Ultrasonic tips in endodontics- A review of literature

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Abstract
During the past few years, there is great advancement seen in endodontic treatment outcome with the development of operating microscope and ultrasonics. It is an adjunct in the treatment of difficult cases. In present day, almost all the endodontic treatment and surgery can be done easily with ultrasonic. This review of the literature aims at presenting the various uses of US tips and gives importance to the broad applications in a modern-day endodontic practice.

Keywords: Ultrasonic tip, Ultrasonic tips in endodontics, Ultrasonic, Innovation.

Introduction
The main aim of introduction of ultrasonics (US) or ultrasonic instrumentation in dentistry was for the cavity preparations.[1–3] With the introduction of high speed handpiece that turned out to be more effective and convenient, this technique couldn't become popular.[4] Ultrasonics gradually had improvments and ultrasonic scaler turned out to be an effective tool that was helpful dental calculus and plaque removal. Richman[5] in 1957 first introduced the concept of US in endodontics. The term endosonics was coined by Martin and Cunningham[6,7] which is ultrasonic and synergistic system of root canal instrumentation and disinfection. Ultrasound is the sound energy with frequency range above 20 kHz. Frequencies of original ultrasonic units is between 25-40 KHz[8] & it was high enough to cause changes in tooth structure. Later low-frequency ultrasonic handpieces evolved to overcome this difficulty, it had frequencies from 1 to 8 kHz.[9-14] Ultrasound is produced by two basic methods.[15–17] The first is magnetostrictive, and second, piezoelectric. Mechanical energy is produced in magnetostrictive when magnetostrictive metal strips in a handpiece is subjected to standing and alternating magnetic field which produces vibrations, whereas in piezoelectric, dimensional changes occur when an electrical charge is applied to crystal which is converted into mechanical oscillation. Comparaively, Piezoelectric unit have various advantages over magnetostrictive units as it offers more cycles per second, 40 versus 24 kHz. The tips of these units work in a linear motion, which is ideal for endodontics whereas, tip of magnetostrictive work in a elliptical motion. When endosonic file is activated by a 30-kHz piezon generator, the position of nodes and antinodes was along the file length. Therefore, with increasing generator power, the file vibration displacement amplitude does not increase linearly. This application turned out to be useful in searching for hidden canals, removal of separated instruments and post & for retrograde filling. Contrarily, motion produced by magnetostrictive unit, is not ideal for either surgical or nonsurgical endodontic use and it requires adequate cooling as the stack generates heat which is one of its drawback.

Applications of US in Endodontics
Currently, ultrasonics have a plethora of uses in dentistry. Either it's therapeutic or diagnostic, for cleaning of instruments before sterilization,[18] or for scaling and root planing of teeth or in root canal therapy.[8,18,19] Ultrasonics has already been proved to be useful in different ways in dentistry. With upgrades seen everyday, the concept of minimally invasive dentistry seems to be content[20] and the desire for preparations with small dimensions has given new outlook to cavity design and tooth-cutting concepts, including ultrasound for cavity preparation.

Ultrasonic Tips in Endodontics
CPR Tips
CPR instruments are compatible with piezoelectric dental ultrasonic scalers.

All CPR instruments, dental instruments as well as ultrasonic tips incorporate a contra-angled shape to access for both anterior and posterior teeth.

The following are the various uses of CPR Instruments.

CPR 1: The CPR-1 can be used safely for post removal. It should be placed 2-3mm above the metal margin to avoid severe damage to the prosthesis if placed directly on ceramics.

CPR 2D: The CPR-2 is primarily used within the pulp chamber. It is an all purpose, tapered instrument.

CPR 3D: CPR-5D: The 3-5 tips must be used on very low power, due to their small cross sectional diameters and lengths. While using tips force should not be applied to the instruments to avoid aggressively removal of dentin and debris along the lateral sides of the tips.

CPR's 3, 4, and 5 are used in all the portion of root.

CPR-6 – CPR-8: The CPR 6, 7, and 8 ultrasonic instruments have a smaller cross-sectional diameter compared to the CPR 3, 4, and 5. The instruments are made of titanium alloy. The benefit of having titanium alloy is increases in tactile sensation, due to smoother cutting action with less chatter. They will hold a bend if applied forcefully.

