Comparison of bacterial colonies adherence on silk and catgut sutures in odontectomy patient at Dr. Pirngadi Hospital

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Abstract

Objective: To compare the different amount of bacterial colonies adhered on silk and catgut sutures in odontectomy patient at Dr. Pirngadi Hospital from May to July 2018.

Material and Methods: This is laboratory experimental study with a "post-test only control group" design which means the threads that have been remove on 7th day postoperative and would be transferred to Microbiology Laboratory, Faculty of Mathematic and Science, Universitas Sumatera Utara. Bacterial colony counter were used to count the amount of bacteria colony on a petri dish containing PCA medium after the colonization

was diluted to 10^{-7} mL. The number of patients studied were 26 people, therefore 13 people used silk sutures and 13 people used catgut sutures.

Results: Statistically analyzed using Mann-Whitney Test. There was no significant difference ($p > 0.05$) between the amount of bacterial colonies adherence on silk and catgut sutures. The mean bacterial colony on silk sutures are $207.38 \pm 173.605 \times 10^7$ CFU/mL, meanwhile on catgut sutures are $115.15 \pm 158.905 \times 10^7$ CFU/mL.

Conclusion: Catgut suture could minimize bacterial colonization better than silk suture.

Keyword: Bacterial colonization, Odontectomy, Oral bacteria, Surgical suture materials

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Introduction

The Surgical extraction of impacted third molar (I3M) still remains one of the most commonly performed surgical procedure in Oral Surgery.¹ However, surgical extraction of impacted third molar, commonly known as odontectomy, also has its risk of complications. Surgical Site Infection (SSI) is among the postoperative local complication that may arise in this surgical procedure.¹ The incidence of infection after third molar surgery is 1-5%.^{1,2} Implantation of foreign materials, including sutures, increasing risk of SSI.^{1,2} Despite of the low incidence of SSI after extraction of impacted third molar, oral cavity is highly contaminated area.¹

The implantation of suture is the final procedure of odontectomy.³ Suture plays an important role in wound healing after surgical intervention, allowing reapproximation of tissues separated by surgical or accidental trauma, the promotion of primary healing and the control of hemorrhage; therefore, suture must be selected carefully.⁴ In particular, sutures used in oral and maxillofacial surgery behave differently from those used in other parts of body because of the quality of body tissue involved, the constant presence of saliva, the high vascularization and functions related to speech, mastication and swallowing.⁴ Suture used in oral cavity,

however, become rapidly covered by dental plaque or biofilm, providing reservoir for pathogens that may cause inflammation of neighboring tissue.^{2,4} Intraoral sutures are bathed continuously in saliva and therefore exposed to approximately 7.5×10^8 microorganism/mL and a minimal number of contaminating bacteria (10^9) was necessary to elicit significant wound infection in absence of suture.^{5,6} Biofilm around sutures may protect microorganism from host defence mechanisms and their susceptibility to antibiotic and other antimicrobial is low.^{2,7}

Silk suture is one of the most commonly use surgical suture in Oral Surgery because of its superior physical characteristics and performance. The problem with silk suture is the acute inflammatory reaction by this material (protein and extraneous materials); host reactions lead to encapsulation by fibrous connective tissue.⁴ In fact, suture placed in gingival and oral mucosa may produce a prolonged tissue reaction which is caused by the continual influx of microbial contamination along the suture channel. An in vitro study that was performed by de Castro et al.⁸ of adherence of fusobacterium nucleatum and prevotella intermedium on silk, nylon, polyglactin 910 and Triclosan coated polyglactin 910 show that silk had the highest bacteria adherence with total of $1.9 \times 10^5 \pm 0.07 \times 10^5$.

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Alternatively, the most commonly used and affordable suture in Indonesia is catgut suture. In a contrast, catgut is a natural, monofilament and absorbable suture made of collagen that have been extracted from cow's serous or sheep's colon sub-mucous.³ Silk and chromic gut showed that bacterial invasion of the suture track was a common outcome regardless of the material used, but it was particularly prominent for silk sutures.⁹ However there are no further recent study for bacterial adherence on catgut suture in odontectomy patient. The present study aimed to compare bacterial adherence on silk and catgut suture in odontectomy patient at General Hospital Dr. Pirngadi from May to July 2018.

