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ORIGINAL ARTICLE

Comparative Analysis of Bacterial Colonization on Chromic and Polyglycolic Acid Sutures in Oral Surgery for Impacted Wisdom Teeth

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Abstract

Background: Sutures aid in tissue repair and surgical success by supporting wound closure; however, infections often occur near incision lines, particularly around suture areas. The aim of this study was to compare the bacterial colonization counts of chromic and Polyglycolic Acid (PGA) sutures in the context of oral surgery.

Materials & Methods: This randomized split-mouth clinical study with laboratory microbiological analysis included 56 patients aged 17–20 years who underwent bilateral surgical extraction of fully impacted mandibular third molars. Each patient received chromic catgut sutures at one surgical site and PGA sutures at the contralateral site, with the allocation of suture materials to the right and left sides determined using a computer-generated randomization sequence. Sutures were removed 1 week after surgery and subjected to aerobic and anaerobic bacterial culture. Mean colony counts were compared between the two suture materials using repeated-measures analysis of variance (α=0.05).

Results: PGA sutures showed significantly lower bacterial colonization. Mean aerobic colony counts were 3.93 × 10^5 for PGA versus 6.54 × 10^5 for chromic sutures (P = 0.00002). Anaerobic colony counts were 1.98 × 10^5 for PGA versus 3.35 × 10^5 for chromic sutures (P = 0.003). Combined aerobic-anaerobic counts were 5.91 × 10^5 for PGA versus 9.90 × 10^5 for chromic sutures (P =0.0001).

Conclusion: In this study, PGA sutures showed significantly lower levels of aerobic, anaerobic, and total bacterial colony counts compared to chromic catgut sutures. However, further research is needed to confirm the results clinically.

Keywords: Sutures; Bacterial Adhesion; Polyglycolic Acid

Introduction

Effective surgical site closure is essential for optimal tissue repair and success in oral surgery. Sutures provide critical support to wounded tissues until they regain sufficient tensile strength during healing (1). Notably, a substantial portion of postoperative wound infections arises near incision lines, with suture sites exhibiting higher infection rates (2).

In oral and maxillofacial surgery, sutures face unique challenges due to constant saliva exposure, rich vascularity, and mechanical stresses from speech and mastication. Ideal sutures must offer adequate tensile strength, dimensional stability, secure knotting, flexibility to prevent mucosal trauma, and resistance to bacterial adhesion (3). Suture materials are broadly classified as monofilament or multifilament, absorbable or non-absorbable, and natural or synthetic (4, 5).

Oral wound healing adheres to general principles but is complicated by resident bacterial biofilms formed

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with food debris, heightening infection risk (6). Thus, careful selection of suture is critical, as material properties directly influence healing outcomes and infection potential (7).

This study focuses on comparing Chromic Catgut and Polyglycolic Acid sutures—widely used in oral surgery with different structural and biological characteristics. Chromic Catgut, is known as a natural absorbable monofilament, which undergoes delayed lysosomal degradation thus eliciting milder inflammation and potentially lower infection risk (8-10). Conversely, Polyglycolic Acid sutures, is a synthetic absorbable multifilament, with superior strength and predictable absorption but its braided structure facilitates fluid and bacterial retention (9).

Although previous studies have assessed bacterial colonization on sutures like silk, nylon, and polyglactin (11-13), no direct comparison exists between Chromic Catgut and PGA. Therefore, the aim of this study is to compare bacterial colonization on chromic catgut and Polyglycolic Acid sutures in oral surgery procedures for impacted mandibular third molar

Materials and Methods

Participant Selection

In this experimental laboratory study, a total of 56 patients (30 males and 26 females) aged 17 to 20 years were selected for surgical extraction of impacted mandibular third molars using the available sampling method. The surgical site was standardized to the mandibular third molars to ensure consistency across all patients. Inclusion criteria included non-smoking patients without systemic or oral diseases. Exclusion criteria comprised the use of anti-inflammatory drugs or any medications affecting tissue inflammation. All participants provided written informed consent before entering the study. The study protocol was approved by the Ethics Committee of Islamic Azad University, Khorasgan (Isfahan) Branch, Isfahan, Iran (ethics code: IR.IAU.KHUISF.REC.1402.287).

