Original Research Paper

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SILK VS ANTIBIOTIC SUTURES IN MINOR ORAL SURGICAL PROCEDURES

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KEYWORDS :

Surgical site infections (SSI) are one of the most common complications throughout all the surgical procedures. SSIs are estimated to account 5% of all the surgical complications and 20% of all healthcare associated infections[4]. SSIs are estimated to range from 0.8 to 10.1% in minor oral surgical procedures[2]. Surgical extraction of third molars, alveoloplasty, vestibuloplasty, placement of dental implants and procedures involving incision followed by primary wound closure are various minor oral surgical procedures. SSIs after placement of dental implants and surgical extraction of third molars range from 1.6 to 11.5%[6] and 0.5 to 1.8%[5] respectively. Host factors (Intrinsic factors), wound factors and surgery related factors contribute to SSIs, hence they are multifactorial. Sutures used in oral cavity are continuously bathed in saliva containing $7.5*10^8$ microorganisms /ml and acts as a reservoir of microbes at surgical site leading to more risk of infection at the site[2]. It has been hypothesised that number of bacteria to develop SSI is about 100,000 times lower in presence of suture material this is because of the wicking phenomenon exhibited by the suture material[3]. In 2002, US food and drug administration were first to approve the use of Triclosan in coating of suture material [4]. Jonge et.al.[7] found triclosan- coated sutures significantly reduce the incidence of SSIs. There is a very limited literature and substantial evidence regarding the effectiveness of antimicrobial coated sutures. The aim of this article is to compare the antibacterial effect of antimicrobial suture to that of traditional silk suture, analyse the different micro-organisms that are responsible for the cause of SSIs and assess the wound healing.

MATERIALS AND METHOD

Total of 40 patients who reported to department of oral and maxillofacial surgery aged between 18-50 indicated for minor oral surgical procedures (surgical removal of third molars, vestibuloplasty etc.) and Patients who agreed to pursue recommended post-operative instructions and follow up regimen were included in the study. Only healthy patients, non-smokers without systemic and/or oral diseases, were included in the study. Patients were categorised using flip coin method. All the minor oral surgical procedures were performed following surgical protocols under strict aseptic conditions. Amoxicillin-Clavulanic acid 625mg were administered 1hr before the procedure and lignocaine hydrochloride 1:200,000 ADR was used as local anaesthetic. suture materials used in the study were 3-0 silk (natural multifilament non-wax coated) with 3/8th patients circle reverse cutting needle & Vicryl PLUS absorbable 4-0 multifilament copolymer of glicolide and lactide 9:1 with 3/8th circle reverse cutting needle. Patients who received silk 3-0 for primary closure were categorised into control group and patients who received vicryl PLUS 4-0 for primary closure were categorised into test group. Minimum of three sutures were given, with each suture material on the incision line. Follow up was done on day 3 and day 7. On 3rd day of follow up required amount of suture material were collected from one the non-prominent site of the incision in sterile Eppendorf tubes, peptone water was used as the medium and sent for microbial analysis, and colony count is assessed 24hr later. Before the Samples were examined, they were placed in (VORTEX) centrifuge for 60 seconds. On 7th day of follow up remaining suture material was removed, collected and sent for microbial analysis; same procedure of sample testing was followed as done on day 3. In the microbiological analysis identification of bacteria and the colony count of most common gram-positive bacteria and gram-negative bacteria was done. Additionally, to view the structure of suture material and colonization of microorganisms, samples were observed under scanning electron microscope. Erythema and wound healing were assessed using Early Healing Index (EHI), which was developed by Wachtel et al. (2003)[11] on day 1, 3 and day 7.

