Effectiveness of calcium alginate treatment for skin graft donor site of burn patients: A case report of three patients

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ABSTRACT

The wound management of skin graft donor site needs a desirable dressing material which can promote healing, cause minimal pain and scarring, prevent infection, inexpensive, and easy to use. In this regard, we reported the calcium alginate dressing which was effectively used on the split thickness of skin graft donor site for three burn patients. The burn patients who have grafting thickness donor site wound are dressed with calcium alginate dressing. The symptoms of pain were assessed by Word Descriptor Scale and Vancouver Scar Scale which indicated hypertrophic scar of the patients. The patients were observed for a period of post-operative from 1 day to 6 months, which showed the efficacy of calcium alginate dressing to give full healing of split skin graft donor sites. Moreover, calcium alginate dressing over donor site were convenient, easy removable, and almost painless for preferred dressing intervention.

Keywords: scar; calcium alginate; skin graft; donor site; burn.

INTRODUCTION

A desirable donor site dressing material should promote healing, cause minimal pain to the patient, prevent infection, minimal scarring, inexpensive and easy to use. Scarring is also one of the major issues caused by surgical recovery and wound healing; it proceeds from inflammatory response to re-epithelialization and finally to formation of

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a permanent scar. Since many of the post-surgery patients complained discomfort within the donor site area due to the conventional dressings and soaking in the dressings with oozing in the donor bed which is yet another issue\(^1\). Therefore, it is essential to apply an adequate dressing to permit maximal recovery of the dermis and epidermis. Thus, the alginate is a rich, natural anionic, phytol polysaccharide (APS) commonly derived from seaweed, comprises mainly differing ratios of d-Mannuronic and l-Guluronic acid, which are covalently bound through 1-4-glycosidic linkages. Alginate is a biocompatible, hydrophilic and biodegradable material, which benefits wound healing because it provides a moist microenvironment (2,3). Calcium alginate polysaccharide (CAPS) has been found suitable for use in pharmaceutical drugs, as a bioactive food ingredient and for cell encapsulation or tissue regeneration (4).

On the other hand, the medical use of calcium alginate dressing is decreasing in Taiwan country. With this above background, this study aimed to quantify the effect of calcium alginate dressing on donor sites of burn patients by using the Word Descriptor Scale (WDS) and the modified Vancouver Scar Scale (mVSS) to assess pain and scar quality, respectively.

**CASE REPORT**

A desirable donor site dressing material should promote healing, cause minimal pain to the patient, prevent infection and induce minimal scarring, and should be inexpensive and easy to use. Scarring is one of the major issues caused by surgical recovery and wound healing; it starts from the inflammatory response, and proceeds to re-epithelialization, and finally, to formation of a permanent scar. Many post-surgical patients complain of discomfort on the donor site area due to conventional dressings and soaking of dressings, with oozing over the donor bed (1); therefore, it is essential to apply an adequate dressing to permit maximal recovery of the dermis and epidermis. Alginate is a rich, natural anionic, phytol polysaccharide (APS) commonly derived from seaweed, comprised mainly of differing ratios of d-mannuronic and l-guluronic acid, which are covalently bound through 1-4-glycosidic linkages. Alginate is a biocompatible, hydrophilic, and biodegradable material, which benefits wound healing because it provides a moist microenvironment (2,3). Calcium alginate polysaccharide (CAPS) has been found suitable for use in pharmaceutical drugs, as a bioactive food ingredient, and for cell encapsulation or tissue regeneration (4).

Meanwhile, the medical use of calcium alginate dressing is decreasing in Taiwan. Given this background, this study aimed to quantify the effect of calcium alginate dressing on donor sites of burn patients by using the Word Descriptor Scale (WDS) and the modified Vancouver Scar Scale (mVSS) to assess pain and scar quality, respectively.

Three burn patients (2 male, 1 female), who were aged between 35 to 64 years, were selected to undergo tangential excision and split-thickness skin graft of the burn wounds. The donor sites were situated on the upper or lower limbs or buttocks of patients. Calcium alginate dressing and standard surgical gauze were applied on the donor sites after skin excision and left in situ for 3 minutes, and were then inspected and photographed. For each patient requiring skin grafting, the following parameters
Dressings for burns were assessed: the patient’s comfort using his or her point of view (pain scores), the ease of dressing, and the quality of regenerated skin. The Word Descriptor Scale (WDS) was scored by asking the patient to point out the pain score, which ranged from 0 (for no pain) to 5 (for worst pain). The modified Vancouver Scar Scale (mVSS) (5) was used to assess the scar quality. WDS and mVSS were both directly assessed daily by 2 independent observers on post-operative days 1, 3, 7, 14, 21, and 28, and on post-operative months 2, 3, 4, and 6.

