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The efficacy of Aloe vera, tea tree oil and saliva as first aid treatment for partial thickness burn injuries

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ABSTRACT

Many alternative therapies are used as first aid treatment for burns, despite limited evidence supporting their use. In this study, Aloe vera, saliva and a tea tree oil impregnated dressing (Burnaid®) were applied as first aid to a porcine deep dermal contact burn, compared to a control of nothing. After burn creation, the treatments were applied for 20 min and the wounds observed at weekly dressing changes for 6 weeks. Results showed that the alternative treatments did significantly decrease subdermal temperature within the skin during the treatment period. However, they did not decrease the microflora or improve re-epithelialisation, scar strength, scar depth or cosmetic appearance of the scar and cannot be recommended for the first aid treatment of partial thickness burns.

1. Introduction

First aid is emergency care or treatment given before regular medical aid can be obtained. In the case of a burn, it should provide analgesia and ideally halt the progression of injury. A prospective audit of 341 new burn patients who presented to the Stuart Pegg Pediatric Burns Centre at the Brisbane Royal Children's Hospital in 2005 (data not shown) identified a number of alternative treatments applied by the public for the first aid treatment of burns. Although approximately 72% of people did use cold or ice water as first aid for burns, there were still a considerable number who used alternative therapies such as Aloe vera or tea tree oil products. Approximately 13% of patients had a Burnaid® dressing (a tea tree oil impregnated hydrogel dressing (sponge) developed by Rye Pharmaceuticals (Roseville, NSW, Australia)) applied as first aid for their burns, either alone or in conjunction with cold water. In most of these cases, the Burnaid® was applied by Queensland Ambulance on route to the hospital. Approximately 2% of patients had Aloe vera applied as first aid for their burns, either alone or in conjunction with cold water.

Although their use is widespread, alternative treatments usually have little evidence to support their use. There is one published study (with no statistical analysis) comparing Burnaid® to water cooling in a porcine model [1]. This study found that 15 °C compresses and Burnaid® reduced skin temperature and improved re-epithelialisation compared to control, although the 15 °C compresses were slightly better than Burnaid®. A recent review of four clinical trials investigating the effect of Aloe vera on burn wounds found that Aloe vera significantly shortened the wound healing time (by approximately eight days) compared to control. They concluded that it may be an effective treatment for first and second degree burns [2]. However, another study examining the effect of Aloe vera on gynecological wounds (wounds complicated by haematomas, seromas or abscess formation

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which were surgically opened or spontaneously underwent dehiscence) [3] found that the gel significantly delayed wound healing by approximately 30 days. Animal studies testing Aloe vera are conflicting, with two studies using guinea pig burns showing that Aloe vera both improved [4] and hindered burn wound healing [5]. Previous studies have shown that saliva has a positive effect on wound healing. Animals lick their wounds instinctively and desalivated rats and mice show a delay in wound healing [6,7]. The application of saliva to skin cells in culture [8] was found to stimulate the metabolic cell activity in a time and dose dependent manner in a comparative, or better manner than 10% foetal calf serum. Extracts from the submandibular and sublingual glands were found to be more effective than parotid gland extracts, indicating the healing effect is specific to salivary components, rather than a generalized moist environment. This effect was confirmed in rat wounds [9] and the application of saliva to bovine wounds was also found to be beneficial [10].

This study examines the efficacy of commonly used alternative first aid treatments (Burnaid® dressing, Aloe vera and saliva) on a porcine deep dermal burn injury. As the current recommendations are to cool the burn wound (usually with cold tap water), the cooling ability of these treatments was measured as well as their long-term (6 weeks) effect on wound healing and scar formation.

