

THE EFFICACY OF CELLULAR ADHESIVE (HISTOACRYL) IN THE MANAGEMENT OF LACERATED WOUNDS IN CHILDREN ATTENDING AN OUT-PATIENT SETTING, AN OBSERVATIONAL STUDYR. V. Jeya Balaji¹, M. Saravanan², Indhumathi³, Kokilam⁴**HOW TO CITE THIS ARTICLE:**

R. V. Jeya Balaji, M. Saravanan, Indhumathi, Kokilam. "The Efficacy of Cellular Adhesive (Histoacryl) in the Management of Lacerated Wounds in Children Attending an Out-Patient Setting, an Observational Study". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 22, June 02; Page: 6257-6265, DOI: 10.14260/jemds/2014/2731

ABSTRACT: Apart from traditional Traditionally suturing for wound closure, other options for wound closure like staples, adhesive tapes and tissue adhesives came into existence and are gaining popularity in clinical practice in recent times. There is an increasing amount of literature supporting the use of TAs for various minor lacerations, including a number of randomized controlled trials (RCTs). Even though TAs are ideal choice for resource poor settings like India, studies documenting the efficacy of tissue adhesives, especially in pediatric population are rare from India. **AIMS & OBJECTIVE:** To study the efficacy of wound healing, occurrence of complications and cost of treatment following cellular Adhesive (Histoacryl) use in children with laceration wounds. **METHODOLOGY:** The study was a cross sectional study, conducted in outpatient setting of department of pediatrics , in a tertiary care teaching hospital, between June 2011 to December 2012. **RESULTS:** A total of 62 children were included in the study. Clean wounds constituted 93.5% of the wounds. Average amount of glue required was 3 to 4 drops. Majority wounds (91.9%) started healing well by the third day of follow-up and they healed well after 7 days. The final outcome was good in 88.7% of the subjects and fair in 3.2% of the subjects. Only 11.3% of participants had some complication. The quantity of tissue adhesive glue used per cm of wound surface was 1.77 drops and the expenditure incurred per cm of wound surface was 44.5 INR. **CONCLUSIONS:** Tissue adhesive glue is effective method of wound closure in pediatric laceration wounds. The complication rates and the need for antibiotic is very minimal with tissue adhesive glue use and it is very economical way of wound closure in pediatric laceration wounds.

KEYWORDS: Histoacryl, Tissue adhesive, laceration wounds, wound healing.

INTRODUCTION: Traditionally the option as available for clinicians for wound closure predominantly included various kinds of sutures. The material used for suturing as well as type and size of needles varied widely. Even though, closure of wounds with sutures enables meticulous closure, suturing requires infiltration of wound edges with local anesthetic to avoid pain during suturing and suture material may induce tissue reactivity. Sutures also usually require removal at a later date, which requires an additional visit to the clinic by the patient and also may add to the cost of treatment. There is also possibility of needle stick injury to the surgeon or assistant while performing suturing.

The other options for wound closure like staples, adhesive tapes and tissue adhesives came into existence and are gaining popularity in clinical practice in recent times. Tissue adhesives (glues) offer the advantages that the patient does not require suture removal at a later date and there is no risk of needle stick injury to the surgeon or assistant. The introduction of tissue adhesives has been received enthusiastically since they may result in equivalent tensile strength, improved cosmetic

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appearance of the scar and lower infection rate when compared with sutures, staples and adhesive tapes, and they are without many of the risks and disadvantages of alternative methods.⁽¹⁾

Tissue adhesives (TAs) have been used in various forms for more than 35 years since the first cyanoacrylate adhesives were synthesized in 1949.⁽²⁾ Cyanoacrylate derivatives, have been used for many years to close simple lacerations. These liquid monomers quickly polymerize to form a strong bond over the approximated wound. This keeps the wound edges together until healing has occurred. The early adhesives were appropriate for small superficial lacerations and incisions but their limited physical properties prevented their use in the management of other wounds. There were also reports of acute and chronic inflammatory reactions.⁽³⁾

Further development led to the introduction of the n-2-butylcyanoacrylates that were purer and stronger. However, these adhesives did not receive widespread acceptance because their clinical performance was limited by their low tensile strength and brittleness.^(4,5)

