th century, when particular devices for reproducing these non-audible human noises were devised[1]. Ultrasound could be a style of sound that features a frequency greater than 25 kHz.

Richman was the primary to supply this approach to endodontics in 1957[2]. Endodontics now uses ultrasound to irrigate root canals, remove posts, damaged tools, and other obstacles from the foundation canal, distribute sealant across the root canal walls, condense gutta-percha root fillings, and improve dentin permeability during bleaching. Because of the goal for small-diameter preparations, the concept of minimally invasive dentistry has generated novel cavity design and tooth-cutting concepts, such as the use of ultrasound for cavity preparation [3].

Sonics and ultrasonics have progressed from primary instrumentation to a passive ultrasonic cleaning approach in root canals. Instrumentation in endodontics has reached strategic levels of importance. The continued refining of endodontic procedures goes hand in hand with the qualitative enhancement of ultrasonic units and therefore the expanded availability of novel tips[4]. As a result, we have seen more highly developed ultrasonic sources that yield optimal use of all available tips, which, because of their differences, frequently necessitate unique techniques of use. Modern ultrasonic units must be capable of high power and precision cutting, further because of the ability to manage not only the frequency but also the amplitude of the vibrations[5].

2. ULTRASONIC TIPS IN ENDODONTICS

Ultrasonic tips in endodontics: Ultrasonic cutting uses piezo-electric oscillations to chop dental hard tissue and restorative materials in an exceedingly non-rotary manner[6]. Ultrasonic tips are the same as the thinnest bur for cutting dentin. Because the operational field is so small, great magnification and suitable illumination are required.

Ultrasonic tip designs range from basic curves to multiangled bends[7] and are available in varying form of shapes and sizes. The following tips are

often long and thin or short and robust; they will be ended or side cutting, and they may be composed of assorted materials like stainless steel or titanium alloys. The efficiency and sturdiness of chrome steel tips are improved by coating them with zirconium nitride or diamond grit. Some tips are meant to be used dry, while others have water ports to help with cooling and washing.

Tips employed in ultrasonics are as follows:-

1. Stropko surgical irrigator

- Works in a very drier field.
- The device attaches to a standard quick-change air–water syringe and can be used to blast air around the sphere to maintain visibility.
- Avoids the event of localized emphysema by delivering a regulated stream of water and air.

2. Enac ultrasonic endodontic system

- Uses stainless-steel= functional and cost-effective (Fig. 1)
- Root canal obturation (without water), removal flare-ups, restorations, flush-cleaning of periodontal pockets and pits/fissures, root-end preparations with angled diamond-coated files, and various scaling procedures are also available.
- Boost your output

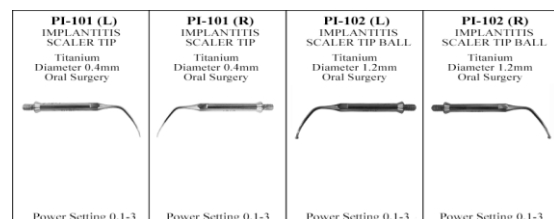


Fig. 1. ENAC surgical scalpel tips Osada Inc

3. Pro Ultra Tips

- introduces by Clifford Ruddle[8]
- There are a total of 8 tips: diamond-coated tips (1–5) and titanium-coated tips (6–8).

→ USE:

- #1 and #2 (17mm) = at medium to high power and used for post removal or removal of large pulp stones (Fig. 2)

- #3 (17 mm), #4 (19 mm) and #5 (25 mm) = at low to medium power, for searching hidden canals, troughing fine fins, narrow isthmus and removing broken instruments.
- #6, #7, and #8 = at lower power range only, used for apical obstruction.



Fig. 2. The Endo Tips 1-5 are coated with zirconium nitride to harden the tips. The Endo Tips 6-8 are long enough to go the full length of the root canal system. ProUltra Endo Tips | Dentsply Sirona

4. Start- X

- Ultrasonic inserts, designed for access cavity improvement and canal orifice positioning provide you with more control and precision (Fig. 3).
- They're made of hard-tempered stainless steel, which means they'll last a long time and the tips won't break if they vibrate in the air [9].



Fig. 3. Ultrasonic tips for access cavity wall refinement and canal orifice location

- 1 – To refine the access cavity wall
- 2 – For finding the MB2 canal
- 3 - For canal opening
- 4 – To remove the metal post
- 5 – To disclose the original anatomy of the pulp chamber floor

5. BUC (spartan instruments)

- Set of access refinement tips[10]
- Tips activated and diamond coated, have inbuilt water ports that continuously bathe them.



