

## Efficacy of Cyanoacrylate in Intraoral Surgical Wound Closure

RANA MAJID MANSOOR<sup>1</sup>, MUHAMMAD IRFAN<sup>2</sup>, JAMAL HASSAN<sup>3</sup>, MUHAMMAD MUSTAFA CHAUDHARY<sup>4</sup>, SHAHID ALI<sup>5</sup>, MUHAMMAD USMAN AKHTAR<sup>6</sup>

<sup>1</sup>Demonstrator, Department of Oral and Maxillofacial Surgery, deMont morency college of dentistry, Lahore.

<sup>2</sup>FCPS Resident, Department of Oral and Maxillofacial Surgery, deMont morency College of Dentistry, Lahore

<sup>3</sup>Demonstrator, Department of Oral and Maxillofacial Surgery, deMont morency College of Dentistry, Lahore

<sup>4</sup>Assistant Professor, Department of Oral and Maxillofacial Surgery, de'Montmorency College of Dentistry, Lahore

<sup>5</sup>Associate Professor, Department of Oral and Maxillofacial Surgery, de'Montmorency College of Dentistry, Lahore

<sup>6</sup>Professor and HOD, Department of Oral and Maxillofacial Surgery, de'Montmorency College of Dentistry Lahore

Correspondence to: Jamal Hassan, Email: [jamalhassan913@gmail.com](mailto:jamalhassan913@gmail.com)

### ABSTRACT

**Objective:** To evaluate the efficacy of cyanoacrylate tissue adhesives in the management of intraoral surgical wounds in term of wound healing.

**Material & Methods:** Descriptive case series study. Department of oral and maxillofacial surgery. Punjab Dental Hospital, Lahore. 6 months i.e. from: 10-08-2017 to 10-02-2018. After meeting the inclusion criteria 140 patients were enrolled. Strict aseptic measures were taken. Tissue glue applied on the incision line in form of drops at equidistant intervals and then allowed to flow and set for 1-2 minutes. The researcher evaluated the efficacy of wound healing clinically on 15<sup>th</sup>, 2<sup>nd</sup> and 7<sup>th</sup> postoperative day. All the collected data was entered and analyzed on SPSS version 21.

**Results:** The mean age of patients was 34.16±9.57 years. Male to female ratio was 0.79:1. The wound healing was found in 128(91.4%) patients and the efficacy achieved in 128(91.43%) patients.

**Conclusion:** The cyanoacrylate tissue adhesives is efficacious for the management of intraoral surgical wounds in term of wound healing

**Keywords:** Wound Healing, Efficacy, Cyanoacrylate, Surgery

### INTRODUCTION

Wound closure is the mainstay procedure in day-to-day practice of oral and maxillofacial surgery.<sup>1</sup> The objective of incision or laceration repair is to approximate the wound edges so that natural healing process can take place uneventfully. Conventional means of wound closure are sutures, staples and surgical tapes.<sup>2</sup> Use of suturing material for intraoral wound closure is not always easy due to inaccessible area, time consumption and requirement of good suturing skills.<sup>3</sup> They also have disadvantages of scar formation. Surgical staples have been designed for extra oral use and surgical tapes lose their strength when come in contact with moisture therefore cannot be used for intraoral wound closure.<sup>4</sup>

Cyanoacrylate exhibit strongest bond (~ 68 kPa) and found to be effective for wound closure. Fibrin based materials are relatively weaker (13 kPa) and are applied as a sealant material for hemostasis in conjunction with suturing. Hydrogel, collagen compounds, peptides, and polyethylene based glycol materials are also considered weak (4 - 17 kPa) and are therefore used as topical dressing or as a sealant.<sup>5, 6</sup>

Methyl Cyanoacrylates is histotoxic and ethyl Cyanoacrylates is also incompatible due to rapid polymerization so they are not used in human tissue. To avoid this, manufacturers have introduced long chain cyanoacrylate i.e. butyl Cyanoacrylates, isobutyl Cyanoacrylates, isoamyl Cyanoacrylates, octyl Cyanoacrylates. They undergo slow polymerization as compared to their earlier counterparts; as a result rate of heat generation is prolonged that dissipate without causing inflammatory reaction.<sup>2</sup>

They have been used for wound closure on face, extraction socket, biopsy, sinus perforation, other sites in general surgery like axilla, perineum, circumcision and to do anastomosis of nerves, intestines, and arteries.<sup>7, 8</sup>

The rationale of this study is to validate the effectiveness of cyanoacrylate for closure of intraoral surgical incision as an alternative to suture materials. The study will project a new insight in the management of intraoral surgical wounds and moreover no such study has been conducted in Pakistan. The objective of the study was to evaluate the efficacy of cyanoacrylate tissue adhesives in the management of intraoral surgical wounds in term of wound healing.

