The Role of Topical Skin Adhesives in Wound Repair

A frequently advantageous alternative to sutures, topical skin adhesives have been available to physicians in the United States for a decade but are still sometimes overlooked or improperly used. The authors describe how they work, the benefits they offer, and how to manage them.

By Andrew Wackett, MD, and Adam J. Singer, MD

The US health care system handles more than 7 million traumatic lacerations each year.[1] The practitioners who treat these injuries have traditionally used sutures when closure was needed. Recently, however, topical skin adhesives have gained wider use as an alternative to sutures.

Since the first clinical use of topical skin adhesives in 1959,[2] several studies have demonstrated their efficacy.[3] They are fast and easy to use, can be applied painlessly, result in excellent cosmetic outcome, do not require a follow-up procedure to remove them after their purpose has been achieved, and are relatively inexpensive.[4] Unfortunately, they are being used mostly for short facial lacerations, especially in children. However, multiple studies now demonstrate that at least one type of adhesive (2-octyl-cyanoacrylate) can be used on wounds of any length in almost any location on the body.

Multiple clinical trials have compared the topical skin adhesives to sutures for laceration and surgical incision.[5] All of the studies come to the same conclusions: the adhesives are comparable to sutures in terms of the rates of infection and dehiscence as well as the ultimate appearance of the scars, and less clinician time is required to apply the adhesives as compared with sutures.

Underutilization and improper use of topical skin adhesives remain common even though the products have been available to US physicians since their FDA approval more than a decade ago. This article will provide the scientific background and clinical pointers necessary to use them correctly.

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DIFFERENT ADHESIVE TYPES

The topical skin adhesives (or glues) are liquid cyanoacrylate monomers that polymerize into long solid chains upon contact with blood and the wound surface, thus sealing and bridging the wound edges together.[6] The structure of the cyanoacrylates varies based on the length of their side chain. In clinical use in the United States, there are butyl cyanoacrylates, such as Indermil and Histoacryl Blue, and octyl cyanoacrylates, such as Dermabond.

Butyl cyanoacrylates have short and straight side chains allowing them to form tight and strong bonds. These agents bind well to the skin surface but can be brittle and fracture along the incision length.[6] Octyl cyanoacrylates have a longer side chain, making them less brittle and less likely to fracture.[7] In general, they are stronger and more flexible than butyl cyanoacrylates. Clinical studies comparing the two types of topical skin adhesives are limited but have demonstrated similar outcomes for short, low-tension wounds.[8] However, wounds under higher tension are more likely to dehisce if repaired with a butyl cyanoacrylate.[9]

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In general, octyl cyanoacrylates are stronger and more flexible than butyl cyanoacrylates.

Recently, various blends of octyl and butyl cyano-

acrylates have also become commercially available. Data on the strength of these are limited.

RATIONALE FOR USE

While suturing can take 2 years to master, skill in the application of topical skin adhesives is rapidly attained.[10] The process is quick, easy, and painless, requiring no local anesthesia. Using a topical skin adhesive largely eliminates the risk of needle sticks,[11] and in sharp contrast to the process of suture removal—often a painful and anxiety-ridden experience for patients, especially young ones—an adhesive simply sloughs off spontaneously after 5 to 10 days.

A moist wound environment provides the optimal condition for wound healing.[12,13] The barrier formed by the cyanoacrylates creates such an environment while also preventing microbial penetration.[14,15] In addition, cyanoacrylates have antimicrobial features against gram-positive organisms, at least in vitro.[16-18] Finally, unlike sutures and staples, they do not leave any hatch marks. For these reasons, closure with a topical skin adhesive tends to result in a better cosmetic outcome.

Topical skin adhesives are also relatively inexpensive. Although the cost of the cyanoacrylates is higher than that of sutures, the overall cost is less when the cost of the suture kit, dressing materials, and suture removal kit are taken into account.[19]

Topical skin adhesives do have some disadvantages. Their strength is equal to 4-0 or higher sutures. If used alone for high-tension wounds, they are more likely than 3-0 sutures to dehisce. Exposure to excessive moisture or friction may cause them to fail, and they do not secure well in the presence of hair. Avoid using them over or near mucous membranes, on areas of the hands or feet that are subject to friction and frequent washing, or on hair-covered areas. If the wound has a very high risk of infection, secondary closure (leaving the wound open to heal spontaneously) is the better choice.