Fig. 4. BUC Tips Endodontic Ultrasonic Tips From Dr. Buchanan | Kerr Dental

- BUC –1 rounded tip, eliminates clefts and ditches in the pulp chamber floor. Cutting and refining line angles, smoothing access walls, and cutting MB troughs are all tasks that need to be completed.
- BUC 1 A is 6.3 mm longer and has a 0.3mm rounded tip as opposed to 0.6mm (Fig. 4).
- BUC 2= medium grit; disk-like radius tip smoothens pulp chamber floors and planes out pulp stones horizontally.
- BUC 2 A = 1.0mm vs. 1.4mm tip size
- BUC 3= fine grit; cutting apically through calcified canals and posts with an exceptionally active tip.
- BUC 3 A is 4mm longer and has a 0.3mm sharp tip as opposed to 0.5mm.

6. UFI Tips

- Dismantling the materials that make up the restorative section and core.
- Double diamond coating gives better cutting effectiveness and makes these tips resistive to sodium hypochlorite.
- Used in a chamber, gives enhanced vision, which enables precise and safe tooth structure removal.

- Pointed Tip: UFI 1
- Rounded Tip: UFI 2
- Round ball Tip (0.75mm): UFI 3
- Round ball tip (1mm): UFI 4
- Football-shaped Tip (0.9× 3mm): UFI 5
- Football shaped Tip (1.30×4mm) (Fig. 5): UFI 6



Fig. 5. 10 UFI™ Ultrasonic Tips ideas | ultrasonic, double diamond, finishing tools

7. CK tip

- Removal of broken instruments, irrigation and troughing
- Through acoustic microstreaming, ultrasonic vibration from the file ensures an efficient cleansing of the root canal system (Fig. 6).



Fig. 6. The Carr-Kanter ultrasonic tip with reverse action is ideal for difficult tasks such as the preparation of MB-2 channels. Carr-Kant Ultrasonic Speciality Tip CK-Scaler MiniEndo II Insert Diamond Coated

8. "4" series

- For troughing around posts and opening calcified canals (Fig. 7)



Fig. 7. The "4" series is geared for troughing around posts and opening calcified canals

9. CPR Tips

- The tips are diamond coated and have a contra-angle form to allow easy passage to both anterior and posterior teeth.
- CPR 1: CPR-1 can be used to remove a post safely. To avoid serious damage to the prosthesis if put directly on ceramics, it should be placed 2-3mm above the metal edge.
- CPR 2D: The CPR-2 is designed for usage in the pulp chamber. It's a tapering, all-purpose instrument[11].
- CPR 3D, 4D, and 5D: feature modest cross-sectional diameters and lengths, making them ideal for low-power applications.
- CPR 3, 4, and 5: can be applied to any part of the root.
- CPR-6–CPR-8: have a smaller cross-section diameter than CPR-3. They're constructed of titanium alloy, which gives them a more tactile feel. (Fig. 8).



Fig. 8. Ultrasonic tips - KerrHawe - PDF Catalogs | Technical Documentation

10. KiS Tips

- Zirconium nitride coated and used for endodontic microsurgery.
- Provides strength.
- Surface roughness
- Significantly faster and smoother cutting
- Leave a slightly rough dentin
- Filling material adheres to a more adhesive surface (Fig. 9).
- To better access, the shaft is lengthened and the angle is raised.



Fig. 9. KiS Ultrasonic Tips (1 ct) - Young Specialties

11. BK3 tips

- Three bends at the tips make it easy to go to any preparation, including MB2 canals.
- BK 3 has exceptional seeing ability and can complete a whole preparation with just one tip. Water is administered directly into the surgical site through the three bends (Fig. 10).



Fig. 10. BK-3 Tips Endodontic Microsurgical Ultrasonic Tips | Kerr Dental

12. Endo success retreatment ultrasonic tips

- The titanium-niobium alloy is a significant advancement that allows ultrasound to be used in the most sensitive of situations (Fig. 11).
- The smear layer, dentin debris, and germs are securely removed from the canal using PUI with the new irrissafe devices.



Fig. 11. Acteon Endo Success Retreatment Kit Endo/Tech

13. Endo success cap ultrasonic tips

- Tips = CAP1, CAP2, CAP3 micro-blade tips
- The new ultrasonic tip kit "EndoSuccess™ Canal Access Prep" is ideal for identifying and open buried or calcified canals, as well as shaping and completing the access cavity. (Fig. 12)



Fig. 12. ACTEON introduces new EndoSuccess endodontic tips | Dentistry IQ

14. Endo success apical surgery kit

- Tips= AS3D, AS6D, AS9D, ASLD, ASRD
- AS3D, AS6D, AS9D, ASLD, and ASRD tips, an autoclave metal support and an autoclave universal wrench.
- AS3D: The AS3D tip is designed for anterior tooth apical surgery. It should be used without any pressure and at the lowest effective power feasible. 30 m diamond-coated, 3 mm length, 9% taper
- AS6D: This is the second instrument in the series, and it should be used to obtain at least a 5mm preparation length. 30 m diamond-coated, 6 mm length, 9% taper
- AS9D: The AS9D tip is designed for complicated cases and enables for root canal preparation up to the coronal third. The diamond coating on the AS9D is solely on the instrument's extremity, so it doesn't over-prepare the canal. 30 m diamond-coated, length 9 mm, taper 8%
- ASLD: Apical surgery of premolars and molars is recommended. This instrument should be handled with extreme caution. 30 m diamond-coated, 3 mm length, 10% taper
- The ASRD tip is indicated for premolar and molar apical surgery. 30 m diamond-coated, 3 mm length, 10% taper (Fig. 13).



