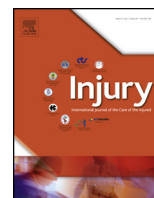




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Complications following chin laceration reparation using tissue adhesive compared to suture in children

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ABSTRACT

Background: Tissue adhesive is widely used in the emergency department to repair minor lacerations but there exists a debate as to whether it should be used for chin lacerations. The main objective of this study was to evaluate the rate of wound dehiscence of chin lacerations repaired with tissue adhesive in comparison to sutures.

Methods: This was a retrospective chart review including all children requiring a facial laceration reparation in a single tertiary care paediatric hospital. The primary outcome was wound dehiscence in the 30 days following reparation, comparing the use of tissue adhesive and sutures. The independent variable of interest was the use of tissue adhesive vs suture. A random sample of charts was reviewed in duplicate to insure reliability of the chart review.

Results: Among the 2044 children presenting with a facial laceration requiring an intervention, 1804 (88%) were repaired using tissue adhesive. The laceration was located on the chin in 360 (18%) of patients. The use of tissue adhesive was not statistically associated with a higher risk of dehiscence for all facial lacerations (difference: 0.2; 95%CI: -1.9 to 0.8%), nor for chin lacerations (difference 2.2%; 95%CI: -7.5 to 4.4%). However, the probability of dehiscence was higher for chin laceration in comparison to other localizations (difference of 1.6%; 95%CI: 0.5–3.6%).

Conclusion: While the rate of dehiscence was higher for chin lacerations compared to other facial localizations, the risk of dehiscence was not statistically different for chin laceration repaired with tissue adhesive or sutures.

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Introduction

Minor trauma is a leading cause of emergency room visits, representing approximately 7–22% of consults to paediatric emergency departments (ED) [1]. Among them, a majority are for skin lacerations of 2 cm or less in length [2]. While it is important to adhere to the principles of wound care by providing the best closure method to ensure optimal healing, there are currently no universally accepted guidelines for the management of skin lacerations [3,4].

Cyanoacrylate tissue adhesive is widely used in EDs to repair minor lacerations [5]. This tissue adhesive is a liquid monomer that undergoes an exothermic reaction when exposed to the moisture of the skin [6]. The reaction changes the polymers and forms a resistant tissue bond, permitting normal healing of the skin [7]. Closure of simple wounds with tissue adhesive has been reported to be the preferred technique of paediatric emergency physicians [8]. In addition, tissue adhesive provide a less painful, needle-free and a faster technique compared to sutures, without risk of needle injury [9]. For those reasons, tissue adhesives are less susceptible to cause distress in children [10].

There is a considerable amount of literature supporting the use of tissue adhesive for minor laceration closures, including randomized controlled trials, in specific population groups [6,8,11–16]. However, the specific conditions in which tissue adhesive is preferable to sutures have not been clearly defined because of the wide variety of study populations in previous clinical trials. It is generally recognized that body regions of high tension or mobility should not be glued, as well as persistently

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oozing (despite LET (lidocaine 4%/epinephrine 0.1%/tetracaine) gel application), and infected or large lacerations of more than 5 cm [17]. Farion and al reported that cosmeses of wounds closed with tissue adhesives and sutures were very similar, but that tissue adhesives had a slightly higher rate of dehiscence, which needs to be considered when choosing a closure method [10]. Despite this, the complication rate of tissue adhesive is difficult to establish because no study has been sufficiently powered to detect a significant difference between the use of tissue adhesive and sutures.

At our institution, emergency physicians use tissue adhesives to repair most facial lacerations. Local plastic surgeons reported occasional laceration dehiscence among children who were treated with tissue adhesive for chin lacerations (personal data). Consequently, it seemed important to evaluate the complication rate of closing a facial wound with tissue adhesive, compared to sutures. More specifically, our primary objective was to evaluate the rate of wound dehiscence of chin lacerations repaired with tissue adhesive compared to sutures.

