Extended Vertical Trapezius Fasciocutaneous Flap (Back Flap) in Face and Neck Burn Scar Reconstruction

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Abstract: Elevation of the skin along with its deep fascia vascular network is a recent facility for flap design. The longitudinal trapezius fasciocutaneous flap was first introduced in 1996; at that time it did not receive much attention, although it has many significant benefits compared with other available procedures.

Sixteen trapezius fasciocutaneous flaps were elevated in 15 patients for reconstruction of severe scarring of the neck and midface. All flaps were based on the deep branch of the transverse cervical artery and included the overlying fascia of the trapezius muscle. Delaying was applied for very long flaps. Two flaps developed minimal distal necrosis (<5 cm) due to longer pedicles (>10 cm below the muscle border). The results indicate that an extra-long back fascia flap based on the descending branch of the transverse cervical artery could be formed, which would be long enough to reconstruct the entire neck and safely transfer it to the midface.

The vertical trapezius fasciocutaneous flap, with its abundant tissue, excellent blood supply, anatomic proximity, wide arc of rotation, and hidden donor site scar, provides a simple and reliable method for primary reconstruction of various midface and neck defects.

Key Words: face and neck burn scar, back flap, hidden donor site

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The vertical trapezius fasciocutaneous flap was first introduced by Isenberg et al[1] for mentosternal burn scar reconstruction in 1996. Two more articles were published by Chinese surgeons in 2000 (in Chinese)[2] and 2006, using the same flap for neck reconstruction.[3] Since 1996 we have used 16 flaps in 15 patients for midface and neck reconstruction. Although this flap was not popularized properly, we found it to be part of a very useful armamentarium for extensive mid- and lower face burn scarring. It is most useful when there is not enough normal pliable skin for tissue for expander insertion. In addition, it is superior to other local rotation flaps due to its hidden donor site. This technique may not have received its due attention because of confusion between this flap and the more aggressive trapezious musculocutaneous flap, which causes significant esthetic and functional disabilities.

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Anatomy

The trapezius is a triangular muscle originating from the occipital bone, the seventh cervical spinus process, and all thoracic spinus processes of the vertebral column. It inserts into the clavicle, the acromion process, and the spine of scapular bone. Motor innervation of the trapezius is supplied by the accessory nerve[4]; weakness of this muscle causes shoulder drop or impaired arm rotation.

The vascular supply consists of a dominant pedicle and several minor pedicles (Fig. 1). The dominant blood supply originates from the transverse cervical artery and vein, a branch of the subclavian artery or thyrocervical trunk and associated veins. This vascular pedicle courses between the sternocleidomastoid and the scalenus muscles, crosses the anterior margin of the trapezius, and enters the deep surface of the muscle at the base of the neck. It then divides into its ascending and descending branches. The descending branch courses along the deep surface of the muscle between the spine and the scapulae. Here it supplies the musculocutaneous perforators, the main source of blood supply to the overlying fascia and skin. Several minor pedicles also supply this muscle. The largest of these is a branch of the occipital artery (which arises from the external carotid). It supplies the superomedial portion of the flap. The entire cutaneous territory of the trapezius measures 34 × 28 cm; this includes several centimeters superiorly and inferiorly beyond the muscle fibers. The cutaneous perforators are located throughout the muscle surface, but the largest and most consistent of these occur along the medical aspect, 2 to 3 cm from the midline.[5] The distal part of the flap is supplied by the dermal-subdermal plexus that originates from the deep fascia vascular network; this makes it a random flap.

METHODS

Since 1996 we have raised 16 trapezius fasciocutaneous flaps in 15 patients (bilateral flaps in 1 case) for severe

