Aesthetic Design of Expanded Bilateral Superficial Temporal Vascular Fascial Pedicled Flap for Repairing Maxillocervical Scars

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Background: Large-scale maxillocervical scars impair face and neck function and damage appearance. The forehead expanded bilateral superficial temporal pedicled flap is a good treatment strategy for this area; however, the traditional cutaneous pedicled flap damages the temporal hair area. This impairs aesthetics and causes alopecia; furthermore, requires an additional pedicle-cut operation.

Methods: A retrospective study was performed on 7 patients with large-scale maxillocervical scars from January 2014 to August 2018. Forehead expanders were implanted in the first-stage operation for all patients. After the injection and rest period, patients were treated using the forehead expanded bilateral superficial temporal vascular fascial pedicled flap. Superficial temporal vascular fascia pedicles were carefully harvested. The use of an intralesional or hidden retrotragus incision was determined by the presence of a preauricular scar. Patient satisfaction with postoperative neck activity and the incision scar was evaluated.

Results: Intralesional and retrovagus incisions were used in 4 and 3 cases, respectively. One flap developed hematoma, which recovered completely after conservative treatment; all other cases had no complications. All flaps healed well. The neck mobility of the patients was significantly improved with no visible scar in the temporal region. Six cases reported being "very satisfied" and one was "relatively satisfied" with their improvement in neck mobility. All cases reported being "very satisfied" with frontotemporal morphology.

Conclusions: The forehead expanded bilateral superficial temporal vascular fascial pedicled flap is a good choice for patients with large-scale maxillocervical scars. This technique can maintain the aesthetics of temporal hair and reduce patients extra surgical injury.

Key Words: large-scale maxillocervical scars, forehead expanders, forehead expanded bilateral superficial temporal vascular fascial pedicled flap

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Repairing large-scale maxillocervical scars, which are caused by different reasons, remains a challenge for plastic surgeons, as it requires the repair of functional problems and postoperative aesthetic reconstruction.[1] It is important to ensure the color and texture are similar between the donor and recipient area and reduce unnecessary scarring. The forehead skin is well matched with other parts of face and neck; furthermore, the donor site can be sutured directly using the extensive application of expanders, which avoids any requirement for grafting. Consequently, this flap is a good choice for face and neck defects. The forehead flap is supplied by the frontal branch of the superficial temporal artery on the temporal side and the supratrochlear and supraorbital artery on the nasal side. However, the latter has insufficient vascular pedicle length to the maxillocervical area and can create an obvious scar on the intercilium.[2] The forehead expanded superficial temporal vascular cutaneous pedicled flap is widely applied. This flap provides sufficient expanded skin and pedicle length to transfer to the maxillocervical region; however, it would create additional scars in the normal skin within the temporal hairline, which may cause dispensable alopecia. Further, additional surgery is required to remove the pedicle.

Increased requirements in public aesthetics have led to the need to consider how to optimize flap design, transfer mode, and personalized aesthetics according to different parts and ranges of lesions. Therefore, we designed the forehead expanded bilateral superficial temporal vascular fascial pedicled flap to treat patients with large-scale maxillocervical scars.

PATIENTS AND METHODS

Clinical Data

We retrospectively collected the clinical data of 7 patients with a large-scale maxillocervical scar from January 2014 to August 2018, including 5 men and 2 women, median age of 41 years (range, 17–55 years). All patients were treated with an expanded forehead flap pedicled with subcutaneous fascia of bilateral superficial temporal vessels. The inclusion criteria were the following: (1) intact morphology of bilateral temporal hair area; (2) undamaged bilateral superficial temporal vessels; (3) the presence of a large-scale maxillocervical scar area, involving the earlobe and above plane. All patients agreed and signed a consent form for publication of their medical records. This study was approved by institutional review board of Plastic Surgery Hospital, Chinese Academy of Medical Sciences.