Patients and methods

Study design and setting

This was a retrospective chart review of all children visiting the ED for traumatic facial lacerations followed by a prospective phone survey of children having a chin laceration. The study was conducted among patients who visited a tertiary care, university-affiliated, paediatric hospital during a two-year period between Dec 1st, 2015 and November 30th 2017. The ED had an annual census of approximately 84 000 patients during the study period. Most children evaluated in the ED are initially seen by a medical student or a resident and then by a regular staff doctor, most of whom are paediatric emergency physicians, but also include paediatricians and general emergency physicians.

Study population

Children visiting the ED for a traumatic facial/head laceration and needing a reparation (suture of tissue adhesive) according to the treating physician were eligible. Children with lacerations at higher risk of dehiscence that would require sutures were excluded [18]. This was defined as lacerations located in high mobility sites such as nose, mouth and eyelids, lacerations of more than 5 cm in length, extending to the muscle or requiring deep layer closure, and lacerations among children with connective tissue disorder, for example, Ehlers-Danlos syndrome. Children at higher risk of infection were also excluded: lacerations resulting from animal bites or heavily soiled lacerations requiring debridement, delays longer than 12 h prior to consultation from the injury, and children with insulin-dependent diabetes mellitus or immunodeficiency.

Outcome

The primary outcome was dehiscence following closure, defined as a second visit to the hospital or other healthcare facility for a laceration dehiscence during the 30 days following reparation. The secondary outcome was infection during the 30 days following reparation.

Independent variables

Clinical and demographic characteristics measures included age and gender of the patients, type, length and localization of the laceration, use of local anaesthesia (topical or infiltrative), and type of reparation used (tissue adhesive or suture).

Procedure

Patient identification

Patients were identified using the computerized database of the ED. All children with a diagnosis of laceration or facial trauma at discharge were identified. Among them, a researcher identified all children fulfilling the inclusion/exclusion criteria by reading their computerized charts. The medical charts of the eligible participants were then manually reviewed to insure eligibility and collect data.

Data collection

A standardized data collection form was created before data extraction and was used to collect all pertinent information. Data were collected by multiple co-investigators using the standardized Case Report Form (CRF) created for this protocol. Each chart was reviewed by one rater, a member of the study team. To insure validity of the data collection, a random sample of 10% of the charts was reviewed by a second co-investigator using the same CRF and blinded to the first evaluation to assess reliability of data abstraction.

In order to increase the validity of the primary outcome evaluation, we conducted a follow-up telephone interview with parents of the sub-group of children who had a chin laceration. The telephone interview was conducted by a member of the research team using a standardized questionnaire. More specifically, the parents were asked if their child required other medical treatment for the chin laceration (see survey in appendix). A maximum of three phone calls were made for each potential participant at different periods of the day and on different days. After obtaining verbal informed consent from the guardian, the researcher performed the standardized phone questionnaire.

Data analysis

All information was entered in an Excel database (Microsoft Inc., Richmond, WA) and analysed with SPSS v25 software (SPSS Inc., Chicago, Illinois). Baseline demographics of the participants were reported. Initially, the inter-rater reliability was measured for the charts evaluated by two raters using the Kappa score. A priori, it was decided that variable showing a Kappa score lower than 0.6 would not be used in the analysis.

The primary analysis compared the proportion of dehiscence of chin wounds closed with tissue adhesive to the ones closed with sutures. To make this possible, we reported the difference in proportions for the two groups in addition to the 95% confidence intervals for the difference. Other analyses compared the proportion of dehiscence of traumatic lacerations of the chin and of other facial parts closed with tissue adhesive using the same approach. Finally, in an exploratory analysis, we compared the proportions of complications (dehiscence and infection) according to the reparation method or other factors (children age, sex, localization of the laceration).

