

Burn Contracture Reconstruction by Delayed Skin Grafting

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ABSTRACT

Burn contractures may change according to the defect after release operation depending on the contracture's localization. The larger the joint, the larger the flap requirements following the contracture release. Generally, flexor surfaces of the body include some important neurovascular structures, and covering the area with a thick and uncontractable tissue following the release operation is of importance. This can be best done by a proper flap selection. However, flap elevation is not devoid of morbidity, and the morbidity changes with the size of the flap. Furthermore, a patient may require many flaps from time to time to treat such a problem, and at the same time the patient may not have enough flap donor site.

This paper presents nine burn contractures treated with split-thickness skin grafting after 3 weeks following contracture release. During this interim 3-week period, the granulation tissue filled the defect up to the level of the adjacent healthy skin. A nonadherent dressing material was applied to the wound to prevent pain and hemorrhage during the waiting period. In the second operation, only the superficial unhealthy granulation tissue was removed and then the defect was covered with split-thickness skin graft, without any complications. The obtained results were as excellent as can be obtained from a flap transfer.

Key words: Burn contracture, releasing, 3 weeks waiting period, skin grafting

INTRODUCTION

When there is a loss of skin, the healing of a wound which that is not grafted is accompanied by a contracture. The degree of contracture may vary with the base on which the wound is situated (2). For example, contracture would be minimal over the skull where the tissue is firm. However, in soft tissues adjacent to the joints, contracture can be expected to be maximal. Flexor contractures are the result of skin deficiencies when appear as a burn complication. However, the skin deficiency itself is not enough to develop a contracture. It may exist only on a joint. If there were no joints in the body, there would be no burn contracture problems (1).

MATERIALS AND METHODS

Nine patients were treated according to the presented method. The age of the patients were changed between 6 and 62. Five patients were male and 4 patients were female. Waiting period between the two operations were 2 weeks minimally and 3 weeks maximally. To minimize the pain and hemorrhage, the wound was covered with one layer of transparent disposable gloves following antibacterial ointment application. Dressings were changed every two days. In the early days after the first operation, external splint was also applied with the plaster of Paris to prevent early recontractures. In the second operation, a surgical drape was used to fix the split-thickness skin graft to the defect area.

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FIGURES 1-6: A man aged 21 was burned at the age of 15. His left knee was held fixed by a type 2-C contracture. Excision of the ulcer and surrounding scar was followed by split-thickness skin graft to the defect three weeks later from the release operation. Histology showed chronic inflammatory changes. Please note good surface of the grafted area and good motion on the knee.

DISCUSSION

The so-called burn contracture is nothing, but the primary fault of the health care workers of underestimated or ignored skin transplantation for a deep burn. It is still the same even today, and there is a need skin transplantation operation to treat such contractures. However, depending on the time passed, it might be more complicated. The contractures after burns are generally flexion contractures. If there is no joint in an area, no contracture

can be seen there. The joint itself may determine what kind of contracture will develop. For example, both flexion and extension contractures can be expected on the wrist joint, but an extension contracture would be rare on the elbow. This may be attributed to the fact that the most relaxed position for any part of the body is a flexed position, and an elbow burned on an extensor surface with an intact flexor surface would not permit to develop an extension contracture.

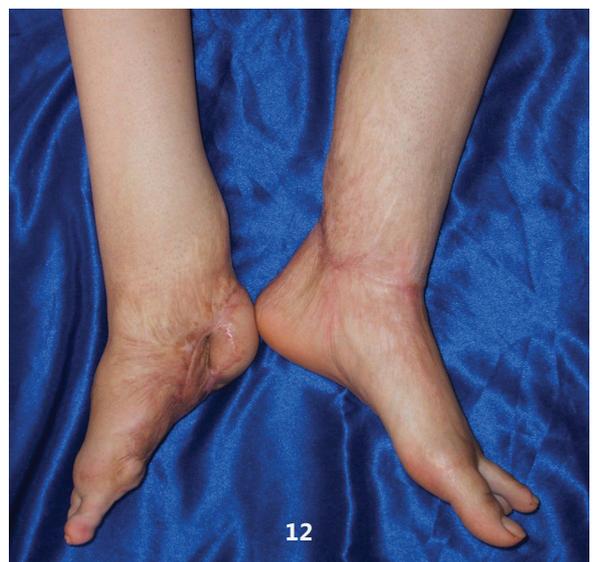


FIGURES 7-9: A woman aged 62 was burned at the age of 5. Her left knee and thigh had a type 2-B contracture. Excision of the ulcer and surrounding scar was followed by split-thickness skin graft to the defect three weeks later from the release operation. Histology showed chronic inflammatory changes. Please note good surface of the grafted area and good motion on the knee.

Although the tissue lost with any burn is essentially the skin, subcutaneous tissues may also be involved occasionally. In cases in which the only burned tissue is skin, a depressed area may not be expected. However, in cases in which subcutaneous tissues are also burned, a depressed tissue defect would be observed. The contracture tissues may have the same features. On some burn contracture cases, the scarred area may have healthy subcutaneous tissues; however, in some cases the scarred skin may be attached directly to the bone with periosteum. Therefore, tissues that are needed after a release operation may change.

