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Selected Topics: Wound Care

EVALUATION OF A LIQUID DRESSING FOR MINOR NONBLEEDING ABRASIONS AND CLASS I AND II SKIN TEARS IN THE EMERGENCY DEPARTMENT

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☐ **Abstract—Background: Minor abrasions and skin tears are usually treated with gauze dressings and topical antibiotics requiring frequent and messy dressing changes. Objective: We describe our experience with a low-cost, cyanoacrylate-based liquid dressing applied only once for minor abrasions and skin tears. Methods: We conducted a single-center, prospective, noncomparative study in adult emergency department (ED) patients with minor nonbleeding skin abrasions and class I and II skin tears. After cleaning the wound and achieving hemostasis, the wounds were covered with a single layer of a cyanoacrylate liquid dressing. Patients were followed every 1–2 days until healing. Results: We enrolled 40 patients with 50 wounds including 39 abrasions and 11 skin tears. Mean (standard deviation) age was 54.5 (21.9) years and 57.5% were male. Wounds were located on the face (n = 16), hands (n = 14), legs (n = 11), and arms (n = 9). Pain scores (0 to 10 from none to worst) after application of the liquid dressing were 0 in 62% and 1–3 in the remaining patients. Follow-up was available on 36 patients and 46 wounds. No wounds rebled and there were no wound infections. Only one wound required an additional dressing. Median (interquartile range [IQR]) time to complete sloughing of the adhesive was 7 (5.5–8) days. Median (IQR) time to complete healing and sloughing of the overlying scab was 10 (7.4–14) days. Conclusions: Our study suggests that a single application of a low-cost cyanoacrylate-based liquid adhesive is a safe and effective treatment for superficial nonbleeding abrasions and class I and II skin tears that eliminates the need for topical antibiotics and dressings.** © 2015 Elsevier Inc.

☐ **Keywords—abrasions; skin tears; liquid adhesive; cyanoacrylates; dressings**

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INTRODUCTION

Each year there are millions of abrasions and skin tears presenting to emergency departments (EDs) throughout the Unites States, with countless more that do not visit the ED (1). A large body of evidence has demonstrated that wounds heal better under a moist wound-healing environment (2–5). In addition, occlusive dressings that create a moist wound environment have also been shown to reduce pain, improve cosmesis, and result in fewer infections (6,7).

The most common method for treating minor wounds such as abrasions and class I and class II skin tears is gauze dressings (such as Band-Aids) with or without topical antibiotic ointments or creams. Although effective, use of such dressings can be burdensome and messy, and exposure of treated wounds to water often causes stinging and maceration. Many commercially available occlusive dressings can reduce the need for frequent and sometimes uncomfortable dressing changes, but need to be protected from bathing and washing. The ideal dressing for minor wounds would be relatively painless,

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inexpensive, create a moist wound healing environment, require a single application, and be resistant to minor exposure to bathing and washing.

The cyanoacrylate topical skin adhesives (TSA) have many of the ideal dressing characteristics noted above by creating an occlusive dressing that also serves as a microbial barrier from external contamination (8). Most available TSA are designed as wound closure devices, are relatively expensive, and only available to health care practitioners (9–11). Several less expensive, commercially available TSA are labeled as skin protectants or for damaged skin, but not for closure of lacerations and surgical incisions. These TSAs may create an occlusive environment and a microbial barrier but are rarely if ever used in the ED or home settings. Availability of an inexpensive, single-application TSA for the treatment of minor, nonbleeding abrasions and class I and II skin tears has the potential to be of benefit to many patients with these wounds.

The objective of the current study was to explore the use of an inexpensive, commercially available cyanoacrylate-based liquid dressing for the treatment of minor nonbleeding abrasions and class I and class II skin tears. Specifically, we determined the time to healing and need for additional wound therapies in a convenience sample of ED patients with skin abrasions and skin tears.

METHODS

Study Design

We conducted a single-center, prospective, open label, noncomparative study to explore the safety and efficacy of a liquid dressing for superficial abrasions and skin tears. The study represents a convenience sample of patients who presented to the ED when one of the investigators was present. The study was approved by the Institutional Review Board and all patients (or their legal representatives) gave written, informed consent. The study was an investigator-initiated study in which the study design, data analysis, and manuscript preparation were performed by the investigators independent of the funding agency.

Setting

The study was conducted at a tertiary, academic medical center with an affiliated residency program in emergency medicine and an annual ED census of 90,000.