Material and Methods

Patients that have been performed odontectomy were asked to come on the 7th day postoperative for removal of implanted suture. The suture was collected in a vial tube containing 10 mL of Natrium Chloride 0.9%. The samples were transferred to Microbiology Laboratory at Faculty of Mathematics and Science, Universitas Sumatera Utara. The Sample processed by diluting the sample into 10^4 - 10^8 dilution and each sample plated into PCA using pour plating technique. The plate then was covered by plastic wrap and incubated into incubator for 1 day at 37°C . The colony formed on the plate was then counted on a bacteria colony counter. Subjects included in this study were patients that had been performed odontectomy from 17 to 59 years old and without systemic diseases at General Hospital Dr. Pirngadi from May to July 2018. The number of patients studied were 30 people in which 15 people used 3/0 suture silk and 15 people used 3/0 catgut suture. Every patient was given an informed consent about the research procedures, received instructions on maintaining oral hygiene by using toothbrush and sodium monofluorophosphate contained toothpaste, prohibited to use mouthwash and was asked about the willingness to participate in this study. Post medication that has been given by operators including levofloxacin, metronidazole, and mefenamic acid. Study was conducted after obtaining Ethical Clearance No: 280/TGL/KEPKFKUSU-RSUPHAM/2018 from Health Research Ethical Committee, Faculty of Medicine, Universitas Sumatera Utara.

All results are checked to ensure the assessment matches the data and criteria used. The end result of each inspection is calculated manually and the data is computerized. However, in this study shows that the number of bacterial adherences on silk and catgut suture in 10^8 dilution did not

meet the criteria bacteria colony counting and so the result that being analyzed statistically is 10^7 dilution. In the Shapiro-Wilk test, it was found that the data in this study were not normally distributed. Thus, the data will be analyzed using the Mann-Whitney test.

Results

Figure 1 the result of normality and homogeneity test of the bacterial adherence on suture silk and catgut suture in 10^7 dilution using Shapiro-Wilk test shows the p-value of bacteria adhered on silk sutures in 10^7 dilution are $p=0.07$ ($p>0.05$) figure 2, meanwhile on catgut sutures are $p=0.01$ ($p<0.05$). Therefore, in can be conclude that bacteria adherence on silk sutures are normally distributed, however on catgut sutures are not normally distributed. Furthermore, the data on this study are not normal table 1.

Figure 3 and figure 4 based on 10^7 dilution results, it was found that the mean score bacterial adherence on the samples using silk was $207.38 \pm 173.605 \times 10^7$ and the mean score of bacterial adherences on the samples using catgut $115.15 \pm 158.905 \times 10^7$ with a p-value of 0.186. Thus, it can be concluded that there is no significant difference between bacterial adherence on silk suture and catgut suture in 10^7 dilution in odontectomy table 2.

Discussion

There are many types of sutures available, and they are segregated depending on material which could be graded based on its composition, structure and degradation. These materials are graded based on different tissue responses as a result of their degradation by hydrolysis. The rate of hydrolysis depends on variables such as pH and temperature of the tissue. Monofilament sutures are associated with a lower tissue abrasion and reduces the risk of infection compared to braided suture materials. There is a lower risk of colonization by microorganisms and the sutures are easier to tie; however, their cut ends can irritate the tissue and mucosa and can cause ulceration. Multifilament's are easy to handle and tie because they have less stiffness and are easier to form a knot; however, their braided structure often facilitates the accumulation of debris or bacteria.⁶

Bacterial adhesion on surfaces is a multifactorial process. Bacteria possess many adhesion molecules, which differ among species and between gram-positive and gram-negative bacteria. These molecules enable bacteria to bind to different extracellular matrix

Table 1 Normality and homogeneity test

Suture type	Shapiro-Wilk significance	Levene Statistic Significance
Silk	0.07	0.215
Catgut	0.01	

Table 2 The mean of each type of suture and significance value

Type of suture	Mean±SD	N	%	P-value
Silk	207.38±173.605	13	100	0.186*
Catgut	115.15 ±158.905	13	100

