Scar dermal transposition flap for depressed scars: A valuable technique for depressed scar management

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Background Various methods have been reported for the improvement of widened or depressed scars. However, scars can be complex at presentation. If a widened but flat portion is combined with a tethered or a depressed area, a scar revision method that can effectively resolve all issues is needed. The authors utilized a dermal portion of the widened scar as a re-adhesion barrier and filled tissue after the release of the tethering or depression.

Methods From July 2014 to December 2017, a total of eight patients presented with combined scars with both widened and depressed areas and underwent scar revisions with scar dermal transposition flaps. The scar flap of the widened scar was de-epithelialized, leaving the dermo-cutaneous pedicle near the depressed area. Without any additional skin incision on the depressed site, the tethering was released by making a skin incision at the scar flap. The de-epithelialized scar dermal flap was transpositioned under the depressed area of the scar.

Results The surgical wounds of all eight patients healed without any complications. The mean follow-up period was 5.25 months. The filling effect of the scar flap persisted without the conspicuous relapse of a depression or tethering. The patients were satisfied with the final results and the fact that no additional incision was needed for the tethered and depressed scar.

Conclusions If the depressed site is near a widened scar, a scar dermal transposition flap may be a versatile option for improving the depression without an additional skin incision.

Keywords Autografts / Cicatrix / Surgical flap

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INTRODUCTION

Scar formation is a natural, physiological response to the healing of damaged tissue. However, abnormal or disturbed collagen synthesis can cause skin texture irregularities, such as depression. Scar treatments should improve both functional and aesthetic aspects of

the scarred area to optimize patient satisfaction. Plastic surgeons use surgical, nonsurgical, and multimodal strategies to treat scars, which begin with an accurate understanding of the characteristics of the scar, as well as the patient's needs.

Depressed scars may occur when the injured tissue is replaced by scar tissue, which causes adhesion and tethering between the overlying skin and the underlying tissues, such as muscle or fascia. The main technique used to resolve depressed scars is to disrupt the connection between the skin and underlying tissue and to prevent re-adhesion [1,2]. However, many patients present with combined scar problems. In such cases, making an additional skin incision over a depression site is considered to be uneconomical. Therefore, we used de-epithelialized scar tissue of the widened scar portion as a transposition flap to fill under the depressed area for volume augmentation and to prevent re-adhesion.

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METHODS

We performed a retrospective review of patients who underwent scar revision with scar dermal transposition flaps due to scars with both widened and depressed areas from July 2014 to December 2017. A total of eight patients were enrolled. We collected data regarding patient characteristics, such as scar location and cause and the total length of the scar. We used the Stony Brook Scar Evaluation Scale (SBSES) classification system to assess the scars. The SBSES is a photo-based scale consisting of five items: width, height, color, hatch marks, and overall appearance. Each item is rated as 0 or 1, with a maximum score of 5 and a minimum score of 0 [3].

The depressed area was first drawn (Fig. 1A), and an incision on the linear scar was then made, leaving a dermal pedicle near the depression site (Fig. 1B). The scar tissue from the linear scar was de-epithelialized. Next, the scar dermal flap was elevated from the base, with or without some subcutaneous fat tissue attached at its undersurface depending on volume requirements. In most cases,

Fig. 1. Surgical techniques. (A) Preoperative clinical photograph. (B) Scar dermal flap elevation. (C) Dermal flap filling the depressed area. (D) Closure and bolster dressing.

the subcutaneous pedicle of the flap was also preserved to provide support for the flap circulation. The depressed area was then undermined to detach the skin from the underlying tethering. The scar flap was transpositioned under the depressed area, and the flap was folded if necessary (Fig. 1C). One or two anchoring sutures were placed between the tip of the scar flap and the subcutaneous tissue of the undermined space. Next, the remaining linear wound was closed as in usual scar revision surgery, with minimal wound tension (Fig. 1D).

RESULTS

Demographic characteristics of the patients are presented in Table 1.

Fig. 2. Case 1: 46-year-old female patient. Clinical preoperative photograph (A), scar dermal flap elevation (B), immediate postoperative clinical photograph (C), and results at 1 year postoperatively (D). White arrow: depressed area; black arrow: scar dermal flap.

Table 1. Demographic data of the patients

Patient no.	Cause	Sex/age (yr)	Location	Follow-up (mon)	Depressed scar area (cm ²)	Linear scar length (cm)	Size of the dermal flap (cm ²)	F/D ratio	Preoperative SBSES (point)	Preoperative SBSES (point)
1	Trauma	M/57	Right cheek	5	2×1	2	2×0.5	0.5	4	5
2	Trauma	F/53	Philtrum	5.5	2.5×0.5	3	2.5×0.5	1.0	1	5
3	Operation	F/32	Left lower leg	7	6×2	10	5×1	0.42	0	3
4	Trauma	M/24	Left lateral canthus	5	1.2×0.5	1.8	1.8×0.5	0.66	2	4
5	Trauma	F/46	Right thigh	12	7×4	7	5×2	0.36	1	2

F/D ratio, ratio of dermal flap size to the depressed scar area; SBSES, Stony Brook Scar Evaluation Scale; M, male; F, female.

Fig. 3. Case 2: 53-year-old female patient. Clinical preoperative photograph (A), scar dermal flap elevation and filling the depressed area (B), and results at 14 months postoperatively (C). White arrow: depressed area; black arrow: scar dermal flap.