Surgical Method

First-Stage Operation: Forehead Expander Implantation

Before the operation, the bilateral superficial temporal arteries were marked with Doppler ultrasonic stethoscope to ensure vascular integrity. The incision was created in the hairline of the forehead and the anatomical level was blunt separated between frontalis muscle and periosteum. A 300- to 400-mL rectangular expander was placed into the stripped cavity according to the area of maxillocervical scar. The suture was removed 2 weeks after the operation. The expansion rate was once every 5 to 7 days, and injection volume was 10% to 15% of the expander size. The injection period was 4 to 6 months. After this, the patients were rested for 2 to 4 weeks before undergoing the second-stage surgery.

Second-Stage Surgery: Scar Resection and Pedicled Flap Transference

The Doppler ultrasonic stethoscope was used again to mark the direction of the bilateral superficial temporal arteries before surgery. The flap area was created based on the range of the scar to be removed in maxillocervical region. The lower edge of the expanded flap incision was marked according to the distance from brow arch to the forehead hairline to ensure donor site suture positioning, which is generally 6

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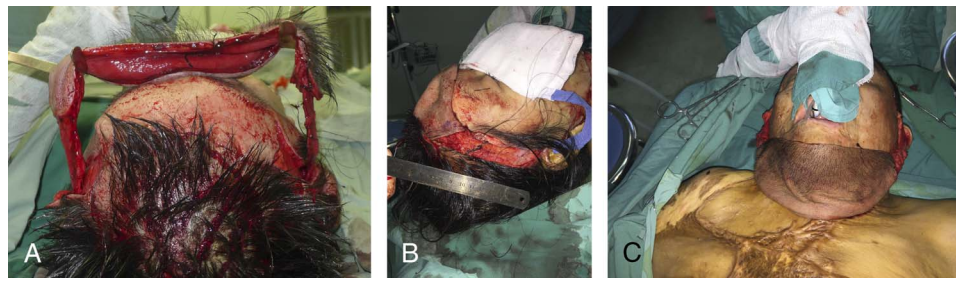

FIGURE 1. A, During surgery, the bilateral subcutaneous fascia pedicles containing superficial temporal vessels were carefully separated and harvested. B, The fascial pedicle was retained at least 2 cm in width, and the length was harvested 8 to 10 cm. C, The vascular fascial pedicled flaps were rotated 180° through the subcutaneous tunnel to the maxillocervical recipient area. full color online

to 8 cm. The upper incision was paralleled along the frontotemporal hairline bilaterally. The location of incision is determined according to whether there are scars in preauricular area. An intralesional incision could be made directly within the scar if required. Alternatively, a hidden retrotragus incision was made along the posterior edge of crus of helix and tragus, similar to a rhytidectomy incision. Bilateral subcutaneous fascia pedicles containing the superficial temporal vessels were carefully separated and harvested (Fig. 1A). Tumescent fluid was injected into the temporal area to facilitate accurate dissection. First, separation was undergoing in subcutaneous fat layer to protect superficial hair follicles and superficial temporal fascia. When we found the vascular pedicle, we dissected the fascia containing superficial temporal vessels from distal to proximal. The fascial pedicle was retained at least 2 cm in width, and the length was harvested 8 to 10 cm (Fig. 1B). The vascular fascial pedicled flaps were rotated 180° through the subcutaneous tunnel to the maxillocervical recipient area (Fig. 1C). A drainage tube was placed under the flap to avoid subcutaneous hematoma. The donor site was sutured without tension and the incision line became the new frontotemporal hairline.

Effect Evaluation

The satisfaction of patients with postoperative neck activity and incision scar was recorded during the follow-up period. The satisfaction evaluation was divided into 4 grades: very satisfied, relatively satisfied, not very satisfied, and very dissatisfied.