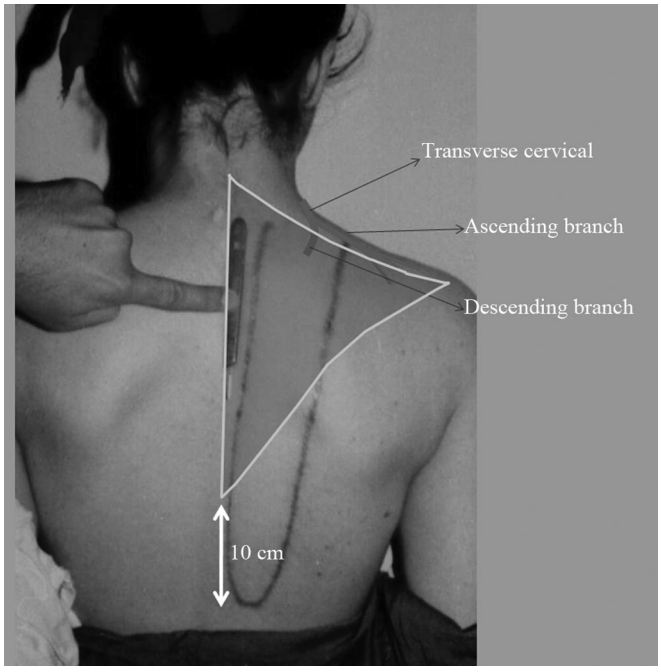

FIGURE 1. Anatomy and design of the extended vertical trapezius fasciocutaneous flap.

scarring of the neck and midface reconstruction (Figs. 2–6) (Table 1). Criteria for choosing patients included lack of enough normal loose and pliable skin for tissue expander insertion, concern about the quality of skin (compared with skin graft), and insistence on having a hidden donor site. The flap tailored along the route of the deep branch of the transverse cervical artery and included the overlying fascia of the trapezius muscle (Fig. 1). For this purpose, the long axis of the flap was centered between 2-cm lateral to the spinal processes of the vertebral column and the medial border of the scapula. The width of the flap was planned and marked by pinching the donor site skin to choose the amount that can be closed primarily (approximately 5–10 cm, mean 7 cm) (Fig. 7).

The pivot point of the flap was accepted as the level of the scapular spine to preserve the superior perforators of the trapezius muscle[6] (Fig. 7). Care should be taken in approaching the superior-medial aspect of the flap to avoid injury to the dorsal scapular and/or the transverse cervical arteries.[1] Doppler ultrasound may help to ensure the presence of perforator vessels, although preserving the proximal attachment of fascia to muscle guarantees its blood supply.

Flap dimensions could be up to 45 × 10 cm (25–45 cm, mean 32 cm), extending caudally as much as 10 cm below the inferior border of the muscle. This distance makes the distal segment of the flap random. In the authors' experience, extending the flap caudally more than 10 cm beyond the muscular margin may endanger the vascular supply of the distal segment. To improve the random circulation of the distal segment, a delayed procedure was performed in all flaps,[7] primarily in 2 stages with 2-week intervals. In the first stage, margins of the flap were cut deep to the fascia; in the second stage, all distal deep perforators were divided blindly through the previous 7-cm incision line. The flaps were rotated to the recipient area with no tunneling and may reach to the mastoid bone, below the ear lobe on the ipsilateral side, and to the angle of the mandible of the contralateral side after cutting the pedicle in 3 weeks time.

FIGURE 2. A 22-year-old female with burn scars of the right side of the face and neck; the scar was completely excised and replaced by the rotated flap. Postoperative photographs were taken 11 months after insetting the flap.

Among the 16 flaps used in the face and neck area, 2 flaps developed minimal distal necrosis (the first 2 cases) due to a longer pedicle, ie, more than 10 cm below the muscle border.

Three weeks postoperatively, the pedicle was separated and rotated to the recipient site. No flap failure occurred and the donor sites were closed primarily. There were no disabilities with regard to shoulder motion. Thinning of the flaps was done in 2 successive operations with removal of the fascia and excision of the deep lying fat of the flap in later stages. This gave a pliable and esthetically more suitable coverage.

Due to wide vertical scarring of the neck in 2 patients, flaps were plicated in the midline after separation of the pedicles (Fig. 5A,B). In these special cases, the width of the

FIGURE 3. A 19-year-old female with extensive burn scars of the right midface, chin, and neck; the scar was completely removed and replaced by a trapezius fasciocutaneous flap. Postoperative photographs were taken 2 years after last defatting of the flap.