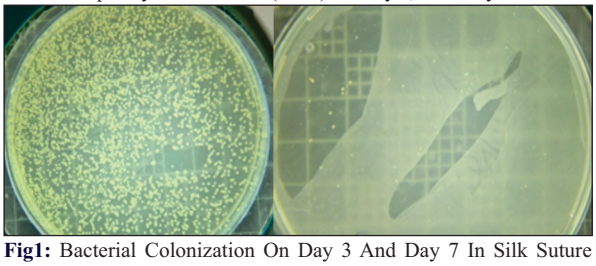

Fig1: Bacterial Colonization On Day 3 And Day 7 In Silk Suture Material

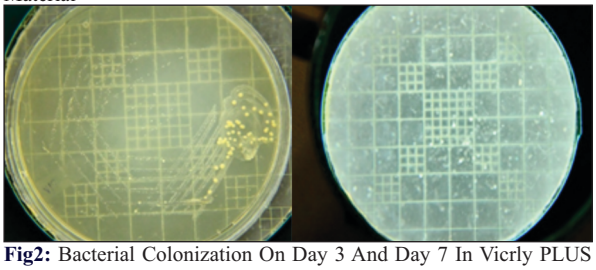

Fig2: Bacterial Colonization On Day 3 And Day 7 In Vicrly PLUS Suture Material

Statistical Analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 21, IBM Inc. Descriptive data was reported for each variable. Summarized data was presented using Tables and Graphs. Data was not normally distributed as tested using the Shaperio-Wilk W test (p-value was less than 0.05) for risk of infection and wound healing score. Mann whitney u test was used, independent t test was used for Colony forming units and chi square test was used for categorical variables. A level of $p<0.05$ was considered statistically significant.

RESULTS

The study sample consisted of 20 men and 20 women, aged between 18 and 35 years, with a mean age of 23.6 years (standard deviation (SD) of 4.77). On Day 3, bacteria were isolated among all 20 (100%) patients for the control group as well as the test group. On Day 7, bacteria were isolated among all 20 (100%) patients in control group, whereas in test group bacteria was isolated only among 9 (45%) patients and among 11 (55%) patients no bacteria were isolated ($p=0.045$). The comparison was done using chi square test, it was found to be significant with maximum patients showing no isolation of bacteria in test group as

compared to control group. The colony count shown in table 1; On day 3, the Mean ± SD, of CFU for control group was 1961.0 ± 531.91 and test group was 2627.0 ± 1857.88 (Fig:3). The comparison was done using independent t - test. It was not found to be statistically significant. On day 7, the Mean ± SD, of CFU for control group was 1369 ± 432.11 and test group was 259 ± 518. The comparison was done using independent t test. It was found to be statistically significant with lower CFU seen in the test group as compared to control group. While considering qualitative analysis (table 2) (fig:4) most frequently isolated gram-positive species include Peptostreptococci spp., Staphylococcus aureus, Streptococcus pyogenes, Streptoccocus agalactiae. Gram negative species included Nisseria, E. coli & veillonella. To be mentioned, on comparison to day 3, day 7 had a very low count of gram-negative bacteria in the control group as well as the test group. In 9 cases (55%) who received antibiotic sutures had no bacteria isolated. With respect to the risk of surgical site infections (table 3), (Fig:5) on day 3, the Mean ± SD, of EHS score for control group was 3 ± 0.0 and test group was 3 ± 0.00 on day 7, the Mean ± SD, of EHS score for control group was 8.42 ± 0.51 and test group was 8.74 ± 0.5. The comparison was done using Mann Whitney u test. It did not show any statistical difference.

Table 1: Comparison of CFU Among Two Groups.

CFU (colony forming units /ml)		
	MEAN	**SD**
DAY 3		
Control Group	1961.00	531.91
Test Group	2627.00	1857.88
P VALUE	0.516, NS	
DAY 7		
Control Group	1369.00	432.11
Test Group	259.00	518.00
P VALUE	0.024*, SIG	

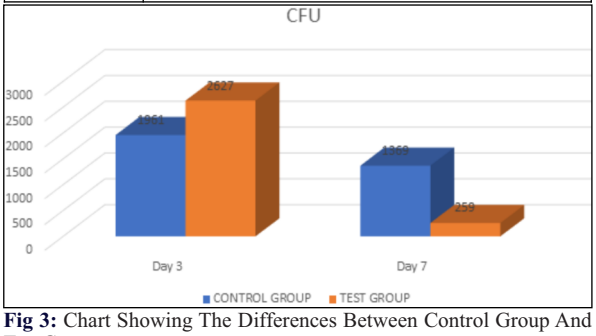

Fig 3: Chart Showing The Differences Between Control Group And Test Group

Table 2: Identification Of Microorganism At Different Follow Up Period For Both The Groups (At Patient Level)

