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To evaluate the antibacterial efficacy of triclosan coated resorbable suture, chlorhexidine coated resorbable suture and non-coated resorbable sutures in alveoloplasty

Shiv Pratap Singh[1], Ayushi Gour[2], Khushboo Chhabaria Peswani[3], Vineeth Vinayakumar[3*]

Abstract

Background and objectives: Sutures at the surgical site can act as a reservoir for microbes, leading to surgical site infection. This mainly occurs in braided sutures due to wicking action. The study was designed to assess the antibacterial efficacy of resorbable triclosan-coated suture and chlorhexidine-coated suture along with its effect on healing after alveoloplasty procedure in comparison to non-coated sutures.

Patients and methods: 45 patients who went for alveoloplasty procedures have been selected by considering inclusion and exclusion criteria. 3 different wound closing suture material are used each in 15 of them and divided into 3 groups (triclosan coated suture, chlorhexidine coated suture, non-coated suture). Wound healing is evaluated by Early wound healing score index and post-operative pain by Mccaffery and Beebe et al scale at interval of 8th, 15th and 30th day post-operatively.

Result: There has been no statistical difference found in wound healing evaluation and post-operative pain assessment between all 3 groups at 8th, 15th and 30th day post- operative. Aerobic bacteria count at the end of 8th day post-operative was found greater in non-coated suture group then in Triclosan coated suture group and least in Chlorhexidine coated suture group with mean score of 731.60, 436.00 and 171.33 respectively and Anaerobic bacteria counts at the end of 8th day post-operative was also found greater in non-coated suture group then in Triclosan coated suture group and least in Chlorhexidine coated suture group with mean score of 563.53, 353.40 and 53.87 respectively.

Conclusion: Triclosan and chlorhexidine are known antibacterial agents. Local drug delivery in the form of coated sutures can be an effective method to inhibit biofilm formation and decrease the bacterial load at the surgical site as shown in our study, it can be concluded that chlorhexidine coated vicryl suture will be a greater choice of wound closing material.

Keywords: Triclosan coated; Alveoloplasty; Surgical site infections; Chlorhexidine coated; Antibacterial; Wound healing

Introduction

Loosening or absence of teeth in adults, old aged and even young adults are one of the common problems faced in 21st century as a lot of factors mainly 'lifestyle' causes severe dental pathologies which ultimately lead to shedding-off of the teeth or extraction procedure which can be either elective or essential. As this will ultimately need to replacement of the teeth which need flat-bed, increased alveolar bone height and uneventful and even non-

Affiliation:

[1]Department of Oral and Maxillofacial surgery, Ram Krishna Medical College Hospital and Research centre, Bhopal, Madhya Pradesh

[2]Department of Prosthodontics and Crown and Bridge, R.K.D.F. Dental College and Research Centre Bhopal

[3]Department of Oral and Maxillofacial Surgery, RKDF Dental College and Research Centre, Bhopal, Madhya Pradesh, India.

***Corresponding author:**
Vineeth Vinayakumar, Department of Oral and Maxillofacial Surgery, RKDF Dental College and Research Centre, Bhopal, Madhya Pradesh, India.

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pathological bone resorption. Facilitating which needs pre-prosthetic procedures such as alveoloplasties. Alveoloplasties were performed as early as 1853. In this year, A. T. Willard' of Chelsea, Massachusetts wrote for the Dental News Letter of the preparation of the ridge of a patient after he had extracted teeth. This operation was considered at that time and for several years later, heroic treatment. Today, alveoloplasty is no longer considered as such but rather as a necessary treatment in preparing the mouth to receive artificial dentures or to enable the patient to resume normal mastication [1].

But, the success of alveoloplasty procedure is dependent on primary wound closure and absence of bacteria at the healing sites. Sutures are used for flap margin approximation and are left at the surgical sites for at least 5-8 days. However, suture surfaces, especially braided ones, have shown to provide a conductive environment for the growth of microbes at the surgical site. A long-term microbial exposure leads to increased chances of surgical site infections (SSIs) and tissue necrosis [1]. The process of seeding a suture track infection at the time of suture removal is an important risk factor. Recent studies have shown that bacteremia can result from the removal of sutures. Moreover, suture removal-induced bacteremia was described to be a possible cause of endocarditis risk. Odontogenic endocarditis involves intraoral bacteria especially Streptococcus sanguis, Streptococcus oralis, and Streptococcus salivarius and sutures used in oral cavity are continuously bathed in saliva containing 7.5×10^8 microorganisms/ml. [2]. This results in continuous wicking of microorganisms along the suture at the surgical site also, suture track infections can have serious consequences on the tissue integration of alveoloplasty [3].

