Medicine Insights

Article

Evaluation of the Effectiveness of Suyule Combined with Stamp Grafting in Treating Lower Extremity Skin Defects in Orthopedic Patients and Its Impact on Scar Formation at the Grafted Site

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Abstract: Objective To evaluate the effectiveness of Suyule combined with postage stamp skin grafting in treating lower limb skin defects in orthopedic patients, and to assess its impact on scar formation at the graft site. Methods Patients with traumatic lower limb skin defects admitted to Deyang People's Hospital were randomly divided into an observation group and a control group using a random number table. The control group received wound dressing changes with Vaseline gauze and conventional gauze packing, while the observation group used gauze coated with Suyule for both dressing changes and graft packing. Wound healing indicators, pain during and after dressing changes, scar assessment at the graft site, number of dressing changes, medical costs, and patient satisfaction were compared between the two groups. Results The observation group had shorter waiting time for grafting and faster healing time after grafting compared to the control group, along with a higher graft survival rate. Pain scores during and after dressing changes, as well as scores for all dimensions and total scar scores, were significantly lower in the observation group. The number of dressing changes and medical expenses were also lower, while patient satisfaction was higher in the observation group ($P < 0.05$). Conclusion The combination of Suyule and postage stamp skin grafting promotes wound healing, reduces dressing-related pain, minimizes scarring at the graft site, and lowers medical costs.

Keywords: Suyule; postage stamp skin grafting; lower limb skin defects; moist wound healing; scar

1. Introduction

Due to the increasing incidence of high-energy injuries such as traffic accidents and mechanical trauma, fractures combined with soft tissue defects in the lower limbs have become increasingly common in orthopedic clinical practice. The skin over the distal leg and dorsum of the foot is thin and poorly vascularized; factors such as fasciotomy for compartment syndrome, necrosis of replanted skin after avulsion injuries, and high tension at incisions following internal fixation can all lead to skin defects. If not promptly covered, these defects are prone to secondary infection and exposure of bone or internal fixation devices, thereby compromising definitive fracture treatment. Split-thickness skin grafting (STSG), known as "stamp grafting," is a commonly used surgical method for repairing such wounds due to its simplicity and minimal donor site damage. However, it requires prolonged dressing changes and granulation tissue development prior to grafting. During postoperative compression bandaging, wound observation is difficult, and gauze often adheres to the graft, causing significant pain upon removal. Healing occurs through epithelial migration across the gaps between grafts, frequently resulting in noticeable scarring that affects limb function and appearance. Techniques such as negative pressure wound therapy are costly and technically complex, limiting their widespread use at primary healthcare levels. Suyule is a petrolatum-based ointment

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dressing containing bismuth subgallate and dextro-borneol, which helps maintain a moist wound environment, reduces dressing adhesion, and has hemostatic and antibacterial properties. This study applied Suyule in the perioperative management of stamp graft wounds to evaluate its effects on wound healing, dressing-related pain, and scar formation. The results are reported below.

2. Materials and Methods

2.1. General Information

Forty patients with traumatic lower limb skin defects admitted to the Department of Orthopedics at Deyang People's Hospital between May 2023 and October 2024 were selected as study subjects. Inclusion criteria: patients with full-thickness skin defects caused by high-energy injury requiring skin grafting, aged 14 years or older, with informed consent from the patient or their guardian. Exclusion criteria: diabetic patients with poor blood glucose control, those allergic to ointment components, patients with mental disorders unable to cooperate, those with uncontrolled osteomyelitis, or those infected with multidrug-resistant organisms. Exclusion during follow-up: death or loss to follow-up during treatment, newly diagnosed tumors, hematological or immune system diseases requiring surgery, radiotherapy, or chemotherapy, or poor compliance resulting in incomplete treatment. Patients were numbered according to admission order and randomly divided into two groups using a random number table, with 20 patients in each group. The observation group included 13 males and 7 females, aged 18–67 (mean ± SD, 42.35±13.26) years; wound area ranged from 35 to 160 cm^2 (mean ± SD, 87.45±32.16 cm^2); causes of injury: traffic accidents (9 cases), heavy object impact (5 cases), machinery entrapment (4 cases), falls from height (2 cases). The control group included 12 males and 8 females, aged 19–65 (mean ± SD, 43.10±12.78) years; wound area ranged from 38 to 155 cm^2 (mean ± SD, 89.20±30.85 cm^2); causes of injury: traffic accidents (8 cases), heavy object impact (6 cases), machinery entrapment (3 cases), falls from height (3 cases). There was no statistically significant difference in baseline characteristics between the two groups, indicating comparability.

