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Case Report

Effectiveness of fire needle combining with moist healing dressing to promote the growth of granulation tissue in chronic wounds: A case report

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ABSTRACT

In this case study, we analyzed the wound-healing process of a patient with a chronic wound who underwent fire needle treatment, and we tracked the coverage of granulation tissue and decrease of slough and exudate. An 85-year-old man had repeated right shoulder and back pain, itching, and skin festering for more than 1.5 years. A fire needle was administered combined with moist dressing once every 5 days to promote wound healing. After six rounds of fire needle treatment, granulation tissue formed over the surface of the wound base, the depth of the wound had become shallow, and the wound area was reduced. No complications occurred during the intervention. Fire needle therapy combined with a moist wound-healing dressing can be an effective alternative approach in managing chronic wounds.

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What is known?

- Chronic wounds are characterized by delayed healing.
- Chronic wounds can lead to disability or even death.
- There is no report about fire needle therapy for patients with chronic wounds.

What is new?

- It reported the effectiveness of a fire needle combined with moist healing dressing in promoting the growth of granulation tissue in an 85-year-old man with a chronic wound.
- Fire needle therapy combined with moist dressing could be used to promote the healing of chronic wounds.

1. Introduction

A chronic wound is the complication of a chronic disease that can lead to disability or even death [1]. Wound healing is a complex biological process wherein the main goal of clinical intervention is the promotion of tissue restoration [2]. It includes three phases: inflammatory, proliferation, and remodeling [3]. In the proliferation phase, fibroblasts proliferate and differentiate into myofibroblasts, and vascular endothelial cells proliferate to form a new vessel. The extracellular matrix is synthesized by fibroblasts and new vessels to form the granulation tissue. The growth of granulation tissue is a necessary process in wound repair and indicates wound healing [4]. Healthy granulation tissue provides scaffolding for the epithelium at the wound edge and can also fill areas with tissue defects [5]. When the tissue is infected or the blood supply is insufficient, the granulation tissue does not grow, thereby delaying wound healing and resulting in a chronic wound.

A chronic wound refers to a wound for which the repair process has been disrupted and the healing has been subsequently delayed [6]. Delayed healing of a chronic wound increases the time and financial burden of dressing changes. Margolis et al. reported that

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the cost of treating wounds in patients with diabetic foot ulcers in the United States in 2007 was \$33,000 per year, and for amputees of foot ulcers, the cost of care was up to \$52,000 per year [7]. This not only affected the quality of life of patients but also brought a heavy financial burden to the health care system. Hence, much research focused on developing novel therapeutic approaches for chronic wound treatment.

The treatment principles of chronic wounds mainly include improving the body's overall state, improving the blood supply to the wound, reducing the inflammatory response, promoting the epithelialization of wound skin, and promoting granulation tissue growth through pharmacological or nonpharmacological therapies [8,9]. At present, studies have reported some therapies for the treatment of chronic wounds, such as ultrasound debridement [10], biological debridement [11], silver dressing [12], negative-pressure wound therapy [13], platelet-rich plasma [14], and growth factor therapy [15]. Due to the lack of clinical evidence, these wound treatment methods currently fail to show obvious advantages. Some methods can be applied only when patients are hospitalized because they cannot be applied in a clinical setting. Hospitalization indicates higher treatment cost, and hence, clinical application is limited.

With the development of Chinese traditional medicine in recent years, many traditional techniques have been widely used in clinical practice. For example, floating-needle therapy improves blood perfusion in local tissue [16], and thunder fire moxibustion relieves scar hyperplasia [17]. Fire needling is an acupuncture therapy that was first recorded in *Huang Di Nei Jing Su Wen*, one of the earliest medical books in China [18–20]. It has the advantages of being safe, reliable, and easy to use without toxicity and side effects.

Herein, we report on a patient who suffered from right shoulder and back pain along with infection. We used fire needle therapy combined with a moist wound healing dressing to promote granulation tissue growth in the chronic wound.