Sample size

The sample size was calculated to compare the proportion of dehiscence of lacerations repaired with sutures versus tissue adhesive. Our expectations were that the proportion of dehiscence would be very low in both groups. However, to be clinically significant, it was estimated that a difference of 10% would be necessary to change practice considering the rapidity of the technique, and the lower pain and distress associated to tissue adhesive. Based on this, it was calculated that we would need to recruit at least 45 children with suture reparation of the chin (smallest group) to have an 80% power to identify a 10% difference

between the two groups (from 2 to 12%). This was calculated with the expectation that there would be four chin lacerations repaired with tissue adhesive for each one treated with sutures. The computerized database of all ED visits suggests that there were approximately 3000 children who visited the emergency room with a laceration during the study period. A quick review of 30 of these charts suggested that approximately 50% of them would be eligible to our study (facial lacerations) and we would have at least 300 chin lacerations. Expecting that one fifth of children with chin lacerations would be treated with sutures (the less frequent method of reparation), we expected to have at least 60 children with sutures and 240 with tissue adhesive.

Ethics

This protocol was reviewed by our local ethic board. Because of the retrospective design of the study, a waiver of consent from the patient/families was sought for this project. As mentioned, the families who were followed-up by phone provided a verbal consent.

Results

Lacerations

From Dec 1st, 2015 to Nov 30th, 2017, a total of 3407 children were seen in the ED for a laceration. Among them, 2044 were facial lacerations deemed eligible according to the inclusion/exclusion criteria. The most common reason for ineligibility were non-facial lacerations (n=654; 19%) or nose/intra-oral/eyelid lacerations (n=448; 13%). The charts of all eligible children were accessible and reviewed. Eligible patients were younger than those not eligible with a median age of 53 months (first and 3rd quartiles: 32–84 months) in comparison to 73 months (first and 3rd quartiles: 35–129 months). Approximately 67% of eligible patients were boys. The most common sites of laceration were forehead (29%), scalp (23%) and chin (18%). Most lacerations (80%) were between 1 and 3 cm in length and the most common reparation procedure was glue for 1809 (89%) children (Table 1). Topical local anaesthetics used were topical lidocaine-epinephrine-tetracaine gel for 218 (11%) children and injected 1% lidocaine with or without epinephrine for 137 (7%) children.

A total of 160 charts were evaluated by two reviewers to assess inter-rater reliability. Among them, 92 (58%) patients were deemed eligible by the two reviewers. With the exceptions of size of the suture, all items of the chart review demonstrated an excellent reliability with Kappa scores higher than 0.75 (Table 2).

All eligible facial lacerations

Among all eligible patients with facial laceration, 13 (0.6%) returned to the emergency department for a dehiscence and three (0.1%) for an infection (Table 3). There was no statistical difference in term of rate of dehiscence (difference of 0.2, 95% CI -1.9 to 0.8) and in term of infection (difference -0.3%, 95% CI -2.4 to 0.2%) between patients treated with tissue adhesive or sutures.

Chin lacerations

There was no statistical difference in the risk of dehiscence between chin lacerations repaired by tissue adhesive (n=7, 2.2%) compared to sutures (n=0, 0%). (difference of 2.2%, 95%CI -7.5 to 4.4%).

The probability of dehiscence was five times higher for children having a chin laceration in comparison to other locations (difference of 1.6%; 95%CI: 0.5–3.6%). Even though 12/13 cases of

Table 1
Information about laceration and reparation for the 2044 eligible patients.

	Participants N (%)
Median in months (1st and 3rd quartile)	53 (32 and 84)
Sex male	1372 (67)
Delay for reparation	
□ <3h	461 (3)
□ 3-6h	945 (6)
□ 6-9h	321 (6)
□ 9-12h	63 (3)
□ Uncharted	254 (12)
Number of lacerations	
□ 1	1985 ()
□ 2	51 (3)
□ >2	8 (0.2)
Localization of laceration	
□ Forehead	592 (3)
□ Scalp	474 (9)
□ Eyebrow	402 (0)
□ Chin	360 (8)
□ Lips	2 (3)
□ Check	53 (3)
□ Other	99 (5)
Size of the largest laceration	
□ <1 cm	257 (3)
□ 1-3 cm	1621 ()
□ 3-5 cm	84 (4)
□ Uncharted	82 (4)
Type of reparation	
□ Glue	1804 ()
□ Suture	180 ()
□ Glue and suture	43 (2)
□ Uncharted	8 (0.4)
Use of topical lidocaine-epinephrine-tetracaine	218 (11)
Use of local injected aesthetic	137 (7)