2.2. Method

Both groups of patients received standardized wound care by the same wound care team, following moist wound healing theory and the TIME principle. Debridement and skin grafting procedures were performed by the same orthopedic surgeon.

2.2.1 Wound Preparation Before Skin Grafting During dressing changes, wound exudate was removed with normal saline, followed by 20 minutes of red light therapy (at a distance of 10 cm). The wound and surrounding skin were disinfected, then rinsed again with normal saline. In the control group, wounds were covered with petrolatum gauze; in the observation group, ointment was evenly applied onto sterile gauze, which was then placed over the wound extending approximately 1 cm beyond the wound edges. Both groups were wrapped with double-layer normal saline-soaked gauze to maintain moisture, and dressing changes were scheduled according to the amount of exudate. The wound was considered ready for grafting when granulation tissue appeared healthy-red, fine-grained, smooth, and free of purulent discharge.

2.2.2 In both groups, autologous split-thickness skin grafts were harvested and divided into postage stamp-sized pieces, which were evenly spaced and sutured onto the wound surface. The control group had the grafts wrapped with sterile gauze followed by compression, while the observation group used gauze coated with ointment before compression. After surgery, the affected limb was elevated and immobilized.

2.2.3 Dressing Removal and Subsequent Management Dressings were removed on postoperative day 7 for both groups. After removal, the observation group continued with gauze dressings impregnated with ointment, while the control group used petrolatum gauze dressings until complete epithelialization of the graft gap was achieved. Both groups received standardized health education and psychological support. After wound healing, patients were guided in functional exercises and scar protection.

2.3. Observation Indicators

(1) Wound healing indicators include the time to skin graft readiness, defined as the period from enrollment to when granulation tissue reaches the standard for grafting, and the post-graft healing time, defined as the duration from dressing removal to graft survival and complete coverage of the wound. At dressing removal, two wound care nurses not involved in the group's dressing changes measured the grafted area using the transparent film tracing method. The graft survival rate was calculated as (grafted area / total grafted area) × 100%.

(2) Pain during dressing change was assessed using the Visual Analog Scale (VAS) before, during, and 10 minutes after dressing removal. The VAS consists of a 10-cm line, where 0 indicates no pain and 10 represents unbearable severe pain; higher scores indicate greater pain intensity.

(3) Scar assessment of the graft site: Within three months after wound healing, a single physician not included in the control group evaluated the scar using the Vancouver Scar Scale (VSS). The scoring included four aspects-color, vascularity, thickness, and pliability-with a total score ranging from 0 to 15. Higher scores indicate more severe scarring.

(4) Number of dressing changes and medical costs: the total number of dressing changes during treatment was recorded. Medical expenses included costs for dressing changes, dressings, and skin graft surgery, but excluded oral medications and other treatment-related costs.

(5) Satisfaction was assessed at discharge using the Chinese version of the Newcastle Nursing Service Satisfaction Scale (NSNS), which consists of 19 items rated on a 5-point Likert scale, with a total score ranging from 19 to 95. Higher scores indicate greater satisfaction.

