

Original Research

Comparative evaluation of the efficacy of diode laser, Endo Activator, passive ultrasonic irrigant, and manual irrigation activation systems in debridement of root canal isthmus

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ABSTRACT:

Aim: Assessment of the efficacy of diode laser, EndoActivator, passive ultrasonic irrigant, and manual irrigation activation systems in debridement of root canal isthmus. **Materials & methods:** A total of 50 freshly extracted mandibular first molars were included and divided into 5 study groups with 10 specimens in each group. Group A- Diode Laser group, Group B- EndoActivator group (EndoActivator sonic handpiece used for irrigation), Group C- Passive ultrasonic irrigant (PUI) group, Group D: Manual irrigation activation system group (Agitation of irrigation using master cone gutta-percha point, and Group E: Control group (No activation of the irrigant). Scoring criteria used was as follows: Score 1 – Clean root canal walls, only a few small debris particles, Score 2 – Few small agglomeration of debris, Score 3 – Many agglomerations of debris covering <50% of the root canal wall, Score 4 – More than 50% of the root canal wall covered with debris and Score 5 – Complete or nearly complete root canal walls covered with debris. **Results:** In group A, most of the specimens demonstrated score 3 while in group B, most of the specimens demonstrated score 1. Among group D, most of the specimens showed score 3. Lowest score was seen among specimens of group C while highest was seen among specimens of group D. Significant results were obtained while comparing the debris score among specimens of all the study groups. **Conclusion:** Endoactivator exhibited lowest score while MDA exhibited maximum score.

Key words: Endoactivator Ultrasonic, Irrigation

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INTRODUCTION

The aim of root canal treatment is to eradicate microorganisms, particularly in the apical region, and to prevent bacterial contamination or regrowth. This is usually obtained by the combination of chemomechanical disinfection of the root canal system, followed by three-dimensional obturation. The first use of laser in endodontics was reported by Weichman and Johnson in 1971 who attempted to seal the apical foramen in vitro with a high power carbon dioxide (CO₂) laser. Since then, many papers on laser use in endodontics have been published. However, the

clinical application of lasers in endodontics started in the late 90s when the new delivery systems, including thin and flexible fibres and endodontic tips, were developed. Today, lasers can be used in various endodontic procedures such as: pulp capping/pulpotomy, cleaning and disinfecting the root canal system, obturation, endodontic retreatment, and apical surgery.¹⁻³

Improve the spreading and efficiency of the irrigant solution, many irrigation devices have been developed, such as Self-Adjusting File®, EndoActivator®, Irrisafe®, and Endovac®.

EndoActivator®, a sonically driven irrigation system, activates irrigant solutions using frequencies in the range of 2–3 kHz. The machine accomplishes hydrodynamic activation of the irrigants that is capable of cleaning the root canal system and irregularities, such as lateral canals. After cleaning, canal obturation can be performed by achieving high adaptability of the filling materials. It is crucial to use sealer during the obturation technique in order to minimize voids between the filling material and the canal wall, and to seal dentinal tubules.⁴

Ultrasonic irrigation of the root canal can be performed with or without simultaneous ultrasonic instrumentation. When canal shaping is not undertaken the term passive ultrasonic irrigation (PUI) can be used to describe the technique. Passive ultrasonic irrigation can be performed with a small file or smooth wire (size 10-20) oscillating freely in the root canal to induce powerful acoustic microstreaming.⁵Hence; the present study was conducted for comparatively evaluating the efficacy of diode laser, EndoActivator, passive ultrasonic irrigant, and manual irrigation activation systems in debridement of root canal isthmus.

MATERIALS & METHODS

A total of 50 freshly extracted mandibular first molars were included and divided into 5 study groups with 10 specimens in each group. Deformed, carious and decayed tooth specimens were excluded. Radiographs of all the specimens was taken. Cleaning and disinfecting of all the specimens were done. Preparation of access cavity was done followed by establishment of patency using number 10 K file.

