

A Clinical Comparison of Silk Sutures and N- Butyl 2- Cyanoacrylate for Closure of Mucosal Incisions

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ABSTRACT

Background: A randomized prospective study was done clinically to compare the efficacy of silk suture and n-butyl cyanoacrylate in closure of oral mucosal incisions.

Material and Method: In thirty patients requiring minor oral surgical procedures bilateral mucosal incisions were placed. One side was closed with n-butyl cyanoacrylate and other with silk suture. Postoperatively patients were recalled on 1st, 7th, 14th and 21th day and evaluated for pain, edema, wound dehiscence and scar. Results were evaluated using chi square test.

Results: The results showed that there was no statistically significant difference between suture and cyanoacrylate for occurrences of pain, edema, and wound dehiscence and scar formation. However, the averages time taken for suturing was considerably more for cyanoacrylate application.

Conclusion: This study suggests that efficacy of cyanoacrylate and suture in intraoral wound closure is similar for postoperative pain, edema, wound dehiscence and scar formation. However, cyanoacrylate has certain advantage like ease of application, less time consuming and is well accepted by patients.

Keywords: Oral mucosa, n-butyl 2 cyanoacrylate, tissue adhesive.

INTRODUCTION

In oral and maxillofacial surgery, closure of soft tissue wounds is primarily done with mechanical devices, such as sutures and staples². Sutures being a classic method of wound closure have many advantages such as achievement of careful closure, low dehiscence rate and resilient tensile strength. However, sutures do have certain disadvantage namely prolonged duration of surgery and anesthesia, tissue reactivity, risk of needle stick injury, undesirable trauma to the intact tissue on either side of wound, permanent suture tracts, early removal which results in dehiscence, anxiety and pain during removal and inadequate esthetics^{1,3,4}.

Tissue adhesives can be broadly defined as any substance with characteristics that allow for polymerization. Polymerization can hold tissues together or serve as a barrier for leakage. Surgeons have been using tissue sealants and adhesives since the early nineteenth century⁷. Tissue adhesives were invented in 1949 and were tried clinically for the first time in 1959¹. There are presently four types of tissue adhesives: fibrin sealants, collagen-based sealants, synthetic polymer-based materials, and protein-based sealants. Utilization of tissue adhesives can be divided into three categories: hemostasis, tissue sealing and local delivery of exogenous substances⁷.

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The first glue developed was Methyl Cyanoacrylate, N-butyl-2-cyanoacrylate, a tissue adhesive has also been tried to seal the wounds of the oral cavity and skin. Advantages of this adhesive over conventional wound closure techniques include easy to use, rapid application, patient comfort, excellent bacteriostatic property, resistant to infection, no risk of needle stick injury, decreased repair time, good haemostasis, eliminates recalled visits and has good short and long time cosmetic outcome^{11,10}. Purpose of this study is to compare the clinical responses of intraoral mucosal incisions closed with n-butyl-2-cyanoacrylates with incisions closed with silk sutures.

AIMS AND OBJECTIVES

The aim of the study is to compare clinically the efficacy of n-butyl-2-cyanoacrylate with silk suture in the closure of oral mucosal incisions. Postoperatively to evaluate for pain, edema, wound dehiscence, scar formation.

MATERIALS AND METHODS

A prospective non-randomized in -vivo study was conducted on the patients reporting to the Department of oral and maxillofacial surgery, Dr. Shyamala Reddy Dental college, hospital & Research centre from September 2008 to September 2010. Thirty patients requiring minor oral surgical procedures bilateral mucosal incisions were placed. One side was closed with n-butyl cyanoacrylate and other with silk suture. Postoperatively patients were recalled on 1st, 7th, 14th and 21th day and evaluated for pain, edema, wound dehiscence and scar. Results were evaluated using chi square test.

MATERIALS

N butyl -2-cyanoacrylate was used in this study, which is available as a Single-use XOIN from medicon laboratories limited and manufactured by Samarth life sciences as 0.25 ml, 0.5 ml, 1ml ampule. The delivery system comes in a packet having an ampule, a syringe, and needle. Our study it is used for closing intraoral incisions.



Fig 1: Materials used in the study.