2. Materials and methods

2.1. *Animal surgery*

All animal work was approved by the institutional animal ethics committee. Eight Large White juvenile pigs of 25–32 kg (average 29.1 kg, approximately 8 weeks of age) were used for the study. Anaesthesia was inducted with an intramuscular dose of 13 mg/kg ketamine hydrochloride (Ketamine 100 mg/mL, Parnell Laboratories, Alexandria, Australia) and 1 mg/kg xylazine (Xylazil 20 mg/mL, Ilium, Troy Laboratories, Sydney, Australia) and was maintained with isoflurane via a size 4 laryngeal mask airway [11]. The hair on the back and flanks was clipped and the skin gently wiped with clean water prior to wounding. Buprenorphine hydrochloride at 0.01 mg/kg (Temgesic 0.3 mg/mL, Reckitt Benckiser, West Ryde, Australia) was administered as an analgesic on induction. The animals were positioned on a flat table, lying on one side with the flank for burn creation upward.

To measure subdermal temperature during burn creation and first aid treatment, a temperature probe was inserted under the skin. A 14-gauge cannula was inserted obliquely beside each wound area and advanced under the dermis until the tip was in the centre of the burn area. The needle was removed from the cannula and a type K thermocouple (Radiospares Components Pty Ltd, Smithfield, Australia) was inserted and taped into position. A digital 54II Fluke thermometer (Fluke Australia Pty Ltd, North Melbourne, Australia) automatically collected and logged temperature measurements every 15 s once the burning device was applied and during the course of the 20 min first aid treatment.

Wounds were created using a technique described previously by our group [12]. A Pyrex laboratory Schott (Mainz, Germany) Duran® 500 mL bottle was used which had the bottom removed and replaced with plastic wrap, which was secured with tape around the base (approximately 8 cm diameter). The bottle was filled with 300 mL of sterile water and heated in a microwave oven until it was 92.0 °C, whereupon the device was placed on the pig flank in a specific anatomical position on the dorsal flank. Immediately prior to burning, a fine mist of room temperature water was sprayed on the wound area to facilitate wound creation. The device was held in place for 15 s. Two burns were created on each animal, one on each flank. As the animal had to be lying flat on each side for the burn to be created (for best contact), the animal had to be flipped horizontally after the first burn had been created before the second one could be produced on the opposite flank.

2.2. *Administration of alternative first aid treatment*

After the first burn created on the first flank, the treatment was commenced as soon as practically possible (within 10 s, which is a realistic delay for treatment of accidental burns). After this time the animal was also turned over to lie on the other flank. The second burn was then created on the opposite flank and treatment again applied within 10 s. One of the 4 different treatments (Aloe vera, Burnaid®, saliva, control) was applied for 20 min to each burn, starting from the time of burn creation. Each animal received the same treatment on both wounds. For control animals, after the burn was created, nothing was applied to the skin for 20 min. For the Aloe vera treatment, leaves of a mature, well-established plant were skinned and enough of the inner pulp and gel was collected and applied directly to the wound to cover it. The Burnaid® treatment (Rye Pharmaceuticals) (10 cm square dressing) was applied directly to the wound. Saliva was collected from a human volunteer before burn creation and continually applied to the wound over the 20 min treatment period as it dried out. After the 20 min treatment period, the wounds were dressed with Jelonet™ (inert paraffin gauze, Smith & Nephew, Hull, UK) and Melolin™ (Smith & Nephew, Hull, UK) secured with Fixomull® retention tape (BSN Medical, Hamburg, Germany). The Aloe vera and saliva were left on the wound under the dressings. The Burnaid® dressing was removed, but the gel residue also remained on the wound under the dressing. The animals were then put into custom-made garments to protect the dressings and wounds over the 6-week period.

2.3. *Microbiology*

To obtain a semi-quantitative examination of the microflora present with each treatment, the clipped porcine flank was swabbed prior to wound creation, after wound creation and after the treatment application of 20 min. The wounds were also swabbed 2 weeks later, when the wounds typically are exudating and colonisation may be present. Swabs which were pre-moistened in saline were taken of each wound for 16 wounds, 2 wounds in each treatment. As the burn areas were well defined, a standard area was swabbed within the burn margin to ensure comparable microbial assessment. Transport media was used to minimise loss of organisms in transit.