Subjects

Patients were eligible for enrollment if they were aged 18 years or older and presented to the ED with a nonbleeding minor skin abrasion or a class I or class II skin tear. According to a classification scheme suggested by Payne and Martin, class I skin tears are defined as skin tears without any tissue loss, class II skin tears are defined as tears associated with partial tissue loss, and class III tears are defined as tears associated with complete tissue loss (12). Patients with deep, infected, heavily contaminated, and actively bleeding wounds that did not respond to application of local pressure were excluded. Patients with a history of allergy to the cyanoacrylates or formaldehyde were also excluded. Patients on oral vitamin K antagonists were not excluded from the study.

Interventions

After patient stabilization all wounds were cleaned with normal saline and any bleeding stopped with application of local pressure. In patients with class II skin tears, the skin edges were approximated with surgical adhesive tape (Steri-Strips; 3M, St. Paul, MN). A cyanoacrylate based liquid formulation (MARATHON LIQUID SKIN PROTECTANT; Medline Industries Inc., Mundelein, IL) was then applied in a single layer to the damaged skin according to the manufacturer's recommendations (Figure 1). This formulation is labeled as a skin protectant and for the treatment of damaged skin and its tensile strength has not been measured or reported. If surgical tape was used to approximate the separated edges of a skin tear, the tape was placed first, and then the liquid bandage was applied over the entire wound including the tape. A prior study has shown that the tensile strength of a surgical tape TSA combination is greater than either method alone (13). After the liquid dressing dried, no additional topical agents or dressings were applied.

Measures and Outcomes

Baseline demographic and clinical data were collected on standardized data-collection forms. Specifically, the area of the damaged skin was measured and a digital image of the wound was obtained. The pain experienced by the patient before, during, and immediately after application of the liquid dressing was measured on a validated verbal numeric scale from 0 (none) to 10 (worst). In addition any re-bleeding after application was noted. Re-bleeding was defined as seepage of blood beyond the borders of the adhesive or significant accumulation of blood underneath the adhesive causing the adhesive to be raised above the surrounding skin.

Patients were monitored every 1−2 days in person or by telephone follow-up to determine if and when the damaged skin healed and the scab fell off and for the presence of any complications, such as recurrent bleeding, pain, local erythema, or wound infection. The use of

Figure 1. Applicator containing liquid dressing.

any additional topical (such as creams, ointments, dressings, or additional applications of the liquid dressing) or systemic interventions (such as oral antibiotics) was also recorded. The patients were followed until wound healing. The wear-off time of the liquid dressing was also determined. Patients who did not return to the ED for follow-up e-mailed an image of their wounds taken with their smart phone.

The primary outcome was days until complete healing. The wound was considered healed when the adhesive and any underlying scab had sloughed off and the wound surface was dry to the touch. Secondary outcomes were recurrent bleeding, infection, and need for additional treatments or dressings. Wounds were considered infected if the patient was prescribed antibiotics by a health care practitioner for presumed wound infection.

Data Analysis

Descriptive statistics were used to summarize the data. Continuous data are presented as means, standard deviations (SD), and 95% confidence intervals (CI), or medians and interquartile ranges (IQR). Binary data are presented as numbers and percentages frequency of occurrence. Assuming that the SD for healing time is no greater than 6 days, as sample of 40 wounds would give a 95% CI around the mean of $\pm$ 2 days.

RESULTS

During the study period a convenience sample of 40 patients was enrolled out of 47 approached. Their mean (SD) age was 54.5 (21.9) years, with a range from 20 to 90 years. Of all patients 23 (57.5%) were male and 17 (42.5%) were female. The mechanisms of injury in these study patients were 22 (55%) falls, 12 (30%) motor-vehicle collisions, and 6 (15%) injuries from sharp objects. The total number of wounds included in the study was 50; 30 of the patients had a single wound, and 10 of the patients had two wounds. Wound types included 39 (78%) abrasions and 11 (22%) skin tears. Wounds were distributed on the face (n = 16 [32%]), hands (n = 14 [28%]), legs (n = 11 [22%]), and arms (n = 9 [18%]). The median (IQR) surface area of the wounds was 1.0 cm^2 (0.4–2.0) ranging from 0.2 to 11.8 cm^2. Adjunctive wound closure devices were used in 2 patients only; both had type II skin tears and required adhesive surgical tape to approximate the wound edges before application of the TSA over the tape. Application of the TSA did not cause any pain or discomfort in 32 (64%) of the wounds. Application of the TSA was associated with mild pain (a verbal numeric score of $\leq$3) in the remaining 18 (36%) patients. There was no re-bleeding in any of the wounds. Of all patients with abrasions, four were on a vitamin K antagonist and presented with continued bleeding from their wounds that did not stop with direct pressure. In all of these cases, the bleeding was stopped by applying pressure proximal to the injury (three of the abrasions were on the tip of the finger and one was on the ear). After achieving hemostasis, the liquid dressing was applied to the wound and the pressure was released after the dressing had dried (usually within 10−20 s). In none of these cases did bleeding recur at any time after treatment. No additional dressings were placed in any of the treated wounds.

