

Assessment and comparison of efficacy of three different root canal irrigants solutions used for root canal therapy

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ABSTRACT

Background

Bacteria have long been recognized as the primary etiologic factors in the development of pulp and periapical lesions. Chemical debridement is especially needed for teeth with complex internal anatomy such as fins or other irregularities that might be missed by instrumentation. Hence; the present study was undertaken for assessing and comparing the efficacy of two different root canal irrigants solutions used for root canal therapy.

Materials & methods

A total of 30 freshly extracted maxillary second premolars were included in the present study. All the tooth specimens were divided into two study groups depending upon the type of root canal irrigants used as follows: Group A- Irrigant 2% chlorhexidine (CHX), and Group B-Irrigant 1% povidone Iodine. Biomechanical preparation of the root canals was done. Regular irrigation of the root canals was done according to the respective groups. For a period of six hours, canals were filled with sterile water followed insertion of endodontic paper points into the canals for two minutes. Same procedure of sampling was repeated after 12 hours and 24 hours. All the paper point samples were placed in mitis salivarius-bacitracin streptomycin (MSBS) agar plates followed by incubation. Assessment of zones of inhibition was done using a magnifying lens.

Results

Mean zone of inhibition among specimens of group A at 0 to 6 hours, 6 to 12 hours and 12 to 24 hours of sampling was 3.79 mm, 3.08 mm, 2.39 mm respectively. Mean zone of inhibition among specimens of group B at 0 to 6 hours, 6 to 12 hours and 12 to 24 hours of sampling was 2.26 mm, 2.01 mm, 1.79 mm respectively. In the present study, a significant reduction in the zone of inhibition was seen among specimens of group A and group B at successive time intervals of sampling (p -value < 0.05). Also, while comparing at different time intervals, it was seen in the zone of inhibition was maximum among specimens of group A in comparison to group B.

Conclusion

In comparison to 1% povidone Iodine, CHX exhibited higher anti-microbial efficacy and hence is the preferred root canal irrigant in comparison to 1% povidone Iodine.

INTRODUCTION

Bacteria have long been recognized as the primary etiologic factors in the development of pulp and periapical lesions. Successful root canal therapy depends

on thorough chemomechanical debridement of pulpal tissue, dentin debris, and infective microorganisms. Irrigants can augment mechanical debridement by flushing out debris, dissolving tissue, and disinfecting

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the root canal system. Chemical debridement is especially needed for teeth with complex internal anatomy such as fins or other irregularities that might be missed by instrumentation.¹⁻³

The smear layer and plugs consist of an organic portion (pulp tissue debris, odontoblastic process, proteins, saliva, microorganisms, and blood cells) and an inorganic portion (minerals from the dentin structure). Some investigators believed that the presence of the smear layer helps in increasing the success rate of endodontic treatment because this layer blocks dentinal tubules and prevents bacterial exchange by reducing dentine permeability. The most common irrigation regiments for the removal of the smear layer includes NaOCl at various concentrations to remove the organic component of the smear layer and complementing its action by means of chelating agents such as 17% ethylenediaminetetraacetic acid (EDTA) to remove the inorganic components.⁴⁻⁶ Hence; the present study was undertaken for assessing and comparing the efficacy of two different root canal irrigants solutions used for root canal therapy.

MATERIALS & METHODS

The present study was conducted with the aim of assessing and comparing the efficacy of two different root canal irrigants solutions used for root canal therapy. A total of 30 freshly extracted maxillary second premolars were included in the present study. Malformed teeth, carious teeth, teeth with more than one root canal, teeth with presence of developmental anomaly were excluded from the present study. All the tooth specimens were divided into two study groups depending upon the type of root canal irrigants used as follows:

Group A- Irrigant 2% chlorhexidine (CHX), and
Group B-Irrigant 1% povidone Iodine

Access opening was done followed by beveling of the apex of the root at 45° angle. This was followed by application of the etchant for thirty seconds at the apex. Afterwards, washing and drying was done. Mounting of the specimens was done on a plaster block. Biomechanical preparation of the root canals was done. Regular irrigation of the root canals was done according to the respective groups. For a period of six hours, canals were filled with sterile water followed insertion of endodontic paper points into the canals for two minutes. Same procedure of sampling was repeated after 12 hours and 24 hours. All the paper point samples were placed in mitis salivarius-bacitracin streptomycin (MSBS) agar plates followed by incubation. Assessment of zones of inhibition was done using a magnifying lens. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software.