FIGURE 4. A 24-year-old female with burn scars of the midneck; the scar was completely removed and replaced by a trapezius fasciocutaneous flap. Postoperative photographs were taken 6 months after the last defatting of the flap.

flap was essentially doubled. In one patient with total burn scarring of the neck, one of our colleagues decided to use bilateral flaps in 2 stages for total reconstruction of the neck (Fig. 6).

DISCUSSION

History

As early as 1889, Manchot described numerous vascular territories including the posterior neck and upper posterior back. In particular, territories of the occipital, scapular, and suprascapular arteries were mentioned. Almost 50 years earlier, Mutter had used a flap from the nape of the neck to relieve burn scar contractures. In 1957, Zovickian[8] repaired pharyngeal fistulas with a similar flap. In 1979, McCraw and coworkers reported use of the upper portion of the trapezius muscle to augment a standard Mutter flap, thus creating a trapezius musculocutaneous flap. This flap was used primarily for head and neck reconstruction after tumor resections, although use of other flaps (such as pectoralis major or deltopectoral flaps) for this purpose has been more prevalent, due to longer arcs of rotation.[9] The trapezius can also be used as a free flap; however, the accessibility and functional expendability of other flaps, such as the latissimus dorsi muscle, make the trapezius a poor choice for free transfer.[5] This muscle has a posterior arc that can cover defects in the skull, posterior neck, and shoulder and may extend to 3 to 5 cm below the inferior angle of the scapula.[10]

The first fascial and fasciocutaneous flaps were described by Ponten[11] in 1981 for lower extremity reconstruction and by Tolhurst et al[12] in 1983 for trunk and axillary reconstruction. Growing knowledge of skin circulation after the recognition of the muscle and musculocutaneous system led to the identification of vascular pedicles emerging between muscles (septocutaneous pedicles) and entering the deep fascia. Elevation of the skin, with its deep fascia vascular network, is a more recent facility for flap design. The vascular supply is derived from the deep fascia at the base of

FIGURE 5. A, upper row, An 18-year-old male with a high vertical burn scar of the mid neck. Lower row, Long flap was raised and plicated in the midline to invent wider coverage of the defect. B, Two years postoperation.

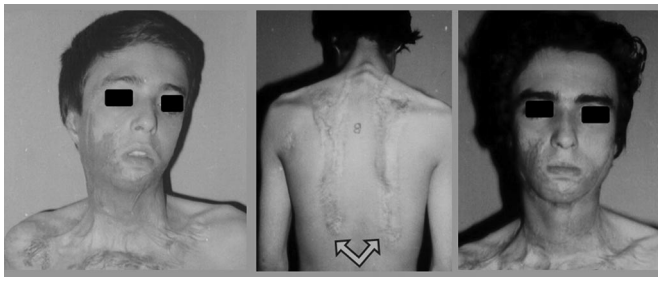

FIGURE 6. Total burn scar of the neck and lower face. Bilateral trapezius flaps were elevated in 2 stages to replace the wide neck scar.

the flap, musculocutaneous perforators, or direct septocutaneous branches of major arteries.[13]

Using trapezious fasciocutaneous flaps beyond the fascia provides a large skin paddle in the hidden area of the body with no necessary sacrifice of the underlying muscle. Primary donor site closure is the other benefit of using this technique. This approach will give the reconstructive surgeon a valuable means to reconstruct the midface and neck without causing ugly and exposed donor site scars. Several reports have already demonstrated the versatility, usefulness, and reliability of these flaps.[1–3] The flap is versatile and can be plicated after cutting the pedicle to give a wider skin paddle if needed (Fig. 5A,B). For very wide facial scars, even bilateral flap elevation is feasible (Fig. 6).

Most flaps used for head and neck reconstruction, such as the deltopectoral, epaulet, and pectoralis major myocutaneous flap, result in anterior chest wall or shoulder disfigurements that are not acceptable, particularly in female patients. The trapezious fasciocutaneous flap gives a much better texture and appearance. Moreover, no contractures will develop in long-term follow up, as occurs with skin grafts. The trapezious fasciocutaneous flap is thinner and more pliable than both the latissimus dorsi and pectoralis major myocutaneous flaps.[6] The important benefit of using this flap is the donor site scar. The scar of the extended vertical trapezius fasciocutaneous flap is placed in the posterior trunk with no visible incision line on the neck, shoulder, or other exposed area of the body; since no muscle is excised, there is no deep scar. Also, no shoulder drop or any other shoulder joint mobility problems occur, as is common in musculocutaneous flap donor sites.