### MATERIALS AND METHODS

This descriptive case series was conducted in department of oral and maxillofacial surgery, Punjab Dental Hospital/dc. Montmorency

College of dentistry, Lahore. Duration of study was six months i.e. from: 10-08-2017 to 10-02-2018, Sample size of the study was 140 patients, using 5% margins of error. 95% level of confidence, taking expected percentage of efficacy of wound healing i.e. 90%.<sup>1</sup> Sample was collected using non probability consecutive sampling.

#### Sample Selection:

**Inclusion Criteria:** Age between 18-50 years, Patients of both genders, Patient undergoing intraoral surgical procedure for surgical wound which was taken as a cut or incision of 2-5 cm in length, made in the oral cavity by a scalpel during surgery, Patients agree to participate in the study and postoperative follow up schedule.

**Exclusion Criteria:** Patient taking immunosuppressive drugs or on steroid therapy and bisphosphonate therapy, Patient with any systemic disorders like diabetes mellitus, blood clotting disorders, peripheral vascular disease, collagen vascular disease etc. which was assessed by history taking and clinical examination, History of allergy to any drug especially to formaldehyde which was assessed by history taking, Patients with habits of smoking, drug addiction and mouth breathing, Emergency patients.

After the approval of synopsis, 140 patients, fulfilling the inclusion criteria was selected from the outdoor patient department of oral and maxillofacial surgery on the basis of history and clinical examination. After explaining the study protocol. Use of data for research and risk benefit ratio, written informed consent was taken from the patient. The patients' demographic details like name, age, gender etc. was recorded on a structured Proforma. A single surgical team headed by a consultant carried out the surgical procedure under general or local anesthesia. Strict aseptic measures were taken. After achieving adequate hemostasis, closure was performed with tissue glue. Incision edges were approximated accurately with an attempt not to leave any gap in between them. Flap was isolated with dry gauze. Tissue glue was applied on the incision line in form of drops at equidistant intervals and then allow to flow and set for 1-2 minutes. Pressure pack was placed and postoperative instructions regarding diet, oral hygiene maintenance and medications (analgesics and antibiotics) was given to the patients or attendants. The researcher was evaluate the efficacy (wound healing that was assessed clinically on 7<sup>th</sup> postoperative day. Wound healing was labelled if wound margins were approximated with no sign of erythema, swelling, pain, bleeding or pus) of wound healing clinically on 15<sup>th</sup>, 2<sup>nd</sup> and 7<sup>th</sup> postoperative day and data was recorded on the structured Proforma.

All the data collected was entered in SPSS-21 and results were analyzed as following: quantitative variable such as age, height, weight & BMI was presented as mean and standard deviation. Qualitative variables such as gender and efficacy were presented as frequency and percentage.

## RESULTS

The mean age of the patients was 34.16±9.57 years. In this study 62(44.29%) patients were males and 78(55.71%) patients were females. Male to female ratio of the patients was 0.79:1. According to this study the mean BMI of the patients was 24.86±5.55 kg/m<sup>2</sup>.

**Table 1**

Table 1: Baseline characteristics of patients

n	140
Age (years)	34.16±9.57
Gender	
Male	62 (44.3%)
Female	78 (55.7%)
BMI (kg/m <sup>2</sup> )	24.86±5.55

The wound healing occurred in 128(91.4%) patients. Efficacy was achieved in 128(91.43%) patients and it was not achieved in 12(8.57%) patients.

Table 2: Distribution of wound healing and efficacy (n=140)

		Frequency	Percentage
Wound healing	Yes	128	91.4%
	No	12	8.6%
Efficacy	Yes	128	91.4%
	No	12	8.6%

## DISCUSSION

Risk of needle stick injuries. Need of revisit for removal of sutures, food lodgment and subsequent infection.<sup>4</sup> For the occurrence of natural process of healing, closure of wound which is the end part of any surgery, the repairing of laceration to edge approximation of the wound is required. With the advancement in surgical procedures, new biomaterials such as cyanoacrylate bioadhesives, are also available as an alternative to the conventionally used suture. Quick application, comfort of patient, infection resistance, qualities linked with hemostatis along with no anxiety related to removal of suture.<sup>2</sup>

The search for a quick and painless method for wound closure with good aesthetic results prompted the use of tissue adhesives as an alternative to suturing materials.<sup>9</sup> Tissues adhesives are divided into three main categories: fibrin based materials, synthetic polymer based materials (cyanoacrylate), collagen and others protein based materials.<sup>5, 6</sup> Ideally, tissue adhesive should be biocompatible and biodegradable; it must have significant cohesive (covalent bonding of glue molecules to each other) and adhesive (bonding of glue molecules to the tissue) properties. It should be relatively hydrophilic so that it can easily spread over the moist surface at body temperature.<sup>6</sup>

