The occasional wound "gluing"

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INTRODUCTION

The modern rural physician has in his or her armamentarium several choices for laceration closure: sutures, tape, staples and tissue adhesives ("glue"). Each has its advantages, disadvantages, wounds to which it is ideally suited and wounds to which it is less well-suited.

This article will concern itself with tissue adhesives, of which, to my knowledge, 9 types are available in Canada, as of this writing (Box 1).

Box 1: Tissue adhesives available in Canada

Octylseal high viscosity tissue adhesive (Medline Industries)

Indermil tissue adhesive (Henkel Ireland Operations and Research Ltd.)

BioGlue surgical adhesive (Cryolife Inc.)

Glubran Tiss 2 (GEM S.r.l.)

SurgiSeal (Adhezion Biomedical LLC)

Coseal Surgical Sealant (Baxter Healthcare Corporation)

Dermabond (Ethicon LLC)

Omnex Surgical Sealant (Ethicon LLC)

Histoacryl (B. Braun Surgical S.A.)

HISTORY OF TISSUE GLUES

Today's tissue adhesives are from a class of molecules known as the cyanoacrylates, first synthesized in 1949. They are composed of a cyanoacetate and formaldehyde monomers, which, when in contact with the normal moisture on the skin, polymerize in an exothermic reaction; this explains why some patients feel a sensation of heat when tissue adhesive is applied.[1,2]

The early cyanoacrylates (e.g., Krazy Glue) were toxic to skin, but by the 1980s, nontoxic tissue adhesives were developed and came into clinical use. Because of their ease of application, they rapidly became accepted for use in the emergency department.

There are minor chemical differences among the various types. In particular, Dermabond forms a longer polymer, which is theoretically stronger, more stable and more flexible than the commonly used Histoacryl, but it is debatable how much clinical advantage this confers in everyday practice.[3–5]

ADVANTAGES

Tissue adhesives are a safe and effective way to close wounds. Advantages include[2]

- fast and relatively painless application, although some patients perceive a feeling of heat;
- "no-needle" application and anesthesia with topical anesthetic cream only (a consideration in pediatric use);
- maximum bonding strength achieved within minutes;
- water-resistant covering;
- no need to return for suture removal;
- can be applied by suitably trained nonphysician personnel during on-call hours (important for rural areas).

Not all wounds are suitable for tissue adhesives. The ideal wound for closure with tissue adhesive is described in Box 2.[2,6]

Box 2: The ideal wound for closure with tissue adhesive

An uncontaminated wound of the head, extremity or torso that is < 4 cm long and

- Has minimal skin tension
- Is seen within 12 hours of injury
- Would otherwise be suitable for closure with 5-0 suture material

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As seen above and in Box 2, adhesive is additionally well suited for

- pediatric use, especially for scalp lacerations;[7]
- flap-type lacerations (so it is handy for the thin skin of elderly patients);
- nail-bed repairs.

Adhesive can be used on areas of high tension or mobility, such as the hands, feet and joint lines, but the extremity or joint must then be immobilized.[2] Deeper wounds can still be closed with tissue adhesive, but layered suture closure or subcuticular sutures (especially on the extremities) should be applied before the adhesive to reduce skin tension. It is vital to have good approximation of the skin margins before any tissue adhesive is applied.[6]

CONTRAINDICATIONS

Wounds for which tissue adhesives are not suitable are listed in Box 3.[2] General contraindications to tissue adhesives include[8]

- sensitivity to any of the components;
- wounds that show evidence of infection or gangrene, or pressure ulcers;
- patients with known preoperative systemic infections, uncontrolled diabetes or diseases, or conditions that are known to interfere with wound healing.

