A Prospective Clinical Evaluation of the Effects of Chlorhexidine, Warm Saline Mouth Washes and Microbial Growth on Intraoral Sutures

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Abstract

Introduction Post operative care of sutured wound is important after surgery. Sutured wounds within the oral cavity are kept clean through frequent rinses with either normal saline, chlorhexidine mouth rinses, hydrogen peroxide diluted with saline, or fresh tap water.

Patients and Methods The patients were randomised into 3 groups (A, B and C). The container used had 34 chlorhexidine, 34 warm saline and 32 warm water mouth rinses. The latter served as control. All selected patients had scaling and polishing done preoperatively when needed. All participants in each group did not receive antibiotics but received analgesics (paracetamol 1 g 8 h for 5 days.).

Results There were 49 females and 51 males, in the age range between 18 and 50 years. Microorganisms were found to grow on sutures with streptococcus viridians predominating followed by staphylococcus epidermides. The effects of chlorhexidine, warm saline and warm tap water mouth washes were not statistically significant.

Conclusion Chlorhexidine, warm salt water and warm tap water averagely produced the same number of colony forming units of bacteria, which shows that the three different mouth washes are equally effective as post-operative mouth rinses after oral surgery.

Keywords Chlorhexidine · Warm saline · Bacteria growth · Suture

Introduction

Post operative care of sutured wound is important after surgery. Sutured wounds within the oral cavity are kept clean through frequent rinses with either normal saline, chlorhexidine mouth rinses, hydrogen peroxide diluted with saline, or fresh tap water [1, 2].

Chlorhexidine is a chemical antiseptic used to combat microbes and intraorally, it is used as 0.1, 0.12, and 0.2 % [3–6] with favorable suture cleansing, healing and epithelialisation of tissues [3, 5]. It is both bacteriocidal and bacteriostatic. The ability of chlorhexidine mouth wash to inhibit bacterial growth on the tooth tissue is well established but it is not known if it can inhibit bacteria growth on intra-oral suture materials [2]. However, warm salt water is frequently prescribed post operatively after minor oral surgery. The saline solution can be prepared by dissolving one-half teaspoon of salt in an 8-ounce glass of warm water [1]. Although Alexander [7], observed that warm salt water mouth wash has no advantage over warm plain tap water in treating or preventing infection or in maintaining oral hygiene, it is still routinely used post operatively after intraoral surgery.

Despite some evidence that chlorhexidine mouth rinse does not have any influence on polyglactin 910 sutures, many professionals do not prescribe its use as mouth rinse because of the fear that it might cause early degradation of resorbable sutures [2].

For more than 50 years, numerous textbooks have advocated the use of saltwater (saline) for post-surgical mouth rinses, apparently on the premise that it is the most

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physiologic irrigant available and will not adversely affect healing tissues [7]. The purpose of this study was to determine the effect of chlorhexidine, warm saline mouth washes and microbial growth on surgically placed intraoral sutures.

Patients and Methods

This is a prospective randomized clinical study, which assessed the effects of chlorhexidine and warm saline mouth washes on intraoral sutures after oral surgical procedures in 100 patients that presented at the Oral and Maxillofacial clinic of the Ahmadu Bello University Teaching Hospital over a 12-month period. The study analysed and determined the presence or absence of association between various parameters like the type of suture, whether chlorhexidine, warm saline mouth washes or warm water were used and bacteria growth on sutures. Permission was obtained from the Ethics Committee of the hospital before the study. Each participant also signed an informed consent form.

The patients were randomised into 3 groups (A, B and C). The container used had 34 chlorhexidine, 34 warm saline and 32 warm water mouth rinses. The latter served as control. All selected patients had scaling and polishing done preoperatively when needed. The surgical procedures, which were carried out either under local or general anesthesia, ranged from intra-oral incisional and excisional biopsies, clean lacerations, 3rd molar surgery and enucleation of small cysts. The suture materials used were 3–0 grade with similar needle type (round body). All the procedures were done by the same operator.

Post Operative Management

All participants in each group did not receive antibiotics but received analgesics (paracetamol 1 g 8 h for 5 days.).

