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COMPARATIVE EVALUATION OF TRICLOSAN COATED POLYGLACTIN 910 SUTURES VERSUS NON-COATED POLYGLACTIN 910 SUTURES IN PERIODONTAL FLAP SURGERY: A CLINICO-MICROBIOLOGICAL STUDY.

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ABSTRACT

Background: Infection at the surgical site can result from sutures acting as a reservoir for bacteria. Due to wicking activity, this mostly happens with braided sutures. One of the options for reducing the microbial load is the use of triclosan coated suture (TCS). The objective of this study was to compare noncoated sutures (NCSs) and TCS in terms of their ability to fight bacteria and their impact on periodontal flap surgery healing. Materials and Methods: The following two groups of 40 patients with chronic periodontitis who met the inclusion criteria for periodontal flap surgery were randomly assigned: first, TCS polyglactin 910 sutures, second, NCS polyglactin 910 sutures, and Every patient was assessed for healing index (HI), postoperative pain (POP), visible plaque index (VPI), and healing at day 0 (baseline), day 7, day 15, and day 30. On day 7, a visual analogue scale (VAS) was also used to evaluate the patients. Each suture's bacterial growth, both aerobic and anaerobic, was assessed after 7 days. Results: Although intragroup evaluation revealed statistically significant improvement, intergroup HI and POP were not statistically significant ($P > 0.05$). Compared to TCS, VPI was higher in NCS. Compared to aerobic bacteria, anaerobic bacteria were substantially less abundant (P 0.05). To lessen the number of microorganisms at the surgical sites, TCS sutures can be used in periodontal procedures.

Keywords: Antibacterial sutures, non-coated sutures, chronic periodontitis, flap surgery, triclosan-coated sutures

INTRODUCTION

Any surgical intervention's success depends on a clean wound site and the absence of microorganisms. Incision site infections are more likely when sutures are used to approximate wounds because they serve as a germ reservoir at the surgical site[1]. In the beginning, materials such as animal gut strings, metal wires, bowstrings, silk, linen, etc. were utilized. The preferred type of material was determined by biocompatibility, pliability, and strength.

Polyglactin 910 sutures are the most often used suture type. This suture is frequently used because its morphological and functional characteristics suit particular requirements for wound closure. Through tests like knot tensile strength, knot security, subjective tiedown, suture roughness, knot sliding, in vivo breaking strength retention, and suture absorption rate, these attributes can be quantified and characterized qualitatively. The handling characteristics and knot security of suture materials are regularly modified by coatings and other processes[3].

Antimicrobial materials that are biologically active are coated on the newly developed materials. The sutures coated with antibacterial substances like triclosan may be able to stop the development of these possible microorganisms. A broad-spectrum antibacterial agent marketed for use in oral products is triclosan. Additionally, its anti-inflammatory properties have been demonstrated[2].

The purpose of the study was to evaluate and compare the microbiological colonization on triclosan-coated polyglactin 910 sutures to non-coated polyglactin 910 sutures in patients undergoing periodontal flap surgery.

MATERIAL AND METHODS

The present study was approved by the institutional ethics committee. All clinical procedures were carried out in department of Periodontics, A J institute of dental sciences, Mangalore.

SAMPLE SIZE ESTIMATION

POWER ANALYSIS CURVE

The sample size has been estimated using the G Power software v. 3.1.9.2. Considering the effect size of 0.5, power of the study at 80% and the margin of the error at 5%, the total sample size obtained is 40. Therefore total 40 units taken will be divided in to 20 in each group.

Participants

A total of 40 patients who visited our department of periodontology were assessed for eligibility. The following inclusion criteria were met by 40 patients (mean age: 39.2 + 10.76 years; 13 men and 17 women).

Inclusion criteria

1. The patients belonged to age group, ranging from 25 to 60 years, irrespective of gender.
2. Only those patients indicated for periodontal flap surgery (>5 mm residual probing depth after Phase I therapy) either localized or generalized.

Exclusion criteria

1. Subjects affected with systemic disorders
2. Subjects with history of antibiotic use within past 6 months
3. Patients who had undergone scaling and root planing procedures within the immediate past 6 months
4. Patients who are known to be sensitive to triclosan.
5. Subjects who are pregnant and lactating
6. Subjects with thyroid disorders
7. Subjects with aggressive periodontitis
8. Subjects who are immunocompromised 9. Subjects with artificial heart valves
10. Smoking
11. Alcoholism were excluded from the study.