RESULTS

Seven patients with large-scale maxillocervical scars were treated with vascular fascial pedicled flaps. The flap size was between 11 × 24 cm

FIGURE 2. A–D, The frontal views show preoperation, 5 months after expander placement, 3 months after the flap transfer, and 78 months after the flap transfer, respectively. The mobility of the neck improved significantly. E–H, The lateral views show preoperation, 5 months after expander placement, 3 months after the flap transfer, and 78 months after the flap transfer, respectively. The temporal hair area was intact. full color online

FIGURE 3. A, The lateral view shows 4 months after expander placement. B–C, The lateral views show 8 and 30 days after flap transfer. The preauricular skin is intact and the hidden incision is designed based on the principle of rhytidectomy along the posterior edge of crus of helix and tragus, where there is no obvious scar. D, The frontal view shows 44 months after the flap transfer, no contracture had reoccurred, and the mobility of the neck improved significantly. The hair on transferred flap was removed completely. full color online

and 14 × 28 cm. Four cases used intralesional incisions because of existing scars in the preauricular area. Three cases used hidden retrotragus incisions. One case developed flap hematoma after surgery. Some sutures were removed to clear the subcutaneous hematoma and the flap recovered completely. No complications were reported in the other 6 cases. All flaps healed well. Three cases underwent flap revision at 3 to 6 months after the second-stage surgery. Mean follow-up at 52 months (range, 33–78 months) assessed the improvement in neck

FIGURE 4. A, The lateral view shows 5 months after expander placement. B–C, The lateral views show 10 days and 52 months after flap transfer. The preauricular skin is intact and the hidden incision is designed based on the principle of rhytidectomy along the posterior edge of crus of helix and tragus, where there is no obvious scar. No contracture had reoccurred. full color online

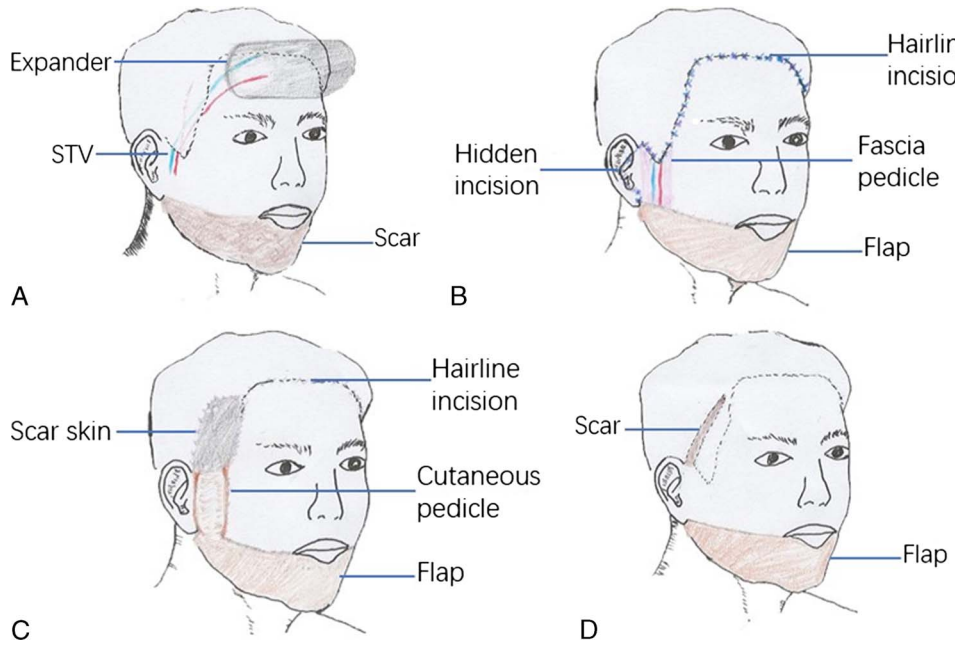

FIGURE 5. A, The forehead expander is implanted when the large-scale maxillocervical scars are present up to the earlobe plane. B, The forehead expanded bilateral superficial temporal vascular fascial pedicled flap is applied with no additional scar in the temporal hair area. C, The forehead expanded bilateral superficial temporal vascular cutaneous pedicled flap is applied; the pedicles are curled into tubes; the bilateral temporal defects are covered with scar skin temporarily, which is restored in the additional pedicle division operation. D, The pedicle division operation is applied with an obvious linear scar in the temporal hair area. full color online

mobility. Six cases reported being "very satisfied" and one reported being "relatively satisfied." All cases were "very satisfied" with their frontotemporal morphology. In addition, the donor site scars were hidden in the hairline, and no alopecia was reported.