SURGICAL PROCEDURE

After proper case recording and selecting the patients surgical procedure was thoroughly explained to the patient and use of n-butyl cyanoacrylate tissue adhesive for closure of surgical wounds as an alternative to sutures. Under aseptic precautions, patient was anaesthetized with 2% lignocaine with adrenaline 1:80000 and prepared for surgery. In third molar surgeries or Alveoloplasties, bilaterally symmetrical crestal incision was made on the lower arch. The length of incision varied from 3-4 cm depending on the surgical access required for the procedure. Closures was performed on one side with n-butyl cyanoacrylate tissue adhesive and on the other side with 3-0 black braided Mersilk suture and these sides were randomly chosen. The side of the incision where n-butyl cyanoacrylate tissue adhesive was to be applied was isolated with dry gauze. The incised edges were accurately approximated, trying not to leave any gap between them. After loading the glue in a syringe, it was applied at the approximated wound margins through the needle in the form of drops for closure of the mucoperiosteal flaps. Under same aseptic precautions, anaesthesia and surgical procedure on the other side, suturing was done with interrupted braided black 3-0 silk suture.

Medications :Tab. Diclomol thrice a day for three days, Cap. Novamox twice a day for five days were given. Follow-up was made at first, seventh, fourteenth and twenty-first postoperative days. During each follow up visit, pain, edema, scar, and wound dehiscence were recorded on a visual analogue scale Statistical analysis of the information obtained was performed. The differences with a $P \leq 0.05$ were found to be statistically significant.



Fig 2: Method of application.

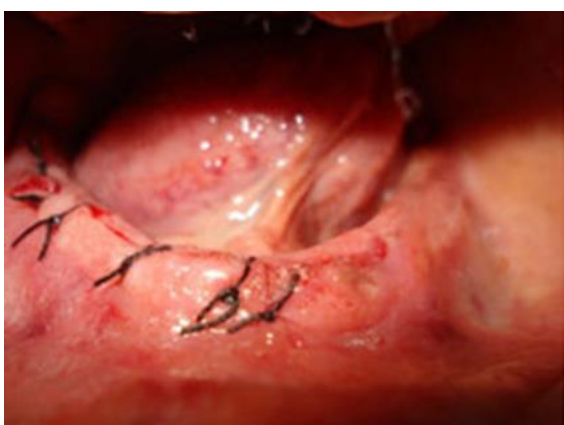


Fig 3: Minor surgical procedures.



Fig 4: Postoperatively 21st Day.

RESULTS

A total of thirty patients were enrolled and treated for various maxillofacial surgical procedures bilaterally. The incisions used for various surgical procedures in these patients were assigned to one of the following two treatment groups:

Group 1: Incisions closed with sutures using 3-0 Mersilk.

Group 2: Incisions closed with n-butyl 2-cyanoacrylates. The procedures were done bilaterally and closure on one side was done using 3-0 Mersilk.

The age of the patients included in study was between 15 years to 60 years, out of which 11 patients (33.3%) were in the age group of 15-30 yrs, 10 patients (30.3%) were in the age group of 30-45 yrs and 9 patients (30.0%) were in age group of 45-60 yrs (table 1). Out of 30 patients in our study, 12 patients (40%) were female and 18 patients (60%) were male. The different surgical procedures performed in the study were surgical extractions of third molars (20 cases), alveoloplasties (9 cases) and other minor surgeries (2 cases) like cyst, canine impaction etc. (table 3). The average time required for closure of third molar removal with silk suture was 4 minutes and N-butyl cyanoacrylate was 1 min. In alveoplasty cases, silk suture required 6 mins and N-butyl cyanoacrylate was 45 sec. In other minor oral surgeries the average time required for closure with silk suture was 5 minutes and N-butyl cyanoacrylate was 45 sec. The patients were followed up on the 1st day, 7th day, 14th day and 21st day for pain, edema, wound dehiscence and scar. All the results were accurately recorded and statistical analysis was done using Chi square test (χ^2).

EDEMA

On day 1, no significant association is observed between materials and edema ($P > 0.05$). Higher number of samples in both the groups are found to have an absence of edema. The number of samples with presence of edema is found to be almost equal in both the groups. The association between material and edema on 14th and on day 21 is not statistically significant ($P > 0.05$).

WOUND DEHISCENCE:

No statistically significant association is observed between material and wound dehiscence on day 1 ($P > 0.05$). Higher number of samples in both the groups were found to have absence of wound dehiscence in both the materials. The number of samples having presence of wound dehiscence was

found to be almost equal in both the groups on day 21 also, the association between material and wound dehiscence was not statistically significant ($P>0.05$). All the samples in Silk Suture group had an absence of wound dehiscence whereas only one sample in N-Butyl-2-Cyanoacrylate group had the presence of wound dehiscence.

