

Efficacy of Isoamyl 2-Cyanoacrylate Tissue Adhesive and 3-0 Vicryl Rapide Sutures in Impacted Mandibular Third Molar Surgery: A Comparative Study

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ABSTRACT

Aim: The present study was undertaken to compare the efficacy of isoamyl 2-cyanoacrylate tissue adhesive with 3-0 vicryl rapide suture for wound closure after the removal of impacted mandibular third molar.

Materials and methods: In this prospective study done in 2018–2020, sample consisted of 60 patients with unilateral impactions divided in two groups equally. In group I, wound closure was done with tissue adhesive and in group II with 3-0 vicryl rapide suture. Patients were evaluated for pain, swelling and trismus preoperatively, immediate postoperatively, postoperative day 2 and 7. Bleeding was assessed immediate postoperatively, postoperative day 2 and 7. Healing was assessed on postoperative day 2 and 7.

Observations: Statistically significant difference was observed in terms of pain on postoperative day 2 and 7 between both the groups (p value—0.028* and 0.002*). In the immediate postoperative period, there was statistically highly significant difference in bleeding between the two groups (p value—0.000**). Statistically significant difference was also observed in terms of wound healing on postoperative day 2 and 7 (p value—0.011* and 0.024* respectively). Statistically significant difference was observed for time of closure and total number of rescue analgesic taken between two groups (p value—0.000** and 0.000**, respectively).

Conclusion: This study concluded that vicryl rapide suture is an optimal alternative for wound closure after removal of impacted mandibular third molar as compared to tissue adhesive.

Keywords: 3-0 Vicryl rapide suture, Isoamyl 2-cyanoacrylate tissue adhesive, Third molar surgery, Wound closure, Wound healing.

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INTRODUCTION

In the past decade, suturing using conventional sutures had remained the mainstay of wound closure and hemorrhage management in third molar surgery. But it has certain limitations such as requirement of good surgical skills and the need of revisit for suture removal. Therefore, various other materials including tapes, staples, and tissue adhesives have been devised for optimal surgical outcome.¹ Cyanoacrylate glue is the general term for quick bonding super glue which forms a tight chain between two surfaces in the presence of moisture. It gets sloughed from the surface of skin and mucosa within 7–10 days after application.² These are further characterized as methyl, ethyl, butyl, amyl, and octyl cyanoacrylate tissue adhesive depending on the length of carbon chain conjugated to cyanoacrylate group. Heat production during curing and toxicity of adhesive decreases with the elongation of carbon chain in these adhesives.

Isoamyl-2-cyanoacrylate is a nontoxic, biocompatible, hemostatic, and bacteriostatic monomeric component in nature. It is less traumatic, more efficient, precise, and safe,² but cannot be used in cases of inadequate haemostasis and has limited moisture resistance.³

A variety of absorbable sutures either braided or monofilament are used for suturing. These sutures must function and be retained until the wound edges develop sufficient tensile strength to stand alone and finally degrade by hydrolysis, enzymatic digestion, and phagocytosis.

Vicryl rapide is irradiated polyglactin 910 suture and has an initial strength comparable to silk. It loses half its strength in

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1 week and has no perceptible strength after 2 weeks⁴ and may disintegrate within 20 days. It is considered to be useful material both intraorally and extraorally. The present study was undertaken to compare the efficacy of isoamyl 2-cyanoacrylate tissue adhesive with 3-0 vicryl rapide suture for wound closure after the removal of impacted mandibular third molar.

MATERIALS AND METHODS

On the basis of pilot study done on a total of 10 patients, sample size of study was determined as a total of 60 patients with the power of study set as 95%. Sample size was calculated using the formula; $n = 2\{(z_1 - \alpha/2 - z_1 - \beta) \div ES\}^2$. This prospective study was conducted

in our institute from May 2018 to May 2020. Ethical clearance was obtained for conducting the study and a standardized protocol was followed in all the patients. Surgical procedure in both groups was done by single experienced operator whereas preoperative and postoperative evaluation was done by another assessor. The patients were selected and divided into two groups (30 patients each) by stratified randomization based on similarity of age, gender, level, and inclination of impacted mandibular third molar (Table 1).

