OPEN ACCESS
Saudi Journal of Oral and Dental Research
Abbreviated Key Title: Saudi J Oral Dent Res
ISSN 2518-1300 (Print) |ISSN 2518-1297 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: http://scholarsmepub.com/sjodr/

Review Article

Ultrasonic in Endodontics: Review

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DOI:10.21276/sjodr.2019.4.6.22 | **Received:** 21.06.2019 | **Accepted:** 28.06.2019 | **Published:** 30.06.2019

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Abstract

During the past few decades' endodontic treatment has benefited from the development of new techniques and equipment, which have improved outcome and predictability. Important attributes such as the operating microscope and ultrasonics (US) have found indispensable applications in a number of dental procedures. Ultrasonics in endodontics has enhanced the quality of treatment and represents an important adjunct in the treatment of difficult cases. Since its introduction, Ultrasonics has become increasingly more useful in applications such as gaining access to canal openings, cleaning and shaping, obturation of root canals, removal of intra canal materials and obstructions, and endodontic surgery. Currently, although ultrasonics (US) is used in dentistry for therapeutic and diagnostic applications as well as for cleaning of instruments before sterilization, its main use is for scaling and root planing of teeth and in root canal therapy, both for orthograde and retrograde therapy. This review article brushes up the role of ultrasonics in endodontotlogy.
Keywords: Ultrasonic, Endodontics.

INTRODUCTION

In order to understand the basic concepts of the use of ultrasonics (US) in dentistry, it must be underlined that ultrasound is sound energy with a frequency above the range of human hearing, which is 20 kHz. In dentistry the range of frequencies employed in the first ultrasonic units was between 25 and 40 kHz. Later, low-frequency ultrasonic handpieces operating from 1 to 8 kHz were developed. These low-frequency devices were found to produce lower shear stresses, thus causing less alteration to the tooth surface [1]. In dentistry ultrasonics (US) or ultrasonic instrumentation was first introduced for cavity preparations, using abrasive slurry. Although the technique received favourable comments, it never became popular, because it had to compete with the much more effective and convenient instruments, i.e. the burs mounted on high speed handpieces. However, a different application was introduced in 1955, when Zinner reported on the use of an ultrasonic instrument to remove deposits from the tooth surface. This was improved upon by Johnson and Wilson, and the ultrasonic scaler became an established tool in the removal of dental calculus and plaque [2]. Currently, although US is used in dentistry for therapeutic and diagnostic applications as well as for cleaning of instruments before sterilization, its main use is for scaling and root planing of teeth and in root canal therapy, both for surgical and non-surgical approach. More recently, the concept of minimally invasive dentistry and the desire for preparations with small dimensions has stimulated new approaches in cavity design and tooth-cutting concepts, including ultrasound for cavity preparation [2]. The use of sonics and ultrasonics in canals has evolved from primary instrumentation to a passive cleaning technique. Although there have been significant advances in canal preparation and debridement, the fact remains that dentinal debris is still routinely found within canal preparations and that clinicians have been slow to adopt ultrasonic or sonic instrumentation as an important adjunct in canal debridement. Ultrasonic irrigation of the root canal can be performed with or without simultaneous ultrasonic instrumentation. Passive ultrasonic irrigation can be an important supplement for cleaning the root canal system and, compared with traditional syringe irrigation; it removes more organic tissue, planktonic bacteria and dentine debris from the root canal. Passive ultrasonic irrigation is more efficient in cleaning canals than ultrasonic irrigation with simultaneous ultrasonic instrumentation [2]. Root-end cavities have traditionally been prepared by means of small round or inverted cone burs in a micro handpiece. In the mid- 1980s, standardized instruments and aluminium oxide ceramic pins were introduced for retrograde filling, but that system could not be used in cases with limited working space or in teeth with large oval canals. Since sonically or ultrasonically driven microsurgical retro tips became commercially available in the early 1990s, this new technique of retrograde root canal instrumentation has been established as an essential adjunct in peri radicular surgery [1].

