World Journal of Environmental Biosciences
Available Online at: **www.environmentaljournals.org**

Volume 10, Issue 1: 61-64

https://doi.org/10.51847/qSRLZYyTel

ISSN 2277- 8047

Ultrasonic Use in Endodontic Management Approach, Review Article

Bakheet Mohammed Al-Ghannam[1], Khalid Abdulmohsen Almuhrij[2], Rund Talal Basfar[3], Raghad Omar Alamoudi[3], Aseel Mohammed Alqahtani[3], Ahmed Atef Sait[3], Ahmed Loay Ghannam[3], Sultan Khalid Abdoun[3*], Reema Adel Aboulkhair[4], Nour Abdulbadea Nuwaylati[5]

[1]Faculty of Dentistry, King Faisal University, Al Ahsa, KSA.
[2]Faculty of Dentistry, Riyadh college of dentistry and pharmacy, Riyadh, KSA.
[3]Faculty of Dentistry, King Abdulaziz University, Jeddah, KSA.
[4]Department of Dentistry, King abdulaziz university, Jeddah, KSA.
[5]Department of Dentistry, Choueifat Dental clinics, Jeddah, KSA.

ABSTRACT

The beneficial improved outcome and predictability of endodontic therapy could be indebted to the development of new equipment and methods. Significant factors, including the operating microscope and Ultrasonics (US), have found crucial uses in several dental practices. Ultrasonics in endodontics had represented a significant adjunct in the healing of tough cases and enhanced the quality of the treatment. Ultrasonics has become gradually beneficial in purpose, like securing contact to the openings of canals, root canal obturation, endodontic surgery, cleaning and shaping, and the eradication of intracanal debris and obstructions. Nowadays, Ultrasonics (US) has dentistry applications for diagnostic and therapeutic procedures in addition to cleaning tools prior to sterilization, its major application is root planing and scaling of teeth and root canal treatment, both for retrograde and orthograde remedy. The purpose of this review article is to focus on the role of ultrasonics in endodontology.
The Medline, Pubmed, Embase, NCBI, and Cochrane databases were looked into for research of patients who developed diverticular disease symptoms. The incidence, etiology, and management options were analyzed. Ultrasonic has different types of usages in the dental industry, it can be involved in cleaning, creating a passage, and separating instruments.

Keywords: *Ultrasonic, Endodontics, Infection, Separated instruments, Mineral trioxide aggregate*

Corresponding author: Sultan Khalid Abdoun
e-mail ✉ Sultkk33@gmail.com
Received: 27 January 2021
Accepted: 30 March 2021

INTRODUCTION

In order to comprehend the basic principles Ultrasonics (US) uses in dentistry, it must be understood that sound energy with an above human hearing frequency range of 20 kHz is ultrasound. The frequency ranges first used in dentistry were between 25 and 40 kHz (Plotino *et al*., 2007). Later, there was the development of lower frequency devices of up to 8 kHz (Plotino *et al*., 2007). Due to the lower shear stresses produced by the low frequency, there was less tooth surface change (Plotino *et al*., 2007). In dentistry, this instrumentation and principles have initially introduced the preparation of cavities using abrasive slurry. Even though the method has been praised, it did not proceed to be as popular due to the competition with more effective and convenient instruments, i.e., the burs mounted on high-speed handpieces. Nonetheless in 1955, at the time where Zinner used an ultrasonic instrument in removing the deposits from the surface of the teeth, another application was introduced (Mozo *et al*., 2012). This was further elaborated on by Johnson and Wilson, the elimin\ation of calculi and dental plaque had to be done by the ultrasonic scaler as it had become an established instrument in the market (Mozo *et al*., 2012). At the moment, even though therapeutic and diagnostic applications are done by US in dentistry as well as for cleansing of tools prior to sterilization, its chief use in root canal therapy in both the non and surgical approach is the root planing and scaling of teeth (Mozo *et al*., 2012). More recently, new approaches in cavity design and tooth-cutting concepts have been stimulated by the ideas of having a minimalist dental impact and the need to use smaller elements, comprising ultrasound for cavity preparation (Mozo *et al*., 2012). The employment of ultrasonics and sonics in canals has evolved from initial instrumentation to an inert cleansing method (Mozo *et al*., 2012). Even with significant developments in the preparation and debridement of canals, it is still maintained that routinely, dentinal remains are found within the preparations if canals with clinicians being reluctant to accept ultrasonic or sonic tools as significant adjuncts in canal cleansing (Mozo *et al*., 2012). Ultrasonic instrumentation may or may not be simultaneously performed while doing the root canal ultrasonic irrigation. A significant complement for root canal system

