Comparison Of 4 Different Suture Materials in Respect to Oral Wound Healing and Clinical Features

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Abstract

Objectives: Closing wounds using sutures is a common medical procedure. Until the tissue has recovered enough of its tensile strength, they provide support as it heals. This study aimed to compare wound healing and clinical features using four different suture materials.

Materials and Methods: There were 40 participants in all, all of whom were having surgery to remove four impacted third molars. Four different types of suture materials (silk, catgut, vicryl, PDF) were used and pocket depth distal to the second molar was assessed after follow-up at each site.

Results: Comparison of Pocket depth measured behind 2nd molar in mm showed that maximum depth was seen in catgut sutures followed by silk sutures and least in PDF sutures and the overall difference between four groups was significant and Pairwise comparison of Pocket depth measured behind 2nd molar in mm showed that PDF suture showed significantly lesser pocket depth as compared to other three suture materials.

Conclusions: Newly described suture material may be helpful in decreasing periodontal complications of the distal of the second molar after surgical removal of the mandibular impacted third molar, including pocket development.

Keywords: Sutures, Oral Surgery, periodontal pockets, wound healing.

Introduction:

Closing wounds using sutures is a standard medical procedure. The suture's primary function is to stop bleeding immediately after surgery and to provide structural support for the soft tissues as they mend and shut, making them less vulnerable to infection. To get the best long-term functional and cosmetic effects from modern oral surgery, effective primary healing, attained by using enough sutures and adequate intraoperative soft tissue manipulation, is currently regarded an essential need [1]. Although oral wound healing is governed by the same broad

principles as other types of wound healing, it does have certain unique aspects. First, bacteria infiltrate the oral mucosa, and they and food debris combine to produce biofilm, which then promotes wound infection. Second, since the tissues in the mouth provide an important role, injuries to the mouth cannot be immobilized. Lastly, active metabolic exchange is absent from the healing process due to the presence of avascular materials (enamel, ceramic, metal) that come into touch with the wounds [1,2]. There are two options for treating a wound. Per primam intentionem (sometimes written as p.i.) healing is a method of mending injuries in which damaged cells are replaced by new ones with the same structure and function as the original cells. The opposite occurs during secondary intention healing (per secundam intentionem), when generic scar tissue replaces the wounded tissue rather than regeneration [3].

Most people believe that every oral surgery carries the danger of a postoperative infection that might potentially delay or even prevent the patient from recovering normally. Suture materials, like any other foreign substance placed in the human body, are associated with an increased risk of infection owing to the adhesion of microorganisms to their surfaces [4]. Two-thirds of all wound infections after surgery begin at the incision site, and this percentage increases when sutures are used [5]. Oral tissue reactivity to suture materials is largely determined by the degree to which microorganisms cling to the suture material.

Several research over the last four decades have shown that synthetic materials behave better to oral tissues than nonsynthetic suture materials do with regard to tissue inflammatory reactions [6,7,8]. Cotton, braided silk, polyester, nylon, and cat gut are among the suture materials most studied in terms of tissue responses; nevertheless, the results of these studies are still up for debate. Cotton threads are linked to a significant increase in tissue inflammation, whereas polyester sutures are only known to generate a minor inflammatory reaction [9]. However, other commercially accessible suture materials, such as polyglycolic acid (PGA) and polyglactin, have also been rated "desirable suture materials" (produced by copolymerization of glycosides and lactides). Their actual usefulness, however, remains a matter of some controversy.

This research aimed to evaluate four commonly used suture materials in oral surgery with respect to oral wound healing and clinical features

Materials and Methods:

The research project was given the go-light by the institution's Ethics Committee. All patients who participated in the study accordingly completed an extensive informed consent. There were 40 participants in all (25 females and 15 males), all of them were 18 to 25 years old and needed surgery to remove four impacted wisdom teeth. Patients were required to be nonsmokers and free of any systemic and/or oral disorders to participate in the trial. Common surgical procedures have been followed to remove both the lower and upper wisdom teeth at the

same time on one side of the mouth. A mandibular mucoperiosteal flap was generated using the envelope approach, with the incision commencing at the first tooth, extending buccally along the external oblique ridge, and ending in the gap formed by the second molar. In this case, the vertical releasing incision for the conventional triangular flap was made at the distal end of the interdental papilla between the patient's first and second maxillary molars. We applied a series of interrupted sutures to promote early wound closure. After around 4-5 weeks, the other set of impacted molars was removed using the same method. Different suture materials (Silk, Vicryl, Catgut, PDF) were used to seal each incision, ensuring that the distribution was equal across the two jaws. For the first patient, we flipped a coin to decide which suture to put, and then we worked our way clockwise around the body until we used each suture material four times in each quadrant. The incision was cleaned and the stitches were removed 7 days after the surgery.