SCAR:

No scar was recorded in both the groups on day 1, On day 7, higher number of samples in both the

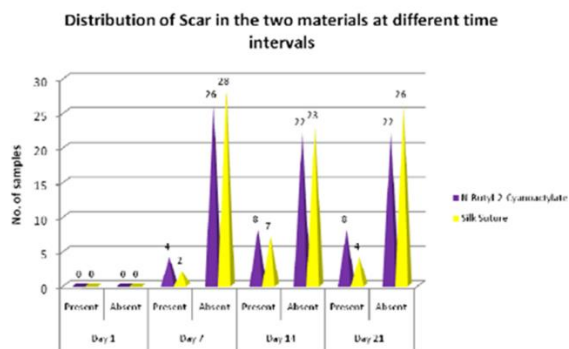
groups was found to have an absence of scar. The association between scar and material on day 7 was not statistically significant ($P>0.05$). On day 14, the number of samples with presence of scars were found to be almost equal in both the groups but no statistically significant association was observed between materials and scar ($P>0.05$). Cyanoacrylate group compared to Silk Suture group on day 21. But no significant association was observed between material and scar on day 21 ($P>0.05$).

Table 1: Comparison of pain and edema between the two materials at different time intervals.

Time interval	Material	No Pain	Mild Pain	Moderate Pain	χ^2	P-Value	EDEMA		χ^2	P-Value
							Present	Absent		
Day 1	N-Butyl-2-Cyanoacrylate	10	12	8	5.114	0.078	9	21	0.300	0.584
	Silk Suture	3	14	13			11	19		
Day 7	N-Butyl-2-Cyanoacrylate	15	14	1	1.239	0.538	5	25	-	-
	Silk Suture	11	17	2			5	25	-	-
Day 14	N-Butyl-2-Cyanoacrylate	24	5	1	1.191	0.551	1	29	1.017	0.313
	Silk Suture	26	4	0			0	30		
Day 21	N-Butyl-2-Cyanoacrylate	30	-	-	-	-	1	29	1.017	0.313
	Silk Suture	30	-	-	-	-	0	30		

Table 2: Comparison of scar and wound dehiscence between the two materials at different time intervals.

Time interval	Material	Wound dehiscence Present	Absent	χ^2	P-Value	scar		χ^2	P-Value
						Present	Absent		
Day 1	N-Butyl-2-Cyanoactylate	13	17	0.069	0.073	-	-	-	-
	Silk Suture	12	18			-	-		
Day 7	N-Butyl-2-Cyanoactylate	6	24	0.098	0.754	4	26	0.741	0.389
	Silk Suture	7	23			2	28		
Day 14	N-Butyl-2-Cyanoactylate	1	29	0.351	0.554	8	22	0.089	0.766
	Silk Suture	2	28			7	23		
Day 21	N-Butyl-2-Cyanoactylate	1	29	1.017	0.313	8	22	1.667	0.197
	Silk Suture	0	30			4	26		



Graph 1: Distribution of scar in the two materials at different time intervals.

DISCUSSION

Wound closure techniques have evolved from the earliest development of suturing materials to resources that include synthetic absorbable sutures, staples, tapes, and adhesive compounds¹⁰ braided silk is the most common suture used for closure of oral wounds³¹.

There are presently four types of tissue adhesives: fibrin sealants, collagen based sealants, synthetic polymer-based materials, and protein-based sealants. The creation of natural glues, surgical staples and tapes to substitute sutures has supplemented the armamentarium of wound closure techniques. The use of tissue adhesives has long appealed to surgeons have Cyanoacrylates were first described in 1949 and their first reported use as clinical adhesives was 10 years later by Coover²⁸. Members of the cyanoacrylate family include methyl, ethyl, propyl, butyl, hexyl, heptyl and octyl cyanoacrylates .9-Methyl-2-cyanoacrylate was the first cyanoacrylate compound to be used as a surgical tissue adhesive. This derivative is a short-chain cyanoacrylate compound containing a methyl group as part of its alkoxy-carboxyl subunit ($R = CH_3$)^{2, 8}. Although methyl-2-cyanoacrylate was a breakthrough advancement in surgical tissue adhesive.