Follow-up to complete wound healing was obtained in 36 (90%) patients with 46 (92%) wounds. None of the

patients lost to follow-up returned to our hospital for any wound complications. In all but one wound, the wound healed without the need for any additional topical treatments or dressings. In 1 patient, an adhesive bandage (Band-Aid) was placed on the wound 3 days later because the liquid bandage had partially sloughed off. This wound healed uneventfully by day 7. There were no reported wound infections. Median (IQR) time to complete sloughing of the adhesive was 7 (5.5–8) days. Median (IQR) time to complete healing and sloughing of the overlying scab was 10 (7.4–14) days. Mean (95% CI) time to healing was 12.4 (10.8–14.1) days. Representative images of wounds are presented in Figures 2–4.

Representative Case Studies

An 89-year-old male patient presented to the ED with sepsis. On attempting to place an intravenous catheter, palmar flexion of the wrist resulted in a long class II skin tear on the dorsum of the hand. The edges of the skin tear were approximated with surgical tape and the wound was covered with a single application of the liquid dressing. The patient required no further treatments and the wound healed uneventfully within 17 days (Figure 2).

A 76-year-old male with a history of atrial fibrillation on warfarin presented to the ED 24 h after accidentally cutting his ear while being shaved with a sharp razor. The abrasion continued to bleed for the next 24 hours when the patient presented to the ED. His international normalized ratio was 5.0. In order to stop the bleeding, the auricle was pinched between the practitioner's thumb and index finger immediately below the abrasion and the liquid dressing was applied in a single layer. After 15 s, the adhesive was dry and the pressure was released. There was no recurrent bleeding and the wound healed uneventfully within 12 days (Figure 3).

A 42-year-old male landscaper accidentally cut his hand with a sharp object. After cleaning the wound, a single layer of the liquid dressing was applied and the patient's wound healed uneventfully within 6 days without the need for any additional topical agents or dressings while allowing continued manual labor (Figure 4).

DISCUSSION

The results of this prospective noncomparative study demonstrate that topical application of a cyanoacrylate-based liquid wound dressing is both safe and effective for treating minor nonbleeding abrasions and class I and class II skin tears in the ED setting. Application of the liquid dressing was painless to minimally painful

Figure 2. Class II skin tear of hand treated with liquid dressing.

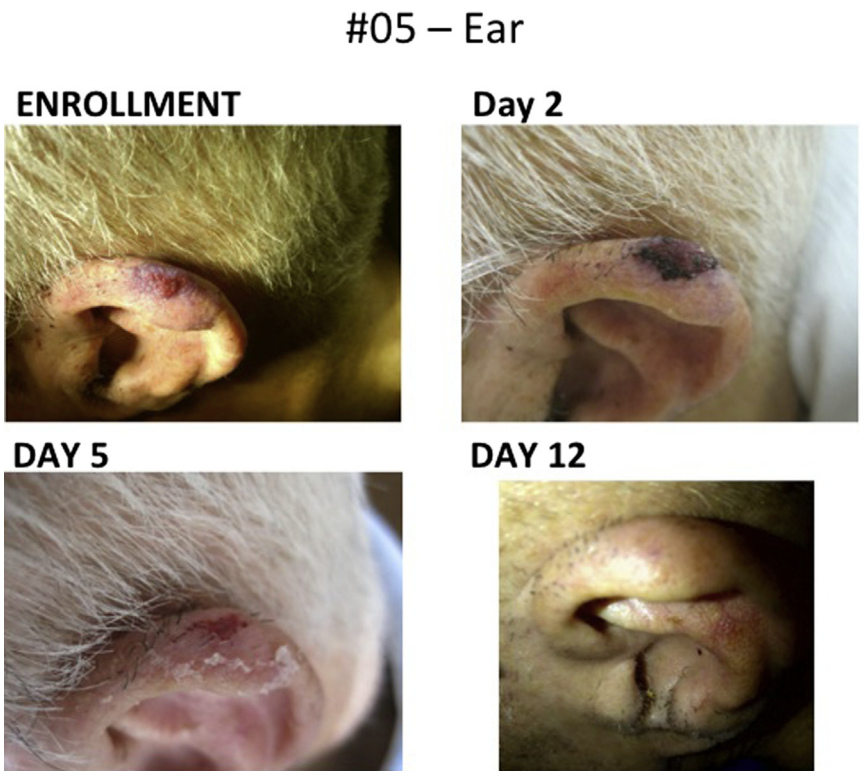

Figure 3. Ear abrasion from razor blade in a patient on Coumadin with an international normalized ratio of 5 treated with liquid bandage. The wound had been bleeding for 24 h before application of the dressing. The bleeding was stopped by applying pressure proximal to the abrasion.

