Original Article

Suture-less Skin Graft Fixation Using Soft Silicon Contact Layer

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ABSTRACT

Introduction: The tie-over method is generally used for fixation after suturing of skin grafts. However, suturing and fixation of skin grafts for extensive burns and ulcers are time-consuming, and tissue damage may occur when there is scarring of the surrounding tissue. In addition, the removal of sutures takes time and is painful. Therefore, we developed a modified skin graft fixation method. Here, we present the application of this modified skin graft fixation method in nine patients.

Material and methods: The study included nine patients (six males, three females) with age ranging from 34 to 70 years and mean age of 55 years. The cause of injury was burn in five cases, with heat press, necrosis due to infection, skin necrosis owing to hematoma, and electrical injury in one case each. This study included mesh skin grafting in three cases, sheet skin grafting in four, and both in two cases. The size of the skin grafts ranged from 30 cm² to 400 cm² with a mean of 203 cm².

The skin graft was not sutured; instead, it was fixed with a silicon contact layer and negative pressure wound therapy (NPWT).

Results: This method was successful in all cases.

Conclusions: This simple and rapid method allows successful skin graft fixation without graft suturing.

Key words: buried staples, fixation, NPWT, silicon contact layer, skin graft

Introduction

Skin grafting is a commonly performed procedure by the plastic surgeons. The conventional skin grafting technique involves compression using the tie-over method after suturing of the graft. However, the sutures must be removed later, which is both time-consuming and painful for the patient. Skin graft fixation using staples is occasionally accompanied by the staples getting buried in the wound1. Damage to the surrounding tissues may occur when there is scarring or when the skin is brittle owing to steroid administration. Negative pressure wound therapy (NPWT) has recently been utilized for graft fixation in lieu of the tie-over method. NPWT is advantageous as it allows even compression of the graft and provides easy control of exudate. However, it has the disadvantages of requirement of additional suture fixation to prevent slippage and increased probability of bleeding during dressing change.

To resolve these problems, we reported a suture-less method of skin graft fixation using a soft silicon contact layer (Mepitel One; Mölnlycke Health Care, Göthenburg, Sweden).

Patients and methods

The study population consisted of nine patients (six males, three females) with age ranging from 34 to 70 years and mean age of 55 years (Table 1), including five cases of burn injury, and one each of heat press injury, necrosis due to infection, skin necrosis owing to hematoma, and electrical injury. Mesh skin grafting was performed in three cases, sheet skin grafting...
in four cases, and both were performed in two cases. The skin grafts ranged in size from 30 cm²–400 cm² with a mean of 203 cm².

**Surgical techniques**

The soft silicon contact layer was cut into rectangular strips that were placed on the border of the graft and surrounding skin (Fig. 1). In cases requiring extensive skin grafts, pieces of the graft were patched together using silicon contact layer strips. Then, another silicon contact layer was placed over the entire skin graft prior to NPWT fixation. The pressure of NPWT was set to 100 mmHg using black GranuFoam dressing (KCI, San Antonio, TX). No ointments were used. We had no restriction, including movement, and dressing exchange was usually performed 7 days postoperatively. All operations were performed by the same plastic surgeon.

**Results**

All grafts were viable in all cases 14 days postoperatively. In one case, the dressing was changed ahead of the schedule owing to continuous fresh bleeding inside the suction tube of NPWT; however, no hemorrhage was present. During dressing changes, the moderate stickiness and followability brought about stability and ease of removal. There was no difference in the skin graft viability depending on the skin thickness. There was no difference while using this method compared to normal fixation. The difference in restriction, including movement, also did not affect the graft viability.

**Case reports**

**Case 3**

A 68-year-old male had a burn injury on the right lower limb
caused by a large-scale fire. The right lower limb had third-degree burns, and skin grafting was performed after 7 days. Debridement up to the subcutaneous adipose layer and meshed split-thickness skin grafting were performed. The split-thickness skin graft was harvested from the left thigh. The soft silicon contact layer was placed on the border of the graft and surrounding skin. It was used to patch the pieces of the graft. Additionally, NPWT was utilized for fixation of the skin graft. Rectangular strips of soft silicon contact layer were placed onto the border of the graft, and another soft silicon contact layer was added over the graft following NPWT (Fig. 2a). We did not restrict postoperative movement, and the graft took well 7 days after the operation (Fig. 2b, c). No contracture was observed at the 1-year follow-up (Fig. 2d).

