Journal of Applied Dental and Medical Sciences
NLM ID: 101671413 ISSN:2454-2288
Volume 6 Issue 1 Jan-March 2020

Original Research

A comparative evaluation of ultrasonic irrigation and syringe irrigation in clinical and laboratory study

Faiqah Lanker[1], Sheetal Reddy[2]

[1,2]Department of Conservative Dentistry and Endodontics, The Oxford Dental College, Bangalore, Karnataka

ARTICLE INFO

Keywords:
Syringe irrigation, Root canal treatment, Ultrasonic irrigation

ABSTRACT

Background: The present study was conducted to compare ultrasonic irrigation and syringe irrigation in clinical and laboratory study.

Materials & Methods: The present study was conducted on 50 single rooted mandibular premolars. We prepared 2 groups of 25 each. In group I, ultrasonic irrigation and in group II, syringe irrigation was performed. The incidence of pain, quality of root canal filling and the number of obturated lateral canals were analyzed and compared between the two groups.

Results: The mean irrigation time in group I was 128.2 seconds and in group II was 217.3 seconds. The difference was significant (P< 0.05). There were 5 cases in group I and 2 cases of incidence of pain in group II. The difference was significant (P< 0.05). In group I, appropriate filling was seen in 21 and under filling in 4 cases and in group II, appropriate filling was seen in 22, over filling in 1 and under filling in 2 cases. The difference was significant (P< 0.05).

Conclusion: Authors found that ultrasonic irrigation has a greater capacity to clean instrumented root canals than syringe irrigation.

Introduction

Endodontic therapy, also termed root canal therapy, involves removal of infected tissue and protection of decontaminated teeth. The root canal system has a complicated anatomical structure, comprising several irregular structures in the root canal wall.[1] Therefore, root canal irrigation is of great importance for eliminating infected pulp tissue, and removing the smear layer and dentinal debris resulting from root canal filing. The efficacy of irrigation relies on both the flushing action of the irrigant and its capacity to dissolve infected tissue.[2]

Disinfection of the root canal system is a specific requirement for endodontic treatment success. Irrigant penetration in the canal system depends on the root canal anatomy, irrigant application techniques, solution volume, root canal instrumentation and irrigant's physic-chemical characteristics.[3] Sodium hypochlorite (NaOCl) and chlorhexidine (CHX) are the most commonly used irrigants, and they are sometimes combined with ethylenediaminetetraacetic acid (EDTA) or other chelating agents. Different studies showed that the use of NaOCl between 2.5% and 5%, combined with 10 - 17% EDTA solutions, is particularly effective in the elimination of organic and inorganic debris.[4]

Ultrasonically activated files usually oscillate at frequencies (25-30 kHz) exceeding human hearing. There are two types of ultrasonic irrigation, with or without simultaneous ultrasonic instrumentation: ultrasonic instrumentation (UI) and passive ultrasonic irrigation (PUI). Syringe irrigation has been used for decades in clinical practice. In comparison, however, ultrasonic irrigation achieves better removal of artificially created dentinal debris from simulated canal irregularities in the root canal following preparation.[5] The present study was conducted to compare ultrasonic

* Corresponding author*: Dr.Faiqah Lanker,Department of Conservative Dentistry and endodontics, The Oxford Dental College, Bangalore, Karnataka*

irrigation and syringe irrigation in clinical and laboratory study.

Materials & Methods

The present study was conducted in the department of endodontics. It comprised of 50 single rooted mandibular premolars. The study was approved from institutional ethical committee.

We prepared 2 groups of 25 each. In group I, ultrasonic irrigation and in group II, syringe irrigation was performed. After instrumentation with a K-file using the step-back technique, the two groups received irrigation using 40 mL of 2.5% NaOCl respectively, followed by conventional lateral compaction. All teeth were evaluated histologically by light microscopy. The incidence of pain, quality of root canal filling and the number of obturated lateral canals were analyzed and compared between the two groups. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

Results

Table I Distribution of teeth

Groups	Group I	Group II
Method	Ultrasonic irrigation	Syringe irrigation
Number	25	25

Table I shows distribution of teeth based on method of irrigation used.