and resulted in complete wound healing without any infection or need for additional treatment within 1−2 weeks in the majority of patients. In patients with type II skin tears, use of an adhesive surgical tape was useful to approximate the edges of the wound before application of the liquid dressing. Thus, our study suggests that the cyanoacrylate-based liquid dressing should be considered as an alternative to standard treatment for minor wounds in the ED because it eliminates the need for frequent and often messy and inconvenient topical antibiotics and dressings. Treatment of abrasions was also effective in patients on oral anticoagulants demonstrating their hemostatic properties. It is important to note that the cyanoacrylate-based liquid dressing used in the current study (MARATHON® LIQUID SKIN PROTECTANT) is labeled as a skin protectant and for use on damaged skin and should not be used as a wound-closure device, but rather as a topical dressing over superficial abrasions and skin tears. The topical liquid dressing should also not be used for contaminated, infected, actively bleeding, or deep wounds.

Although topical skin adhesives have been widely and successfully used as a wound-closure device, few studies have evaluated their use as a wound dressing. A study of 162 volunteers with recent minor cuts or abrasions randomized patients to either a liquid adhesive bandage (a flexible formulation of octyl-2-cyanoacrylate) or a control device (Band-Aid) (14). At day 12, there was no difference between the number of completely healed wounds in the liquid and standard bandage groups ($p = 0.49$). However, the liquid bandage provided better hemostasis and pain relief than the Band-Aid. The ability of the cyanoacrylates to achieve hemostasis has also been demonstrated in a porcine epistaxis model, even after intravenous heparinization (15). Although the exact mechanisms leading to hemostasis are yet to be determined, it is likely that the hemostatic properties of the cyanoacrylates can be attributed to their ability to seal off injured blood vessels and their function as a passive surface for platelet aggregation and coagulation (15).

The use of topical cyanoacrylate-based dressings has also been reported in elderly patients with skin tears. Several years ago, Milne and Colbert published their results in which a cyanoacrylate-based dressing was applied in 20 nursing home patients with class II and III skin tears (16). Of all patients, healing was complete in 18 (90%) and mild to moderate temporary pain was reported in only 2 patients. None of the study patients developed localized or systemic infection and all were allowed to continue to shower or bathe. Application time was very brief (approximately 1½ min) and the average cost was < $1 per application. Because there was no

Figure 4. Abrasion to hand from sharp object treated with the liquid dressing.

need for frequent dressing changes, clinicians were very satisfied with the use of the liquid bandage.

Studies in animals have also found that superficial mechanical and thermal wounds heal faster when treated with a cyanoacrylate-based liquid bandage (17–19). In contrast, a liquid bandage was not found to be effective in patients with partial thickness burns because the dressing tended to slough off rapidly due to exposure to heavy exudation associated with these burns (20). Octyl-2-cyanoacrylate has also been used successfully as a liquid bandage after suturing of facial neoplasms (21).

Limitations

Our study has several notable limitations. First, our study included a convenience sample of patients when one of the investigators was present. Thus, it is possible that there is a selection bias and that our findings may not be representative of all patients with superficial abrasions and skin tears. Second, the study was conducted at a single medical center that may not generalize to all settings. Third, four patients (each with one wound) were lost to follow-up. Although none of these patients returned to our ED with a wound complication, we cannot be sure that they did not present to another hospital with a complication. Finally, this was a noncomparative study. However, a prior study comparing a liquid adhesive to gauze dressings found similar rates of healing (14).

CONCLUSIONS

In conclusion, our study suggests that application of an inexpensive, commercially available cyanoacrylate-based liquid dressing is a safe and effective treatment for superficial, nonbleeding abrasions and class I and class II skin tears, which eliminates the need for topical antibiotics and dressings. Due to their hemostatic properties, the cyanoacrylate-based liquid dressing may also be used in patients receiving oral vitamin K antagonists.

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ARTICLE SUMMARY

1. Why is this topic important?

Many patients present to the emergency department with minor wounds such as abrasions and simple skin tears. Although effective, treatment with topical antibiotics and dressings is messy and sometimes uncomfortable and time consuming. An inexpensive liquid dressing that is applied only once would simplify wound care and reduce the discomfort associated with frequent dressing changes.

2. What does this study attempt to show?

This study attempts to show that it is possible to treat minor wounds with a single application of a liquid adhesive dressing.

3. What are the key findings?

This study shows that a single application of an inexpensive liquid adhesive allows healing of minor wounds without the need for frequent dressings changes and is not associated with obvious adverse events.

4. How is patient care impacted?

Minor wounds, such as abrasions and superficial skin tears, can be managed with a single application of an inexpensive liquid adhesive, obviating the need for frequent and messy dressing changes.