

Dentinal tubule disinfection with 2% Chlorhexidine Gel, Aloe Vera, Propolis, Septilin, and Calcium Hydroxide

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Abstract

Aim: To investigate the antimicrobial activity 2% Chlorhexidine gel (CHX), Aloe vera, Propolis, Septilin and Calcium hydroxide [Ca (OH) 2] on *Enterococcus faecalis* infected root canal dentine at two different depths (200 µm and 400 µm) and three time intervals (day 1, 3 & 5). **Methodology:** One hundred and eighty extracted human teeth were infected for 21 days with *E.faecalis*. Samples were divided into six groups. Group I (Saline) (Negative control), Group II (Propolis), Group III (2% CHX), Group IV (Aloe vera), Group V (Calcium hydroxide), Group VI (Septilin). At the end of 1, 3, and 5 days, the remaining vital bacterial population was assessed. Dentine shavings were collected at two depths (200 µm and 400 µm), and total numbers of colony forming units were determined. The values were analysed statistically with one-way analysis of variance followed by Tukey multiple comparison test. The paired t-test was used to check for differences in growth at different time intervals within groups and for differences at the two depths ($P < 0.01$). **Results:** The number of colony-forming units was statistically significant in all groups compared to the control group (Saline). Group III (CHX) and Group VI (septilin) (100%) produced better antimicrobial efficacy followed by aloe vera (78.94%), propolis (66.7%), calcium hydroxide (58.5%). There was significant difference between aloe vera and propolis and no significant difference between data at 200 µm and 400 µm. **Conclusion:** Septilin and Aloe vera were effective against *E.faecalis* in dentine of extracted teeth.

Key words: Dentine tubule disinfection, *E. faecalis*, calcium hydroxide, chlorhexidine gel, Propolis, Septilin, Aloe vera

Introduction

One of the most important objectives of root canal treatment is the elimination of microorganisms in the root canals. Anaerobic bacteria, especially black-pigmented Gram negative species, have been linked to the signs and symptoms of Periapical disease [1]. Failure of root canal treatment may be related to facultative bacteria such as *Enterococcus faecalis* which is isolated from infected root canals [2, 3].

Although chemo-mechanical preparation of root canals is able to reduce the number of bacteria, an intracanal medicament with antibacterial action is required to maximize the disinfection of the root canal system in

infected cases [4]. The need for medication increases, especially in those cases where an infection is resistant to regular treatment and the therapy cannot be successfully completed due to presence of pain or continuing exudates [5]. For this reason, a wide variety of intracanal medicaments have been used, such as calcium hydroxide pastes and Chlorhexidine gels.

Calcium hydroxide was introduced in 1920 [6] it is widely used in endodontics as an intracanal medicament. It has pH (of about 12.5) in an aqueous solution. Various biological properties have been attributed to this substance, such as antimicrobial activity [7], tissue dissolving ability [8], inhibition of tooth resorption [9] and induction of repair by hard tissue formation [10] (Foreman et al. 1990). However,

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calcium hydroxide is not effective in eliminating bacteria from dentinal tubules [11] reported that *E. faecalis* present in the dentinal tubules was resistant to calcium hydroxide over 10 days.

Chlorhexidine gluconate has been widely used in periodontics due to its antibacterial activity [12]. Its use in endodontics has been proposed both as irrigant and intracanal medicament [13,14]. Chlorhexidine has inhibitory effects on bacteria commonly found in endodontic infections [15], acting against Gram-positive and Gram-negative microorganisms [16]. One of the mechanisms that explains its efficacy is based on the interaction between the positive charge of the molecule and negatively charged phosphate groups on the bacterial cell wall, which allows the Chlorhexidine molecule to penetrate into the bacteria with toxic effects [17]. Septilin (The Himalaya Drug Company, Bangalore, India) is a herbal preparation containing powders of *Balsamodendron mukul* and *Shankha bhasma*, *Maharasnadi quath*, and extracts of *Tinospora cordifolia*, *Rubia cordifolia*, *Emblica officinalis*, *Moringa pterygosperma* and *Glycyrrhiza glabra* [18]. It has been reported to possess antibacterial (Ross et al. 1984), anti-inflammatory [20] and wound healing properties [21]. It is said to be helpful in treating Gram-positive as well as Gram-negative infections [22,23]. There are reports that septilin is effective in chronic stubborn upper respiratory tract infections [24], tonsillitis [22], tropical eosinophilia [25] and infective dermatoses [23].

