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Effect of a Chest Compression Device for Scar Prevention Combined with Nurse-Patient WeChat Group on Scar Formation after Keloid Excision

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Abstract: *Objective:* To investigate the effect of a chest compression device for scar prevention combined with a nurse-patient WeChat group on scar formation after keloid excision. *Methods:* Forty patients with chest wall keloids who underwent keloid excision surgery at the Department of Plastic and Reconstructive Surgery, First Medical Center of PLA General Hospital from June 2022 to June 2024 were selected. They were randomly divided into two groups: the observation group (20 cases) and the control group (20 cases). Both groups underwent routine keloid excision, followed by compression therapy for 6 months. The observation group used a chest compression device, while the control group used a compression garment. Scar width, hypertrophy, and Vancouver Scar Scale (VSS) scores were compared between the two groups. *Results:* There were no significant differences between the two groups in terms of gender, age, disease course, lesion area, and lesion site ($P > 0.05$). The overall effective rate in the observation group was 95.00%, significantly higher than the 65.00% in the control group, with a statistically significant difference ($P < 0.05$). After a 6-month follow-up, all VSS indicators (except for pliability) in the observation group (using the chest compression device) were significantly lower than those in the control group ($P < 0.05$). *Conclusion:* Compared to the traditional compression garment, the chest compression device for scar prevention is more effective in preventing scar hypertrophy after chest wall keloid excision and improving the appearance of scars. It is worth promoting for clinical application.

Keywords: Scar prevention; Compression device; Scar hypertrophy

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1. Introduction

Keloids are benign skin tumors, typically formed due to excessive proliferation and deposition of the extracellular matrix during the skin healing process [1,2]. This condition not only affects the patient's appearance

but can also cause functional impairments, significantly reducing their quality of life. Data shows that about 50% of keloids occur on the anterior chest wall, which is associated with the high skin tension in this area [3]. Currently, various treatments for keloids are available, including surgical excision, drug injections, silicone gel sheets, radiation therapy, and pressure therapy. While surgical excision is a commonly used primary treatment method, the risk of postoperative recurrence remains concerning, with recurrence rates ranging from 45% to 100% [4,5]. In the prevention and treatment of keloids, elastic compression has been widely adopted as a simple, safe, and cost-effective physical therapy. Its mechanism involves applying continuous pressure on the scar surface to reduce local blood flow, inhibiting fibroblast proliferation and collagen synthesis, thus effectively suppressing scar hypertrophy and promoting scar maturation [6]. In recent years, the chest compression device for scar prevention has gradually been applied in clinical practice as a new pressure therapy tool. This device can be customized according to individual differences and scar locations, providing continuous, uniform, and controllable pressure, effectively reducing scar hypertrophy and improving scar appearance. This study aims to explore the impact of a chest compression device for scar prevention on scar formation after keloid excision, offering more treatment options for clinical practice.

2. Materials and methods

2.1. General information

Forty patients with chest wall keloids, comprising a total of 36 lesions, who underwent keloid excision surgery at the Department of Plastic and Reconstructive Surgery of the First Medical Center of the PLA General Hospital between June 2022 and June 2024 were selected.

Inclusion criteria:

(1) Patients with chest wall keloids treated at the Department of Plastic and Reconstructive Surgery

(2) Age between 20 and 60 years

(3) Clear consciousness, able to cooperate with treatment

(4) Local patients who can return to the hospital for follow-up visits conveniently

Exclusion criteria:

(1) Patients with severe heart, brain, liver, or kidney diseases

(2) Patients with diabetes

(3) Patients with cognitive impairment who cannot cooperate with treatment

2.2. Methods

2.2.1. Surgical method

In this study, both groups of patients underwent standard keloid excision surgery. All surgeries were performed by the same experienced team of plastic surgeons to ensure consistency and professionalism in the surgical procedures. During surgery, the scar tissue was thoroughly excised while minimizing skin tension to reduce the risk of postoperative scar formation. Advanced cosmetic suturing techniques were used to achieve better aesthetic results during the recovery process.

2.2.2. Postoperative management

After surgery, all patients received routine anti-infection treatment and regular wound care to reduce the risk

of postoperative infection and promote wound healing. Pressure therapy began after suture removal, which occurred 3 to 7 days postoperatively, to further prevent scar formation.

Control group: Traditional compression therapy and routine care were used. Photos of scar changes were taken monthly or bi-monthly to present to physicians during face-to-face consultations for timely adjustment of care plans.

