

Comparing Knotless and Conventional Suture for Wound Closure after Impacted Third Molar Surgery

Dr. Satya Priya Shivakotee,¹ Dr. Sumit Singh,² Dr. Premit Pokharel,³ Dr. Lokesh Verma⁴

^{1,2,4}Department of Oral and Maxillofacial Surgery, Kantipur Dental College and Hospital, Kathmandu, Nepal

³Department of Oral and Maxillofacial Surgery, Nepal Medical College and Hospital, Kathmandu, Nepal

Correspondence:

Dr. Satya Priya Shivakotee. Email: drsatyapriyashivakotee@gmail.com

ABSTRACT

Introduction: Suturing after mandibular third molar surgery presents with difficulties of restricted access, instrumentation, and securing knot. Good suture material and technique can negate complications.

Objective: To compare effectiveness of 3-0 knotless barbed suture (polydioxanone) with 4-0 polyglactin 910 in achieving wound closure after impacted mandibular third molar surgery.

Materials and Method: A non-randomised trial was carried out after ethical clearance from 2022 August to 2022 October in patients requiring surgical horizontal third molar extraction visiting Kantipur Dental College. Wound closure was done using 3-0 knotless suture for study group and 3-0 polyglactin 910 for control group. Clinical parameters measured were: time for wound closure, pain, swelling, wound dehiscence, food lodgement. Data were analysed using SPSS-v.20.

Result: Forty patients (29 males, 11 females) participated in study (mean age of 32.0 years). Mean time for wound approximation was 2.10 minutes and 3.30 minutes for study and control groups respectively ($P < 0.001$). Difference in visual analogue scale score ($P < 0.508$), and swelling ($P < 0.001$) were significant on first post-operative day in study group than control group indicating reduction in pain ($P < 0.001$) and swelling ($P < 0.001$) on seventh post-operative day in study group compared to control group. Wound dehiscence and food lodgement were absent in study group whereas in control group, wound dehiscence was noted in two and food lodgement in six patients on day seven.

Conclusion: Knotless suture is effective alternative to conventional sutures for intraoral wound closure as it reduces suturing time, facilitates effective wound closure and minimises knot-related complications.

Keywords: Food lodgement; knotless barbed suture; pain; polyglactin 910 suture; swelling; wound dehiscence.

INTRODUCTION

Suturing after removal of impacted third molar achieves wound closure and re-approximation of wound edges to facilitate wound healing and haemostasis.¹ Suturing following mandibular third molar surgery presents following difficulties: restricted access, difficulty in instrumentation and securing knot. Conventional suturing places knots to secure suture and maintain adequate tension.² Additionally, knots by themselves present clinical

problems: accumulate food debris and bacteria which may predispose to infection, may loosen or slip over some time leading to wound dehiscence. Knotting process may weaken suture material

Citation

Shivakotee SP, Singh S, Pokharel P, Verma L. Comparing knotless and conventional suture for wound closure after impacted third molar surgery. *J Nepal Dent Assoc.* 2022 Jul-Dec;22(35):84-90.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution CC BY 4.0 Licence.

© 2022 JNDA | Published by Nepal Dental Association

adjacent to knots, leading to its breakage and compromised wound strength.³ Furthermore, knots can result in localised tissue irritation.³ Knots over wound can also cause ischaemia due to additional pressure thus predisposing wound to infection. Further, conventional suturing with knots increases overall operating time.⁴ Good suture material and technique can negate these complications. Knotless barbed suture is particularly designed monofilament suture with barbs along entire length of suture, orientated in opposite direction to the needle.⁵ The retention capacity of the sutures, in the absence of knots, is directly proportional to the number of barbs engaging into tissues.⁶ The aim of this study was therefore to analyse advantages of knotless suture for wound closure after third molar surgery.

MATERIALS AND METHOD

The study was conducted prospectively as a non-randomised clinical trial after institutional ethical clearance from 2022 August to 2022 October comparing 3-0 knotless suture (study group) with 4-0 polyglactin 910 (control group) for wound closure following surgical removal of horizontally impacted mandibular third molars.

