능형 피하경 피판을 사용한 사지부 화상후 구축성 함몰 Scar Band 재건

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Rhombus Subcutaneous Pedicle Skin Flap for Reconstruction of Linear Depressed Postburn Scar Band

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This paper presents our clinical experiences for reconstruction of the linear depressed postburn scar band by rhombus subcutaneous pedicle skin flap (RSPF). We report new RSPF, its versatility, and effectiveness for correction of the mild to moderate linear depressed postburn scar band. To correct the postburn scar band, we have newly designed the Rhombus Subcutaneous Pedicle Skin Flap (RSPF), which is made as rhombus-shaped skin flap on the inside of scar band. After excision of burn scar band, the each vertex of RSPF flap is advanced into the skin defects at apex of extended skin incision, which is starting from the upper and lower portion of the removed burn scar band at a near right angle. This flap can add more extra skin to adjacent superior and inferior area of excised scar band. We have experienced 2 cases of RSPF for reconstruction of linear depressed postburn scar band deformities in lower extremity. After 3 weeks to 3 months postoperative follow ups, relatively satisfactory results were obtained in all cases. We had successfully reconstructed the linear depressed postburn scar postburn band of lower extremity using the rhombus subcutaneous pedicle skin flap. For the correction of mild to moderate sized linear depressed postburn scar band deformities in extremity, the RSPF is simple, and very effective without donor morbidity. (*J Korean Burn Soc* 2020;23:25-29)

Key Words: Rhombus subcutaneous pedicle skin flap, Burn scar band, Burn scar contracture

INTRODUCTION

Residual burn deformities caused by postburn scar contractures frequently occur despite adequate treatment in the acute burn. Depending on the severity of burn scar contracture features, internal cord like fibrous scar tissue frequently form linear postburn scar band that is shown as linear tight depressed scar deformities. And it is usually accompanied by functional limitations as well as the

ugly appearance of the limbs along the scar band¹⁾.

For reconstruction of the burn scar band deformities, the surgical treatment such as release of burn scar contractures and skin graft, tissue expansion, local flap, and Z-plasty can be performed.

The release of the scar contractures and skin graft is the most widely used surgical method which has a wide indication. But skin grafts have disadvantages such not only the different color and texture of the grafted skin to the recipient but also leave another scar on skin graft donor site.

For reconstruction of burn scar contracture using tissue expansion, the transferred skin after tissue expansion is similar to the color and texture of the skin defects. Because similar skin tissue, that is transferred to the lesion, is brought from the adjacent area of the scar. Therefore this method shows usually excellent cosmetic

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results. As known disadvantages in tissue expansion procedures, there is usually not much amounts of skin to be obtained, and it needs more than two or more multi-staged surgery.

Local skin flap is relatively easy and it has good cosmetic effect by using the skin tissue adjacent the lesion. However, in many clinical instance, the transfer of the large sized local skin is usually limited. Therefore it is frequently not suitable for reconstruction of big sized burn scar contractures deformities.

In addition, various Z-plasty analog, V-Y plasty can correct small to moderate sized burn scar band on the limbs. But Z-plasty is difficult to apply in the severe burn scar band, and the size of original burn scar cannot be reduced. The V-Y advancement skin flap has effective in linear burn scar band, but it also has disadvantages not to reduce the size of burn scar.

Ideal correction of post-burn scar band deformities in the extremity should be able to complete release of scar contractures, reducing burn scars at the same time, and it is desirable to minimize the donor scar.

To this end, the authors devised a new Rhombus Subcutaneous Pedicle Skin Flap (RSPF). Using RSPF, we successfully reconstructed the moderate sized linear depressed postburn scar band in the lower extremity without donor scars.