More recently stronger tissue adhesives have been developed by combining plasticizers and stabilizers to increase flexibility and reduce toxicity when applied topically for skin closure.⁽⁶⁾ Practitioners experienced in suturing find TAs quick and easy to use following a brief orientation to the product and its limitations. Application of a TA is relatively painless for the patient, and provides an excellent cosmetic outcome.^(7,8) No follow-up appointment for suture removal is required, and one study has shown TAs to be a cost-effective alternative to sutures.⁽⁹⁾

There is an increasing amount of literature supporting the use of TAs for various minor lacerations,⁽¹⁰⁻¹⁵⁾ including a number of randomized controlled trials (RCTs) that support TAs in their respective study populations. However, due to the wide variation in study parameters, there are no generalized, definitive answers about the effectiveness of TAs. Different patient populations have been studied, with some studies of TAs restricted to children or adults, while others had no age restrictions. The size and location (face, extremity) of the wound as well as the agents being compared [TA versus standard wound closure (SWC), TA versus TA] have also varied.⁽¹⁶⁻²⁷⁾

Studies documenting the efficacy of tissue adhesives, especially in pediatric population are albeit rare from India. Considering the ease of application, efficacy in wound healing, absence of pain and cost effectiveness make tissue adhesives makes them ideal choice for Indian scenario. With this background the current study is undertaken to document the efficacy of tissue adhesives in treating laceration wounds in Indian children.

AIMS & OBJECTIVE:

1. To study the efficacy of wound healing following cellular Adhesive (Histoacryl) use in children with laceration wounds.
2. To study the occurrence of complications following cellular Adhesive (Histoacryl) use in children with laceration wounds.
3. To assess the cost of treatment following cellular Adhesive (Histoacryl) use in children with laceration wounds.

METHODOLOGY:

Study setting: The study was conducted in outpatient setting of department of pediatrics, in a tertiary care teaching hospital.

Study duration: The study was conducted between June 2011 to December 2012.

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Inclusion and exclusion Criteria: Children between 1 to 15 years of age, who were affected by laceration wounds, were included in the study. Exclusion criteria included locations, subject to high tension, and areas with poor adhesive potential. These sites included the genitalia, mucous membranes and joints. Patients with known allergy to adhesives were also excluded.

Sample size and sampling: All the patients presenting to the study setting during the study period, who satisfied the inclusion criteria were included in the study. Hence no sampling was done.

Study procedure: For all the study subjects included in the study, the details regarding site, nature and size of the wound were noted. After cleaning the wound surface, the wound edges were approximated and the Histacryl tissue adhesive glue was applied to close the wound. The patients were followed up on day three and day seven to assess the wound healing and the occurrence of nay complications.

Ethical Approval: The study was approved by Institute's human ethics committee. Informed written consent was sought from all the participants and only those who consented to participate were included in the study.

Statistical Analysis: Descriptive analysis of socio demographic variables, wound characteristics, details of the histacryl use and particulars of wound healing at different follow up periods were analyzed. Occurrence of various complications at different stages of wound healing was also documented and presented descriptively. Expenditure incurred was also assessed and described appropriately.

RESULTS: A total of 62 children were included in the study. Out of 62, the minimum age was 1 year, maximum age was 13 years and majority of children were between 6 to 10 years. Male children constituted 79% of the study subjects and proportion of female children was 21%. (Table 1).

	Frequency	Percent
I. Age group		
0 to 5	12	19.4
6 to 10	39	62.9
11 and above	11	17.7
Total	62	100.0
II. Gender		
Male	49	79.0
Female	13	21.0
Total	62	100.0
Table 1: Demographic characteristics of study population ((N=62)		

The most common site of wound in the current study was chin followed by eye brow or eyelid and scalp. Injuries on fore head and other parts of the face constituted the remaining portion and minor proportion wounds were on limbs. Majority of the wounds were between 1 to 3cms in length.

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Major portions (93.5%) of the wounds were clean and septic wounds constituted only 6.5% of the total wounds. (Table 2).