The study involved subjects who presented to the department of oral and maxillofacial surgery at Kantipur Dental College and Hospital, Dhapasi, Kathmandu, Nepal for the surgical extraction of impacted mandibular third molars, patients with horizontal impaction was selected for the study based on the preoperative assessment of orthopantomogram. Following formula was used for sample size estimation:¹

$$n = \frac{f(\alpha, \beta) \times 2 \times SD^2}{D^2}$$

(where, standard deviation, SD = 5 and D = 5.16)

$$n = \frac{2 \times 10.5 \times (5)^2}{(5.16)^2}$$

$$= 20 \times 2 = 40 \text{ (20 in each group)}$$

Hence, the total sample size needed was 40. Hence each study group [20 samples x 2 groups = 40 sample.

Patients had the treatment plan explained to them, and signed informed consent was obtained to take part in the study. Patient's age, sex, and medical history of significant relevance were recorded. The inclusion criteria consisted of patients belonging to American Society of Anaesthesiology 1 (ASA). Patients with any pre-existing systemic disease or condition, history of medication with anticoagulants and those with known history of lignocaine allergy were excluded from the study.

Surgical removal of the impacted teeth was performed under local anaesthesia by single surgeon in all the cases. The surgical procedure was standardised as follows; 5% povidone-iodine solution was used for site preparation and 2% lignocaine hydrochloride with 1:80,000 adrenaline bitartrate was administered as inferior alveolar, lingual, and buccal nerve blocks. Conventional Ward's incision was placed to raise a mucoperiosteal flap, anterior incision curves forward from the distobuccal corner of the crown of the lower second molar and it ends alongside the mesiobuccal cusp of that tooth. Incision was then extended distally level with the buccal side of the tooth to the external oblique ridge. Bone removal was done using a surgical drill under cold saline irrigation for surgical exposure, tooth was sectioned at cemento-enamel junction separating crown and roots and delivering crown and root separately.

Haemostasis was achieved and wound closure was performed with 4-0 polyglactin 910 suture (dyed) for the control group and 3-0 knotless suture for the study group respectively. The technique of suturing was simple interrupted sutures for the polyglactin 910 group (Figure 1). For the knotless group, suturing proceeded from the distal end of the wound (second molar) to the proximal end, by utilising a continuous suturing technique. The ends of the suture material were pulled in opposite directions to activate the suture material which helped the barbs to engage the tissue layer firmly and also provided close approximation of the margin. The suture material on either side was cut close to the mucosa without the placement of knots and with no exposure of suture material in the oral cavity (Figure 2).



Figure 1: Wound closure by simple interrupted suture technique.

The parameters assessed were closure time, Visual analogue scale (VAS) for pain score, facial swelling, food lodgement, and wound dehiscence. Time taken for wound closure was assessed from start of suturing till the time of complete flap approximation. The VAS was used to assess pain. The patient was asked to rate the severity of pain from 0 to 10, where 0 indicates no pain, 5 indicates moderate pain, and 10 indicates the worst pain. Facial swelling was measured in millimetres (mm) and recorded. The points A, B, C, D, and E were marked and three reference lines of AC, AD, and BE were drawn using these points. Point A was the most posterior point on the tragus, point B was at the lateral canthus of the eye, point C was the most lateral point on the corner of the mouth, point D was the soft tissue pogonion and point E was the most inferior point on the angle of the mandible. The swelling was measured depending on the difference between the averages of pre and post-operative measurements [(Preoperative AC+AD+BE) – (Post-operative AC+AD+BE)]. Presence of food lodgement and wound dehiscence was assessed by checking the surgical area visually. The patients were checked for all the above-mentioned parameters on first and seventh post-operative days. Same antibiotic and analgesics were prescribed for all the patients for five days. Post-surgical and standard oral hygiene instructions were given.

Normality test results (Kolmogorov-Smirnov test and Shapiro-Wilk test) showed that the samples followed a normal distribution. Independent t-test and Chi-square test were used to compare the mean values between the control and experimental groups.



Figure 2: Wound closure by knotless suture.

The level of significance was fixed as = 0.05 (two-tailed). IBM SPSS Statistics for windows, version 20.0 (IBM Corp., Armonk, N.Y., USA) was used for the data analysis.

RESULT

A total of 40 patients participated in the study (29 males and 11 females) with the mean age of 32.0 years. The mean time taken for achieving wound closure with the knotless suture was 2.10 minutes, whereas in polyglactin 910 suture it was 3.30 minutes (Table 1). Statistically significant reduction in the duration for approximation of wound was showed by study group as compared to the control group ($P < 0.001$).

The VAS score on the first post-operative day in the study group was 8.55 and 8.70 in the control group ($P = 0.508$). On the seventh post-operative day the VAS score was significantly less that is 4.45 in the study group and 5.80 in the control group ($P < 0.001$). Demonstrating significantly less pain in the study group (Table 2).

