Journal of Athletic Training 2008;43(2):222–224

www.nata.org/jat

Tissue Adhesives for Simple Traumatic Lacerations

Joel W. Beam, EdD, LAT, ATC

University of North Florida, Jacksonville, FL

Reference/Citation: Farion K, Osmond MH, Hartling L, et al. Tissue adhesives for traumatic lacerations in children and adults. *Cochrane Database Syst Rev.* 2001(4);CD003326.

Clinical Question: What is the clinical evidence base for tissue adhesives in the management of simple traumatic lacerations?

Data Sources: Studies were identified by searches of the following databases: Cochrane Wounds Group Specialized Trials Register (September 2003), Cochrane Central Register of Controlled Trials (CENTRAL) (CDROM 2003, issue 3), MEDLINE (1966 to September 2003, week 1), EMBASE (1988 to 2003, week 36), Web of Science Science Citation Index (1975 to September 13, 2003) and various clinical trials registers (September 2003). Investigators and product manufacturers were contacted to identify additional eligible studies. The search terms included *wounds and injuries, laceration, face injury, nose injury, tissue adhesives,* and *acrylates.*

Study Selection: Each study fulfilled the following criteria: (1) The study was a randomized controlled trial that compared tissue adhesives with standard wound closure (SWC) (sutures, staples, adhesive strips) or tissue adhesive with tissue adhesive. (2) The wounds were acute, linear lacerations less than 12 hours old, resulting from blunt or sharp trauma. (3) The wound length, width, and depth allowed for approximation of the edges with minimal tension after deep sutures were placed, if required. Studies were included with no language or publication status restriction, with participants of any age recruited in an emergency department, outpatient clinic, walk-in clinic, or other primary care setting. Studies were excluded if the wounds were stellate lacerations, puncture wounds, mammalian bites, infected, heavily contaminated or devitalized, crossing joints or mucocutaneous junctions, in hair-bearing areas, or in patients with keloid formation or chronic illness.

Data Extraction: The characteristics of the study and participants, interventions, outcome measures, and findings were extracted by one author and verified by a second using a standard form. The primary measure was cosmetic outcome. Secondary measures were pain with the procedure, time to complete the procedure, and complications (erythema, infection, discharge, need for delayed closure, and dehiscence). Studies were divided into 2 groups as follows: group 1, comparisons among tissue adhesives with SWC, and group 2, comparisons among different tissue adhesives. All eligible studies were assessed for methodologic quality independently by 2 investigators using the Jadad Scale, which evaluates randomization, double blinding, withdrawals, and dropouts and is scored on a 5-point (maximum) scale. The data from the tissue adhesive and SWC studies were pooled and analyzed with a random-effects model. The I^2 statistic was used to determine heterogeneity among the studies. χ^2 analysis was performed to compare participant age, wound location, and type of tissue adhesive among the studies. The data from the studies comparing tissue adhesives were pooled and analyzed using a fixed-effects model.

Main Results: The search criteria identified 39 eligible studies, of which 11 met the inclusion criteria. In 10 studies, a tissue adhesive was compared with SWC. Five groups used butylcyanoacrylate, and 5 used octylcyanoacrylate. For SWC, 6 groups used sutures, 2 used adhesive strips, and 2 used a combination of methods, although most used sutures. Six studies were limited to pediatric patients and 2 to adult patients; 2 included patients of any age. Wounds were limited to facial lacerations in 2 pediatric studies and 1 group with patients of any age. Lacerations requiring deep sutures were excluded in 4 studies. One group compared tissue adhesives (butylcyanoacrylate and octylcyanoacrylate) among pediatric patients with facial lacerations not requiring deep sutures. In the 11 included studies, authors of 9 randomized and evaluated 1 laceration per patient, whereas 2 groups included patients with more than 1 laceration. In 1 group, each laceration was independently randomized and evaluated, and the other group randomized the patient and assigned all lacerations to a treatment group (tissue adhesive with SWC or tissue adhesive with tissue adhesive). The sample sizes ranged between 60 and 163 lacerations, and all 11 studies were performed in emergency departments.

The primary measure in all included studies was cosmetic outcome. The majority of groups used the Cosmetic Visual Analogue Scale, the Wound Evaluation Score, or a combination of these measures. Three groups measured cosmetic outcome with nonvalidated scoring systems. Assessment time periods were grouped and reported at (1) 5 to 14 days, (2) 1 to 3 months, and (3) 9 to 12 months after wound closure. Secondary outcomes were pain (as noted on visual analogue scale) and time to complete the procedure (as mean number of minutes). The 11 studies scored from 1 to 3 on the Jadad Scale. Adequate allocation concealment was reported in only 1 group.