Table II Assessment of irrigation time

Groups	Mean time (Seconds)	P value
Group I	128.2	0.001
Group II	217.3	

Table II, graph I shows that mean irrigation time in group I was 128.2 seconds and in group II was 217.3 seconds. The difference was significant (P< 0.05).

Graph I Assessment of irrigation time

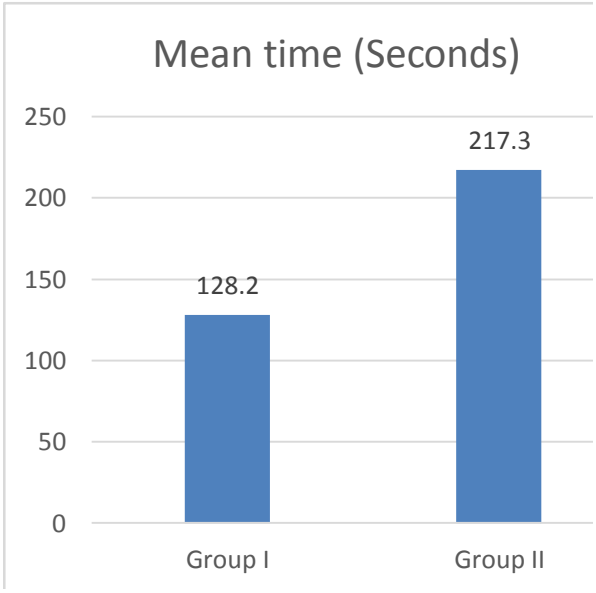

Table III Incidence of pain in two groups

Groups	Number	P value
Group I	5	0.001
Group II	2	

Table III shows that there were 5 cases in group I and 2 cases of incidence of pain in group II. The difference was significant (P< 0.05).

Table IV Comparison of filling in all groups

Groups	Group I	Group II	P value
Appropriate	21	22	0.001
Over	0	1	
Under	4	2	

Table IV shows that in group I, appropriate filling was seen in 21 and under filling in 4 cases and in group II, appropriate filling was seen in 22, over filling in 1 and under filling in 2 cases. The difference was significant (P< 0.05).

Discussion

Passive ultrasonic irrigation (PUI) has showed to be more effective than conventional irrigation in cleaning and disinfecting root canals.[6] PUI-activated irrigation produces acoustic microwaves, cavitation and heat generation, that helps the irrigant to access to the difficult-to-reach places, favouring the elimination of dentinal debris, opening tubules and maximizing the irrigant antibacterial effect, because it can spread better along the root canal system. There are some variants in this technique. Ultrasonic intermittent activation, used with three 20 seconds sequences, removed more dentinal debris than conventional syringe irrigation.[7] Currently, an ultrasound oscillation frequency of 30 KHz, with displacement amplitude of 20 - 30 μm, is recommended. It seems that a volume increase does not significantly improve washing action and effectiveness in debris removal.[8] The present study was conducted to compare ultrasonic irrigation and syringe irrigation in clinical and laboratory study.

In this study, In group I, ultrasonic irrigation and in group II, syringe irrigation was performed. Llena et al[9] included thirty extracted human teeth which were divided into three groups. According to final irrigation regimen, 5.25% sodium hypochlorite (Group A, NaOCl), 2% chlorhexidine (Group B, CHX) and saline solution (Group C, control group) were applied with Irrisafe 20 tips (Acteon) and PUI. Irrigant was mixed with 0.1% rhodamine B. Sections at 2 mm, 5 mm, and 8 mm from the apex were examined with confocal laser scanning microscopy (CLSM). The percentage and maximum depth of irrigant penetration were measured. In all groups, highest penetration depth and percentage of penetration were observed at the 8 mm level. At 2 mm level, Groups A and B had significantly greater depths and percentages in penetration than Group C ($p < 0.05$), but there were no significant differences between Groups A and B. At 5 mm level, penetration depths and percentage of penetration was not significantly different among the groups.