To counter this, sutures with anti-bacterial activity have been developed to prevent microbial colonization of the suture material in operative incisions. Triclosan [5-chloro-2- (2, 4-dichlorophenoxy) phenol] is a broad-spectrum bacteriocidal agent that has been used for more than 40 years in various products, such as toothpaste and soaps. Higher concentrations of triclosan work as a bacteriocidal by attacking different structures in the bacterial cytoplasm and cell membrane. At lower concentrations, triclosan acts as a bacteriostatic agent and also possess anti-inflammatory property, binding to a product of the Fab I gene called enoyl-acyl reductase and thus inhibiting fatty acid synthesis. Several studies have shown that the use of triclosan-coated sutures leads to a reduction of the number of bacteria in vitro and also reduces the incidence of wound infections in animals or clinical trials [4].

Other antibacterial suture i.e. chlorhexidine coated suture, which is synthetic anti- microbial drug, is also bacteriostatic at lower concentration and bacteriocidal at higher concentration. Sutures coated with chlorhexidine can also be a possible alternative in preventing or reducing the SSI [5].

In this study we sought to compare the efficacy of triclosan coated vicryl suture and chlorhexidine coated vicryl suture in contrast with non-coated vicryl suture by evaluating the microbial adherence by colony forming units at 8th day post-operative, evaluating the post-operative pain 8^{th}, 15^{th} and 30^{th} day post-operatively and by evaluating the early wound healing score 8^{th}, 15^{th} and 30^{th} day post-operatively in 45 patients who went for alveoloplasty procedure.

Aim: To evaluate the antibacterial efficacy of triclosan coated resorbable suture, chlorhexidine coated resorbable suture and non-coated resorbable sutures in alveoloplasty.

Materials and Methods

Inclusion Criteria

- Patient in need of alveoloplasty procedure
- Age 25-70 years and free of any systemic disease such as diabetes and hypertension

Exclusion Criteria

- Patients taken antibiotics in any form in the past 3 months
- Smokers
- Immunocompromised patients
- Pregnant or lactating women
- Any known allergies to chlorhexidine or triclosan

Method

- Prior thorough case history and consent is taken.
- Sample size - 45 patients, who are randomly divided into 3 groups of 15 each.
- After alveoloplasty procedure 3 different types of suture material (Triclosan coated, chlorhexidine coated and non-coated vicryl) will be used for the closure of wound.
- Post operative the suture was removed according to standard procedures under sterile conditions with sterile scissors and tweezers and adhered microorganism isolated.
- The sutures will be immediately transferred into sterile tube containing reduced transport fluid medium.
- Four millimeters of the suture material will be examined.
- Post operative instructions will be given and analgesics (ibuprofen 400 mg TDS for 5 days) will be prescribed.
- Antibiotics will not be prescribed to any of the study patients to determine the effect of the antibacterial coating present on the experimental sutures.
- Warm water rinse instead of antimicrobial mouthwash will be instructed twice daily for 1min, for 30 days to eliminate confounding effect imparted by it.
- All the patients will be recalled on day 8, day 15, and day 30.

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Surgical site infection and healing index by Early wound healing score:

Early wound healing score: The Early wound healing score is composed of 3 parameters: clinical signs of re-epithelization(CSR), clinical signs of haemostasis (CSH), and clinical signs of inflammation (CSI). The early wound healing for ideal wound healing was 10 points [3].

Parameter	Description	Point
CSR	Merged incision margins	6
	Incision margins in contact	3
	Visible distance between incision margins	0
CSH	Absence of fibrin on the incision margins	2
	Presence of fibrin on the incision margins	1
	Bleeding at the incision margins	0
CSI	Absence of redness along the incision length	2
	Redness involving <50% of the incision length	1
	Redness involving >50% of the incision length and/or pronounced swelling	0

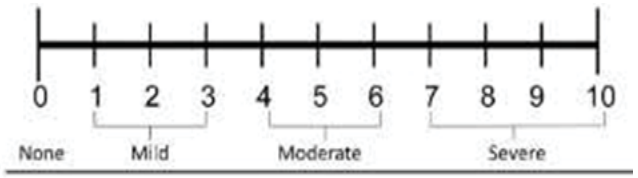
Post-operative pain by Mccaffery and Beebe et al.