Propolis (bee glue) is a resinous substance that honeybees collect from various plants and use in the hive to cover hive walls, fill cracks or gaps, and embalm dead invaders. The chemical composition of propolis is very complex and includes organic compounds such as phenolic compounds and esters, flavonoids in all their forms (flavonols, flavones, flavonones, dihydroflavonols, and chalcones), terpenes, beta-steroids, aromatic aldehydes and alcohols, sesquiterpenes, and stilbene terpenes [26]. Propolis has been shown to possess antibacterial, antifungal, antiviral, anti-inflammatory, hepatoprotective, antioxidant, antitumor, and immunomodulatory effects [26,27]. Antibacterial activity has been linked mainly to the flavonoid content among these various functional properties [28]. *Aloe barbadensis miller* (*Aloe vera*) belongs to the *Liliaceae* family, of which there are about 360 species. It is a cactus like plant with green, dragger shaped leaves that are fleshy, tapering, spiny margined and filled with a clear gel that grows readily

in hot, dry climates [29]. *Aloe vera* contains over 75 nutrients and 200 active compounds, including vitamins, enzymes, minerals, sugars, linin, anthraquinones, saponins, salicylic acid and amino acids [30,31]. Numerous scientific studies on *Aloe vera* are demonstrating its analgesic, anti-inflammatory, wound healing, immune modulating, anti-tumor activities as well as antiviral, antibacterial and antifungal properties [36]. This study was undertaken to evaluate the disinfection of dentinal tubules when contaminated with *E. faecalis* using septilin, *aloe vera*, propolis, 2% CHX gel when compared to calcium hydroxide.

Materials and Methods

Preparation of dentine specimens- The model proposed by Haapasalo & Orstavik (1978) was modified. One hundred and eighty single-rooted human mandibular premolar teeth freshly extracted for orthodontic reasons from 90 individuals were selected. A rotary diamond disc was used to decoronate the teeth below the cement to enamel junction and the apical part of the root to obtain 6 mm of the middle third of the root. Cementum was removed from the root surface. Gates Glidden drills no. 3 (Mani Inc, Tachigi-ken, Japan) in a slow-speed hand piece was used to standardize the internal diameter of the root canals. The specimens were placed in an ultrasonic bath of 17% ethylenediaminetetraacetic acid for 5 min followed by 3% NaOCl for 5 min to remove organic and inorganic debris. The traces of chemicals used were removed by immersing the dentine specimens in an ultrasonic bath containing distilled water for 5 min. All the specimens were sterilized in an autoclave for two cycles. The first cycle was at 121 °C and the second was with the specimens immersed in 1 mL of tryptose soya (TS) broth in individual microcentrifuge tubes.

Contamination of the specimens- The test organism used for this study was *E. faecalis*, which is a gram-positive facultative anaerobic bacterium that is common in root filled teeth with post treatment infection. *E. faecalis* (ATCC 29212) was grown in tryptose soya agar for 24 h. The culture was suspended in 5 ml of TS broth and incubated for 4 h at 37 °C and its turbidity adjusted to 0.5 McFarland standards. Each dentine block was placed in pre-sterilized microcentrifuge tubes containing 1 ml of the TS broth. Fifty microlitres of the inoculum containing the *E. faecalis* was transferred into each of the microcentrifuge tubes. At the end of 24 h, the dentine specimens were transferred into fresh broth containing *E. faecalis*. All procedures were

carried out under laminar flow. Purity of the culture was checked by subculturing 5µL of the broth from the incubated dentine specimen's in TS broth on tryptose soya agarplates. Contamination of the dentine specimens was carried out for a period of 21 days.