Further research and development produced the longer side chain derivatives and isobutyl-2-cyanoacrylate and n-butyl-2-cyanoacrylate were manufactured. The medical applications of n-butyl 2-cyanoacrylate include its use as an adhesive for lacerations of the skin and in the treatment of bleeding from vascular structures, rhinoplasty, blepharoplasty, cartilage implantation, and

stabilizing skin grafts. Butyl cyanoacrylate has been used to treat arteriovenous malformations by application of the glue into the abnormality through angiography.^{31, 35}.

The amount of inflammation on the sutured and glued incision lines was different. The epithelialization on the sutured side was not uniform and there was significant scar formation. If the sutures remained for long durations or were tied tightly it resulted in cross hatching which ultimately left behind an unsightly scar¹⁹.

The greatest limitation of the currently available butyl cyanoacrylate is that it tends to become brittle after polymerization and is prone to fracture if placed over skin creases, long lacerations or areas of movement. Another disadvantage being that it cannot be used in areas of tension. The small sample size, possibility of complications other than the criteria involved in our study, shorter period of follow up, absence of an objective measurement technique, and the cost of tissue adhesive were limitations of the study. Future studies are required to evaluate long term results of intraoral usage to further its application.

CONCLUSION

Our study clinically compared n-butyl 2-cyanoacrylate with silk suture for closure of intraoral wounds. Postoperative parameters like pain, edema, wound dehiscence and scar were evaluated. In oral and maxillofacial surgery, closure of soft tissue wounds is primarily done with mechanical devices, such as sutures and staples. Tissue adhesive for wound closure is an emerging technology with innovative concepts and cutting-edge applications. Presently in oral and maxillofacial surgery, adhesives have a minimal role, but this is changing rapidly.

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CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

- Gassner R. Wound closure materials. *Oral Maxillofacial Surg Clin N Am* 2002; 14: 95– 104.
- Elshall M, Hesham H, Yazeed Al-Harbi. Closure of intraoral surgical incisions: a comparison between suturing and tissue adhesion.
- Coulthard P et al. tissue adhesive for closure of surgical incisions. *Coch Database Syst Revi* 200;3.
- Brett TR, Maxey TS: A prospectus on tissue adhesives, *Am J Surg* 2001;(182):40s-44s,
- Mobley RS, Hilinski J, Toriumi. Surgical tissue adhesives. *Facial Plast Surg Clin N Am* 2002; 10:147–154
- Shivamurthy DM, Singh S, Sasidhar. Comparison of octyl-2-cyanoacrylate and conventional sutures in facial skin closure. *Natl J Maxillofac Surg* 2010;(1):15-19.
- N-Butyl-2-cyanoacrylate topical tissue adhesive .product literature
- Michael J, Beckman EJ. Adhesive Use in Oral and Maxillofacial Surgery. *Oral Maxillofacial Surg Clin N Am* 2010 (22)195–199.
- Peterson's. Text book of principles of oral and maxillofacial surgery. second edition
- Bhaskar SN et al. Effect of butyl cyanoacrylate on the healing of extraction wounds. *Oral Surg Oral Med Oral Pathol* 1967; 24(5): 604-616.
- Robert OG. Studies concerning the histotoxicity of isobutyl-2-cyanoacrylate tissue adhesive when employed as an oral haemostat. *Oral Surg Oral Med Oral Pathol* 1975
- Avery BS et al. The use of Butyl Cyanoacrylate as a tissue adhesive in maxillofacial surgery. *Br J Oral Surg* 1982;20:84-95.
- Javelet J, Torabinejad M, Robert D. Isobutyl cyanoacrylate: A clinical and histologic comparison with sutures in closing mucosal incisions in monkeys. *Oral Surg Oral Med Oral Pathol* 1985;59(1):91-94.
- Toriumi M et al. Histotoxicity of cyanoacrylate tissue adhesives. *Arch Otolaryngol Head and Neck Surg* 1990;116:546-50.
- Giray CB et al. Comparison of silk sutures and n-butyl 2-cyanoacrylate on the healing of skin wound. A pilot study. *Aust Dent J* 1995;40(1):43-5.
- Samuel PR, Roberts AC and Nigam A. The use of Indermil (n-butyl cyanoacrylate) in Otolaryngology and Head and Neck Surgery. A priliminary report on the first 33 patients. *J Laryngol and Otol* 1997;111(6):536-40.
- Giray CB, Atasever A, Durgun B and Araz K. Clinical and electron microscopic comparison of silk sutures and n-butyl 2-cyanoacrylate in human mucosa. *Aust Dent J* 1997; 42(4):255-8.
- Quinn J et al. Tissue adhesive versus suture wound repair at 1 year: randomized clinical trial, correlating early 3 month, and 1 year cosmetic outcome. *Ann Emerg Med* 1998; (32): 645–649.
- Shermak MA, Wong L, Inoue N, Chao E and Manson PN. Butyl-2-cyanoacrylate fixation of mandibular osteotomies. *Plast Reconstr Surg* 1998;102(2):319-24.
- Amiel GE, Sukhotnik I, Kavar B and Siplorich L. Use of N-Butyl-2-Cyanoacrylate in elective surgical incisions-Long term outcomes. *J Am Coll Surg* 1999;89(1):21-5.
- Charter A. Wound glue: a comparative study of tissue adhesive. *Accd Emerg Nur* 2000;(8):223-227.
- Perez M, Fernandez I, Daysi M, Bretana GM. Use of N-butyl in oral surgery: biological and clinical evaluation. *Artif Organs* 2000; 24(3):241-243.
- Pelissier P, CasoliV, Le Bail B, Martin D and Baudet J. Internal use of n-butyl-2-Cyanoacrylate (Indermil) for wound closure: an experimental study. *Plast Reconstr Surg* 2001; 108(6):1661-6.
- Al-Belasy FA and Amer MZ. Hemostatic effect of n-butyl-2- Cyanoacrylate (Histoacryl) glue in