	Day 3		**Day 7**	
Microorganism	**Control**	**Test**	**Control**	**Test**
	(N=20)	**(N=20)**	**(N=20)**	**(N=20)**
E. coli	7	2	4	1
NEISSERIA	8	8	6	4
PEPTOSTREPTOCOCCI	8	14	6	5
PEPTOSTREPTOCOCCUS. SPP.	11	6	13	9
STAPH. AUREUS	15	15	8	8
STREPTOCOCCS PYOGENS	5	5	10	3
STREPTOCOCUS AGALACTIAE	2	3	3	3
VEILLONELLA	6	5	6	2
LACTOBACILLUS SPP	0	1	0	0
STREPTOCOCCI	0	1	0	0
NO BACTERIA ISOLATED	0	0	0	11
E. coli	35	10	20	5
NEISSERIA	40	40	30	20
PEPTOSTREPTOCOCCI	40	70	30	25
PEPTOSTREPTOCOCCUS. SPP.	55	30	65	45
STAPH. AUREUS	75	75	40	40
STREPTOCOCCUS PYOGENES	25	25	50	15
STREPTOCOCCUS AGALACTIAE	10	15	15	15
VEILLONELLA	30	25	30	10
LACTOBACILLUS SPP	0	5	0	0
STREPTOCOCCI	0	5	0	0
NO BACTERIAL ISOLATED	0	0	0	55

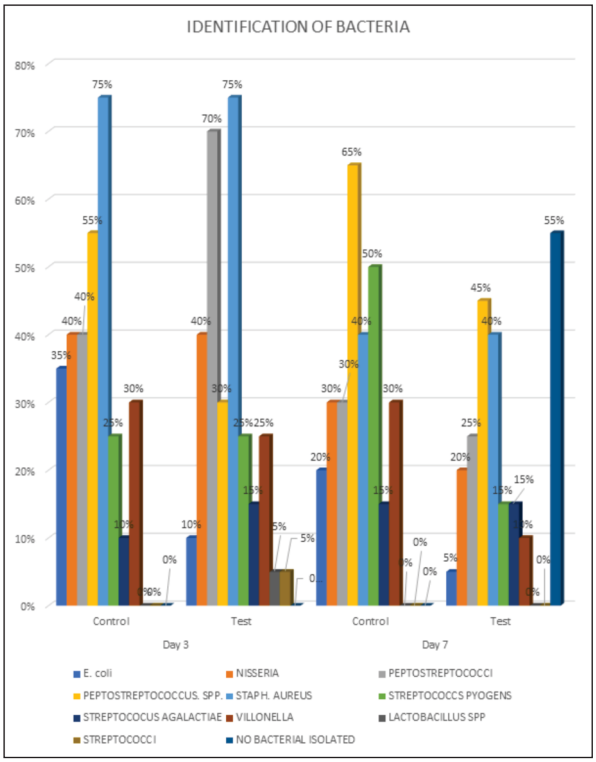

Figure 4: Identification Of Microorganism At Different Follow Up Period For Both The Groups (at Patient Level)

Table 3: Comparison Of Risk Of Surgical Site Infection Among Two Groups.

	EHS SCORE	
	MEAN	**SD**
DAY 3		
CONTROL GROUP	3	0.00
TEST GROUP	3	0.00
P VALUE	1.000	
DAY 7		
CONTROL GROUP	8.42	0.51
TEST GROUP	8.74	0.73
P VALUE	0.246,NS	

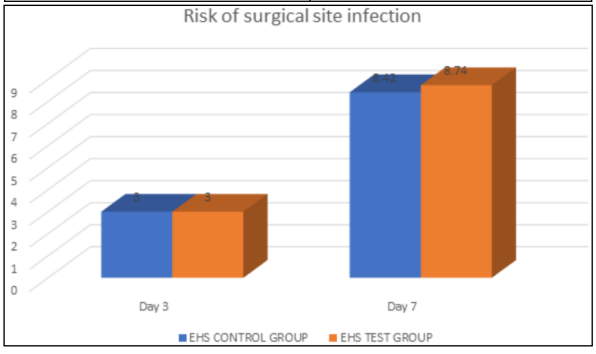

Fig: 5 Chart Showing Risk Of Surgical Site Infection Among Two Groups

DISCUSSION

The anatomical uniqueness of the oral cavity is responsible for differences between oral wounds and those in other parts of human body in terms of propensity to infection occurrence. Surgical site infections are the third most common cause of nosocomial infections. They are most common complication after surgical procedures. About