RESULTS

In the present study, a total of 30 freshly extracted maxillary second premolars were included and were divided into two study groups depending upon the type of root canal irrigants used as follows: Group A- Irrigant 2% chlorhexidine (CHX), and Group B-Irrigant 1% povidone Iodine. Mean zone of inhibition among specimens of group A at 0 to 6 hours, 6 to 12 hours and 12 to 24 hours of sampling was 3.79 mm, 3.08 mm, 2.39 mm respectively. Mean zone of inhibition among specimens of group B at 0 to 6 hours, 6 to 12 hours and 12 to 24 hours of sampling was 2.26 mm, 2.01 mm, 1.79 mm respectively. In the present study, a significant reduction in the zone of inhibition was seen among specimens of group A and group B at successive time intervals of sampling (p- value < 0.05). Also, while comparing at different time intervals, it was seen in the

zone of inhibition was maximum among specimens of group A in comparison to group B.

Table 1: Comparison of mean zone of inhibition

Group	Time of sampling			p- value
	0 to 6 hours	6 to 12 hours	12 to 24 hours	
Group A	3.79	3.08	2.39	0.00*
Group B	2.26	2.01	1.79	0.01*
p- value	0.02*	0.00*	0.00*	-

*: Significant

DISCUSSION

The essence of endodontic therapy is the restoration of the treated tooth to its proper form and function in the masticatory apparatus in a healthy state. There are three basic established phases in endodontic treatment known as 'ENDODONTIC TRIAD" comprising biomechanical preparation, irrigation and disinfection, and obturation. Every facet of the treatment is important and must be performed in a predetermined manner, if any step is faulty, entire system may fail. Various chemical root canal irrigants used successfully are sodium hypochlorite (NaOCl) and 2% chlorhexidine (CHX).⁷⁻⁹ Hence; the present study was undertaken for assessing and comparing the efficacy of two different root canal irrigants solutions used for root canal therapy.

In the present study, a total of 30 freshly extracted maxillary second premolars were included and were divided into two study groups depending upon the type of root canal irrigants used as follows: Group A- Irrigant 2% chlorhexidine (CHX), and Group B-Irrigant 1% povidone Iodine. Mean zone of inhibition among specimens of group A at 0 to 6 hours, 6 to 12 hours and 12 to 24 hours of sampling was 3.79 mm, 3.08 mm, 2.39 mm respectively. Mean zone of inhibition among specimens of group B at 0 to 6 hours, 6 to 12 hours and 12 to 24 hours of sampling was 2.26 mm, 2.01 mm, 1.79 mm respectively. Shahani MN et al assessed the

antimicrobial substantivity of 2% chlorhexidine gluconate, 1% povidone iodine, 2.5% hydrogen peroxide followed by 2% sodium hypochlorite, and 2% sodium hypochlorite alone as irrigants in instrumented root canals. 2% chlorhexidine showed antimicrobial substantivity lasting up to 72 h, followed by 1% povidone iodine, and 2% sodium hypochlorite. Thus 2% chlorhexidine should be used as a final rinse irrigant in endodontic treatment protocols.¹⁰

Gomes JE et al compared the reaction of rat subcutaneous connective tissue to 0.9% sterile saline, 2.5% sodium hypochlorite (NaOCl), 5.25% NaOCl and 2% chlorhexidine gluconate solution or gel. Six circles were demarcated on the dorsal skin of 24 male Wistar rats, leaving 2 cm between each circle. Using a syringe, 0.1 mL of each root canal irrigant was injected subcutaneously into 5 circles. In the 6th circle, the needle of an empty syringe was introduced into the skin, but no irrigant was injected (control group). Evaluations were undertaken at 2 h, 48 h, 14 days and 30 days post-procedure. Tissue samples were excised, embedded in paraffin blocks and 3- μ m-thick sections were obtained and stained with hematoxylin and eosin. The group treated with 2.0% chlorhexidine gluconate gel presented a moderate inflammatory response at 14 days, which decreased at 30 days, being considered similar to that of the control group, 0.9% saline solution, 2.0%