Physics behind Ultrasonics

The first is magnetostriction, which converts electromagnetic energy into mechanical energy. A stack of magnetostrictive metal in the handpiece is subjected to a standing and alternating magnetic field, as a result of which vibrations are produced. The second method is piezoelectric principle. A crystal is used which changes the dimensions when an electric charge is applied. This crystal deformation is converted to mechanical oscillations with no production of heat. At the ultrasonic frequency, the main driver oscillates in a true longitudinal manner and as it moves back and forth a transverse wave is generated along the length of the endosonic file. This transverse wave is characterised by nodes and antinodes along the length of the file. The nodes represents site of minimum displacement or oscillations and antinodes represents sites of maximum displacement or oscillations.

The most frequent applications of US in endodontics are

- Access refinement, finding calcified canals, and removal of attached pulp stones.
- Removal of intracanal obstructions (separated instruments, root canal posts, silver points, and fractured metallic posts)
- Increased action of irrigating solutions
- Ultrasonic condensation of gutta-percha
- Placement of mineral trioxide aggregate (MTA)
- Surgical endodontics: Root-end cavity preparation and refinement and placement of root-end obturation material
- Root canal preparation[1]

Ultrasonic & Access cavity Preparation

One of the challenges in endodontics is to locate canals, particularly in cases in which the orifice has become occluded by secondary dentin or calcified dentin secondary to the placement of restorative materials or pulpotomies. With every access preparation in a calcified tooth, there is the risk of perforating the root. A lack of a straight-line access is the leading cause of separation, perforation, and the inability to negotiate files to the radiographic terminus.[2] Microscopic visualization and ultrasonic instruments are a safe and effective combination to achieve optimal results. In conventional access procedures, ultrasonic tips are useful for access refinement, location of MB2 canals in upper molars and accessory canals in other teeth, location of calcified canals in any tooth, and removal of attached pulp stones [2]. Advantages of ultrasonic tips are that they do not rotate, thus enhancing safety and control, while maintaining a high cutting efficiency. This is especially important when the risk of perforation is high. The visual access and superior control that ultrasonic cutting tips provide during access procedures make them a most convenient tool, especially when treating difficult molars. When locating the MB2 canals in upper molars, Ultrasonics is an excellent means for the removal of secondary dentin on the mesial wall. Ultrasonics works well when breaking through the calcification that covers the canal orifice. A troughing tip is always a good choice [2]. Bigger tips with a limited diamond coated extension should be used during the initial phase of removing calcification, interferences, materials, and secondary dentin, as they offer maximum cutting efficiency and enhance control while working in the pulp chamber. The subsequent phase of finding canal orifices should be carried out with thinner and longer tips that facilitate cutting. The diamond-coated tips used in orthograde endodontic treatment have shown significantly greater cutting efficiency than either stainless steel tips or zirconium nitride– coated tips, but they have a tendency to break. Moreover, thinner diamond-coated tips seem to be able to transmit the oscillation of the ultrasonic unit more efficiently into dentin; this results in a more aggressive cutting action. Ultrasonic cutting seems to be significantly influenced by the power setting, as larger fragments of dentin are removed at higher power, and by the ultrasonic unit type used. Therefore, care should be exercised while searching for canal orifices, as aggressive cutting may cause an undesired modification of the anatomy of the pulp chamber [2].

Ultrasonic & Separated instruments

Clinicians are frequently challenged by endodontically treated teeth that have obstructions such as hard impenetrable pastes, separated instruments, silver points, or posts in their roots. If endodontic treatment has failed, these obstructions need to be removed to perform nonsurgical retreatment. They include appropriate burs; special forceps; ultrasonic instruments in direct or indirect contact; peripheral filing techniques in the presence of solvents, chelators, or irrigants; microtube delivery using mechanical adhesion techniques; and different kits and extractors. Ultrasonic energy has proven effective as an adjunct in the removal of silver points, fractured instruments, and cemented posts. It has often been advocated for the removal of broken instruments because the ultrasonic tips or endosonic files may be used deep in the root canal system. Furthermore, the use of an ultrasonic endodontic device is not restricted by the position of the fragment in the root canal or the tooth involved. The prognosis of these cases mainly depends on the preoperative condition of the peri apical tissues. For this reason an attempt to remove broken instruments should be undertaken in every case. When these obstructions can be removed, successful treatment or retreatment generally occurs. If an instrument can be removed or bypassed and the canal can be properly cleaned and filled, nonsurgical endodontics is a more desirable and conservative approach. The removal of an obstacle from a root canal must be performed with a minimum of damage to the tooth and the surrounding tissues. Too much destruction of tooth structure will complicate the restorative phase and as a result will most likely decrease the overall prognosis. Although it is possible to remove many fragments, a small number cannot be removed because of limited access, despite the use of ultrasonic tips. When the obstacle prevents access to the root apex, adequate preparation, disinfection, and obturation of the entire root canal system are not possible. Straight-line access is essential and allows for maximum visibility of the metallic fragment. For that reason, the use of magnification (dental operating microscope or loupes) is essential, as it provides direct visualization with excellent illumination, allowing instrumentation at high magnifications [2].