CASE REPORT

We have experienced cases of reconstruction using RSPF in patients with linear depressed burn scar contracture band deformities in thigh. The design of the RSPF flap is as follows. Firstly the amounts of removed scars are evaluated along the linear depressed scar band site as elliptical fashion. And then the design of the RSPF are made as rhombus-shaped skin flap on the inside of scar band. The extended skin incision of RSPF flap is perpendicular to the long axis of the band. The length of the extended incision line perpendicular to the upper and lower vertices of the RSFP is set to be equal to the height of the upper and lower triangles of the RSFP. According to the severity of scar band, 2~3 or multiple RSPF flap shall be made.

After the previous designed elliptical excision of the

band scars, the RSPF flap is elevated via rhombus shaped skin incision. The vertical extended skin incision are made at the upper and lower pole of this flap to release the adjacent scar contractures of the lesion. The upper and lower vertices of the elevated RSPF are advanced into upward and downward to the skin defects of extended skin incision site. This RSPF can make easy repair of the skin defects after excision of band scars and also it will release the remaining scar contractures at the adjacent upper and lower skin of the excised scar band (Fig. 1).

We have experienced 2 cases of RSPF for reconstruction of linear depressed postburn scar band deformities in lower extremity.

1. Illustrated Case 1

At the age of two, the 34-year-old woman sustained from scalding burn on her left thigh. She was shown scar band deformities with surrounding diffuse burn scars on her left posterior thigh. The RSPF was designed for correction of scar band deformities. After excision of the linear depressed burn scar band, and then RSPF was elevated and transferred to the skin defects of the extension skin incision area of scar band. The skin defects after excision of scar band was sutured directly layer by layer. On post-operative 3 weeks, the well corrected depressed burn scar band deformities on her left posterior thigh were shown (Fig. 2).

Flap Design

Fig. 1. Design of Rhombus Subcutaneous Pedicle Skin Flap (RSPF). This flap can add more skin to adjacent superior and inferior area of the scar band after excision of linear depressed scar band.

Fig. 2. (Upper left) The 34 year-old-female patient suffered from scalding burn, deep 2nd-3rd degree on her left thigh at age of 2. She showed moderate linear depressed postburn scar band deformities on her left lateral thigh. (Upper right) Design of RSPF. (Lower left) Immediate postoperative after transfer of rhombus subcutaneous pedicle skin flap. (Lower right) At postoperative 3 weeks, improved depressed scar band deformities of her left thigh was shown.

Fig. 3. (Upper left) The 45 year-old female patient suffered from scalding burn, deep 2nd-3rd degree on her left thigh at age of 1. She showed moderate linear scar band with depressed deformities on her left posteromedial thigh. (Upper right) Immediate postoperative after transfer of the rhombus subcutaneous pedicle skin flap. (Lower left) Postoperative 9 days, well survived RSPF was noted. (Lower right) At postoperative 2 month, the improved depressed scar band deformities of her left thigh was noted.

2. Illustrated Case 2

The 45 year-old-female had scalding burn on her left thigh at age of 1. She showed moderate burn scar band with depressed deformities on the left posterior thigh. After the RSPF was designed, the scar band of left posterior thigh was excised, and then RSPF was elevated and it was transferred to the skin defects. On postoperative 2 months follow up, the depressed postburn scar band

deformities on left thigh were improved (Fig. 3).

After 3 weeks to 3 months postoperative follow ups, relatively good results were obtained in all cases.

DISCUSSION

Burn scar band with contractures in extremities often results in not only limited exercise in functional aspects

but also ugly features. To correct these functional and cosmetic dysmorphia, the surgical treatment is often required.

The surgical treatments for these problems are various such as skin graft, tissue expansion, Z-plasty, local flap, and free flap after following the release of burn scar contractures. Skin graft is commonly used method after release of burn scar contractures. When using the skin graft, there is another shortcoming such as scars in the donor site, and tendency to re-contractures when it is applied to the joint area of extremity.

