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Bacterial Colonization of Suture Materials in the Oral Cavity

Kolonizacja nici chirurgicznych przez bakterie w jamie ustnej

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Abstract

Background. There are some potential risk factors of wound infection in oral cavity surgery related to the type of a suture material.
Objectives. The identification of micro-organisms present on two different suture materials commonly used in oral surgery and their susceptibility to microbial colonization.
Material and Methods. Material collected from 25 patients appearing for dentoalveolar surgical procedures, was divided into two groups. The first group included 12 patients and the second 13 patients. In the first group, the material used was a multifilament absorbable suture, used in standard surgical procedures and swabs taken from oral vestibule. In the second group absorbable multifilament thread and non-absorbable monofilament sutured were used simultaneously to the same wound. Suture materials were excised 7 days after surgery and placed onto transport medium plates. They were inoculated 3–4 hours after collection.
Results. Identification of microbes was carried out with commercially available tests: API 32 Strep., API 20A, ID 32GN, ID 32 Staph (bioMerieux). There was no significant difference in susceptibility for microbials between both groups. Prevailing bacteria isolated from both groups were oral cavity streptococci identified as *Streptococcus oralis/Streptococcus anginosus* group.
Conclusions. In the absence of proof for differences of colonization between mono- and multifilament suture, our method of choice for suture material selection should be its convenience for a surgeon, rather than its ability for bacterial adherence (**Dent. Med. Probl. 2011, 48, 1, 19–22**).

Key words: suture material, monofilament, multifilament, absorbable, non-absorbable, bacterial colonization.

Streszczenie

Wprowadzenie. Istnieją potencjalne czynniki ryzyka zainfekowania rany chirurgicznej w jamie ustnej związane z zastosowaniem różnych rodzajów nici chirurgicznych.
Cel pracy. Identyfikacja mikroorganizmów obecnych na dwóch różnych typach nici chirurgicznych powszechnie stosowanych w chirurgii stomatologicznej i ich podatność na kolonizację przez bakterie.
Materiał i metody. Materiał badawczy stanowiły próbki pobrane od 25 pacjentów, którzy przechodzili zabiegi w obrębie wyrostków zębodołowych jamy ustnej. Ze względu na zastosowane procedury i użyty materiał szewny wyodrębniono 2 grupy pacjentów. W pierwszej, trzynastoosobowej grupie pacjentów materiałem były plecione nici stosowane w standardowych procedurach chirurgii jamy ustnej i wymaz z przedsionka jamy ustnej. W drugiej grupie obejmującej dwunastu pacjentów do zaopatrzenia tej samej rany stosowano jednocześnie plecioną, resorbowalną nić oraz nieresorbowalny monofilament. Szwy usuwano 7 dni po zabiegu i przenoszono na podłoża transportowe. Posiew wykonywano po 3–4 godz. od pobrania. Identyfikację drobnoustrojów izolowanych z materiału przeprowadzono za pomocą testów komercyjnych API 32 Strep., API 20A, ID 32GN oraz ID 32 Staph (bioMerieux).
Wyniki. Nie stwierdzono istotnych różnic w podatności na kolonizację mikrobiologiczną między ocenianymi rodzajami nici chirurgicznych.
Wnioski. Brak różnic w kolonizacji nici chirurgicznych jednowłókienkowej i plecionej pozwala stwierdzić, że podstawowym parametrem przy wyborze materiału szewnego w dalszym ciągu pozostaje subiektywna ocena chirurga, a nie podatność na wzrost kolonii bakteryjnych (**Dent. Med. Probl. 2011, 48, 1, 19–22**).

Słowa kluczowe: materiał szewny, nić jednowłókienkowa, nić pleciona, resorbowalna, nieresorbowalna, kolonizacja bakteryjna.

There are some potential risk factors of wound infection in oral cavity surgery related to choosing improper suture material. It has been clearly stated in the literature that monofilament sutures are less susceptible for colonization of microbes than multifilaments (polyfilaments, braided). Unfortunately they are not as "handy" for a doctor and less convenient for a patient. They are more difficult to handle because of a lack of intrinsic stretching ability. They have memory which can create slippage and cause knots to untie. In this study we evaluated the genera and amount of bacteria colonizing both sutures. The sutures were taken from the patients of II Maxillo-Facial Surgery Clinic at the Medical University, Warsaw, submitted for oral surgery procedures in 2006. We used multifilament, resorbable material and monofilament, nonabsorbable sutures.

