

Comparative evaluation of antimicrobial efficacy of two intracanal medicaments and irrigants in conjunction to each other: An in vivo study

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Abstract

Background: Due to the complex anatomy of the root canal, mechanical instrumentation leaves significant portions of the root canal walls untouched and there is no evidence that instrumentation alone can completely eliminate microorganisms from the root canal. Therefore additional irrigants and medicaments are required to disinfect the root canal system to reduce the bacterial load to promote healing. **Aim:** This study aims to evaluate and compare the antimicrobial efficacy of calcium hydroxide and triple antibiotic paste (metronidazole, ciprofloxacin and cefaclor) as intra-canal medicaments in presence of different irrigants as, chlorhexidine and sodium hypochloride, by microbial quantification. **Materials and Methods:** The present study is randomized controlled trial which aims to assess the antimicrobial efficacy of calcium hydroxide and triple antibiotic paste (metronidazole, ciprofloxacin and cefaclor) as intra-canal medicaments in presence of different irrigants as, chlorhexidine and sodium hypochloride. In the present study all the subjects visiting to the department of Pedodontics will be included after obtaining voluntary informed consent from the subjects' parents/guardians. **Results:** All the groups in the study, i.e: group IA, IB, IIA, and IIB showed reduction in the pre- and post-operative microbial count present in the root canals. Whereas among all the groups, the group IIA tend to show the most reduced microbial count, followed by IIB, IA and IB respectively. **Conclusion:** Adequate amount of irrigation and an appropriate intra-canal medicament can help in achieving this goal. Use of irrigants and intra-canal medications in conjunction with each other will give a synergistic effect in the disinfection protocol.

Key Words: antimicrobial efficacy.

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INTRODUCTION

Dental caries is the most common and infectious disease occurring in children (primary dentition). Caries involving enamel, dentin and pulp in primary dentition, is a common entity due to less thickness of enamel/dentine

and large pulp chambers. As a result, teeth with infected root canals with interradicular infections is a common problem in primary dentition. Early exfoliation of primary teeth due to pulpal involvements, can cause many problems to the child including, space loss, ectopic eruptions, impactions of permanent successors, development of aberrant habits as tongue thrusting, speech problems, and impairment of function. Therefore, to avoid the complications and to maintain the arch integrity, it is necessary to preserve the intact tooth in the oral cavity until its correct time of exfoliation. Acariously pulpally infected tooth, successfully disinfected and the clinical crown restored to its full function shall provide with all the functions of intact natural tooth. Endodontic infections in deciduous root canals are associated with wide diversity of microorganisms. Endodontic treatment are procedures to debride and disrupt and remove the

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microbial ecosystem associated with the disease process. (Rana *et al*). Anaerobic and aerobic microorganisms, black pigmented bacilli, streptococci, mutans streptococcus and gram negative aerobic rods were found in necrotic pulp and periapical lesions (Silva *et al*, 2006). Both aerobic and anaerobic microorganisms as well as facultative microorganisms can be found in the deciduous root canals. The complexity of the root canal system, presence of numerous dentinal tubules, invasion of the dentinal tubules by microorganisms, formation of smear layer during instrumentation are common problems encountered during routine endodontic procedure. To overcome these obstacles, irrigants are a necessity in endodontic treatment of primary teeth. Intracanal irrigants exert their effects mechanically and chemically. Mechanical effects are generated by back and forth flow of the irrigation solution during cleaning and shaping of the infected root canals, significantly, reducing the bacterial load. Irrigants used in primary endodontic treatment are Sodium hypochloride, Chlorhexidine, MTAD, Ethylenediaminetetraacetic Acid and Citric Acid, Carisolv, Ozonated water and Herbal irrigants. Sodium hypochloride is the most commonly used irrigating solution. It gives rise to sodium and hypochlorite ions when combined with water thereby establishing an equilibrium with hypochlorous acid which is responsible for the antibacterial activity of NaOCl. Chlorhexidine is used at 2% concentration as an irrigating solution, it reacts with negatively charged groups on the cell surface, thereby showing greater reduction of intracanal bacteria when compared to sterile saline solution. As the pulpally involved teeth frequently involve the radicular areas of the tooth, reduction of microbial count and sterilization of the infected canals is a mandatory issue. The lesions are repaired or regenerated by the host's natural tissue recovery process, if the canals are well sterilized. Recalcification of the infected dentin takes place. Therefore, disinfection and sterilization of infected canals is an important step in pulp therapies. Commonly used intracanal medicaments in endodontics are Calcium hydroxide, Chlorhexidine gel, Triple antibiotic paste, etc. Pediatric Endodontic treatment should include the

removal of necrotic content, instrumentation and intracanal dressings as essential steps.

