



RESEARCH ARTICLE

COMPARATIVE STUDY BETWEEN THE EFFICACY OF CONVENTIONAL PLAIN VICRYL AND ANTIBACTERIAL VICRYL CONTAINING TRICLOSAN

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Key words:-

Third molar surgery, antibiotic resistance, surgical site infections, conventional plain vicryl, vicryl plus containing triclosan. Abbreviations: SSI: Surgical Site Infection, MRSE: Methicillin Resistant, Staphylococcus epidermidis, MRSA: Methicillin Resistant Staphylococcus aureus, NSAID: Non-steroidal anti-inflammatory drug, IBM: International Business Machines, PMN: Polymorphonuclear Neutrophils, ACP: Acyl Carrier Protein

Abstract

Introduction: Third molar surgeries are the most commonly practiced surgeries in the dental office. The incidence of surgical site infection is still higher in spite of antibiotic prophylaxis owing to the need for the use of alternative measures. Antibacterial sutures are recently being used following third molar surgeries to reduce the incidence of surgical site infections and inflammatory sequels. Objectives: To assess vicryl plus sutures in comparison with conventional plain vicryl in various parameters like swelling, infection, trismus, erythema and pain.

Methods: Total of thirty patients having bilateral impacted mandibular third molars were selected. Plain vicryl was used for primary closure after disimpaction on the former side (Group A) and vicryl plus containing triclosan for the same on the contralateral side (Group B). Swelling, trismus, erythema, infection and pain were compared between the groups consecutively on 3rd, 7th, 15th days and one month. The observations and results were compiled. Results: The study yielded significant statistical results in terms of trismus, pain and erythema although the numerical significance was seen in all parameters.

Conclusion: Vicryl suture containing triclosan was comparatively more effective in reducing the post-surgical sequel after third molar surgery than conventional plain vicryl suture.

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Introduction:-

The surgical removal of impacted third molars represents the keystone of oral and maxillofacial ambulatory procedures. Numerous studies indicate that the incidence of postoperative infections following the surgical removal of third molars ranges from 1 to 5.8%¹

Surgical Site Infection (SSI) is the index of the health care system of any hospital. SSIs are the second most frequently reported health-care-associated infections and lead to significant morbidity and mortality². Globally, surgical site infection rates have been reported in a range from 2.5 to 41.9%³

The most common organisms responsible for SSI include Staphylococcus aureus, Staphylococcus epidermidis, methicillin-resistant S. aureus (MRSA), and methicillin-resistant S. epidermidis (MRSE). Therefore, active inhibition of these organisms at the surgical site may help reduce the overall rate of postoperative infections.⁵

Four classes of wounds with increasing risks of surgical site infections were described as clean, clean-contaminated, contaminated and dirty. In accordance with Peterson's classification of procedures, surgical removal of third molars is considered to be Class II or clean-contaminated type.²

One novel method in the alleviation of infection following a surgery is the use of antibiotics to reduce post-operative complications caused by micro-organisms in the oral cavity. Amidst the wide use of antibiotics, there is also a growing concern about the use of antibiotics during removal of impacted third molars.⁶ Routine antibiotic prophylaxis is unwarranted for routine operations to remove third molars in healthy patients. So, in the recent days indiscriminate use of conventional antibiotics is avoided.

Therefore, to avoid the increased consumption of antibiotics, an alternative was in need of the hour to prevent the incidence of surgical-site infections.

Secondly, suturing is indicated following third molar surgeries. The prime motive of suturing is to promote optimal healing by primary intention. Suturing provides adequate tension of wound closure without dead space but loose enough to obviate tissue ischemia. Furthermore, suturing reduces post-operative bleeding and narrows the extraction socket, which can prevent food from entering into it and protect the blood clots.²¹

Suture material has been recognized as a potential nidus for infection enabling microorganisms to penetrate into deep tissues. It is known that infected sutures induce and maintain an inflammatory reaction, interfering with the normal healing process, potentially resulting in complications.⁶

Sutures coated with an antibacterial agent, can substantially decrease the risk for healthcare-associated infection. One such antibacterial suture available is Vicryl Plus (polyglactin 910 impregnated with triclosan). World Health Organization recommends the use of triclosan-coated sutures for reducing the risk of SSI in their recent guideline, independent of the type of surgery based on moderate level of evidence.⁷

