

## A STUDY ON THE HEALING EFFECT OF HONEY ON INFECTED OPEN FRACTURE WOUNDS

Mohammad Fakoor<sup>1</sup>, Mohammad Hassan Pipelzadeh<sup>2</sup>

### ABSTRACT

**Objective:** Failure of antibiotic therapy in the treatment of open wounds that result from acute complicated traumatic orthopedic injuries is a clinical problem. In this study, honey was used in the control of infections.

**Methodology:** One hundred two patients who suffered traumatic open fractures with grade II or III on Castillo scale and despite treatment with classical antibiotics, the wounds did not heal were included. The wounds were initially washed with normal saline and a layer of honey, obtained commercially, was applied and covered with sterile gauze. The patients were instructed to follow the same dressing pressure on discharge. Follow up was on weekly basis, until complete wound healing.

**Results:** Almost in all, except two, discharge from wounds stopped within two weeks, with a production of healthy granulation tissue in the wound beds. The duration for complete wound closure was between 2 to 5 months, which was related to the initial wound size. Two cases, both had large wounds, required re-deridement, suturing and grafting and took 11 and 13 months for complete wound closure.

**Conclusion:** The findings suggest that honey is useful in the control and treatment of infected wounds that follow complicated traumatic orthopedic injuries.

**KEY WORDS:** Honey, Acute complicated orthopedic injuries, Open fractures, Infection.

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### INTRODUCTION

Honey has been used for medical purposes for a variety of conditions since antiquity.<sup>1</sup> It was used in the Ayurvedic medicine since 2500 BC and other old cultures as well.<sup>2</sup> More recent studies attributed its antibacterial activity to four properties of honey: firstly, honey has a low water content, thus facilitating an

“osmotic effect” which leaves very little water molecules for microbial growth. However, the rate of inhibition of growth varies with the species of bacteria, the antibacterial activity<sup>3</sup> and the source of honey.<sup>4</sup> Secondly, honey has a low pH between 3.2 to 4.5, and this acidity is low enough to inhibit the growth of most microorganisms.<sup>5</sup> Thirdly, production of hydrogen peroxide, as result of glucose oxidase, has a very potent bactericidal activity, similar to those produced by the macrophages.<sup>6</sup> Fourthly, other researchers found several still not fully characterized phytochemicals with antibacterial activity to be present in honey.<sup>5</sup> Although this evidence support the notion that honey does possess one or another of these activities, it seems that the combination of these qualities make honey a special natural product that withstood test of time. Furthermore, not all these antibacterial activities need to act

1. Mohammad Fakoor,  
Department of Orthopedic Surgery,
2. Mohammad Hassan Pipelzadeh, Ph.D  
PhD Pharmacology,  
Department of Pharmacology,
- 1,2: Medical School, Ahwaz Jundishapur  
University of Medical Sciences,  
Ahwaz - Iran.

Correspondence

Mohammad Hassan Pipelzadeh,  
Email: mhpipelzadeh@yahoo.com

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simultaneously, for example the osmotic effect is possibly the first to come in play and with subsequent dilution with wound fluid hydrogen peroxide is generated and takes over this role. The phytochemicals do not lose their antibacterial activity therefore can act at later stages of control of wound infection.

Honey has been demonstrated to be effective against two notoriously problem producing bacteria, namely methicillin-resistant *Staphylococcus aureus*<sup>7</sup> and *Pseudomonas aeruginosa*.<sup>4</sup> This quality makes the use of honey in the treatment of both acute and chronic surgical wounds an attractive one. Furthermore, prolonged use of honey does not lead to development of drug resistance as those experienced with antibiotic use,<sup>8</sup> principally because the actions of honey are not mediated via a single mechanism thus limits the ability of resistance factors to gain success in controlling the growth of the microorganisms that develop them.

Although many previous studies with the aim of studying the effectiveness of honey in the treatment and control of both acute and chronic wounds in both human and animals have been undertaken, there is as yet no evidence of its usefulness in the treatment of infected orthopedic surgical wounds. Hence the aim of the present study was to study the role of honey in the control of infection of wound in these types of patients.