The swelling score on the day one in the study group was 38.1 mm when compared to control group 40.9 mm ($P < 0.001$) and on day seven, the study group exhibited lesser swelling than the control group (36.5 mm versus 39.5 mm) ($P < 0.001$) (Table 3).

Wound dehiscence and food lodgement were absent in both the groups in the first post-operative day, whereas on the day seven, two patients showed wound dehiscence (Table 4) and six patients showed food lodgement in the control group (Table 5).

Table 1: Distribution of study participants based on mean time taken for suturing.

Group	N	Mean±SD (mins)	P value
Case	20	2.10±0.44	<0.001
Control	20	3.30±0.47	

Table 2 : Distribution of study participants based on mean pain score.

VAS (pain)	Mean±SD (case)	Mean±SD (control)	P value
Day 1	8.55±0.66	8.70±0.73	0.508
Day 7	4.45±0.75	5.80±1.00	<0.001

Independent t-test.

Table 3: Distribution of study participants based on mean swelling.

Swelling	Mean±SD (case) (mm)	Mean±SD (control) (mm)	P value
Post-operative	35.9±1.40	38.5±2.02	<0.001
Day 1	38.1±1.68	40.9±2.03	<0.001
Day 7	36.5±1.39	39.5±1.99	<0.001

Independent t-test.

Table 4: Distribution of study participants based on wound dehiscence.

Wound dehiscence		Case	Control	P value
Day 1	Absent	20 (100)	20 (100)	-
	Present	-	-	
Day 7	Absent	20 (100)	18 (80)	0.147
	Present	-	2 (20)	

Chi-square test.

Table 5: Distribution of study participants based on food lodgment.

Food lodgment		Case	Control	P value
Day 1	Absent	20 (100)	20 (100)	-
	Present	-	-	
Day 7	Absent	20 (100)	14 (70)	<0.001
	Present	-	6 (30)	

Chi-square test.

DISCUSSION

Surgical closure of wounds is a process that has been performed with needle and thread since prehistorical times. Proper wound closure plays a vital role in determining the overall surgical outcome. Suturing is the most common method of intraoral wound closure, which is challenging in many ways such as: restricted access to intraoral anatomical sites especially the retro molar and the palatal area, for instrumentation;⁷ the presence of oral secretions,

food debris and distinct microbial flora which can predispose to wound contamination; the dynamic anatomical structures that stretch the wound margins during vital functions like mastication, speech, and swallowing.⁸ Traditional suturing depends on knots to secure the sutures to the tissues. The placement of knots is also important for providing the necessary strength to hold the wound margins in the approximated position especially during the period of early wound healing.⁹ In general, conventional knot tying sutures require time and training, which

may easily extrude with high infection rate related to knots as knots attract debris.³ Knot slippage at time of approximation of tissues leads to inadequate wound closure, wound dehiscence etc. Knotting also causes reduction in the tensile strength of the classic suture by 35 - 95 % due to structural deformation of the suture material.¹⁰

The use of barbed sutures was first reported by McKenzie in human cadaveric models and animal studies.¹¹ After FDA approval in 2004,¹² barbed sutures have been extensively used in various surgical procedures. The barbs are positioned in opposing directions from the central transition zone. Core diameter of knotless barbed suture is comparatively lesser to polyglactin 910 of same size, even so the diameter is small the tensile strength and mechanical integrity of barbed suture is considerably more efficient than similar sized conventional suture.¹³ The novel barbs on the ligatures make the suture grab the tissue without allowing the suture to slide back, with more than 20 points of fixation per inch of tissue, providing unfluctuating distribution of tension along the wound margins. The time taken for mass absorption is 180-240 days compared with polyglactin 910 sutures which is 56-70 days.¹⁴

In conventional suture placement of knots to achieve a secure closure often consumes an enormous amount of time, especially in regions with restricted access such as the retromolar and palatal region. Knotless suture reduces the suturing time as they omit the need for knot placement. The knotless sutures also simplify the suturing technique in the mandibular angle region which is considered as an area of restricted access for intraoral suturing.¹⁵ Suturing with knotless sutures is less technique sensitive, these sutures greatly improved the surgeon's comfort in tissue approximation. Same has been demonstrated by current study, a statically significant reduction in time taken for wound closure in comparison with a conventional suture.

