

Original Article

Bacterial Accumulation on Triclosan-Coated and Silk Sutures After Dental Implant Surgery

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ABSTRACT

Background and Aim: The risk of surgical site infection may depend on bacterial attachment and physical and chemical properties of suture materials. This study aimed to evaluate bacterial accumulation on triclosan-coated (Vicryl Plus) and silk sutures placed at different distances from Vicryl Plus after dental implant surgery.

Materials and Methods: In this randomized controlled trial, 20 patients who required dental implants were included. Their surgical sites were large enough to include at least four sutures. The surgical site was sutured first with Vicryl Plus and then with three silk sutures placed at 3, 6, and 9 mm distances from Vicryl Plus. Sutures were removed 7 days after surgery, and the samples were placed in microbiological cultures specific to Enterococci and Escherichia coli (E. coli). Subsequently, the numbers of colony-forming units (CFUs) and bacterial growth rates were evaluated. Kruskal-Wallis and Mann-Whitney U tests were used for statistical analysis.

Results: There were no significant differences in the number of CFUs and growth rates of microorganisms isolated from triclosan-coated and silk sutures 7 days post-operatively ($P>0.05$).

Conclusion: Triclosan-coated sutures have no benefits over silk sutures placed at different distances from Vicryl Plus.

Keywords: Sutures, Surgical Wound Infection, Bacterial Adhesion, Polyglactin 910/pharmacology, Triclosan/pharmacology, Dental Implant

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Introduction:

Surgical site infection is a postoperative complication that may occur after dental implant surgery. The probability of this infection is related to intrinsic and extrinsic factors present at the time of surgery. The suture material is defined as a potential risk factor for wound infection in oral surgery.^(1,2)

The selection of appropriate suture may depend on bacterial adhesion, duration of the presence of sutures, tensile strength, handling quality of the suture, and surgeon's preference.⁽¹⁻⁵⁾ Suture materials are usually classified based on mechanical properties (such as tensile strength), bio-absorbable properties (absorbable and non-absorbable sutures),

and macrostructure (monofilament and braided sutures).

Suture tissue reactivity is another important factor evaluated in previous research.⁽⁶⁾ Braided and absorbable sutures produce a greater inflammatory response.^(1,6) Monofilament suture has been described to decrease the number of bacteria, to make handling difficult, and to contribute to patient discomfort because of its physical composition.^(1,6-10)

Triclosan-coated multifilament suture reduces surgical site infections due to its antibacterial property.⁽¹¹⁻¹³⁾ However, this antibacterial effect has been observed during the first three days after suture placement, and this antibacterial suture can provide little safety in surgical site infection control.⁽³⁾

The most common aerobic and anaerobic bacteria attributed to the oral cavity are Streptococci, Enterococcus faecalis, Bacteroides, and Actinomyces.⁽¹³⁾ In previous studies, antibacterial coated sutures decreased microorganisms generally cultured from surgical sites, especially Staphylococcus aureus (*S. aureus*), Staphylococcus epidermidis (*S. epidermidis*), and Escherichia coli (*E. coli*). The inhibition zone produced by triclosan-coated sutures against *E. coli* has been reported to be 20 mm.⁽¹¹⁻¹³⁾

The present study aimed to compare *E. coli* and Enterococcus accumulation in Vicryl Plus and silk sutures placed at 3, 6, and 9 mm distances from Vicryl Plus after dental implant surgery.

Materials and Methods

This randomized controlled study was conducted at the Dental Faculty of Islamic Azad University of Medical Sciences, Tehran, Iran. The Bioethical Committee of Islamic Azad University has approved this study (IR.IAU.DENTAL.REC.1397,21). All the participants signed written informed consent.

Patients without general contraindications to dental implant treatment, such as systemic problems, were included in the study. Their surgical sites were large enough to include at least four sutures. The surgical site was first sutured with antimicrobial polyglycolic acid suture (triclosan-

coated suture, Vicryl Plus, braided absorbable suture; Ethicon, Inc., Somerville, NJ, USA) and then with three silk sutures (braided non-absorbable suture; Ethicon, Inc., Somerville, NJ, USA) placed at 3, 6, and 9 mm distances from Vicryl Plus. Consequently, the effect of triclosan antimicrobial coating on adjacent sutures was evaluated. Postoperative antibiotic treatment (500 mg amoxicillin) and 0.2% Chlorhexidine gluconate mouthwash (Donyaye Behdasht. Lab., Tehran, Iran) were prescribed for all patients.

