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

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ABSTRACT

Objectives

Minor abrasions and skin tears are very common, and most are treated with gauze dressings with or without topical antibiotics requiring frequent and messy dressing changes. A low cost liquid dressing that requires only a single application, creates an occlusive wound healing environment, and functions as a microbial barrier would be of benefit to millions of patients each year. We determined the safety and efficacy of a cyanoacrylate-based liquid dressing for minor abrasions and skin tears in the ED.

Methods

We conducted a single center, prospective, non-comparative study in a convenience sample of adult ED patients with minor non-bleeding skin abrasions and class I and II skin tears. After cleaning the wound and achieving hemostasis with local pressure the wounds were covered with a single layer of a cyanoacrylate liquid dressing. No additional topical agents or dressings were applied. 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 (SD) age was 54.5 (21.9) years and 57.5% were male. Wounds were located on the face (16), hands (14), legs (11) and arms (9). Application of the liquid dressing resulted in little if any pain in all 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 (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

A single application of a cyanoacrylate based liquid application is a safe and effective treatment for superficial non-bleeding abrasions and skin tears that eliminates the need for topical antibiotics and dressings.

BACKGROUND AND SIGNIFICANCE

Each year there are millions of abrasions and skin tears presenting to emergency departments (ED) 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. While 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, 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 a microbial barrier from external contamination.[8] Most available TSA while relatively strong, are designed as wound closure devices, are relatively expensive, and only available to healthcare practitioners.[9-11] Several weaker TSA, while inappropriate for closure of lacerations and surgical incisions, also 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 non-bleeding abrasions and skin tears has the potential to be of benefit to many patients with these wounds.

Goals of this Study

The objective of the current study was to determine the safety and efficacy of a commercially available cyanoacrylate based liquid dressing for the treatment of minor non-bleeding 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 abrasions and skin tears.

METHODS

Study Design

We conducted a single center, prospective, open label, non-comparative study to evaluate the safety and efficacy of the 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 ages 18 years and older and presented to the ED with a non-bleeding minor skin abrasion or a class I or II skin tear. 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 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). Additional applications were allowed at the discretion of the clinician. After the liquid dressing was dry, 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.

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 the presence of any complications such as recurrent bleeding, pain, local erythema and/or wound infection. The use of 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.

Data Analysis

Descriptive statistics were used to summarize the data. Continuous data are presented as means and standard deviations or medians and inter-quartile ranges (IQR).

Binary data is presented as numbers and percentages frequency of occurrence. Because this was a non-comparative pilot study no sample size was calculated.

RESULTS

During the study period a convenience sample of 40 patients were 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 injury from sharp objects 6 (15%). The total number of wounds included in the study was 50; 30 of the patients had a single wound while 10 of the patients had two wounds. Wound types included 39 (78%) abrasions and 11 (22%) skin tears. Of all wounds, 16 (32%) were on the face, 14 (28%) were on the hands, 11 (22%) were on the legs, and 9 (18%) were on the arms. 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 two patients only; both had type II skin tears and required adhesive surgical tape to approximate the wound edges prior to 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 3 or less on a scale from 0 (none) to 10 (worst) 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 seconds). In none of these cases did bleeding recur at any tome following treatment.

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 one patient, an adhesive bandage was placed on the wound. 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. 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 IV 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 Coumadin presented to the ED 24 hours 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 INR 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 seconds the dressing 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.

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 that 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. While 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 non-comparative study. However, a prior study comparing a liquid adhesive to gauze dressings found similar rates of healing.

DISCUSSION

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

the cyanoacrylate based liquid dressing used in the current study (MARATHON® LIQUID SKIN PROTECTANT) does not have great tensile strength 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 wounds, or deep wounds.

While 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).[12] 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.[13] While 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.[13]

The use of topical cyanoacrylate based dressings has also been reported in elderly patients with skin tears. In a convenience sample of 20 patients with Payne-Martin Category II and III skin tears of less than 8 hours' duration, Milne and Corbett reported complete healing occurred with 1 application of the liquid bandage in 90% (18/20) of study subjects; 5% (n = 1) reported transient mild pain (less than 15 seconds), and 90% (n = 19) reported no pain.[14] There were no incidents of cellulitis or infection. Shower and

bathing routines were not interrupted. Cost averaged less than $1 per application and clinician time averaged 1.5 minutes per application. Clinicians reported high satisfaction because repeated dressing changes were eliminated.

Studies in animals have also found that superficial mechanical and thermal wounds heal faster when treated with a cyanoacrylate based liquid bandage.[15-17] In contrast, a liquid bandage was not found to be effective in patients with partial thickness burns since the dressing tended to slough off rapidly due to exposure to heavy exudation associated with these burns. [18] Octyl-2-cyanoacrylate has also been used successfully as a liquid bandage after suturing of facial neoplasms.[19]

In conclusion, we have demonstrated that application of a cyanoacrylate based liquid dressing is a safe and effective treatment for superficial, non-bleeding abrasions and class I and II skin tears that 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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Figure 1. Applicator containing liquid dressing.