The concentration of chlorhexidine mouth rinse used was in solution as 0.2 %. It was given twice a day for 7 days and about 30 min after brushing. Warm water and salt was prescribed as 8-ounce glass of the normal saline solution rinse before and after every meal [1, 10]. Warm tap water was used as control group. On the 7th day, a suture was removed from each sub-group and immediately placed in Stuart's transport medium [19] and sent to the laboratory for microscopy and culture. The sutures were cultured on blood agar containing 5 % defibrinated sheep blood as well as on McConkey agar and incubated at 37 °C for 24 h [11, 17, 19]. The test tubes containing the sutures had earlier been vortexed for 2 min³ in order to obtain a homogenous suspension. Decimal dilutions (10^{-1} , 10^{-2} and 10^{-3}) were then prepared from this suspension in sterile saline. These counts were compared in the three experimental groups to provide an indication of the

degree of plaque distribution and any inhibitory effect of the chlorhexidine and warm saline mouth washes compared to warm tap water mouth wash respectively.

Statistical Analysis

The computations and results were obtained using the SPSS 20 and MedCalc as employed for data analysis. The following inferential statistical analyses were used to compare the effectiveness of the three different mouth wash solutions for chromic cat gut and vicryl groups. The response variable in this experiment was the number of colony forming units (cfu/ml) of bacteria. The effectiveness of a mouth wash was inversely proportional to the number of colony forming units of bacteria. The one-way analysis of variance (ANOVA) at the 5 % level of significance was used for the analysis.

Results

The results of the study are shown in the tables and figures below.

Table 1 shows the age and sex distribution into various subgroups of chromic catgut patients while Table 2 shows age and sex distribution into various subgroups of vicryl patients.

In (11)11.3 % of specimen there was no growth while (86)88.6 % yielded growth which was either mixed or pure growth and these are shown in Table 3.

Table 4 shows the descriptive statistics for the number of colony forming units of bacteria on chromic catgut and vicryl groups for three different mouth wash solutions. From the table, CHL has a mean of 650.0 (cfu/ml) with a SD of 83.2 and SE of 58.8. The 95 % confidence interval for the mean of CHL is between 97.4 and 1397.4; among others. The descriptive statistics of the remaining treatment solutions are shown in the table while the line plot is depicted in Fig. 1.

The ANOVA results are depicted in Table 5 above $P > 0.05$. There was no significant difference in the mean number of colony forming units of bacteria produced by the three different mouth washes. Hence, chromic catgut and vicryl groups that washed with CHL, warm salt water and warm tap water averagely produced the same number of colony forming units of bacteria, which means that, the three different rinsing solutions were equally effective. The mean plot is depicted in Fig. 2.

Comparing the Chromic Catgut and Vicryl Groups

Similarly, the following inferential statistical analysis was used to compare the effectiveness of vicryl and chromic

Table 1 Age and sex distribution into various subgroups of chromic catgut patients

Age	Sex						Total
	Females			Males			
	CHL	WS	WWW	CHL	WS	WWW	
<i>Years</i>							
18–27	4	3	2	6	4	4	23
28–37	2	4	3	4	1	3	17
38–47	0	1	0	1	1	2	5
48–50	0	3	2	0	0	0	5
Total							50

CHL chlorhexidine, WS warm saline, WWW warm water mouth wash

Table 2 Age and sex distribution into various subgroups of vicryl patients

Age	Sex						Total
	Females			Males			
	CHL	WS	WWW	CHL	WS	WWW	
<i>Years</i>							
18–27	3	5	7	4	4	3	26
28–37	2	2	1	5	3	1	14
38–47	2	2	1	1	1	1	8
48–50	0	0	0	0	0	0	0
Total							

catgut groups. The response variable in this experiment was the number of colony forming units (cfu/ml) of bacteria. The effectiveness of a group was inversely proportional to the number of colony forming units of bacteria. The two-sample *t* test at the 5 % level of significance was used for the analysis. The computations were obtained using the SPSS 20 and MedCalc as employed for data analysis.