Wound characteristics	Frequency	Percent
I. Site of wound		
Chin	14	22.6
Eye brow/ eye lid	13	21.0
Scalp	12	19.4
Fore head	9	14.5
Face (other than mentioned above)	6	9.7
lower limb	5	8.1
Upper limb	3	4.8
II. Size of the wound (in cm)		
Up to 1	12	19.3
1.1 to 2	33	53.2
2.1 to 3	13	21.0
3.1 to 5	4	6.5
III. Nature of wound		
Clean	58	93.5
Septic	4	6.5

Table 2: Descriptive analysis of wound characteristics (N=62)

Out of 62 subjects the maximum amount of tissue adhesive glue used was 8 drops. Majority of the participants required 3 to 4 drops of the glue. (Table 3)

Number of drops used	Frequency	percentage
1 to 2	17	27.4%
3 to 4	30	48.4%
5 to 6	13	21.0%
above 6	2	3.2%

Table 3: quantity of tissue adhesive glue used (N=62)

Major portion (91.9%) of wounds started healing well by the third day of follow-up and they healed well after 7 days. The final outcome was good in 88.7% of the subjects and fair in 3.2% of the subjects. It was poor only in 1.6% of the subjects and another 6.5% of the participants did not come for follow-up. (Table 4)

Status of wound healing	Frequency	Percent
I. Follow up 3rd day		
Healing well	57	91.9
Fair healing	2	3.2
Not healed	1	1.6
Lost to follow-up	2	3.2
II. Follow up 7th day		
Healed Well	57	91.9
Not healed	1	1.6
Lost to follow-up	4	6.5
III. Final outcome		
good	55	88.7
Fair	2	3.2
Poor	1	1.6
Lost to follow-up	4	6.5

Table 4: Status of wound healing during follow-up (N=62)

The requirement of antibiotic was very minimal, as 82.2% of the subjects did not require any antibiotic use. In remaining 18.8% of the subjects, broad spectrum antibiotics like amoxicillin, ciprofloxacin and Cefixime were used. (Table 5)

Anti-biotic used	Frequency	Percent
No	51	82.2
Amoxicillin	5	8.2
Ciprofloxacin	3	4.8
Cefixime	3	4.8

Table 5: Status of antibiotic use (N=62)

Only 11.3 % of participants had some complication. Gaping of the wound was seen in 6.5% of the wounds followed by infection and edema in 3.2% and 1.6% of the subjects respectively. (Table 6)

Complication	Frequency	Percent
Wound gap	4	6.5
Infection	2	3.2
Healing by secondary intention (Edema)	1	1.6
Total complication rate	7	11.3

Table 6: occurrence of complications (N=62)

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The quantity of tissue adhesive glue used per cm of wound surface was 1.77 drops and the expenditure incurred per cm of wound surface was 44.5 INR. (Table 7)

Parameter	Quantity
Total length of the wound surface (In cm)	124
Consumption of tissue adhesive glue (Number of drops)	
Quantity of tissue adhesive glue used	220
Quantity of tissue adhesive glue used per cm of wound	1.77
Expenditure (in INR)	
Total expenditure	5525
Expenditure per cm of wound treated	44.5
Table 7: Summary of treatment expenditure using tissue adhesive glue	

DISCUSSION: Apart from traditional suturing, the other options for wound closure like staples, adhesive tapes and tissue adhesives came into existence. These are gaining popularity in clinical practice in recent times. Since tissue adhesives (glues) offer many advantages like the patient does not require suture removal at a later date and there is no risk of needle stick injury to the surgeon, may result in equivalent tensile strength, improved cosmetic appearance of the scar and lower infection rate when compared with sutures, staples and adhesive tapes, and their introduction has been received with lot of enthusiasm from the clinicians.⁽¹⁾

Since the scarcity of studies on the subject, especially in pediatric population, the current study was conducted on 62 children, majority of them were between 6 to 10 years, out of which males constituted 79%. The age and gender composition of the study population is similar to the other published studies and clearly depicts the injury proneness of the male children in the age group of 6 to 10 years.

Major portion (91.9%) of wounds started healing well by the third day of follow-up and they healed well after 7 days. The final outcome was good in 88.7% of the subjects and fair in 3.2% of the subjects. It was poor only in 1.6% of the subjects and another 6.5% of the participants did not come for follow-up. Bruns TB et al in their study of 61 children have concluded that, the use of Histoacryl Blue (HAB) tissue adhesive for laceration repair is an acceptable alternative to conventional suturing with a comparable cosmetic outcome.

