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COMPARATIVE CLINICAL AND MICROBIOLOGICAL ANALYSIS OF THE ANTIMICROBIAL EFFICIENCY OF ANTIBIOTIC-COATED SUTURES VERSUS NON-COATED SUTURES IN PERIODONTAL FLAP SURGERY

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ABSTRACT: Introduction: Flap surgeries can be followed by some complications due to the infection of the operating site. Sutures at the operating site can predispose to surgical site infections by harbouring the microorganisms due to their wicking action. Triclosan-coated antibacterial sutures can be used an effective substitute to traditional sutures due to its ability to reduce biofilm. **Aim:** This trial evaluates clinically and microbiologically the effectiveness of antibacterial coated sutures compared to non-coated ones. **Materials and Methods:** 20 sites in 10 systemically well patients were diagnosed with Stage III Periodontitis [2017 AAP Classification] and was allotted into group A and group B randomly in a split-mouth design for the research. Flap surgery was performed, and in Group A, triclosan-coated polyglycolic acid braided sutures were placed and in Group B non-coated polyglycolic acid braided sutures were placed. In both the groups, Visible Plaque Index (VPI) and total microbial colony count on the suture were assessed on the suture removal day. Healing Index (HI) was assessed on the 8th day and day 30. Other clinical parameters were evaluated and recorded at baseline, 3rd month and 6th month post-therapy. **Results:** Visible plaque was reduced to 50% in the triclosan group and there was a momentous variation in the microbial load amid the two groups. **Conclusion:** Triclosan-coated antibacterial sutures can be an efficacious alternative to conventional sutures to lessen the frequency of surgical site infections (SSIs).

INTRODUCTION: Periodontitis is an immune-inflammatory disease marked by microbial dysbiosis and persistent deterioration of the tissues that support the teeth. Periodontal therapy aims to establish a healthy periodontium with a sound attachment apparatus resulting in proper form, function, and aesthetics.

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Periodontal flap surgery is the most dynamic and frequently used surgical approach. The triumph of periodontal therapies mainly depends on the wound's primary sealing and diminution of the pathogenic organisms at the operative sites.

Sutures help in the approximation of the flap margins, and they stabilize the wound margins, and aid in undisturbed wound healing [1]. A long-standing exposure of suture surfaces to microbes can lead to amplified surgical site infections (SSIs) and necrosis of tissues [2]. The physiochemical properties of a suture material stimulate its ability to entice microbes and subsequently endorse wound infections [3].

Along with introducing antimicrobial solutions and antibiotic formulations into the surgical sites, the development of antimicrobial-coated sutures is currently of interest as a potential adjuvant in lowering the incidence of surgical site infections (SSIs). This paved the way for sutures coated with triclosan to replace normal polyglycolic acid sutures. It is stated that the broad-range antibacterial agent triclosan has antibacterial qualities [4]. It penetrates the cell wall and by pointing multiple cytoplasmic and membrane receptors; it changes the bacterial RNA synthesis and interferes with their growth causing cell death [5].

Vicryl Plus is an adsorbabale synthetic multifilament suture that combines the qualities of the material with possible antibacterial capabilities because of triclosan surface coating. Vicryl Plus has demonstrated the ability to lessen *S. aureus* and *S. epidermidis* bacterial stock colonization. The present study, a comparison was done in terms of antibacterial efficiency of triclosan-coated resorbable polyglycolic acid sutures (Vicryl Plus) and non-coated resorbable polyglycolic acid sutures and evaluated the changes in the clinical, microbial, and healing properties.

MATERIALS AND METHODS: The research populace was taken up from the outpatient sections of the Department of Periodontics, Tamil Nadu Government Dental College and Hospital, Chennai, India. Patients who meet the following inclusion criteria must be systemically healthy, aged 20 to 50 years, of both genders and have a probing depth of 5 mm post Phase I therapy. Patients who signed the consent forms and were willing to participate voluntarily were recruited for the study. Patients with established systemic diseases or metabolic problems, as well as those with poor oral hygiene maintenance following Phase I medication, are excluded from consideration. Individuals who use tobacco products or are on any medicine, have known allergies, or use tobacco products are not taken up. Pregnant / Lactating women also come under exclusion criteria.

Sample Criteria: Ten patients were recommended for open flap debridement to reduce the number of persistent periodontal pockets. In a split-mouth design, the patients' quadrants with the deepest periodontal pockets were selected and arbitrarily separated into the succeeding categories.