In group I, isoamyl 2-cyanoacrylate tissue adhesive was used whereas in group II, 3-0 vicryl rapide suture was used. All the patients belonging to ASA class I and aged between 18 and 40 years with healthy dental and periodontal status were included in the study. Patients with systemic diseases and smokers were excluded from the study. IOPA X-rays and panoramic radiographs were taken to assess the level and inclination of third molar. Preoperative examination included (a) facial measurements taken with the help of a tape (in mm). These included: distance from lateral canthus of eye to angle of the mandible, distance from tragus to the outer corner of mouth, and distance from tragus to pogonion; mean of these values was taken as baseline for that side;⁵ (b) maximum interincisal opening (in mm). Informed written consent was obtained from each patient. In every patient, decision of wound closure with particular method (isoamyl 2-cyanoacrylate tissue adhesive or 3-0 vicryl rapide suture) was done by tossing a coin for first impaction followed by alternate use of another method.

The surgery was carried out under strict aseptic conditions and local anesthesia using 2% lignocaine hydrochloride with 1:200,000 adrenaline. All patients rinsed with 0.12% chlorhexidine solution preoperatively. Ward's incision was given and full thickness flap was reflected. After adequate bone removal, the tooth was removed followed by debridement and toileting of the socket. In group I patients, the flap was repositioned and isolated with sterile dry gauze. The first layer of isoamyl 2-cyanoacrylate tissue adhesive [AMCRYLATE, Concord Drugs Limited, India] was put on incision line by droplet method, followed by another layer after 20 seconds (Fig. 1). No pressure gauze was kept over the surgical site. While in the second group of patients ($n = 30$), flap was repositioned and closed with 3-0 vicryl rapide suture [ETHICON NW2732, Johnson & Johnson private limited, Aurangabad, India] in an interrupted fashion (Fig. 2). The patients were given Tab Amoxycillin 500 mg and Clavulanic acid 125 mg TDS for 5 days and Tab Paracetamol 650 mg TDS for 3 days. In case of severe pain, patients were given rescue medication [Tab Ketorolac 10 mg] and total analgesic intake was recorded for 7 postoperative days.

Degree of pain (Table 2)⁶ and bleeding (Table 3)⁶ were graded by patients immediately after surgery, on 2nd and 7th postoperative day according to VAS scale provided. Wound healing was evaluated in each patient on 2nd and 7th postoperative day and scored as 0—no wound breakdown, 1—slight wound breakdown explorable with blunt instrument, 2—moderate wound breakdown with socket exposed, and 3—severe wound breakdown with socket exposed and nonvital bone visible.⁷

The data obtained were subjected to statistical analysis. Detailed descriptive analysis was carried out. For normally distributed data (age), mean \pm SD were compared using "t" test. For skewed data (VAS, maximum interincisal opening, etc.), groups were compared using Chi-square test. Statistical significance was

Table 1: Type and level of mandibular third molar impaction in each group

Type and level of impaction		Mesioangular Groups		Horizontal Groups		Vertical Groups		Distoangular Groups	
Class	Position	I (n)	II (n)	I (n)	II (n)	I (n)	II (n)	I (n)	II (n)
I	A	2	1	0	0	0	1	0	0
	B	2	3	0	0	1	1	0	1
	C	0	0	0	0	0	0	0	0
II	A	5	4	1	1	2	2	2	0
	B	8	8	5	5	1	1	1	2
	C	0	0	0	0	0	0	0	0
III	A	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0

Group I, tissue adhesive group; Group II, vicryl rapide sutures; n, number of patients



Fig. 1: Wound closure with isoamyl 2-cyanoacrylate tissue adhesive



Fig. 2: Wound closure with 3-0 vicryl rapide suture

established at $p < 0.05$. Statistical analysis was conducted using SPSS for windows version 17 (SPSS Inc. Chicago, Illinois, USA).

RESULTS

Of 60 patients selected for the study, 33 were female patients while 27 were male patients with female-to-male ratio as 1.2:1.

Statistical analysis of the mean postoperative VAS pain scores in both the groups showed significant difference on day 2 and 7 (p value = 0.028* and 0.002*) with lower VAS score in group II throughout the follow-up period (Table 4).

Regarding bleeding as evaluated on VAS, there was statistically highly significant difference between the two groups in immediate postoperative period (p value = 0.000**) implying better hemostatic effect of tissue adhesive whereas no significant difference in

bleeding index was found on day 2 and 7 between both groups (Table 4).

Of 30 patients in group I, 6 patients (20%) showed impaired wound healing on 2nd postoperative day and 8 patients (26.7%) on 7th postoperative day as compared to only 1 patient (3.3%) in group II (p value—0.011 and 0.024, respectively).

The mean time for closure of surgical wound in group I was 76.33 ± 25.68 seconds as compared to 229.70 ± 61.37 seconds for group II (p value—0.000**) which showed a highly significant difference statistically.

