

Comparative evaluation of antiseptic pomade to prevent bacterial colonization after periodontal flap surgery- a clinical & microbiological study

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Abstract

Introduction: Surgical site infections can occur due to capillary effects of sutures resulting in bacteria permeating the wounds. By incorporating antimicrobial agents in the sutures these complications might be avoided through inhibition of the bacterial pathogens. The aim of this study was to compare the bacterial colonization of two different antiseptic coated silk sutures after periodontal flap surgery.

Materials and Method: 30 patients scheduled for treatment of periodontal pockets with flap surgery were selected and divided randomly and equally into three groups- Plain suture, Chlorhexidine and Tetracycline coated. On the 7th and 15th postoperative day 2 millimeters of the suture was harvested from each patient and the bacteria that had adhered to them were cultured. The number of colony-forming units per milliliter (CFU/mL) was determined and the groups were compared using the Mann-Whitney statistical test ($P < 0.05$).

Results: The antibacterial coated sutures showed statistically significant difference in CFUs/ml compared to plain uncoated sutures.

Conclusion: In this experimental model, the antiseptic pomade was effective in reducing bacterial colonization on silk braided sutures.

Keywords: Silk suture, Chlorhexidine, Tetracycline; Colony-forming unit, Antiseptic coated suture

Introduction

Periodontal disease, a chronic oral infectious disease is amongst the most prevalent diseases worldwide and also remains the major cause of tooth morbidity. The major characteristics of the disease are the presence of gingival inflammation, periodontal pocket formation, loss of connective tissue attachment and alveolar bone around the affected teeth. The primary goal of periodontal therapy is to arrest the progression of periodontal disease and maintain the natural dentition in health and comfortable function. This goal can be accomplished by non-surgical therapy in patients with mild to moderate periodontitis, whereas in advanced cases, open flap debridement results in greater success.⁽¹⁾

Proper wound closure accompanied most importantly by absence of bacteria at the healing site are the most important factors affecting the success of any periodontal surgical procedure. Sutures used in oral cavity are continuously bathed in saliva containing 7.5×10^8 microorganisms/mL and can act as a reservoir of microbes at the surgical site leading to increased chances of infection at the surgical site.⁽²⁾ This results in continuous wicking of microorganisms along the suture at the surgical site which results in a prolonged inflammatory response and Surgical Site Infection (SSI). Studies regarding the use of antibiotic-coated sutures were conducted and have shown varying results in prevention of SSI for many years.^(3,4) Sutures impregnated or coated with antibacterial agents have been developed in an attempt to reduce bacterial

adherence and colonization. A suture made from Polyglactin 910, coated with the antiseptic agent Chlorhexidine, is an example of one such product that has been used in different situations.^(5,6) The aim of the present study was to assess whether Chlorhexidine and tetracycline antiseptic pomade could reduce the bacterial colonization of silk braided sutures after periodontal flap surgery.

Materials and Method

Patient's selection criteria: The presented clinical study was performed at the Department of Periodontology and Oral Implantology, I.T.S Centre for Dental Studies & Research, Ghaziabad, India. The research protocol was reviewed and approved by the Ethical Committee of the Institution. All patients were educated about the study and then written consent was acquired before enrolment in the study. The study was conducted for a period of three months.

A flow diagram for complete methodology is presented in Fig. 1. Twenty (30) patients were diagnosed with the problem of Chronic Periodontitis. The patients with age group between 18-45 years and periodontal pockets > 5mm were included in the study. Patients in gestation or lactation period, medically compromised, allergic to the medicament were excluded from the study.