General information:

- The patient is asked to make three pain rating, corresponding to current ,best and worst pain experienced over the past 24 hours.
- The average of the 3 ratings was used to represent the patients level of pain over the previous 24 hours.

Patient instructions (adopted from McCaffery, Beebe et al. 1989)

Indicate the intensity of current, best ,and worst pain levels over the past 24 hours on a scale of 0 (no pain) to 10 (worst pain imaginable).



Microbiological assessment by colony forming units, among

Triclosan coated resorbable suture

Chlorhexidine coated resorbable suture

Non coated resorbable suture

Collection of samples - In sterile sample container, media used thioglycolate

Lab-

- Liquid broth –Neutrient broth
- 1 hour incubate at 37°C
- After incubate cultivation process
- In neutrient agar, blood agar , macconkey agar
- Incubate at 37°C for 24 hours
- After incubation – Exmination 1) Physical, 2) Biochemical

Source of data

Sample collection will be carried out from Department Of Oral & Maxillofacial Surgery RKDF Dental College and Research Centre, Bhopal.

Sampling method

- Randomized-control study.
- A total number of 45 cases of alveoloplasty procedure were randomly selected.
- Out of these 15 cases will fall under experimental Group-I (triclosan coated resorbable suture)
- 15 cases will fall under experimental Group-II (chlorhexidine coated resorbable suture)
- Remaining 15 cases will fall under control Group (non coated resorbable suture)
- Duration of study will be 1.5 years.
- The follow-up for assessing post operative pain, incidence of surgical site infection will be done at 8^{th},15^{th} and 30^{th} day post-operatively and microbial assessment by colony forms units to be done for removed sutures.

Figure 1: Pre operative intraoral.

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Figure 2: Alveoplasty and suture placement done.

Figure 3: Post operative intra oral.

Observations and Results

45 patients were included in this study who went for Alveoloplasty procedure under LA were randomly selected for 3 different sutures for wound closure. In 15 patients non-coated vicryl 3-0 sutures were used, in another 15 patients triclosan coated vicryl 3-0 sutures were used and in remaining 15 patients' chlorhexidine coated 3-0 vicryl sutures is used. [table 1].

Table 1: Inter group comparison of early wound healing index at 8th day among the groups.

Group	N	Min	Max	Mean	SD	P value
Group V	15	8.00	10.00	9.00	0.53	1
Group T	15	9.00	9.00	9.00	0.00	NS
Group C	15	9.00	9.00	9.00	0.00	

Statistical Analysis: Kruskal-Wallis Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

Wound healing index were evaluated under parameters such as- (1) Clinical signs of re-epithelizations (2) Clinical signs of hemostasis (3) Clinical signs of inflammation in all 45 patients at 8th day post-operatively and found that out of score 10 mean score in group Vicryl is 9, mean score in group triclosan is 9 and mean score for group Chlorhexidine is 9 and P value is 1.0 which is statistically non-significant (table 2).

Table 2: Inter group comparison of early wound healing index at 8th day between the groups.

Groups	Mean	SD	Mean difference	P value
Group V	9.00	0.53	0.00	1.000
Group T	9.00	0.00		NS
Group V	9.00	0.53	0.00	1.000
Group C	9.00	0.00		NS
Group T	9.00	0.00	0.00	1.000
Group C	9.00	0.00		NS

Statistical Analysis: Mann-Whitney U Test. Statistically significant if P<0.05. S: Significant; NS: Not significant.

Inter-group comparison between group vicryl and group triclosan shows mean difference of 0.00 and in between group vicryl and group chlorhexidine shows mean difference of 0.00 is also non- significant. Thus, there has been no difference in observation found in terms of wound healing index at post-operative day 8th between all 3 groups. At 15th day post-operatively found that mean score in group Vicryl is 9.93, mean score in group triclosan is 9.80 and mean score for group Chlorhexidine is 9.93 and P value is 0.415 which is statistically non-significant. Inter-group comparision between group vicryl and group triclosan shows mean difference of 0.13 and in between group vicryl and group chlorhexidine shows mean difference of 0.00 is also non-significant. Thus, there has been no difference in observation found in terms of wound healing index at post-operative day 15th index between all 3 groups (tables 3 and 4).

Table 3: Inter group comparison of early wound healing index at 15th day among the groups.