All patients who were recruited received phase I therapy. A periodontal re-evaluation was done one month after Phase I therapy, and patients who still had pockets deeper than 5 mm were chosen for this study. This criterion was met by 40 patients, making them candidates for periodontal flap surgery to reduce chronic periodontal pockets. In each patient, the quadrant with the deepest periodontal pockets was picked. They were subsequently divided up into one of the following groups randomly: 1. A simple interrupted suturing procedure with triclosan-coated polyglactin 910 sutures (VICRYL PLUS, ETHICON®, 4-0 swaged, rounded

body needle). 2. Non-coated polyglactin 910 sutures with a simple interrupted suturing technique (VICRYL, ETHICON®, 4-0 swaged, rounded body needle).

Study procedure

Suture material was assigned using a double-blinded process. Simple interrupted sutures were used to secure the flaps together internally using one of the suture materials. On day 7, the suture was removed, and the development of biofilm as well as the presence of particular microorganisms were examined. Analgesics (ibuprofen 400 mg, TDS 5 days) were also prescribed along with postoperative instructions. To assess the impact of the antibacterial coating on the experimental sutures, no patient in the trial received an antibiotic prescription. To counteract its confounding effects, warm water rinsing was advised twice daily for one minute for 30 days in place of antimicrobial mouthwash. On days 7, 15, and 30, every patient was recalled back.

Parameters evaluated

Healing index (HI) by Landry et al[4] signifies the healing after periodontal flap surgical procedure. According to this index, the scoring criteria are as follows:

1. Very poor tissue color: ≥50% of gingiva red, response to palpation: bleeding, granulation tissue: present, incision margin: not epithelialized, with loss of epithelium beyond incision margin, suppuration present
2. Poor tissue color: ≥50% of gingiva red, response to palpation: bleeding, granulation tissue: present, incision margin: not epithelialized, with connective tissue exposed
3. Good tissue color: <25% of gingiva red, response to palpation: no bleeding, granulation tissue: none, incision margin: no connective tissue exposed
4. Very good tissue color: <25% of gingiva red, response to palpation: no bleeding, granulation tissue: none, incision margin: no connective tissue exposed
5. Excellent tissue color: all tissues pink, response to palpation: no bleeding, granulation tissue: none, incision margin: no connective tissue exposed.

By Mccaffery and Beebe et al. (1989), postoperative pain (POP) was measured using the numeric rating scale. Patients were asked to rate their level of discomfort on a scale of 0 to 10.

One of the most prevalent and trustworthy methods of evaluating plaque is the Visible Plaque Index by Ainamo and Bay[5]. Repeatability is improved by the straightforward interpretation of the scoring criteria (visible plaque is either present or absent).

Microbiological assessment

Colony-forming units

On day 7, once the suture was removed, it was immediately put into a reduced transport fluid medium and sent to our college's microbiology department for additional examination. To achieve a 1:106 dilution, a serial dilution approach was used. From there, 0.1 ml was evenly divided across six blood agar plates. For 72 hours, three of these plates were incubated aerobically at 37°C while the remaining three were incubated anaerobically. The plates were taken out of the incubator after 72 hours of incubation, and colony forming units were recorded. For each plate, colonies were counted, and the number of colonies/ml was determined using the formula: c = n /(s x d) (where c=cfu/ml, n=number of colonies, d=dilution factor, and s=volume transferred to plate). To determine the total number of bacteria, the number of colonies/ml was calculated as the mean. After Gram staining, colonies were analysed for their morphological traits using a light microscope and oil immersion (x100).

Statistical analysis

The Kruskal-Wallis test was used to evaluate the intergroup analyses of HI and POP. Using the Friedman test, the intragroup analysis was carried out. The Chi-square test was used to evaluate the presence of plaque on sutures. The one-way ANOVA test was used to evaluate the intergroup comparison of CFU/ml. Pairwise comparisons between the two groups were made using the Dunn-Bonferroni post hoc test. Using the paired t-test, the intragroup analysis of CFU/ml was carried out. For each test, a P value of <0.05 was regarded as statistically significant.

RESULTS

Healing index

When the distribution of HI at various follow-up intervals was compared between the two groups, it was found that there was no statistically significant difference. In both groups, intragroup comparison revealed an increase in the mean HI rankings from day 0 to day 30 throughout the follow-up period that was statistically significant ($P < 0.05$) [Tables 1 and 2].