cleansing is Passive ultrasonic irrigation, and when contrasted with traditional syringe irrigation, there is more elimination of the planktonic bacteria, organic tissue, and dentine remains from the root canal (Mozo *et al*., 2012). This makes it much more efficient in canal cleansing than ultrasonic instrumentation with concurrent ultrasonic irrigation (Salim *et al*., 2019). Traditional preparation of Root-end cavities was done through a small round or inverted cone burs in a micro handpiece (Salim *et al*., 2019). In the mid- 80s, uniform tools and ceramic pins and aluminum oxide were presented for retrograde filling, however, their use was limited to the cases with adequate working space and teeth with small non-oval canals. In the early 1990s, when the ultra- and sonically driven micro-operational retro tips were commercially accessible there has been a founding of this new method of a regressive root canal as a vital addition in peri radicular operation (Plotino *et al*., 2007; Begeç & Bahşi,2021).
The purpose of this review is to discuss ultrasonically and it is usages in the dental industry

MATERIALS AND METHODS

Articles were selected from the PubMed database through the use of the indicated mesh keys ((“Ultrasonic "[Mesh]) AND (“indications and usages ”[Mesh]) OR (“Ultrasonic indications and usages])).
The articles were selected for review based on their containment of the following discussion topics: diverticular disease recent diagnosis and treatment. Whilst the articles that did not contain the indicated titles as chief discussions were excluded from the criteria.
Of 1,202 articles indexed in the last 20 years, nearly 90 were chosen and evaluated. Where the number was reduced to 31. Through the use of other research links and studies, additional articles were recognized and considered. Professional recommendations and commentary were introduced to assist in the practical assessment of the files.

RESULTS AND DISCUSSION

Physics behind ultrasonics
First Magnetostriction, is the conversion of mechanical energy from electromagnetic energy. A stack of magnetostrictive metal in the handpiece is exposed to a standing and alternating magnetic field; resulting in the production of vibrations (Salim *et al*., 2019). The piezoelectric principle is the second approach. This is in the form of a crystal which alters features with the application of a charge of electricity (Salim *et al*., 2019). Without heat production, the crystal distortion is transformed into motorized oscillations. The main driver oscillates in a true longitudinal fashion since it is at an ultrasonic frequency, whilst rocking from side to side, there is the generation of a transverse wave longitudinally on the endodontic file. The transverse wave is designated by antinodes and nodes along the length of the file. The nodes represent the minimum oscillations or dislodgment, whereas the antinodes represent spots of utmost oscillations or displacement (Salim *et al*., 2019; Belousova *et al*., 2021).

Ultrasonic & access cavity preparation
Locating the canals is considered to be one of the challenges in endodontics, mainly in cases in which the orifice is found to be blocked by ancillary dentin or calcified dentin secondary to the positioning of pulpotomies or heating elements (Mozo *et al*., 2012). In each open calcified tooth, there is the risk of puncturing the root. Straight-line contact deficiency is the principal reason for parting, puncturing, and the incapacity to convey files to the radiographic boundaries (Mozo *et al*., 2012). Ultrasonic apparatus and microscopic visualization are a harmless and applicable combination to ensure the best outcomes (Mozo *et al*., 2012). In standard procedures, ultrasonic tips are beneficial for the refinement of access, MB2 canal location in the top molars and other teeth’s accompaniment canals, calcified canal location in any tooth, and eradication of pulp stones that are attached (Mozo *et al*., 2012). The advantages of an ultrasonic tip are that it does not rotate. As a result, it enhances control and safety, and at the same time, it maintains its efficiency in cutting (Zogheib *et al*., 2021). This becomes a huge advantage when there is a significantly high risk of perforation. The superior control and ophthalmic retrieve that ultrasonic sharp tips give while on access procedures ensure that they are the handiest instrument, specifically when dealing with tough molars (Zogheib *et al*., 2021). An exceptional method when finding the MB2 canals in top jaw molars, for the eradication of ancillary dentin on the mesial wall is ultrasonics. When the breaching of the calcification covering the canal opening, ultrasonics works perfectly. A good choice is usually a troughing tip [2]. Larger tips without ample extensions coats of a diamond could be employed in the first phase of removal of calcification, materials, ancillary dentin, and interferences, as it enhances the control while working in the pulp chamber, offers maximum cutting efficiency. The discovery of canal orifices being the ensuing phase must be done with thinner, longer tips that enable cutting (Mozo *et al*., 2012). A higher efficiency has been shown by the diamond-coated tips used in orthograde endodontic treatment in cutting than either zirconium nitride-coated or stainless steel tips, however they are weaker (Mozo *et al*., 2012). Furhermore, thinner diamond-coated tips are capable to transfer the ultrasonic unit’s oscillations more resourcefully into dentin; resulting in a more violent cutting activity. There seems to be an impact of the power setting to the cutting with bigger dentin debris being cleared when higher power is. Consequently, while probing for canal holes we need to observe some care since violent abrasion can lead to an unwanted alteration in the pulp chamber composition (Mozo *et al*., 2012).