Triclosan (2, 4, 4-trichloro-2-hydroxydiphenyl ether) is a stable, synthetic, polychlorinated, aromatic hydrocarbon with broad, antimicrobial properties. It is lipophilic and active within a broad pH range (optimum pH 4–8) unlike other antiseptics which become inactive at high or low pH.⁴ Polyglactin 910 suture with triclosan has demonstrated antibacterial activity *in vitro* against *S. aureus*, *S. epidermidis*, MRSA and methicillin-resistant *S. epidermidis* (MRSE).⁸ When used in sutures, triclosan shows no generation of microbial resistance to antibiotics nor has been proved to be toxic in a variety of test systems.

Triclosan passively dissipates from implanted sutures to the surrounding tissues where it is absorbed into the bloodstream and widely distributed, but not confined to any particular tissue or organ system.⁴ In this matter of concern triclosan seems to be a safe substance in its use as antibacterial suture material after third molar surgeries.

All these considerations pave way for the advent of antibacterial sutures which can be used post-operatively without the indiscriminate use of antibiotics.

This study focuses on the comparison between the efficacy of conventional plain polyglactin 910 (Vicryl) and antibacterial polyglactin 910 containing triclosan (Vicryl plus).

Inclusion criteria

Patients above 18 years of age with bilateral impacted mandibular third molars with no signs of infection and adequate mouth opening.

Exclusion criteria

1. Patients who have taken drugs that might alter the course of study prior in a span of 2-3 weeks.
2. Patients on any drugs that affect the healing of surgical site. Eg. NSAIDs, steroids and cytotoxic drugs.

Pre-Operative assessment of the patient

The subjects were divided into two groups:

Group A: patients for whom plain vicryl sutures were used for primary closure (former side).

Group B: patients for whom triclosan coated vicryl plus sutures were used for primary closure (contralateral side).

The selection of Group A and Group B was decided by tossing a coin.

Pre-operative measurements which aided in the calculation of swelling and trismus post-operatively were done as follows:

1. Distance between the lower attachment of auricular lobe to the chin medial point and distance between the medial canthus of the eye to the gonial angle was measured.
2. Inter-incisal distance in open-mouth position was measured.

Study design

Disimpaction was performed under local anesthesia and primary closure with plain vicryl was carried out on the control side. Follow-up assessments were conducted on 3rd, 7th, 15th days and 1 month, excluding trismus, which was evaluated until the 15th day. After a minimum of three weeks, disimpaction was performed on the contralateral side with primary closure using vicryl plus. Antibiotics were not prescribed, and any infection detected during follow-up was treated with irrigation and antibiotics.

Postoperative assessment

Pain was scored using numerical pain rating scale (NRS) from 0-10

- absence of pain
- pain value less than or equal to 5
- 2 – pain value more than 5

Erythema was scored as

- absence of any signs of erythema
- presence of erythema or redness around the surgical site
- bleeding from the surgical site
- ulceration of the surgical site

Swelling was scored as

- absence of swelling
- increase in swelling, less than or equal to 10 mm compared to pre-surgery
- increase in swelling, more than 10 mm compared to pre-surgery

Trismus was scored as

- absence of any difference
- decrease in mouth opening, less than or equal to 10 mm compared to pre-surgery
- decrease in mouth opening, more than 10 mm compared to pre-surgery

Infection was scored as

- 0 – absence of infection
- 1 – presence of infection

Observations and results:-

Data was investigated for normality using the **Shapiro-Wilk test and it showed that the data significantly deviate from normal distribution.** Descriptive statistics were derived as mean, standard deviation, minimum, maximum and median values. The scoring between the control and test side on the 3rd day, 7th day, 15th day and 1 month were analysed using Chi-square test. The level of statistical significance was determined at $p < 0.05$.

Swelling and infection were found to be numerically significant and statistically insignificant on all the follow-ups. Trismus and pain were statistically significant on all follow ups till 15th day. Erythema was found to be statistically significant on the 3rd day follow up only.