The sutures were removed after 7 days and were placed in Brain Heart Infusion (BHI) Broth (HiMedia Laboratories Pvt. Ltd., Mumbai, India), which supported the growth of aerobic microorganisms. After 12 hours, the microorganisms were transferred to Bile Esculin Agar (HiMedia Laboratories Pvt. Ltd., Mumbai, India) for Enterococci and MacConkey Sorbitol Agar (HiMedia Laboratories Pvt. Ltd., Mumbai, India) for *E. coli* and were seeded in specific microbiological cultures. Following the incubation of plates at 37°C for 24 hours, colony-forming units (CFUs) and bacterial growth rates were evaluated.^(1,3,13)

The sample size was calculated based on previous studies according to power calculations with a 5% alpha error rate.^(14,15) A minimum of 20 patients was estimated for statistical significance. For each suture, the mean and standard deviation (SD) were calculated for the two microorganisms using Kruskal-Wallis test. The comparison between the sutures was carried out using Mann-Whitney U test.

Result:

The research was conducted on 160 samples, including two types of suture materials (silk and Vicryl Plus), and two types of microorganisms (Enterococcus and *E. coli*). Eleven women and nine men with the mean age of 49.2 years participated in this study.

The mean and SD of microorganism count for Enterococcus were 5000±22400 CFU/ml for Vicryl Plus, 400±1500 CFU/ml for silk1 (3-mm distance from Vicryl Plus), 600±2250 CFU/ml for silk2 (6-mm distance from Vicryl Plus), and 3350±12240 CFU/ml for silk3 (9-mm distance from Vicryl Plus).

There were no statistically significant differences among the sutures for Enterococcus count ($P=0.08$). The growth rate of Enterococcus was $5\pm 1\%$ for Vicryl Plus, 0 for silk1, $10\pm 2\%$ for silk2, and $10\pm 2\%$ for silk3. This difference was not significant for Enterococcus growth rate ($P=0.9$).

The mean and SD of microorganism count for E.coli were 250 ± 1100 CFU/ml for Vicryl Plus, 400 ± 1700 CFU/ml for silk1, 2900 ± 12280 CFU/ml for silk2, and 1800 ± 7800 CFU/ml for silk3. There were no statistically significant differences among the sutures for E.coli count ($P=0.7$). The growth rate of Enterococcus was $5\pm 1\%$ for Vicryl Plus, $10\pm 2\%$ for silk1, $10\pm 2\%$ for silk2, and $10\pm 2\%$ for silk3; the difference was not significant for E.coli growth rate ($P=0.9$).

Discussion

The present study shows that triclosan-coated suture has no antibacterial effect 7 days after surgery. E.coli and Enterococcus accumulations of Vicryl Plus suture were comparable to the bacterial accumulations of silk sutures. Also, the quality of suture material (triclosan-coating) did not affect the bacterial accumulation of adjacent sutures placed at different distances from Vicryl Plus in the current study.

Bojar et al studied bacterial accumulation to evaluate the effect of the suture on the host environment.⁽¹³⁾ They evaluated the direct antimicrobial activity of triclosan-coated suture and found that the inhibition zone against E. coli reached 20 mm. However, in the present study, Vicryl Plus suture did not decrease bacterial accumulation on itself or adjacent sutures.

Asher et al found that bacterial adhesion of coated polyglactin suture was not different from that of other suture materials 7 days after oral surgery.⁽¹⁾

In a clinical study by Sala-Pérez et al, the antibacterial effect of Monocryl Plus suture was observed after 3 days, but this effect was not considerable 7 days after oral surgery.⁽³⁾ In addition, antibacterial activity of triclosan-containing suture was reported for 96 hours in a study by Edmiston et al and for 12 hours in a study by Masini et al.^(16,17)

Based on previous studies and the results of the present study, it can be concluded that the use of triclosan-coated suture offers no benefit in oral surgery.^(3,16-20)

Previous studies have examined the effects of Chlorhexidine antibacterial mouthwash on suture materials with controversial outcomes. The prescription of this mouthwash after surgery did not decrease bacterial accumulation on the sutures in a study by Asher et al.⁽¹⁾

However, Venema et al showed that the use of antiplaque mouthwashes decreased viable organisms on uncoated and triclosan-coated sutures.⁽²⁰⁾

This factor was not assessed in the present study and is suggested for future research. Although the SDs of bacterial CFUs and growth rates were large in the present study, they were in accordance with the results of previous studies and should be verified by larger sample sizes in future studies.

Conclusion:

According to the results of the present study, triclosan-coated sutures have no benefits over silk sutures. Also, Vicryl Plus did not decrease E.coli and Enterococcus accumulation of silk sutures placed at different distances from Vicryl Plus.

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