Case 8
A 46-year-old female received a third-degree burn injury on the right axilla while cooking and underwent skin grafting 1 month after the injury. Debridement up to the subcutaneous adipose layer and full-thickness skin grafting were performed. The donor skin was harvested from the right lower abdomen, and the donor site was sutured for closure. Fixation was performed using a soft silicon contact layer and NPWT without any sutures. The soft silicon contact layer was used at the fixation of the border of the graft and the surrounding skin and the pieces of the graft. The strips of soft silicon contact layer were placed on the border of the graft and another soft silicon contact layer was placed on top before performing NPWT (Fig. 3a). We did not restrict postoperative movement, and the graft took well 7 days after the operation. There was no contracture of the shoulder joint 8 months postoperatively (Fig. 3b).

Discussion
Conventionally, skin graft fixation is performed using sutures and staples. This method has a number of disadvantages as it is time-consuming, and suture removal is painful for the patient, with a risk of surrounding tissue damage and bleeding. Although fixation using staples may be quicker, its removal requires time and may be accompanied by pain as well as the risk of staples being buried in the wound. There have been some previous reports regarding the fixing methods for skin grafts. Ramos reported that although a sheet-like skin graft is fixed at several places with tape, it is difficult to adapt to mesh skin grafts owing to the poor fixability of the skin graft. Sakamoto et al. reported a fixing method using octyl-2-cyanoacrylate (Dermabond; Ethicon Inc., Somerville, NJ, USA). This method fixes mesh skin graft to the surrounding skin with Dermabond. There is less surrounding skin tissue damage and suture removal is not necessary using this method. However, the adaptation is limited only to mesh grafts, and the grafts should overlap.

Other suture-free fixation methods have been reported; nevertheless, the wound dressing material used for fixation does not provide sufficient adhesiveness, and use of ointments...
such as petroleum jelly is necessary to achieve better adhesion. The soft silicon contact layer used for graft fixation has moderate adhesiveness, good transparency, and no water absorbency. It shows less adhesion to the surrounding tissue. However, there have been no detailed reports regarding this fixation technique. Fixation using this material is simple, and removal of sutures and staples or overlapping the surrounding tissues is not required. This method is convenient for postoperative pain control, and fixation of the skin graft without damage to the surrounding tissue is possible due to its moderate adhesiveness. Even when eschar remains, fixation is possible if the amount of leachate is limited. However, this method is not recommended in cases with large amounts of leachate owing to the risk of deadhesion of the silicon contact layer.

The negative pressure of the NPWT was set to 100 mmHg. This time, we applied to the skin graft after the wound bed preparation was performed. Therefore, the formation of granulation tissue was not necessary, with only the immobilization considered sufficient, thus a lower pressure was selected.

This material has moderate elasticity and followability. Fixation using this contact layer anchors the skin graft in the plane of motion, and it is difficult for the graft to slip off. We have experienced that when wound dressings with poor adhesiveness were used, rough fixation of the skin graft left gaps in the non-fixed area as the NPWT foam contracted. However, there were no such complications when the soft silicon contact layer was used for fixation. In addition, there was neither bleeding nor damage to the graft with exchange of NPWT. This method does not require restriction of postoperative movement, even around the joints. Therefore, fixation of the skin graft using the silicon contact layer and NPWT is considered an ideal method.

### Conclusion

We developed a suture-less fixation method for skin grafting, which showed satisfactory results in all clinical cases. The combination of a soft silicon contact layer and NPWT is an ideal method for skin graft fixation.

### Sources of funding

None.

### Conflicts of interest

None declared.

### Abbreviation

NPWT = negative pressure wound therapy

### References

1) Liu HL, Chung HP: A simple technique for the retrieval of buried staples. *Burns* 2012; 38: 1086-8.
2) Ramos RR: An easy and safe method of split-thickness skin graft fixation. *Burns* 2007; 33: 1074-5.
3) Sakamoto Y, Kishi K: “The dendritic bonding technique”: a newly-devised technique for the fixation of mesh skin graft. *J Surg Tech Case Rep* 2012; 4: 92-3.
4) Inatomi Y, Kadota H, Kamizono K, Hanada M, Yoshida S: Split thickness skin grafting without any bolster sutures. *J Jpn P R S* 2017; 37: 238-43. [in Japanese]
5) Patton ML, Mullins RF, Smith D, Korentager R: An open, prospective, randomized pilot investigation evaluating pain with the use of a soft silicone wound contact layer vs bridal veil and staples on split thickness skin grafts as a primary dressing. *J Burn Care Res* 2013; 34: 674-81.