Ultrasonic & GP Removal

The most common endodontic core material is gutta percha. Ultrasonically activated spreaders have been used to thermoplasticize gutta-percha in a warm lateral condensation technique. In some in vitro experiments, this was demonstrated to be superior to conventional lateral condensation with respect to sealing properties and density of gutta-percha. Ultrasonic spreaders that vibrate linearly and produce heat, thus thermoplasticizing the gutta-percha, achieved a more homogeneous mass with a decrease in number and size of voids and produced a more complete three-dimensional obturation of the root canal system. A number of obturation protocols have been described for ultrasonic condensation of gutta-percha: (a) ultrasonic softening of the master cone followed by cold lateral condensation ; (b) one or two times of ultrasonic activation after completion of cold lateral condensation (c) ultrasonic activation after placement of each second accessory cone; or (d) ultrasonic activation after placement of each accessory cone. Warm lateral condensation combines the advantage of having control over the length of the root fill, similar to cold lateral condensation, with the superior ability of a thermoplasticized material to replicate the three-dimensional shape of the root canal. Ultrasonic condensation of gutta-percha is quickly mastered and has several advantages over other warm lateral condensation techniques. It was observed that heat was generated only during ultrasonic activation, and the plugger appeared to cool rapidly once activation ceased. The size of the heat carrier (ultrasonic spreader) can be chosen to match the diameter of the root canal, and the ultrasonic spreader can be curved to match the curvature of the root canal. Furthermore, gutta-percha does not stick to the ultrasonic file when the ultrasonic unit is activated. Also, the low temperature produced by the unit at its lowest power setting may result in less volumetric changes of gutta-percha upon cooling. The obturation technique recommended when using the ultrasonic techniques consists of initial placement of a gutta-percha cone to the working length followed by cold lateral condensation of two or three accessory cones using a finger spreader. The ultrasonic spreader is then placed into the centre of the gutta-percha mass 1 mm short of the working length and activated at intermediate power to prevent charring of root surfaces and fracture of the ultrasonic spreader [3]. After activation, the ultrasonic spreader is removed, and an additional accessory cone is placed, followed by energizing with the activated ultrasonic spreader. This process is repeated until the canal is filled. During each subsequent step, the ultrasonic spreader should be placed slightly more coronally [3]. The ultrasonic spreader must be in the mass of gutta-percha for about 10 seconds to achieve thermoplasticization. Leaving it in the canal for more than 10 seconds can produce a rise in temperature that is damaging to the root surface. In addition, it has been demonstrated that placement of sealers with an ultrasonically energized file promoted a better covering of canal walls with better filled accessory canals than placement of sealers with hand instruments[3]. Using a probe tip or even a standard prophylaxis tip, the machine is set to maximum power. If the ultrasonic instrument has been used to remove materials from the pulp chamber, it is easy and uncomplicated to extend the tip into the orifices of the canals at the same time. This will also help to locate the canals and clarify the internal anatomy. With copious irrigation, the tip is inserted into each canal orifice. The gutta percha will soften immediately and come out of the canal. Depth of penetration into the canal will be limited by the length of the tip[4].

Ultrasonic & Cleaning of Instrument

Ultrasonic energy has been proven to be more effective at enhancing cleaning than other alternatives, including spray washing, brushing, turbulation, air agitation, and electro-cleaning in many applications. The ability of ultrasonic activity to penetrate and assist the cleaning of interior surfaces of complex parts is especially noteworthy. Cleaning in most instances requires that a contaminant be dissolved, displaced or both dissolved and displaced. The mechanical effect of ultrasonic energy can be helpful in both speeding dissolution and displacing particles. Just as it is beneficial in cleaning, ultrasonics is also beneficial in the rinsing process. Residual cleaning chemicals are removed quickly and completely by ultrasonic rinsing. While removing a contaminant by dissolution, it is necessary for the solvent to come into contact with and dissolve the contaminant. The cleaning activity takes place only at the interface between the solvent and the contaminant. As the solvent dissolves the contaminant, a saturated solvent layer develops at the interface between the solvent and the contaminant. Once this has happened, cleaning action stops as the saturated solvent can no longer attack the contaminant and fresh solvent cannot reach the contaminant. Ultrasonic cavitation and implosion effectively displace the saturated solvent layer to allow fresh solvent to come into contact with the contaminant remaining to be removed. This is especially beneficial when irregular surfaces or internal passageways are to be cleaned.

