Wound healing outcomes after laceration repair with adhesive

Sarah Lewis and colleagues present the results of an audit of patient and clinician experience of emergency wound-closure procedures

Summary

It is important to be able to demonstrate that clinical practice and choice of products are based on evidence. This article discusses findings from an audit of wound-healing outcomes, ease of use, and patient and practitioner satisfaction associated with the use of a tissue adhesive in an emergency department. It briefly discusses wound and adhesive types, and shows that using such products for specific lacerations can provide safe and effective closure and acceptable healing outcomes for patients and clinicians, and reports the results of the study.

Keywords
Tissue adhesive, lacerations, wound repair outcomes

LACERATION REPAIRS take up a large amount of emergency nurse practitioners' (ENPs') time. Between 2008 and 2009, for example, about 8.5 per cent of patients who presented to emergency departments (EDs) in the UK were given a primary diagnosis of laceration (NHS Information Centre for Health and Social Care 2011).

Wound-closure procedures must therefore be quick and easy to carry out, and should provide acceptable cosmetic outcomes with minimal pain, trauma and complications for patients.

However, although rapid wound closure can be achieved with minimal pain, complications can arise and can be difficult to monitor if the patients concerned do not return to EDs. As a result, ENPs rarely have the opportunity to see how well, or poorly, wounds have healed or assess the cosmetic outcomes.

The authors decided, therefore, to undertake an audit of patient and clinician experiences of the wound closure procedure followed, and product used, in their ED. The aim of this audit was to determine whether or not the tissue adhesive used in the ED provided clinicians and patients with satisfactory outcomes and was easy to use.

Tissue adhesives are sterile liquids that polymerise, or set, when moist. When coming into contact with moisture on the skin surface, therefore, they can hold wound edges together and provide a microbial (Narang *et al* 2003, McAuliffe 2010) and waterproof film to protect the wounds.

Compared with other wound-closure methods, such as strips, sutures or staples, tissue adhesives:

- Are quick and easy to use (Coulthard *et al* 2010).
- Are non-invasive and so present less risk of tissue trauma or needle-stick injuries.
- Do not require secondary dressings.
- Do not require patients to return for removal.

There are about five different tissue adhesives available in the UK, each of which has unique features, chemistry and benefits, and it is the responsibility of clinicians to determine which of these adhesive provides the safest, most secure and most cost-effective means of wound closure.

At the authors' ED, for example, a sterile blend of 90 per cent n-butyl and 10 per cent 2-octly cyanoacrylate tissue adhesive is used. This adhesive was manufactured for the closure of clean, fresh wounds with easily apposed edges, specifically for use in EDs or trauma settings where there is no refrigeration.

The product comes pre-assembled, which helps to avoid loss of time through spillage or transfer of adhesive onto gloves, and with an adhesive applicator with flow-controlling tip to help ensure precise application. This means that it is safer than

other types of adhesive for use on facial wounds or those near the eye.

Ethical permission for the authors' audit was given by the South Manchester Research ethics service, and approval given by the trust's research and development department and management.

Patients who presented to the ED between October 2009 and July 2010, and whose wounds were suitable for closure with tissue adhesive, were invited to participate in the audit.

Potential participants were given copies of a leaflet informing them about the audit and the product. Those who agreed to take part were assumed to have given their written, informed consent.

Inclusion and exclusion criteria were comparable to the ED's standard procedures for determining suitability for wound closure with tissue adhesives, with the addition that patients, or their representatives, could give informed consent.

Wounds considered suitable for inclusion were simple lacerations, up to 5cm long and with easily apposed edges, in patients of at least 12 months of age. Excluded from the audit were wounds:

- Caused by animal or human bites, or by scratches.
- Caused by crushes or that had become heavily contaminated.
- In patients with blood-clotting disorders or known allergy to cyanoacrylates.
- More than 5cm long unless deep sutures had been used to remove skin surface tension.
- More than six hours old.
- Located over joints that had not been immobilised.
- Located in or near the mucosa, breast areolae or eye orbit tissue.