Trismus Scores	Groups		Total	Chi-square test value	p-value
	Control Side	Test Side			

Trismus at 3 rd day	Absence of any difference in mouth opening	Count	0	12	12	23.027	0.000*
		% within Trismus at 3 rd day	0.0%	100.0%	100.0%		
		% within Groups	0.0%	40.0%	20.0%		
		% of Total	0.0%	20.0%	20.0%		
	Decrease in mouth opening, less than or equal to 10 mm compared to pre-surgery	Count	19	18	37		
		% within Trismus at 3 rd day	51.4%	48.6%	100.0%		
		% within Groups	63.3%	60.0%	61.7%		
		% of Total	31.7%	30.0%	61.7%		
	Decrease in mouth opening more than 10 mm compared to pre-surgery	Count	11	0	11		
		% within Trismus at 3 rd day	100.0%	0.0%	100.0%		
		% within Groups	36.7%	0.0%	18.3%		
		% of Total	18.3%	0.0%	18.3%		
Trismus at 7 th day	Absence of any difference in mouth opening	Count	9	26	35		
		% within Trismus at 7 th day	25.7%	74.3%	100.0%		

Relationship of trismus at various time periods between control and test side

*Statistically Significant ($p < 0.05$)

		% within Groups	30.0%	86.7%	58.3%	19.817	0.000*
		% of Total	15.0%	43.3%	58.3%		
	Decrease in mouth opening, less than or equal to 10 mm compared to pre-surgery	Count	21	4	25		
		% within Trismus at 7 th day	84.0%	16.0%	100.0%		
		% within Groups	70.0%	13.3%	41.7%		
		% of Total	35.0%	6.7%	41.7%		
	Absence of any difference in mouth opening	Count	22	30	52	9.231	0.002*
		% within Trismus at 15 th day	42.3%	57.7%	100.0%		
		% within Groups	73.3%	100.0%	86.7%		
		% of Total	36.7%	50.0%	86.7%		

Trismus at 15th day	Decrease in mouth opening, less than or equal to 10 mm compared to pre-surgery	Count	8	0	8		
		% within Trismus at 15 th day	100.0%	0.0%	100.0%		
		% within Groups	26.7%	0.0%	13.3%		
		% of Total	13.3%	0.0%	13.3%		