Group	N	Min	Max	Mean	SD	P value
Group V	15	9.00	10.00	9.93	0.26	0.415
Group T	15	9.00	10.00	9.80	0.41	
Group C	15	9.00	10.00	9.93	0.26	NS

Statistical Analysis: Mann-Whitney U Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

Citation: Shiv Pratap Singh, Ayushi Gour, Khushboo Chhabaria Peswani, Vineeth Vinayakumar. To evaluate the antibacterial efficacy of triclosan coated resorbable suture, chlorhexidine coated resorbable suture and non-coated resorbable sutures in alveoloplasty. Dental Research and Oral Health. 8 (2025): 12-20.

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Table 4: Inter group comparison of early wound healing index at 15th day between the groups.

Groups	Mean	SD	Mean difference	P value
Group V	9.93	0.26	0.13	0.291
Group T	9.8	0.41		NS
Group V	9.93	0.26	0	1
Group C	9.93	0.26		NS
Group T	9.8	0.41	0.13	0.291
Group C	9.93	0.26		NS

Statistical Analysis: Mann-Whitney U Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

At 30th day post-operatively found that mean score in group Vicryl is 10.00, mean score in group triclosan is 10.00 and mean score for group Chlorhexidine is 10.00 and P value is 1.0 which is statistically non-significant. Inter-group comparision between group vicryl and group triclosan shows mean difference of 0.00 and in between group vicryl and group chlorhexidine shows mean difference of 0.00 is also non-significant. Thus, there has been no difference in observation found in terms of wound healing index at post-operative 8th, 15th and 30th day index between all 3 groups (tables 5 and 6).

Table 5: Inter group comparison of early wound healing index at 30th day among the groups.

Group	N	Min	Max	Mean	SD	P value
Group V	15	10	10	10	0	1
Group T	15	10	10	10	0	NS
Group C	15	10	10	10	0	

Statistical Analysis: Kruskal-Wallis Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

Table 6: Inter group comparison of Early wound healing index at 30th between the groups.

Groups	Mean	SD	Mean difference		P value
Group V	10	0	0		1
Group T	10	0			NS
Group V	10	0		0	1
Group C	10	0			NS
Group T	10	0		0	1
Group C	10	0			NS

Statistical Analysis: Mann-Whitney U Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

Microbiological assessment by colony forming units were assessed at 8th day post- operative with light microscope and mean aerobic count among group Vicryl was found 731.60 which ranges from 610-789 x 10^7 CFU/ml, mean aerobic count among group triclosan was found 436.00 which ranges from 410-778 x 10^7 CFU/ml and, mean aerobic count among group chlorhexidine was found 66.47 which ranges from 44-345 x 10^7 CFU/ml. There was significantly less concentration of aerobic bacteria in group chlorhexidine at 8th day post-operatively. And inter-group comparision between group vicryl and group triclosan shows mean difference of 295.60 which had a significant difference and comparison between group vicryl and triclosan shows mean difference of 560.27 which also had significant difference. Thus, both anti-bacterial sutures proved to minimize the aerobic bacterial count among which chlorhexidine have greater efficacy against aerobic bacteria (tables 7 and 8).

Table 7: Inter-group comparison of 8th day – aerobic among the groups.

	N	Min	Max	Mean	SD	P value
Group V	15	610	789	731.6	48.4	0
Group T	15	410	478	436	18.72	S
Group C	15	44	345	171.33	66.47	

Statistical Analysis: Kruskal-Wallis Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

Table 8: Inter-group comparison of 8th day – aerobic between the groups.

Groups	Mean	SD	Mean difference	P value
Group V	731.6	48.4	295.6	0
Group T	436	18.72		S
Group V	731.6	48.4	560.27	0
Group C	171.33	66.47		S
Group T	436	18.72	264.67	0
Group C	171.33	66.47		S

Statistical Analysis: Mann-Whitney U Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

Mean anaerobic count among group Vicryl was found 563.53 which ranges from 522-596 x 10^7 CFU/ml, mean aerobic count among group triclosan was found 353.40 which ranges from 313-400 x 10^7 CFU/ml and, mean aerobic count among group chlorhexidine was found 53.87 which ranges from 0.00-91.00 x 10^7 CFU/ml. There was significantly less concentration of anaerobic bacteria in group chlorhexidine at 8th day post- operatively. And inter-group comparison between group vicryl and group triclosan shows mean difference of 210.13 which had a significant difference and comparison between group vicryl and triclosan shows mean difference of 509.66 which also had significant difference. Thus, both anti-bacterial sutures proved to minimize the anaerobic bacterial count among which chlorhexidine have greater efficacy against anaerobic bacteria (tables 9 and 10).

