MICROBIOLOGICAL EVALUATION OF BACTERIAL ADHERENCE TO DIFFERENT SUTURE MATERIALS IN PATIENTS UNDERGOING PERIODONTAL SURGERY: AN EXPERIMENTAL STUDY

MICROBIOLOGICAL EVALUATION OF BACTERIAL ADHERENCE TO DIFFERENT SUTURE MATERIALS IN PATIENTS UNDERGOING PERIODONTAL SURGERY : AN EXPERIMENTAL STUDY

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ABSTRACT

Aim:The aim of this study is to compare and assess the oral microbial colonization on four different suture materials in patients undergoing periodontal surgical procedures.

Methodology:Black Silk 3-0, Vicryl 3-0 (Polyglycolic Acid), Prolene 3-0, and Ethilon 3-0 were the four suture materials employed in this study. Patients who underwent complete mouth flap surgery received four different types of sutures. Suture specimens were transported in sterile containers to the microbiological laboratory and Bacterial Colony Forming Units (CFU) were measured after 48 hours on the agar plate using a magnifying colony counter.

Statistical Analysis:SPSS software 20.0 was used to decode and test the recorded index measurements. For bacterial development around various suture materials, the mean and standard deviation were calculated. Turkey's HSD Post-hoc test was used for the variance analysis.

Results:The PI value showed statistically significant `difference. The preliminary result showed that the Ethilon suture had the least microbial appearance followed by proline sutures.

Conclusion :In comparison to the other materials, we can conclude that ethilon type suture materials had the least bacterial adhesion property, followed by proline suture. As a result, periodontal procedures can use ethilon and proline sutures.

Key words:Suture material, bacterial colony forming unit, vicryl, silk, proline, ethilon, bacterial adherence

INTRODUCTION

Sutures are required at the end of a surgical treatment to ensure a satisfactory outcome. The majority of periodontal surgical treatments necessitate primary wound closure, which can be accomplished using a variety of suture types. They are classed as natural or synthetic, as well as absorbable or non-absorbable, depending on how long they last in the host tissues.[1]

Several intrinsic and extrinsic risk factors present at the time of surgery influence the development of postoperative surgical site infections. The suture material is commonly regarded as a nidus for microbial adhesion and wound infection, according to research conducted by various scholars. The bacterial adhesion to a suture material is dependent on the microbial

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INTRODUCTION:

species as well as the composition and structure of the suture, according to the early research.[2–4]

Cotton, braided silk, polyester, nylon, and cat gut are among the suture materials that have been studied for tissue reactions, however the results have been mixed. Sutures that are braided are more likely to colonise than those that are monofilament. [9–11]

Other studies have found that silk sutures are more susceptible to bacterial invasion and severe tissue inflammatory reactions than other suturing products. Sortino et al. [2] reported that the bacterial count over braided silk and PGA sutures was similar; however, other studies have found that silk sutures are more susceptible to bacterial invasion and severe tissue inflammatory reactions than other suturing products. [5–8]

Despite abundant saline irrigation, wounds repaired with buried absorbable subcutaneous sutures (subcuticular) were more vulnerable to infection after Staphylococcus aureus contamination, according to an animal study.[12] Not only the tissue in a surgical wound, but also the suture material, can be contaminated by germs. The inert surface of a suture is quickly coated with tissue proteins such as fibrinogen, fibronectin, collagen, and other soluble substrates, all of which act as adhesins for microbial adhesion.[12]

The degree of infection elicited by different sutures depends on their physical and chemical configuration.[14] The mechanisms by which surgical sutures potentiate infection in wounds are multiple.[15] Several investigators have compared the incidence of infection in wounds closed with various suture materials both experimentally and clinically. Elek and Conen, in their studies with normal human subjects observed that approximately 1,000,000 staphylococci were necessary to cause an infection when introduced by intradermal injection or into a simple wound, but when the organisms were introduced with a silk suture, which was placed subcutaneously, as few as 100 organisms could initiate an infection.[16]