Table 6 shows the descriptive statistics of the number of colony forming units of bacteria for the two suture groups. From the table, chromic catgut had a mean of 811.4 with a SD of 318.4 and SE of 183.8. The line plot is depicted in the Fig. 3.

The *t* test (Table 7) shows that $P > 0.05$, which means that there is no significant difference in the mean number of colony forming units of bacteria in the two suture groups. The mean plot is depicted in Fig. 4.

Discussion

Microorganisms of the oral microbiota can adhere to suture materials, a fact favoring their passage into the surgical wound and causing odontogenic infections and

Table 3 Type of organism isolated from sutures

Micro-organism	Chlorhexidine mouth wash		Warm saline mouth wash		Warm water mouth wash	Total
	C	V	C	V	C V	
Staph aureus	0–0		1–1		1–0	3
Staph epidermidis	7–7		4–1		1–2	22
Strept viridans	4–15		13–1		6–7	46
Pseudomonas	0–0		2–1		0–1	4
Klebsiella	4–1		4–4		3–3	19
Coliforms	1–0		0–1		1–0	3
E. coli	0–0		0–1		2–0	3
Branch cata	0–1		1–0		0–1	3
Aerobic spores	0–0		0–0		1–0	1
Proteus	0–1		0–0		0–0	1
Total	16		25		15	105

V vicryl, C chromic catgut

bacteraemia. This situation is favored or prevented, depending on the adsorption properties of the suture material and oral hygiene care of the patient during the postoperative period [8].

The present study shows that 88.6 % of the specimen cultured yielded microorganisms. Although, eleven of the specimens had no growth, perhaps because no anaerobic culture was carried out (as at the time the research was conducted, our centre lacked facilities for anaerobic culture), it is not impossible that some of them would have probably grown anaerobes. McCaul et al. [3] and Bojar et al. [9] had cultured both aerobic and anaerobic microorganisms from intra oral sutures in separate studies. Similarly, studies carried out by Bojar et al. [9] and Edmiston et al. [10] had a clear reduction ($P < 0.01$) in the gram positive and gram negative bacteria adherence to triclosan-coated braided sutures. Contamination of suture material in the oral cavity mainly originates from saliva [8, 9], which contains approximately 7.5×10^8 microorganisms/ml [8].

Adekeye and Adekeye [11], isolated staphylococcus aureus, staphylococcus epidermidis, E. coli, klebsiella, proteus species, pseudomonas from abscesses in the oral cavity. Brook and Hirokawa [12]; Peterson et al. [13], recognized streptococcus viridians, staphylococcus aureus, staphylococcus epidermidis, klebsiella, proteus, E. coli as organisms that are responsible for infection in head and neck injuries. This study cultured the same organisms. According to Faria et al. [8] staphylococci and enteric bacilli are not usually found in the oral cavity and if present they occur in small numbers and are part of the transitory microbiota.

Table 4 Descriptive statistics for rinsing solutions

Rinsing solutions	Mean	Standard	95 % confidence interval for mean		SE
			Lower bound	Lower bound	
CHL	650.0	83.2	97.4	1397.4	58.8
WSMW	854.4	455.5	237.7	4946.6	322.1
WWMW	708.3	58.9	178.9	1237.8	41.7
Total	737.6	229.0	497.3	977.9	93.5

Fig. 1 Mouth washes**Table 5** ANOVA for rinsing solutions

Sources of variation	Sum of squares	df	Mean square	F	Sig.
Between groups	44350.6	2	22175.3	0.305	0.757
Within groups	217836.4	3	72612.1		
Total	262187.0	5			

The use of an antiseptic for the control of microorganism adherence to suture material is an extremely important procedure, reducing the risk of transient bacteraemia, especially in patients with a serious predisposition to bacterial endocarditis and those with immunological dysfunction [14]. Several mouth washes are used for oral hygiene, but studies investigating their action in sub-Saharan Africa are scarce.

From our study CHL, warm salt water and warm tap water averagely produce the same number of colony forming units of bacteria, which shows that the three different mouth washes are equally effective. Alexander [7] observed in his study that warm salt water mouth wash has no advantage over warm plain tap water in treating or preventing infection, or in maintaining oral hygiene.