Box 3: Wounds for which tissue adhesives are not suitable

- Jagged or stellate lacerations
- Bites
- Puncture or crush wounds
- Mucosal surfaces
- High-moisture areas (e.g., buttocks and perineum)
- Hands, feet and joint wounds, unless kept dry and immobilized

OUTCOME

A Cochrane review[4] found "no significant difference in cosmetic outcome between tissue adhesives and standard wound closure, or between different tissue adhesives." The authors state that tissue adhesives "offer the benefit of decreased procedure time and less pain, compared to standard wound closure."[4]

There is a small increase in the rate of dehiscence with tissue adhesives compared with standard sutures (4% v. 1%–2%).[4,6] The degree to which this is related to poor wound selection or poor technique of application is not known.[4,6] Infection rates are not increased[1–3] as long as proper attention is paid to wound cleansing (see below).

GENERAL PROCEDURE FOR USE OF TISSUE ADHESIVE

There are slight differences among the different products, so read the package-insert directions. Assuming that the wound meets the selection criteria (Boxes 2 and 3), the following guidelines are common to all products[3]:

- Adequate hemostasis must be obtained before the use of tissue adhesive.
- The general principles of wound care still apply: proper cleansing, irrigation, removal of debris and review of the patient's tetanus status. A topical anesthetic cream can be applied, if desired.
- All products have some toxicity to subcutaneous tissue, so the wound edges must be approximated during application to avoid instilling adhesive directly into the wound, where it can cause acute inflammatory reactions, giant cell reactions, inclusion body formation and seromas.
- Proper positioning of the patient is important (Box 4).[1,3] Tissue adhesive is often used for facial lacerations, so leakage into the eye is a concern. (Note that tissue adhesives themselves are not toxic to the eye — they are actually used for corneal perforations.)

Box 4: Positioning and precautions

- Position the patient so that when excess adhesive flows downward by gravity, it flows to an innocuous area.
- A rim of petrolatum jelly may be applied around the wound to block runoff.
- Have readily available a gauze sponge to quickly wipe up any excess adhesive.
- Use gravity to control the risk of leakage into the eyes: if the laceration is on the forehead, position the patient in a slight Trendelenburg position, if below the eye, use a slight reverse Trendelenburg position. Cover the eyes with gauze and/or apply a ridge of petrolatum jelly around the eyes to protect them.[1,3]
- If there is inadvertent leakage into the eye, do not apply water — it will only accelerate the polymerization. Apply a copious amount of antibacterial ophthalmic ointment (e.g., erythromycin) to break down the tissue adhesive. The eye will open in 1–2 days; do not attempt to pry it open. You may wish to obtain ophthalmologic consultation.[1]

USE OF HISTOACRYL

Histoacryl is simple to use.[9] It is applied in a single layer and sets in about 30 seconds.

1. To open the ampoule, hold it securely and give the tip a full turn.
2. Without squeezing the ampoule, turn it so that the applicator tip faces downward, and gently tap on the tip to "load" the adhesive tip.

3. Push the wound margins together (or have an assistant do this) (Fig. 1). (If there is substantial wound tension, insert subcuticular sutures beforehand.)



Fig. 1. Gently press the wound edges together.

4. Two techniques are acceptable to close the wound: the "spot-weld" method and the "continuous-flow" method.
   For the spot-weld method:
   a) Push the wound margins together (Fig. 1).
   b) Press the base of the ampoule gently and apply the Histoacryl as a series of small drops along the length of the incision line (Fig. 2). (For those of us who took shop courses in high school, this resembles spot-welding.)

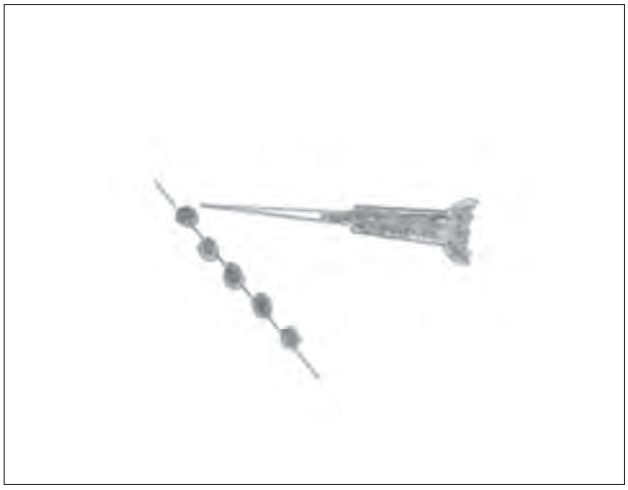


Fig. 2. The spot-weld method.