## SUBJECTS AND METHODS

*Subjects:* This clinical intervention study was conducted on a total of 102 (male 87, female 15) patients, after an informed consent, who had suffered from acute complicated open fractures following traumatic orthopedic injuries with grades II and III on Castillo scale over 34 months (from April 2002 to February 2005). All the patients were initially managed for their fractures by use of debridement of traumatized and necrotic tissues and fixation of the fractures by use of internal or external fixtures. The inclusion criteria was presence of wound discharge unresponsive to other treatment modalities including oral or injected antibiot-

ics (cephalexin and cefazolin respectively). Furthermore, frequent dressing of the wounds not only did not result in improvement, but on occasions developed an increase in wound size. The pathological results on biopsy samples reported chronic infections.

*Protocol of treatment:* Treatment protocol entailed cleaning of wound with normal saline and application of a layer of commercially purchased honey, produced from the mountainous area of Shar-e-Kord in Iran, and covered with sterile gauze on daily basis. Treatment was initiated when the patients were hospitalized. Follow up treatments were carried out by the patients or by their relatives after discharge. Follow-ups were made on weekly on out-patient basis. Wound healing was considered when discharge had ceased and the wound surface was completely closed.

## RESULTS

Of the 102 (87 males and 15 females), 91 patients had suffered from lower extremity injuries and the remaining 11 had their traumatic injuries in the upper extremity. The mean age of the patients was 37 years (range from 7 to 63 years old). All the patients without exception completed their treatment schedules and were satisfied with the out come. Cessation of wound discharge and production of healthy granulation tissue were evident within two weeks of treatment in all but two patients, during which a gradual decrease in edema and wound exudates was observed. More favorable wound closure was obtained with small wounds (15cm<sup>2</sup>) with complete closure after 2 months, while larger wounds required honey dressing for 5 months. A 23 years old girl had suffered type 2 tibia-fibular fractures, which was managed by close nailing with proximal locking under C-arm X-ray. Two cases had complications, which were re-debrided, sutured and auto grafted. One healed completely after 11 months and the other after 13 months of honey dressing.

## DISCUSSION

Even though honey has been medically used in traditional medicine over many years, modern health cares hesitate to employ it in wound healing. The main reasons are that its use is often messy or there is no standardized preparation readily available in most countries of the world, especially in developing countries where they usually resort to commercially available sources produced from their region.<sup>9,10</sup> It provides advantages in term of its low cost, ease of availability and optionally effective therapy in various cutaneous conditions ranging from burns, ulcers and surgical wounds. Furthermore, honey has been used in the treatment of gastrointestinal conditions.<sup>11</sup> Scientifically based studies with specific aim of evaluating the antibacterial activity of honey are not new, and many studies have been conducted since 1919 which addressed this issue.<sup>1</sup> Most recent works on standardized preparations are reported which are devoid of man-made and environmentally-introduced toxins.<sup>12,13</sup> In the present study employed commercially available honey produced locally and found it to be effective and all the patients without exception healed uneventfully.

The use of honey in the treatment of partial-thickness burns in both human and animal studies<sup>14,15</sup> has provided ample evidences of its effectiveness in promoting healing of un-infected burns. Various studies on other types of wounds also confirmed its stimulatory property as an agent that promotes wound repair via activation of growth factors.<sup>16</sup> Further studies addressed its anti-inflammatory property which was demonstrated by reduction in edema and pain<sup>17</sup> and reduction of necrosis induced by free-radicals.<sup>18</sup> However, to our knowledge, no previous study on the effectiveness of honey in the treatment of infected wounds that developed following open fractures has been published. Although this study did not identify the exact mechanism(s) that governed the healing effect of honey, the initial findings of this study clearly highlighted

its beneficial effect on the healing of infected wounds that were unresponsive to conventional antibiotic treatment.

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