They have also felt that the advantages of tissue include less pain to the child, no need for suture removal, and more efficient use of physician time. Parents were also more likely to recommend HAB over suturing for laceration repair.⁽⁴⁾ Quinn JV et al in their study on 81 children have concluded that Histoacryl Blue is a faster and less painful method of facial laceration repair that has cosmetic results similar to the use of sutures.⁽⁵⁾

Aukerman DF et al in their review have concluded that tissue adhesives are effective and yield results comparable to those with conventional suturing of superficial, linear, and low-tension lacerations. The cosmetic outcome is similar; wound complications, such as infection and dehiscence, may be lower with tissue adhesives. Farion, K. J et al also felt that Wound closure of superficial lacerations by tissue adhesives is quicker and less painful compared with conventional suturing.^(28,29)

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The requirement of antibiotic was very minimal, as 82.2% of the subjects did not require any antibiotic use. Only 11.3 % of participants had some complication. Gaping of the wound was seen in 6.5% of the wounds followed by infection and edema in 3.2% and 1.6% of the subjects respectively. Farion, K. J et al in their review felt that, While cosmes is an important outcome for both patients and providers, other outcome measures must be considered before declaring TAs equivalent to sutures and other SWC methods.

The use of TAs is significantly quicker (average 5.7 minutes faster) and less painful than SWC. In clinical practice, this is particularly important to consider when treating young children. Suturing wounds in this age group can be emotionally traumatic for the child (unless sedation is used) as well as for the parent. Though sedation is safe and uncomplicated for the majority of patients, this adds time and increased cost and complexity. No difference was found for infection, delayed closure or discharge.⁽²⁹⁾

The quantity of tissue adhesive glue used per cm of wound surface was 1.77 drops and the expenditure incurred per cm of wound surface was 44.5 INR. Osmond et al.'s 1995 study⁽⁹⁾ provided an economic comparison of tissue adhesives and suturing found that tissue adhesives were more cost effective than both dissolving and non-dissolving sutures. Zempsky WT et al have concluded Tissue adhesive is the preferred method of closure of pediatric facial lacerations because it results in the most efficient use of resources and is preferred by the majority of parents.⁽³⁰⁾

CONCLUSIONS:

1. Tissue adhesive glue (Histoacryl) is effective method of wound closure in pediatric laceration wounds.
2. The complication rates and the need for antibiotic are very minimal in wounds treated with tissue adhesive glue.
3. Tissue adhesive glue use is very economical way of wound closure in pediatric laceration wounds.

LIMITATIONS: The study did not include any comparison group using other methods of wound closure. A comparative study with traditional suturing would have provided more authentic conclusions.

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REFERENCES:

1. Osmond MH. Pediatric wound management: the role of tissue adhesives. *Pediatric Emergency Care* 1999; 15 (2): 137-40.
2. Coover HN, Joyner FB, Sheere NH. Chemistry and performance of cyanoacrylate adhesive. *Journal of the Society of Plastic Surgery of England* 1959; 1: 5-6.
3. Houston S, Hodge JW Jr, Ousterhout DK, Leonard F. The effect of alpha-cyanoacrylates on wound healing. *Journal of Biomedical Materials Research* 1969; 3(2):281-9
4. Bruns TB, Simon HK, Mc Lario DJ. Laceration repair using a tissue adhesive in a children's emergency department. *Pediatrics* 1996; 98: 673-5.