Examining cosmetic outcome, 8 groups (565 lacerations) used the Cosmetic Visual Analogue Scale to compare tissue adhesives and SWC. The authors reported no significant differences in scores at the time periods of 5 to 14 days, 1 to 3 months, and 9 to 12 months. A subgroup analysis showed a significant ($P = .005$) superiority of butylcyanoacrylate over SWC at 1 to 3 months. Using the Wound Evaluation Score, 4 studies (364 lacerations) compared tissue adhesives with SWC. No significant differences in cosmetic scores were found at 5 to 14 days, 1 to 3 months, or 9 to 12 months. One group (83 lacerations) compared butylcyanoacrylate with octylcyanoacrylate and reported no significant differences in cosmetic scores using the Cosmetic Visual Analogue Scale at 1 to 3 months and the Wound Evaluation Score at 5 to 14 days and 1 to 3 months.

Examining secondary outcomes, 6 groups (570 lacerations) compared tissue adhesives with SWC using the visual analogue scale for pain. Scores reported by parents, patients, physicians, and nurses significantly favored tissue adhesives. In 6 studies (584 lacerations), tissue adhesives were significantly favored over SWC in time to complete the procedure. For complication outcomes, 8 groups (727 lacerations) demonstrated significantly fewer incidences of erythema and an increased risk of dehiscence with tissue adhesives compared with SWC. No

significant differences were shown for infection, delayed closure, or discharge. Among 83 lacerations, 1 group compared butylcyanoacrylate with octylcyanoacrylate and reported no significant differences in combined patient-reported and parent-reported visual analogue pain scores, time to complete the procedure, dehiscence, or infection.

Conclusions: This review provides evidence that tissue adhesives are an option to SWC (sutures, staples, adhesive strips) for the management of simple traumatic lacerations. Overall, no significant differences were found in cosmetic scores at the reported assessment periods between tissue adhesives and SWC. At 1 to 3 months, a subgroup analysis significantly favored butylcyanoacrylate over SWC. Tissue adhesives significantly lowered the time to complete the procedure, levels of pain, and rate of erythema. However, the data revealed a significant increase in the rate of dehiscence with the use of tissue adhesives when compared with SWC. The low methodologic quality of the evidence should be considered in the interpretation of the findings.

Key Words: wound closure, tissue bonding, open wounds

COMMENTARY

Cyanoacrylate derivative tissue adhesives were developed in 1949 and have had a long history of use in tissue bonding outside the United States. In 1998, the Food and Drug Administration approved octylcyanoacrylate for use and, currently, 2-octylcyanoacrylate in low-viscosity and high-viscosity formulas (Dermabond, Ethicon Inc, Somerville, NJ) is the only tissue adhesive approved and available commercially in the United States.[1] Tissue adhesives are commonly used to replace standard wound closure (SWC) (sutures, staples, adhesive strips) in the management of surgical and traumatic wounds. The literature investigating the use of tissue adhesives is vast, but the variability of interventions, wound sizes and locations, participant ages, and outcome measures has lessened comparisons among tissue adhesives and SWC. Perhaps most important in these investigations are the outcome measures of cosmetics, pain with and time to complete the procedure, and rate of complications such as infection, erythema, and dehiscence. Are tissue adhesives effective for closure of simple traumatic lacerations? Among athletic trainers, is their use appropriate with healthy individuals involved in athletic and work activities?

Farion et al[2] presented several clinical implications in the use of tissue adhesives for the management of simple traumatic lacerations. Several findings support the suggestion that tissue adhesives are an alternative to SWC. Overall, no significant differences were seen between tissue adhesives and SWC in short-term or long-term cosmetic outcomes, which may be the most important outcome among individuals who sustain facial and neck lacerations. However, a subgroup analysis significantly favored butylcyanoacrylate for cosmetic outcome at 1 to 3 months compared with SWC. Also, the use of tissue adhesives significantly lowered the incidence of erythema compared with SWC. Tissue adhesives significantly lowered both the time to complete the wound closure procedure (by an average of 4.7 minutes) and pain scores reported by parents, patients, physicians, and nurses. The authors suggested that these findings should be considered in the management of lacerations in children, as SWC can be emotionally traumatic for the patient and parent.[2]

The evidence provided in this review for the management of simple traumatic lacerations among healthy individuals applies directly to athletic trainers. Tissue adhesives appear to provide a rapid, reliable method of wound closure when an immediate return to athletic and work activities is necessary.[3] However, few groups have empirically studied the effects of environmental (heat, cold, and moisture) and physical (rigid equipment and surfaces, friction, and tension) stressors on tissue adhesives.[3] Two groups examined the use of a tissue adhesive (Dermabond) for the closure of traumatic lacerations sustained by ice hockey athletes during competition in a senior men's world championship[4] and professional season.[3] Thirty-six lacerations (length range = 0.8 cm to 8 cm) sustained to the eyebrow, eyelid, or general face were closed with a tissue adhesive. These authors[3,4] reported that all athletes returned immediately to competition after the procedure (1 laceration was sustained at the end of the match), cosmetic outcomes at the conclusion of competition and day 7 were either ''acceptable'' or ''good/excellent,'' and no erythema, infection, discharge, or need for delayed closure occurred. In a study[3] of professional athletes, 1 wound demonstrated a small, superficial dehiscence after competition, but cosmetic assessment did not change at day 7.