Relationship of pain at various time periods between control and test side

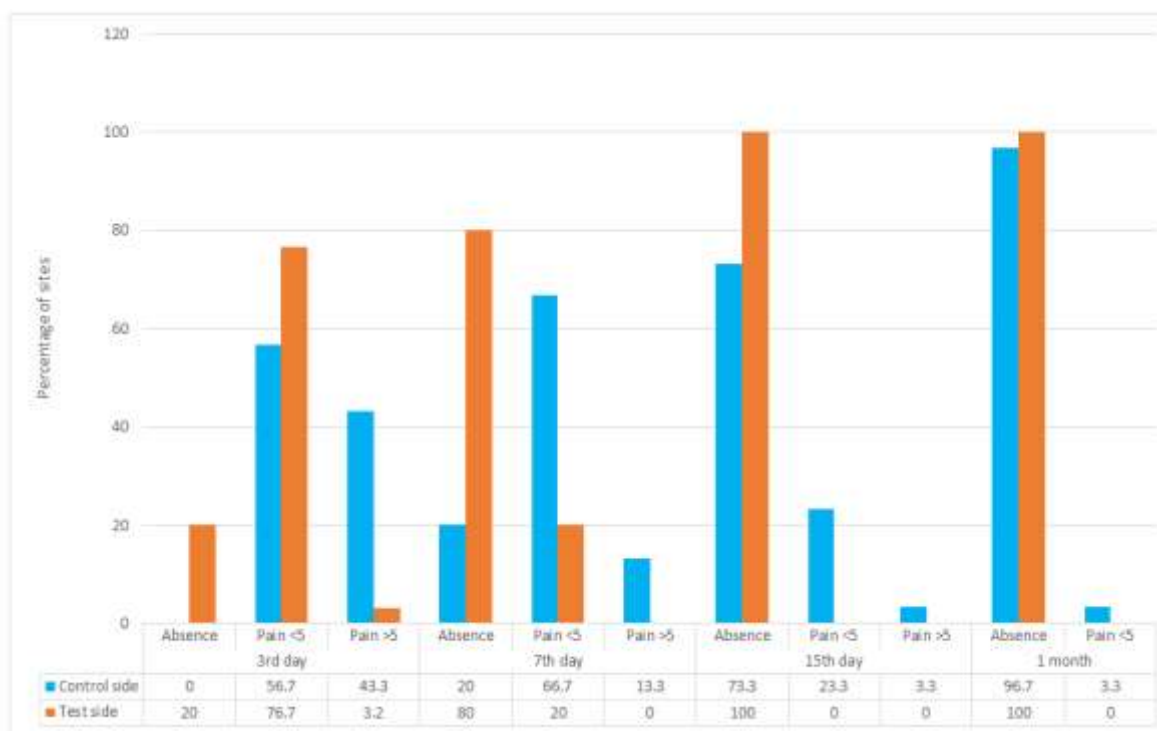
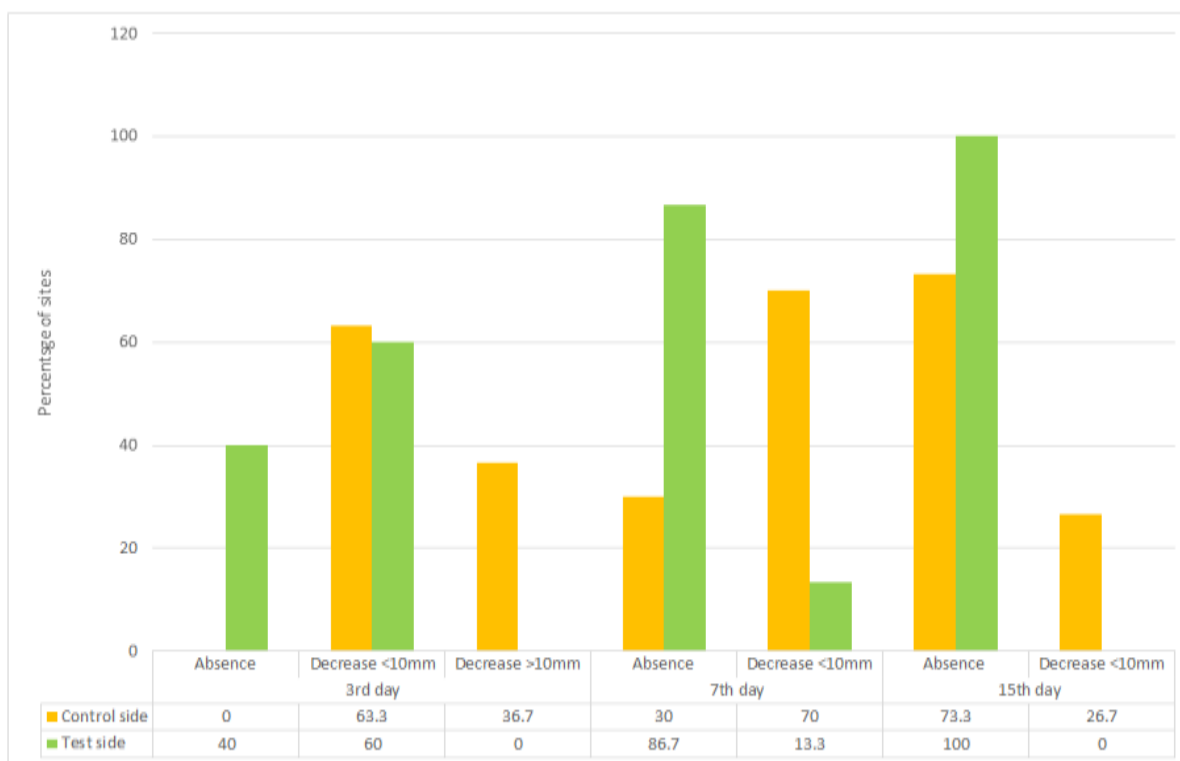
Pain Scores			Groups		Total	Chi-square test value	p-value
			Control Side	Test Side			
Pain at 3 rd day	Absence of pain	Count	0	6	6	17.186	0.000*
		% within Pain at 3 rd day	0.0%	100.0%	100.0%		
		% within Groups	0.0%	20.0%	10.0%		
		% of Total	0.0%	10.0%	10.0%		
	Pain assessment less than or equal to 5	Count	17	23	40		
		% within Pain at 3 rd day	42.5%	57.5%	100.0%		
		% within Groups	56.7%	76.7%	66.7%		
		% of Total	28.3%	38.3%	66.7%		
	Pain assessment greater than 5	Count	13	1	14		
		% within Pain at 3 rd day	92.9%	7.1%	100.0%		
		% within Groups	43.3%	3.3%	23.3%		
		% of Total	21.7%	1.7%	23.3%		
Pain at 7 th day	Absence of pain	Count	6	24	30	22.338	0.000*
		% within Pain at 7 th day	20.0%	80.0%	100.0%		
		% within Groups	20.0%	80.0%	50.0%		
		% of Total	10.0%	40.0%	50.0%		
	Pain assessment less	Count	20	6	26		
		% within Pain at 7 th day					