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Table 9: Inter-group comparison of 8th day – anaerobic among the groups.

	N	Min	Max	Mean	SD	P value
Group V	15	522	596	563.53	24.25	0.000
Group T	15	313	400	353.4	27.52	
Group C	15	0	91	53.87	26.32	

Statistical Analysis: Kruskal-Wallis Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

Pain was assessed by McCaffery & Beebe pain scale at 8th, 15th and 30th day post- operatively and found that mild pain was seen in all patients in all three groups which ranges from score 1-3 and 8th and 15th day posteratively assessment showed no pain in all the patients in all 3 groups. Thus, no significant difference in term of post-operative pain were seen between all 3 groups (tables 11 and 12).

Table 10: Inter-group comparison of 8th day – anaerobic between the groups.

Groups	Mean	SD	Mean difference	P value
Group V	563.53	24.25	210.13	0
Group T	353.4	27.52		S
Group V	563.53	24.25	509.66	0
Group C	53.87	26.32		S
Group T	353.4	27.52	299.53	0
Group C	53.87	26.32		S

Statistical Analysis: Mann-Whitney U Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

Table 11: Inter-group comparison of pain among the groups.

Duration	Group	Mild pain		No pain		Total		P value
		N	%	N	%	N	%	
8th day	Group V	15	100	0	0	15	100	1
	Group T	15	100	0	0	15	100	
	Group C	15	100	0	0	15	100	NS
15th day	Group V	0	0	15	100	15	100	1
	Group T	0	0	15	100	15	100	
	Group C	0	0	15	100	15	100	NS
30th day	Group V	0	0	15	100	15	100	1
	Group T	0	0	15	100	15	100	
	Group C	0	0	15	100	15	100	NS

Statistical Analysis: Kruskal-Wallis Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

Table 12: Inter-group comparison of pain between the groups.

Duration	Group	P value	Result
8th day	Group V Vs Group T	1	NS
	Group V Vs Group C	1	NS
	Group T Vs Group C	1	NS
15th day	Group V Vs Group T	1	NS
	Group V Vs Group C	1	NS
	Group T Vs Group C	1	NS
30th day	Group V Vs Group T	1	NS
	Group V Vs Group C	1	NS
	Group T Vs Group C	1	NS

Statistical Analysis: Mann-Whitney U Test. Statistically significant if P<0.05. S: Significant; NS: Not significant

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Discussion

Alveoloplasty is a very common procedure done in day to day minor oral- surgical dental setups and a number of choices of wound closing materials are present today. Preference in choosing an intra-oral suture material has been changed with time because of presence of normal micro-floral in oral cavity and continuous exposure to saliva which together can lead to bacteremia. A multi-filamentous silk suture is been a traditional choice of preference for intra-oral wound closure but as it has been known that manipulation of structures in the oral cavity results in release of oral bacteria in to the bloodstream and the process of seeding a suture tract infection at the time of suture removal is an important risk factor [1,3]. Moreover, intra-oral suture removal-induced bacteremia is also described to be a possible endocarditis risk. So preferring a mono-filamentous absorbable suture can be a choice to reduce suture induced bacteremia as eliminating the need of suture removal and less adherence of bacteria on suture [3].

As the absorbable sutures are left in oral cavity for longer duration and a long term microbial exposure leads to increased chance of surgical-site infection and tissue necrosis. The sutures coated with triclosan and chlorhexidine have potential to prevent the growth of potential pathogens present in oral cavity at surgical-site. Triclosan is a broad spectrum bacteriocidal agent, at lower concentration it act as bacteriostatic and at higher concentration it act as bacteriocidal by binding to a product of Fab I gene called enoyl- acyl reductase and thus inhibiting fatty acid synthesis. Chlorhexidine is a synthetic antimicrobial drug, is also bacteriostatic at lower concentration and bacteriocidal at higher concentration. Thus, the use of triclosan coated and chlorhexidine coated suture can be a possible alternative to conventional noncoated suture in preventing and reducing the incidence of surgical site infection [1].