Warfarin-treated patients undergoing oral surgery. *J Oral Maxillofac Surg* 2002; 61(12):1404-9.

25. Fabio CA, Jornet PL, Fenoll AB, Murcia. Effects of scalpel (with and without tissue adhesive) and cryosurgery on wound healing in rat tongues. *Oral Surg Oral Med Oral Pathol* 2005;100:E58-63.

26. Handschel J.G.K., Depprich ,Dirksen D, Runte, Zimmermann A. A prospective comparison of octyl-2-cyanoacrylate and suture in standardized facial wounds. *Int J Oral Maxillofac Surg* 2006; 35:318-323.

27. Samet I et al. Biochemical and histopathological findings of N-Butyl-2-Cyanoacrylate in oral surgery: an experimental study *Oral Surg Oral Med Oral Pathol Oral Radiolo Endod* 2006;102: e14-e17.

28. Lumsden AB, Eugene Heyman R. Prospective randomized study evaluating an absorbable cyanoacrylate for use in vascular reconstructions. *J Vasc Surg* 2006; 44:1002-9.

29. Byung, Jin-Young, Shi-Jiang. Cyanoacrylate adhesive for closing sinus membrane perforation during sinus lifts. *J Cranio Maxillofac Surg* 2006;34: 505-509.

30. Kulkarni S, Dodwad V, Chava V. Healing of periodontal flaps when closed with silk sutures and N-butyl cyanoacrylate: a clinical and histological study. *Indian J Dent Res* 2007; 18:72-7.

31. Elgazzar RF et al. Cyanoacrylate glue versus suture in peripheral nerve Reanastomosis. *Oral Surg Oral Med Oral Pathol Oral Radiolo Endod* 2007;104:465-72.

32. Gillian AG, Barry OR. Incidence of hypertrophic and keloid scars after N-butyl-2-cyanoacrylate tissue adhesive had been used to close parotidectomy wounds: a prospective study of 100 consecutive patients. *Br J Oral Surg* 2009;47:290-293.

33. Ghoreishian M, Gheisari R, Fayazi M .Tissue adhesive and suturing for closure of the surgical wound after removal of impacted mandibular third molars: A comparative study. *Oral Surg Oral Med, Oral Pathol Oral Radiolo Endod* 2009;108:e14-e16.

34. Elshall M, Hesham H, Yazeed Al-Harbi. Closure of intraoral surgical incisions: a comparison between suturing and tissue adhesion.

35. Shivamurthy DM, Singh S, Sasidhar. Comparison of octyl-2-cyanoacrylate and conventional sutures in facial skin closure. *Natl J Maxillofac Surg* 2010;(1):15-19.

36. Michael J, Beckman EJ. Adhesive Use in Oral and Maxillofacial Surgery. *Oral Maxillofacial Surg Clin of N Am* 2010 (22)195-199.