   c) Use the neck of the applicator tip to connect the dots and then spread the Histoacryl across the entire length of the incision line. Only a thin layer is required.

   For the continuous-flow method:
   a) Lightly hold the wound edges together.
   b) Here, the Histoacryl is applied by pressing on the base of the ampoule and moving the applicator down the length of the incision to apply the tissue adhesive in a continuous layer. You must maintain a constant pressure on the ampoule as you apply (Fig. 3).

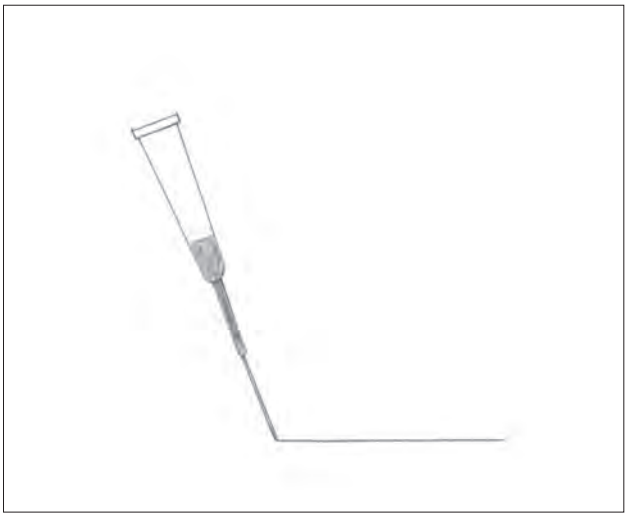


Fig. 3. The continuous-flow method.

With either technique, press the wound edges together for 30–60 seconds to ensure proper polymerization.[3]

Tissue tape may be applied afterward for greater tensile strength, especially if the wound is long.

USE OF DERMABOND

The technique for Dermabond differs slightly.[3,10]

1. Point the applicator with the tip pointing upward and away from the patient.
2. Squeeze and crush the plastic Dermabond applicator. Release the pressure. Turn the applicator so that the tip is pointing downward, and gently squeeze so that the applicator tip is coated with adhesive.
3. Approximate the wound edges, gently squeeze the tube and apply the adhesive in a thin layer along the wound, with a gently brushing motion, allowing a 5–10 mm margin around the wound. Approximate the wound edges for 30 seconds.
4. Apply a second, thin layer of Dermabond with a similar brushing motion and approximate the wound edges for 30 seconds, and then apply a third, thin layer.
5. Approximate the wound edges for 60 seconds.
6. Full polymerization will be obtained within 3 minutes.

As above, tissue tape may be applied afterward for greater tensile strength, especially if the wound is long.

POSTOPERATIVE CARE

A bandage is not required but may be applied. The patient should be told to keep the wound dry and clean for 24 hours, after which time he or she can gently cleanse the wound and shower. The tissue adhesive will peel off by itself in 5–8 days.[6]

If the wound dehisces, the patient should return. Dehisced wounds can be closed with tape or sutures. If the wound shows signs of infection, oral antibiotics can be prescribed in the usual manner, but topical antibiotics must be avoided because they can weaken the adhesive.

SUMMARY

- Select the right wound
- Select the tissue adhesive
- Prepare anything else you will need (e.g., gauze, petrolatum jelly)
- Prep the wound properly, as you would for suturing
- Position the patient to prevent adhesive falling in the eye
- Press the wound edges together
- Apply the adhesive, dry and repeat if necessary
- Clean up

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