2. Materials and methods

2.1. Study design

A case study design was used to analyze the wound healing process of a chronic wound with the fire needle treatment and to track the coverage of granulation tissue and decrease of slough and exudate. This study was approved by the Medical Ethics Committee of The First Affiliated Hospital of Guangzhou University of Chinese Medicine (No. ZYYECK2018058) [21]. The patients provided informed consent for publication of the case. The case report is prepared according to the CARE checklist.

2.2. Patient details

An 85-year-old Chinese man from Guangdong Province suffered from right shoulder and back pain along with infection for more than 1.5 years and was admitted to the First Affiliated Hospital of Guangzhou University of Chinese Medicine on October 8, 2016. The patient was 175 cm tall and weighed 72 kg and was in retirement. He complained of repeated pain and itching with skin ulceration at the right shoulder back area. Considering that the patient was older and could not tolerate surgical debridement because of multiple comorbidities, the doctor referred the patient to the wound care specialist team for wound treatment. The patient did not report having fever or chills and had a history of hypertension (hypertension grade 3), chronic heart failure (heart function II level) and coronary atherosclerotic heart disease, chronic renal failure (CKD3 period), type 2 diabetes mellitus, and chronic obstructive pulmonary disease (COPD). As the patient was Chinese, he had no barrier

to communication with the nurse.

2.2.1. Physical examination

The patient's body temperature was 36.5 °C, and the blood pressure was 100/70 mmHg, with a pulse rate of 80 beats/min and oxygen saturation of 99%. The wound bed, located at the right shoulder back, was approximately 6.0 cm×3.0 cm. The wound edge was clear and dark red, and the wound bed was white. The wound had a purulent discharge with malodor. The skin around the wound was pigmented. The patient's flexion and extension, abduction, rotation, and other activities of the right shoulder joint were normal. Pain at the wound site was rated using a digital rating scale: 2 points before changing the dressing, 6 points during changing the dressing, and 3 points after changing the dressing.

2.2.2. Laboratory examination

Peripheral blood analysis revealed the following properties: white blood cells, $9.02 \times 10^9/L$; hemoglobin, 103 g/L; granulocytes, 69.9%; fasting glucose, 6.65 mmol/L; biochemical indicators: carbamide, 15.01 mmol/L; creatinine, 175 $\mu\text{mol/L}$; and cysteine protease inhibitor C, 1.36 mg/L; inflammatory indicators: high-sensitivity C reactive protein, 27.3 mg/L, and procalcitonin, normal (<0.25 ng/mL). The patient was allergic to cephalosporin antibiotics. Wound abscess was collected for bacterial culture, which revealed the presence of *Enterobacter cloacae*.

2.2.3. Diagnosis

According to the clinical symptoms and bacterial culture results, we confirmed a diagnosis of soft tissue infection in the right shoulder and the back.

2.3. Treatment

- (1) Accurately assess and record the wound status: wound size, location, and wound healing capacity. Develop a wound management plan: the anti-infection, combination of conservative sharp debridement, and autolytic debridement. The moist dressing is used to remove local necrotic tissue, and fire needle therapy promotes the growth of granulation tissue.
- (2) Clean the wound and the surrounding skin.
- (3) Disinfect the wound with potent iodine, and remove traces of iodine with saline.
- (4) Combine conservative sharp debridement with autolytic debridement to remove local necrotic tissue fractionally. Remove loose inactivated tissue with sterile forceps. If the necrotic tissue is firmly attached to the wound bed, then remove the tip of the necrotic tissue with a sterile surgical blade and leave the remaining base.
- (5) After local disinfection and removal of partial necrotic tissue, a fire needle was applied to the necrotic tissue that cannot be removed. Pick up a cotton ball containing 95% alcohol with sterile forceps and wring out the cotton ball to avoid excessive alcohol dripping and burning sensation in the patient's skin. Prepare a needle tip with dimensions of 0.30 mm×50 mm, heat the needle tip in a flame until it turns red, and rapidly pierce the necrotic tissue that cannot be removed. Do not keep the needle in the tissue; instead, pull it out quickly. A needle hole is formed when the fire needle is inserted, and a second fire needle should not be inserted in the same needle hole. Insert the needle at an angle perpendicular to the wound bed and at a needling depth of about 0.2 cm–0.5 cm, with the depth of the needle determined according to the thickness of the muscle. Apply the fire needle every five days (avoiding the original place). During dressing