Z-plasty and its analog, local flap surgery are relatively frequently used for the treatment of limb postburn scar contractures. Z-plasty, which lift the flaps of both sides of the triangle, after elevation of triangular flaps from the base of the flap, and then these two triangular flaps are repositioned in each other. In this process, the surrounding tissue is pulled and the fill up the skin defects, and as a result, the force of the scar contracture is rearranged, and the scar length is also extended²⁾. However, during the process of lifting the flap, blood circulation damage may easily occur, which may cause necrosis at the end of the flap. Also in the process of relocating the raised flaps, there is a disadvantage that the anatomical position is changed. Also its use is frequently limited in reconstruction of small sized burn scar contractures.

Tissue expansion is an extended procedure to cover the affected area. It has the advantage of being excellent in beauty because the straight tissue comes from the normal tissues around the scar. But if the scar area is wide, its use is frequently limited, and this method needs frequently 2 or more staged procedures. Therefore completion of tissue expansion operation takes a relatively long time. And 1.5~35% of complications are reported after tissue expansion such as postoperative hematoma, pain, infection, expander exposure, and striation of expanded skin during over-expansion³⁾.

In 1988, Suzuki et al. reported the treatment of burn scars using a rotation flap with wide rotation arc, which enabled safe elevation of the flap based on the relatively wide subcutaneous diameter of the flap⁴⁾.

By Niekerk in 2008, multiple Y-V flaps were used to correct postburn scar contractures⁵⁾. In 2005, the opposing running Y-V flap technique was devised by Lin et al. for reconstruction on axillary burn scar contracture⁶⁾. These

techniques had the effect of extending the length of the scar, but had the disadvantage of performing only releasing the contracted tension strength the scar without excision of scar itself.

In 2005, Murakami et al. reported some cases of correction of burn contracture of finger joint by the scar band rotation flap⁷⁾. This rotation flap is subcutaneous pedicle skin flap consisting of scar band itself, and its use is confined in small sized area of scar contractures. In 2015, Lee et al. reported some cases of correction of mild to moderate postburn depressed scar band deformities with normal adjacent skin along the scar band by using modified Y-V flap surgery⁸⁾.

The authors newly designed and applied RSPF to remove the scar band, and excision of the scar itself at the same time. when there is significant residual burn scar contractures in the upper or lower adjacent skin of the excised scar band, this method give extra skin tissue to the upper and lower adjacent skin area, then complete release of burn scar contractures could be done including the surrounding scar band area. This method could be done without skin graft.

To do this, firstly determining the expected excision amounts of the scar band along its longitudinal axis is made. And the rhombic shaped skin flap, which is located at inside the scar band, is designed including extension skin incision line. The extension skin incision is made perpendicular to the upper and lower borders of the scar band and from the each apex of rhombic flap. At this time, the length of extension skin incision is same length as height of the upper and lower half of the rhombus flap. Then the RSPF is advanced to restore skin defects that occurred after opposite extension skin incision by moving the apex to the top and bottom of each incision. Therefore it is designed to restore the skin defects generated after removing the band scars and two extension skin incisions by moving the rhombus flaps to the apex of the upper and lower skin extension incisions. In other words, the V-shaped flaps are inserted into the upper and lower adjacent skin parts of the excised scar band area, so that the skin resurfacing is relatively simple and effective after excision of the center portion of the depressed scar band, and can add some extra skin to upper and lower part of scar band, which area frequently has

some mild to moderate contractures of skin.

The severity of postburn scar band are categorized as mild, moderate, severe by authors. The mild severity means the width of scar band is below 1 cm, moderate severity belongs to the width of scar band is 1~3 cm, and severe severity means the width of scar band is over 3 cm. In RSPF transfer, there are some limits to correct severe postburn scar band, because correction of severe postburn scar band usually need skin grafts after scar band removal.

In the author's way, when the patient has small to moderate linear depressed burn scar band on extremity, and want to simultaneously remove some amounts of burn scar and, no more donor scar, then the RSPF can be transferred successfully. This flap gives good results of removing scar band with some scar reduction without donor morbidity.

The small to moderate depressed linear depressed postburn scar band in the extremity can be successfully reconstructed using the rhombus subcutaneous pedicle skin flap, and there is no donor morbidity.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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