Group A: Experimental group- Triclosan-coated polyglycolic acid braided sutures (3-0) **Fig. 1.**

Group B: Control group- Non-coated polyglycolic acid braided sutures (3-0) **Fig. 2.**

FIG. 1: TRICLOSAN COATED POLYGLYCOLIC ACID BRAIDED SUTURES

FIG. 2: NON COATED POLYGLYCOLIC ACID BRAIDED SUTURES

Study Protocol: Informed consent from the patient was acquired following permission from the Institutional Ethical Committee for the study.

Clinical measures, such as the Gingival Bleeding Index, Plaque Index, Probing Pocket Depth, and Clinical Attachment Level, were used for the periodontal evaluation. Phase-I periodontal therapy was performed in each group. This was tailed by open flap debridement for both groups after 6 weeks. Suture samples were taken from both groups and a microbiological analysis of the samples was performed.

Clinical Parameters: Clinical parameters were estimated in Group I and Group II subjects before and after therapy.

- Visible Plaque index
- Gingival bleeding index
- Probing depth in mm (PD)

- Clinical attachment level in mm (CAL)
- Healing index

Surgical Procedure: After getting consent from the patient, with 5% betadine solution, both intra-&extra-oral antisepsis procedures were carried out. Using block or infiltration procedures, 2% Lignocaine HCl with adrenaline (1:80,000) was used to anesthetize the operative site. Then, on the lingual/palatal and frontal surfaces, crevicular incisions were made with Bard Parker blade No. 15, extending to one tooth on each side. A full thickness mucoperiosteal flap was elevated with the help of an elevator. A comprehensive debridement of both soft and hard tissues was performed following flap reflection using the region-specific Gracey curettes. After debridement, a generous amount of 0.9% normal saline irrigation was conducted. After the debridement, the flaps are approximated with triclosan–coated polyglycolic acid (3-0) braided suture in Group A **Fig. 3** and non-coated polyglycolic acid (3-0) braided suture in Group B **Fig. 4** quadrants respectively. Post-operative instructions were given, and post-surgical evaluation was done at 8th, 30th day, 3 months and 6 months post-therapy. Plaque index, Bleeding index, Pocket probing depth, Clinical attachment level, and healing index are assessed clinically.

FIG. 3: FLAP APPROXIMATED WITH TRICLOSAN COATED POLYGLYCOLIC ACID (3-0) SUTURES

FIG. 4: FLAP APPROXIMATED WITH NON COATED POLYGLYCOLIC ACID (3-0) SUTURES

Microbial Assessment: On day eight, the sutures were removed, and they were quickly put into a carrier medium of peptone broth and sent to the microbiological lab for additional examination Fig. 5. A serial dilution procedure was used. 0.1 ml was then uniformly plated on six distinct blood agar plates. For 72 hours, three of these plates were nurtured aerobically at 37°C and the other three aerobically. Following a 72-hour development period, the plates were removed from the incubator and the total colony-forming units were recorded.

FIG. 5: SUTURES COLLECTED IN THE PEPTONE BROTH CARRIER MEDIUM

Statistical Analysis: The statistical analysis was conducted using IBM SPSS version 20.0 (IBM Corp., 2011). Armonk, NY: IBM Corp.; IBM SPSS Statistics for Windows, Version 20.0. Mean and SD were used to depict quantitative data (VPI, HI, GI, PPD, CAL, CC). The Student's t-test and the Independent Samples t-test were employed to compare the clinical parameters of the two research groups. Repeated Measures ANOVA was employed for the intra-group comparison (to evaluate any significant changes in clinical parameters over the course of the study). A P value of less than 0.05 was regarded as a statistically significant difference during the duration of the trial.

RESULTS:

Visible Plaque Index: On the 8th day post-surgery, twenty sites, ten of which were from the non-coated suture group and five of which were from the triclosan suture group, exhibited the existence of plaque on their sutures. There was a statistically momentous variation ($P < 0.05$) **Table 1, Fig. 6.**

Healing Index: HI at various maintenance intervals was equal for both the groups, according to the intergroup comparison, and it was not statistically significant **Table 1**. A statistically

significant (P < 0.05) rise in the mean ranks of HI from day 0 to day 30 throughout the maintenance period was detected in both suture groups in the intragroup comparison.

Gingival Bleeding Index: The outcomes of the intergroup comparison exhibited no statistically significant variation in the bleeding ratings at different follow-up intervals for either group **Table 1**.

An intragroup comparison between the two suture groups revealed a statistically significant (P < 0.05) reduction in the mean bleeding scores from baseline to three and six months.