change, if fresh granulation is seen to grow from the pinhole, then stop the application; if not, continue to apply the fire needle.

- (6) Cut suitable dressing according to wound size and apply externally to the wound. A hydrophilic fiber silver-containing dressing (Model No.: 403740; Specification: 4 cm × 20 cm, registration certificate: China National Food and Drug Administration 2013 No. 3641816) was used in this case.
- (7) Gauze and cotton pads were used as external wrap.

3. Results

After the first fire needle treatment, scattered pink granulation tissue grew on the wound bed where the fire needle was applied, and the yellow slough on the base had decreased. After the second fire needle treatment, hyperplasia of the pink granulation tissue at the base of the wound occurred, and the yellow slough was significantly reduced. After the third fire acupuncture treatment, a large amount of bright red granulation tissue could be found around the site of fire needle application, while only a small amount of yellow slough remained, and the wound depth became shallow. After the fourth fire needle treatment, there was obvious hyperplasia of bright red granulation tissue in the wound base with a small amount of yellow slough remaining, and the wound depth was obviously shallow. After the fifth fire acupuncture needle, the wound base had been covered by granulation tissue showing a bright red color. After the sixth treatment with the fire needle, the granulation tissue in the wound base grew further, the depth of the wound had become smaller than that before, and the wound area was reduced.

Throughout the treatment process, the patient was highly compliant and was assured that traditional Chinese medicine therapy was beneficial for human health. Thus, he never rejected receiving fire needle treatment. The treatment was also well tolerated and without any symptoms such as dizziness, trembling, or sweating. No complications occurred during the intervention. The growth process of granulation tissue is shown in Fig. 1. Table 1 shows the timeline of interventions and outcomes.

4. Discussion

Fire needle therapy is an acupuncture technique involving quick insertions of a red hot needle into targeted areas of the body [22], and it is widely accepted as an effective approach in the management of chronic gastritis, segmental vitiligo, gonitis, and so on [23–25]. However, there are few reports about its efficacy in the management of chronic wounds. In the present case, fire needle acupuncture combined with moist healing dressing for the treatment of chronic wounds was shown to be efficacious.

The use of fire needles can locally improve microcirculation and metabolism, and it promotes the dissipation of congestion around the wound site. Studies have shown that fire acupuncture can rapidly eliminate or improve pathological changes such as local tissue edema, hyperemia, exudation, adhesion, calcification, and ischemia, accelerate circulation, and repair damaged tissue [26,27]. Fire acupuncture can rapidly carbonize the tissue that comes into contact with the needle, change the original chronic wounds into multiple fresh acute wounds, stimulate the release of local inflammatory factors and growth factors, and promote the dissolution of necrotic tissues and the growth of granulation.

Wound bed tissue is of various types including necrotic tissue, slough, and granulation tissue. Fire needling is applied to areas of slough because it is a dead tissue that thickens and hardens over time and is difficult to remove. The yellow slough suggests colonization of a large number of bacteria, which causes delayed wound

healing.

After the fire needle treatment, the wound surface is left with pinholes, which can promote drainage of the wound, especially unobstructed drainage of the deep wound, and promote granulation tissue growth. This is also the reason why the granulation tissue appeared first at the pinholes in this case. The combination of moist healing theory and external application of traditional Chinese medicine can promote the growth of wound granulation tissue and accelerate wound healing.