Ultrasonic & Post Removal

Nonsurgical endodontic retreatment of teeth restored with intra radicular posts continues to present a challenge because of the inherent difficulties of removing posts without weakening, perforating, or fracturing the remaining root structure. Ultrasonics has provided clinicians with a useful adjunct to facilitate post removal with minimal loss of tooth structure and root damage. Many studies have focused on the removal of metallic posts; however, retreatment of fiber-reinforced composite posts cemented with adhesive systems presents a new challenge in cases in which endodontic treatment has failed [2]. Different bur kits have been proposed to remove fiber posts; however, the preservation of maximum root structure requires the use of specific ultrasonic tips and adequate magnification. The disruption of the composite structure through the action of ultrasonic vibration seems to be the most effective technique in fiber post removal. Esthetic white posts are more difficult to remove because their color matches that of dentin, whereas the black carbon fiber posts clearly contrast to dentin. Removal is done in a dry field using a continuous stream of air with direct vision of the ultrasonic tip and the coronal portion of the post, alternated by air and water spray to clean the remnants of fibers and dentin [2]. It is important that the entire composite material that was used in the luting procedure be removed. If the adhesive procedure was done well, removal of the tenaciously attached adhesive materials will be difficult, and high magnification must be used to guide the ultrasonic tip to selectively remove the attached composite material. If the ultrasonic tip leaves behind gray streaks, it is a clear indication that resin composite or resin composite cement is still present. The need of consuming fiber posts is based on the fact that the viscoelastic nature of composite resin dampens vibrations and adsorbs energy [2]. Conductance of vibration forces within a post is proportional to the square root of the modulus of elasticity of the post material. Therefore, a fiber-reinforced composite post with a significantly lower modulus of elasticity than stainless steel or titanium conducts vibration less efficiently. Combining the low modulus of elasticity of post materials with composite resin cements causes a change in the effectiveness of ultrasonics as an aid in post removal. Resin cements are not friable and do not tend to produce micro fractures due to ultrasonic vibration. It was suggested that the absence of a water spray seems to increase the action of ultrasonics when applied to posts cemented with resin cements, possibly because of the increase in heat. The capacity of adhesion of a resin cement, and consequently mechanical retention, gradually reduces with the number of thermal cycles [2]. Several studies point to the fact that ultrasonic vibration of posts facilitates their removal while conserving tooth structure and reducing the possibility of fractures or root perforations. Several studies have demonstrated a reduction in tensile failure loads of intra radicular-cemented posts after ultrasonic vibration.

Recommended Protocols

Based on the best available evidence to date, we recommend the following protocols to provide safe and effective therapy using ultrasonic devices in intra radicular obstruction removal. Attempt to radiographically image residual dentin thickness for the working level within the root (this will help judge heat transfer rates to the attachment); thicknesses less than 1 mm, in combination with metallic or ceramic posts, will transmit heat rapidly. Use devices that allow water to reach the working end of the ultrasonic tip to provide maximum cooling effect. Use copious water spray and effective suction at a continuous rate; there is ample evidence that when the working end of any ultrasonic device is deep within the root, heat generation occurs rapidly. Monitor the post temperature at one- to two minute intervals; this seems to be the most prudent standard given the evidence that extreme temperatures on the root surface can be reached in five minutes even when a coolant is used. When possible, monitor heat buildup in the post by touching it; even a gloved finger will be able to sense a post overheating. If post removal attempts are continued beyond 10 minutes, allow for two-minute rest intervals (using timers with beepers) between ultrasonic device applications; heat buildup appears to be dissipated in stages, and recovery of physiological temperatures occurs slowly. Use a refrigerant spray applied to a cotton swab or an ice stick to cool down the post if necessary; the expansion-contraction effects of this strategy are minimal compared with the severe outcomes of a burn injury. Use post-pullers act as adjuncts to ultrasonic energy [5].