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

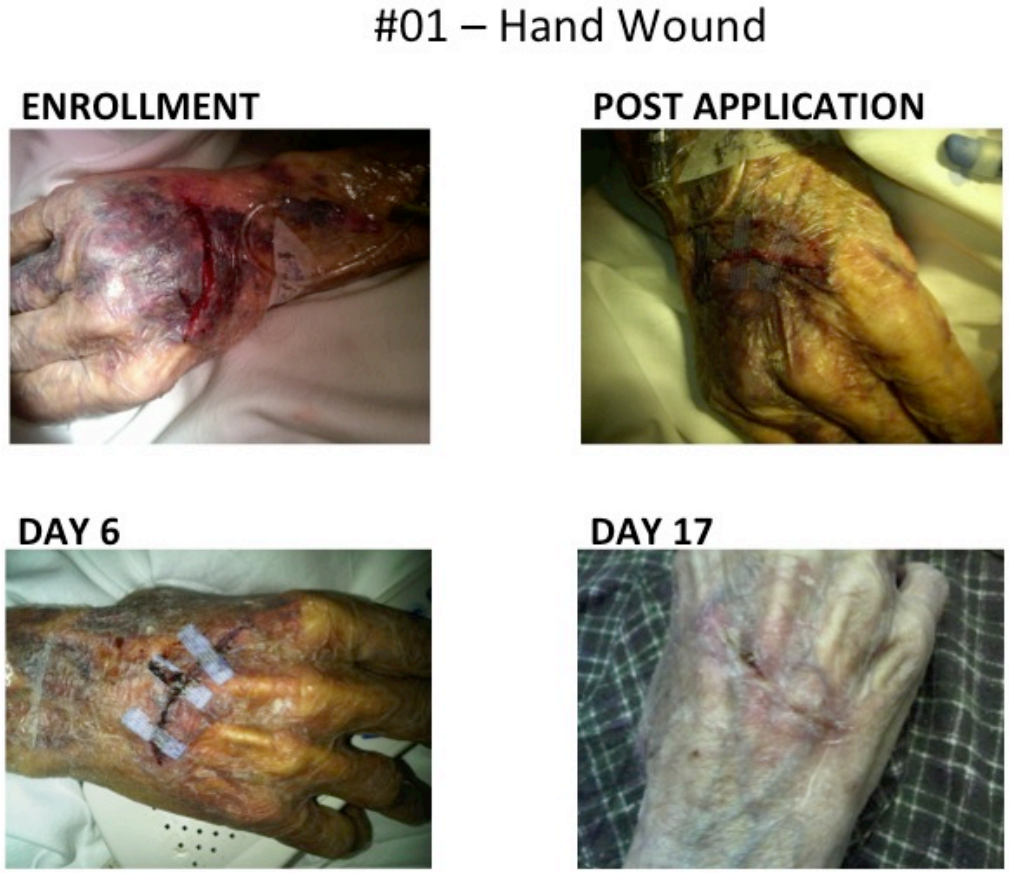

Figure 2. Ear abrasion from razor blade in a patient on Coumadin with an INR of 5 treated with liquid bandage. The wound had been bleeding for 24 hours before application of the dressing. The bleeding was stopped by applying pressure proximal to the abrasion.

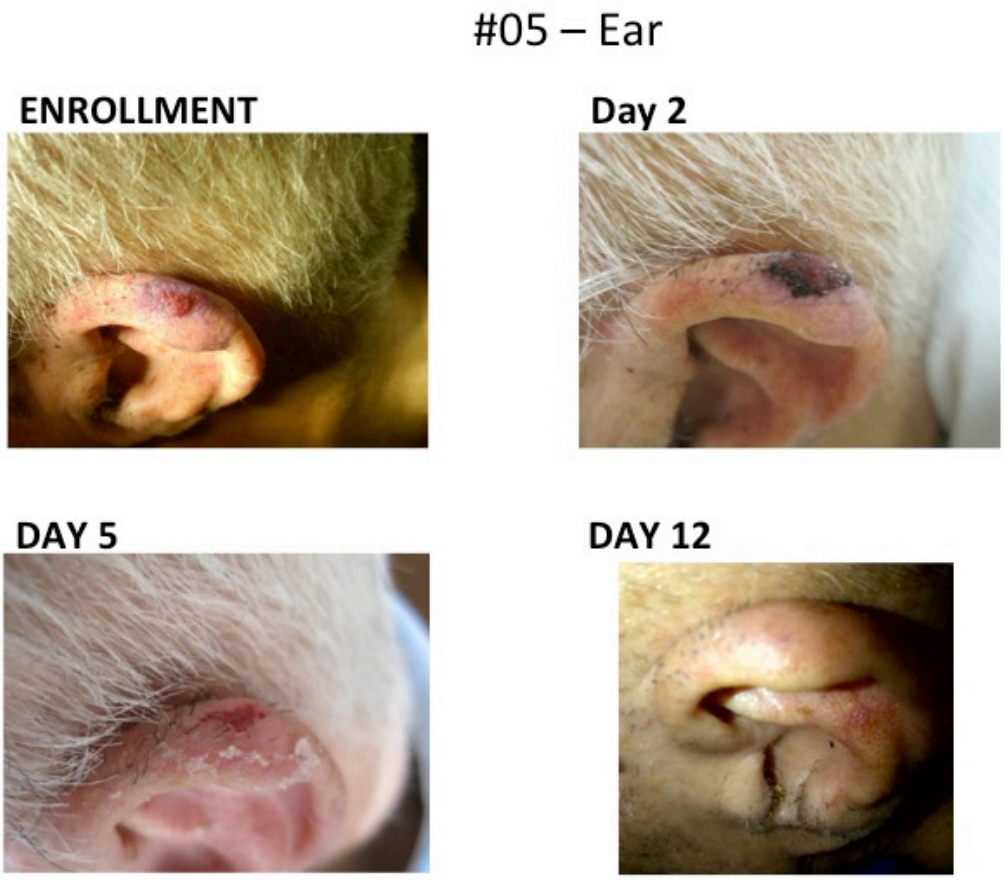

Figure 3. Abrasion to hand from sharp object treated with the liquid dressing.