Postoperative pain

Intergroup comparison showed a statistically significant difference ($P < 0.05$) between the mean rankings for POP across both groups at baseline (day 0), but no statistically significant difference ($P > 0.05$) between the mean ranks for POP across both groups for follow-ups. From day 0 to day 30 of follow-up, POP for both groups decreased statistically significantly ($P<0.05$) [Tables 1 and 2].

Visible plaque index

On the day after suture removal, 30 patients displayed the presence of plaque on sutures; 20 patients belonged to the NCS group, and 5 patients to the TCS group. Statistics showed that this difference was significant ($P <0.05$).

Microbial assessment

Colony-forming units

The concentration of both aerobic and anaerobic bacteria, measured as 107 CFU/ml, was substantially lower in TCS than in NCS (P 0.05). Anaerobic bacteria were substantially less abundant than aerobic bacteria (P 0.05). [Table 3]. According to a pairwise comparison of the suture groups, TCS was superior to NCS at lowering the concentration of aerobic ($P = 0.027$; $P = 0.001$) and anaerobic ($P = 0.019$; $P = 0.000$) microorganisms.

Table 1 Shows the intergroup comparison of the wound healing index and postoperative pain in the two groups at various time points.

Interval	Groups	P	
		Wound HI	POP
Day 0 (baseline)	NCS	0.91 (NS)	0.008 (S)
	TCS		
Day 7	NCS	0.86 (S)	0.17 (NS)
	TCS		
Day 15	NCS	0.68 (NS)	0.14(S)
	TCS		
Day 30	NCS	0.98 (NS)	1 (NS)
	TCS		

P value obtained from Kruskal–Wallis test, Significant at $P<0.05$ NCS – Noncoated sutures; TCS – Triclosan-coated suture; CCS – Chlorhexidine-coated suture; NS – Not significant; S – Significant; HI – Healing index; POP – Postoperative pain; P – Probability value

Table 2 Compares the wound healing index and postoperative pain in the two groups at various time points.

Groups	Intervals	n	Wound HI		POP	
			Mean rank	P	Mean rank	P
TCS	Day 0 (baseline)	20	1.35	<0.05(S)	5	<0.05(S)
	Day 7		1.85		2.80	
	Day 15		3.05		1.65	
	Day 30		3.75		1.55	
NCS	Day 0 (baseline)	20	1.30	<0.05(S)	4.95	<0.05(S)
	Day 7		1.90		3.05	
	Day 15		3.25		1.70	
	Day 30		3.55		1.35	

P value obtained from Kruskal–Wallis test, Significant at $P<0.05$ NCS – Noncoated sutures; TCS – Triclosan-coated suture; CCS – Chlorhexidine-coated suture; NS – Not significant; S – Significant; HI – Healing index; POP – Postoperative pain; P – Probability value

Table 3 Shows the colony-forming units in both groups.

Incubation	Groups	Mean±SD	P
Aerobic	TCS NCS	444.1±104.54 726.5±184.74	<0.05(S)
Anaerobic	TCS NCS	356.5±81.39 596.3±155.64	<0.05(S)

P value obtained from Kruskal–Wallis test, Significant at P<0.05 NCS – Noncoated sutures; TCS – Triclosan-coated suture; CCS – Chlorhexidine-coated suture; NS – Not significant; S – Significant; HI – Healing index; POP – Postoperative pain; P – Probability value

DISCUSSION

In periodontal surgical therapy, postoperative problems are reported to occur in 5.5% of cases[6], but another study showed a prevalence of such issues to be 2.09%.[7]. One of the most common causes of postoperative complications is surgical site infection (SSI). Due to their wicking properties, surgical sutures increase the risk of developing SSIs[8] by drawing fluid and bacteria into the wound site. It has been documented in the literature that surgical sutures can be coated with antibacterial substances like triclosan and chlorhexidine. Antimicrobial sutures significantly decreased the risk of SSI, according to a comprehensive analysis by Wu et al. (2017)[9]. The antimicrobial coatings effects were consistent across various suture, wound, and procedure types. The data from randomized controlled trials was moderate, whereas that from observational research was of extremely poor quality. TCS may lower the incidence of SSI, according to this systematic review findings; however, the quality of the available data is moderate to low, and many studies had conflicts of interest. The results of surgical sutures coated with these antibacterial agents in surgical periodontics are so little understood due to a lack of data. Therefore, the goal of the current investigation was to determine how their antibacterial capabilities affected the tissues following periodontal flap surgery.