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Topical skin adhesives are ideal for low-tension traumatic lacerations with edges that can be easily approximated.

Topical skin adhesives are ideal for low-tension traumatic lacerations with edges that can be easily approximated.[4] They are also excellent for skin tears, flaps, and fragile skin because they are less likely than sutures to strangulate tissue.[20] As long as they are allowed to dry completely, they are suitable for use in wounds that will be subsequently dressed or splinted.

TIPS FOR SUCCESSFUL USE

Most wounds require vigorous irrigation, including facial wounds; it is one of the most important deterrents to infection. Injection of an anesthetic is usually not necessary, unless debridement or deep exploration is being performed. However, topical anesthetics such as LET (lidocaine, epinephrine, and tetracaine mixture) can be beneficial not only by making the cleaning process less painful but also because the hemostatic action of epinephrine allows for easier adhesive application.

Once the wound is prepared, the edges are opposed manually by using gentle pressure with one's fingers or with the aid of initial application of surgical tapes, and the topical skin adhesive is applied as a thin continuous layer or discrete beads (Figures 1a & 1b). Occasionally it can be helpful to have one person approximate the wound edges while another applies the adhesive. Butyl cyanoacrylates are applied as a single layer because they polymerize rapidly and buildup of multiple layers is not possible. Octyl cyanoacrylate is applied in two layers, with a 30-second pause in between.

Aftercare is quite simple, the key being to keep the wound clean and dry. The octyl cyanoacrylate products will tolerate brief moisture, such as that from showering, soon after application. Butyl cyanoacrylate adhesives should be kept dry for 48 hours. None of the topical skin adhesives can withstand swimming, prolonged soaking, or periods of heavy perspiration, and they may separate prematurely under these conditions.

A topical skin adhesive forms its own moisture-containing, antimicrobial dressing, so a traditional wound dressing is unnecessary. However, patients sometimes want to cover their wound. They should be instructed not to do so until the adhesive is completely dry. They should also be advised not to use antibacterial ointments, which can cause a topical skin adhesive to loosen prematurely.

PRECAUTIONS TO OBSERVE

The pitfalls of topical skin adhesive use include runoff (especially with spillage into the eyes), adherence of

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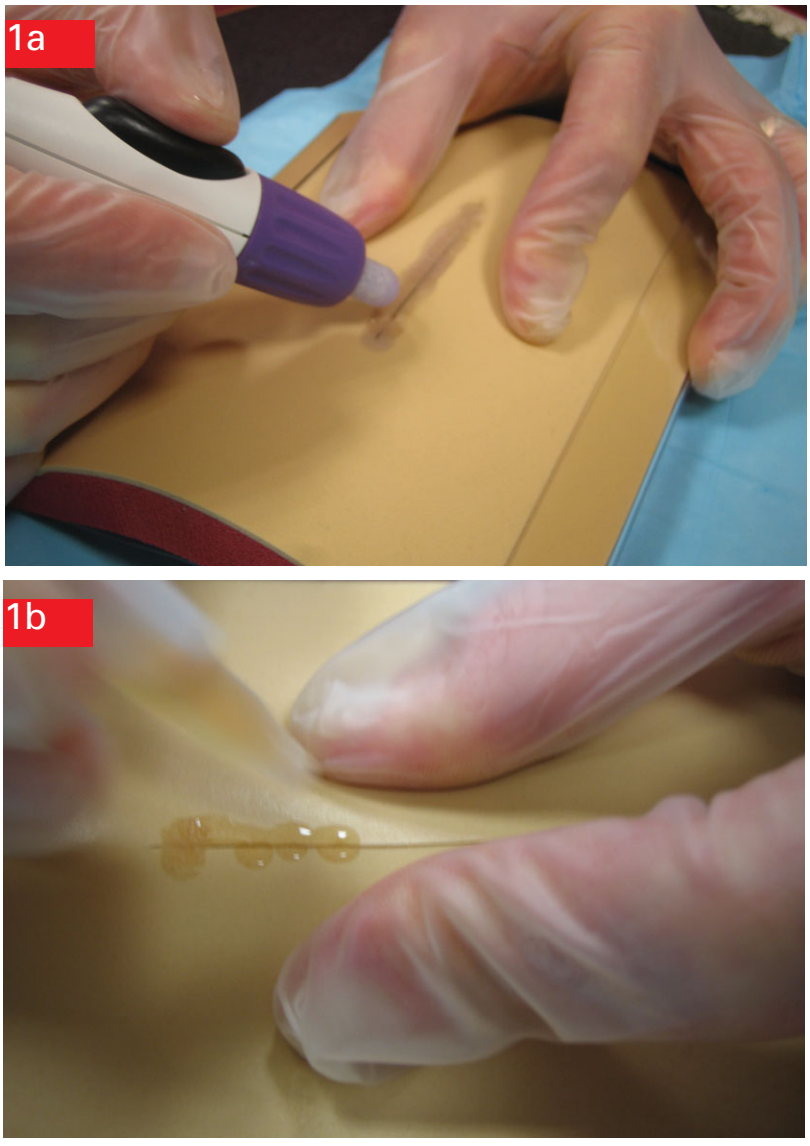

