

ORIGINAL ARTICLE

COMPARATIVE EVALUATION OF EFFICACY OF ANTIMICROBIAL PROPERTIES OF SODIUM HYPOCHLORITE AND ALOE VERA SOLUTIONS AS ROOT CANAL IRRIGANTS

Gursimran Singh Marwah¹, Sameer Khajuria², Ravneet Kaur³, Reeva Singh⁴, Charanpreet Singh⁴

¹PG student, Department of Conservative dentistry, ²PG student, Department of Periodontics, ³PG student, Department of Pedodontics, ⁴Intern, BRS dental college & Hospital, Sultanpur, Panchkula

ABSTRACT:

Background: The removal of pulpal and dentinal debris and the elimination of viable microorganisms from the root canal system are of paramount importance during endodontic therapy. It has been reported that viable bacteria remain within the canal system even after chemomechanical preparation. The present study was planned to compare efficacy of antimicrobial properties of sodium hypochlorite and aloe vera solutions as root canal irrigants. **Materials and methods:** For the study, 30 extracted teeth were collected. Only single rooted teeth were selected and teeth having defects such as calcifications, internal and external resorption, cracks, etc were excluded from the study. The working lengths of the teeth were determined using K-file (number 15). For irrigation of canals with different solutions, 80% Aloe Vera solution and 2.5% sodium hypochlorite solution were prepared. Now, the teeth were divided into 3 groups with 10 teeth in each group: The Aloe Vera Group; The Normal Saline Group; and the Sodium Hypochlorite Group. **Results:** The difference of antibacterial effects on *E. faecalis* of the Aloe Vera group and the normal saline group were non-significant. In comparison to these two groups, the sodium hypochlorite group showed statistically significant antibacterial effect on *E. faecalis*. **Conclusion:** From the results of present study, we concluded that Sodium hypochlorite is best suited for irrigating root canal with *E. faecalis* infection in comparison to aloe vera solution.

Keywords: Aloe vera, Irrigants, Sodium hypochlorite

Corresponding author: Dr. Gursimran Singh Marwah, PG student, Department of Conservative dentistry, BRS dental college & Hospital, Sultanpur, Panchkula

This article may be cited as: Marwah GS, Khajuria S, Kaur R, Singh R, Singh C. Comparative evaluation of efficacy of antimicrobial properties of sodium hypochlorite and aloe vera solutions as root canal irrigants. *J Adv Med Dent Scie Res* 2017;5(4):18-21.

Access this article online	
<p>Quick Response Code</p> 	Website: www.jamdsr.com
	DOI: 10.21276/jamdsr.2017.5.4.5

INTRODUCTION:
Root canal morphology is complex and contains numerous ramifications and anatomical irregularities.¹ The removal of pulpal and dentinal debris and the elimination of viable microorganisms from the root canal system are of paramount importance during endodontic therapy. It has been reported that viable bacteria remain within the canal system even after chemomechanical preparation.² These observations call for an effective intracanal disinfection of the root canal system. The effectiveness of intracanal medications in achieving disinfection is still controversial. Tissue toxicity seems to be directly related to its antimicrobial effects.³ The most potent antimicrobial medications are also the most irritating to the host tissues. Potent antimicrobial activity, dissolving of remaining pulp tissues with no systemic hazards,

reducing instrument friction during mechanical preparation and availability are among the main requirements for an ideal root canal irrigant. Sodium hypochlorite is one of the most commonly used irrigation solutions in endodontics, which is used at a concentration of 0.5-5.25%. Its principal properties are its antibacterial activity due to its proteolytic potential and its tissue-dissolving capacity; however, its disadvantages are its toxicity and unfavorable odor and taste.^{4,5} Herbal extracts, such as *Aloe vera* having antimicrobial, anti-inflammatory, and therapeutic effects are promising to be used as endodontic irrigants. *Enterococcus faecalis* a Gram-positive, facultative anaerobe is often used to investigate the effectiveness of endodontic irrigants and medicaments. *E. faecalis* has been identified as the species most commonly recovered from teeth with failed endodontic treatment in up to 77% of cases using culture or

molecule method. Many authors have demonstrated that *E. faecalis* has the ability to resist intracanal medicaments and to survive as a single microorganism within the canal system.⁶⁻⁸ So, the present study was planned to compare efficacy of antimicrobial properties of sodium hypochlorite and aloe vera solutions as root canal irrigants.