The problem of pathogenic microorganisms' ability for suture material colonization is common in dental and maxillo-facial literature [1–4]. Researches of sutures whith antibacterial properties that can protect the wound have been carried out [1, 4]. The matters under discussion usually refer to general surgery, orthopeadics or plastic surgery. However, we can notify that this underevalued problem exists in oral cavity surgery [2, 3, 5]. Oral cavity provides the ideal environment for many species and genus of microorganisms. Sutures used in oral surgery should avoid or limit bacterial adhesion and proliferation to those parts exposed to oral fluids. We can distinguish various permanent and temporary bacterial flora whose quantity depends on various endogenous and exogenous factors. Bacteria significantly attributable to both oral cavity physiology and pathology include *Streptococcus viridans*, Gram-positive bacillus such as *Actinomyces, Eubacterium, Lactobacillus, Propionibacterium*; Gram-negative *Neisseria* or Gram-negative bacillus *Haemophilus, Actinobacillus, Campylobacter, Prevotella, Porphyromonas*. Fungi can also be reported, most notably *Candida albicans* species. During ones whole life, oral microflora undergoes changes. Bacteria play a significant role in oral cavity inflammations. Within the oral cavity, microflora remains inherently stable, and collects in small reservoirs denoted by the topographical anatomy of the oral cavity. An important factor for infection could be invasive nature of treatment related to oral/maxillo-facial surgery [2, 6]. Wound debridement and suture materials in dental surgery are an unquestionable challenge for operating surgeon. On one hand, good vascularisation of the oral region is conducive to fast healing but on other, the presence of saliva specific bacterial flora and conditions related to speech, mastication and food swallowing demand particular selection of a suture. The problem is made more significant in cases when treating patients with immunological deficiency or susceptibility to endocarditis. Anti-bacterial prophylaxis is mainly carried out perioperatively; however, the incidence of bactereamia occurs during suture removal [2]. Monofilament sutures seem to have less favorable conditions for colonization than multifilament ones; however, its application for oral surgery is limited because of shape memory (leading to irritation of sensitive mucosa), low knot durability and low elasticity.

Natural sutures like silk or catgut are recommended by some surgical book's authors, but these are easily colonized by micro-organisms, or not authorized for use [6, 7].

Material and Methods

The study was carried out on two types of surgical suture: absorbable, multifilament and non-absorbable monofilament: Dexon II® (Sherwood Davis&Geck) and Ethilon® (Ethicon/Johnson & Johnson). Suture size depended on type of the procedure but commonly 4–0 was used.

Material collected from 25 patients, aged 23–45, male and female, appearing for dentoalveolar surgical procedures at 2nd Department of Maxillo-Facial Surgery, was divided into two groups. The first group included 13 patients and the second 12 patients. Informed consent was obtained from each patient and both suture samples and swabs were taken. Pre or post operative antibiotics were not used within both groups of patients. Post operative instructions included cold compress, NSAIDs and chlorhexidine mouth rinse.

First groups material was multifilament absorbable suture used in standard surgical procedures. For comparison the swab was taken from oral vestibule adjacent to the wound. The second group was absorbable multifilament thread and non-absorbable monofilament sutured simultaneously to the same wound. Suture materials were excised 7 days after surgery and placed onto transport medium plates. Each sample 3–4 hours after collection was washed in saline bufer and inoculated onto Columbia agar with 5% sheep blood and incubated in aerobic, anaerobic and increased carbon dioxide atmospheres.

Colonies were isolated and initially identified due to morphological features and Gram method staining. Further identification was carried out with commercial tests API 32 Strep, API 20A, ID32 GN, ID32 Staph (bioMerieux).

Results

Within both groups miscellaneous bacterial flora were reported. Only in one case from the first group we recognized homogenous growth of Gram-negative *Klebsiella pneumoniae* isolated from suture sample. In other materials the presence of 2, 3 or even 4 (in a single case) different microorganisms were observed.

Prevailing bacteria isolated from both groups were oral cavity streptococci identified as *Streptococcus oralis/Streptococcus anginosus* group. They were present in 9 of the 13 samples from first group and in 11 of 12 samples from second group. There was no significant difference between mentioned species in attendance at mono-, multifilament suture and mucosal swabs. In one case such organism was isolated from sample of multifilament thread but not from parallel sample of non-absorbable monofilament. Other sparssely isolated species were *Streptococcus mitis, Streptococcus salivarius, Streptococcus sanguis* and *Streptococcus mutans. Streptococcus mitis* was found in 4 patients belonging to the first group (in 3 cases on suture as well as on swab and at one case on swab only) and at none of patients from second group.