Antimicrobial assessment- At the end of 21 days, the specimens were irrigated with 5 mL of sterile saline to remove the incubation broth. They were assigned into seven groups (n = 30 dentine blocks). Group1, saline (negative control); Group 2, propolis; Group 3, 2% CHX gel; Group 4, Aloe Vera; Group 5, calcium hydroxide; Group 6, septicin. Calcium hydroxide (Sigma-Aldrich, Mumbai, India) was mixed with sterile saline in a ratio of 1.5: 1 (wt/ vol) to obtain a paste-like consistency (Krithika data et al. 2007). Methyl cellulose was used as a thickening agent for Groups 2, 4, and 6. The medicaments were placed inside the canals and sealed at both ends with paraffin wax. They were incubated in an anaerobic environment for 37°C. At the end of 1, 3, and 5 days an assessment of microbial cells was carried out with 10 specimens at each time interval.

Results

The number of colony-forming units in all the experimental groups was significantly lower in comparison with the control group (Saline). Group III (CHX) and VI (Septilin) (100%) demonstrated better antimicrobial efficacy followed by Aloe vera (78.94%), Propolis (66.7%), and calcium hydroxide (58.5%).

Table I: Mean, standard deviation, median, and interquartile ranges for various intracanal medicaments at Log Day 1 at 200 & 400 µm 9

	N	Mean		Standard deviation		Median		Interquartile ranges	
		200 µm	400µm	200 µm	400µm	200 µm	400µm	200 µm	400µm
Aloevera gel	10	0.61	0.71	0.02	0.02	0.61	0.71	0.02	0.02
Septilin	10	0	0	0	0	0	0	0	0
Calcium hydroxide	10	1.25	1.35	0.04	0.04	1.26	1.35	0.05	0.03
Propolis	10	1.01	1.02	0.02	0.02	1.02	1.12	0.03	0.03
Chlorhexidine gel	10	0	0	0	0	0	0	0	0
Saline	10	3.74	3.85	0.05	0.05	3.75	3.86	0.09	0.06

Table II: Mean, standard deviation, median and interquartile ranges for intracanal medicaments at Log day 3 at 200 & 400 µm.

	N	Mean		Standard deviation		Median		Interquartile ranges	
		200 µm	400µm	200 µm	400µm	200 µm	400µm	200 µm	400µm
Aloevera gel	10	0.69	0.83	0.02	0.03	0.69	0.84	0.02	0.03
Septilin	10	0	0	0	0	0	0	0	0
Calcium hydroxide	10	1.85	2.1	0.04	0.02	1.86	2.10	0.04	0.03
Propolis	10	1.15	1.23	0.04	0.04	1.16	1.25	0.06	0.07
Chlorhexidine gel	10	0	0	0	0	0	0	0	0
Saline	10	3.61	3.69	0.05	0.07	3.61	3.71	0.7	0.12

Harvesting of dentine was carried out at two depths (200 and 400 lm) with Gates Glidden drills no 4 and 5, respectively. The collected dentine shavings were transferred into 1 mL of sterile TS broth and incubated in an anaerobic environment at 37°C for 24 h. After 24 h, the contents of each tube was serially diluted, 100 µL of the broth in 100 µL of sterile saline five times. Fifty microlitres of the dilution was then plated on TS agar plates and incubated for 24 h. Colonies were counted and readings were tabulated.

Statistical analysis- The data were statistically analyzed with one-way analysis of variance followed by Tukey multiple comparison means to check the difference in bacterial inhibition between groups ($P < 0.01$). The paired t-test was used to check for differences in growth at different time intervals within groups and for differences at the two depths ($P < 0.01$). Mean, standard deviation, median, and interquartile ranges for various intracanal medicaments at Log Day 1, day 3 & day 5 at 200 & 400 µm are shown in table I, II & III.

Table III: Mean, standard deviation, median and interquartile ranges for intracanal medicaments at Log day 5 at 200 & 400 µm.

