

## Review Article

# Research progress of scar repair and its influence on physical and mental health

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**Abstract:** A scar is a normal and an inevitable physiological response to the natural healing process of wounds or trauma in the human body. The essence of scar is a kind of abnormal and unsound tissue that does not possess the structure, physiological function and vitality of normal skin tissue. Scars not only affect the beauty of the body surface, but also impede the physiological function of the related tissues and organs, and even lead to deformities. Therefore, scar repair is of great significance to patients' appearance, physiological function as well as physical and mental health. Currently, the main approaches for scar repair in clinic are photorejuvenation or fruit acids. The purpose of this study is to investigate the current research progress of scar repair and the impact of scar repair on the physical and mental health of patients.

**Keywords:** Scar repair, physical health, mental health, research progress

### Introduction

A scar is a normal and an inevitable physiological reaction in the natural healing process of wounds or traumas [1]. Essentially, scar is a kind of abnormal and unsound tissue that does not possess the structure, physiological function and vitality of normal skin tissue [2]. Scar not only affects the beauty of body surface, but also can hinder the physiological function of related tissues or organs, and even lead to deformities. Scars cause great physical pain and mental anguish to patients, especially those left by burns, scalds, severe trauma, and acne [3]. The severity of scars depends on their nature and characteristics, as well as their secondary revision on deeper tissues. A scar is always an imperfect replacement of the healthy skin before injury. To be more specific, from a mechanical point of view, its resistance to strengthening is diminished; from a nutritional point of view, it affects the exchange of oxygen and nutrients; from a functional point of view, it causes deformity and dysfunction of the damaged tissue; from an aesthetic point of view, it causes disruption to the appearance [4-6]. Therefore, scar repair is of great importance for

the patient's appearance, physiological function, and physical and mental health.

Currently, the main methods for scar repair include hormonal therapy, surgical excision, radiation, and medications such as herbal [7, 8]. Each of these methods has its own advantages and disadvantages, showing limited overall efficacy and side effects. Therefore, there is an urgent need to find a treatment method that is more specific to scar repair with fewer side effects and promising efficacy in clinical practice.

The aim of this study was to investigate the research that advances in scar repair and the impact of scar repair on the physical and mental health of patients.

### Progress on Chinese medicine for scar repair

Traditional Chinese medicine (TCM) has a long history of scar repair, such as an early book '*Taiping Shenghui Fang*': *Prescriptions for Eliminating Scarring*. It was recorded that one of the important causes of scarring is "heat and toxicity in the internal organs". Therefore, many

studies have reported on the treatment for scars by clearing heat and detoxifying toxins with Chinese herbs. A study by Wang et al. found that a decoction of 250 g of Dahurian Vine, 50 g of Salvia, 50 g of Safflower, and 100 g of Angelica, which was used to wet and soak burn scars, was significantly more effective than hormone therapy without causing side effects associated with long-term hormone use [9]. In addition, TCM believes that a healed scar after injury is still a local gangrene, which is caused by damage to the skin, obstruction of the meridians, imbalance of the Ying and Wei, and Qi stagnation and blood stasis, so blood activating and stasis removing herbs are also often applied to promote the repair effect of scars [10].

In terms of pharmacological research, experiments have found that herbs such as monomeric tanshinone, safflower, blood exhaust powder, and total glycosides of Panaxginseng can promote the repair of scars, which to a certain extent confirms the effectiveness and scientific validity of blood-activating and stasis-transforming herbs on treating scars. Liu et al. found that after hyperplastic scars were treated with topical capsaicin film for 3 months, the hardness of scars was significantly reduced, blood flow was decreased, and the color of scars was significantly improved [11]. In addition, a study by Fan et al. found that revitalizing and pain-relieving soup could reduce the proliferation of fibroblasts and the deposition of extracellular matrix such as collagen in scar tissues by downregulating the expression of Fas and FasL, thus preventing scar proliferation and adhesion [12]. In order to accelerate wound healing and reduce scar formation, the use of astringent or astringent herbs can be very effective during the healing process. A study by Chen et al. found that topical application of umeboshi could effectively eliminate keloid scars from surgery, burns and trauma, and sores during the healing period. Chen's study showed that this treatment was highly effective for fresh scars with few toxic side effects, but was also less effective for long-term scars [13]. Chinese medicine believes that in the late stage of trauma, patients have weak positive qi, external evil toxins, blood stagnation, undrained evil turbidity and siltation, which result in swelling, thus forming scars. In this case, herbs tonifying qi and yin have a favorable effect on scar repair. In the