Materials and methods:

The study was conducted in the Department of Conservative Dentistry and Endodontics of the dental institution. For the study, 30 extracted teeth were collected. Only single rooted teeth were selected and teeth having defects such as calcifications, internal and external resorption, cracks, etc were excluded from the study. The working lengths of the teeth were determined using K-file (number 15). Enlarging of apical portion of all teeth was done using no. 15 and 20 K-files. All the teeth were mounted vertically in self cure acrylic and were rinsed with normal saline while preparing the canal. Bacterial suspensions of *Enterococcus faecalis* standard strain 11700 were prepared from the culture plates. 10-20 microlitres of bacterial suspension was injected in root canal of each tooth. After contamination, the teeth were placed in moist environment and were incubated at 37°C for 48 hours.

For irrigation of canals with different solutions, 80% Aloe Vera solution and 2.5% sodium hypochlorite solution were prepared. Now, the teeth were divided into 3 groups with 10 teeth in each group: The Aloe Vera Group; The Normal Saline Group; and the Sodium Hypochlorite Group. In the Aloe vera group, Aloe vera solution was used as canal irrigator, in the normal saline group, normal saline was used and in sodium hypochlorite group 8 milliliters of 2.5% sodium hypochlorite solution was used as the canal irrigator.

After irrigating the canal with different irrigants, sample was taken from each canal and inoculated to culture plates. These culture plates were incubated at 37°C for 48 hours and after 48 hours were checked for bacterial colony counts.

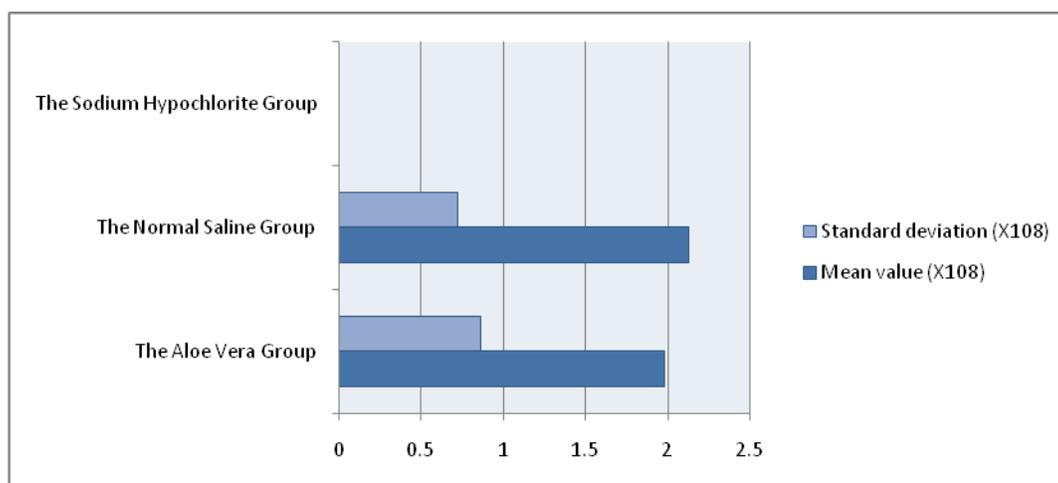
RESULTS:

Table 1 shows the comparative evaluation of mean value and standard deviation of bacterial colony counts with different irrigants. It was observed that the difference of antibacterial effects on *E. faecalis* of the Aloe Vera group and the normal saline group were non-significant ($p > 0.05$). In comparison to these two groups, the sodium hypochlorite group showed statistically significant antibacterial effect on *E. faecalis* ($p < 0.05$) [Figure 1].

Table 1: Comparison of mean value and standard deviation of bacterial colony counts in each group

	The Aloe Vera Group	The Normal Saline Group	The Sodium Hypochlorite Group
Mean value (X10 ⁸)	1.98	2.13	0
Standard deviation (X10 ⁸)	0.86	0.72	0

Figure 1: Comparison of mean value and standard deviation of bacterial colony counts in each group



DISCUSSION:

Up to nine times more *E. faecalis* species have been isolated from failed root canals than from primary endodontic infection.⁹ *E. faecalis* was chosen in the present study because of its high prevalence in secondary endodontic infection. Herbal medicaments are gaining importance because of their therapeutic properties. Aloe vera is a naturally occurring herbal medicament having antibacterial properties. It has anti-inflammatory, antibacterial, antifungal, and antiviral properties. Because it contains anthrax quinine, it inhibits *E. faecalis* and *Streptococcus pyogenes*.^{10, 11} The present study compared the efficacy of antimicrobial properties of sodium hypochlorite and aloe vera solutions as root canal irrigants. In the present study, we observed the difference of antibacterial effects on *E. faecalis* of the Aloe Vera group and the normal saline group were non-significant ($p > 0.05$). In comparison to these two groups, the sodium hypochlorite group showed statistically significant antibacterial effect on *E. faecalis*. Sahebi S et al conducted a study to compare the antimicrobial effect of Aloe Vera solution with sodium hypochlorite on *E. faecalis* in the root canals of human extracted teeth. Sixty human extracted single rooted teeth were selected for this in vitro study. The teeth recruited in this study had no cracks, internal resorption, external resorption and calcification. *Enterococcus faecalis* was injected in the root canals of all teeth. The teeth were then divided into three groups randomly. Each group consisted of 20 teeth that were all rinsed with one of the following solutions: sodium hypochlorite 2.5%, Aloe vera and normal saline. Subsequent to rinsing, root canals of all teeth were sampled. The samples were cultured and growth of the bacteria was assessed after 48 hours. The number of colonies of the bacteria was then counted. The difference between the inhibitory effect of Aloe vera and normal saline on *E. faecalis* was not significant according to independent t-test ($p = 0.966$). The inhibitory effect of sodium hypochlorite on *E. faecalis* was much greater than that of Aloe vera and normal saline ($p < 0.001$). It was concluded that Aloe vera solution is not recommended as a root canal irrigator, but future studies are suggested to investigate the antibacterial effect of Aloe vera with longer duration of exposure and as an intra canal medicament.¹² Bhardwaj A evaluated the efficacy of natural derivative irrigants, *Morinda citrifolia* juice (MCJ), Aloe Vera and Propolis in comparison to 1% sodium hypochlorite with passive ultrasonic irrigation for removal of the intraradicular *E. faecalis* biofilms in extracted single rooted human permanent teeth. Biofilms of *E. faecalis* were grown on the prepared root canal walls of 60 standardized root halves which were longitudinally sectioned. These root halves were re-approximated and the samples were divided into five groups of twelve each. The groups were, Group A (1% NaOCl), Group B (MCJ), Group C (Aloe vera), Group D (Propolis) and Group E (Saline). These groups were

treated with passive ultrasonic irrigation (PUI) along with the respective irrigants. The root halves were processed for scanning electron microscopy. Three images (X2.5), coronal, middle and apical, were taken for the twelve root halves in each of the five groups. The images were randomized and biofilm coverage assessed independently by three calibrated examiners, using a four-point scoring system. 1% NaOCl with passive ultrasonic irrigation (PUI) was effective in completely removing *E. faecalis* biofilm and was superior to the natural irrigants like MCJ, Aloe vera and Propolis tested in this study. The authors concluded that 1% NaOCl used along with passive ultrasonic irrigation was effective in completely removing *E. faecalis* biofilm when compared to natural irrigants (MCJ, Aloe Vera and Propolis). Babaji P et al performed a research aimed to evaluate 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. Results were tabulated and statistically analyzed using Statistical Package for the Social Sciences software for Windows, version 19.0. (IBM Corp., Armonk, NY). 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*. Hence, these irrigants can be used as root canal irrigating solutions.^{13, 14}

Karkare SR et al compared the antimicrobial activity of saturated and diluted (1:1) hydroalcoholic extract of Aloe vera, garlic, and 5% NaOCl against *E. faecalis* using the commonly used agar diffusion method. Saturated hydroalcoholic extract of *A. vera* showed the highest zone of inhibition against *E. faecalis*. NaOCl, which is considered as gold standard, also showed higher zones of inhibition. Fedorowicz Z et al performed a research to assess the effects of irrigants used in the non-surgical root canal treatment of mature permanent teeth. Randomised controlled trials in single or multi-rooted permanent teeth with pulpal or periapical pathology or both, which require root canal treatment. Irrigants either against each other or against inactive irrigant or placebo. Combinations of irrigants were allowed and if used in conjunction with EDTA (ethylenediaminetetra-acetic acid) or similar chelating agents. Two review authors independently assessed risk of bias of included trials and extracted data. It was concluded by authors that although root canal irrigants such as sodium hypochlorite and chlorhexidine appear to be effective at reducing bacterial cultures when compared to saline, most of the studies included in this review failed

to adequately report these clinically important and potentially patient-relevant outcomes. There is currently insufficient reliable evidence showing the superiority of any one individual irrigant. The strength and reliability of the supporting evidence was variable and clinicians should be aware that changes in bacterial counts or pain in the early postoperative period may not be accurate indicators of long-term success. Future trials should report both clinician-relevant and patient-preferred outcomes at clearly defined perioperative, as well as long-term, time points.^{15, 16}

CONCLUSION:

From the results of present study, we concluded that Sodium hypochlorite is best suited for irrigating root canal with *E. faecalis* infection in comparison to aloe vera solution.

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Source of support: Nil

Conflict of interest: None declared

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