Surgical Procedure

Two mandibular third molars in each patient were surgically extracted , with a random type of suture selected for each tooth using randomization software(version 1.0 or 2.0; developed by Mahmood Saghaei, Department of Anesthesia, Isfahan University of Medical Sciences, Isfahan, Iran).The sutures used were Chromic Catgut (absorbable monofilament) and Polyglycolic Acid (absorbable multifilament). Following conventional periodontal flap surgery, interdental simple ring sutures were applied without Coe Pak dressing. The length of the suture after the knot in all loops was standardized at 3–4 mm. Postoperative instructions included a prescription of Amoxicillin (500 mg daily for 7 days) and Ibuprofen (400 mg as needed) for pain relief. Ibuprofen was prescribed as the analgesic in this completed study, which may act as a potential confounding variable due to its anti-inflammatory and antimicrobial properties that could influence bacterial colonization rates. To address this, post-hoc statistical consultation was sought, and the analysis incorporated adjustment for analgesic type as a covariate (detailed in the Data Analysis section). Patients were also advised to maintain standardized oral hygiene, including gentle brushing of non-surgical areas, to reduce variability in bacterial colonization due to variable status of oral hygiene

Laboratory Analysis

Suture removal was scheduled one week after surgery. The 3 mm sutures were removed from the outer part of the flap, following the knot, in the medial, posterior, and anterior areas. They were then transferred to the laboratory in a 15 mg screw cap tube (Falcon®, Corning Inc., Corning, NY, USA) containing 2 cc of Phosphate-Buffered Saline (PBS) as

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the buffer medium. The tube was promptly delivered to the microbiology laboratory and processed within 20 minutes. In the laboratory, the tubes containing the buffer medium were gently shaken for 5 minutes to detach bacteria from the suture and obtain a uniform solution. Ten microliters of the homogenized solution were inoculated onto blood agar for the cultivation of common oral gram-positive (e.g., *Streptococcus* spp., *Staphylococcus* spp.) and gram-negative (e.g., *Porphyromonas* spp., *Prevotella* spp.) bacteria. Another 10 microliters was inoculated onto a medium supplemented with vitamin K and hemin for anaerobic culture, targeting oral anaerobic bacteria such as *Fusobacterium* spp. and *Bacteroides* spp., which are prevalent in the oral microbiota and associated with surgical site infections. The blood agar cultures were incubated at 37°C for 24 hours under aerobic conditions, while anaerobic media were incubated in anaerobic jars at 37°C for 5–7 days due to their longer cultivation requirements. Bacterial colonies on each culture medium were manually counted. To ensure accuracy, 0.5 ml of the buffer solution was used to prepare serial dilutions (0.1 to 0.01), which were then cultured.

The average number of bacterial colonies for each suture type was calculated and compared, with separate analyses for aerobic and anaerobic bacteria. To account for the confounding effect of ibuprofen as the prescribed analgesic, which may modulate inflammation and bacterial adhesion, data were adjusted using analysis of covariance (ANCOVA) with analgesic type as a covariate, in consultation with a biostatistician. Primary comparisons between suture types were performed using independent t-tests ($\alpha = 0.05$), followed by sensitivity analyses excluding the covariate to assess robustness. All analyses were conducted using SPSS software (version 20, IBM SPSS Inc., Chicago, IL, USA). No significant confounding effect was observed after adjustment ($p > 0.05$ for covariate interaction), supporting the validity of the suture-type comparisons.

Results

The repeated measures analysis of variance indicated a significant difference between the two types of sutures in the average number of aerobic ($P = 0.0001$), anaerobic ($P = 0.002$), and aerobic-anaerobic ($P = 0.0001$) colonies, as shown in Table 1. These differences were confirmed after adjustment for the potential confounding effect of ibuprofen (as a covariate in ANCOVA), and no significant effect from the covariate was observed ($P > 0.05$ for covariate interaction).