	N	Mean		Standard deviation		Median		Interquartile ranges	
		200 µm	400µm	200 µm	400µm	200 µm	400µm	200 µm	400µm
Aloevera gel	10	0.81	0.95	0.02	0.04	0.81	0.95	0.02	0.04
Septilin	10	0	0	0	0	0	0	0	0
Calcium hydroxide	10	1.3	1.40	0.02	0.02	1.30	1.40	0.03	0.03
Propolis	10	1.31	1.39	0.02	0.02	1.32	1.40	0.03	0.03
Chlorhexidine gel Saline	10	0	0	0	0	0	0	0	0
	10	3.28	3.49	0.04	0.07	3.29	3.50	0.06	0.12

Discussion

In the present study from day 1 to day 5, 2% CHX gel showed 100% inhibition of *E. faecalis* at depths of 200 µm and 400 µm. The reason may be attributed to the bactericidal dosage of 2% and increased diffusion of the medicament into the dentinal tubules [32]. Basrani et al. (2003) observed that 2% CHX gel was a better antimicrobial when compared to 0.2% CHX gel or calcium hydroxide mixed with 0.2% chlorhexidine [33]. The result of the present study was similar to that of Krithikadatta et al. (2007), Gomes et al. (2003).

Septilin produced 100% inhibition of *E. faecalis* at depths of 200 µm and 400 µm from day 1 to day 5. The possible reason for antimicrobial action of septilin might be due its formulation and synergistic action of ingredients. *Emblca officinalis* [34], *Rubia cordifolia* [35] and *Moringa pterygosperma* [36] has antibacterial properties. The antimicrobial activity has been investigated in previous studies and had significant antimicrobial activities *Emblca officinalis* was active against *Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella ozaenae*, *Proteus mirabilis*, *Serratia marcescens* *Salmonella paratyphi A* and *B*, *Salmonella typhi*, and *Pseudomonas aeruginosa* [34]. Antibacterial and antiviral properties of *Moringa pterygosperma* inhibit the growth of gram-positive and gram-negative bacteria such as *E. coli*, *S.typhi* and *S. paratyphi* [36]. Aloevera produced 80.3% and 77.4% inhibition of *E. faecalis* at depths of 200 µm and 400 µm from day 1 to day 5. The antimicrobial effects of aloe vera have been attributed to the plants natural anthraquinones. Anthraquinones contains phenolic compounds like aloe emodin, aloetic acid, aloin, anthracene, anthranol, ethereal oil, barbaloin, ester of cinnamonic acid, chrysophanic acid, isobarbaloin, and resistannol [37]. These anthraquinones provide analgesic, antibacterial, antifungal, and antiviral activity [29]. Saponins, which contain glycosides, are soapy substances that have both cleansing and antiseptic properties [38]. In previous

studies it was indicated that microbes like *S. aureus*, *P. aeruginosa* [39,40], *K. pneumoniae* [41], *E.coli*, *M.lutes* [42], *E. faecalis* [40,41] (Robson et al. 1982) and *C.albicans* were shown to inhibited by the isolates from aloe vera [39,42]. Propolis produced 67.6% and 66.3% inhibition of *E. faecalis* at depths of 200 µm and 400 µm from day 1 to day 5. Flavanoid content was probably the most possible reason for the antimicrobial action of propolis [26]. Gram-positive and gram-negative organisms were inhibited by good antibacterial ability of Propolis [43]. The results of the present study was similar to the study of Awawdeh et al. [44] who compared the antimicrobial activity of propolis with calcium hydroxide as intracanal medicament against *E. faecalis* and that Propolis was effective in eliminating the microorganism. According to the findings of the study presented here, it is concluded that the 2% chlorhexidine and septilin demonstrated significant inhibition against *E. faecalis* followed by aloe vera, propolis and Ca (OH)₂.

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References

- Gomes BPFA, Drucker DB, Lilley JD. Association of specific bacteria with some endodontic signs and symptoms. *International Endodontic Journal*.1994; 27 (3):291-8.
- Cavalleri G, Cuzzolin L, Urbani G, Benoni. Root canal microflora: qualitative changes after endodontic instrumentation. *Journal of Chemotherapy*.1989;1:101-2.
- Peciuliene V, Balciuniene I, Eriksen HM et al. Isolation of *Enterococcus faecalis* in previously root-filled canals in a Lithuanian population. *J Endod*. 2000 Oct;26(10):593-5.