MATERIALS AND METHODOLOGY

a. Patients and teeth involved in the study: Sixty five infected primary teeth of patients from the age 3 to 10 years of age, were considered in this study. Patients with the chief complaint of pain or history of pain who reported to the Department of Pedodontics, Bharati Vidyapeeth Deemed University and Dental College, Sangli, were considered in the study. Patients presented with history of night pain, or swelling with related tooth. Intraoral swelling and sinus tract also evident. Parents were informed about the study methodology, expected results of the treatment. A written consent was obtained from the parents prior to the start of the study.

b. Radiographic Evaluation: Before commencement of the treatment, radiographic investigation was carried out. Radiovisography was used for the radiographic evaluation. Caries involving enamel, dentin and pulp were detected in the radiographs. Few teeth also presented with mild physiologic resorption. Teeth with, resorption more than twothird of the roots were not included in the study. Teeth presented with intraradicular radiolucency.

c. Case Selection

Inclusion Criteria

- Primary molars with caries involving pulp.
- Restorable tooth structure.

Exclusion Criteria

- Subjects with mental/physical disability.
- Tooth which cannot be isolated with rubber dam.
- Subjects on any systemic antibiotics.
- Parents/ Guardians who are not consenting for the child participation.

D) Distribution of subjects: All the Children were randomly distributed into 4 groups of 15 children each.

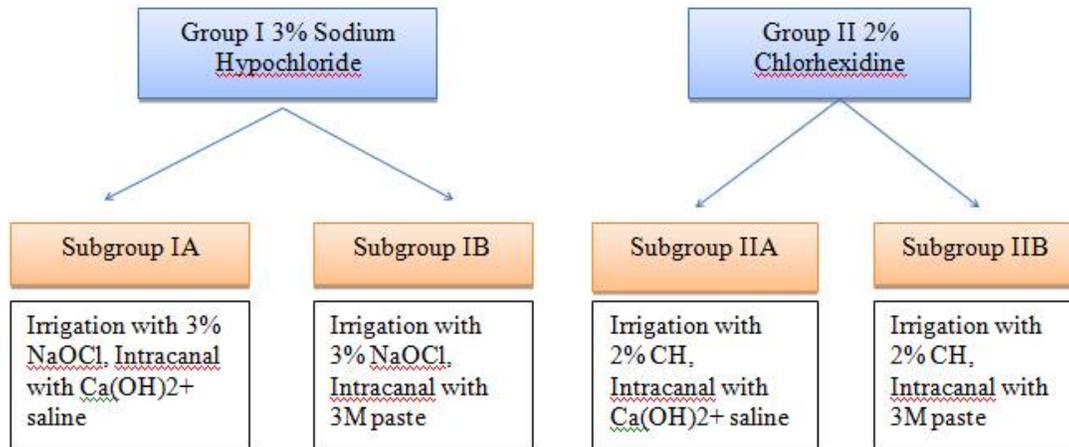


Figure 1:

E: Materials required

1. Iodine disinfectant
2. Nutrient agar and broth
3. 5% sodium thiosulphate
4. 2% chlorhexidine
5. 3% sodium hypochloride
6. MacConkey Blood Agar
7. Calcium hydroxide with normal saline
8. TAP(triple antibiotic paste with normal saline)
9. Rubber dam

PROCEDURE

- At the start of study, the medical and dental history of child were taken and the children were subjected to a clinical and radiographic examination.
- Pulpectomy indicated deciduous molars were chosen for the study.
- Under strict aseptic conditions, the procedural tooth was anaesthetised with 2% lignocaine and isolated with rubber dam. The tooth and adjacent rubber dam were disinfected with a tincture of iodine.
- Endodontic access was achieved with a sterile high speed bur. If rubber dam isolation could not be maintained during pulpectomy procedure, the case was eliminated from the study.
- On gaining access to the pulp, a sterile 10 number Hfile was inserted into the root canal upto the apical foramina to obtain the root canal contents and transfer into the sterile container containing peptone water and sealing the bottle tightly for onward transfer to the microbiological laboratory.
- Then working length determination was done by radiographic method.
- All the canals were debrided of pulp tissue by the conventional method with Hfiles. Copious

irrigation with the irrigants is carried out during the debridement of canals.