Fig. 13. Acteon Endo Success Apical Surgery Kit Endo/Tech

15. TRU Tips

- TRU 1- dimensions (1mm x 1.4mm taper), Radius preparation tip= 12mm length, give chamfer shape to the dentin.
- TRU 2- dimensions (1.3mm X 1.7mm taper), Preparation tip= 12mm length, use= give chamfer shape to the dentin
- TRU 3- dimensions (0.6mm taper), Preparation tip= flat shoulder, 18mm length, Use= preparation of the shoulder shaping.
- TRU 4- dimensions (1.1mm taper), Preparation tip= flat shoulder, 18mm length, use= shaping and finishing shoulder, tip is larger at distal end.

16. Pro ultra-piezo flow ultrasonic irrigation needle

- The application of ultrasonic vibration is employed in non-surgical root canal irrigation.
- To generate the energy for tip oscillation, the Piezo Flow irrigation needles are used together with a piezoelectric ultrasonic energy-generating device (Fig. 14)
- Sodium hypochlorite (up to 6%), EDTA (up to 17%), Chlorhexidine (up to 2%), and BioPure MTAD are all compatible irrigants. [3].



Fig. 14. ProUltraPiezoFlow Ultrasonic Accessory Pack Dentsply Sirona

17. Irrisafe

- Smear layer, dentin debris, and germs are safely removed from the root canal.
- Sodium hypochlorite is used during passive ultrasonic irrigation (PUI).
- The instruments are color-coded according to ISO standards and come in sizes 20 and 25.
- Available in 21mm and 25mm lengths. (Fig. 15).



Fig. 15. Acteon - IRRI 20, 25 ACTEON

❑ Tips according to there usage and motion:-

1. Access refinement tip

- Because ultrasonic tips are lesser in size than the tiniest burs, the dentin may be scraped away in small portions and with more precision.
- The pulp chamber is being "unroofed."
- Tips = CPR 2D or BUC 1 SINE tips 1-6.

2. Vibratory tips

- Ultrasonic vibration has been shown in studies to minimize tensile force used to remove both cast and prefabricated posts [12].
- Tips = VT (Sybron Endo), VibraPost by B&L Biotech, OsadaEnac ST09, and CPR 1.
- The spherical or flat tips of these devices are pressed against the post to transfer vibration.
- pushed circumferentially with full intensity until the post loosens or dislodges.

3. Bulk removal tip

- Pointed and durable tip which is used at the ultrasonic unit's moderate or maximum intensity [13].
- Tips = BUC 1 and CPR 2D
- tips= diamond coated, contain a water outlet near the cutting surface for better washing and cooling of the operating site.

4. Troughing tip

- Tips = CPR 3D, 4D, and 5D, which are 15, 20, and 25 mm in length BUC 3, CT 4.
- They are employed in the coronal, middle, and apical thirds of root canals, and their choice is determined by the depth at which they must be performed.

5. Surface lesion (SL) ultrasonic tip

- carry out restorative preventative procedures while preserving the integrity of the teeth

- Occlusal sealants/composites, cervical restorations, crown margin repairs, retentive preparations for bonded composites, and other restorative dentistry procedures can now be performed with more precision, visibility, and accessibility [14].
- Micropreparations on occlusal surfaces and proximal locations are suitable.
- Efficient crown margin repair, cervical restorations, and retentive preparations for bonded composite restorations.

3. CONCLUSION

Over the previous 65 years, the evolution of ultrasound in dentistry has been examined. When it was discovered that cutting dental materials with an abrasive slurry made of aluminium oxide could be done. During the 1950s, dentists identified the following advantages of utilizing ultrasonic to prepare tooth cavities: cutting the tooth with very little force; no pain in the majority of cases; no harm to the pulp; the precision of cut and good finish. The following are the most important advantages: low noise; no discomfort in the great majority of situations, obviating the need for anaesthetic; total seeing ability and access; accurate cutting; less intrusive preparation; chosen hard material cutting; It is not suitable for cutting delicate materials such as gingiva or tongue; it reduces bleeding; it doesn't leave residue on the tip, making cleaning easier; and it reduces the smear layer.

Ultrasonics in endodontics is mostly advantageous to dentists in many aspects. It is considered the future of dentistry with minimum drawbacks.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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