ORIGINAL ARTICLE

5. Quinn JV, Drzewiecki A, Li MM, Stiell IG, Sutcliffe T, Elmslie TJ, Wood WE. A randomised, controlled trial comparing a tissue adhesive with suturing in the repair of paediatric facial lacerations. *Annals of Emergency Medicine* 1993; 22: 1130–5.
6. Quinn J, Wells G, Sutcliffe T. A randomized trial comparing octylcyanoacrylate tissue adhesive and sutures in the management of lacerations. *JAMA* 1997; 277(19):1527–30.
7. Osmond MH. Wound repair and tissue adhesives. In: Moyer VA, Elliott EJ, Davis RL, et al. (eds). *Evidence Based Pediatrics and Child Health*. 1st edition. London: BMJ Books, 2000.
8. Sells L, Mihalov L. Topical anesthetics and tissue adhesives: a new generation in pediatric wound management. *Pediatr Emerg Med Rep*. 1999; 4:1–10
9. Osmond MH, Klassen TP, Quinn JV. Economic comparison of a tissue adhesive and suturing in the repair of pediatric facial lacerations. *J Pediatr*. 1995; 126:892–5
10. Applebaum JS, Zalut T, Applebaum D. The use of tissue adhesion for traumatic laceration repair in the emergency department. *Ann Emerg Med*. 1993; 22:1190–2.
11. Elmasalme FN, Matbouli SA, Zuberi MS. Use of tissue adhesive in the closure of small incisions and lacerations. *J Pediatr Surg*. 1995; 30:837–8.
12. Mizrahi S, Bickel A, Ben-Layish E. Use of tissue adhesives in the repair of lacerations in children. *J Pediatr Surg*. 1988; 23:312–3.
13. Morton RJ, Gibson MF, Sloan JP. The use of histoacryl tissue adhesive for the primary closure of scalp wounds. *Arch Emerg Med*. 1988; 5:110–2.
14. Perron AD, Garcia JA, Parker Hays E, Schafermeyer R. The efficacy of cyanoacrylate-derived surgical adhesive for use in the repair of lacerations during competitive athletics. *Am J Emerg Med*. 2000; 18:261–3.
15. Watson DP. Use of cyanoacrylate tissue adhesive for closing facial lacerations in children. *BMJ*. 1989; 299:1014.
16. Barnett P, Jarman FC, Goodge J, Silk G, Aickin R. Randomised trial of histoacryl blue tissue adhesive glue versus suturing in the repair of paediatric lacerations. *J Paediatr Child Health*. 1998; 34:548–50.
17. Bruns TB, Simon HK, Mc Lario DJ, Sullivan KM, Wood RJ, Anand KJ. Laceration repair using a tissue adhesive in a children's emergency department. *Pediatrics*. 1996; 98:673–5.
18. Bruns TB, Robinson BS, Smith RJ, et al. A new tissue adhesive for laceration repair in children. *J Pediatr*. 1998; 132:1067–70.
19. Hollander JE, Singer AJ. Application of tissue adhesives: rapid attainment of proficiency. *Stony Brook Octylcyanoacrylate Study Group. Acad Emerg Med*. 1998; 5:1012–7.
20. Osmond MH, Quinn JV, Sutcliffe T, Jarmuske M, Klassen TP. A randomized, clinical trial comparing butylcyanoacrylate with octylcyanoacrylate in the management of selected pediatric facial lacerations. *Acad Emerg Med*. 1999; 6:171–7.
21. Quinn J, Wells G, Sutcliffe T, et al. A randomized trial comparing octylcyanoacrylate tissue adhesive and sutures in the management of lacerations. *JAMA*. 1997; 277:1527–30.
22. Quinn J, Wells G, Sutcliffe T, 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; 32:645–9.
23. Quinn JV, Drzewiecki A, Li MM, et al. A randomized, controlled trial comparing a tissue adhesive with suturing in the repair of pediatric facial lacerations. *Ann Emerg Med*. 1993; 22:1130–5.

ORIGINAL ARTICLE

24. Saxena AK, Willital GH. Octylcyanoacrylate tissue adhesive in the repair of pediatric extremity lacerations. *Am Surg.* 1999; 65:470–2.
25. Schultz A, Olesgaard P. [Tissue glue in minor skin lesions. A prospective controlled comparison between tissue glue and the suturing of skin minor lesions]. In Danish. *Ugeskr Laeger.* 1979; 141:3106–7.
26. Simon HK, McLario DJ, Bruns TB, Zempsky WT, Wood RJ, Sullivan KM. Long-term appearance of lacerations repaired using a tissue adhesive. *Pediatrics.* 1997; 99:193–5.
27. Simon HK, Zempsky WT, Bruns TB, Sullivan KM. Lacerations against Langer’s lines: to glue or suture? *J Emerg Med.* 1998; 16:185–9.
28. Aukerman DF, Sebastianelli WJ, Nashelsky J. Clinical inquiries. How does tissue adhesive compare with suturing for superficial lacerations? *J Fam Pract.* 2005 Apr; 54 (4):378.
29. Farion, K. J., Osmond, M. H., Hartling, L., Russell, K. F., Klassen, T. P., Crumley, E. and Wiebe, N. (2003), Tissue Adhesives for Traumatic Lacerations: A Systematic Review of Randomized Controlled Trials. *Academic Emergency Medicine*, 10: 110–118. doi: 10.1197/aemj.10.2.110
30. Zempsky WT, Zehrer CL, Lyle CT, Hedbloom EC. Economic comparison of methods of wound closure: wound closure strips vs. sutures and wound adhesives. *Int Wound J* 2005;2:272—281.

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