1. In Subgroup IA and IB, the teeth were irrigated with 3% sodium hypochloride and alternate use of saline.
2. In Subgroup IIA and IIB, the teeth were irrigated with 2% chlorhexidine and alternate use of saline.
3. The debrided teeth were thoroughly dried and intracanal medicaments were placed into the dry canals.
4. In Subgroup IA and IIA Calcium hydroxide were placed(Calcium Hydroxide with saline).
5. In Subgroup IB and IIB triple antibiotic paste was used(triple antibiotic paste with saline).
6. After 1 week the patient is recalled, and the intracanal medicament is removed with Hfiles and thoroughly irrigated with normal saline. A swab with paper points in the canals is taken as sample and transferred to the laboratory in peptone water for microbial examination.
7. Later the teeth were obturated with zinc oxide eugenol paste using lentulo spirals.

MICROBIOLOGICAL EXAMINATION

- The vials containing the samples were agitated for 30 seconds on a vortex at power setting 4 before aliquot disbursement.
- Plates were inoculated with McConkey Blood Agar.
- They were incubated at temperature of 37degree Celsius for 1 day.
- Colony characters were noted in case of any growth.
- Colony counting in this study was carried out with digital colony counter.

Statistical Analysis

- All the data from the case sheet are transferred to Microsoft excel. From this, data was retrieved

into SPSS software version 16 for statistical analysis.

- Statistical significance fixed at ≤ 0.05 .

- ANOVA test and Tukey HSD were employed to check the difference of microbial count among all the four groups

RESULT

Table 1:

| ANOVA | | | | | |
|----------------|------------------|-----------|-------------|--------|------|
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 41547.500 | 3 | 13849.167 | 14.861 | .000 |
| Within Groups | 33550.000 | 36 | 931.944 | | |
| Total | 75097.500 | 39 | | | |

Table 2:

| Multiple Comparisons Tukey HSD | | | | | | |
|-----------------------------------|-----------|----------------------|------------|------|-------------------------|-------------|
| (I) Group | (J) Group | Mean Difference (IJ) | Std. Error | Sig. | 95% Confidence Interval | |
| | | | | | Lower Bound | Upper Bound |
| IA | IB | 27.000 | 13.652 | .215 | 63.77 | 9.77 |
| | IIA | 50.000* | 13.652 | .004 | 13.23 | 86.77 |
| | IIB | 46.000* | 13.652 | .009 | 9.23 | 82.77 |
| IB | IA | 27.000 | 13.652 | .215 | 9.77 | 63.77 |
| | IIA | 77.000* | 13.652 | .000 | 40.23 | 113.77 |
| | IIB | 73.000* | 13.652 | .000 | 36.23 | 109.77 |
| IIA | IA | 50.000* | 13.652 | .004 | 86.77 | 13.23 |
| | IB | 77.000* | 13.652 | .000 | 113.77 | 40.23 |
| | IIB | 4.000 | 13.652 | .991 | 40.77 | 32.77 |
| IIB | IA | 46.000* | 13.652 | .009 | 82.77 | 9.23 |
| | IB | 73.000* | 13.652 | .000 | 109.77 | 36.23 |
| | IIA | 4.000 | 13.652 | .991 | 32.77 | 40.77 |

*. The mean difference is significant at the 0.05 level.

All the groups in the study, i.e.: group IA, IB, IIA, and IIB showed reduction in the pre and postoperative microbial count present in the root canals. Whereas among all the groups, the group IIA tend to show the most reduced microbial count, followed by IIB, IA and IB respectively.

DISCUSSION

The differences in the preoperative and postoperative colony forming units of microbial count in our present study showed significant amount decrease in microbial count in all the groups of combinations of irrigants and intracanal medicaments. The clinical studies in infected primary teeth suggest 3Mix to be an effective root canal treatment material. minocycline may cause tooth discoloration because of photoactivation. Minocycline binds to calcium ions via chelation to form an insoluble complex. It should be limited to the root canal because of the potential risk of tooth discoloration.

Calcium hydroxide plays an important role in endodontics, through its ability to induce hard tissue formation, its moderate antibacterial action and its tissue dissolving capability (Nerwich *et al.* 1993). Ca(OH)₂ dressing may both prevent root canal reinfection and

interrupt the nutrient supply to remaining bacteria (Siqueiraand Lopes1999). Its high pH (around 12.5) has a destructive effect on cell membranes and protein structure(Spangberg1994). To be effective against bacteria located inside the dentinal tubules, the hydroxyl ions from Ca(OH)₂ should diffuse into dentine at sufficient concentrations and should exceed the dentine buffering ability, reaching pH levels sufficient to destroy bacteria (Siqueiraand Lopes 1999). Use of chlorhexidine inendodontics has been proposed both as irrigant and intracanal medicament (Delanyetal.1982, Vahdatyetal. 1998, Jeansonne and White 1994, Siqueiraand Uzeda 1997, Ferrazetal.2001). Chlorhexidinehasinhibitory effects onbacteriacommonly found in endodontic infections (Cervone *et al.* 1990), acting against grampositive and gramnegative migroorganisms (Waler1990). One of the mechanismsthat explains its efficacyisbased on the interaction between the positive charge of themoleculeandnegatively charged phosphate groups on the bacterial cell wall, which allows the chorhexidinemoleculeto penetrate into the bacteria with toxic effects (Lindskog *et al.* 1998, Hugo and Longworth1964).