In 1937, Shambaugh and Dunphy studied the comparative incidence of infection in contaminated wounds closed with silk or with chromicized catgut in dogs. The wounds were contaminated either with feces or an uncounted staphylococcal culture.[17] Whipple, in 1933, strongly advocated the use of silk in repair of clean wounds, indicating that the incidence of

infection was actually less than when chromicized catgut was used.[18]

Since the choice of the sutures utilized in periodontal surgical interventions may play a key role in optimal postsurgical wound healing, this study is aimed to compare and assess the oral microbial colonization on a selected four types of suture material in patients undergoing periodontal surgical procedures.

MATERIALS AND METHODS:

The Vivekananda Dental College for Women's institutional research ethics committee approved this study. The goal of the study was explained to the patients, and signed informed consent was obtained for each patient's participation.

The study involved 15 patients who were undergoing full mouth flap surgery at Vivekanandha Dental College for Women in Tiruchengode's Department of Periodontology.

The study comprised systemically healthy individuals between the ages of 35 and 55, patients with a minimum of 20 teeth, patients requiring full mouth periodontal flap procedures, and patients willing to return for regular recall appointments.

Patients who had received periodontal therapy in the previous 6 months, patients on antimicrobial therapy in the previous 3 months, patients with a history of systemic diseases affecting the periodontium, pregnant and lactating women, and patients who required antimicrobial therapy and use of chlorohexidine post-operatively were all excluded.

Black Silk 3-0, Vicryl 3-0 (Polyglycolic Acid), Prolene 3-0, and Ethilon 3-0 were the four suture materials employed in this study.

Patients who underwent complete mouth flap surgery received four different types of sutures, as well as post-operative instructions. Patients were summoned back after 7 days, and stitches were removed. Suture specimens were transported in sterile containers to the microbiological laboratory.

After that, the specimen was placed in the Nutrient broth liquid medium for inoculation.

The material was then slowly blended. After that, 1 mL of Broth was inoculated in a solid medium called Nutrient Agar plate. The agar plate was then tightly sealed and incubated for 48 hours inverted at 37°C.

Bacterial Colony Forming Units (CFU) were measured after 48 hours on the agar plate using a magnifying colony counter.

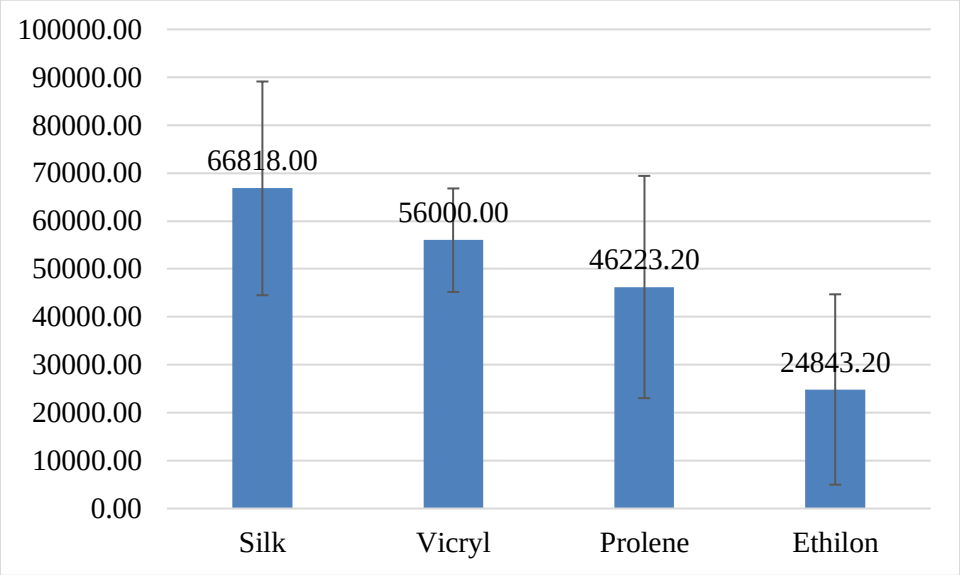
STATISTICAL ANALYSIS :

SPSS software 20.0 was used to decode and test the recorded index measurements. For bacterial development around various suture materials, the mean and standard deviation were calculated. Turkey's HSD Post-hoc test was used for the variance analysis.