Ultrasonic & Placement of MTA

Ultrasonics can be used in the placement of MTA but it has poorer adaptation to the canal walls and surface voids in the set cement. An invitro study by Anita *et al*. found that ultrasonic tip pushes the MTA material against the tube wall, leaving voids in the body of the material as the tip was removed from the specimen. Although the tube-wall surfaces appeared visually covered with MTA, the core of the MTA specimens had voids that created radiolucent areas, which was seen radiographically[6]. Ultrasonics has the ability to improve the placement and seal of MTA as an apical barrier in the pulpless immature root. The inherent irregularities and divergent nature of some open apices may predispose the material to marginal gaps at the dentin interface. The ultrasonic vibration applied to an endodontic condenser improves the flow, settling, and compaction of MTA apically [7]. During placement of the MTA, the ultrasonic energy seemed to flow the MTA apically more efficiently than with only hand instruments. Also, the ultrasonically condensed MTA appeared denser radiographically with fewer voids [7]. The recommended placement method consists of selecting a condenser tip, then picking up and placing the MTA with the ultrasonic tip, followed by activating the tip and slowly moving the MTA material down using a 1- to 2-mm vertical packing motion. Direct ultrasonic energy will vibrate and generate a wavelike motion, which facilitates moving and adapting the cement to the canal walls. In a case of repairing a defect apical to the canal curvature, Ruddle recommends incrementally placing MTA deep into a canal, then shepherding it around the curvature with a flexible trimmed gutta-percha cone utilized as a plugger. A precurved 15 or 20 stainless steel file is then inserted into the material and placed to within 1 or 2 mm of the working length. This is followed by indirect ultrasound, which involves placing the working end of an ultrasonic instrument on the shaft of the file. This vibratory energy encourages MTA to move and conform to the configurations of the canal laterally as well as controlling its movement. This technique was recommended initially for placing MTA in open and diverging apices, but it can also be used to put the material in root-end cavities, in perforations, and especially in perforations of the floor of the pulp chamber [8].

Ultrasonic & Rootend Cavity Preparation

The development of ultrasonic and sonic retro tips has revolutionized root end therapy, improving the surgical procedure with better access to the root end, resulting in better canal preparation. Ultrasonic retro tips come in a variety of shapes and angles, thus improving some steps during the surgical procedures. A number of studies compared root-end preparations made with microsurgical tips to those made with burs. They demonstrated additional advantages of this technique, such as deeper and more conservative cavities that follow the original path of the root canal more closely. A better-centered root-end preparation also lessens the risk of lateral perforation. Furthermore, the geometry of the retro tip design does not require a beveled root-end resection for surgical access, thus decreasing the number of exposed dentinal tubules and minimizing apical leakage [2]. They also enable the removal of isthmus tissue present between two canals within the same root. It is considered a timesaving technique that seems to have a lower failure rate. The cleaning effect and the cutting ability of ultrasonic retro tips have been described as satisfactory by many authors. Furthermore, Ultrasonics produced less smear layer in a retro-end cavity compared to a slow-speed handpiece. The refinement of cavity margins that were obtained with the ultrasonic tips may positively affect the delivery of materials into the cavities and enhance their seal, even if cavities prepared with erbium: YAG lasers have been shown to produce significantly lower microleakage than ultrasonic preparations [2].

Ultrasonic & Removal of Smear Layer

Ultrasonic delivery system activated by NaOCl can create smear-free canal surfaces. Whilst concentrations of 2–4% sodium hypochlorite in combination with ultrasonic energy were able to remove smear layer, lower concentrations of the solutions were unsatisfactory [9]. The apical region of the canals showed less debris and smear layer than the coronal aspects, depending on acoustic streaming, which was more intense in magnitude and velocity at the apical regions of the file. Cameron compared the effect of different ultrasonic irrigation periods on removing smear layer and found that a 3- and 5-min irrigation produced smear-free canal walls, whereas 1-min irrigation was ineffective [9]. Researchers who found the cleaning effects of ultrasonics beneficial used the technique only for the final irrigation of root canal after completion of hand instrumentation. Ahmad *et al*. claimed that direct physical contact of the file with the canal walls throughout instrumentation reduced acoustic streaming. Acoustic streaming is maximized when the tips of the smaller instruments vibrate freely in a solution.