Antibiotics (amoxicillin 500 mg or clindamycin 300 mg) and washing with chlorhexidine solution 0.2% twice daily for seven days were prescribed for all patients after surgery. In addition, patients were instructed to use cold packs beginning 15 minutes after the end of the treatment and continuing until the start of sleep. Four milligrams of dexamethasone were given the day before surgery and again the day after to reduce swelling and discomfort. Administering 400 mg of ibuprofen four times a day for the first two days following surgery helped with the discomfort. The depth of the periodontal pocket in the distal of the second molar was measured by William’s probe (Juya Instruments PVT, Tehran, Iran). Three sizes of distobuccal, mid-distal, and distolingual were measured, and the average of these three numbers was recorded.

Statistical Package for the Social Sciences was used for all analyses (SPSS software package, version 24.0; SPSS Inc., Chicago, IL, USA). Statistical information was summarized using mean, median, standard deviation (SD), and range. One-way ANOVA test for Comparison of Pocket depth measured behind 2^{nd} molar in mm and Pairwise comparison of Pocket depth measured behind 2^{nd} molar in mm was done by Post hoc LSD test. When the p-value was less than 0.05, it was determined that a difference existed.

Results:

Table 1: Comparison of Pocket depth measured behind 2^{nd} molar in mm

Groups	N	Mean	SD	p value
Silk	10	2.55	1.01	0.004*
Vicryl	10	2.20	0.42	
Catgut	10	2.70	1.06	

PDF	10	1.40	0.52	

One way ANOVA test; * indicates significant difference at p≤0.05

Comparison of Pocket depth measured behind 2nd molar in mm showed that maximum depth was seen in catgut sutures followed silk sutures and least in PDF sutures and the overall difference between four groups was significant.

Table 2: Pairwise comparison of Pocket depth measured behind 2nd molar in mm

Pair	p value
Silk vs Vicryl	0.337
Silk vs Catgut	0.679
Silk vs PDF	0.003*
Vicryl vs Catgut	0.173
Vicyrl vs PDF	0.033*
Catgut vs PDF	0.001*

Post hoc LSD test; * indicates significant difference at p≤0.05

Pairwise comparison of Pocket depth measured behind 2nd molar in mm showed that PDF suture showed significantly lesser pocket depth as compared to other three suture materials.

Discussion:

Although several suture materials are available for use in dentistry and medicine, it is crucial that surgeons always keep in mind the particulars of the suture material they are using, as well as the biological processes of healing and the interactions of the suture with the surrounding tissues. It is important for the surgeon to keep in touch with the wound margins while waiting for the tissues of the previously raised surgical flaps to achieve the necessary strength. However, studies comparing drugs' relative efficacy have yielded mixed results. This investigation aimed to do just that by amassing data on how various suture materials perform in oral surgical procedures and how tissues react to them [10]. Commonly used in oral and other surgical sutures, silk has been the material of choice for many years [11]. Despite being less expensive and more user-friendly than other nonabsorbable suture materials, silk is not a "material of choice" for oral surgical procedures. It has been established through studies of the oral tissue response to sutures that all suture materials cause inflammation, making it the most common reaction to sutures. Nylon, polyester, ePTFE, polyglecaprone 25, and PGA all cause reactions, but silk and cotton provoke the strongest reactions. Contrary results were seen in the present study where in comparison to silk, catgut, and vicryl, PDF suture showed the least pocket depth when measured behind 2nd molar in mm.