RESULTS :

All 15 subjects completed the study. The PI value showed statistically significant difference. The preliminary result showed that the Ethilon suture had the least microbial appearance followed by proline sutures.

Graph 1: Comparison among bacterial contamination of the four materials



Graph 2: Box plot showing bacterial contamination among the four materials

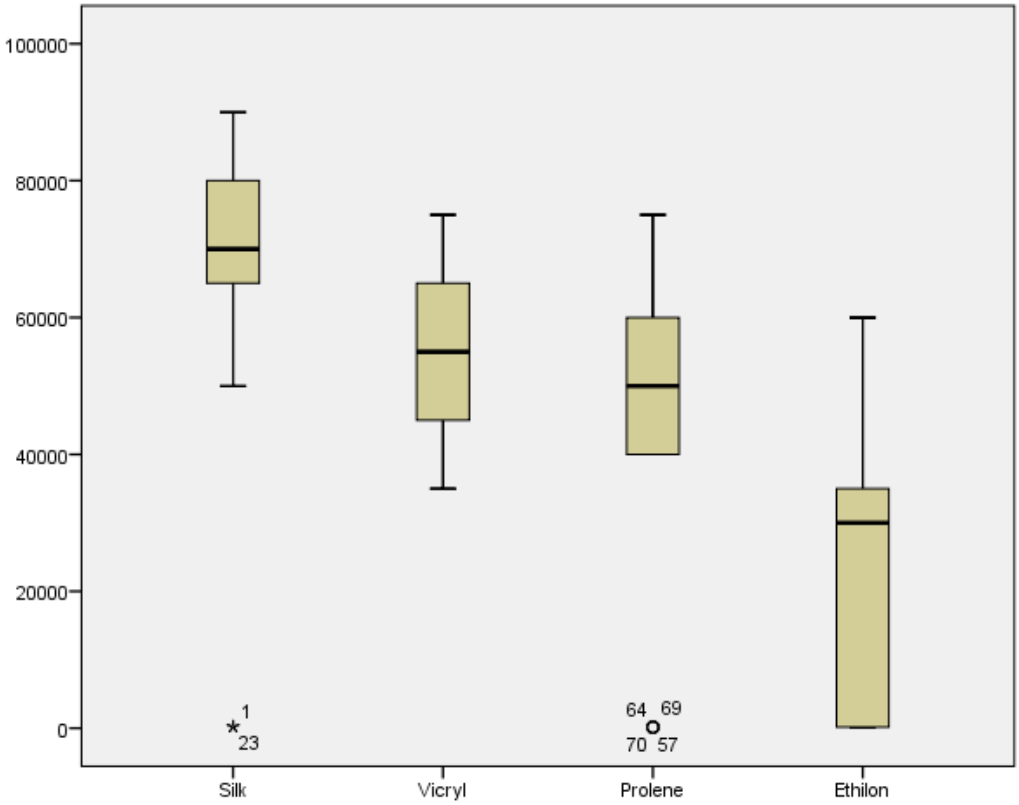


Table 1: Mean bacterial growth around different suture materials

	Mean±SD	95% Confidence Interval for Mean		F ratio	p-value
		Lower Bound	Upper Bound		
Silk	$6.7\pm2.2 \times 10^4$	5.8×10^4	7.6×10^4	20.620	<0.001*
Vicryl	$5.6\pm1.1 \times 10^4$	5.2×10^4	6.0×10^4		
Prolene	$4.6\pm2.3 \times 10^4$	3.7×10^4	5.6×10^4		
Ethilon	$2.5\pm1.8 \times 10^4$	1.7×10^4	3.3×10^4		

