

Ultrasonics: An Essential Endodontic Tool - A Review

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Mini Review

Volume 3 Issue 3

Received Date: September 10, 2018

Published Date: September 19, 2018

DOI: 10.23880/oajds-16000194

Abstract

In modern endodontics ultrasonics plays an important role for the success of endodontic therapy. Ultrasound is sound energy having frequency in the range of more than 20000 Hz. Ultrasonics has recently been used in endodontics for various steps like, modifying root canal access like removal of pulp stones and canal calcifications, activation of irrigating solutions in root canals, ultrasonic removal of posts during retreatment, removal of broken instruments and obstructions from canals, application of sealers to canal walls; condensation of gutta-percha during canal obturation, root end preparation during periapical surgery.

Keywords: Ultrasonics; Endodontic Tool; Root canal treatment

Introduction

Ultrasonics was first introduced for cavity preparation using abrasive slurry [1,2]. Initially the technique received favorable reviews but later it never became popular, as it had to compete with the much more effective and convenient method of cavity preparation like the high-speed hand piece. Initially ultrasonic units had a range of frequencies between 25000 and 40000 Hz. Upto 1957 application of ultrasound in dentistry was limited mainly to periodontics, but later Richman, in 1957, introduced it to endodontics [3]. Ultrasound is produced by basic two techniques. The first is magnetostriction, in which magnetostrictive metal strips present in a hand piece are subjected to a standing and alternating magnetic field, as a result vibrations are produced. The second method is based on the piezoelectric principle, by which a crystal is used that changes dimension when an electrical charge is applied.

Deformation of this crystal is converted into mechanical oscillation and vibrations.

Ultrasonics use in endodontics has broadened to various steps like modifying improving root canal access preparation, removing pulp calcifications, location of canal orifices, activation of irrigating in root canals; removal of posts during retreatment procedures, removal of broken instruments in the canal and other obstructions from the root canal; placement and application of sealer to the root canal walls; condensation of gutta-percha during root obturation; apical root end preparation during periapical surgery [4].

The purpose of this review is to discuss the published work on uses of ultrasonics in endodontics.

Uses of Ultrasonics

The main uses of ultrasonics in endodontics are

- a) It modifying and improving access in root canals e.g removing pulp stones, pulp chamber calcifications. Location of canal orifices, removing coronal interferences like lingual shoulder.
- b) Activation of irrigating solutions in the root canals and improving in cleaning and smear layer removal
- c) Removal of broken instruments, files, sealers, gutta percha, root canal fillings, posts, intracanal medicaments from root canal
- d) Application and placement of sealer around the root canal walls
- e) Compaction of obturating materials in root canals.
- f) Placement of mineral trioxide aggregate (MTA) in the canals.
- g) Root-end cavity preparation and refinement and placement of root-end obturation material.

Improving Access and Canal Location

Access cavity preparation is an important step in root canal therapy canal preparation and locating the canals. Ultrasonics instruments helps in identifying the canals which has been occluded by calcified dentin or secondary dentin after the placement of restorative materials. When the straight line access cannot be obtained during root canal treatment it may lead to perforation and inability to obtain radiographic terminus [5]. Vibrations are produced by a stack of magnetostrictive metal strips in hand piece is subjected to alternating magnetic field [6]. Ultrasonics tips have the superior control over the visual access of the canal. It is most commonly used in locating the second mesiobuccal canal of the maxillary molar by cutting its secondary dentin. Ultrasonics easily breaks the calcification which covers on the dentinal surface and makes way for the good access for the cleaning and shaping procedure [7].

Increasing Efficacy of Endodontic Irrigants

In order to obtain the success of root canal treatment, all the canals must be disinfected with antiseptic solution. For the antiseptic solution to dispense inside the dentinal tubules ultrasonics plays an important role During ultrasonic irrigation, small oscillating smooth wire or file, which is placed in the root canal at the centre, after cleaning and shaping, which transmits the energy of file to the irrigant as effective as possible [8].

Sodium hypochlorite is the solution which is mainly used as the endodontic irrigant. It is used in the passive

ultrasonic irrigation which removes more dentin debris, pulp tissue and the planktonic bacteria from the root canal which will be more efficient than the manual syringe type.

Retrieval of Broken Instruments

Sometimes, when the files or post get struck inside the root canal, ultrasonics can be used in retrieving those instruments, as it has the property of engaging deep into the root canal irrespective of the position of the broken instrument it can be removed [9] ultrasonic tips are used in this situation in order to remove the broken files from the root canal by its vibratory motion [5].

Condensation of Gutta-Percha Root Fillings

Ultrasonically activated spreaders are used in warm lateral compaction technique for obturation. This was demonstrated to be superior to conventional lateral condensation in terms of sealing properties. Heat is produced by linear vibration of ultrasonic tips, thus thermoplasticizing gutta-percha and achieving a more homogeneous mass [10]. This technique has also been evaluated clinically with favourable results [11].

Placement of Mineral Trioxide Aggregate

Ultrasonics are used for placement of MTA in canals both orthogradely as well as retrogradely. The recommended method consists of selecting and placing the MTA with the ultrasonic tip, followed by activating the tip and moving the MTA material down using a 1- to 2-mm vertical packing motion. Direct ultrasonic energy will generates a wavelike motion and facilitates moving and adapting the cement to the canal walls. Retro apical preparation of cavity is also achieved by ultrasonic tips before placement of MTA during apical surgery [12,13].

Conclusion

It is concluded from this review of the literature that ultrasound offers many applications and advantages in clinical endodontic practice. Ultrasound Improves visualization and access to apical foramen. It allows a more conservative approach in removing tooth structure. In addition, better action of irrigation solutions is achieved with increased smear layer removal apart from achieving various other benefits. The overall quality of treatment and long-term success is increased.

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