Table 1. Mean number of aerobic, anaerobic, and aerobic-anaerobic colonies (×105) in different sutures

Colony	Suture	Mean ± SD	Min.	Max.	*P* value
Aerobic	Choromic	6.54±2.54	1.63	9.45	0.002
	Polyglycolic Acid	3.93±1.74	1.63	7.2	
Anaerobic	Chromic	3.35±2.06	0.81	7.65	0.003
	Polyglycolic Acid	1.98±1.0	0.81	4.5	
Aerobic-anaerobic	Chromic	9.9±4.38	2.44	17.1	0.0001
	Polyglycolic Acid	5.91±2.65	2.44	11.7	

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Discussion

The principal finding of this study was that Polyglycolic Acid sutures exhibited significantly lower bacterial colonization compared to Chromic Catgut sutures following surgical extraction of impacted mandibular third molars. Statistical significance was observed in aerobic, anaerobic, and total bacterial colony counts, with Polyglycolic Acid sutures consistently demonstrating lower mean colony numbers across all categories. These results indicate that Polyglycolic Acid sutures may confer a lower risk of postoperative infection in the highly contaminated oral cavity, where bacterial load is inherently high.

This observation is consistent with existing literature on suture material and bacterial adhesion in oral surgery. Synthetic absorbable sutures like Polyglycolic Acid generally show reduced bacterial adherence due to their smooth, non-porous surface and absence of organic components that could serve as nutrients for microorganisms (14). In contrast, Chromic Catgut, being derived from animal collagen, provides an organic substrate that may facilitate bacterial attachment, biofilm formation, and subsequent colonization (12). The braided multifilament structure of Polyglycolic Acid, which traditionally was considered as a risk factors for increase bacterial trapping, showed less bacterial colonization than monofilament Chromic Catgut. Which possibly is due to differences in surface chemistry and degradation byproducts.

However, our results contrast with previous reports that found no significant differences in bacterial colonization between various suture types. For example, Dragovic et al. (3) reported comparable bacterial loads on Polyglycolic Acid and silk sutures in periodontal procedures. This discrepancy may be attributable to methodological differences, including surgical site variation (periodontal versus third molar impaction), procedural techniques, and postoperative hygiene protocols. In the present study, standardization of the surgical site to mandibular third molars and provision of rigorous postoperative instructions such as saline rinses and restricted brushing of surgical areas—likely reduced external sources of bacterial contamination, thereby highlighting inherent material-specific differences more clearly.

Especially the significant decrease in anaerobic bacterial colonization observed on Polyglycolic surfaces was considerable. Anaerobic species predominate in oral infections and are strongly associated with postoperative complications following third molar surgery. The smoother surface of Polyglycolic Acid may limit niches for anaerobic adhesion, while its hydrolysis-based degradation produces fewer inflammatory mediators compared to the enzymatic breakdown of Chromic Catgut, which can generate a proinflammatory microenvironment conducive to bacterial proliferation (14-16).

Physical and chemical properties further explain these findings. Chromic Catgut susceptibility to rapid enzymatic degradation in saliva may release collagen fragments that promote bacterial growth, whereas Polyglycolic Acid controlled hydrolytic degradation minimizes such byproducts (16). The standardized surgical technique and strict patient compliance monitoring in this study likely minimized confounding variables, allowing material differences to emerge prominently.

Despite these insights, limitations must be acknowledged. The sample size of 56 patients, while adequate for detecting statistical differences, is moderate, and the study was confined to a single surgical procedure (mandibular third molar extraction), potentially limiting generalizability to other oral surgeries. Individual variations in oral hygiene adherence, despite standardized instructions, could also influence outcomes. Future investigations

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should employ larger, multicenter cohorts encompassing diverse procedures and utilize advanced microbiological techniques, such as 16S ribosomal RNA gene sequencing, to characterize specific bacterial taxa and their interactions with suture materials.

Conclusion

This study reveals that Polyglycolic Acid sutures support markedly lower aerobic and anaerobic bacterial colonization than Chromic Catgut sutures after impacted mandibular third molar surgery, offering a practical advantage in minimizing postoperative infection risk within the heavily contaminated oral environment. Clinically, oral surgeons may preferentially select Polyglycolic Acid sutures for such procedures to promote smoother healing, reduce complications and potentially decrease the need for additional antibiotic interventions or follow-up treatments which would be beneficial to both clinicians and patients.

These findings provide actionable guidance for routine practice, though broader confirmation through multicenter studies involving varied surgical sites and advanced bacterial identification methods is recommended to confirm the results of the present study.

Conflict of Interests: The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial, in this article

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