Observation group: The scar-prevention chest compression device was used, which included a chest band and an airbag. The chest band was used to secure the patient's chest, while the airbag, shaped like a disk, was placed on the surgical incision. The rear of the airbag was connected to an air valve, which extended through a long slot on the front of the chest band to the exterior. This device simplified the structure, minimizing the compression area on the patient and focusing pressure on the surgical incision (see **Figure 1**).

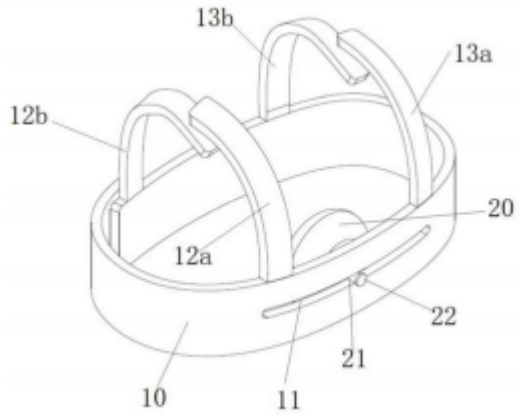

Figure 1. Scar-prevention chest compression device

On top of routine care, a nurse-patient WeChat group was established. This care group aimed to better manage patients, provide personalized care services and promote patient recovery. Regular health education content related to the condition, including prevention and rehabilitation knowledge, was shared in the group through text, images, and videos to help patients better understand and accept the information. Patients were encouraged to ask questions, which were answered by medical staff or experienced patients. This helped reduce patients' concerns and anxiety, improving their confidence and cooperation with the treatment.

Both groups continued compression therapy for 6 months to assess the impact of different treatment methods on scar healing outcomes.

2.3. Observation indicators

2.3.1. Efficacy rate

Based on the degree of scar hypertrophy and patients' subjective symptoms, treatment outcomes were classified into the following categories:

(1) Good outcome: Complete disappearance of itching and pain symptoms, flat scars, and no recurrence of the scar within 6 months.

(2) Significant effect: Most itching and pain symptoms disappeared, with mild local scar hypertrophy. Scars were controlled, and scar thickness was reduced by 70%–80% as measured by scar 3D morphology

software [7].

(3) Ineffective: No reduction in itching and pain symptoms, significant hypertrophy observed, and no notable change in scar thickness compared to before.

Efficacy rate = (Number of good outcomes + Number of significant effects) / Total number × 100%.

2.3.2. Vancouver Scar Scale

The Vancouver Scar Scale (VSS) is an assessment tool used to quantify scar characteristics, with scores ranging from 0 to 15. A higher score indicates a more severe degree of scar hypertrophy. The scale includes four main components:

Table 1. Vancouver Scar Scale (VSS)

Evaluation criteria	Score range
Skin color	0 points: Color similar to surrounding normal skin, nearly normal
	1 point: Lighter color
	2 points: Mixed colors
	3 points: Darker color
Vascularity	0 points: Normal skin color, similar to other body parts
	1 point: Pinkish color
	2 points: Reddish color
	3 points: Purplish color
Thickness	0 points: Normal thickness
	1 point: Thickness between 0–1 mm
	2 points: Thickness between 1–2 mm
	3 points: Thickness between 2–4 mm
	4 points: Thickness over 4 mm
Pliability	0 points: Normal pliability
	1 point: Supple (deforms with minimal resistance)
	2 points: Yielding (deforms under pressure)
	3 points: Firm (resists deformation, moves in a block-like manner under pressure)
	4 points: Banding (feels like a cord, contracts when the scar stretches)
	5 points: Contracture (scar permanently shortened, leading to disability and distortion)

2.4. Statistical analysis

SPSS 23.0 statistical software was used for data analysis. Measurement data conforming to a normal distribution were expressed as mean ± standard deviation (SD), and comparisons between the two groups were performed using *t*-tests. Count data were expressed as percentages (%), and comparisons between groups were performed using the χ^2 test. A *P*-value of < 0.05 was considered statistically significant.

3. Results

3.1. Comparison of baseline data between the two groups

There were no statistically significant differences between the two groups in terms of gender, age, disease duration, lesion area, or lesion site ($P > 0.05$), making them comparable. See **Table 2**.