	than orequalto5		76.9%	23.1%	100.0%		
		% withinGroups	66.7%	20.0%	43.3%		

		%ofTotal	33.3%	10.0%	43.3%		
		Count	4	0	4		
		% withinPain at 7 th day					
			100.0%	0.0%	100.0%		
		% withinGroups	13.3%	0.0%	6.7%		
		%ofTotal	6.7%	0.0%	6.7%		
		Count	22	30	52		
		% withinPain at 15 th day					
			42.3%	57.7%	100.0%		
		% withinGroups	73.3%	100.0%	86.7%		
		%ofTotal	36.7%	50.0%	86.7%		
		Count	7	0	7		
		% withinPain at 15 th day					
			100.0%	0.0%	100.0%		
		% withinGroups	23.3%	0.0%	11.7%		
		%ofTotal	11.7%	0.0%	11.7%		
		Count	1	0	1		
		% withinPain at 15 th day					
			100.0%	0.0%	100.0%		
		% withinGroups	3.3%	0.0%	1.7%		
		%ofTotal	1.7%	0.0%	1.7%		
		Count	29	30	59		
		% withinPain at 1month					
			49.2%	50.8%	100.0%		
		% withinGroups	96.7%	100.0%	98.3%		
		%ofTotal	48.3%	50.0%	98.3%		
		Count	1	0	1		
		% withinPainat1 Month					
			100.0%	0.0%	100.0%		

		% withinGroup s	3.3%	0.0%	1.7%		
		%ofTotal	1.7%	0.0%	1.7%		

*StatisticallySignificant(p<0.05)



Discussion:-

Third molar surgery is one of the most ubiquitous surgical procedures in the field of oral and maxillofacial surgery. One of the most common post-operative complications following third molar surgery is the incidence of surgical site infection. One novel method in the alleviation of infection following third molar surgery is the use of antibiotics which reduces post-operative complications caused by oral microbiota²

But the practice of antibiotic prophylaxis should adhere to the principles delineated by Peterson. Third molar surgery is a clean-contaminated type of surgery and therefore use of routine antibiotic prophylaxis is a controversial topic.²⁰

It is emphasized that indiscriminate use of antibiotics leads to some sort of adverse reactions and development of antibiotic resistance.¹⁵

In a study conducted by **Siddiqui et al. (2009)** he showed that the use of prophylactic antibiotics did not have statistically significant effects on post-operative infections in third molar surgeries. This study was in accordance with the study conducted by **Ataoglu et al. (2008)**, **Poeschle et al. (2003)** and **Sekharet al. (2001)**.

A study was conducted by **Maroofa Hafiz et al. (2017)** in which the effects of vicryl and silk sutures on post-operative sequelae (pain, erythema, trismus, swelling and infection) were compared. This study concluded that vicryl was well-suited for handling and does not allow plaque accumulation with faster healing of wounds whereas the silk suture showed a larger number of PMNs in its vicinity and comparatively slower healing capacity. Similar results were obtained by **Fawad Javed et al. (2012)** and **Harshinee Chandrasekharet al. (2017)**.