Ultrasonic & separated instruments
There is a frequent challenge to medical officers due to endodontically treated teeth with impediments, like silver points, hard, impenetrable pastes, posts in their roots, or separated instruments (Salim *et al*., 2019). If endodontic treatment was not successful, prior to the nonsurgical retreatment the impediments have to be removed. They include special burs, appropriate forceps, straightforward or indirect contact ultrasonic tools, exterior filing practices in solvents, irritants, or chelators, mechanical adhesion techniques for microtube delivery, and diverse extractors and kits. Ultrasonic energy had shown to be an efficient technique as an addition in the silverpoint removal, broken tools, and fortified positions (Pruthi *et al*., 2020). It has usually been encouraged for the fractured tool removal since the endodontic files, and ultrasonic tips can be employed in the deep root canal system. In addition,

there is no limitation in the employment of US endodontic tools location of the fragments in the root canal or the tooth implicated. The case diagnosis usually depends on the initial condition of periapical tissues (Salim *et al*., 2019). For this reason, in any case, there has to be an attempt to eliminate the fractured tools. When removed, in most cases there is an effective remedy. If a tool is to be bypassed or removed and there can be effective cleaning and filling of the canal, the best option is the nonsurgical endodontics approach (Mozo *et al*., 2012). Obstacle removal from a root canal ought to be done with the least damage to the surrounding tissues and the tooth itself. An overall prognosis could be caused by the extreme destruction of the structure of the tooth which could also be accompanied by problems in the healing phase (Mozo *et al*., 2012). Even though there is a possibility of the eradication of most fragments, due to the limited access a small number might end up not being removed, in spite of ultrasonic tip use. When the obstacle prevents root apex access, it is still not possible to have efficient planning, cleansing, and obturation of the complete root canal. The Direct-line approach is vital whilst allowing the metallic fragment to be the most visible. As a result, magnification (loupes or dental operating microscope) use is crucial, since it ensures straight-up picturing with exceptional illumination, maintaining the high magnifications of the tools (Mozo *et al*., 2012).

Ultrasonic & cleaning of instrument

The efficiency of ultrasonic energy in cleansing enhancement than its competition is notable, including electro-cleaning in many applications, spray washing, air agitation, and brushing tribulation (Ansar & Harishsshetty, 2018). The notable ultrasonic ability to breach and help in the internal cleaning surfaces of difficult parts. Cleaning in most cases requires that a contaminant be displaced, dissolved, or both (Ansar & Harishsshetty, 2018). Ultrasonic energy's mechanical effect may be helpful in both displacing particles and speeding dissolution. In the same way that ultrasonics is beneficial as a cleaning instrument. In addition, ultrasonics is beneficial when used in the process of rinsing (Ansar & Harishsshetty, 2018). Ultrasonic rinsing is used to completely eradicate the remaining chemicals of cleansing. In dissolution, the removed contaminant needs to be in contact with the solvent to dissolve it (Salim *et al*., 2019). The cleaning process is specifically at the interface between the contaminant and the solvent. A saturated solvent layer develops when the solvent dissolves the contaminant and at the interface (Salim *et al*., 2019). When this happens the cleansing stops as the saturated solvent does not have a direct line to the contaminant, and it can not be grasped by fresh solvent (Bentley, 1994). For a fresh solvent to be linked directly to the contaminant that is to be eradicated, implosion and ultrasonic cavitation efficiently displace the saturated solvent stratum. This is advantageous, mainly when cleaning internal and irregular passageways (Salim *et al*., 2019).

