

# Comparative Evaluation Of Antimicrobial Efficacy Of Three Endodontic Irrigating Solutions Against Enterococcus Faecalis

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## ABSTRACT

**Background:** Irrigants and intracanal medicaments form a necessary adjunct that enhances the antimicrobial effect of mechanical cleansing and thus augments overall clinical efficacy. Hence; the present study was undertaken for analyzing and comparing the efficacy of three endodontic irrigating solutions against *Enterococcus Faecalis*.

**Materials & methods:** A total of thirty single rooted mandibular first premolar specimens were included. Sectioning of the specimens was done at cement-enamel junction level. Instrumentation of the root canals was done with rotary instruments to an apical size of ProTaper F3. Vertical sectioning of all the specimens was done along the mid-sagittal plane into two halves. All the specimens were divided into following study groups: Group A: 5% Sodium hypochlorite, Group B: 0.2% Chitosan and Group C: Saline. Inoculation of the bacterium was done in the broth in all the tissue culture wells. The biofilm on root canal surface was taken with a sterile scalpel and inoculated on agar plates and incubated. Colony forming units were then analyzed. Analysis of all the results was done using SPSS software.

**Results:** Mean CFU among specimens of group A, group B and group C were found to be 0.59, 2.118 and 90.184 respectively. While analyzing the results statistically, significant results were obtained.

**Conclusion:** Sodium hypochlorite exhibited maximum efficacy against *Enterococcus Faecalis*.

**Key words:** Antimicrobial Efficacy, Irrigation, *Enterococcus faecalis*

## 1. INTRODUCTION

The success of the endodontic treatment primarily depends on successful removal of microbes from the infected root canal system. The persistence and growth of bacteria in root

canal system is the main causative factor in pulpal and periradicular lesions. Although bacteria are the main microorganisms found in primary endodontic infections, there are some studies which state the presence of fungi in infected root canals. *Candida albicans* and *Enterococcus faecalis* are considered the most resistant species of fungi and bacteria which are responsible for root canal treatment failures. The collagenolytic activity of *C. albicans* promotes colonisation in the root canal as it uses dentin as a nutrient source leading to its high virulence.<sup>1-4</sup>

Irrigants and intracanal medicaments form a necessary adjunct that enhances the antimicrobial effect of mechanical cleansing and thus augments overall clinical efficacy. Owing to its pronounced antimicrobial activity and its exceptional capacity to dissolve pulp tissue and organic components of the smear layer, sodium hypochlorite (NaOCl) still remains the irrigant of choice. Chitosan is a non-toxic cationic biopolymer usually obtained by alkaline deacetylation from chitin, which is the principal component of crustacean exoskeletons. Chitosan treatment improves the resistance of the dentinal surface to degradation by collagenase.<sup>5-7</sup> Hence; the present study was undertaken for analyzing and comparing the efficacy of three endodontic irrigating solutions against *Enterococcus Faecalis*.

## 2. MATERIALS & METHODS

The present study was commenced with the aim of comparing the efficacy of three endodontic irrigating solutions against *Enterococcus Faecalis*. A total of thirty single rooted mandibular first premolar specimens were included. Deformed, carious and specimens with presence of any structural anomaly were excluded. Pure culture of *Enterococcus faecalis* was inoculated on Mueller-Hinton agar plates incubated at 37°C overnight with sterile brain heart infusion broth. 5% sodium hypochlorite, 0.2% Chitosan and normal saline groups were taken for the study. For preparing 0.2 percent chitosan solution, 0.2 mg of chitosan was diluted in 100ml of 1% acetic acid. 5% sodium hypochlorite was used as provided by the manufacturer. Sectioning of the specimens was done at cement-enamel junction level. Instrumentation of the root canals was done with rotary instruments to an apical size of ProTaper F3. Vertical sectioning of all the specimens was done along the mid-sagittal plane into two halves. The concave tooth surface was minimally grounded to achieve flat surface to enable placement in tissue culture wells exposing the root canal surface to *Enterococcus faecalis* to form a biofilm. All the specimens were divided into following study groups:

- Group A: 5% Sodium hypochlorite (n=20; after vertical sectioning)
- Group B: 0.2% Chitosan (n=20)
- Group C: Saline (negative control) (n=20)

This was followed by sterilization of the samples with ultraviolet radiation and placement in the wells of tissue culture plates. Then, inoculation of the bacterium was done in the broth in all the tissue culture wells. The sectioned tooth specimens were then placed in the tissue culture wells and inoculated at 37°C for 6 weeks. After one and a half month of inoculation, all specimens were placed in sterile petridishes and the test irrigation solutions were delivered onto them. Then, the biofilm on root canal surface was taken with a sterile scalpel and inoculated on agar plates and incubated. Colony forming units were then analyzed. Analysis of all the results was done using SPSS software.

## 3. RESULTS

Mean CFU among specimens of group A, group B and group C were found to be 0.59, 2.118 and 90.184 respectively. While analyzing the results statistically, significant results were obtained. Efficacy of root canal irrigants was found to be of following order:

**Group C < Group B < Group A**

Table 1: Mean Colony forming units (CFUs)

Groups	Mean CFU/ml (x 10 <sup>8</sup> )	SD
Group A	0.590	0.621
Group B	2.118	1.176
Group C	90.184	2.596

Table 2: Comparison of mean CFUs

Group comparison	t-statistics	p- value
Group A versus Group B	-1.852	0.002*
Group B versus Group C	-1.462	0.010*
Group A versus Group C	-1.648	0.000*

\*: Significant

#### 4. DISCUSSION

Microorganisms predominantly bacteria are the primary etiological factor in the development of pulp and periapical lesions. Successful root canal therapy depends on thorough chemomechanical debridement of pulpal tissue, dentin debris, and microorganisms. Almost half of the canal walls are left unprepared with usage of stainless steel files and nickel–titanium rotary instruments. Therefore, irrigation is an essential part of the root canal treatment. Chemical debridement is especially needed for teeth with complex internal anatomies such as fins, cul de sacs, intercanal communications, and other irregularities.<sup>8- 10</sup> Hence; the present study was undertaken for analyzing and comparing the efficacy of three endodontic irrigating solutions against *Enterococcus Faecalis*.

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A published report has recommended the removal of the smear layer through the irrigation of the root canal with sodium hypochlorite followed by a final irrigation with EDTA. Chitosan, a natural polysaccharide, is prominently used in dentistry because it is biocompatible, biodegradable, bio-adhesive, and non-toxic, with broad-spectrum antimicrobial properties

and chelating activity. Chitosan has the ability to remove the smear layer and unblock dentin tubules without promoting significant dentin erosion.<sup>11- 13</sup> Yadav P et al evaluated antibacterial effect of 0.25% Chitosan, 0.5% Chitosan, 2% chlorhexidine and 3% sodium hypochlorite against *Enterococcus faecalis* and *Candida Albicans*. Significant reduction of colony forming units (CFU)/mL was observed for the chitosan groups and the antibacterial activity of the chitosan groups was at par with 3% NaOCl and 2% Chlorhexidine. The use of chitosan as a root canal irrigant might be an alternative considering the various undesirable properties of NaOCl and chlorhexidine.<sup>14</sup>

Kondreddi N et al compared the antibacterial efficacy of sodium hypochlorite (NaOCl), chlorhexidine (CHX), chitosan and their combinations in vitro. A total of 60 samples were divided into six groups according to the solutions used for irrigation, that is, CHX, NaOCl, chitosan, alternating solution of chitosan and hypochlorite, alternating solution of chitosan and CHX, and saline. A statistically significant difference was found in the number of CFU between experimental groups compared to the control group and also among five experimental groups ( $P > 0.001$ ). Maximum antibacterial activity was seen when chitosan was used alternatively with CHX and NaOCl. Independently, hypochlorite showed maximum antibacterial activity followed by CHX and chitosan which showed almost similar antibacterial activity. There is synergistic antibacterial activity when chitosan is used alternatively with 2% CHX or 5% NaOCl.<sup>15</sup>

## 5. CONCLUSION

From the above results, the authors concluded that sodium hypochlorite exhibited maximum efficacy against *Enterococcus Faecalis*.

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