Regarding mean rescue analgesic consumption, there was highly significant difference between both the groups (p value—0.000**) with the mean of 2.90 tablets consumed by each patient in tissue adhesive group as compared to 0.97 tablets consumed in the suture group.

The difference of both average maximum interincisal opening and facial swelling measurements between two groups on all postoperative days was not significant statistically. One patient of each group had alveolar osteitis which was managed by giving obtundent dressing.

DISCUSSION

Cyanoacrylates were first recognized to have adhesive property in 1959. Cyanoacrylate glue belongs to the family of polymers formed by reversible condensation of formaldehyde with a cyanoacrylate ester. The number of alkyl groups in the side chain of cyanoacrylate can be increased from one (methyl cyanoacrylate), to two (ethyl), to four (butyl), and to five (isoamyl) but usually not more than eight (octyl cyanoacrylate). The main distinguishing feature between the esters is the size of molecule. These long-chain acrylates degrade at a slower rate and permit the degradation products to be more safely metabolized resulting in less intense inflammatory response. They undergo hydrolytic attack of carbon-carbon bond to produce formaldehyde and cyanoacetate.¹ Isoamyl 2-cyanoacrylate is nontoxic, biocompatible, hemostatic, and bacteriostatic in nature. It is less traumatic, more efficient, precise, and safe. It can be used for intraoral wound closure, as an alternative to sutures for gluing the mucoperiosteum to bone.¹

A variety of absorbable and nonabsorbable sutures either braided or monofilament are used for suturing. An ideal suture material should have resistance to traction, dimensional stability,

Table 2: Visual analog scale to evaluate pain

0	No pain	The patient feels well.
1	Slight pain	If the patient is distracted, he/she does not feel the pain.
2	Mild pain	The patient feels the pain even if he/she is concentrating on some activity.
3	Severe pain	The patient is very disturbed but nevertheless can continue with normal activities.
4	Very severe pain	The patient is forced to abandon normal activities.
5	Extremely severe pain	The patient must abandon every type of activity.

Table 3: Visual analog scale to evaluate bleeding

0	No bleeding	The patient does not detect any blood in saliva.
1	Oozing	The patient detects slight blood but it is not very noticeable.
2	Accidental low bleeding	The patient has low bleeding sometimes.
3	Continuous low bleeding	The patient has low bleeding often.
4	Massive bleeding	Continuous high bleeding.

Table 4: Comparison of pain, bleeding and wound healing in both groups

Variables	Follow-up period	Group I (n = 30) (Mean ± SD)	Group II (n = 30) (Mean ± SD)	Mean difference	z value	p value
Pain	Immediate postoperative	0.30 ± 0.59	0.13 ± 0.43	0.17 ± 0.16	1.358	0.175
	Postoperative day 2	1.87 ± 1.01	1.30 ± 0.91	0.57 ± 0.1	2.199	0.028*
	Postoperative day 7	1.63 ± 1.52	0.57 ± 0.77	1.06 ± 0.75	3.034	0.002**
Bleeding	Immediate postoperative	0.23 ± 0.43	1.03 ± 0.18	0.8 ± 0.25	5.464	0.000**
	Postoperative day 2	0.13 ± 0.35	0.03 ± 0.18	0.10 ± 0.17	1.390	0.165
	Postoperative day 7	0.00 ± 0.00	0.03 ± 0.18	0.03 ± 0.18	1.000	0.317
Wound healing	Postoperative day 2	0.27 ± 0.58	0.00 ± 0.00	0.40 ± 0.64	2.557	0.011*
	Postoperative day 7	0.47 ± 0.86	0.07 ± 0.37	0.72 ± 0.42	2.260	0.024*

Group I, tissue adhesive group; Group II, vicryl rapide sutures; n, number of patients; * $p < 0.05$, significant; ** $p < 0.001$, highly significant

absence of memory, knot safety, and flexibility sufficient to avoid damage to oral mucosa. An advantage of absorbable sutures is that they generally do not require removal. However, these materials incite varying degrees of tissue response due to their degradation by hydrolysis, enzymatic digestion, or phagocytosis. The suture must function until the wound edges develop sufficient tensile strength to stand alone. After this period, suture acts as a foreign body and impairs postoperative wound healing. A study done on human attached gingiva showed epithelialization by 72 hours.⁸ McCaul et al.⁹ in their study reported that gut, polyglycolic acid, and polyglactin 910 have median survival times of 4, 15, and 28 days, respectively. In the same study, their preferred time for suture removal had been stated between 5 and 14 days.⁹ On the basis of operator preference, the longevity of gut was considered insufficient and that of polyglycolic acid and polyglactin 910 were considered excessive but vicryl rapide seems to be about right.⁹ Vicryl rapide contributes to faster healing of wounds in humans, with the lower incidence of dehiscence and milder local reactions.⁹