In traditional suture the knot entraps the food debris leading to microbial colonization, which acts as a nidus of infection causing the surrounding tissue reaction.¹⁶ Lesser incidences of inflammation and irritation to the localised tissue by the virtue of the

knotless nature of barbed sutures provide good wound healing. In current study, no food lodgment was appreciated, whereas six patients in the control group showed food lodgment. Bacterial adherence was seen to be the least with knotless barbed sutures by Fowler et al., who comparatively assessed the bacterial adherence in contaminated wound models between barbed monofilament sutures and conventional braided sutures.¹⁷ Further, the watertight wound closure prevents any seepage of fluids into the wound. The above-mentioned factors may be responsible for the reduced post-operative pain or infection which eventually contributed to better wound healing as exhibited by current study.

Rettenmaier et al. and Seidhoff et al. found lesser wound dehiscence with barbed sutures when compared to conventional sutures in laparoscopic hysterectomy procedures.^{13,15} In current study, no incidence of wound dehiscence was observed in the study group. However, two patient in the control group demonstrated wound dehiscence which was managed by periodic wound irrigation and follow up. The strength of any wound immediately after wound closure determines the incidence of wound dehiscence. Wound strength is further dependent on the strength of the suture material which is indicated by straight-pull strength and knot pull strength.¹⁸ Straight-pull tensile strength represents the force that can break the suture when force is applied parallel to the entire length of the suture while knot-pull tensile strength reflects tissue holding capacity of smooth conventional sutures.¹⁹ However, knot pull tensile strength is not applicable for barbed sutures by virtue of their knotless suturing technique. Current study also demonstrated that the wound apposition in the knotless group of patients was better when compared to the patients in the conventional group. The barbs facilitated even distribution of the forces over larger contact areas along the wound margin which is critical for wound healing.²⁰

Knotless suturing, as observed in current study simplify the suturing technique and reduce the suturing time. It offers patient comfort in terms of reducing tissue reaction, absence of knot leading to lesser knot related complications such as wound dehiscence and infection, maintenance of good oral

hygiene which directly influences wound healing and better approximation of the tissue edged due to deep anchoring of the barbs. In current study, no adverse effects were observed with barbed sutures. The limitation of knotless suture is if the surgical site needs to be revisited for any specific clinical indication, removal of the suture can be traumatic to the tissues because of its firm engagement into the tissues and the cost of the suture material.

CONCLUSION

In the present study, it was found that the barbed suture reduces intraoperative time required for

suturing and simplifies wound closure in areas of restricted access. It facilitates superior wound healing by providing adequate wound strength and preventing complications related to knots. It was more effectiveness in achieving wound closure after impacted mandibular third molar surgery. Hence, knotless suture benefits both surgeon and patients so it can be used as an alternative to conventional suturing.

Conflict of interest: None.