2/3rd surgical site infections occur along the incision lines. According to the literature, the ability of suture material to induce infection corresponds approximately to the degree of inflammatory reaction caused by sterile suture and risk for surgical site infections increases by three- fold in presence of suture material. According to Elek SD, Conen Pe.et.al; it is estimated that about 100 cfu/ml is enough to initiate a SSI in case of conventional sutures(silk). Singh PK.et.al have explained in their study about the importance of chemical composition of the suture material (triclosan coated). However, Venema et.al.[17] in an invitro study with Vicryl PLUS suture showed that there was no bacterial inhibition around the suture material. In contrast many other studies (13,15,16.) have, tend towards Vicryl PLUS suture material which showed a significant amount of decrease in the bacterial colonization. In our study we have derived from our results that there was a massive difference between the bacterial colonization shown on day 7 between the silk and the antibiotic suture material (Vicryl Plus),. However, there was not much of difference on day 3 between both of them. The scanning electron microscopic view of the suture structure also showed a very less bacterial adhesion around the Vicryl suture. These results which we obtained in our study shows that there was bacterial colonization in both silk and Vicryl PLUS suture material on day 3, but Vicryl PLUS showed significantly less colonization around the suture material on day 7 because, triclosan at lower concentration is a bacteriostatic agent that inhibits the bacterial colonization of many non-sporulating gram -positive and gram negative bacterial species[17]. MIC (Minimum Inhibitory Concentration) is 1.5 µg/cm that acts efficiently against the inhabitant bacteria in the oral cavity[17].

Ming.et.al.[17] in his invitro study showed there was great efficiency shown by the suture material which was coated with triclosan, also it showed a typical zone of inhibition around the bacteria like Staph. aureus. In this present study, The most common bacteria that were identified around the suture material were Staph. aureus, Peptostreptococcus.spp. among the gram positive and Neisseria spp. being the most dominant among the gram negative bacteria. Other bacteria that were identified in trace amounts were streptococci spp., among gram positive bacteria and Veillonella spp. among gram negative bacteria. E.coli. was among the catalase positive and Lactobacillus spp. were catalase negative bacteria those were identified. The Vicryl PLUS suture material yielded the lowest number of gram negative and gram positive bacteria, mainly the difference was observed on day 7 when there were no bacteria were isolated in few cases. However, on day 3 there were high percentage of staph. Aureus (75%), Peptostreptococci spp.(30%) (p value < 0.05).

In case of silk sutures, on day 3 there was a higher amount of staph. aureus, (75%) Peptostreptococci. Spp. (55%)., among the gram positive bacteria and among the gram negative bacteria Neisseria spp. (40%)., E.coli (35%) and Veillonella spp (30%) (p value<0.05)., dominated. On comparison there was a slight decrease in the staph. aureus count (45%) on day 7 with respect to the vicryl PLUS suture material, Ming.et.al investigated the invitro efficacy of antibacterial suture material which showed significant decrease in MARSA (methicillin resistant Staph. aureus) organisms. However, Peptostreptococci spp (65%)., showed no decrease on day 7, Sergi Sala-Pérez Et. al.[1] has shown that this is because of the most common bacterial flora present in oral cavity. Banche G, Roana J. Et.al.[18] have also produced evidence about the common oral microbiota that cannot be completely eliminated by presence of any antibacterial resorts rather can be only controlled in there growth rate. Among the gram negative bacteria we could only find presence of commensals like E.coli (25%).

As far as erythema is concerned there were no cases of erythema observed along the line of incision in either of them. With respect to the post -operative discomfort, On day 7, the Mean ± SD, of WBS score for control group was 1.00 ± 0.00 and test group was 1.05 ± 0.23. which was not that significant on comparing both the suture materials. The result of the present study is in harmony with other authors who are in accordance with antimicrobial suture material that produces less incidence of SSIs. In the current, study effort was made to compare two different type of suture material by quantifying and quantitating the different microbes that were a greater risk to cause SSIs. Also, we investigated the wound healing and erythema around the two suture materials. Although, this study had a good number of samples, it was not possible to investigate various other parameters such as strength of the suture material and tension around the wound or any histopathological features associated with two different suture materials.

CONCLUSION

Based on our results, there were no cases of post-operative infections in the use of either suture materials. Nevertheless, there is a benefit in reducing the risk of SSI in using the antibacterial suture as it reduces the colonization of bacteria as time progresses. However, it would be reasonable to conclude, by saying that a greater number of randomized controlled trails and meta-analysis are required for a better clarity regarding the effectiveness of antimicrobial suture material in reducing the risk of SSIs.

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