Placement of mineral trioxide aggregate (MTA)

Witherspoon and Ham *et al*. explained the use of ultrasonics to help in the MTA placement. The intrinsic deviating character of some open tops and irregularities can expose the elements to peripheral gaps at the interface of the dentin (Aminoshariae *et al*., 2003). It has been shown that with the aid of ultrasonics, a particularly improved MTA dealing was gained. Its positioning with an endodontic condenser and ultrasonic vibration enriched the settling, flow, and MTA compaction (Aminoshariae *et al*., 2003). Moreover, radiographically, the ultrasonically condensed MTA seemed heavier, with lesser holes. The suggested technique of positioning consists of the choosing of a condenser tip, then putting the MTA with the ultrasonic tip, thereby energizing the tip and gradually lowering the MTA substance down using a 1- to 2-mm vertical packing motion. the direct vibration of ultrasonic energy generates a wavelike motion, that allows the shifting and adjusting the canal walls to the cement if repairing a problem apical to the canal curve. Ruddle suggests an incremental placement of MTA deep into a canal, then driving it about the warp with an elastic trimmed gutta-percha cone mainly used as a plugger (Macwan & Deshpande, 2014). A pre-curved 15 or 20 stainless steel file is sequentially driven into the material within 1 or 2mm of the expected length. An indirect ultrasound follows, involving the placement of a working end of an ultrasonic tool on the file shaft. The MTA is encouraged to move due to this vibratory energy making it conform to the lateral canal configurations, in addition to movement control (Macwan & Deshpande, 2014). This method was initially suggested for MTA placement in open and diverging apices, however, it could be employed in putting root-end cavity substances, in punctures, and specifically in pulp-chamber floor perforations (Rao *et al*., 2009).

CONCLUSION

Ultrasonics has various benefits and uses in medical endodontics. An enhanced therapy coupled with a more conventional advance as it is selectively eradicating the structure of the tooth, particularly in hard circumstances whereby a particular tip design or angulation allows access to the constrained work areas, the allows procedures that are impossible with the traditional treatment techniques. As a result, access improvement, abstraction of separated tools or posts, and the location of calcified canals had generated better results. Furthermore, condensation of gutta-percha and better action of irrigation solutions have been gained from the ultrasonic introduction. Root end cavity preparation trailed by material positioning in the areas that are commonly constrained had especially improved the long-term success and the quality of treatment. Finally, the merging of technologies such as ultrasonics, steering the improvement of practices and better tools which has changed the practice of endodontics today.

ACKNOWLEDGMENTS: None

CONFLICT OF INTEREST: None

FINANCIAL SUPPORT: None

ETHICS STATEMENT: None

REFERENCES

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.

Ansar, A., & Harishsshetty, K. (2018). Uses of ultrasonics in endodontics, a review. *International Journal of Advanced Research, 6*, 1448-1459.

Begeç, Ö. A., & Bahşi, E. (2021). Evaluation of the clinical performance of different bulk-fill composites according to clinical evaluation criteria. *Annals of Dental Specialty, 9*(1), 53-61.

Belousova, N. A., Mamylina, N. V., Korchemkina, Y. V., Maltsev, V. P., Pavlova, V. I., Semchenko, A. A., & Permyakova, N. E. (2021). Psychophysiological aspects of formation students' willingness for wellness by means of physical education. *Journal of Advanced Pharmacy Education and Research, 11*(4), 35-40.

Bentley, E. M. (1994). The value of ultrasonic cleaners in dental practice. *British Dental Journal*, *177*(2), 53-56.

Macwan, C., & Deshpande, A. (2014). Mineral trioxide aggregate (MTA) in dentistry: A review of literature. *Journal of Oral Research and Review*, *6*(2), 71-74.

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-e516.

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.

Pruthi, P. J., Nawal, R. R., Talwar, S., & Verma, M. (2020). Comparative evaluation of the effectiveness of ultrasonic tips versus the Terauchi file retrieval kit for the removal of separated endodontic instruments. *Restorative Dentistry & Endodontics*, *45*(2), e14-e.

Rao, A., Rao, A., & Shenoy, R. (2009). Mineral trioxide aggregate—A review. *Journal of Clinical Pediatric Dentistry*, *34*(1), 1-8.

Salim, S., Feroze Raheem, D., Kumar, G. A., Ch, T., Mustafa, M., & Vajpayee, A. (2019). Ultrasonic in *Endodontics, 4*, 421-427.

Zogheib, C., Roumi, R., Bourbouze, G., Naaman, A., Khalil, I., & Plotino, G. (2021). Effects of ultrasonic refinement on endodontic access cavity walls: A microcomputed tomography analysis. *Journal of Conservative Dentistry, 24*(1), 29-35.