CASE 1

A 31-year-old male patient was admitted to the hospital in March 2014 with maxillocervical scars caused by natural gas burns 10 months ago. Physical examination revealed irregular large-scale scars in the maxillocervical region up to the ears bilaterally. The scars were hyperplastic, dark red in color, tough in texture, and higher than the normal skin, which significantly limited head supination. A 400-mL rectangular expander was placed under the frontalis muscle at the first stage surgery. This was expanded regularly after the operation. The second stage was performed 5 months later. At this point, the maxillocervical scar was excised, and the forehead expanded superficial temporal vascular fascial pedicled flap was transferred and used to repair the defects. An intralesional incision was made directly because there are obvious scars in preauricular area. The donor and recipient areas healed well after surgery and neck mobility was significantly improved. At follow-up after 76 months, no contracture had reoccurred, the scar on frontotemporal hairline was inconspicuous, and the hair morphology was normal. The patient was satisfied with the treatment results (Figs. 2A–H).

CASE 2

A 17-year-old female patient was admitted to the hospital in April 2017 with maxillocervical scars caused by flame burn 6 years ago. A 300-mL rectangular expander was placed at the first stage surgery. The second stage was performed 4 months later. A retrovagus incision was made because there are no obvious scars in preauricular area. At follow-up after 44 months, no contracture had reoccurred, the scar on frontotemporal hairline was inconspicuous. The hair on transferred flap was removed by laser (Figs. 3A–D).

CASE 3

A 52-year-old female patient was admitted to the hospital in May 2016 with maxillocervical scars caused by flame burn 3 years ago. A 300-mL rectangular expander was placed at the first stage surgery. The second stage was performed 5 months later. A retrovagus incision was made because there are no obvious scars in preauricular area. At follow-up after 52 months, no contracture had reoccurred, the scar on frontotemporal hairline was inconspicuous (Figs. 4A–C).

DISCUSSION

The maxillocervical region is located in the exposed area between the face and neck. This is a vulnerable site for various burns and trauma.[3] Scars in this region affect neck movement and lead to lower lip valgus and quarrel traction. The cervicomental angle is an important aesthetic hallmark of the face and neck.[4,5] Severe maxillocervical scars will cause the inferior maxillocervical margin to rotate from the horizontal to vertical position, resulting in angle enlargement or disappearance, which seriously impairs aesthetics. This area requires sufficient skin to fully relieve the contracture. A local flap can provide skin of a similar color and texture; however, the amount of available skin in this region is limited.[1] In addition, forced pulling can lead to further displacement and deformation. Simple skin grafting is not the preferred option because of differences in color and contracture.[6] For patients with extensive burns, the axial flaps in adjacent areas are often unusable because of simultaneous injuries.[7] Furthermore, the free flap is bloated, and the donor site is traumatized.[8]

The forehead has a similar color and texture to the maxillocervical region. The expansion technique can provide sufficient skin for grafting, and the thinner flap reduces bloating. This flap often transfers to the maxillocervical region with some hair, which can help with beard rebuilding in male patients. This is not pleasant for female patients; therefore, surgical and laser hair removal should be performed later. To date, the expanded forehead superficial temporal vascular cutaneous pedicled

flap has been widely applied. This provides sufficient blood supply with no need for micromanipulation technology.[8,9] The bilateral pedicles are rolled up as skin tubes; however, this method can increase trauma and cost for patients to undertake an additional pedicle division operation. In addition, this method causes additional wounds in the bilateral temporal hair region that results in linear scalp scarring and alopecia, which is more distinctive in male patients with short hair. It is important to consider how to reduce scarring with the continuous increase in people's aesthetic requirements; therefore, we made full use of the original scar in the maxillocervical area to reduce any additional incisions in normal tissue. Furthermore, we designed the vascular fascial pedicled flap to treat the scar, reduce the number of operations, and protect the morphology of the normal temporal hair area (Figs. 5A–D).