In the present study the two mouth washes tested showed no appreciable effect on bacterial growth on the suture materials ($P > 0.05$) compared with warm tap water.

Fig. 2 Mouth washes **Fig. 3** Suture groups

Chromic catgut and vicryl groups produce the same number of colony forming units of bacteria.

Previous investigators [15] have found a reduction in the number of streptococci in patients who rinse pre and post operatively with chlorhexidine. The present study noted the highest number of streptococcus viridans in chlorhexidine subgroup of vicryl. This finding agrees with that of Sortino et al. [16], who observed that the use of chlorhexidine did not significantly affect the presence and type of microorganisms on the suture used. However, a recent study by Harnet et al. [4], found a reduction in infection rate compared to control when the authors used suture materials protected by chlorhexidine functionalized polyelectrolyte multilayer films.

We noted from Figs. 1, 3 that there is a significant (although not statistically) increase in colony forming unit when chlorhexidine and warm water was used in patients with vicryl sutures. Also from Fig. 3, when warm saline was used there was a significant increase in colony forming unit in patients with chromic catgut. With all other conditions remaining unchanged, we suggest this could be due to the nature of chromic catgut rather than the mouth wash.

Table 6 Descriptive statistics for suture groups

Suture groups	Mean	SD	95 % confidence interval for mean		SE
			Lower bound	Lower bound	
Chromic catgut	811.4	318.4	20.6	1602.3	183.8
Vicryl	663.7	115.6	376.5	950.9	66.8
Total	737.6	229.0	497.3	977.9	93.5

Table 7 *t* test for suture groups

T	df	Sig. (2-tailed)	Mean difference	SE of difference
0.755	4	0.492	147.7	195.6

Fig. 4 Suture Methods

We did not observe any statistically significant effect of bacteria growth on the longevity of the sutures. This could be due to the fact that microorganism do not destroy the suture. The total number of organisms cultured after the use of warm saline mouth wash was 26 yet its longevity was not different after the use of chlorhexidine and warm water mouth washes in chromic catgut group.

Furthermore, the total number of microorganisms cultured after the use of chlorhexidine was 25 yet its longevity was less compared to that of warm saline mouth wash but was the same compared to control. The mean longevity of the suture that cultured microorganism was compared with those that did not culture organisms and there was no statistical difference. The present study showed that there was no appreciable effect of the use of chlorhexidine and warm water mouth washes on the absorption time of chromic catgut. This is in agreement with the result of McCaul et al. [3].

There was no statistically appreciable effect after the use of chlorhexidine and warm water mouth washes on the absorption time of vicryl. This is in agreement with some investigators [2], although the authors worked on 22 patients of which only 10 rinsed with chlorhexidine. However, in this study, 34 patients rinsed with chlorhexidine and 34 with warm water and salt mouth washes and there were no statistical differences. This finding agrees with the observation of some authors [18] that mouth rinses do not produce any significant change on intraoral resorbable sutures.

The effects of the use of chlorhexidine and warm saline mouth washes on bacterial growth on chromic catgut and vicryl are not appreciable ($P > 0.05$). The effects of mouthwashes on healing process shows that chlorhexidine, in a concentration and time-dependent manner, affects negatively, fibroblasts and keratinocyte cell proliferation in vitro and can impair wound healing [8].

Conclusion

Bacteria were found to grow on vicryl and chromic catgut with the *Streptococcus viridian* predominating. From the study, chlorhexidine and warm saline mouth washes had no significant effects on both suture absorption time and bacterial growth on sutures. Chlorhexidine, warm salt water and warm tap water averagely produced the same number of colony forming units of bacteria, which shows that the three different mouth washes are equally effective as post-operative mouth rinses after oral surgery.