Table 2. Comparison of baseline data between the two groups

Group	*n*	Gender		Age (mean ± SD, years)	Average disease duration (mean ± SD, months)	Lesion area (mean ± SD, cm²)
		Male	Female			
Control	20	7	13	38.95 ± 6.52	7.20 ± 2.31	8.60 ± 4.01
Observation	20	10	10	35.85 ± 10.78	6.87 ± 2.87	9.10 ± 3.94
χ^2 / t		0.921		0.113	0.401	0.398
P		0.337		0.273	0.691	0.693

3.2. Postoperative treatment effects after 6 months in both groups

The total efficacy rate in the observation group was 95.00%, which was significantly higher than the control group's 65.00%, showing a statistically significant difference ($P = 0.048$). See **Table 3**.

Table 3. Postoperative treatment effects after 6 months [*n* (%)]

Group	*n*	Good outcome	Significant effect	Ineffective	Total efficacy rate
Control	20	8 (40.00%)	5 (25.00%)	7 (35.00%)	13 (65.00%)
Observation	20	16 (80.00%)	3 (15.00%)	1 (5.00%)	19 (95.00%)
χ^2					3.906
P					0.048

3.3. Comparison of VSS scores after 6 months post-surgery

The observation group had significantly lower VSS scores in terms of skin pigmentation, vascularity, thickness, and total score compared to the control group (all $P < 0.05$). However, the difference in pliability was not statistically significant ($P > 0.05$). See **Table 4**.

Table 4. Comparison of VSS scores after 6 months post-surgery (mean ± SD, points)

Group	Vancouver Scare Scale (VSS)				
	Pigmentation	Vascularity	Thickness	Pliability	Total score
Control	1.84 ± 0.94	1.47 ± 0.81	2.43 ± 1.10	1.57 ± 0.91	7.31 ± 2.35
Observation	1.13 ± 0.67	0.81 ± 0.58	1.51 ± 0.81	1.23 ± 0.74	4.68 ± 1.81
t	2.751	2.963	3.012	1.296	3.965
P	0.009	0.005	0.005	0.203	< 0.001

4. Discussion

Keloids are a pathological condition that forms due to excessive tissue repair following skin damage. The histopathological basis primarily manifests as an overaccumulation of the extracellular matrix, mainly collagen, and abnormal proliferation of fibroblasts. The anterior chest area is a common site for keloid formation, usually developing from minor skin injuries caused by various factors and progressing with noticeable symptoms such as itching, pain, or a feeling of tightness [9]. Although the exact pathogenesis of keloids is still unclear, many researchers believe that individual differences and the high tension in the chest skin are significant contributing factors [10]. Despite early postoperative radiotherapy, recurrence may still occur due to the interplay of multiple factors. The specific mechanisms of recurrence are not yet fully understood in both domestic and international research. Studies have shown that the persistent high tension in the chest area, frequent daily activities, and injuries crossing the midline make keloids more prone to proliferation, leading to a higher recurrence rate [11,12]. Some scholars suggest that tension promotes fibroblast proliferation and reduces apoptosis, inducing the synthesis of large amounts of extracellular matrix, which in turn leads to collagen fiber rearrangement and vascular proliferation. These changes collectively promote the formation and proliferation of pathological scars [13]. Therefore, reducing skin tension in the chest can help inhibit the proliferation and recurrence of keloids to some extent [14]. In clinical practice, the use of chest compression devices for preventive measures has been shown to effectively achieve elastic compression. Compared to traditional compression garments, this device allows for more precise control of pressure distribution, especially in specific areas like the scapula and chest, providing better pressure regulation.

This study suggests that in the observation group, the total efficacy rate reached 95.00%, significantly higher than the control group's 65.00%, with a statistically significant difference ($P < 0.05$). After six months of follow-up, the scar scores in the observation group (using the chest compression device for keloid prevention) were lower than those in the control group across all parameters of the VSS, except for pliability, with statistically significant differences ($P < 0.05$). These results indicate that the chest compression device has a significant clinical effect in preventing keloid proliferation.

5. Conclusion

In summary, the use of a chest compression device for preventive intervention can effectively control local pressure distribution, and inhibit excessive fibroblast proliferation and collagen deposition, thus reducing the risk of scar proliferation and recurrence. Compared to traditional compression garments, this device offers more precise pressure regulation, higher patient comfort, and better adherence, making it a promising option for clinical application.

Disclosure statement

The authors declare no conflict of interest.

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