REFERENCES

1. Ramkumar Ceyar KA, Thulasidoss GP, Raja Sethupathy Cheeman S, Sagadevan S, Panneerselvam E, Krishna Kumar Raja VB. Effectiveness of knotless suture as a wound closure agent for impacted third molar - A split mouth randomised controlled clinical trial. *J Craniomaxillofac Surg.* 2020;48(10):1004-8. [[PubMed](#) | [Full Text](#) | [DOI](#)]
2. Oladega AA, James O, Adeyemo WL. Cyanoacrylate tissue adhesive or silk suture for closure of surgical wound following removal of an impacted mandibular third molar: A randomised controlled study. *J Craniomaxillofac Surg.* 2019;47(1):93-8. [[PubMed](#) | [Full Text](#) | [DOI](#)]
3. Miloro, M., Ghali, G., Larsen, P. and Waite, P. Peterson's Principles of Oral and Maxillofacial Surgery. 2nd Edition, BC Decker Inc., Canada;2004. [[Full Text](#)]
4. Selvi F, Cakarer S, Can T, Kirli Topcu Sİ, Palancioglu A, Keskin B, Bilgic B, Yaltirik M, Keskin C. Effects of different suture materials on tissue healing. *J Istanbul Univ Fac Dent.* 2016;50(1):35-42. [[PubMed](#) | [Full Text](#) | [DOI](#)]
5. Paul MD. Bidirectional barbed sutures for wound closure: evolution and applications. *J Am Coll Certif Wound Spec.* 2009;23;1(2):51-7. [[PubMed](#) | [Full Text](#) | [DOI](#)]
6. Rajih E, Meskawi M, Alenizi AM, Zorn KC, Alnazari M, Borhan W, et al. Long-term urinary functional outcome of vesicourethral anastomosis with bidirectional polyglycolic (Monocryl®) vs. barbed polyglyconate suture (V-Loc™ 180) in robot-assisted radical prostatectomy. *Can Urol Assoc J.* 2020;14(3):E74-E79. [[PubMed](#) | [Full Text](#) | [DOI](#)]
7. Kasi Ganesh S, Panneerselvam E, Sharma AK, Raja Vb K. Knotless Suture for Wound Closure in Intraoral Surgery-A Report of 2 Cases. *J Oral Maxillofac Surg.* 2018;76(9):1954.e1-1954.e4. [[PubMed](#) | [Full Text](#) | [DOI](#)]
8. Sharma AK, Thulasi Doss GP, Panneerselvam E, Ganesh SK, Krishna Kumar Raja VB. Use of knotless barbed sutures for closure of intraoral incisions for maxillofacial trauma: A randomised controlled trial. *Br J Oral Maxillofac Surg.* 2021 Feb;59(2):e72-e78. [[PubMed](#) | [Full Text](#) | [DOI](#)]
9. Son D, Harijan A. Overview of surgical scar prevention and management. *J Korean Med Sci.* 2014;29(6):751-7. [[PubMed](#) | [Full Text](#) | [DOI](#)]
10. Greenberg JA, Einarsson JI. The use of bidirectional barbed suture in laparoscopic myomectomy and total laparoscopic hysterectomy. *J Minim Invasive Gynecol.* 2008;15(5):621-3. [[PubMed](#) | [Full Text](#) | [DOI](#)]
11. Warner JP, Gutowski KA. Abdominoplasty with progressive tension closure using a barbed suture technique. *Aesthet Surg J.* 2009;29(3):221-5. [[PubMed](#) | [Full Text](#) | [DOI](#)]
12. Greenberg JA, Clark RM. Advances in suture material for obstetric and gynecologic surgery. *Rev Obstet Gynecol.* 2009;2(3):146-58. [[PubMed](#) | [Full Text](#)]
13. Bautista T, Shabbir A, Rao J, So J, Kono K, Durai P. Enterotomy closure using knotless and barbed suture in laparoscopic upper gastrointestinal surgeries. *Surg Endosc.* 2016;30(4):1699-703. [[PubMed](#) | [Full Text](#) | [DOI](#)]
14. Vicini C, Meccariello G, Cammaroto G, Rashwan M, Montevecchi F. Barbed reposition pharyngoplasty in multilevel robotic surgery for obstructive sleep apnoea. *Acta Otorhinolaryngol Ital.* 2017;37(3):214-7. [[PubMed](#) | [Full Text](#) | [DOI](#)]
15. Gogulanathan M, Elavenil P, Gnanam A, Krishnakumar Raja VB. Evaluation of fibrin sealant as a wound closure agent in mandibular third molar surgery - A prospective, randomised controlled clinical trial. *Int J Oral Maxillofac Surg.* 2015;44(7):871-5. [[PubMed](#) | [Full Text](#) | [DOI](#)]

16. Siedhoff MT, Yunker AC, Steege JF. Decreased incidence of vaginal cuff dehiscence after laparoscopic closure with bidirectional barbed suture. *J Minim Invasive Gynecol.* 2011;18(2):218-23. [[PubMed](#) | [Full Text](#) | [DOI](#)]
17. Fowler JR, Perkins TA, Buttaro BA, et al. Bacteria adhere less to barbed monofilament than braided sutures in a contaminated wound model. *Clin Orthop Relat Res.* 2013;471:665-71. [[PubMed](#) | [Full Text](#) | [DOI](#)]
18. Javed F, Al-Askar M, Almas K, Romanos GE, Al-Hezaimi K. Tissue reactions to various suture materials used in oral surgical interventions. *ISRN Dent.* 2012;2012:762095. [[PubMed](#) | [Full Text](#) | [DOI](#)]
19. Paul MD. Barbed sutures for aesthetic facial plastic surgery: Indications and techniques. *Clin Plast Surg.* 2008;35:451- 61. [[PubMed](#) | [Full Text](#) | [DOI](#)]
20. Paul MD. Barbed sutures in aesthetic plastic surgery: Evolution of thought and process. *Aesthet Surg J.* 2013;33(3):17S-31S. [[PubMed](#) | [Full Text](#) | [DOI](#)]