book *Taiping Shenghui Fang*, there is a prescription for eliminating scars. Egg yolk is separated from 5-7 boiled eggs, scrambled black and rubbed on the scars, and visible effect can show in three days.

This shows that herbal medicine has its unique advantages in the treatment of scars, such as its low toxic effect, which makes up for the side effects caused by long-term treatment with hormones and other drugs. At present, a lot of studies have confirmed the effect of herbal medicine on scar repair, the types of herbal medicines are numerous. Therefore, more subsequent studies are needed to explore the optimal herbal medicine with the highest safety for patients.

### **Current status of hormone therapy for scar repair**

Local hormone injection at the scar sites is the most effective non-surgical treatment method widely used. Some studies have shown that local hormone injection can inhibit PDEF gene expression and transcription thus inhibit the proliferation of scar fibroblasts and type I and III collagen synthesis of fibroblasts. Besides, hormone can also induce the apoptosis of scars [14, 15]. Tretinoin is a glucocorticoid, which has a large number of condensed ketone groups in the molecular structure. It can stimulate the molecular surface activity and directly intervene the synthesis and abnormal growth of collagen fibers, which causes the formation of scars combined with the dysregulation of fibroblast proliferation, so tretinoin can be applied for scar repair [16-18]. Li et al. investigated the effectiveness of topical application of tretinoin and found that the efficacy was satisfactory for scars of short duration, small size and softer texture. Patients with a smaller number of lesions had smaller foci and more significant efficacy [16].

A large number of studies have shown that the combined use of drugs is more effective than single drug in the treatment of scars. A study by Bian et al. found that the total therapeutic efficacy of tretinoin acetate combined with fluorouracil closure (86.2%) was significantly higher than that of the tretinoin acetate alone (67.5%), and the combination group was lower than the control group in terms of recurrence rate [19]. The study by Li et al. illustrated that as compared with glucocorticoids alone, hor-

mone combined with fluorouracil administration could play a synergistic role of anti-inflammation and inhibition of collagen fibers and vascular proliferation with significantly higher efficiency, and the combination of the two can reduce complications such as arterial dilation, tissue atrophy, and hypopigmentation. Wang et al. used Depo-Provera injection mixed with 2% lidocaine injection at a ratio of 1:1 and injected into the lesion through multiple points until the whole lesion got pale, once every three weeks, three times for each course for three consecutive courses. By comparing with liquid nitrogen freezing treatment, they found the Depo-Provera injection group showed significantly higher treatment efficiency and lower adverse effects [14].

Hormone has a favorable effect in the treatment of scars, but there are obvious side effects resulted from long-term use of hormone. So, in the process of hormone treatment attention should be paid to the drug dose. Additionally, the hormone should not be injected into the subcutaneous shallow parts, surrounding normal tissue or over the scar tissue site. Prevention of infection at the injection site is also important.