SINE Tips
SINE 1 – Pointed tip
SINE 2 – Rounded tip
SINE 3 & 4 - Tip round ball shaped, small and large
SINE 5 & 6 – Tip is football shaped, small and large

Use- refinement during endodontic access procedure
1. Diamond coated
2. 18 mm is the working length

Pro Ultra Tips
1. Total 8 tips are there-
2. No. 1-5 are diamond coated
3. No. 6-8 are Titanium coated
4. Use- Disassemble dental restorations and cores
   a. To locate hidden and calcified canals
   b. Remove intracanal obstruction material
   c. Eliminate pulp stone
   d. Dislodge post and broken instruments

Start X
No. 1 – To refine access cavity wall
No. 2 – For finding MB2 canal
No. 3- For canal opening
No. 4 – To remove metal post
No. 5 – To disclose the original anatomy of pulp chamber floor

Smart X BUC Tips
BUC -1 & 1 A: Gross dentin removal
Moving access line angles
Chasing MB2 canal
Unroofing pulp chambers
BUC 2 & 2 A: To plane attached pulp stones from pulp chamber floor
BUC 3 & 3 A: Extremely active instruments with sharp tips for chasing canals halfway up a root or for digging around a post or carrier based obturator to remove it.

UFI Tips

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

Ideal for disassembling restorative segment and core materials. Cutting efficiency of these tips increases because of the double diamond coating and is resistant to sodium hypochlorite.

They are used in the chamber and their main advantage is enhanced vision. Additionally, they offer precise and safe removal of tooth structure.

KiS Tips
The KiS ultrasonic tips are diamond coated and specially used for endodontic microsurgery. The shaft of these tips are longer and angle is increased to improve access.

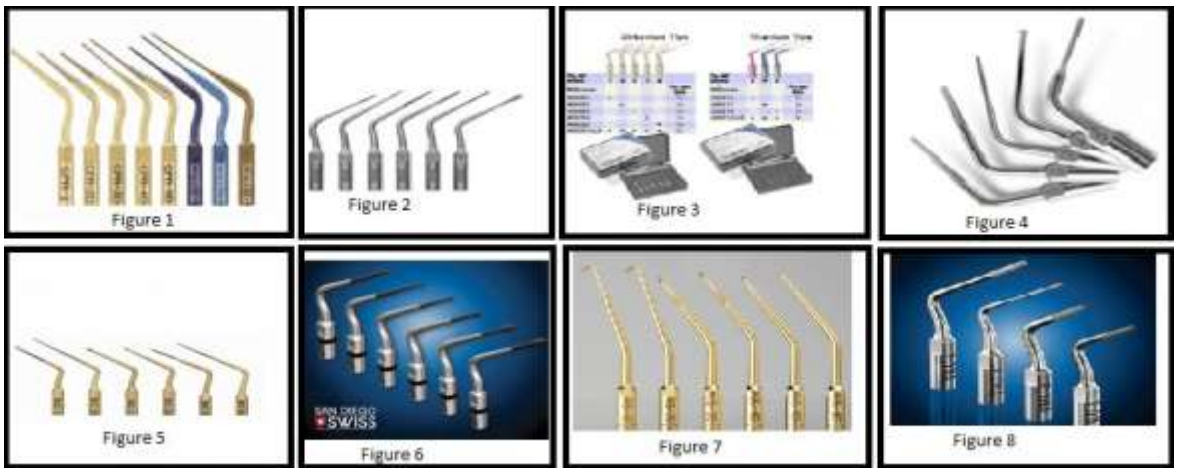
TRU Tips
TRU 1
1. (1mm x 1.4mm taper)
2. Radius preparation tip, 12mm in length.
3. Used to give chamfer shape to the dentin.

TRU 2
1. (1.3mm X 1.7mm taper)
2. Preparation tip is 12mm in length.
3. Used to give chamfer shape to the dentin

TRU 3
1. (0.6mm taper)
2. Preparation tip is flat shoulder which is 18mm in length.
3. Use for preparation of the shoulder shaping.

TRU 4
1. (1.1mm taper)
2. Preparation tip is flat shoulder which is 18mm in length
3. For shaping and finishing shoulder, tip is larger at distal end

Figures



Conclusions

It can be concluded from this review of the literature that clinical endodontics has seen a lot of lead due to utilization of US. In a conventional treatment, lot of limitations are faced specifically in situations where work areas gets restricted due to specific angulations or tip design during removing tooth structure. US providing a better visualization with a conservative approach provides better opportunities. Which in turn provides better results in access refinement, location of calcified canals and removal of separated instruments or posts. And with the use of US, better action of irrigation solutions and condensation of gutta percha has also been noted. Root-end cavity preparation followed by placement of materials in an area that is more often than not constrained has especially improved the quality of treatment and long-term success. Finally, endodontics has seen a lot of advancement due to utilization and application of new technologies such as US which has guided endodontics towards improved techniques and use of materials.

Conflict of Interest: None.

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