Recent Advances

The SINE tips feature a patented and innovative double composite diamond coating, specially designed working ends, and a water delivery system. Synergistically, these combined features promote precision, efficiency, durability and safety. The specific SINE instrument chosen is based on the appropriate tip configuration required to effectively perform any given procedure. SINE tips should be used with a light brush-cutting motion and are ideal for progressively refining and finishing the access cavity. They may be used dry or wet. In general, ultrasonic instruments are used at the lowest power setting that will efficiently accomplish the clinical task. When performing certain ultrasonic procedures, such as those requiring higher energy levels conducted over longer intervals of time, then water should be used to provide a coolant. SINE Ultrasonic Instruments are for use only with piezoelectric ultrasonic units and work optimally on the Satelec P5 generator (Tulsa Dental Specialties). The instrument whose length, diameter, and tip shape best suits the procedural task should be selected and activated at a low power setting, then the power increased to the point, but not beyond, where the tip is efficiently completing the required task. All SINE tips have been designed with water ports. Water port technology affords both a spray and a coolant which some clinician's desire when performing certain clinical procedures. Water is adjusted according to the task at hand, typically a light mist [10].

SL (surface lesion) ultrasonic tips

Spartan's new Surface Lesion SL Tips have been designed to accomplish restorative preventative procedures while conserving sound tooth structure. Occlusal sealants/composites, cervical restorations, repairs to crown margins, retentive preparations for bonded composites and other restorative dentistry can now be done with greater precision, visibility and accessibility. Spartan, a leader in Ultrasonic Innovation, brings to restorative dentistry the technology that has revolutionized endodontics. Spartan Ultrasonic Tips have become the standard of care for endodontic retreatment, microsurgery and access refinement. They are ideal for micropreparations on occlusal surfaces/proximal areas. They are highly efficient in crown margin repair, cervical restorations and retentive preparations for bonded composite restorations. Diamond coating provides micro-abrasive cutting efficiency and precision preparations. The operator should be aware that ultrasonic tips with small diameters are subject to breakage at any time. In order to reduce the incidence of premature breakage or failure, only a very light pressure should be applied by the operator, and the suggested intensity settings should be followed. All SL instruments incorporate a contra-angled shape allowing for improvement in procedural access into formerly difficult to treat areas. These are the same designs found in virtually all dental instruments as well as ultrasonic tips for scaling and periodontal use [11].

Endo success retreatment ultrasonic kit

The Endo Success Retreatment kit addresses the problems most commonly met during endodontic retreatment procedures. The use of the patented Titanium-Niobium alloy is a major innovation giving optimal ultrasound use in the most delicate of circumstances. At the end of the treatment or the retreatment, cleaning of the root canal is essential to guarantee success. Passive ultrasonic irrigation performed with the new irrisafe instruments safely removes the smear layer, the dentine debris and the bacteria from the root canal.

Endo success cap ultrasonic kit

Supplied with the CAP1, CAP2, CAP3 micro-blade tips, a metallic support, and an universal autoclavable wrench. The success of endodontic treatment involves shaping an irreproachable access cavity. The new "EndoSuccess™ Canal Access Prep" ultrasonic tip kit is the perfect solution for locating and opening hidden or calcified canals and shaping and finishing the access cavity. These new CAP tips greatly enhance the endodontic treatment allowing the practitioner to perform the best possible endodontic work.

Endo success apical surgery ultrasonic kit

This ultrasonic tips kit is the perfect solutions for the problems most commonly encountered during apical surgery. It contains AS3D, AS6D, AS9D, ASLD, ASRD tips, on an autoclavable metal support.

START-X

Start-X ultrasonic tips are a new, simple addition to the current DENTSPLY Maillefer ultrasonic Endodontic tips range, designed to improve the quality of Endodontic treatments. START.X Ultrasonic Tips achieve higher control and precision with ultrasonic inserts specifically designed for access cavity refinement and canal orifice location. These simple-to-use tips have multiple applications so that the dentist knows exactly which tip to use in which situation. The tips are made of hard tempered stainless steel so they have strong resistance to wear and tear and the tips can vibrate in the air without breaking. A micro-milled active part creates a smooth finish and minimises the risk of diamond grit loss in the patient's mouth [12].