Cyanoacrylates were discovered by a German chemist in 1949 and ten years later, in 1959 Coover et al reported their use in surgical field.<sup>2, 3, 6</sup> They are synthetic tissue adhesives that undergo exothermic polymerization on coming in contact with moist tissue surface to form thin flexible film that held the wound edges together.<sup>2, 3</sup> Their monomer is synthesized by reversible condensation of formaldehyde with cyanoacrylate ester. Their general formula is CNCH<sub>2</sub>=COOR, where R is side chain. The number of alkyl group in the side chain can be increased from one (Methyl Cyanoacrylates) to eight (Octyl Cyanoacrylates) to constitute various homologues of cyanoacrylate.<sup>2</sup>

Polymerization of the material takes place in 10-15 sec. They are not absorbable and are sloughed off from the tissue surface in 7-10 days.<sup>10</sup> They also undergo degradation by hydrolysis into formaldehyde and cyanoacrylate ester but it can take months to years.<sup>9</sup> The toxicity of cyanoacrylate has been

attributed to several factors including: direct toxicity of monomer such as methyl-2-cyanoacrylate or of by products such as formaldehyde and heat generated from polymerization.<sup>5</sup>

In this study the wound healing was found in 128(91.4%) patients and the efficacy achieved in 128(91.43%) patients. It was reported by few authors that there are numerous benefits of using cyanoacrylates at clinical level, such as, less surgery duration, establishment of shielding barrier, as well as its application is painless.<sup>11, 12</sup>

The literature has very little information about the intraoral application of cyanoacrylates.<sup>2</sup> In 2013, Vastani et al<sup>13</sup> observed that surgical incision closed with cyanoacrylates healed with less inflammatory response (40.0%) as compared to the sutures (93.3%). The same results were obtained in the study conducted by Kumar et al.<sup>14</sup> In 2015, Setiya et al found that the use of cyanoacrylate showed better hemostasis, decreased pain and postoperative swelling as compared to the sutures. Wound dehiscence is the most common complication associated with the use of cyanoacrylates, reported as 1-10% in different studies. The efficacy of cyanoacrylate tissue adhesive for wound healing has been reported as 90%.<sup>2</sup> A study by Alexander T. Trott et al<sup>15</sup> documented that Cyanoacrylate Tissue Adhesives are easy to apply, perform as well as traditional sutures, and simplify wound care, they are likely to attract widespread interest and rapidly find their outcome.

Octylcyanoacrylate (Dermabond) is approved by the Food and Drug Administration for laceration closure. International studies have shown its utility in wound closure and have shown it to be as good or better than suture closure for speed, patient preference, and cosmesis, with no difference in the rate of dehiscence or infection.<sup>16</sup>

A study by Hesham. S. Khalil et al<sup>18</sup> showed that the patient satisfaction was more obvious when using cyanoacrylate rather than suture, because of lack of requirement for its removal and less irritation during healing than suture. Cyanoacrylate is a good haemostatic agent with fabulous adhesive properties and tissue margins holding strength.<sup>19, 20</sup>

With surgical application of cyanoacrylates, it was found that it helps in organ repair, vessels repair, skin repair, repairing of nerves, repairing mucosa grafts, laceration wound closure and incisions<sup>21, 22</sup> as well as helps in treating extraction sockets, fractures fixation in mandible, intra oral wound healing, free gingival grafting fixation, periodontal flaps healing.<sup>13, 23, 24</sup>

According to this study by stratifying by age among ≤ 30 years patients the efficacy achieved in 54(96.4%) patients whereas in patients with age > 30 years the efficacy achieved in 74(88.1%) patients (p-value=0.124). Stratifying by gender among male patients the efficacy achieved in 56(90.3%) patients whereas in females patients the efficacy achieved in 72(92.3%) patients (p-value=0.677). Similarly by stratifying by BMI among patients with normal BMI the efficacy achieved in 44(83%) patients whereas in patients with abnormal BMI the efficacy achieved in 84(96.6%) patients (p-value=0.010).

According to this study the cyanoacrylate tissue adhesives is efficacious for the management of intraoral surgical wounds in term of wound healing

## REFERENCES

1. El-rewainy MA, Osman SM, Hassan NE. The Use Of N-Butyl Cyanoacrylate Adhesive In The Closure Of Muco-Periosteal Flap After The Surgical Extraction Of Impacted Mandibular Third Molar. Alexandria Dent J 2016;40(2).
2. Sagar P, Prasad K, Lalitha R, Ranganath K. Cyanoacrylate for intraoral wound closure: a possibility? International journal of biomaterials 2015;2015.
3. Setiya S, Halli R, Shah A, Chhabaria G, Singh T. Comparative evaluation of efficacy of tissue glue and sutures after surgical removal of impacted mandibular third molars—A prospective controlled clinical study. Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology 2015;27(2):183-8.