The key aspect of this operation is to peel off the superficial temporal fascia containing superficial temporal vessels. This includes the galea aponeurotica upwardly and frontalis muscle forwardly and continues to the superficial musculoaponeurotic system under the zygomatic arch.[10] This layer is adjacent to the subcutaneous tissue; therefore, separating the anatomical level is very important. If too shallow, it will cause hair follicle injury. In contrast, if too deep, it will damage the superficial temporal vessels and facial nerve. We injected tumescent fluid into the temporal area to facilitate accurate dissection. Sufficient arterial supply and venous return are the basis of flap survival. Before surgery, we detected the integrity and location of bilateral vessels via Doppler ultrasonic stethoscope. The superficial temporal artery runs from the external carotid artery and travels up from the upper edge of parotid gland to the front of the tragus. It is divided into the frontal and parietal branches between the horizontal line of lateral canthus and upper edge of auricle.[10,11] There are abundant anastomotic branches in the midforehead that ensure sufficient arterial blood supply. Most anatomical studies have reported that the location and number of superficial temporal veins are not constant.[12] Most were located 1 to 2 cm behind the arteries, except in the proximal region where it is adjacent to the superficial temporal artery.[10,13] Similar results were obtained in our study. The temporal branch of facial nerve runs in the deep layer of superficial temporal fascia parallel to the frontal branch of superficial temporal artery.[10] It is necessary to retain a wide enough vascular pedicle to ensure sufficient venous return because of the lack of skin and subcutaneous vascular network and variations in vein number and location. The vascular fascial pedicle should be retained at least 2 cm in width, and the lower boundary should be within 0.5 cm below the frontal branch of superficial temporal artery. This ensures vessel integrity and avoids injuring the temporal branch of the facial nerve.

The main purpose of this surgical method is to reduce the dispensable scar. Compared with the traditional cutaneous pedicle, this method needs additional bilateral incisions in front of ears, which is required to transfer the bilateral vascular fascial pedicles through a subcutaneous tunnel to the recipient region. We determined the specific surgical strategy according to the condition of preauricular skin. Intralesional incisions can be made if the scar is existed in preauricular area. In contrast, a hidden incision can be designed based on the principle of rhytidectomy if the preauricular skin is intact. This incision is made along the posterior edge of crus of helix and tragus to reduce scar exposure (Figs. 4A–B). During the operation, it is necessary to free the subcutaneous space sufficiently to ensure that there is no compression of the bilateral vascular fascial pedicle and avoid the occurrence of venous reflux obstruction, which may cause flap congestion and necrosis.

This vascular fascial pedicled flap can reduce the incidence of surgical scars and number of operations required to treat the large-scale maxillocervical scar. However, the indication is relatively limited. First, retaining an intact temporal hair area is the premise of our surgical procedure. Moreover, it is only suitable for cases where the maxillocervical scars are visible up to the plane of earlobe. Otherwise, an additional incision is required in the normal skin under the earlobe for the fascial flap transfer. We have successfully anastomosed the superficial temporal vessels with facial vessels to avoid an additional incision; however, this method increases the surgical difficulty and risks of vascular crisis.

CONCLUSIONS

Large-scale maxillocervical scars significantly impact the appearance and mobility of the face and neck. Surgeons focused on how to provide sufficient skin with a similar color and texture. The increased aesthetic requirements of patients have increased the need to reduce unnecessary damage and additional scar. Using the bilateral superficial temporal vascular fascial pedicled flap, we have obtained a better outcome in 7 patients. Although its indications are relatively limited, this surgical method avoids obvious scar and alopecia within the temporal hair area. In addition, it reduces a pedicle division operation when compared with the traditional cutaneous pedicled flap method. In conclusion, the forehead expanded superficial temporal vascular fascial pedicled flap is a good choice for repairing large-scale maxillocervical scars.

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