After a week of treatment, both graft and donor sites appeared to be healed (Figure 1A and B). At 2 weeks post-grafting, the graft was well-healed (Figure 1C). All the areas were healed with satisfactory scars by day 21 (Figure 1D).

The results of the WDS indicated the pain scores (Figure 2A). The mVSS scores, meanwhile, evaluated scar vascularity, pliability, pigmentation, and height on days 1, 3, 7, 14, 21, and 28, and months 2, 3, 4, and 6, and are shown in Figure 2B-F. The WDS results indicated that the calcium alginate dressing produced less pain to no pain (score: 3 to 0) from the 21st day onwards (Figure 2A), whereas the VSS results of measured vascularity, pigmentation, pliability, and clinical scar thickness (i.e. the thickness of the scar that is above the surface of the skin) were noted to decrease during the same time, which suggests that the calcium alginate dressing decreases pain, as well as scar.

Figure 1. The donor site wound was covered with new calcium alginate dressing on (A) post-operative day 1; area mark of skin graft donor site, and hemostatic by calcium alginate dressing; (B) day 3 (C) day 7 (D) day 21.
formation, in burn patients. In detail, an mVSS score for vascularity of 0 was attained from 3 on the 3rd month of evaluation (Figure 2B); an mVSS score for pigmentation of 0 was attained beginning on the 2nd month of evaluation (Figure 2C); maximum pliability (mVSS score: 2) was achieved on the 21st day of evaluation (Figure 2D); and minimum scar thickness (mVSS score: 2) was noted from the 7th day of evaluation onwards (Figure 2E).

**DISCUSSION**

The Vancouver Scar Scale (VSS) is one of the validated subjective scales in the assessment of hypertrophic scars, which includes both observer and patient evaluations(6). Particularly, it is used to measure the percentage of the originally treated wound surface that becomes hypertrophic(7). Extensive research has led to an increase in knowledge regarding the pathophysiologic processes of wound healing and the formation of scars(8).

The survival of the burn patient has increased significantly in the last decades and the demand for further development of methods for skin resurfacing has increased. This has led to the development of skin substitutes. More studies on tissue engi-
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Engineering and skin substitution may produce more evidence and support for their long-term clinical effectiveness. In this regard, alginates are highly absorbent, gel-forming materials with hemostatic properties(9), and it has long been known that more rapid wound healing occurs when a gel is formed at the wound surface and dehydration is prevented(10,11,12,13). The release of calcium by exchange with sodium can support hemostasis, while the alginate serves as a matrix for aggregation of platelets and erythrocytes(14,15,16). Furthermore, the biodegradable nature of calcium alginate is such that it is converted to sodium alginate, which is soluble in body fluids and ensures that there is no residue to cause inclusion of fibers into the wound. Thus, the concomitant risk of hypertrophic scarring, which may occur with cotton or porcine dressings, is obviated(17,18). Recently, Wang et al. (19) proved that a polysaccharide-enriched dressing outperformed a traditional dressing in reducing wound size, minimizing hypertrophic scar formation, regulating cytokines, and maximizing anti-microbial effects. In this case study, the ability of calcium alginate to produce significant hemostasis in skin graft donor sites in the first 5 minutes after surgery has been proven. The virtues of leaving the dressing undisturbed until healing is complete are currently being investigated.

CONCLUSION

The results of WDS and mVSS scores indicated that the post operation outcome has been admirable; the patient was free of complaints. They were discharged one week after the operation without any complication and made an uneventful recovery effort tolerance at six months follow-up in outpatient clinic.

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海藻酸鈣用於治療燒燙傷患者皮膚移植捐贈處之有效性：三位患者之病例報告

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中文摘要

皮膚移植捐贈區的傷口修復所適合的敷料需要可以促進傷口癒合，使得傷口疼痛及疤痕形成程度達到最小，同時避免傷口感染的狀況，並且具備便宜容易使用的特性。
在此篇文章中，我們報導了海藻酸鈣敷料可有效使用於三名燒傷患者的皮膚移植捐贈區。將海藻酸鈣敷料覆蓋於燒傷患者之皮膚移植捐贈區上後，利用 Word Descriptor Scale 和溫哥華疤痕評估量表針對傷口疼痛以及疤痕狀態進行評估。觀察患者術後 1 天至 6 個月的時間，結果顯示在使用敷料前患者疼痛及肥厚性疤痕程度高，使用敷料 3 周後使皮膚移植捐贈區完全癒合。此外，在移植區敷上藻酸鈣敷料無疼痛刺激產生，且移除敷料時無溶解問題且無疼痛感，可成為臨床燒燙傷敷料使用的選擇。

關鍵字：疤痕；藻酸鈣；皮膚移植捐贈區；燒傷

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