Probing Pocket Depth: The intergroup comparison outcomes showed no statistically significant difference in the probing depth between the two groups at different follow-up periods **Table 1**. An intragroup comparison between the two suture groups revealed a statistically significant (P < 0.05) decline in the mean probing depth from baseline to three and six months.

TABLE 1: INTERGROUP COMPARISON OF CLINICAL PARAMETERS: (*STATISTICALLY SIGNIFICANT)

Variable	Timeline	Group	Mean	Std. Deviation	P value
Visible Plaque Index		Triclosan coated	.5000	.52705	0.008*
Healing Index	8th day	Triclosan coated	2.7000	.48305	0.388
		Uncoated	2.5000	.52705	
	30th day	Triclosan coated	4.5000	.52705	0.67
		Uncoated	4.4000	.51640	
Gingival Bleeding Index	Baseline	Triclosan coated	75.4000	5.56557	0.74
		Uncoated	74.6400	4.76613	
	3 months	Triclosan coated	22.7400	4.14707	0.84
		Uncoated	22.3800	3.90464	
	6 months	Triclosan coated	12.7100	1.97903	0.23
		Uncoated	11.7800	1.32397	
PPD	Baseline	Triclosan coated	7.6100	1.24495	0.92
		Uncoated	7.6700	1.41504	
	3 months	Triclosan coated	4.8400	.66198	0.82
		Uncoated	4.9200	.93666	
	6 months	Triclosan coated	2.4200	.42374	0.62
		Uncoated	2.5200	.47796	
CAL	Baseline	Triclosan coated	7.5400	1.22129	0.89
		Uncoated	7.4600	1.34429	
	3 months	Triclosan coated	4.7500	1.05436	0.89
		Uncoated	4.6800	1.25769	
	6 months	Triclosan coated	2.5800	.55936	0.86
	Uncoated	2.5300	.70087	Uncoated	

Clinical Attachment Level: The intergroup comparison results showed no statistically significant variance in the CAL between the two groups at different maintenance intervals **Table 1**. The mean clinical attachment levels in both suture groups increased from baseline to three and six months, with a meaningful (P < 0.05) gain observed in the intragroup comparison.

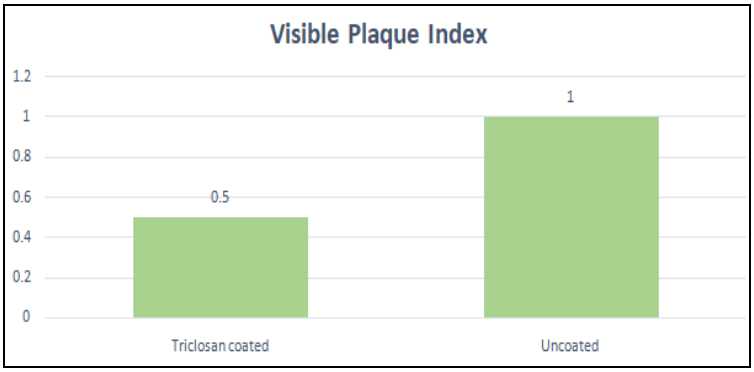

FIG. 6: INTERGROUP COMPARISON OF CLINICAL PARAMETERS

Microbiological Colony Count: The intergroup comparison showed that the mean total microbial colony count of Group A and Group B is 1.63±0.74 and 5.99±1.44x107 CFU/ml, which was statistically important variation (p=0.001) **Table 2, Fig. 7**.

TABLE 2: INTERGROUP COMPARISON OF MICROBIOLOGICAL PARAMETERS: (*STATISTICALLY SIGNIFICANT)

Variable	Timeline	Group	Mean	Std. Deviation	P value
Microbial colony count		Triclosan coated	1.6310	.74603	0.0001*
		Uncoated	5.9920	1.14493	