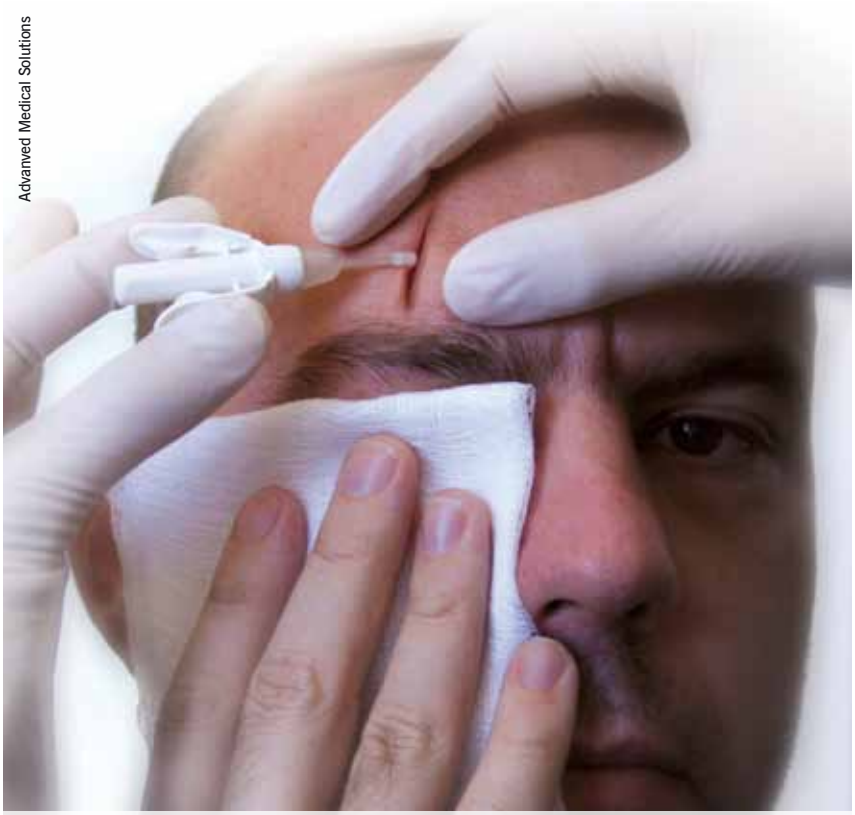
Information on demographics and lacerations, including their lengths and positions, were recorded on data collection forms for each participant. In addition, the lacerations were photographed before wound closure.

Each participant's wound was closed with the tissue adhesive in accordance with standard operating procedures, which include ensuring that wounds are clean and dry, and that their edges can be apposed easily before adhesive application. The wounds were then photographed again.

Data collection

Data were collected for the audit on two occasions, one immediately after the wound closure procedure was completed and the other during follow-up appointments.

Immediately after wound closure, participating patients or their parents or guardians were given copies of a visual analogue score (VAS) scale and asked to indicate numerically how painful they found, or thought that their children found, the wound closure procedure, with 0 representing 'no pain' and 10 representing 'severe pain'.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Some tissue adhesives are safer than others for use on facial wounds or wounds near the eye

In each case, clinicians were asked to record in the same VASs whether they had found closure 'very easy', 'easy', 'normal', 'difficult' or 'very difficult', and how long it took for the glue to set.

They were also asked to record whether or not reapplication of the product was necessary, and whether they were, in general terms, 'satisfied' or 'dissatisfied' with the adhesive.

Participating patients or their parents or guardians were asked to return to the ED between ten and 14 days after wound closure for follow up. At these times, their wounds were photographed again and evaluated for signs of erythema, oedema, pain or tenderness, inflammation, heat, infection or dehiscence. The degree of apposition attained and ability of the adhesive to close the wounds successfully were also recorded.

During these appointments, participating patients, or their parents or guardians, were given copies of a second VAS scale and asked to record numerically their satisfaction with their scars, with 0 representing the 'worst scar' they

had ever had and 10 representing the 'best scar' they had ever had. They were also asked to record their satisfaction with the cosmetic appearance of their scars, with 0 representing 'very dissatisfied' and 10 representing 'very satisfied'. Finally, they were asked to record whether they found the wound-closing experience as a whole 'much better', 'better than', 'as', 'worse than' or 'much worse than' expected.

Clinicians were asked to record their satisfaction with the scars, and with the cosmetic appearance of the scars, according to the scale used by the patients in the same VASs. In addition, they were asked to record whether the outcomes of wound closure with tissue adhesive were 'much better', 'better than', 'the same as', 'worse than' or 'much worse than' expected.

Finally, patients and clinicians were invited to state whether they had experienced any difficulties with the procedure.

Initial results

Sample data The final sample size was 20 patients, of whom 17 were male and three female. They ranged in age from two years to 79, with a mean average age of 33.

Wound data were recorded and photographs taken of all 20 participants. All wounds were classified as lacerations, ranging in length from 5.0mm to 50.0mm, with a mean of 21.9mm; in depth from 1.0mm to 5.0mm, with a mean of 2.9mm; and in width from 1.0mm to 10.0mm, with a mean of 2.5mm.

Wound location varied, with six being on the forehead, seven on the scalp, three on the hand and four on the chin, ear, eyebrow or elsewhere on the face.

No local anaesthetic was required for any of the closures and only one patient was discharged with antibiotics. Seventeen patients required no secondary dressing to cover the laceration after closure but two wounds were covered with self-adhesive absorbent dressing and one with gauze.

Pain The pain scores reported by participating patients or their parents or guardians ranged from 0 to 5.5, with a mean score of 1.0.

Sixteen patients reported no pain on application, three reported a 'mild', stinging pain and one reported pain of more than 2 on the pain scale. However, the patient who reported having experienced pain in the VAS had earlier denied doing so during adhesive application, which puts the high pain score of 5.5 into doubt.

Ease of use Clinicians rated 15 of the closures as 'very easy' and four as 'easy', while one was deemed 'difficult' because a small section of the laceration continued to bleed after initial closure and had to be re-glued.