Figure 1 An Individual result comparison of bacteria colonies adhesion count in silk suture vs. catgut suture after 10⁷ dilution **Figure 2** Mean bacterial count of silk and catgut suture after 10⁷ dilution

protein and on foreign-body materials, such as sutures, are coated shortly after they are introduced into the human body. The microbial characteristics therefore, depend in the first instance on its affinity for such proteins. Concerning direct binding of bacteria to surfaces, interspecies comparison showed that pathogens tend to be hydrophobic and that their hydrophobic properties decide whether bacteria preferably bind to hydrophobic or to hydrophilic surfaces. Surface roughness and capillarity also influence adhesion of bacteria.¹⁰

Wetting fluids rising in a narrow tube if immersed is a phenomenon called “capillary ascension” that is the consequence of which is a molecular activity (adhesive and cohesive force) between adjacent bodies. Multifilament sutures have narrow tubular inner spaces that can transport fluids (driven by capillary action) as in a wick. This means that monofilament sutures are not capable of absorbing and transporting fluids by capillary action. However, as a second factor, swelling has to be considered as well. This term describes the ability of suture to absorb fluids because of chemical characteristic of filament body and can also be observed in monofilament sutures. The fluid uptake of the multifilament sutures results from both actions. There have been attempts to reduce capillarity by coating and jacketing or polishing, as in former times. This feature should be examined/viewed carefully/taken into consideration as it has potential to cause the suture to be contaminated by microorganisms, in which the consequences are wound-healing disturbances and suture fistulas. For example, bacterial contamination of silk sutures result in abscess with conglomeration of inflammatory cells around suture. If there are virulent bacteria inside the suture, suture-induced-abscesses can occur even years after surgery.¹¹

From histologic investigations of contaminated sutures, it is known that interstices can be penetrated by bacteria, which then are protected against immunologic defenses of the body. The potential for bacterial transport via multifilaments both in vitro, using two chambers connected by a tube containing the suture, and in vivo. Monofilaments sutures were unable to support such movement. Only nonmotile bacteria and no absorbable synthetic sutures were examined in that study. Which compared multifilament absorbable PGA sutures those of with silk, catgut, and steel, the monofilament structures of steel and catgut showed no bacterial transport, whereas silk and PGA sutures did. Other studies on modern, absorbable synthetic sutures had opposite results, however, and investigators suggested that degradation product inside the suture create

Figure 3 Plating of bacteria colony that adhered to silk suture after 10^7 dilution

Figure 4 Plating of bacteria colony that adhered to catgut suture after 10^7 dilution

an antimicrobial environment that is supposed to prevent bacterial growth and transport.¹¹

Motility of bacteria could also be an important factor to bacteria transport. In study of capillarity action and suture dependent bacterial transport performed by Geiger et al.¹¹ showed that motile bacteria managed to migrate from one chamber to another on a silk suture. This result means that the migration is not attributable primarily to a capillary effect. This finding may be explainable by a special way of braiding non capillary silk, where the fibers run at changing angles but never parallel to the axis of the suture. The path of rising fluids is therefore extended and rendered more impassable, whereas no protection against motile bacteria is offered.¹¹

Some other factor that could have affected the quantity of bacterial adhesion in sutures are related to oral hygiene. It has been known that some patients have problems in maintaining adequate oral

hygiene. It has been known that some patients have problems in maintaining adequate oral hygiene because of the limitation in opening the mouth, pain and swelling on the surgical site a few days postoperatively. These factors/problems cause patients to hesitate to brush their teeth especially at the surgical site/area.

Conclusion

Based on the results and data analysis, it can be concluded that the usage of catgut sutures in odontectomy can minimize incidence of surgical site infection. It is shown by the number of bacteria colonies adherence on catgut is less than on silk sutures. However, the superiority of silk's physical properties including flexibility, the ease to knot and knot's security might be a disadvantage for catgut suture. Catgut suture has a rigid nature which could irritate patient's mucosa especially on its cut end may give discomfort for patient. However, in microbiological stand point catgut sutures could give a better result rather than silk sutures although it wasn't significant.

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Conflict of Interest

The authors report no conflict of interest.

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