Oral suture materials were compared for their efficacy and safety using histological analysis [9]. Compared to the oral tissues around the sutures, the number of

neutrophilic polymorphonuclear leukocytes was found to be significantly higher in the area directly adjacent to the silk sutures [12]. Furthermore, it was discovered that fibroblast and new capillary formation was reduced close to oral silk sutures. Because of this, it's possible that receiving a silk suture causes more intense tissue reactions and longer recovery times. Given that various bacteria have varying degrees of adhesion, the suture material itself may theoretically play a role in eliciting tissue reactions. Katz et al. [13] investigated in vitro the ability of different microorganisms to adhere to different sutures and elicit tissue responses. Braided silk sutures have been shown to have significantly less bacterial adhesion than nylon [13]. Recent studies have shown that among the many types of sutures, polypropylene (NA-Mono Surgipro®) suture has the lowest bacterial burden. Evidence for the safety of polypropylene sutures in the mouth is sparse, although studies comparing the microbial populations of silk, nylon, and PTFE sutures show that the former two are far less favorable to bacteria. Polypropylene suture was shown to have less microbial adherence because of its ultrasmooth surface. Knowing that a higher bacterial load on the fibers is connected with a higher infection risk is significant. All postoperative jaw infections, according to the literature [14-16], occurred in the lower jaw. Sutures have been hypothesized to have a role in the emergence of postoperative infection; however, they have not been investigated as a potentially major factor determining delayed infection. In this study by using the Post hoc LSD test**,** a Pairwise comparison of Pocket depth measured behind the 2nd molar in mm**,** showed that PDF suture showed significantly lesser pocket depth as compared to the other three suture materials.

The risk of problems like stitch abscesses may be reduced by opening the sutures just before inserting them into the gingival tissues. The reason behind this is that each time a suture comes into contact with the mouth, it gets contaminated. The findings of previous authors [17] that the physical structure of the threads is more essential than their chemical makeup in generating an inflammatory reaction after observing a similar reaction around two different multifilament sutures (Sofsilk® and Polysorb®). Given the conflicting findings in research on secondary and primary repair in terms of minimizing problems, such as pain and edema, and taking into account the benefits of the novel suture in this study we compare the four different types of suture materials [18].

Periodontal abnormalities at the distal of the second molar close to the surgical site, which manifest years after the procedure, are another significant consequence. Contrary to postoperative inflammatory consequences, which are often the major sources of pain and discomfort for patients after surgery and include bleeding, swelling, pain, the development of a pocket, and loss of distal attachment [19]. Many patients are unaware of or disregard the second molar's post-operative gingival attachment as a minor problem. However, the patient is unable to practice good hygiene due to the existence of the pocket and the loss of gingival attachment surrounding the tooth. This creates a vicious

cycle wherein increasing the depth of the pocket further impairs the patient's ability to practice good hygiene. Therefore, it is crucial to avoid these serious consequences [20,21].

The novel suture is thought to be superior to the traditional suture in terms of pocket depth and second molar attachment loss given the attributes listed above. The main goal of this research was to assess the effects of novel suture material on the periodontal health of the second molar which has been the subject of a few investigations. The present suture materials' clinical implications include their simple pattern and effective use in wound closure, which makes it useful in surgery to have a water-tight wound closure.

Conclusion:

The newly described suture material may be helpful in decreasing periodontal complications of the distal of the second molar after surgical removal of the mandibular impacted third molar, including pocket development.

References:

1. Siervo S, Lorenzini L (2008) Suturing techniques in oral surgery. Quintessenza Edizioni, 223 p. [ISBN: 9788874921201]
2. 2. Silverstein LH, Kurtzman GM, Shatz PC (2009) Suturing for optimal soft-tissue management. J Oral Implantol 35(2):82–90. https:// doi.org/10.1563/1548-1336-35.2.82
3. Zuhr O, Hürzeler M (2012) Plastic-esthetic periodontal and implant surgery: a microsurgical approach. Quintessence Publishing 858 p. [ISBN: 978-1-85097-226-6]
4. Alexander JW, Kaplan JZ, Altemeier WA (1967) Role of suture materials in the development of wound infection. Ann Surg 165(2):192–199
5. Favero MS, Gaynes RP, Horan TC, Emori TG, Stroud LA, Archibald LK et al (1996) National Nosocomial Infections Surveillance (NNIS) report, data summary from October 1986– April 1996, issued May 1996. Am J Infect Control 24(5):380– 388. https://doi.org/10.1016/S0196-6553(96)90026-7 [ISBN: 01966553 (ISSN)]
6. T. Okamoto, M. F. Gabrielli, and M. A. Gabrielli, "Influence of different types of non-resorbable suture material on the healing of extraction wounds—a histological study in rats," The Journal of Nihon University School of Dentistry, vol. 32, no. 2, pp. 104–115, 1990.
7. W. A. Castelli, C. F. Nasjleti, R. Diaz-Perez, and R. G. Caffesse, "Cheek mucosa response to silk, cotton, and nylon suture materials," Oral Surgery Oral Medicine and Oral Pathology, vol. 45, no. 2, pp. 186–189, 1978.
8. G. E. Lilly, J. L. Cutcher, J. C. Jones, and J. H. Armstrong, "Reaction of oral tissues to suture materials. IV," Oral Surgery, Oral Medicine, Oral Pathology, vol. 33, no. 1, pp. 152–157, 1972.
9. R. S. Abi Rached, B. E. de Toledo, T. Okamoto et al., "Reaction of the human gingival tissue to different

suture materials used in periodontal surgery," Brazilian Dental Journal, vol. 2, no. 2, pp. 103–113, 1992.

10. Landry RG, Turnbull RS, Howley T (1988) Effectiveness of benzydamyne HCl in the treatment of periodontal post-surgical patients. Res Clin Forums 10:105–118
11. S. D. Macht and T. J. Krizek, "Sutures and suturing: current concepts," Journal of Oral Surgery, vol. 36, no. 9, pp. 710–712, 1978.
12. N. Yilmaz, S. Inal, M. Muğlali, T. Güvenç, and B. Baş, "Effects of polyglecaprone 25, silk and catgut suture materials on oral mucosa wound healing in diabetic rats: an evaluation of nitric oxide dynamics," Medicina Oral, Patologia Oral y Cirugia Bucal, vol. 15, no. 3, pp. e526–e530, 2010.
13. S. Katz, M. Izhar, and D. Mirelman, "Bacterial adherence to surgical sutures. A possible factor in suture induced infection," Annals of Surgery, vol. 194, no. 1, pp. 35–41, 1981.
14. Asher R, Chacartchi T, Tandlich M, Shapira L, Polak D (2018) Microbial accumulation on different suture materials following oral surgery: a randomized controlled study. Clin Oral Investig 23:1–7. https://doi.org/10.1007/s00784-018-2476-0
15. James RC, MacLEOD CJ (1961) Induction of Staphyloccocal infections in mice with small Inocula introduced on sutures. Br J Exp Pathol 42(3):266–277
16. Monaco G, Cecchini S, Gatto MR, Pelliccioni GA (2016) Delayed onset infections after lower third molar germectomy could be related to the space distal to the second molar. Int J Oral Maxillofac Surg 46(3):6–11. https://doi.org/10.1016/j.ijom.2016.09.011
17. Abi Rached RS, de Toledo BE, Okamoto T, Marcantonio Júnior E, Sampaio JE, Orrico SR et al (1992) Reaction of the human gingival tissue to different suture materials used in periodontal surgery. Braz Dent J 2(2):103–113
18. Goel A (2016) Surgical sutures - a review. Delhi J Ophthalmol (26): 159–162. https://doi.org/10.7869/djo.161
19. Selvig KA, Torabinejad M (1996) Wound healing after mucoperiosteal surgery in the cat. J Endod 22(10):507–515. https://doi.org/10.1016/S0099-2399(96)80008-2 [ISBN: 0099–2399]
20. Hochberg J, Meyer KM, Marion MD (2009) Suture choice a nd other methods of skin closure. Surg Clin NA 89(3):627–641. https://doi.org/10.1016/j.suc.2009.03.001
21. Homsy CA, Fissette J, Watkins WS 3rd, Williams HO, Freeman BS (1969) Surgical suture-porcine subcuticular tissue interaction. J Biomed Mater Res 3(2):383–402. https://doi.org/10.1002/jbm.820030216