Set time In 13 of the 20 patients, the tissue adhesive set in between ten and 30 seconds; for three, it took longer than 30 seconds; for another four, it took less than ten seconds.

Reapplication The first application of tissue adhesive resulted in successful wound closure in 17 patients. Of the three reapplications, one was due to persistent bleeding, as stated already, one was due to an initial misapplication of adhesive to a hair surrounding a head wound and one was due to unspecified reasons.

Clinician satisfaction Clinicians reported satisfaction with tissue adhesive in 19 of the 20 cases. The one case in which a clinician was dissatisfied involved the application of adhesive to hair, which is not recommended by the adhesive manufacturer.

Follow-up results

Wound healing status Of the 20 patient participants in the first audit, 13 returned, on average 11 days later, for review. None reported or showed clinical signs of oedema, pain or tenderness, heat, drainage, discharge, or infection, and none had required antibiotics or steroids since wound closure. In one, there was slight erythema and inflammation to the wound margins, but no evidence of infection.

Complete apposition of wound edges was achieved in ten patients, and three had reached between 50 and 99 per cent apposition.

In two of the latter cases, the wounds were assessed as having dehisced superficially, and were expected to heal without further treatment. One of these occurred in a two-year-old boy who had had tape strips placed over his laceration after it had been closed with adhesive. He had pulled off some of these strips and this probably had led to the re-opening of the wound.

Bonding status of adhesive The adhesive had completely sloughed off in five of the 13 patients who returned for follow up and had sloughed off partially in seven of them. The product remained intact in one patient.

Patient satisfaction At follow up, patients' ranked their satisfaction with the scars and their cosmetic appearance highly.

Scores for satisfaction with the scars ranged from 5 to 10, with a mean of 8.4, and those for satisfaction with cosmetic appearance ranged from 3.5 to 10, with a mean of 8.7. On both satisfaction scales, scores exceeded 7 in 11 out of the 12 cases.

In only one case, in which the child concerned had pulled off the tape strips covering the wound, was closure rated 'worse than expected'. Of the remaining 12, two were deemed 'as expected', six 'better than expected' and four 'much better than expected'.

Clinician satisfaction Clinicians also ranked the appearance of patients' scars at follow up, and their overall satisfaction, highly.

On the scale for scar satisfaction, the scores ranged from 3 to 10, with a mean of 7.9, and on the scale for cosmetic appearance satisfaction, scores ranged from 3.5 to 10, with a mean of 8.2. On both satisfaction scales, scores exceeded 7 in 11 out of the 12 cases.

Clinicians rated wound-closure outcomes 'as expected' in 11 of the lacerations, 'better than expected' in six and 'much better than expected' in three. The remaining two, which are discussed above, were rated 'worse than expected'.

Difficulties experienced No difficulties were reported by patients or clinicians between initial wound closure to follow up.

Limitations

This audit was limited by how few participants attended follow-up appointments. Although all participating patients, or their families or carers, signed forms stating that they wound re-attend for follow up, and were offered travelling expenses, seven of them failed to do so. This may have been due in part to the short time periods between initial wound closure and follow up, which will be extended if further, similar studies are undertaken by the authors.

The amount of adhesive supplied in the applicators also limited the audit to patients with superficial wounds that were up to 5cm long. If the manufacturer produces larger applicators, the authors may undertake another study of patients with deeper or larger wounds.

Finally, taking high quality images of wounds in young children proved particularly challenging.

Conclusion

It is unusual in emergency care to witness the results of the care delivered. This audit gave the ED's practitioners greater confidence in using tissue adhesive and when assuring patients that its use is generally painless and quick, causes minimum distress, and produces good outcomes.

The tissue adhesive used in the audit is up to date and can be distinguished from other adhesives by its unique applicator. It provides excellent cosmetic outcomes, causes minimal pain on application, and results in high levels of patient and clinician satisfaction, no instances of dehiscence that require retreatment, and no infection.

Practitioners who use it, moreover, can reduce the risk of infection by adopting an aseptic non-touch technique.

The most rewarding aspect of the audit, however, was seeing that the patients who returned were satisfied with the treatment they received. This is evidence that the care that ENPs provide is successful and provides satisfactory healing outcomes.

Implications for practice

Among methods of wound closure in the emergency department (ED), skin adhesive:

- Is cost effective. There is no need to use anaesthetics or dressings, or for patients to return to have their sutures removed.
- Is safe. There is no need to use needles so patients and nurses are less exposed to blood-born viruses.
- Is quick and easy to use. This expedites patients' journey times and helps staff manage ED breach times.
- Produces satisfactory cosmetic results.
- Is less traumatic, particularly for children, making subsequent visits to the ED less of an ordeal.

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Declaration of interest
MedLogic Global Ltd provided the tissue adhesive discussed in this article. It also offered to pay the travel expenses of participants in the audit, and provided a digital camera for photographing their wounds before and after treatment. No other funding was sought or offered by the authors

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