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## Original Research Article

## Shoelace and honey technique: An innovative and inexpensive method of wound healing

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## ABSTRACT

**Background:** Wound closure and wound infection have been a great enemy to orthopaedic surgeons since the beginning of time. Many wound closure techniques have been described and controversy exists as to an optimal method. Healing by secondary intention used to be a commonly employed technique but is less popular nowadays. Most wound closures require split skin thickness grafting which increases morbidity and scarring<sup>1</sup> and additional wound at donor site. Gradual mechanical dermal apposition technique that is shoelace technique has gained popularity and has been shown to be effective in closure of wounds. Shoelace technique for wound closure is widely used in other medico-surgical specialties, this technique is unusual in orthopaedic surgery, but the simplicity of the procedure, demanded us to follow it in our cases.

Honey is the most ancient wound dressing biomaterial. Honey is known for its anti-oxidant, anti-bacterial and anti-inflammatory properties which were used for better and faster wound healing. Both the methods combined together make it a magic formula for the wound healing.

**Materials and Methods:** We have 21 patients presenting to VDGMC, LATUR from a period from May 2020 to December 2023, with difficult primary wound closure were included in the study. The patients underwent surgical fracture fixation (if any), followed by application of shoelace technique and honey dressing for the patient. An infant feeding tube and skin staples were used for the technique. Patients were followed till the complete wound healing occurred. The average time required for the wound healing using this technique was 3.2 weeks. Once the skin was approximated by dermatotractorion, delayed primary suturing was done and regular dressing protocol was followed.

**Result:** Our study showed an excellent wound healing in 20 cases with duration of wound healing less than 3 weeks, which also waived of the need for an extra procedure of skin grafting. 1 wound had continuous wound discharge which needed an extra debridement procedure longer duration for closure.

**Conclusion:** The successful outcome observed in these cases, and at a very low cost, allows for its consideration as indicated for situations similar to that presented in this study, especially in patients with poor economic background.

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## 1. Introduction

In the literature, there is a plethora of innovative techniques and variations focusing on dermal apposition<sup>1</sup> which takes advantage of the elastic property of skin for delayed primary closure of wounds. These include shoelace technique,

subcuticular suture, ty-raps, sureclosure, dynamic wound closure, STAR silver bullet wound closure device. Shoelace technique for wound closure is widely used in other medico-surgical specialties viz, general surgery for abdominal closures.<sup>2</sup> This method works on the principle of gradual dermatotractorion<sup>3</sup> of the skin and the subcutaneous tissue so as to approximate the far ends of the skin.<sup>3</sup> The dermatotractorion technique provides closure of wounds and

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avoids the necessity of extra surgical procedures like skin grafting and flap covers.<sup>3</sup> Hence, the associated cost implications, morbidity and complications rate are decreased with simple bedside procedure.

Honey on the other hand, is known for its anti-oxidant, anti-bacterial and anti-inflammatory properties<sup>4-7</sup> which were used for better and faster wound healing. The role of honey as a dressing material has been studied by many authors. Studies shows that wound healing properties of honey include stimulation of tissue growth, enhanced epithelisation,<sup>8</sup> and minimised scar formation. These effects are mainly due to honey's acidity, hydrogen peroxide content,<sup>7</sup> osmotic effect, nutritional and antioxidant content, stimulation of immunity and to unidentified compound. Most of the studies involving honey dressing were conducted on different types of diabetic wounds. Inhibition of growth of organisms such as *Staphylococcus aureus*, *Enteropathogenes* and *Candida albicans*<sup>5</sup> in undiluted honey has been attributed to inhibin in various studies.

## 2. Materials and Methods

All the patients who fulfilled the inclusion criteria were included in the study. Patients visiting to VDGMC, latur orthopaedics OPD/ Emergency department with open fractures and acute soft tissue injuries at the upper and lower extremities were enrolled for the study. The patient with fractures underwent fracture stabilization procedure primarily on an emergency basis, depending on the operation protocol. In those operated patients, in which wound could not be approximated, even after the fracture stabilization were then included for the shoelace and honey dressing of wound healing. Patients having only soft tissue injury and soft tissue loss without any fracture, were primarily enrolled for the shoelace and honey technique. Detailed informed consent was taken from the patient, after explaining the procedure thoroughly. 21 patients were finally selected for the study, after the skeletal stabilization was done for the patients. Period of the study was extended from May 2020 to December 2023.

### 2.1. Inclusion criteria

1. All the patient where primary closure was difficult were included for the study.
2. Cases with fasciotomy wounds, treated for compartment syndromes.

### 2.2. Exclusion criteria

1. Cases not willing for consent for the procedure.
2. Cases with active signs of infection were also excluded from the study.