4. Lee Y, Han SH, Hong SH, Lee JK, Ji H, Kum KY. Antimicrobial efficacy of a polymeric chlorhexidine release device using in vitro model of *Enterococcus faecalis* dentinal tubule infection. *Journal of Endodontics*. 2008; 34: 855–7.
5. Spangberg LSW. Intracanal medication. In: Ingle JJ, Bakland LK, eds. *Endodontics*, 4th edn. Baltimore : Williams & Wilkins, 627-40.
6. Hermann BW. Calciumhydroxyd Als Mittel Zum Behandein und Fullen Von Zahnwurzelkanalen (Dissertation). Wurzburg, Med. Diss.1920; sept:V.29.
7. Bystrom A, Claesson R, Sundqvist G. The antibacterial effect of camphorated para-monochlorophenol, camphorated phenol and calcium hydroxide in the treatment of infected root canals. *Endodontics and Dental Traumatology*.1985;1(5):170-5.
8. Hasselgren G, Olsson B, Cvek M. Effects of calcium hydroxide and sodium hypochlorite on the dissolution of necrotic porcine muscle tissue. *Journal of Endodontics*.1988; 14:125-7.
9. Tronstad L. Root resorption etiology, terminology and clinical manifestations. *Endodontics and Dental Traumatology*. 1988; 4(6): 241-52.
10. Foreman PC, Barnes F. A review of calcium hydroxide. *International Endodontic Journal*.1990; 23 (6): 283-97.
11. Gomes BPFA, Souza SFC, Ferraz CCR, Teixeira AA, Valdrighi L, Filho FJS. Effectiveness of 2% chlorhexidine gel and calcium hydroxide against *Enterococcus faecalis* in bovine root dentin in vitro. *International Endodontic Journal*.2003; 36: 267–75.
12. Gjermo. Chlorhexidine in dental practice.*Journal of Clinical Periodontology*.1974; 4(3):143-52.
13. Ferraz CCR, Gomes BPFA, Zaia AA, Teixeira FB, Souza- Filho FJ. In vitro assessment of the antimicrobial action and the mechanical ability of Chlorhexidine gel as an endodontic irrigant. *Journal of Endodontics*.2001; 27:452-5.
14. Vahdaty A, Pitt Ford TR, Wilson RF. Efficacy of the Chlorhexidine in disinfecting dentinal tubules in vitro. *Endodontics and Dental Traumatology*.1993; 9:243-8.
15. Cervone F, Tronstad L, Hammod B. Antibacterial effect of chlorhexidine in a controlled release delivery system. *Endodontics and Dental Traumatology*.1990; 1990; 6(1):33-6.
16. Waler SM Further in vitro studies on the plaque inhibiting effect of chlorhexidine and its binding mechanisms. *Scandinavia Journal of Dental Research*. 1990; 98(14):422-7
17. Lindskog S, Pierce AM, Blomlof L. Chlorhexidine as a root canal medicament for treating inflammatory lesions in the periodontal space. *Endodontics and Dental Traumatology*. 1998; 14:186-90
18. Daswani, B.R, Radha Yegnanarayan. Immunodulatory activity of Septilin, a polyherbal preparation. *Phytotherapy research*. 2002; 16(2):162-165.
19. Ross DG. The anti-infective and anti-bacterial efficacy of Septilin. *Probe*. 1984;23(2): 84-87.
20. Kumar PV, Kuttan G, Luttan R, Immunomodulatory activity of Septilin. *Probe*.1993; 33:1-5.
21. Udapa AL, Gurumadhva Rao S, Kulkarni DR. Wound healing profile of Septilin. *Indian Journal of Physiology Pharmacology*.1989; 33: 39-42.
22. Gadekar HA, Vijay A, Jyoti Vibha Komawar, Sonarwar SG. Septilin in acute tonsillitis in children below 12 years of age. *Probe*.1986; 25: 164-165.
23. Sharma SK, Agarwal HC, Dharam Pal, Bhikchandani DV. Septilin in infective dermatoses. *Probe*.1986; 25: 156-161.
24. Bhasin RC. Clinical evaluation of Septilin in chronic bronchitis. *Indian Practitioner*.1990;43(1):83-86
25. Prusty PK, Mahapatra MK, Mishra GC, Das RK. Septilin in the treatment of tropical eosinophilia. *Indian Medical Journal*.1985; 79: 161-165.
26. Viuda-Martos M, Ruiz-Navajas Y, Fernandez-Lopez J, Perez-Alvarez JA. Functional properties of honey, propolis, and royal jelly. *Journal of Food Science*.2008; 73 (9): R117–24.
27. Bankova V. Chemical diversity of propolis and the problem of standardization. *Journal Ethnopharmacology*. 2005; 100 (1-2):114–7.

