Research Article

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The Effectiveness of 2% Chlorhexidine Gel in Reducing Intracanal Bacterial Count

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Abstract

Background: *Root canal treatment is normally prescribed to treat an infection, and as with all surgical procedures an aseptic technique is essential throughout. Even after complying with the best of the treatment regimes a root canal therapy can fail due to the presence of certain resistant, residual organisms. This study is all about clinical efficacy of 2% chlorhexidine gel in reducing intra canal bacterial count during RCT instrumentation. A total of 138 patients participated in this study. The sample included 69 male and 69 female patients. The mean age of the sample was 28.3 (SD = 4.16). The mean baseline bacterial count was 4.51 x 10^6 as compared to post medication count after 15 days which was 2.88 x 10^6. Bacterial growth/positive culture was found in only 29.7% of patients. Furthermore, effectiveness of $CA(OH)_2$/2% chlorhexidine gel as measured by 50% decrease in bacterial count was observed in 65.2% patients*

Conclusion: *In conclusion, the results of $CA(OH)_2$/2% chlorhexidine gel in the present study was able to reduce bacterial count after 15 days. These results suggested that CHX gel might be more effective at curtailing bacteria, and thus be better suited as intra canal medication.*

Keywords: Apical Periodontitis, Chlorhexidine, Disinfection, Intra canal medication.

Root canal treatment is normally prescribed to treat an infection, and as with all surgical procedures an aseptic technique is essential throughout. Success of endodontic treatment directly contingent on the eradication of the infection before root filling. Even after complying with the best of the treatment regimes a root canal therapy can fail due to the presence of certain resistant, residual organisms [1].

Bacteria that survive in the root canal system after chemomechanical preparation have been shown to rapidly multiply when the canals are left empty [2]. the rapid regrowth suggests that the conditions within empty root canal systems favour bacterial proliferation. In order to prevent bacterial regrowth, and preferably to eliminate residual bacteria, antibacterial intracanal medication is used between subsequent treatment appointments [2].

The ultimate biological aim of root canal treatment is either to prevent or cure apical periodontitis [3]. Several researches have clearly demonstrated the involvement of bacteria in the development and persistence of apical periodontitis. Therefore, elimination of bacteria has been the main focus of root canal treatment. Numerous studies have been conducted over half a century primarily to gain a better understanding of the microbial flora and the ecological conditions in infected root canals and secondly to find the ideal means of eliminating bacteria from the root canal system [4].

For many years, sodium hypochlorite has been used as an intracanal irrigating solution and calcium hydroxide as an intra canal inter-appointment medicament [5,6]. Combined with mechanical preparation they have provided a good outcome for endodontic therapy. Recent studies, however, indicate that a small number of bacteria still survive at the time of root filling in many teeth [7,8]. Calcium hydroxide $Ca(OH)_2$ is ineffective against some of microorganisms such as enterococcus faecalis, which is found in the case of persistent root canal infection or RCT failure cases [1,9]. In addition, some studies have questioned the effectiveness of $Ca(OH)_2$ to disinfect the canal and reported a residual flora in the canal after one or more weeks with use. It is necessary to explore new antimicrobial agents that are effective in eliminating intracanal microorganisms including facultative microorganisms such as Enterococcus faecalis.

Currently, there is an extensive research activity investigating new methods and materials to be used for the irrigation and disinfection of the root canal system. In earlier study, placement of $Ca(OH)_2$/2% CHX gel intracanal dressing for at least 2 weeks rendered 64% of canals bacteria free in teeth with RCT failure cases [10]. In another study synergistic action resulted from the mixture of $CA(OH)_2$/2% CHX gel and its efficacy was greater than calcium hydroxide alone [11].

Therefore, the aim of this study was to assess of the effectiveness of 2% chlorhexidine gel in reducing intracanal bacterial count.

Materials and Methods

A total of 138 participants were recruited among the patients treated at the Nishtar Institute of Dentistry, Multan. A consultation appointment was scheduled for each patient to identify potential subjects for inclusion in the study. The examination included a complete medical history, extra-oral and intra-oral examination. Patients fulfilling inclusion criteria were History of previous endodontic treatment anterior as well as posterior teeth, Teeth with an adequate coronal structure amenable to proper isolation, temporization and restoration; Patients with bacterial cells per canal 10^3 to 10^7, Duration of RCT failure not less than 12 months, while Grossly carious tooth not favorable for rubber application., Known hypersensitivity, allergies or idiosyncratic reaction to any study medication, Immature teeth with open apices. Medically compromised patients such as diabetes mellitus, renal failure and organ transplant were excluded from study.

An information letter explaining the project was given to all potential study participants. All participants were volunteers and gave their full consent by signing the Informed Consent Form. Diagnosis of RCT failure cases was made with the help of history, clinical examination and periapical radiograph. Surface of tooth was isolated with rubber-dam. In case of RCT failure cases old restoration was removed and caries were excavated. Root canal filling was removed with gates gladden and hand file. Sterile endodontic file was placed into canal and length was adjusted within 1 mm of apex confirmed by x-ray. Sterile #10 file advanced to working length was used to agitate the canal content for 1 min. Entire canal constituent was adsorbed on sterile paper point and was transferred to precluded thioglycolate broth and culture was labeled as S_1. Root canal was cleaned and shaped with endodontic file using conventional endodontic technique in the presence of 2%chlorhexidine gel. A copious amount of NaOCL was used for irrigation. 5% Sodium thiosulfate was use to neutralize NaOCL. Next, the root canal was irrigated with NaOCl and agitated with the master apical file. The canal was dried with sterile paper points and packed with 2% CHX +$Ca(OH)_2$ slurry and temporized with a thick layer of Cavit and antibiotic will be prescribed. The next appointment was scheduled on 15 days.