In this case, moist dressing is also applied to promote wound healing. The moist healing theory has been confirmed in a large number of studies [28–31]. Compared with traditional dry healing, moist healing has the advantages of promoting cell migration, accelerating the formation and epithelialization of wound neo-vascularization, reducing scar formation, alleviating dressing pain, and protecting granulation tissue. Therefore, moist wound healing dressings have been widely used in the healing of chronic wounds [28–31]. Fire needle acupuncture, a kind of traditional medicine, has been widely used in China [21,22,32]. It is extensively used for treating surgical diseases, but its application in chronic wounds is rarely reported.

In line with our results, Winter [33] revealed that the healing time of pig tissue wounds in a moist closed environment was 50% shorter than that of exposed dry wounds. The findings of that study pointed out that if the blister is not punctured, it can promote the movement of surface epithelial cells, which is conducive to rapid wound healing. Hinman et al. showed the same results in human tissues, demonstrating that wounds heal faster in a wet environment [34]. Moist dressings could protect the wound by dissolving and absorbing the necrotic tissue and fibrous protein; additionally, they maintain constant temperature and humidity, which promotes the migration of macrophages, fibroblasts, and epithelial cells and prevents the scabbing and shedding of new granulation tissue, creating the ideal environment for wound healing [35–38]. Moist dressings also create an airtight environment, which serves as a barrier to trauma and infection; enhances local bactericidal ability; and prevents cross infection.

5. Limitations

The effectiveness of fire needle therapy combined with moist dressing on chronic wounds is obvious; however, the limitations of this case study cannot be ignored. First, the operation personnel is required to have certain surgical debridement technology and expertise in fire acupuncture, so that patients with chronic wounds can receive professional nursing, and fire acupuncture technology can be popularized. Second, because the surface of chronic wounds is covered with slough, the depth of the wound bed is not yet clear, resulting in an unclear depth suitable for needle insertion. Further, after the treatment, the patient was transferred to the cardiovascular department for further treatment; therefore, we did not follow-up for a long time and the long-term efficacy of fire needle therapy for chronic wounds cannot be determined. Third, with the increasing number of patients with cancer, chronic wounds will surely have a direct effect on patients as well as their caregivers' psychosocial functions or quality of life, for example, an unhealing surgical wound or stoma. However, the effectiveness and feasibility of fire needle therapy remain unclear and further research such as randomized controlled trials are warranted for the treatment of different types of chronic wounds in different populations. At last, a standardized manual or guideline for fire needle therapy and therapy-related evaluation tools (i.e., scales development and validation) in chronic wounds should be developed to make procedures universal.