Streptococcus sanguis colonies were recognized on 7 samples, collected from 5 different patients (three patients in first group and two of secound group). Microorganisms like *Streptococcus salivarius*, *Streptococcus mutans* and *Enterococcus faecalis* were isolated from single patients belonging to the second group.

Other like *Aerococcus viridans* was reported on swab taken in group one and on monofilament suture in group two, coagulase-negative staphylococci were present on swab as well as on suture in a group one patient and on multi-filament suture in second group. Presence of *Candida albicans* was confirmed in 4 cases, three of them in the first group – swab and suture, last on multifilament suture in group two.

Anaerobic incubation allowed to isolate *Bacteroides* sp., *Actinomycessp* sp., *Eubacterium* sp., *Prevotella* sp. from both types of sutures. Most of anaerobic species were identified with API20A test as *Actinomyces israelii,* which is one of the naturally found oral cavity flora types. Only in one case *Actinomyces naeslundii* was found. It has been stated in the literature that *Actinomyces viscosus* was most often isolated, however it has not been noted in our findings. Anaerobes were isolated from 15 patients. Within the first group 4 patients: 3 – *Actinomyces israelii* (two on sutures), 1 – *Bacteroides* sp. and 1 – *Prevotella* sp. both on vestibular mucosa and, in the second group – 11 patients as follow: 5 – *Actinomyces israelii*, 1 – *Actinomyces naeslundi*, 2 – *Bacteroides* sp., 1 – *Eubacterium* sp. and 2 – *Prevotella* sp.

Results are also presented in Table 1.

Table 1. Bacterial colonization on suture materials in the oral cavity

Tabela 1. Kolonizacja nici chirurgicznych przez bakterie w jamie ustnej

Microorganism	No of patients (Liczba pacjentów)	Group I (Grupa I) *n* = 13		Group II (*n = 12*)	
		absorbable (resorbowalne)	vestibule swab (wymaz z przedsionka jamy ustnej)	absorbable (resorbowalne)	non-absorbable (nieresorbowalne)
Klebsiella pneumoniae	1	1	–	–	–
Streptococcus orali/ Streptococcus anginosus	20	9	9	11	10
Streptococcus mitis	4	3	4	–	–
Streptococcus sanguis	5	3	2	–	2
Streptococcus salivarius	1	–	–	1	1
Streptococcus mutans	1	–	–	1	1
Enterococcus faecalis	1	–	–	1	1
Aerococcus viridans	2	–	1	–	1
Staphylococcus coagulase-negative	2	1	1	1	1
Candida albicans	4	2	3	1	–
Actinomyces israelii/ (A. naeslundii)	8	2	1	5	5 (1)
Bacteroides spp.	3	–	1	2	2
Eubacterium spp.	1	–	–	–	1
Prevotella spp	3	–	1	2	2

Discussion

According to our achieved results it is difficult to estimate which specific sutures were more susceptible to colonization of microbes because isolated species were present on both mono- and multifilament suture in the same patients. Contact of suture material with oral cavity flora is clearly significant. We noted a small diversity of isolated microorganisms. The most predominant were oral streptococci. Probably, small disparity was related with the post operative instructions included chlorhexidine mouth rinse.

Research into ideal sutures for oral mucosa dressings should not only include its biocompatibility but a serious consideration must be given to its mechanical compliance and behaviour. The suture should be resistant to lengthening and rupture but must be delicate enough to protect and safeguard the mucosa. Ideal material should be bacteriostatic, without adherence propriety to avoid microbe proliferation and wound penetration [3, 8]. Sutures, beside their desirable antibacterial properties have to be neutral for adjacent tissues to allow natural healing process [9, 10]. However we did not observe any differences in the inflammatory reaction of the tissues caused by different types of suture' materials in this study. There was also no significant post operative infections that might have occurred in the studied patients.

In the absence of proof for differences of colonization between mono- and multifilament suture, our method of choice for suture material selection should be its convenience for surgeon, rather than its ability for bacterial adherence. Although confirmed, colonization by pathogens on sutures leads to the recommendation that sutures should be removed as early as possible after the performed surgery, to eliminate or limit the reservoir of oral pathogens. Sutures may be potential risk factors for bacterial penetration and proliferation within the wound. So, research into the ideal suture should always combine good physical attributes with antimicrobial properties. Undoubtedly, more studies should be done to study the sutures effect on post operative infection rate and wound healing.

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