Performing a release operation is generally easy. What might be difficult is to cover the defect that exists after the release operation. If some important anatomical structures, such as tendons without paratenon, or bones without periosteum appear after burn, then skin grafting operation may be impossible. Furthermore, an irregular surface may appear yielding an undesirable result. Having a smooth surface is an optimal condition, and this may be obtained only by waiting for developing granulation tissues. The waiting period has some disadvantages, and one of these is to change dressing every two days. However, nonadhesive dressing materials are selected for this, which is generally not painful. When an adhesive dressing material is applied on a large wound, each time it will bleed and may cause pain, which is not acceptable. Another possible disadvantage is the development of infection, no infection was observed in the present study. The last disadvantage of the technique is that a second operation is obligatory.

In fact, the delayed skin grafting approach is not new. Cannon et al. described the use of this approach when the hemostasis in the recipient bed is incomplete. According to them, the reason for delay, is that a graft applied 2–5 days later will have every prospect for living in the wound bed (6). This study aimed to apply skin graft with a delay based on a purpose. However, according to Cannon et al. a delayed skin grafting has no disadvantages and can be done when it is not possible to transfer a skin graft in the first operation. Their approach reminds the principle of Gilles mentioned in the book of Millard: "Never do today what can honorably be put off until tomorrow" (7). Another difference between the two delayed skin grafting procedures is the interval between the two operations, which is at least 2 weeks in this



FIGURES 10-12: A young girl 16 was burned at the age of 1. Her right foot was held fixed by a type 2-B contracture in the metatarsophalangeal joint level. Excision of the ulcer and surrounding scar was followed by split-thickness skin graft to the defect three weeks later from the release operation. Kirschner wires were also used.

TABLE 1: Summary of the features of patients.

Case no	Gender and old	Burn contracture type	Localzation	Waiting period after releasing	Additional technique applied	Result
1	F-62	Type 2A	Left lower extremity	3 weeks	No	Very good
2	F-16	Type-2B	Left foot	3 weeks	Osteotomy Kirschner wire Reverse sural flap	Good
3	M-23	Type-2A	Left thigh	3 weeks	No	Very good
4	M-6	Type-2B	Left foot	3 weeks	Kirschner wire Z-plasty	Good
5	M-9	Type-2A	Right antecubital region	2 weeks	No	Good
6	M-40	Type-2C	Right foot plantar region	3 weeks	No	Good
7	M-10	Type-2A	Dorsal surface of the left foot	3 weeks	Z plasty Kirschner wire	Good
8	F-55	Type-2C	Left groin	2 weeks	No	Very good
9	F-24	Type-2A	Left arm and forearm	3 weeks	No	Good

study as against 2–5 days in the study by Cannon et al. There is another report in the literature that mentions the advantages of the delayed skin grafting. Beekhuis reported that split-thickness skin graft performing in 48-72 hours later had some advantages such as: saving of time, cost, suturing, avoidance of bulky dressing, and hematoma formation. He used the split-thickness skin grafts to the flap donor site following head and neck cancer surgery. According to him, the ideal time for grafting would require a 2- or 3-day delay after creating a raw surface and cutting the graft (9) which means the skin graft was harvested in the first operation and applied later by storing it under proper conditions. In this study, fresh skin grafts were always used because the study aimed to prepare the bed. There is also another delayed skin grafting report applied on autologous cultured dermal substitutes with 12 days after the first operation (12).

With a 10-year experience and by presenting 129 patients with burn contractures, Iwuagwu et al. reported that the use of full-thickness skin grafts is preferred over split-thickness skin grafts in the postburn contracture release (3). However, finding out enough donor site may not always be possible for full-thickness skin grafts. For this reason, using dermal regeneration template

has been advocated in managing severe multiple extensive scar contractures (4). It must be stated that the delayed skin grafting approach gives the chance to use split-thickness skin graft instead of full-thickness skin graft. The main disadvantage of the split-thickness skin grafting is the so-called secondary scar contracture that occurs more frequently than full-thickness skin grafting. Yet, one should remember that secondary contraction follows biological changes in the host bed and not in the transplanted skin. For example, a skin graft transplanted to a relatively fixed site, such as pericranium, will show less contraction than a skin graft on a mobile site, such as eyelid. The presence of the myofibroblast explains that the transplanted skin is a passive victim of a contracting recipient bed (8). By using a delayed approach, the study aimed to prepare the host area not to contract.

Obaidullah and Alsam used the term “chronic contractures.” In their paper they advocated the use of eight slings for axillary post-burn contractures to maintain the release (5). Differential diagnosis between the chronic and acute contractures may be done according to the nature of the scar tissue. If the present scar is mature, then it can be called as chronic contracture.

The presented technique was not used in any patient with axillary burn contracture because this may prevent to sacrifice the latissimus dorsi muscle. However, a fixed position with full extension and abduction of the arm for 2-3 weeks may be more unbearable for both the patients and the doctor.

The delayed skin grafting procedure after releasing operation for burn contractures should be seriously taken into consideration. It has many advantages beyond. Six times dressing change in 2-3 weeks is not troublesome, and none of the patients complained about it. On seeing the results of this approach, all of the patients confessed to be operated on. The main disadvantage of the pain with dressing change can be eliminated by applying a nonadhesive material, which is cost effective. A one-layer of disposable transparent gloves are strongly recommended. Any procedure that decrease the need for any type of flap or full-thickness skin graft and allows an acceptable reconstruction with split-thickness skin grafting is worth to give attention since there are much more donor site for split-thickness skin graft. Although the results obtained with flap surgery having a potential to look better, even in the difficult areas like neck cannot be denied, good results can be obtained by skin grafting with proper splintage and maintenance of the fully released state (10). It is better to use a thick split-thickness skin graft (11).

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