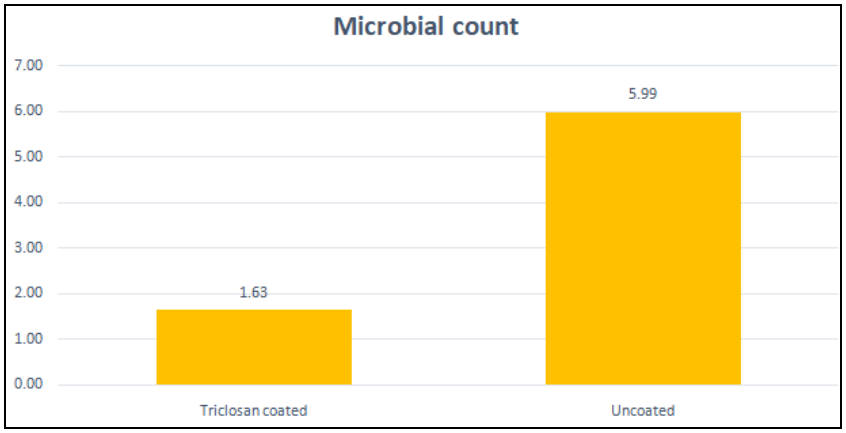

FIG. 7: INTERGROUP COMPARISON OF MICROBIOLOGICAL PARAMETERS

DISCUSSION: Periodontitis is an immune-inflammatory disease that grounds pathological changes in the tooth-supporting structures. When oral hygiene maintenance and non-surgical therapies cannot switch periodontitis, surgical therapy is recommended to eradicate the deep pockets and to create a periodontal milieu that is easily maintainable by the patient and limit the recurrence of the disease. Limiting the biofilm at the healing sites and achieving primary wound closure are critical to the outcome of periodontal operations. Every surgical technique involves the dynamic constituent of the sutures, which are used to support and approximate the operative borders and promote undisturbed wound healing [1].

Post-surgical hitches in periodontal surgical therapy have been testified in 5.5% of the cases [6]. Surgical sutures, especially braided ones, promote the accumulation of bacteria and fluid into the wound site due to their wicking action and increase the chance of developing Surgical Site Infections (SSIs). Therefore, it may be desirable to use a suture material that can inhibit the growth and colonization of harmful microorganisms. Due to the sutures' susceptibility to contamination, triclosan, a broad-spectrum antibacterial agent, was used to treat them [6]. Henceforth the research was intended to appraise the usefulness of triclosan-coated antibacterial braided sutures in contrast with non-coated braided sutures both clinically and microbiologically. 20 sites in 10 patients were assigned for the study in a split-mouth design. The visible plaque was condensed to 50% in the Triclosan-coated suture set, suggesting the effectiveness of antibacterial-coated sutures in lessening the plaque than the non-coated suture group. This result was in unity with the results obtained by Kruthi *et al* (2014) [7] and Prerna *et al* (2020) [8]. Antibiotics with a systemic effect are typically administered to prevent surgical site infections. Nevertheless, Antibiotic resistance has emerged due to careless antibiotic use.

Antibacterial-coated sutures are an efficient alternative to achieve an unceasing provision of anti-microbial agent at the operating site. None of the individuals in our study mentioned any edema or other infection-related symptoms. This was consistent with findings from Marjo Renko (2013) [9], who found that using sutures containing triclosan significantly decreased the occurrence of all SSIs in contrast to regular sutures. Similarly, Oswal *et al.* (2014) [10] showed a reduced chance of post-operative infections while using triclosan-coated sutures. Janani K *et al.* (2018) also concluded that patients who are endangered by surgical site infections would benefit greatly from coated

sutures. The TCS group's mean healing index score was 2.70 on the eighth day, 4.50 on the thirty-first day, and 2.50 on the eighth day, 4.40 on the thirty-first day for the NCS group. While statistically significant differences in the healing scores amid the two sites were absent, there was a notable increase in both groups' healing scores from the eighth to the thirtieth day. It can be deduced that the ability of tissues to repair wounds is unaffected by the existence or lack of an antibacterial coating on the suture. This outcome was consistent with research conducted by Prerna *et al.* (2020) [8] and Rasic *et al.* (2011) [12], which found no evidence of any positive effects on healing from the use of antibacterial sutures. However, after modest oral surgical operations, Kruthi *et al.* (2014) [7] had reported that in areas where TCS were employed compared to NCS, healing of the operative site was marginally improved on the sixth day postoperatively. When employing anti-bacterial coated sutures, Sharma *et al.* (2017) [13] also reported similar results. According to research done by Ford *et al.* (2005) [14], ability of Triclosan-coated polyglactin 910 sutures to prevent bacterial colonization led to better healing outcomes than those of conventional polyglactin 910 sutures. Additionally, there was a significant reduction in post-operative pain.

At baseline, three months, and six months, the TCS group's average gingival bleeding index score was 75.4, 22.74, and 12.71, respectively. At baseline, three months, and six months, those for the NCS group were 74.64, 22.38, and 11.7, respectively. Between the baseline and 6-month points, both groups' gingival bleeding index values significantly decreased. The gingival bleeding index values did not differ statistically between the two groups. The findings of Ford *et al.* (2005) [14], who demonstrated an improvement in the clinical parameters using antibacterial sutures, were in conflict with this outcome.