2.4. Statistical Analysis

Data analysis was performed using SPSS 26.0 software. Continuous variables, which were tested for normal distribution, were expressed as mean ± standard deviation, and group comparisons were conducted using independent samples t-tests. Categorical data were presented as frequencies and percentages, and group comparisons were analyzed using χ^2 tests or Fisher's exact probability method. A P value less than 0.05 was considered statistically significant.

3. Results

3.1. Comparison of Wound Healing Parameters between the Two Groups

The observation group had shorter waiting times for skin grafting and shorter healing times after grafting compared to the control group, with a higher survival rate of skin grafts. The differences were statistically significant ($P < 0.05$), as shown in Table 1.

Table 1. Comparison of Wound Healing Indicators between the Two Groups ($\bar{X}$±s)

Group	Number of cases	Skin graft waiting time (d)	Skin graft survival rate (%)	Healing time after skin grafting (days)
Observation group	20	13.22±1.77	93.63±3.16	11.89±2.11
Control group	20	17.17±2.54	87.52±4.49	16.85±2.55
t-value		5.702	4.972	6.696
P-value		<0.001	<0.001	<0.001

3.2. Comparison of VAS Scores at Different Time Points between the Two Groups for Unpacking and Medication Replacement

There was no statistically significant difference in VAS scores between the two groups before dressing change ($P > 0.05$). During and after dressing change, the VAS

scores in the observation group were significantly lower than those in the control group ($P < 0.05$), as shown in Table 2.

Table 2. Comparison of VAS Scores at Different Time Points for Two Groups with Package Opening and Medication Change ($\bar{X}\pm s$, Points)

Group	Number of cases	Before changing the dressing	Changing the dressing	10 minutes after changing the dressing
Observation group	20	3.48±0.88	3.20±0.86	1.85±0.69
Control group	20	3.62±0.93	5.93±0.97	4.24±0.99
t-value		0.506	9.406	8.787
P-value		0.616	<0.001	<0.001

3.3. Comparison of VSS Scores between the Two Groups of Skin Graft Areas

Three months after wound healing, the scores for each dimension and the total score of the VSS in the observation group were lower than those in the control group, with statistically significant differences ($P < 0.05$), as shown in Table 3.

Table 3. Comparison of VSS Scores between the Two Groups in the Graft Area ($\bar{X}\pm s$, Points)

Group	Number of cases	Color	Vascular distribution	Thickness	Softness	Total score
Observation group	20	1.15±0.67	0.70±0.47	0.95±0.83	1.35±0.67	4.15±1.46
Control group	20	1.80±0.70	1.75±0.55	2.00±0.79	3.00±0.92	8.55±1.54
t-value		3.008	6.489	4.098	6.492	9.276
P-value		0.005	<0.001	<0.001	<0.001	<0.001

3.4. Comparison of Dressing Changes, Medical Costs, and Satisfaction between the Two Groups

The observation group had fewer dressing changes and lower medical costs than the control group, with a higher NSNS score, and the differences were statistically significant ($P < 0.05$), as shown in Table 4.

Table 4. Comparison of Dressing Change Frequency, Medical Costs, and Satisfaction between the Two Groups ($\bar{X}\pm s$)

Group	Number of cases	Number of dressing changes (times)	Medical expenses (RMB)	NSNS Score (points)
Observation group	20	10.40±1.96	4732.96±604.80	87.35±3.31
Control group	20	12.95±2.19	6128.97±699.22	80.50±4.01
t-value		3.885	6.753	5.892
P-value		<0.001	<0.001	<0.001

4. Discussion

4.1. SpeedyHeal, When Combined with Postage Stamp Skin Grafting, Can Shorten the Waiting Time for Grafting and Improve Graft Survival Rate.