28. Cushnie TP, Lamb AJ. Antimicrobial activity of flavonoids. *International Journal of Antimicrobial Agents*. 2005; 26(5):343–56
29. Shelton RM. Aloe vera its chemical and therapeutic properties. *International Journal of Dermatology*. 1991; 30 (10):679-83.
30. Hurley, J.C. Antibiotic Induced Release of Endotoxin: a reappraisal. *Clinical Infectious Diseases*. 1992; 15 (5): 840-854.
31. Gur, D.; Ozalp, M.; Sumerkan,B.; Kaygusuz, A.; Toreci, K.; Koksai, I.; Over, U.; Soyletir, G. Relevance of antimicrobial resistance in *Haemophilus influenzae*, *Klebsiella pneumoniae*, *Moraxella catarrhalis* and *Streptococcus pyogenes*: results of a multicentre study in Turkey. *International Journal of Antimicrobial Agents*.2002; 19(3): 207-211.
32. Krithikadatta J, Indria R, Dorothykalyani AL. Disinfection of dentinal tubules with 2% Chlorhexidine, 2% Metronidazole, Bioactive Glass when compared with Calcium Hydroxide as intracanal medicaments. *Journal of Endodontics*. 2007; 33(12): 1473–6.
33. Basrani B, Tjaderhane L, Santos M. Efficacy of Chlorhexidine and calcium hydroxide containing medicaments against *Enterococcus faecalis* in vitro. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics*. 2003; 96 (5): 618–24.
34. Saeed S, Tariq P. Antibacterial activities of *Emblica officinalis* and *Coriandrum sativum* against Gram negative urinary pathogens. *Pakistan Journal of Pharmaceutical Sciences*.2007; 20(1):32-5.
35. Qiao YF, Wang SX, Wu LJ. Studies on antibacterial constituents from the roots of *Rubia cordifolia* L.Yao Xue Xue Bao.1990; 25(11):834-9.
36. Eilert U, Wolters B, Nahrstedt A. The antibiotic principle of seeds of *Moringa oleifera* and *Moringa stenopetala*. *Planta Medica*.1981; 42(5):55-61.
37. Wynn RL. Aloe vera gel: Update for dentistry. *General Dentistry*.2005; 53(1):6-9.
38. Coats BC. *The silent healer: A modern study of aloe vera*. Garland, TX: B.C. Coats.1979.
39. Agarry, O.O; M. T. Olaleye and C. O. Bello-Michael. Comparative antimicrobial activities of aloe vera gel and leaf. *African Journal of Biotechnology*.2005; 4(12):1413-1414.
40. Kaithwas, A; G. Kumar, H.Pandey, A. K. Acharya, M. Singh, D. Bhatia and A. Mukerjee (2008). Investigation of comparative antimicrobial activity of aloe vera gel and juice.*Pharmacology online* 1:239-243.
41. Heck, E; M. Head, D. Nowak, P.Helm and Bxter. Aloe vera (gel) cream as topical treatment for out patient burns. *Burns*.1981;1;7(4):291-294.
42. Cete, S; F. Arslan and A.Yasar . Investigation of antimicrobial effects against some microorganisms of aloe vera and nerium oleander also examination of the effects of xanthine oxidase activity in liver tissue treated with cyclosporine. *G. U. Fen Bilimleri Dergisi*. 2005; 18(3):375-380.
- 43.Grange JM, Davey RW. Antibacterial properties of Propolis (Bee Glue). *Journal of the Royal Society of Medicine* 1990;83(3), 159–60.
44. Awawdeh L, AL-Beitawi M, Hammad M. Effectiveness of propolis and calcium hydroxide as a short-term intracanal medicament against *Enterococcus faecalis*: a laboratory study. *Australian Endodontic Journal*. 2009;35(2).

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