*Significant at p≤0.05

Table 2: Tukey's HSD Post-hoc test results among the four materials

Comparative groups		Mean Difference	p-value	95% Confidence Interval	
Silk	Vicryl	10818.000	.216	Lower Bound	Upper Bound
	Prolene	20594.800	.002*	-3722.87	25358.87
	Ethilon	41974.800	.000*	6053.93	35135.67
Vicryl	Silk	-10818.000	.216	27433.93	56515.67
	Prolene	9776.800	.300	-25358.87	3722.87
	Ethilon	31156.800	.000*	-4764.07	24317.67
Prolene	Silk	-20594.800	.002*	16615.93	45697.67
	Vicryl	-9776.800	.300	-35135.67	-6053.93
	Ethilon	21380.000	.001*	-24317.67	4764.07
Ethilon	Silk	-41974.800	.000*	6839.13	35920.87
	Vicryl	-31156.800	.000*	-56515.67	-27433.93
	Prolene	-21380.000	.001*	-45697.67	-16615.93

*Significant at p≤0.05

DISCUSSION :

Numerous disease states have been linked to bacterial biofilm formation. It has long been acknowledged that the presence of suture material increases the risk of infection, and SSIs, which are frequently linked to suture materials, are likely linked to bacterial biofilm formation. Suture adhesion qualities were related to the degree of infection. When compared to other braided sutures, monofilament sutures like ethylon have the least microbial adhesion.

The fact that bacteria cling to different suture materials at varied rates supports the theory that bacterial adherence to sutures plays a substantial role in tissue reaction induction. Because sutures get contaminated as soon as they come into contact with the oral cavity, it's best to open them shortly before passing them through the gingival tissues to avoid complications like stitch abscesses[20]. It's possible that the enormous inflammatory response elicited by many confounding circumstances "masks" the tissue reactions elicited by the suture material.

The adhesion of radiolabeled S. aureus and Escherichia coli to ten suture materials was investigated by Chu and Williams [19]. Braided suture proved to be preferred by S. aureus and E. faecalis over monofilament suture. Because of its bigger, more complicated surface area, it's tempting to believe braided suture is more prone to bacterial adherence. Similarly, in this study when comparing braided silk sutures to vicryl and prolene, braided silk sutures had the highest coloby forming units, while ethilon sutures had the lowest coloby forming units and the least bacterial adherence.

Studies on oral tissue reactions to sutures have found that all sutures cause inflammatory reactions, with silk and cotton causing the most, and nylon, polyester, ePTFE, polyglecaprone, and PGA causing the least. Katz et al. looked at bacteria's capacity to adhere to different types of sutures and trigger tissue responses. The results showed that bacterial adhesion to braided silk sutures was five to eight times higher than nylon, which had the least quantity of germs adherent[10], supporting the current investigation.

By documenting the presence or absence of bacterial plaque along the suture track, Leknes et al.[21] studied the inflammatory responses in oral tissues sutured with silk and ePTFE. Bacterial plaque was found in 10 of the 11 silk suture channels and four of the 11 ePTFE suture channels, according to the findings.

Similarly, when comparing the silk suture to the ethilon and proline sutures, the bacterial coloby producing unit was found to be highest in the silk suture.

According to the findings, the ethilon suture had the least microbial appearance, followed by proline sutures, and is the best suture for optimal wound healing after periodontal surgery. The fact that this study has a smaller sample size is one of its limitations. The study did not include monofilament absorbable suture material which is another limitation. More research incorporating microbiological and histological examination could offer insight on the importance of proper suture selection for oral surgical operations.

CONCLUSION :

Depending on multiple parameters, including surface qualities and bacterial adhesion properties, various suture materials used in periodontal procedures cause varying degrees of tissue responses. In comparison to the other materials, we can conclude that ethilon type suture materials had the least bacterial adhesion property, followed by proline suture. As a result, periodontal procedures can use ethilon and prolene sutures.

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