CK TIP

CK tips are used for removal of broken instruments, irrigation and troughing. It has CK tip with file and CK tip with needle. For ultrasonic energy in a root canal, Ultrasonic vibration through a file ensures an efficient cleaning of the root canal system through acoustic micro streaming.

Pro ultra-piezo flow ultrasonic irrigation needle

Pro Ultra Piezo Flow Ultrasonic Irrigation Needles are for use in non-surgical root canal irrigation by application of ultrasonic vibration. The Piezo Flow irrigation needles are used in conjunction with a piezoelectric ultrasonic energy-generating unit to provide the energy for tip oscillation. A syringe or other irrigation source is attached to the Luerlock connection on the ultrasonic needle. Removal of irrigant is through the operatory vacuum source. Syringes, extension tube-sets, and wrenches are available separately (SKU# PIEZOFLOWAP). Compatible irrigants include sodium hypochlorite (up to 6%), EDTA (up to 17%), Chlorhexidine (up to 2%) and BioPure MTAD however working times may vary [13].

CONCLUSION

The piezoelectric ultrasonic device has the potential to become routinely incorporated into almost every component of endodontic treatment, re-treatment, and apical microsurgery. It is an indispensable and a precise tool with which the most challenging clinical situations, such as finding hidden root canals and removing root canal obstructions, can be done with relative ease, predictability, and conservancy. It can be seen by the few innovative studies which take advantage of the energizing ability of ultrasound that a thorough understanding of how ultrasonic tips and files behave with irrigants and tooth structure can produce methods and conditions to truly enhance the beneficial effect of such energy in the confined root canal space.

REFERENCES

1. Plotino, G., Pameijer, C. H., Grande, N. M., & Somma, F. (2007). Ultrasonics in endodontics: a review of the literature. *Journal of endodontics*, *33*(2), 81-95.
2. Mozo, S., Llena, C., & Forner, L. (2012). Review of ultrasonic irrigation in endodontics: increasing action of irrigating solutions. *Medicina oral, patologia oral y cirugia bucal*, *17*(3), e512.
3. Walmsley, A. D., Laird, W. R. E., & Lumley, P. J. (1992). Ultrasound in dentistry. Part 2—periodontology and endodontics. *Journal of Dentistry*, *20*(1), 11-17.
4. Singh, B. P., Kamat, S., Hunger, S., & Saraf, P. (2012). Root canal obturation by ultrasonic condensation of gutta percha and an in vitro investigation on the quality of obturation. *Endodont*, *24*, 109-15.
5. Dominici, J. T., Clark, S., Scheetz, J., & Eleazer, P. D. (2005). Analysis of heat generation using ultrasonic vibration for post removal. *Journal of endodontics*, *31*(4), 301-303.
6. Aminoshariae, A., Hartwell, G. R., & Moon, P. C. (2003). Placement of mineral trioxide aggregate using two different techniques. *Journal of Endodontics*, *29*(10), 679-682.
7. Ahmadi, F., McLoughlin, I. V., Chauhan, S., & Ter-Haar, G. (2012). Bio-effects and safety of low-intensity, low-frequency ultrasonic exposure. *Progress in biophysics and molecular biology*, *108*(3), 119-138.
8. Walmsley, A. D. (1987). Ultrasound and root canal treatment: the need for scientific evaluation. *International Endodontic Journal*, *20*(3), 105-111.
9. Violich, D. R., & Chandler, N. P. (2010). The smear layer in endodontics–a review. *International endodontic journal*, *43*(1), 2-15.
10. Stock, C. J. (1991). Current status of the use of ultrasound in endodontics. *International Dental Journal*, *41*(3), 175-182.
11. Gabriel, N. A., Alin-Florin, T., Vlad-Florin, V., & Dumitru, M. (2012). APPLICATIONS OF ULTRASONICS in endodontics. *Revista de Tehnologii Neconventionale*, *16*(3), 15.
12. Dalai, D. R., Bhaskar, D. J., Agali, C. R., Singh, N., & Singh, H. (2014). Modern concepts of ultrasonic root canal irrigation. *Int J Adv Health Sci*, *1*(4), 1-4.
13. Bansode, P. V., Pathak, S. D., Wavdhane, M. B., Khedgikar, S. B., & Pandey, A(2017). Endosonics: Revolutionizing Endodontics.