All these considerations paved way for the advent of antibacterial sutures (coated with substances like povidone-iodine, chlorhexidine, triclosan etc.) which can be used post-operatively without the indiscriminate use of antibiotics.

In our study, vicryl plus suture (with triclosan) was used in comparison with plain vicryl after third molar surgery on various parameters like swelling, trismus, erythema, pain and infection.

Its mechanism of action is by blocking of lipid synthesis by specifically inhibiting an NADH-dependent enoyl-acyl carrier protein (ACP) reductase or FabI. Triclosan induced K^+ leakage, indicative of membrane damage occurs at bactericidal levels.¹⁷ The amount of triclosan added to suture reaches 1.5 microgram/cm and the range of minimum inhibitory concentration (MIC) against oral microbes is 0.00178 microgram/ml.²² Diffusion pattern of triclosan from sutures was maintained for 21 days.²³

Similar results were obtained in a study conducted by **Shama Mohan et al. (2020)** in which vicryl containing chlorhexidine as an antibacterial substance was used.

The reason for swelling to be insignificant between the test and control groups is likely to be the difficulty index variations for differently impacted teeth. Also swelling post-operatively can be caused by the response of the tissues to manipulation and the trauma caused during surgery as mentioned by **Elitska and Deliverska et al. (2016)** and **Ahmed Khan et al. (2011)**. Also, according to **Elhag et al. (1985)** corticosteroids prescribed to reduce post-operative swelling seems to be ineffective when no antibiotic therapy was associated with it.

Trismus is a normal and expected outcome following third molar surgery. Trismus mainly occurs due to soft tissue retraction during surgery and there is a strong correlation between pain and trismus with pain being the prime reason for trismus according to **Miloro Metal. (2004)**.

Bony impactions increased the probability of trismus by 37.5% according to **Atalay B et al. (2008)**. Pain and trismus were highest on 3rd day which gradually decreased around 7th day. According to a study by **Ayaz H et al. (2012)** 37.7% patients reported pain on 3rd post-operative day and 43.4% patients had no pain on 7th post-operative day.

Secondly, pain is increased in cases of post-surgical infection where the microbial colonization is higher. The usage of antibacterial sutures reduces the formation of microbial biofilm over the suture material. A study conducted by **Sergi Sala-Perez et al. (2015)** concluded that when antibacterial suture (vicryl with triclosan) was used instead of silk for primary closure following third molar surgery, the total colonization rate was 83% and 65% lower than silk suture on 3rd and 7th days post-operatively.

The results obtained in our study on pain were in accordance with **Ford et al. (2005)**, **Sneha Krishnan et al. (2020)** and **Shama Mohan et al. (2020)**.

There were no cases of erythema noted when vicryl plus suture was used. Whereas, when plain vicryl was used, on 3rd post-operative day 10% of population had signs of erythema. This gave a statistically significant result. This is

attributed to the fact that usage of antibacterialsuture resulted in lesser bacterial colonization leading to decreasedlocaltissueinflammationasdiscussedbyObermeieretal. (2018).

Erythemascoresonthe7th daydidnotprovidestatisticallysignificantresultowingtothefactthatthecontrolsidehadjust2casesof erythema reported on the seventh post-operative day. This was inaccordance with the study conducted by Ford et al. (2005) and ShamaMohan et al. (2020).

There was only a total of 4 cases with infection as mentionedwhen plain vicryl was used of which 3 cases were noted on the 3rd post-operative day and 1 case was noted on the 7th post-operative day. The patients who had infection with the presence of purulent dischargewere treated with antibiotics. Infection among the individuals in eithergroup was statistically insignificant in nature owing to the very fewcases reported in these healthy individuals. This result obtained in ourstudywassimilartotheresultsof ShamaMohanetal.(2020).

Summaryandconclusion:-

Fromtheabovecomparativestudy,itshowssignificantdifferences in the diminishment of the symptomatic parameters liketrimus, pain and erythema when vicryl suture containing triclosan wasused. Thoughparameterslikewellingandinfectionwerenon-significant inthisstudyit canbeattributedtothefactthat italsodepends on other contributing factors like the difficulty index associatedwith differently impacted third molars and the need for a larger sample size that can offer substantial results. And the lack of microbiologicalpointofobservationlimitsthisstudy.

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