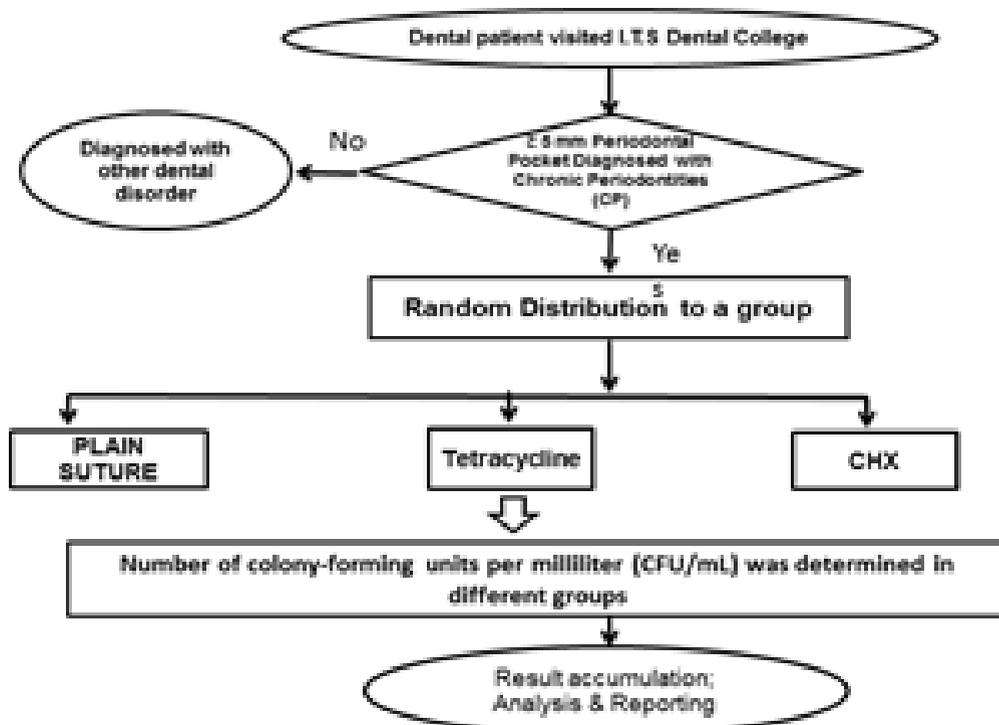


Fig. 1: Flowchart showing the study methodology

Patient's allocation & procedures: Patients were assigned equally but randomly to one of the three treatment groups (N = 30). Envelopes containing identifications for treatment groups were enclosed, mixed, and then numbered. Each participant was randomly allocated to one of the following group. Twenty minutes before each surgical procedure, the patients were instructed to use chlorhexidine (0.2%) as a mouth rinse for 1 minute.

In each of the experimental groups (n=10) the black 3-0 silk braided suture was covered with the antiseptic pomade either tetracycline or 0.2% chlorhexidine and in the control group (n = 10) the plain suture was used without any pomade. The pomade was applied to the suture thread by the examiner immediately before performing the suturing. The examiner placed the pomade on the tip of the thumb and index finger, and then slid the thread between them until it was saturated with pomade.

On the 7th and 15th post-operative day suture materials were harvested from the external part from each patient. Harvested pieces were immediately immersed in the sterile tubes to maintain a viable bacterial culture (Fig. 2). Each tube contained 4.2 mg of sodium chloride, 3.1mg of anhydrous dipotassium phosphate, 0.3 ml of bidistilled glycerine and 0.7ml of distilled water.



Fig. 2: Sterile tubes for collection of suture

The tubes were kept in a constant mechanical flux at 12 rpm for 10 minute. The deposits that were induced were discarded and the suspension was subjected to 10 fold dilutions. The first dilution of 10^{-1} was prepared by pipetting 1ml of the suspension and diluting it in 9 ml saline solution (0.85% NaCl). From the first 10^{-1} dilution (1:10) subsequent dilutions were prepared upto 10^{-3} by transferring 1ml of each dilution to obtain the next (Fig. 3). The tubes were kept under constant homogenization. One ml of each dilution was plated on a medium of blood agar plus defibrinated sheep blood (5ml blood agar per 100ml base medium), reaching a pH of 6.6 -7.0.



Fig. 3: Preparation of Serial Dilutions

The plates were incubated at 37 degrees centigrade under microaerophilic conditions (5% CO₂) for 48 hours (Fig. 4). After incubation the number of colony forming units per ml (CFU/ml) were recorded with the aid of colony counter (Fig. 5).