In this study we evaluated the potency of these two antibacterial coated sutures in the terms of incidence of surgical site infection by early wound healing index, post-operative pain by McCaffery and Beebe scale and microbial assessment which has been done by examining specimen under light microscope and results show that there was no statistical difference between healing index and post-operative pain in all the three groups. Thus, none of the cases developed surgical site infection in follow-up period. Though, Kruthi et al reported that healing is slightly better in triclosan coated suture while in comparision to non-coated and similar findings were seen by Chhavi Sharma et al with chlorhexidine coated suture [19,24]. On the other hand Ford et al did not reported any added benefits using antibacterial suture and observed diminished post-operative pain and edema with use of triclosan as compared to non-coated suturers [26]. However, in this current study, the use of antibacterial sutures did not alter any result in pain, healing and surgical site infection.

The absence of bacteria at the surgical site is one of the prime requirements for uneventful healing. Systemic antibiotics are used more commonly to avoid postsurgical infections. The use of antibiotics in immunocompromised patients is often required. However, injudicious use of antibiotics has led to emergence of antibiotic resistance. Moreover, with the use of systemic antibiotics, local concentration of certain drugs fail to reach minimum inhibitory concentration for pathogens, thereby not effectively controlling their growth in oral cavity. Local delivery of antibiotics can be used to overcome these limitations. Antibacterial-coated suture is one of the effective alternatives to obtain a sustained release of antibacterial agent at the surgical site, thereby eliminating the need of systemic antibiotics. In our study, none of the patients reported any swelling or other signs of infections in spite of not receiving any systemic antibiotics. Similarly, observed no postoperative infection in any of the study patients, irrespective of whether they received any prophylactic, therapeutic, or no antibiotic at all [24].

Colony counts of aerobic as well as anaerobic bacteria were least in chlorhexidine coated suture followed by Triclosan coated suture whereas it was highest in Non coated suture, and this difference was significant statistically. Kruthi et al reported that bacterial adherence was more in non coated suture as compared to triclosan coated suture. Non coated suture group showed more of aerobic bacterial adherence whereas anaerobic bacteria were more adhered to coated suture groups [19]. Chhavi Sharma et al revealed that the aerobic bacteria load was higher in chlorhexidine coated suture as compared to non-coated suture whereas the anaerobic bacterial load was more in non-coated suture as compared to chlorhexidine coated suture [24].

In our study, triclosan coated suture group did not show statistically significant reduction in colony forming unit count. This could be due to reduced drug concentration of the antimicrobial agent in the suture. Gram staining revealed the presence of Gram-positive cocci in clusters, Gram-positive and Gram-negative rods, Gram-positive filaments, and Gram-positive chains of cocci. Although specific bacterial species identification was done and based on the morphological characteristics and Gram staining, the colonies observed was staphylococcus species, streptococcus species, Escherichia coli, actinomyces species and peptostreptococcus species.

Triclosan and chlorhexidine are known antibacterial agents. Although, results of Triclosan coated sutures in previous study were significant in clean-contaminated and mixed wounds but few studies suggests that it should be used with caution as it may have negative effect on wound healing but no results are seen of it accumulating in body. The significance of local drug delivery in the form of coated

sutures can be an effective method to decrease the bacterial load at the surgical site as shown in our study, thereby reducing the need to give any systemic antibiotics and eliminating the need of antimicrobial mouthwash post-surgery. However, further studies to evaluate the effect of antibacterial-coated sutures in other intraoral surgeries could be performed. The correlation between the use of such sutures and their effect on bone and soft-tissue loss post-surgery can further be studied.

Conclusion

Triclosan and chlorhexidine are known antibacterial agents. Local drug delivery in the form of coated sutures can be an effective method to inhibit biofilm formation and decrease the bacterial load at the surgical site as shown in our study, thereby reducing the need to give any systemic antibiotics and eliminating the need of antimicrobial mouthwash postsurgery. Moreover, the reduced biofilm formation near the surgical site can also improve the clinical success of any surgery. Thus, after analyzing and evaluating the data, we found that chlorhexidine coated suture works best against anaerobic and aerobic bacteria when compared with triclosan coated and non-coated suture. So, it can be concluded that chlorhexidine coated vicryl suture will be a greater choice of wound closing material in alveoloplasty procedures. Although, its application in other minor and major oral surgical procedure is not well documented in literature. So, more studies should be conducted on larger scale with more diverse case selections to come to a more stronger conclusion for other oral surgical procedures.

Transparency Declaration

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Conflict of Interest

The authors have no conflicts of interest relevant to this article to disclose.

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Author contributions

All authors contributed to analyzing the patient case as well as the authoring and editing of the manuscript.

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