Dehiscence may have the potential to be a limiting factor in the use of tissue adhesives for wound closure by athletic trainers. For most, the goal of using tissue adhesives is timely wound closure with an immediate return to sport or work activities for the healthy individual. In the review, Farion et al[2] revealed a significant increase in the risk of dehiscence when tissue adhesives were compared with SWC. The authors suggested that wound characteristics (length, width, and depth), patient characteristics (age), allied health care provider skill level/training, or different tissue adhesives may have affected these findings.[2] Additionally, tissue adhesives are not appropriate for use with all wounds, and proper wound cleansing, debridement, and dressing techniques should not be compromised to achieve a quick closure and return to activity.[3,5] The use of tissue adhesives is contraindicated in animal bites; stellate wounds; wounds with evidence of infection, gangrene or ulceration; mucosal surfaces or across mucocutaneous junctions; areas of high moisture or dense hair; and areas of high tension such as joints.[1,5] Further research is needed to examine the effects of environmental and physical stressors on the rate of dehiscence and the short-term and long-term effects on cosmetic outcome among various populations.

The review by Farion et al[2] has several limitations. The studies in the review scored between 1 and 3 on the Jadad Scale from the lack of blinding, randomization, and reporting of dropouts and withdrawals. Blinding of the physician and patient may be impossible based on the interventions (sutures, staples, tissue adhesive) being compared. Subjective assessment of cosmetic outcomes and time to complete the procedure resulted in heterogeneity in the results, lessening the ability to compare the findings. The lack of studies comparing different tissue adhesives in the review reduced the clinical implications of the findings. With Food and Drug Administration approval of only one tissue adhesive in the United States, studies comparing different tissue adhesives cannot be conducted. Farion et al[2] proposed that per-patient cost savings of individual tissue adhesives may be a deterrent to comparison studies among different adhesives in other countries.

Tissue adhesives are available to athletic trainers without a prescription, but their use in the management of traumatic lac-

erations may be restricted based on state credentialing and scope-of-practice laws. As a result, athletic trainers should refer to their individual state practice acts to determine approval before use. The use of tissue adhesives for simple traumatic lacerations is not specifically mentioned in the National Athletic Trainers' Association Education Council *Athletic Training Educational Competencies.*[6] However, the management of open wounds is included, and clinical proficiencies are a required component of entry-level athletic training education programs. Manufacturer directions suggest that only trained clinical professionals should apply a tissue adhesive. Application of tissue adhesive and tissue approximation can be learned in athletic training education programs and are somewhat similar to medical adhesive ampules or vials and adhesive closure strips commonly used with lacerations and incisions.

Clinical evidence suggests that tissue adhesives can replace SWC for the management of simple traumatic lacerations. For athletic trainers, it appears that tissue adhesives offer a quick method of wound closure in situations with time restrictions. Additional studies of tissue adhesives are needed, focusing on the rate of complications (infection, delayed closure, dehiscence, and discharge), cost effectiveness (supply costs, personnel time, and follow-up), extent (depth, width, and shape) and location (scalp or joint) of the laceration, and practicality of application to provide athletic trainers with appropriate guidelines for use with healthy individuals.

REFERENCES

1. Product information for Dermabond. http://www.dermabond.com/home.jhtml?_requestid=213895. Accessed September 1, 2006.
2. Farion K, Osmond MH, Hartling L, et al. Tissue adhesives for traumatic lacerations in children and adults. *Cochrane Database Syst Rev.* 2001(4); CD003326.
3. 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(3):261–263.
4. Branfield AS. Use of tissue adhesives in sport? A new application in international ice hockey. *Br J Sports Med.* 2004;38(1):95–96.
5. Bruns TB, Worthington JM. Using tissue adhesive for wound repair: a practical guide to Dermabond. *Am Fam Physician.* 2000;61(5):1383–1388.
6. National Athletic Trainers' Association. *Athletic Training Educational Competencies.* 4th ed. Dallas, TX: National Athletic Trainers' Association; 2006.

Joel W. Beam, EdD, LAT, ATC, provided conception and design; acquisition and analysis and interpretation of the data; and drafting, critical revision, and final approval of the article.

Address correspondence to Joel W. Beam, EdD, LAT, ATC, University of North Florida, Brooks College of Health, Athletic Training/Physical Therapy Department, 1 UNF Drive, Jacksonville, FL 32224-2673. Address e-mail to jbeam@unf.edu.