Fig. 4: Incubation Chamber



Fig. 5: Colony Counter

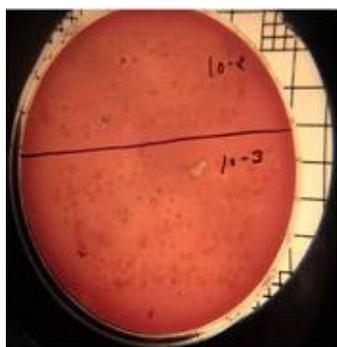


Figure A. Plain Suture

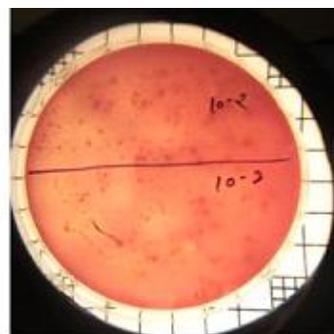


Figure B. Tetracycline

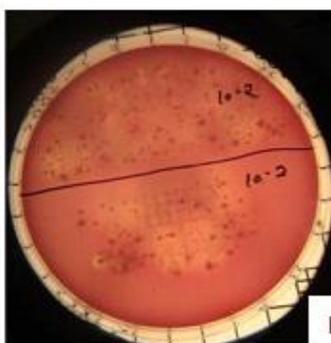


Figure C. Chlorhexidine

Fig. 6: Colony forming units A. Plain Suture B. Tetracycline C. Chlorhexidine

The total number of Colony forming units was multiplied with the dilution factor in the experimental and control groups in the samples collected on 7th and 15th post-operative day and a tabulation was achieved. (Fig. 6)

Statistical analysis: Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 16.0 for windows). Test for qualitative variables, mean and standard deviation were calculated. To test the significance of difference of mean rank of bacterial contamination of the silk braided between three groups was test by Mann-Whitney *U* test.

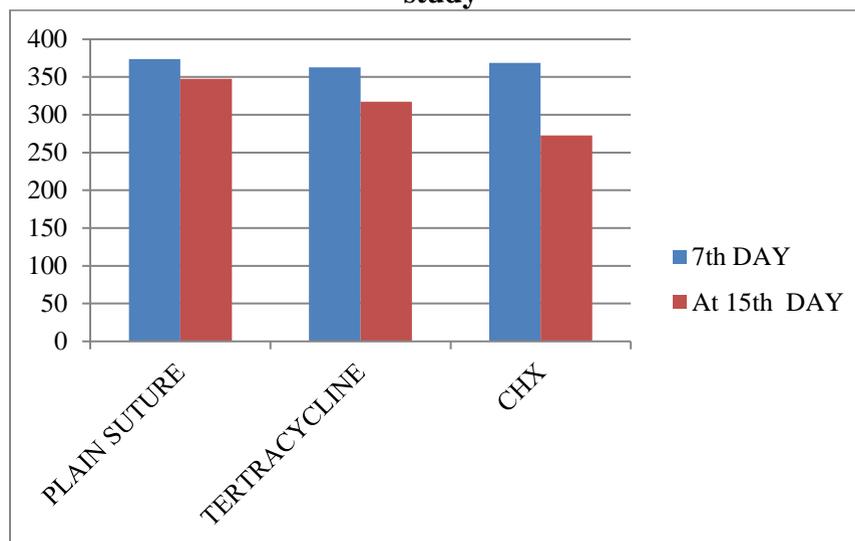
Results

The mean colony-forming units (CFU/mL) scores at 7th Day in Plain Suture, CHX and tetracycline were 373.60 ± 43.295 , 362.80 ± 42.166 and 368.70 ± 42.375 respectively. At 15th Day the mean colony-forming unit's scores were found to be 347.60 ± 44.061 , 317.30 ± 42.075 and 272.80 ± 52.917 in the control and test group respectively. There was significant difference ($p < 0.05$) in the mean colony-forming units at 15th Day in both test and control groups. (Table 1, Graph 1).