Table 2
Inter-rater reliability for the chart review (n = 160 charts for eligibility and 93 charts for other characteristics).

Characteristics	Kappa score
Eligibility (yes/no)	0.88 (0.81–0.96)
Delay for reparation	0.82 (0.72–0.93)
Number of lacerations	0.79 (0.50–1.00)
Localization of laceration	0.95 (0.89–1.00)
Size of the laceration	0.78 (0.64–0.91)
Use of Lidocaine-epinephrine-Tetracaine gel	0.78 (0.54–1.00)
Use of local anaesthesia	0.92 (0.76–1.00)
Type of reparation	0.96 (0.87–1.00)
Type of suture (n = 12)	Perfect agreement in 11/12
Size of suture (n = 12)	0.43 (0–99)
Return to the ED	0.80 (0.40–1.00)
Return elsewhere in hospital	0.66 (0.04–1.00)
Any return	1.00 (0.50–1.00)

dehiscence occurred among patients who were treated with tissue adhesive, there was no statistically significant difference between tissue adhesive and sutures for the risk of dehiscence for the analysis of all eligible children (difference: 0.2; 95% CI: -1.9 to 0.8%, as stated above).

A total of 288 (80%) families of the 360 children with a chin laceration, were reached by phone to evaluate outcomes. Among

Table 3
Outcomes for all patients and for chin laceration.

	All patients	Tissue adhesive N (%) 95%CI	Suture N (%) 95%CI	Difference in %(95%CI)
All patients	N= 2044	1772	215	
Dehiscence	13 (0.6)	12 (0.7)	1 (0.5)	0.2 (–1.9 to 0.8)
Infection	3 (0.1)	2 (0.1)	1 (0.5)	–0.3 (–2.4 to 0.2)
Chin laceration	357	321	36	
Dehiscence	7 (2.0)	7 (2.2)	0	2.2 (–7.5 to 4.4%)
Infection	0	0	0	0 (–9.6 to 1.2)

Table 4
Logistic regression for the association between predictors and risk of complication.

	OR (95%CI)
Age in months	1.00 (0.99–1.01)
Sex male	0.60 (0.19–1.89)
Chin laceration vs. other locations	3.84 (1.41–10.46)
Use of Lidocaine-epinephrine-Tetracaine gel	2.05 (0.43–9.68)
Use of injected anaesthetics	0.85 (0.06–12.42)
Reparation with tissue adhesive	0.85 (0.09–8.35)

them, seven reported the need to consult for dehiscence and none for infection. They all came back to our ED and were already identified by the chart review.

The very small number of complications limited the power to investigate for predictors of complications. Using logistic regression, chin lacerations were statistically associated with complications (dehiscence or infection) with an OR of 3.68 (95%CI: 1.36–9.93), while age, gender, use of topical or injected anaesthetics and method of reparation were not (Table 4).

Discussion

This retrospective chart review identified a very low and similar probability of complications (dehiscence or infection) following repair of facial lacerations in children using tissue adhesive or sutures. While the rate of dehiscence was higher for chin lacerations than other localizations, the probability of dehiscence was not statistically different for chin laceration repaired with tissue adhesive or sutures.