CONCLUSION

Owing to the unique and complicated anatomy of deciduous teeth and its importance of retention in the jaw, proper disinfection and retention of the pulpally involved primary teeth for appropriate amount of duration is of utmost importance. Adequate amount of irrigation and an appropriate intracanal medicament can help in achieving this goal. Use of irrigants and intracanal medications in conjunction with each other will give a synergistic effect in the disinfection protocol.

REFERENCE

1. Heling I, Chandler NP. Antimicrobial effect of irrigant combinations within dentinal tubules. *International Endodontic Journal*. 1998 Jan 1;31(1):814.
2. Mohammadi Z, Abbott PV. The properties and applications of chlorhexidine in endodontics. *International endodontic journal*. 2009 Apr 1;42(4):288302.
3. Takushige T, Cruz EV, Asgor Moral A, Hoshino E. Endodontic treatment of primary teeth using a combination of antibacterial drugs. *International Endodontic Journal*. 2004 Feb 1;37(2):1328.
4. Gomes BP, Souza SF, Ferraz CC, Teixeira FB, Zaia AA, Valdrighi L, SouzaFilho FJ. Effectiveness of 2% chlorhexidine gel and calcium hydroxide against *Enterococcus faecalis* in bovine root dentine in vitro. *International Endodontic Journal*. 2003 Apr 1;36(4):26775.
5. Ahmed N, Neelakantan P. Antiseptics and antibiotics used in regenerative endodontics. *International Journal of Pharmaceutical and Clinical Research*. 2013;5(4):14144.
6. Parasuraman VR, Muljibhai BS. 3MixMP in Endodontics—An overview. *IOSR J Dent Med Sci*. 2012; 3:3645.
7. Ercan E, Özekinci T, Atakul F, Gül K. Antibacterial activity of 2% chlorhexidine gluconate and 5.25% sodium hypochlorite in infected root canal: in vivo study. *Journal of endodontics*. 2004 Feb 1; 30(2):847.
8. Silva LA, NelsonFilho P, Faria G, SouzaGugelmin MC, Ito IY. Bacterial profile in primary teeth with necrotic pulp and periapical lesions. *Brazilian dental journal*. 2006; 17(2):1448.
9. Rana V, Baba SM, Pandey A. Bacteriology of infected deciduous root canal: a review.
10. Haapasalo M, Endal U, Zandi H, Coil JM. Eradication of endodontic infection by instrumentation and irrigation solutions. *Endodontic topics*. 2005 Mar 1; 10(1):77102.
11. Estrela C, Estrela CR, Barbin EL, Spanó JC, Marchesan MA, Pécora JD. Mechanism of action of sodium hypochlorite. *Brazilian dental journal*. 2002; 13(2):1137.
12. Gajan EB, Aghazadeh M, Abashov R, Milani AS, Moosavi Z. Microbial flora of root canals of pulpallyinfected teeth: *Enterococcus faecalis* a prevalent species. *Journal of dental research, dental clinics, dental prospects*. 2009; 3(1):24.
13. Spencer HR, Ike V, Brennan PA. the use of sodium hypochlorite in endodontics—potential complications and their management. *British dental journal*. 2007 May; 202(9):555.
14. NerwichA, FigdorD, Endo D, Messer HH (199S) pH changes in rootdentinovera4weekperiodfollowingrootcanaldressing with calcium hydroxide. *Journal of Endodontics*96, 302–6.
15. Vahdaty A, PittFordTR, Wilson RF (1993) Efficacy of chlorhexidine in disinfecting dentinal tubules in vitro. *Endodonticsand DenJalTraumatology* 9, 243–8.
16. SiqueiraJF,Jr,UzedaM(1997)Intracanalmedicaments:Evaluationoftheantibacterialeffectsofchlorhexidine,metronidazole,andcalciumhydroxideassociatedwiththreevehicles. *Journal ofEndodontology*3, 167–9.
17. Spangberg LSW (1994) Intracanal medication. In: Ingle JI, BaklandLfl, eds. *Endodontology*, 4th edn. Baltimore: Williams and Wilkins, 627–40
18. WalerSM (1990) Furtherin vitrostudiesontheplaqueinhibiting effectof chlorhexidineanditsbindingmechanisms. *Scandinavia JournalofDentalResearch*98, 422–7.

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