Table 1: Debris score

Debris score	Group A	Group B	Group C	Group D	Group E
Score 1	2	5	2	1	0
Score 2	4	4	3	3	0
Score 3	3	1	4	5	0
Score 4	1	0	1	1	5
Score 5	0	0	0	0	5
Total	10	10	10	10	10
Chi-square value	23.545				
p-value	0.0000 (Significant)				

DISCUSSION

There is consensus that laser irradiation has the potential to kill microorganisms and to remove debris and smear layer from root canals. In root canal disinfection, there is insufficient evidence to suggest that any specific laser is superior to the traditional endodontic treatment.⁶Various irrigation solutions and techniques have been investigated for better CH elimination from dentinal walls. Manual instrumentation with a master apical file and copious irrigation seems inadequate for complete dressing removal. To overcome these shortcomings, mechanical agitation of the irrigants has been proposed as a novel technique using sonic and ultrasonic units. One of the most common sonic

Biomechanical preparation was done along with intermittent irrigation using 5.25% sodium hypochlorite (NaOCl). Random distribution of all the specimens was done into following study groups according to final irrigation protocol adopted as follows: Group A- Diode Laser group, Group B- EndoActivator group (EndoActivator sonic handpiece used for irrigation), Group C- Passive ultrasonic irrigant (PUI) group, Group D: Manual irrigation activation system group (Agitation of irrigation using master cone gutta-percha point, and Group E: Control group (No activation of the irrigant). The images of each section were taken with a digital camera attached to a stereomicroscope and the images were viewed on the computer. Scoring criteria used was as follows: Score 1 – Clean root canal walls, only a few small debris particles, Score 2 – Few small agglomeration of debris, Score 3 – Many agglomerations of debris covering <50% of the root canal wall, Score 4 – More than 50% of the root canal wall covered with debris and Score 5 – Complete or nearly complete root canal walls covered with debris. All the results were recorded and analysed using SPSS software.

RESULTS

In group A, most of the specimens demonstrated score 3 while in group B, most of the specimens demonstrated score 1. Among group D, most of the specimens showed score 3. Lowest score was seen among specimens of group C while highest was seen among specimens of group D. Significant results were obtained while comparing the debris score among specimens of all the study groups.

agitation devices is the EndoActivator system which is comprised of a portable handpiece and three noncutting flexible polymer tips in different sizes. Its design allows safe activation and the production of vigorous intracanal fluid agitation. On the other hand, most ultrasonic devices which are used for passive ultrasonic irrigation (PUI) operate at 25–30 kHz.⁷⁻¹⁰Hence; the present study was conducted for comparatively evaluating the efficacy of diode laser, EndoActivator, passive ultrasonic irrigant, and manual irrigation activation systems in debridement of root canal isthmus.

In group A, most of the specimens demonstrated score 3 while in group B, most of the specimens demonstrated score 1. Among group D, most of the

specimens showed score 3. Lowest score was seen among specimens of group C while highest was seen among specimens of group D. Significant results were obtained while comparing the debris score among specimens of all the study groups. Adl A et al compared the efficacy of EndoActivator, passive ultrasonic irrigation, and Ultra X in removing calcium hydroxide from the artificial grooves in root canal walls. The root canals of 50 extracted human maxillary incisors were instrumented by using the ProTaper rotary system up to #F4 (size 40/0.06 ProTaper) and the teeth were split longitudinally. Lateral grooves were created in the apical and coronal parts of one half and the middle part of the other half. Calcium hydroxide paste was applied to the grooves and the root halves were reassembled. After seven days, the calcium hydroxide was removed from the canal by using one of the EndoActivator, passive ultrasonic irrigation, and Ultra X devices; one group went without irrigation (control group). No statistically significant difference existed among the experimental groups at the coronal and middle grooves. However, Ultra X was significantly more effective than passive ultrasonic irrigation at the apical grooves. Ultra X can be reported to remove the calcium hydroxide from the apical third more efficiently than passive ultrasonic irrigation.¹¹ In another study conducted by Kumar S et al, authors compared the efficacy of CanalBrush (CB), EndoActivator (EA), and Passive Ultrasonic Irrigation (PUI) on the removal of triple antibiotic paste (TAP) from root canal walls. Thirty-six extracted human single-rooted teeth were prepared using ProTaper Universal rotary files (DentsplyMaillefer, Ballaigues, Switzerland) up to size F5. The root canals were filled with TAP, and after 21 days, roots were randomly assigned to three groups (n = 10) according to irrigation regimens used: CB, EA, and PUI. There were significant differences among the experimental groups according to the different parts of the root canals ($P < 0.05$). At the apical and middle third, EA and PUI groups removed more TAP than CB group; however, there was a statistically significant difference only between CB and PUI groups (<0.01 at apical third and <0.05 at middle third). At the coronal third, there was no statistically significant difference between all the three groups ($P > 0.05$). PUI led to superior results compared to CB in the middle and apical thirds. There was no significant difference between EA and PUI techniques.¹²

CONCLUSION

Endoactivator exhibited lowest score while MDA exhibited maximum score.

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