chlorhexidine solution and 2.5% NaOCl at this experimental period.¹¹

In the present study, a significant reduction in the zone of inhibition was seen among specimens of group A and group B at successive time intervals of sampling (p-value < 0.05). Also, while comparing at different time intervals, it was seen in the zone of inhibition was maximum among specimens of group A in comparison to group B. Babaji P et al evaluated the antimicrobial effect of herbal root canal irrigants (Morinda citrifolia, Azadirachta indica extract, Aloe vera) with sodium hypochlorite (NaOCl). The bacterial *E. faecalis* (ATCC) culture was grown overnight in brain heart infusion (BHI) broth and inoculated in Mueller–Hinton agar plates. Antibacterial inhibition was assessed using agar well diffusion method. All five study irrigants were added to respective wells in agar plates and incubated at 37°C for 24 h. Bacterial inhibition zone around each well was recorded. Highest inhibitory zone against *E. faecalis* was seen in NaOCl followed by *M. citrifolia* and *A. indica* extract, and the least by *A. vera* extract. Tested herbal medicine (*A. indica* extract, *M. citrifolia*, *A. vera*) showed inhibitory zone against *E. faecalis*.¹²

CONCLUSION

From the above results, the authors concluded that in comparison to 1% povidone Iodine, CHX exhibited higher anti-microbial efficacy and hence is the preferred root canal irrigant in comparison to 1% povidone Iodine. However; further studies are recommended.

REFERENCES

1. Baumgartner JC, Falkler WA. Bacteria in the apical 5 mm of infected root canals. *J Endod.* 1991; 17:380-3.
2. Kakehashi S, Stanley HR, Fitzgerald RJ. The effects of surgical exposures of dental pulps in germ-free and conventional laboratory rats. *Oral Surg Oral Med Oral Pathol.* 1965; 20:340-9.
3. Bansal P, Gupta H. Smear layer in endodontics – A review. *Indian J Dent Sci.* 2009; 1:67-9.
4. Paranjpe A, de Gregorio C, Gonzales AM, Gomez A, Silva Herzog D, Pina AA, et al. Efficacy of the self -adjusting file system on cleaning and shaping oval canals: A microbiological and microscopic evaluation. *J Endod.* 2012; 38:226-231.
5. Albrecht Lynn J. Evaluation of Apical Debris Removal Using Various Sizes and Tapers of ProFile GT Files. *J Endod.* 2004; 30:425-8.
6. Mohammadi Z. Chlorhexidine gluconate, its properties and applications in endodontics. *Iran Endod J.* 2008; 2:113-25.
7. Siqueira JF, Jr, Alves FR, Almeida BM, de Oliveira JC, Rôças IN. Ability of chemomechanical preparation with either rotary instruments or self-adjusting file to disinfect oval-shaped root canals. *J Endod.* 2010; 36:1860-5.
8. Sjogren U, Figdor D, Persson S, Sundqvist G. Influence of infection at the time of root filling on the outcome of endodontic treatment of teeth with apical periodontitis. *Int Endod J.* 1997; 30:297-306.
9. Baker NA, Eleazer PD, Averbach RE, Seltzer S. Scanning electron microscopic study of the efficacy of various irrigation solutions. *J Endod.* 1975; 4:127-35.
10. Shahani MN1, Subba Reddy VV. Comparison of antimicrobial substantivity of root canal irrigants in instrumented root canals up to 72 h: an in vitro study. *J Indian Soc Pedod Prev Dent.* 2011; 29(1):28-33. doi: 10.4103/0970-4388.79925.

11. Gomes JE et al. Comparison of the biocompatibility of different root canal irrigants. *J Appl Oral Sci.* 2008; 16(2):137-144.
12. Babaji P, Jagtap K, Lau H, Bansal N, Thajuraj S, Sondhi P. Comparative evaluation of antimicrobial effect of herbal root canal irrigants (Morinda citrifolia, Azadirachta indica, Aloe vera) with sodium hypochlorite: An in vitro study. *J Int Soc Prev Community Dent.* 2016; 6(3):196-199.