Table 1: Comparison of colony forming unit between test and control groups

CFU	Groups	Mean	Std. Deviation	t-test value	P-value	Mean Difference
At 7 th Day	Plain Suture	373.60	43.295	.820	-.228	10.800
	Tertracycline	362.80	42.166			
	CHX	368.70	42.375			
At 15 th Day	Plain Suture	347.60	44.061	.002*	-3.031	74.800
	Tertracycline	317.30	42.075			
	CHX	272.80	52.917			
Unpaired t-test *significant difference (p-value<0.05)						

Graph 1: Show the colony forming units with time in different groups incorporated in the study



Discussion

Infection associated with surgery is one of the major complications in surgery. Sutures can serve as the nidus for such an infection via adhering bacteria entering the wounds by capillary action and form infamous biofilms, leading to chronic infections. Hence the sutures can cause so called suture-associated infections, induced by proliferation of adhering pathogens.⁽⁷⁾ Anti-microbial coatings for surgical sutures can solve that problem via protecting sutures by inhibiting bacterial growth. The findings of the present study provide insight into the mechanism by which the use of a suture coated with a bactericidal agent would protect wounds, in agreement with earlier reports.^(8,9)

In addition, this study demonstrated that the antimicrobial activity of the compound was sustained over a long period of time, including the early period in the postoperative timeline, when a surgical wound is usually most subject to microbial exposure resulting from technical complications, such as mastication and brushing. As many surgeons consider the silk suture to be the gold standard, and also because among natural suture materials it has been demonstrated with better handling characteristics hence it was chosen as a material of choice for this study. Also the multifilament sutures are preferred, because monofilament is more difficult to manipulate, exhibits poor knot security and has sharp ends that irritate oral tissue. However, the use of multifilament sutures has been challenged by some studies, which suggest that this type of suture can act as a wick, leading bacteria into the wound, causing severe inflammation.⁽¹⁰⁾ Earlier studies^(11,12) used a similar methodology and evaluated the effect of this pomade on tissue adjacent to surgical site. The authors evaluated the clinical and microbiological parameters and have found no adverse effects within the tissue. Studies have examined the effectiveness of chlorhexidine in different

suture materials and surgical sites.^(13,14) Tissue-based studies in an animal model have suggested that triclosan-coated braided sutures exhibited no adverse effect on wound healing but did exhibit antibacterial activity sufficient to prevent in vivo bacterial colonization.⁽¹⁵⁾ The scanning electron microscope (SEM)⁽¹⁶⁾ study revealed that the deposition of Tetracycline onto the surface of silk sutures does not generate more friction and less tenacity and knot strength than the untreated silk sutures. These characteristics combined with good drug release and antimicrobial characteristics suggest that Tetracycline drug is suitable to improve the functional properties of suture materials. Thus, in our study we have compared the efficacy of the antimicrobial chlorhexidine and tetracycline coated surgical silk sutures on bacterial colonization after periodontal flap surgery both clinically and microbiologically. Overall, the results of this study showed that antibacterial-coated sutures exhibited an inhibitory bactericidal activity against the commensal bacteria that colonize oral surgical wounds. The results also showed that the antiseptic coated silk braided sutures had a satisfactory clinical behavior for routine use without the risk of bacterial contamination of the surgical wound. Also, that the antiseptic efficacy of tetracycline coated suture is significantly better than chlorhexidine and plain surgical silk suture.

The limitation of the present study is a small sample size because this increased the possibility of bias if some patients were more efficient than others in maintaining oral hygiene after surgery. Randomization of patients was done to minimize this possibility of bias, but a larger number of participants could also have minimized possibilities for this variable. Nevertheless, the statistically significant difference between the groups was so great ($P < .002$) that a larger sample size probably would not have affected the results significantly. Therefore, the efficacy of this antiseptic pomade as a

coating for sutures should be investigated further by a larger sample size evaluating its clinical outcomes, microbiology also the economic benefits. Further more studies should be conducted to compare antiseptic-coated silk braided suture with a monofilament suture

Conclusion

The methods used in the present study were safe and satisfactory for well being of all the patients. Within the limits of this study, it is safe to conclude that the antiseptic pomade treatment modality using tetracycline proved to be the most effective treatment in terms of reducing bacterial colonization on silk braided sutures as compare to chlorhexidine and plain suture.

However, long term follow-ups are warranted for better authentication of the results.

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