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The effect of burn rehabilitation massage therapy on hypertrophic scar after burn: A randomized controlled trial

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ABSTRACT

Objective: To evaluate the effect of burn rehabilitation massage therapy on hypertrophic scar after burn.

Method: One hundred and forty-six burn patients with hypertrophic scar(s) were randomly divided into an experimental group and a control group. All patients received standard rehabilitation therapy for hypertrophic scars and 76 patients (massage group) additionally received burn scar rehabilitation massage therapy. Both before and after the treatment, we determined the scores of visual analog scale (VAS) and itching scale and assessed the scar characteristics of thickness, melanin, erythema, transepidermal water loss (TEWL), sebum, and elasticity by using ultrasonography, Mexameter®, Tewameter®, Sebumeter®, and Cutometer®, respectively.

Results: The scores of both VAS and itching scale decreased significantly in both groups, indicating a significant intragroup difference. With regard to the scar characteristics, the massage group showed a significant decrease after treatment in scar thickness, melanin, erythema, TEWL and a significant intergroup difference. In terms of scar elasticity, a significant intergroup difference was noted in immediate distension and gross skin elasticity, while the massage group significant improvement in skin distensibility, immediate distension, immediate retraction, and delayed distension.

Conclusion: Our results suggest that burn rehabilitation massage therapy is effective in improving pain, pruritus, and scar characteristics in hypertrophic scars after burn.

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1. Introduction

Hypertrophic scarring after surgical procedures and trauma, especially, burns, is a great concern for patients and a challenging problem for clinicians. Peacock defined hypertrophic scars as scars raised above the skin level but within the confines of the original lesion [1]. Hypertrophic scars may cause significant functional and cosmetic impairment, pain, and pruritus, which compromise the patients' quality of life [2–4]. These scars are caused by a general failure in normal wound-healing processes [5]. Post-burn hypertrophic scars typically appear on the trunk and extremities.

Hypertrophic scars usually develop within 1–3 months of injury, whereas keloid scars may appear up to 12 months after the injury [6]. The nature of scarring appears to depend on factors such as race, age, genetic predisposition, hormone levels, atopy, and immunologic responses of the patient, type of injury, wound size and depth, anatomic region affected, and mechanical tension on the wound [7]. The presence of complications, such as bacterial colonization and infection of the wound, seems to promote hypertrophic scarring [6–11]. The development of hypertrophic scars in burn wounds is mainly influenced by the time to heal and the depth and size of the wound [12,13]. Unfortunately, most of the reports published on post-burn scarring do not accurately define these factors [14,15], and only a few authors have used validated criteria or classification systems to define hypertrophic scarring [12,16–18].

Hypertrophic scars are currently managed by application of silicone gel, pressure therapy, intralesional corticosteroid injection, laser therapy, cryotherapy, radiation, surgery, etc. According to Roh et al., massage therapy for post-burn hypertrophic scar improved pruritus, Vancouver scar scale (VSS), and depression [19].

Various tools are currently available for the assessment of hypertrophic scars. The VSS is a validated subjective scale [20–22], as is the patient and observer assessment scale (POSAS), which encompasses both patient and observer evaluations [23,24]. Tools for the objective assessment of hypertrophic scars are scarce. Nevertheless, reports have been published on the use of negative impressions of the scar, ultrasound images, laser doppler flow, color measurements, and three-dimensional systems for the analysis of hypertrophic scars [20,25,26].

This study sought to determine the effects of burn rehabilitation massage therapy for hypertrophic scar management after burn by using objective evaluation tools.

2. Materials and methods

We enrolled patients who were admitted to our hospital for the rehabilitation hypertrophic scars developing after the acute management of burns, including skin grafts. The study was designed as a prospective randomized experimental and control group study; the subjects were randomized into 2 groups, namely, the massage group, which received both standard therapy and burn rehabilitation massage therapy, and the control group, which received only standard therapy. Medical staff not involved in the study randomly assigned patients to the 2 groups using a computer-generated allocation random number table and prepared the procedure for each patient. All participants were reviewed and approved by the Institutional Review Board. The standard therapy comprised range of motion (ROM) exercise for the prevention of burn scar contracture, silicone gel application, pressure therapy, intralesional corticosteroid injection, and application of whitening cream, anti-redness cream, and moisturizing oil for hypertrophic scar management. Patients were administered burn rehabilitation massage 3 times a week, at 30 min per session for each area by specialized burn rehabilitation massage therapists. Effleurage, friction, and petrissage massage were performed after the application of Rosakalm® cream (Plante system, France), moisturizing Emu oil (Emu spirit, Australia) oil and Physiogel® lotion (Stiefel, United States). The effects of the treatment were evaluated on the basis of the visual analog scale (VAS; score, 0–10) and itching scale (score of 0–4) for pruritis. Additionally, 5 of the following parameters were applied to objectively investigate and measure burn scar characteristics: (1) scar thickness, (2) scar melanin and erythema, (3) scar transepidermal water loss (TEWL), (4) scar sebum, and (5) scar elasticity. Patients were assessed both before treatment and after treatment, before discharge from the hospital, by rehabilitation doctor. And assessors blinded to whether the patient had received standard care or burn rehabilitation massage therapy.

A total of 160 subjects were divided into a massage group ($n = 80$) and a control group ($n = 80$), but 4 subjects in the massage group withdrew from the study and 10 from the control group were excluded since they were lost to follow up. The final analysis included 76 subjects in the massage group and 70 in the control group, i.e., 146 subjects in all (Fig. 1).

2.1. Methods of measurement

2.1.1. Measurement of scar thickness

The thickness of the scar was measured by a high-resolution ultrasonic wave equipment (128 BW® Medison, Korea) by using a 7.5-MHz probe. The ultrasound image enabled the differentiation of the subcutaneous fat layer and the muscle layer from the scar. The measurements enabled the assessment of the thickness of the scar in a unit centimeter (cm) [27–29].

2.1.2. Measurement of level of scar melanin and erythema

The mexameter® (MX18 Courage-Khazaka Electronics GmbH, Germany), which uses the principle of "photo-spectrum analysis," was used to measure the melanin and severity of erythema in the skin, in a relative unit of A.U., ranging from 0 to 999. A higher value indicates a higher level of melanin deposition and erythema. The measurement is obtained immediately after the skin comes in contact with the sensor [26,30].

2.1.3. Measurement of scar TEWL

TEWL was measured by a Tewameter® (Courage-Khazaka Electronic GmbH, Germany). The probe was positioned on the affected area for 30 s, and an average value was obtained. The Tewameter® is a common equipment used for evaluating skin barrier function, and TEWL is measured in g/h/m^2[26,30].