In the TCS and NCS groups, the average probing depth at baseline was 7.61 mm and 7.67 mm, respectively. Both the sets showed a significant decrease in periodontal probing depth (PPD) at 3 months (4.84mm and 4.92mm) and 6 months (2.42mm and 2.52mm), respectively. However, there was no statistically significant variation amid the two groups at baseline, three months, and six months, respectively, according to the intergroup comparison (p=0.92, p=0.62, p=0.82). Both the TCS group and the NCS group showed a correspondingly substantial decrease in clinical attachment level (CAL) at 3 months (4.75mm and 4.68mm) and 6 months (2.58mm and 2.53mm) from baseline (7.54mm and 7.46mm), respectively. However, the intergroup comparison revealed statistically no significant difference between the two groups.

The mean total microbial colony count on the TCS and NCS groups sutures was 1.63 and 5.99 x 107 CFU/ml, respectively. This indicates a highly significant variation in the mean microbial colony count between the two groups (p=0.001). These results were consistent with the conclusions of Kruthi *et al.* (2014) [7], who reported that microbial attachment was higher in NCS compared to TCS (P < 0.001). Sharma et al. (2017) [13] also reported similar results with antibacterial sutures. Sethi KS, Karde PA, Joshi CP (2016) [15] conducted a similar study to evaluate inhibition of the biofilm and activity against the periodontal pathogens and discovered that the anti-bacterial sutures were more advantageous.

These results were also in line with Sala Perez S *et al* (2020**)** [17] who steered a trial in which the usefulness of monofilament us poliglecaperone triclosan coated synthetic suture was compared with silk sutures. The effectiveness of Monocryl plus was maximal at 72 hours, and it had an edge over the non-coated sutures as it restrained the growth of the bacteria in the operative site, thereby tumbling the incidence of SSI. Similarly, Prerna *et al* (2020) [8] did a comparative study using TCS, CCS and NCS-coated sutures and concluded that the antibacterial efficiency was highest in TCS group followed by CCS group and least in NCS group.

In contradiction to the above results an *in-vitro* study by Venama *et al.* (2011) [17] found no significant benefit in using antimicrobial sutures such as the triclosan-coated ones. It stated that it can be combined with chlorhexidine for improved results. Similarly, Etemadi A *et al.* (2019) [18] studied the use of Vicryl plus suture and silk suture and concluded that there were no significant benefits to using the former. Asher R (2019) [19] also reported

that bacterial adherence and growth to monofilament using nylon material was much less than that of coated polyglactin. In the present study, triclosan-coated antibacterial sutures exhibited better results than non-coated sutures regarding visible plaque and total microbial colony count. However, the two sets had no variation in the healing and other clinical parameters. None of the above-cited studies discussed the effects on gingival bleeding, probing pocket depth, and clinical attachment level. The present study evaluated the effects on gingival bleeding, probing pocket depth and clinical attachment level. This result may be beneficial for selecting appropriate suture materials for periodontal surgical procedures. Nevertheless, continuing clinical and microbiological trials with higher sample sizes need to be boarded on to demonstrate the effectiveness of Triclosan-coated anti-bacterial sutures. Triclosan-coated antibacterial sutures can be an imperative substitute for non-coated sutures to encourage biofilm control and lower the occurrence of surgical site infections.

CONCLUSION: The current research was directed to assess the efficacy of polyglycolic acid sutures coated with triclosan in contrast to non-coated polyglycolic acid sutures in periodontal flap surgery. Throughout the trial, the periodontal tissues tolerated polyglycolic acid sutures, both coated and uncoated, with good tolerance. Compared to group B, group A had better results in visible plaque scores and microbiological analysis, indicating the positive effect of the triclosan-coated anti-bacterial sutures. Local drug delivery through the anti-bacterial coated sutures can be advantageous as it impedes biofilm development and down-regulates microbial load at the surgical site. Moreover, the reduced biofilm formation increases the clinical success of any therapy. Therefore, all these factors should be taken into account in the conclusion. Within the constraints of the current investigation, it is possible to conclude that, to support biofilm control and lower the frequency of surgical site infections (SSIs), antibacterial sutures coated with triclosan can be a beneficial alternative to traditional sutures. Henceforth, the results obtained from the present study can pave the way for further research in this field with the progress of novel, ground-breaking resources and technologies.

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