We found that mean irrigation time in group I was 128.2 seconds and in group II was 217.3 seconds. A number of investigations have shown that removal of the smear layer exacerbates the penetration of bacteria into the dentinal tubules, suggesting that the smear layer might serve as a barrier against bacterial infection. Nonetheless, others argue that the smear layer might compromise the therapeutic effect of intra-canal medications by impeding the penetration of medications into the dentinal tubules, thus protecting bacteria already present there. Besides, the smear layer itself may also be infected by bacteria located within dentinal tubules. Therefore, it is considered prudent to eliminate the smear layer covering the infected root canals.[10,11]

We found that there were 5 cases in group I and 2 cases of incidence of pain in group II. In group I, appropriate filling was seen in 21 and under filling in 4 cases and in group II, appropriate filling was seen in 22, over filling in 1 and under filling in 2 cases.

Syringe irrigation has been used for decades in clinical practice. In comparison, however, ultrasonic irrigation achieves better removal of artificially created dentinal debris from simulated canal irregularities in the root canal following preparation (13). Results from scanning electron microscopy (SEM) observations support the superiority of PUI over syringe irrigation for elimination of debris from the root canal, even with a lower concentration of sodium hypochlorite (NaOCl) solution.[12]

The shortcoming of the study is small sample size.

Conclusion

Authors found that ultrasonic irrigation has a greater capacity to clean instrumented root canals than syringe irrigation.

References

1. Dalai DR, Bhaskar DJ, Chandan Agali R, Singh N, Singh H (2014) Modern concepts of ultrasonic root canal irrigation. Int J Adv Health Sci 1, 1-4.
2. Roy RA, Ahmad M, Crum LA (1994) Physical mechanisms governing the hydrodynamic response of an oscillating ultrasonic file. Int Endod J 27, 197-207.
3. Van der Sluis LW, Versluis M, Wu MK, Wesselink PR (2007) Passive ultrasonic irrigation of the root canal: a review of the literature. Int Endod J 40, 415-426.
4. Al-Jadaa A, Paqué F, Attin T, Zehnder M (2009) Necrotic pulp tissue dissolution by passive ultrasonic irrigation in simulated accessory canals: impact of canal location and angulation. Int Endod J 42, 59-65.
5. Paiva SS, Siqueira JF Jr, Rôças IN, Carmo FL, Ferreira DC, Curvelo JAR et al. (2012) Supplementing the antimicrobial effects of chemomechanical debridement with either passive ultrasonic irrigation or a final rinse with chlorhexidine: a clinical study. J Endod 38, 1202-1206.
6. Jiang LM, Verhaagen B, Versluis M, Langedijk J, Wesselink P, van der Sluis LW (2011) The influence of the ultrasonic intensity on the cleaning efficacy of passive ultrasonic irrigation. J Endod 37, 688-692.
7. Andrabi SM, Kumar A, Zia A, Iftekhar H, Alam S, Siddiqui S (2014) Effect of passive ultrasonic irrigation and manual dynamic irrigation on smear layer removal from root canals in a closed apex in vitro model. J Investig Clin Dent 5, 188-193.
8. Van der Sluis LW, Wu MK, Wesselink PR (2007) The evaluation of removal of calcium hydroxide paste from an artificial standardized groove in the apical root canal using different irrigation methodologies. Int Endod J 40, 52-57.
9. Llena C, Forner L, Cambralla R, Lozano A. Effect of three different irrigation solutions applied by passive ultrasonic irrigation. Restorative Dentistry & Endodontics. 2015 May 1;40(2):143-8.
10. Boutsioukis C, Kishen A (2012) Fluid dynamics of syringebased irrigation to optimise anti-biofilm efficacy in root-canal disinfection. Roots: Int Mag Endod 2012, 22-31.
11. Figdor D, Sundqvist G. A big role for the very small: understanding the endodontic microbial flora. Aust Dent J 2007;52(Suppl):S38–51.
12. Nair PN, Henry S, Cano V, Vera J. Microbial status of apical root canal system of human mandibular first molars with primary apical periodontitis after ‘‘one-visit’’ endodontic treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005; 99:231–5.