Pain alters the quality of life in the postoperative period after removal of third molar. In the present study, severity of pain was greater in group I as compared to group II with significant statistical difference on postoperative day 2 and 7. As tissue adhesive was not able to maintain the closure of high-tension wounds and got sloughed away leading to wound dehiscence at distobuccal gingival rim of adjacent second molar where distal relieving incision leading into sulcular incision resulted in exposure of distal surface of second molar and bone with exposure of free nerve endings, hence increased incidence of pain. In accordance to the present study, Alkadi and Stassen¹⁰ in their study also found greater pain scores on sutureless side as compared to single suture group because of delayed wound healing and hypersensitivity at the exposed distal root surface of adjacent second molar. In contrast to present study findings, Oldaega et al.¹¹ reported that the mean (\pm SD) postoperative VAS pain scores were lower in tissue adhesive group due to lesser tissue handling compared to suture group on all postoperative days except day 3 following removal of impacted mandibular third molar. However, difference in pain between two groups was not significant. Joshi et al.² also reported that postoperative pain was more on closure with sutures as compared to tissue adhesive after surgical removal of mandibular third molar during first 3 postoperative days with a marked elevation in pain on 2nd postoperative day. This difference in pain between both groups was due to lesser tissue handling and inflammation in tissue adhesive group. Ghoreishian et al.⁶ in their study reported no significant difference in the VAS score of pain between tissue adhesive and suture group for first 5 postoperative days.

In the present study it was found that bleeding immediately postoperative was significantly less in tissue adhesive group as compared to suture group which is supported by Al-Belasy and Amer¹² who described the hemostatic effect of cyanoacrylate tissue adhesive on warfarin treated patients undergoing oral surgery. It is hypothesized that the ester forms a macrofilm causing mechanical blockage, which also acts as a surface agent to activate the clotting cascade. Ghoreishian et al.⁶ and Oladega et al.¹¹ also reported in their studies that on postoperative day 1, there was significantly less incidence of bleeding when wound closure was done with tissue adhesive as compared to suturing group. Joshi et al.² also reported no postoperative bleeding in any case of tissue adhesive group whereas blood ooze was observed in some of the cases in which wound closure was done with suturing.

Wound healing was assessed in terms of wound dehiscence. In the present study, wound dehiscence was noticed more in tissue adhesive group. Dumville et al.¹³ also reported in a systematic review that incidence of wound dehiscence in tissue adhesive group was more as compared to the suture group. Although the systematic review excluded sites with high tension, tensile strength of cyanoacrylate may still be lower than that of sutures and this could have accounted for more dehiscence.¹¹ In 2011, Joshi et al. also reported certain limitations of tissue adhesives in clinical situations where excessive lateral tension across the wound is present, dry surface cannot be achieved, presence of infection and large dead spaces underneath the closure. Oladega et al.¹¹ also reported a higher incidence of wound dehiscence in tissue adhesive group than suturing. Coulthard et al.¹⁴ also reported in their review that sutures were significantly better than tissue adhesive for minimizing wound dehiscence and should be used for high tension wounds. Gazivoda et al.¹⁵ reported faster healing with vicryl rapide suture in comparison to dextron and catgut as it caused lesser wound dehiscence and tissue reaction. Author stated in their study better healing with vicryl rapide suture because of coating of suture with Ca-stearate which enabled passage through tissue with minimal resistance and did not allow plaque adherence.

In the present study, it was found that time for closure of flap was significantly less in tissue adhesive group which is supported by studies of Oladega et al.,¹¹ Gogulanathan et al.¹⁶ (2015), and Dumville et al.¹³

Vicryl rapide sutures were also found to be cost effective as they were more economical and single suture pack sufficed for a single surgical site. The limitations of the present study included that split mouth study design could not be taken and the period of follow-up was short.

CONCLUSION

This study concluded that vicryl rapide suture is an optimal alternative for wound closure after removal of third molar as compared to tissue adhesive. Although tissue adhesive has some advantages like hemostatic effect and lesser time of application but uncomplicated healing is most required after removal of third molar which is less in case of tissue adhesive. More multicentric clinical trials with split mouth study design are required to be undertaken for further confirming the efficacy of vicryl rapide suture as a better alternative of wound closure not only in third molar surgery but also in other maxillofacial surgeries for intraoral use.

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