Patient lying comfortably on bed, through wound wash is given with normal saline, to remove the slough and

debris. Under sterile anesthesia and under all aseptic precautions, with help of Insulin syringe, local anesthesia is given with 2 percent lignocaine with adrenaline along the edges of the wound. Staples were placed about 1 cm from wound edge to prevent wound edge from curling inward and 3-4 cm interval along the edge of fasciotomy wound. Now a Infant feeding tube/suction tube is taken and the skin over which staples<sup>9</sup> to be applied is marked with a marker. Infant feeding tube/Suction tube is fixed in the form of a shoelace starting from one end in a zig zag manner and brought it to the starting end. Now the two free ends of the Infant feeding tube/suction tube are gently pulled in a manner so as to bring the opposing ends closer.

With maintaining the same tension, the ends are tied in a simple knot. Now, with the help of a sterile gauze, honey is applied over the wound area, and normal regular dressing is done. Everyday dressing is removed and the knots loosened and dermatotraction applied and knots are put back. Tightening was done by pulling one end of tube at a time with tension adjusting manually until maximum approximation of the edge without undue tension was obtained. Dressing is closed with a layer of honey. Progressive tightening of shoelace permitted gradual reapproximation of the skin. This method is carried out every day, until the two ends of the skin are completely approximated. The two ends are sutured with regular non absorbable sutures and sutures are removed after a week.<sup>10,11</sup>

## 3. Results

2 patient in our study showed an excellent result, with the average duration of wound healing to be less than 3.2 weeks (22 days). Maximum duration required was 26 days and the minimum being 10 days. One patient in our study had continuous watery discharge, from the wound site, and hence needed an extra procedure with wound debridement and flap coverage for the exposed bone.

The shoelace technique has been used with success for several years to close open wounds. This technique for gradual closure involves running a silastic vessel loop through skin staples placed at the skin edge along the edges of the wounds. The successful out-come observed in these cases, and at a very low cost, allows for its consideration as indicated for situations similar to that presented in this study, especially in patients with poor economic background.

## 4. Discussion

There is published literature for the Shoelace techniques<sup>9,12-15</sup> and has been found very useful in the treatment of the open wounds. Honey on the other hand is again established as a wound debriding agent with successful outcomes. In this study, we could clearly



**Figure 1:** Showing the day 0 wound picture, before the procedure



**Figure 4:** Showing the day 12 wound picture, after the removal of sutures.



**Figure 2:** Showing the day 2 wound picture.



**Figure 3:** Showing the day 6 wound picture, after the removal of suction tube.

**Table 1:** Showing the master chart for the given study.

| Name            | Age | DM/HTN | Days required | wound size |
|-----------------|-----|--------|---------------|------------|
| Chikamalliah    | 35  | No     | 10            |            |
| Eshwara         | 26  | Yes    | 12            |            |
| Maribassappa    | 44  | No     | 14            |            |
| Gowamma         | 56  | No     | 26            |            |
| Rangashetty     | 52  | No     | 14            |            |
| Panduranga      | 43  | Yes    | 11            |            |
| Karimallapa     | 26  | No     | 10            |            |
| Puttasiddama    | 32  | No     | 14            |            |
| Mahadev         | 36  | No     | 12            |            |
| Gururaj         | 39  | Yes    | 12            |            |
| Puttaraju       | 58  | Yes    | -             | 6*2        |
| Siddashetty     | 58  | No     | 15            | 6*3        |
| Gopalamma       | 62  | No     | 16            | 9*1        |
| Abhilash        | 28  | No     | 12            | 9*3        |
| Rangaswamy      | 66  | Yes    | 21            | 11*1       |
| Anjaneyaswamy   | 54  | No     | 14            |            |
| Rangappa        | 48  | Yes    | 17            |            |
| Mahadevaiah     | 32  | No     | 12            |            |
| Ramakanth       | 66  | No     | 14            |            |
| Subramanyaswamy | 52  | No     | 15            |            |
| Aravind Kumar   | 59  | Yes    | 17            |            |

reconfirm their effectiveness in the process of wound healing. This study however also is first of its Kind in the history where these two methods have been combined, for obtaining a faster rate of wound healing.

Similar results have been obtained by the study done by Galois et al, where Daily tightening of the shoelace permits gradual approximation of the skin edges until complete closure is attained. Closure is then possible in 15 to 20 days.<sup>16</sup>

In another similar, shoelace technique was used for the wound healing of the fasciotomy wounds, gave an average duration for healing of about 4 weeks, which is slightly more

than that of our study.<sup>17</sup>

In another study, Wounds in the control group took a mean duration of 15.4 days (range 9 - 36 days) to be ready for surgical closure. In honey dressing group, the wounds required a mean duration 14.4 days (range 7 to 26 days) to achieve similar status.

In another study by Eid and Elsoufy performed the shoelace technique in 17 patients with fracture and reported no major complications.

## 5. Conclusion

Both shoelace technique and honey are safe, reliable and effective methods for closure of large wounds. It takes less time to closure, does not need a second procedure for closure thus reduces need of nursing care, hospital stay resulting in lower morbidity, healthcare cost and better aesthetic result.

## 6. Conflict of Interest

None.

## 7. Source of Funding

None.

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