A total of five patients were analyzed, excluding those patients who were lost to follow-up. There were three female and two male patients. Their mean age was 42.4 years, and the average follow-up period was 7 months. Four of the patients had scars due to trauma, while in the other cases, the scars were due to previous operations. The mean length of the scars was 4.8 cm. The mean SBSSES score was 1.6 points preoperatively and 3.8 points postoperatively.

All patients were satisfied with the final results, especially with the fact that no additional incisions were needed. The augmented area was well maintained throughout the follow-up period. All wounds healed without any complications, such as disruptions or infections.

Case 1

A 46-year-old female patient (patient no. 5) had a depressed scar after trauma. A surgical procedure was performed in the manner described above. Twelve months after surgery, the replaced volume was well maintained and the patient was very satisfied with the improvement of the depression (Fig. 2).

Case 2

An upper lip depressed scar in a 53-year-old female patient (patient no. 2) was released using the technique described above. Five and a half months after surgery, improvement in the tethering was observed, even when the patient smiled (Fig. 3).

DISCUSSION

Scars are an unavoidable consequence of normal wound healing, and abnormal wound healing processes result in unsatisfactory results. Scars can occur in various forms, including linear, wide, depressed, hypertrophic, and keloid forms. Scars can occur from a variety of causes, including fat absorption due to poor circulation, infection, trauma, surgical scars, and even after steroid injections to treat hypertrophic scars [4]. Scars should have a similar color and contour to the surrounding skin, and should not cause distortion of the surrounding structures. The goal of scar revision is to

create these ideal scars [5].

When connective tissue is destroyed by various causes, the gap is replaced with scar tissue, which causes tethering and adhesion between the overlying skin and underlying tissues, such as muscle fascia [6]. This process leads to depressed or tethered scars. These scars can be managed by either minimally-invasive procedures or by specific types of surgical revisions. The goals of minimally-invasive methods for depressed scars are to disrupt the connection underneath the skin and to prevent re-adhesion [7]. Dermal tunneling and subcision are mainly used with fat grafts or hyaluronic acid fillers [8,9].

The materials to correct contour deformities can be classified into two groups: autogenous and nonautogenous substances. Non-autogenous substances include silicone and artificial dermal matrix (ADM). A disadvantage of these materials is that they can cause an immune response, such as foreign body reaction and infection. Fat tissue, dermofat, dermis, fascia, cartilage, and bone are autogenous materials used to correct contour deformities. These materials can provide satisfactory outcomes, although their viability and volume may decrease in the long term. In particular, 60% to 70% of fat grafts may be resorbed in 1 year [10]. Alternatively, other autogenous grafts, such as dermis and dermofat grafts, are considered more appropriate for depressed scars due to their relative stability. Dermal grafts are advantageous in that they are easy to obtain and, if they are obtained from scar tissues, allow simultaneous revision of scars. Moreover, they undergo vascularization more quickly than other autogenous tissues, meaning that a shorter immobilization period is needed for stabilization.

Doubt may arise about the viability of folded or stacked dermal grafts and its maintenance of the mass effect in the long term. Sevin et al. [11] compared histopathologic and structural changes in unfolded and folded dermal grafts used to correct contour deformities. The thickness and histopathologic changes of unfolded and folded dermal grafts were evaluated at 6 and 12 months after graft placement in 10 rabbits. Increased fibrosis in the folded grafts had a mass-like effect, which was preserved in the long term.

Many methods have been utilized in the past to correct depressed

scars. An early technique involved excision of the epidermis and a superficial layer of the dermis, advancement of the wound edges over the remaining dermal tissue, and burying the scarred subcutaneous tissue under the wound edges. A similar technique was introduced by Gillies and Millard in 1957, using the scar tissue overlapping technique, along with application of the double-breasted vest principle [12,13].

When surgical revision is chosen, three-dimensional tissue rearrangement is needed [14-17]. In reports of many other surgical methods, it was stated that the scar tissue was not discarded, and that de-epithelialized scar tissue was utilized for volume replacement [11,18,19]. However, many patients present with combined scar problems. In particular, it is common for people to have scars with a partial area of depression in a widened scar or a combined area of depression near a widened scar. For such cases, we introduced a scar dermal flap transposition technique in which the tissue of the widened scar is de-epithelialized through a dermal transposition flap and used to fill the depressed area.

Our method has several advantages. First, the incision is applied only to the widened scar, so no additional skin incision or filler procedure is needed at the depression site. In addition, the use of autogenous dermal or dermofat tissue with an additional vascular pedicle may improve tissue survival by providing a long-term volume replacement effect with fewer complications.

The main limitation of this method is that it is difficult to obtain optimal effects unless the volume of the dermal flap in the depression site is sufficient. Accordingly, we found that a higher ratio of the dermal flap area to the depressed scar area was associated with a better SBSSES score. However, this procedure can be readily considered for outpatient surgery in patients who refuse fat injection or the use of a foreign substance such as a filler. If the patient desires additional volume replacement, additional procedures (ADM, fat graft, filler, etc.) can be performed during the follow-up period. Other limitations of this study include its retrospective nature and the small number of cases.

If a depressed site is near a widened scar, a scar dermal transposition flap may be a versatile option for improving the depression without additional skin incisions or filling procedures, such as fat grafts.

NOTES

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Ethical approval

The study was approved by the Institutional Review Board of Catholic Medical Center Office of Human Research Protection Program (IRB No. KC19RESI0314) and performed in accordance with the principles of the Declaration of Helsinki. Written in-

formed consents were obtained.

Patient consent

The patients provided written informed consent for the publication and the use of their images.

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