FIGURES 1a & b. Application of different adhesive types.
1a. Octyl cyanoacrylate adhesive (Dermabond) is painted on in a continuous manner. **1b.** Butyl cyanoacrylate adhesive (Indermil) is applied in discrete spots like welding.

foreign materials to the wound, introduction of the adhesive into the wound, burning sensation, wound infection, and wound dehiscence.

To avoid runoff, position the wound horizontally and apply small amounts of adhesive at a time by carefully controlling the release of the adhesive from the tip of the applicator. Additionally, if working near the patient's eyes, cover the eyelids with ointment or a moistened gauze or both. If the wound is above the eye, place the patient in the Trendelenburg position; if the wound is below the eye, use reverse Trendelenburg.[21] Cyanoacrylates are not toxic to the cornea and have been used to close corneal incisions, but these precautions will prevent untoward complications such as eyelashes becoming glued together. Should that happen despite the best efforts, application of a petrolatum-based ointment and an eye patch will allow the glue to be wiped away after 12 to 24 hours.

It is not uncommon for the fingertip of a glove to adhere to the adhesive. This, too, can be prevented to some extent by positioning the wound horizontally and applying the adhesive in small amounts. Also, switching hands frequently is recommended, with the other hand being used to appose the wound edges before the adhesive dries completely. If your glove does adhere to the adhesive, peel it off the patient's skin slowly and gently while supporting the wound with your free hand.

Introduction of adhesive into the wound can delay healing and cause tattooing (staining).[22] Meticulous wound apposition and gliding gently over the wound with the applicator, taking care not to press down, will help to prevent this. If adhesive does get into the wound, antibacterial ointment or sulfadiazine can be applied to ease its removal.

Polymerization is an exothermic reaction. The thicker the adhesive layer, the greater the heat release and the more the patient may experience a burning sensation. Avoid this by applying a small amount and spreading it evenly over the wound.

Finally, wound dehiscence can occur with topical skin adhesives, especially when they are used alone on high-tension wounds. As previously noted, they are no stronger than 4-0 sutures, so they should not be used alone on a wound that would require sutures of 3-0 strength or greater unless it is going to be splinted or has been approximated first with deep dermal tension-relieving sutures.[23] To close particularly long or irregularly shaped lacerations, a

combination of octyl cyanoacrylate and surgical tape together offers greater tensile strength than either would alone.[24]

In summary, topical skin adhesives are fast, easy to use, and produce excellent cosmetic outcomes if applied properly and used for appropriate wounds. In addition, they are painless, inexpensive, and do not require the patient to return for a finishing procedure. They can play a significant role in the management of wounds for any emergency practitioner. □

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