References

- Peterson LJ (1998) Principles of surgery. contemporary oral and maxillofacial surgery 3rd edition Mosby, pp 44–56
- Dalben GD, Chone LAF, Oliveira PP, Consolaro A (2008) Evaluation of sutures after immersion in nonalcoholic benzyd-amine hydrochloride mouthrinse by scanning electron microscopy. Clin Oral Inv 12:287–290
- Mc Caul LK, Bagg J, Jenkins WMM (2000) Rate of loss of polyglactin 910 (Vicryl Rapid) from the mouth: a prospective clinical study. Br J Oral Maxillofac Surg 200(38):328–330
- Harnet JC, Legum E, Bale V, Tenembaun H, Ogier J, Haikel Y, Vodauche C (2008) Antibacterial protection of suture materials by chlorhexidine-functionalized polyelectrolyte multilayer films. J Mater Sci 20:185–193
- Hermesh CB, Charles B, Hilton TJ, Biesbrook AR, Baker RA, Cain-Hamlin JMC, Clanahan SF, Gerlach RWC (1998) Peri-operative use of 0.12% chlorhexidine glutamate for the prevention of alveolar osteitis: efficiency and risk factor analysis. J Oral Surg 55:381–387
- Nejat E, Ahu A, Bukem G, Tanju K (2001) Investigation of bacteremia after orthodontic bonding and debonding following chlorhexidine mouth wash application. Angle Orthod 7:190–194
- Alexander RE (1998) Patients should use salt water mouth rinse after surgery. Eleven myths of dentoalveolar surgery. JADA 198(129):1273

8. Faria RL, Cardoso LML, Akisue G, Pereira CA, Junqueira JC, Jorge AOC, Santos JRVP (2011) Antimicrobial activity of *calendula officinalis*, *camellia sinensis* and chlorhexidine against the adherence of microorganisms to sutures after extraction of unerupted third molars. *J Appl Oral Sci* 19(5). Print version ISSN 1678–7757
9. Bojar Witold, Kazmierka Katarzyna, Szalwinski Michal, Zareba Tomasz (2009) Triclosan-coated sutures in oral surgery. *Adv Clin Exp Med* 18(4):401–405
10. Edmiston C, Seabrook G, Goheen M, Krepel C, Johnson C, Lewis B, Brown K, Towne J (2003) Bacterial adherence to surgical sutures: can antibacterial-coated sutures reduce the risk of microbial contamination? *J Am Coll Surg* 203:481–489
11. Adekeye EO, Adekeye JO (1982) The pathogenesis and microbiology of idiopathic cervicofacial abscesses. *J Oral Maxillofac Surg* 200:100–106
12. Brook I, Hirokawa R (1989) Microbiology of wound infection after head neck and cancer surgery. *Ann Otol Rhinol Laryngol* 98:323–325
13. Peterson K, Hayes DK, Blice JP, Hale RE (2008) Prevention and management of infections associated with combat-related head and neck injuries. *J Trauma Inj Infect Crit Care* 64:265–276
14. Clark WB, Magnusson I, Walker CB, Marks RG (1989) Efficacy of perimed antibacterial system on established gingivitis. (I) clinical results. *J Clin Periodontol* 16:630–635
15. Soares UN, Ito IY, Barros VM (2001) Effect of antiseptic treatment of alveolar surgical wounds on bacterial growth on cotton suture threads. *Pesqui Odontol Bras* 15:41–46
16. Sortino F, Lambardo C, Sciacca A (2008) Silk and polyglycolic acid in oral surgery: a comparative study (oral and maxillofacial Surgery). *Oral Surg Oral Med Oral Pathol Oral Radiol Endod-ontol* 105:3
17. Johnson JT, Myers EN, Thearde PB, Sigler BA, Scharmm VL (1984) Antibacterial prophylaxis for contaminated head and neck surgery. *Laryngos* 94:46–51
18. Ottem JE, Wiedmann-Al-Ahmad M, Jahuke H, Pelz K (2005) Bacterial colonization on different suture materials. a potential risk for intraoral dentoalveolar surgery. *J Biomed Mater* 748:627–635
19. Baker FJ, Silvaton RE, Pallister CJ (1997) Preparation of culture media. *Introduction to medical laboratory technology* 5th edition Butterworth-Heinemann, Linacre, Jordan Hill, Oxford, Johannesburg, Melbourne, New Delhi, Singapore pp 507