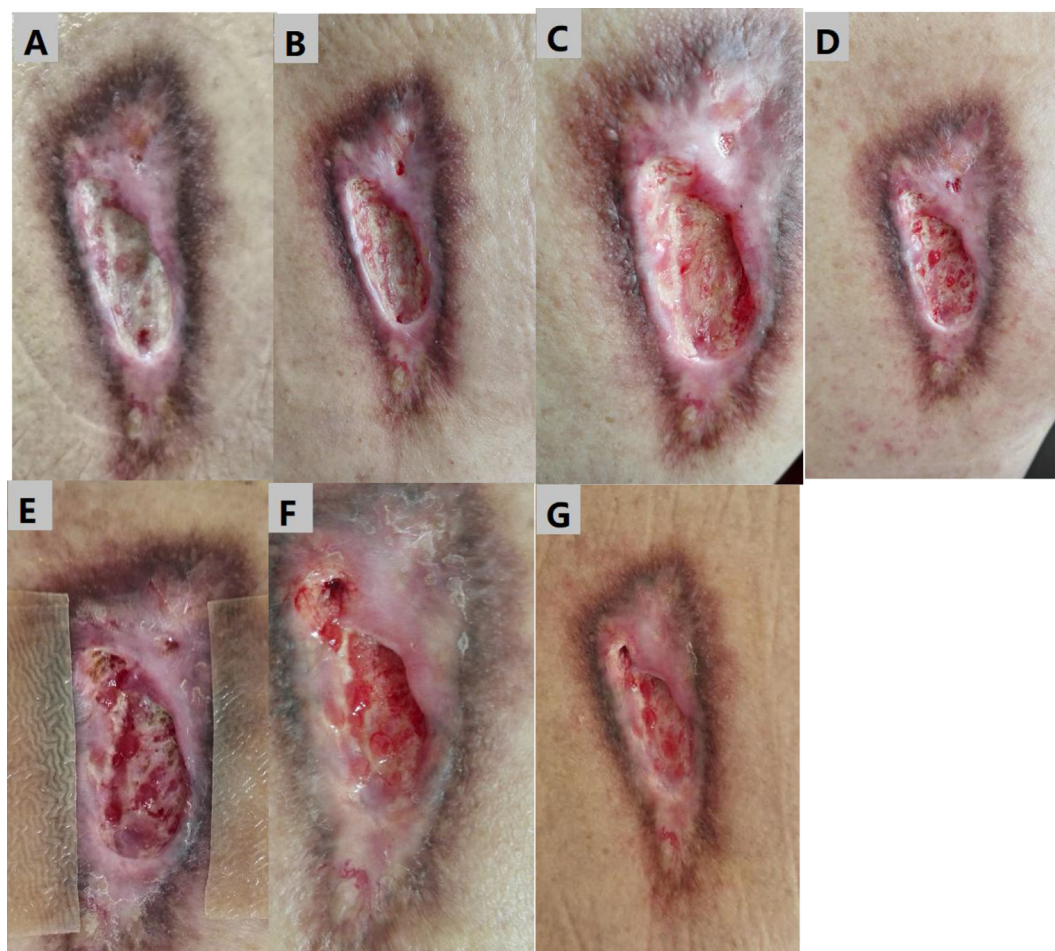


Fig. 1. The growth process of granulation tissue(A–G).

Table 1

Timeline of intervention with fire needle treatment for a 85-year-old man with chronic wound.

Date	Process	Wound status
8/12/2016	Admitted to hospital	Right shoulder and back infection for more than 1.5 years
12/12/2016	Referred to the wound specialist group	Diagnosed with a soft tissue infection of the right shoulder and back (Fig. 1A)
16/12/2016	The first fire needle treatment	Scattered pink granulation tissue grew, yellow slough decreased (Fig. 1B)
21/12/2016	The second fire needle treatment	Pink granulation tissue showed hyperplasia and yellow slough reduced significantly (Fig. 1C)
26/12/2016	The third fire needle treatment	Much red granulation tissue and less yellow slough (Fig. 1D)
30/12/2016	The fourth fire needle treatment	Obvious hyperplasia of bright red granulation tissue and less yellow slough (Fig. 1E)
4/1/2017	The fifth fire needle treatment	The wound base was covered by granulation tissue (Fig. 1F)
9/1/2017	The sixth fire needle treatment	Granulation tissue grew further, the wound area reduction (Fig. 1G)

6. Conclusions

To the best of our knowledge, this is the first study to describe the effectiveness of fire needle combined with moist dressing in promoting the growth of granulation tissue in chronic wounds. The findings of this case study suggest that fire needle therapy combined with moist dressings is an effective treatment for patients with chronic wounds.

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Author statement

Haijiao Wang: Conceptualization, Software. **Yingxuan Gu:** Formal analysis, Writing-original draft. **Linfeng Huang:** Methodology. **Xiaohui Hu:** Methodology. **Xiaojun Wang:** Project administration. **Zhen Zeng:** Resources, Writing-original draft. **Xiaoming Quan:** Writing-review and editing. **Zengjie Ye:** Writing-review and editing.

Declaration of competing interest

The authors have no conflicts of interest to disclose.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2020.05.008>.

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