### **Surgical treatment for scars**

With the continuous development of science and technology, the techniques of surgical treatment for scar tissues have continued to improve [20-22]. The current mainstream surgical methods and their advantages and disadvantages are as follows. Surgical excision and direct suture is mostly suitable for scars in regular shape and with loose surrounding tissues, but the skin defect caused by scar excision is often larger than the actual area of the scar [23]. Fractional excision is suitable for scars that are large in extent and cannot be directly sutured or implanted in one excision, such as exposed areas, the face and neck. Skin free implantation refers to the use of skin excluding subcutaneous fat tissue for autologous grafting. This method is more suitable for the excision of large scars and skin defects left after the repair of scar contracture deformity. Flap transplantation is suitable for scars involving deep tissues or at exposed areas such as the face and functional areas, which can obtain fitting skin color and texture to achieve satisfactory appearance and functional repair. Surgeons who perform this operation need to

be aware not to damage the blood vessels within the flap during the process. Reimplantation involves removing most of the overproliferated scar tissue and preserving the scar epidermis with a thin layer of fibrous tissue to be grafted onto the scar excised wound. This method is suitable for patients with large deep burns. He et al. reported that the reimplantation treatment for larger proliferative scars not only reduced the area of the donor area but also achieved the purpose of scar removal. Follow up showed that the vast majority of patients had no recurrence of scars. Besides, the replanted skin was flat and soft. The degree of pigmentation or absence was reduced compared with that of before reimplantation. Also, the symptoms caused by scars such as pain and itchiness basically all disappeared [24]. Dermabrasion refers to the grinding of the epidermis and dermal papillae layer to reduce the normal skin tissue at the edge of the depressed scar, so that a new local trabecular surface is formed. Using epithelial regeneration crawling repair, the trabecular surface is re-healing. This method is mainly applicable to small depressed scars left by smallpox, chicken pox, acne and other skin diseases that have been cured and stabilized [25]. Another surgical method is skin soft tissue expansion, which uses the expansion effect of tissue expanders to obtain additional skin soft tissue for the repair of skin defects and organ reconstruction. Since the skin soft tissue expansion for the buried site is mostly from the normal adjacent tissue. After expansion the additional skin obtained can match the skin of the healthy area in terms of color, texture, structure and hair content [26].

### **Impact of scar repair on patients' physical and mental health**

Scars not only cause unpretty appearance, pain and discomfort, but also affect the skin function and psychological health, especially scars on the face, hands and perineum. In today's biopsychosocial model of medicine, plastic surgeons should pay attention to the patient's psychological conditions while repairing the patient's scars through surgical procedures or other methods. Scar repair is a long process designed for the physical and psychological recovery of the patient. Studying the psychological state of the patients is essential to promote their physical and psychological recovery. A professional assessment for evalu-

ating patients' somatic function, sleep quality, chronic itchiness and pain during the consultation should be established to obtain a more objective result of patients' psychological status [27, 28]. Patients' families are suggested to take an active role in patients' recovery by giving patients more understanding, support and care [29]. Rehabilitation regimen for patients with scar includes professional health care from professionals. It can also play a positive role in psychological rehabilitation by mutual support among scar patients. The online cognitive-behavioral intervention treatment method introduced by Bessell et al. can effectively reduce the psychological issues of patients with scar, showing a therapeutic effect that is comparable to the face-to-face intervention treatment by psychologists [30]. Xue et al. used group psychological counseling and group psychological intervention for multiple rehabilitation patients at the same time and achieved favorable results [31]. In addition, with the improvement of people's demand for quality of life, cosmetic dermatology has emerged, which combines health care, laser medicine and traditional physical and chemical therapy with the treatment of skin scars, which is not only used for scar repair, but also can play a good role in the treatment of scar-induced hyperpigmentation, acne and other complications, which completely caters to the aesthetic psychology of scar patients and has an indispensable role in their physical and mental health [32].

With the rapid changes in science and technology and the continuous development of medicine, the treatment options for scar repair are becoming more diverse and showing improving effectiveness. In addition to the common treatment options mentioned above, photorejuvenation, laser, and pulsed techniques for scar have gradually begun to be applied in clinical practice [33-35]. Comprehensive therapies are now more common in clinic and are welcomed by patients for their significant efficacy and fewer adverse effects. Regardless of the treatment option, we should follow the treatments for respective indications as well as the patient's individual needs to meet the patient's requirements. Attention should also be given to the patient's psychological health while achieving effective treatment results.

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### Disclosure of conflict of interest

None.

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