4. Halli R, Joshi A, Kini Y, Kharkar V, Hebbale M. Retrospective analysis of sutureless skin closure in cleft lip repair. *Journal of Craniofacial Surgery* 2012;23(1):e40-e4.
5. Mizrahi B, Weldon C, Kohane DS. Tissue adhesives as active implants. *Active implants and scaffolds for tissue regeneration*: Springer; 2010. p. 39-56.
6. Buckley MJ, Beckman EJ. Adhesive use in oral and maxillofacial surgery. *Oral and Maxillofacial Surgery Clinics* 2010;22(1):195-9.
7. Sameena T, Sethy S, Patil P, Shailaja K, Ashraf MO. Cyanoacrylate: a bio adhesive for suture less surgery: a review. *Asian Journal of Research in Chemistry* 2014;7(3):349.
8. Devrukhkar VN, Hegde RJ, Khare SS, Saraf TA. Evaluation of isoamyl 2-cyanoacrylate tissue adhesive in management of pediatric lacerations: An alternative to suturing. *Annals of maxillofacial surgery* 2015;5(1):49.
9. Martín-Ballester A, García-Cerdá D, Prieto-Moure B, Martín-Martínez JM, Lloris-Carsí JM. Use of cyanoacrylate adhesives in dermal lesions: a review. *Journal of Adhesion Science and Technology* 2014;28(6):573-97.
10. Joshi AD, Saluja H, Mahindra U, Halli R. A comparative study: efficacy of tissue glue and sutures after impacted mandibular third molar removal. *Journal of maxillofacial and oral surgery* 2011;10(4):310-5.
11. Singer AJ, Thode HC. A review of the literature on octylcyanoacrylate tissue adhesive. *The American journal of surgery* 2004;187(2):238-48.
12. Turkaslan T, Ozcan H, Dayicioğlu D, Ozsoy Z. Use of adhesives in cleft palate surgery: a new flap fixation technique. *Journal of Craniofacial Surgery* 2005;16(4):719-22.
13. Vastani A, Maria A. Healing of intraoral wounds closed using silk sutures and isoamyl 2-cyanoacrylate glue: A comparative clinical and histologic study. *Journal of oral and maxillofacial surgery* 2013;71(2):241-8.
14. Kumar MS, Natta S, Shankar G, Reddy SHK, Visalakshi D, Seshiah G. Comparison between silk sutures and cyanoacrylate adhesive in human mucosa-a clinical and histological study. *Journal of international oral health: JIOH* 2013;5(5):95.
15. Trott AT. Cyanoacrylate tissue adhesives: an advance in wound care. *Jama* 1997;277(19):1559-60.
16. Perron AD, Garcia JA, Hays EP, Schafermeyer R. The efficacy of cyanoacrylate-derived surgical adhesive for use in the repair of lacerations during competitive athletics. *The American journal of emergency medicine* 2000;18(3):261-3.
17. Ashoka C. A m. Evaluation of octyl-2-cyanoacrylate tissue adhesive as an acceptable alternative to sutures in head & neck surgery [Ph.D. dissertation] Bengaluru, India: Rajiv Gandhi University of Health Sciences Karnataka.;. 2005.
18. Khalil HS, Elshall MA, Al-Harbi Y, Al-Asmar S, Al-Wadee M. HEALING OF ORAL SURGICAL WOUNDS USING 3/0 SILK SUTURE AND NSBUTYL CYANOACRYLATE TISSUE ADHESIVE. *DENTAL JOURNAL* 2009;55(2607):2613.
19. McGraw V, Caffesse R, editors. *Cyanoacrylates in periodontics*. The Journal of the Western Society of Periodontology/Periodontal abstracts; 1978.
20. Greer Jr RO. Studies concerning the histotoxicity of isobutyl-2-cyanoacrylate tissue adhesive when employed as an oral hemostat. *Oral Surgery, Oral Medicine, Oral Pathology* 1975;40(5):659-69.
21. Ellis D, Shaikh A. The ideal tissue adhesive in facial plastic and reconstructive surgery. *The Journal of otolaryngology* 1990;19(1):68-72.
22. McNeill JI. Applicator for cyanoacrylate tissue adhesive. *Ophthalmic Surgery, Lasers & Imaging Retina* 1989;20(3):211.
23. Barbosa F, Corrêa D, Zenóbio E, Costa F, Shibli J. Dimensional changes between free gingival grafts fixed with ethyl cyanoacrylate and silk sutures. *Journal of the International Academy of Periodontology* 2009;11(2):170-6.
24. Dalvi A, Faria M, Pinto A. Non-suture closure of wound using cyanoacrylate. *Journal of postgraduate medicine* 1986;32(2):97.