Lower limb traumatic skin defects often have poor blood supply and slow granulation tissue growth; prolonged preparation time before grafting may lead to uncertainty regarding fracture healing. In this study, the observation group had a shorter waiting time for grafting compared to the control group, and achieved a higher graft survival rate. The ointment used is based on petrolatum, which forms a moist, semi-occlusive microenvironment over the wound, promoting fibroblast proliferation and new blood vessel formation. Bismuth subgallate activates coagulation factor XII, reducing wound bleeding, while dextroborneol has antibacterial properties that help lower

bacterial load in the wound. Previous studies using similar compound ointments for treating infected wounds showed higher granulation growth rates at all observed time points and improved [1] wound healing rates compared to controls, consistent with our findings. Close adherence between the graft and the wound bed is essential for early graft survival and vascularization. Research has shown that dressing fixation in lower limb graft areas affects graft attachment; improving graft-to-bed contact reduces graft necrosis and shortens hospitalization duration [2]. In the observation group, gauze soaked in the ointment was applied over the graft. The oily base fills gaps between the graft and gauze, ensuring more uniform pressure, minimizing graft desiccation and displacement, resulting in higher graft survival rates and shorter healing times.

4.2. Speedy Healer Combined with Postage Stamp Skin Grafting Can Reduce Dressing Change Pain

Dressing change pain is the most common discomfort experienced by wound patients, primarily caused by adhesion between dressings and wounds, as well as mechanical stimulation during removal. This study found that pre-dressing change VAS scores were similar between the two groups, while both during and after dressing changes, the observation group had significantly lower scores than the control group. Conventional gauze dressings, after 5 to 7 days of exudate consolidation and graft integration, tend to tear off the skin grafts upon removal, causing bleeding and pain. Ointment forms a continuously lubricating barrier layer between the wound and gauze, minimizing adhesion and thereby substantially reducing procedural pain. Some researchers have summarized relevant evidence, concluding that using low-adherent dressings, reducing dressing frequency, and closely monitoring patient pain during dressing changes are key [3] strategies for managing procedural wound pain-measures consistent with those applied in this study.

4.3. Speedy Healer Combined with Postage Stamp Skin Grafting Can Reduce Scar Formation in the Grafted Area

The gaps between skin grafts in stamp grafting are filled by the migration of surrounding epithelium, resulting in prolonged healing time and uneven collagen deposition, which are the main causes of scar hypertrophy and contracture in the grafted area. Studies have shown that for extensive skin defects caused by high-energy injuries to the lower limbs, expanded skin grafting combined with a moist wound environment promotes better healing quality and reduces skin contracture. Other research indicates that improving the wound bed beneath autologous skin grafts can reduce [4] scar thickness, softness, coloration, and vascular distribution scores. In this study, three months after healing, the VSS scores across all [5] dimensions and the total score in the observation group were lower than those in the control group. This may be due to the ointment maintaining moisture in the graft gap, promoting epidermal cell migration, shortening the time required for epithelialization, reducing excessive granulation tissue formation; borneol has anti-inflammatory effects, which help alleviate excessive activation of fibroblasts by inflammation; and no graft detachment occurred during dressing removal, thereby avoiding secondary injury and subsequent worsening of scarring.

4.4. SpeedyHeal Combined with Postage Stamp Skin Grafting Can Reduce Medical Costs and Improve Patient Satisfaction

In this study, the observation group had fewer dressing changes and lower medical costs compared to the control group, and showed higher patient satisfaction. Research has shown that appropriately reducing the frequency of dressing changes can alleviate patients' discomfort, accelerate wound healing, and reduce scar form [6]ation-findings consistent with those of this study. Ointments are inexpensive, require no special equipment, and can be used properly by nursing staff after simple training. Faster wound healing enables earlier fracture surgery, shortens hospital stays, and reduces patients' financial burden.

5. Conclusion

This study is a single-center trial with a small sample size and a follow-up period of only three months, lacking quantitative assessment of graft contracture and long-term limb function. Further confirmation requires multi-center studies with larger sample sizes. Nevertheless, the combination of Suyule and postage stamp skin grafting can shorten the waiting time for grafting, improve graft survival rate, reduce dressing change pain, minimize scar formation at the graft site, lower medical costs, and is simple to perform, making it suitable for promotion and use in primary hospitals.

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