At the second appointment, the tooth was isolated with a rubber dam. Intracanal medicament was passively removed with a K-file and irrigated. Neutralization of the $Ca(OH)_2$/2% CHX gel dressing was accomplished with 2 mL of 0.5%citric acid followed by 2 mL of 3% Tween 80/0.3% L-lecithin introduced into each canal with a sterile tuberculin syringe with a 30-GMaxi-Probe irrigation needle. The canals was irrigated again and dried. The canal was dried and then filled with saline and a culture sample will obtained and labeled S_2.

All cultures were collected in prereduced fluid thioglycolate. The thioglycolate broth cultures was incubated at 37 ºC inspected daily for turbidity for the first 7 days, then weekly for another 3 weeks to assure that slow-growing microorganisms was included. After incubation, the colony-forming units (CFUs) were obtained. Effectiveness of CHX gel was measured in terms of reduction in bacterial count i.e.

Reduction in bacterial count = Total bacteria in Sample 2 – Total bacterial in Sample 1 and Reduction in > 50% bacteria from baseline count was considered as effectiveness of 2% Chlorhexidine gel.

Results

A total of 138 patients participated in this study. The sample included 69 male and 69 female patients. The mean age of the sample was 28.3 (SD = 4.16). The mean baseline bacterial count was 4.51 x 10^6 as compared to post medication count after 15 days which was 2.88 x 10^6 (Table-1).

Table 1: Descriptive Statistics

	Mean	SD	Min	Max	Range
Age in Years	28.30	4.21	20.00	39.00	19.00
Baseline Bacterial count (10^6)	4.51	1.24	1.12	8.83	7.71
Post Medication Bacterial count (10^6)	2.88	1.44	0.28	6.73	6.45

Bacterial growth/positive culture was found in only 29.7% of patients. Furthermore, effectiveness of $CA(OH)_2$/2% chlorhexidine gel as measured by 50% decrease in bacterial count was observed in 65.2% patients (Table-2).

Table 2: Frequency Distribution

		Frequency (n)	Percentage (%)
Reduction in Bacterial Count	**Negative**	41	29.7
	Positive	97	70.3
Effectiveness	**Negative**	48	34.8
	Positive	90	65.2

To test the significant of decrease in bacterial count, paired sample t-test was applied. Application of 2% chlorhexidine gel with $CA(OH)_2$, did affect a decrease in positive cultures. In fact, the proportion of positive 15-day cultures was only 29.7% after application of $CA(OH)_2$/2% chlorhexidine gel. Similarly, there was significant decrease in bacterial count after 15 days. The low numbers of bacteria after 2% chlorhexidine gel was applied ($2.88x10^6$) certainly made prospects of significant improvement in the subsequent step likely (Table-3).

Table 3: Paired Samples Test

	Paired Differences		t	df	P-value
	Mean	**Std. Deviation**			
Pre – Post Bacterial Count	1.624	1.412	13.512	137	.000

The significant difference in the mean count of bacteria, before ($4.51xl0^6$) and after ($2.88xl0^6$) application of $CA(OH)_2$/2% chlorhexidine gel, suggested that it did exert a meaningful antibacterial effect. Furthermore, reduction in bacterial count after 15 days was not associated with either gender or age of the patients.

Discussion

In the absence of a control group to assess the efficacy of $CA(OH)_2$/2% chlorhexidine gel, the results of the present study is discussed in relation to Paquette's study, where canals were medicated with CHX liquid, and the study by Manzur et al., where 2% CHX gel was used as intracanal medication in 11 teeth [8,12]. Paquette et al. reported a significant increase in the proportion of positive 14-day cultures,

from 48% at the end of canal preparation, to 68% after medication [8]. In the present study, 29.7% of all 15- day cultures obtained after $CA(OH)_2$/2% chlorhexidine gel were positive, which were lower than those of Manzur et al., who reported 45% of positive post-medication cultures [12].

The significant decrease recorded in the present study in mean bacterial counts before (4.51×10^6 per canal) and after (2.88×10^6 per canal) canal medication, was in disagreement with the non significant increase (from 1.46×10^2, to 7.84×10^2 per tooth) reported by Manzur et al. In contrast, Paquette et al. reported a significant increase in the mean bacterial concentration (from 5.38, to $1.08 \times l0^2$ canal volume) after medication with 2% CHX liquid [8,12]. These differences are consistent with earlier findings that the CHX liquid may have partially escaped from the apical foramen, and that a gel form might have been better suited for intracanal medication than liquid as reported by our study.

An ideal intracanal medication should possess long-term antimicrobial and suitable physico-chemical properties, so as to prevent root canal recontamination for extended periods of time (214, 279). Paquette et al. noted that often, at the beginning of the second treatment session, the CHX liquid in the canals was depleted, potentially allowing bacterial growth between treatment sessions. In the past, concerns have been raised regarding the potential interference of CHX gel residue with the seal of the root canal filling [13,14]. These concerns have been disputed by an *in vitro* study, where canals medicated with CHX gel did not demonstrate greater leakage than other canals [15].

Conclusion

In conclusion, the results of $CA(OH)_2$/2% chlorhexidine gel in the present study was able to reduce bacterial count after 15 days. These results suggested that CHX gel might be more effective at curtailing bacteria, and thus be better suited as intracanal medication.

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