There was no statistically significant difference between the groups in healing indices in the present investigation. Therefore, we may conclude that the antibacterial coating on the suture has no effect on the tissues ability to repair wounds. During the time of follow-up, none of the patients experienced any suture site infections. After minor oral surgical operations, Kruthi et al[10], reported that healing at the surgical site was marginally improved on the sixth postoperative day in regions where TCS was used as opposed to NCS. Rasi et al.[11], on the other hand, did not note any further advantages of using antimicrobial suture. When TCS was used instead of normal NCS, Ford et al[12], observed a lower incidence of POP and less edema. However, in the current investigation, the patient's perception of pain was unaffected by the use of antibacterial sutures.

However, in the TCS group, visible plaque reduced by up to 50%, indicating that antibacterial-coated sutures are more successful at reducing plaque than NCS. In 8 patients in the NCS suture group, there was evidence of wound dehiscence. While it happened in 2 patients of the TCS group on day 7 postoperatively, all patients in both groups had a satisfactory wound closure by day 15. This is consistent with the research results published by Kruthi et al[10].

One of the key prerequisites for an uncomplicated recovery is the absence of microorganisms at the surgery site. To prevent postoperative infections, systemic antibiotics are more frequently administered. Immunocompromised patients frequently necessitate the usage of antibiotics. Antibiotic resistance has, however, developed as a result of inappropriate antibiotic use. Additionally, the local concentration of some medications fails to achieve the minimum inhibitory concentration for infections when systemic antibiotics are used, making it difficult to effectively control the growth of these organisms in the oral cavity. To get around these limitations, local antibiotic delivery can be used. The use of systemic antibiotics can be replaced by the use of antibacterial-coated sutures, which provide a prolonged release of an antibacterial agent at the surgical site. Despite not getting any systemic antibiotics for the course of our investigation, none of the participants experienced any edema or other infections-related symptoms. In an identical manner, Oswal et al. reported finding no postoperative infection in any of the research participants, regardless of whether they had received any preventive, therapeutic, or antibiotics at all[13].

There was a statistically significant difference in the colony counts of aerobic and anaerobic bacteria in TCS and NCS (P 0.05). According to Kruthi et al.[10], more bacteria adhered to NCS than TCS (P 0.001) in their study. Compared to coated suture groups, the NCS group had more aerobic bacterial adhesion. Gram staining showed the presence of Gram-positive cocci in clusters, as well as Gram-positive and Gram-negative rods, filaments, and chains of cocci. Although it was not feasible to identify specific bacterial species, morphological traits and Gram staining indicated that the colonies could be Staphylococcus species, Streptococcus species, Escherichia coli, Actinomyces species, and Pepto streptococcus. The presence of the viridians group of Streptococci species was indicated by the alpha hemolysis seen around the colonies.

Comparing TCS to NCS, a clear reduction in the production of biofilms was observed. It can be difficult to draw any firm conclusions from the current literature due to lack of studies, small sample sizes, and inconsistent results. Additional well-defined randomized controlled studies with a large sample size are required to assess the additional benefits that antibacterial coating confers on tissue-healing capacity. Additionally, it's important to examine the antibacterial agent's precise concentration and medication release profile. The impact of antibacterial-coated sutures in other intraoral operations, however, might be examined in more detail in future research. Further research can be done to determine the relationship between the usage of these sutures and the postoperative loss of soft tissue and bone. It was not possible to characterize the particular bacterial species present in the biofilm surrounding the sutures in either group of our investigation. Additional research on a bigger sample size is necessary to generalize the findings of the current study.

CONCLUSION

A well-known antibacterial agent is triclosan. According to our study, local drug delivery in the form of coated sutures can be an efficient way to prevent the development of biofilms and reduce bacterial loads at the surgical site, reducing the need for systemic antibiotics and performing in with the need for antimicrobial mouthwash after surgery. Furthermore, the therapeutic success of any surgery might be enhanced by the decreased biofilm formation close to the surgical site. Thus, it can be inferred from an analysis and evaluation of the data that triclosan-coated antibacterial sutures are appropriate for use in periodontal surgery. To assert its superiority over traditional NCSs, however, its cost-benefit ratio needs to be studied in more extensive clinical trials.

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