Our results are comparable to previous studies showing that tissue adhesive is clinically equivalent to sutures regarding the risk of dehiscence. Randomized controlled trials reported dehiscence rates for tissue adhesive varying between 0 to 12%, but they all failed to show a difference between tissue adhesive and sutures [6,8,11,13,15,16]. A systematic review of randomized controlled studies reported a small increase in the risk of dehiscence for the group of lacerations repaired with tissue adhesive in comparison to sutures without difference in term of aesthetic outcomes [10]. In their pooled analysis of 718 patients, the number needed to treat with sutures to avoid a dehiscence was 25 among children. This is lower than what we identified in our study (500 for all eligible children with facial laceration and 45 for children with a chin laceration). To our knowledge, and considering the very low probability of dehiscence, no previous study was powered enough to demonstrate a statistical difference for the dehiscence risk. For example, a randomized controlled trial aiming to identify an increase in the risk of dehiscence from 1% to 5% would need 285 participants per group.

The current study carries strengths related to the evaluation of a large sample of children treated in a real-life situation. Real life setting is usually less restrictive and more at risk of complication than the strict setting of clinical trial [19]. Therefore, the very low proportion of complications demonstrated in this study is a good indicator that the tissue adhesive procedure is safe and effective.

Our results show that 88% of lacerations were repaired by tissue adhesive, indicating the preferences of paediatric emergency physicians of our institution. This is in concordance with prior results reporting that tissue adhesive utilization is more frequent in children, particularly to repair facial lacerations [20] and that it is the preferred technique of physicians [8]. The frequent use of tissue adhesive may also explain why our plastic surgeons, who follow complications of dehiscence, were more often seeing children treated with tissue adhesive from the ED than sutures. This shows the importance of having the denominator and not only the numerator when assessing the risk of a procedure.

Our study has limitations. Firstly, there is the possibility that patients did not return to the same hospital for a complication and thus were missed from the evaluation of the primary outcome. This should, however, be similar in both interventions (tissue adhesive and suture) and should not impact the primary conclusion. Also, to assess this possibility, a sub-group of children, 80% of those with chin laceration, were reached by phone and 0/288 contacted families reported visiting another healthcare facility for a complication. The tissue adhesive application technique of each physician was not evaluated. However, all children in our setting are treated by a certified physician experienced in paediatric emergency medicine. Furthermore, the low complication rate is reassuring of the quality of the procedure. The most important limitation of this study is related to the potential indication biases associated with the reparation technique used. It is possible that children for whom the treating physician decided to use sutures instead of tissue adhesive were more at risk of dehiscence. However, it would be interesting to have clear guidelines in situations where glue repair is better than sutures. While reviewing more than 3000 charts, only 36 had a chin laceration repaired using suture. This was less than expected in our sample size calculation and decreased the power of the statistical analysis. However, the margins of the 95% confidence interval for the difference between suture and tissue adhesive do not reach what we defined as clinically significant (10%). As this is a retrospective study, some of the charts were not complete according to all the details analysed: the type of suture used, time between the injury and the repair, etc., were not always found in the chart. Finally, the study was conducted in a single tertiary care paediatric ED and all patients were treated by a physician experienced in paediatric emergency medicine. Our low complication rate may not be applicable in another type of setting.

Conclusion

The probability of dehiscence is greater in cases of chin lacerations versus other facial wounds. However, facial wounds, and more specifically chin lacerations, repaired with tissue adhesive are not at higher risk of complication than wounds repaired with sutures in a paediatric ED. Our study therefore allows the use of tissue adhesives for simple lacerations of the face in general, and of the chin with minimal risk of dehiscence or infection. Risk factors of dehiscence and infection should be identified using a prospective cohort.

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Author contributions statement

All seven authors conceived and designed the study. CSML, SA, GSJ, BC and JG participated in data collection. JG performed the statistical analysis of the data. CSML drafted the manuscript, and all authors contributed substantially to its revision. Each author listed on the manuscript has seen and approved the submission of this version of the manuscript and takes full responsibility for the manuscript. No payment in any form was given to anyone to produce the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Conflict of interest

All co-investigators declare that they have no conflict of interest.

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