Fewer operations, thinner flap, and less defatting procedures make the free groin or parascapular flap the only comparable technique. The risk of anastomosis failure and

TABLE 1. Patient Summary

Cases	Age/Sex	Burn Scar Location and Size (cm)	Previous Operations	Flap Dimensions (cm)	Flap Outcome	Recipient Site Location	Donor Site Dimensions (cm)
Case 1	22♀	Right side of the neck (15 × 20)	Split thickness skin graft	35 × 8	No necrosis	Right side of the neck, complete coverage	12 × 7
Case 2	19♀	Right midface, chin, and neck with contracture band (15 × 12)	None	25 × 7	No necrosis	Right side of the neck, complete coverage	12 × 10
Case 3	24♀	Midneck burn scar contracture (18 × 12)	None	45 × 9	Necrosis, tip of the flap	Neck scar complete coverage	18 × 12
Case 4	18♂	Extensive burn scar of midneck and trunk with some contracture (12 × 20)	Split thickness skin graft	37 × 8	No necrosis	Midneck, complete coverage ,with turning down and spreading the flap	26 × 16
Case 5	15♂	Total neck burn scar (40 × 25)	Previous split thickness skin graft	1–25 × 6 2–28 × 6	No necrosis	Bilateral double flap was used in 2 stages	32 × 10
Case 6	23♀	Burn scar of the right side of the neck and trunk (15 × 12)	None	40 × 10	Necrosis, tip of the flap	Right neck, complete coverage	12 × 10
Case 7	23♀	Right side of the neck and face, keloid former (15 × 8)	None	27 × 8	No necrosis	Right side of the face and neck, extending to ear lobule	15 × 8
Case 8	17♀	Total burn scar of left face	Forehead, nose, and both lips coverage by skin graft	28 × 6	No necrosis	Left side of the face and neck, complete coverage	13 × 7
Case 9	14♂	Neck and trunk burn scar (7 × 14)	Previous split thickness skin graft of lower neck	25 × 5	No necrosis	Right side of the face and neck	12 × 5
Case 10	20♂	Burn scars of face, nose, neck, and trunk (18 × 30)	Split thickness skin graft of chin and neck	40 × 9	No necrosis	Lower neck, ear to ear coverage	32 × 7
Case 11	11♂	Midneck burn scars contracture (7 × 10)	None	27 × 5	No necrosis	Midneck, coverage	12 × 6
Case 12	24♀	Right side of the chin (7 × 20)	None	29 × 8	No necrosis	Right side of the face and chin	8 × 6
Case 13	11♂	Right side of the neck and face	None	25 × 7	No necrosis	Right neck, incomplete coverage	12 × 7
Case 14	27♀	Midneck burn contracting scar (9 × 8)	None	38 × 6	No necrosis	Midneck, complete coverage	12 × 8
Case 15	26♀	Left-sided burn scar of the neck (15 × 20)	None	40 × 9	No necrosis	Left neck and face, complete coverage	22 × 14

need for sophisticated operation and expertise are the disadvantages of using free flaps. The perplexing nature of microsurgery and the risks involved in performing this procedure inhibit this kind of surgery from being performed in many institutions around the world; here, pedicled flaps would be a more practical procedure.

The drawbacks regarding this flap are its limitation in the width, which is restricted to 8–10 cm. This width is determined by pinching the donor site skin to be closed primarily. Also, the length of this flap cannot be extended to more than 10 cm below the lower border of the muscle. In very long flaps, a 2-stage delaying procedure is mandatory for safe flap elevation; thinning after insertion of the flap is done for better esthetic results.

CONCLUSION

Trapezius fasciocutaneous flaps are excellent reconstructive tools for selected defects. Our experience indicates that the extra-long back fascia flap, pedicled with the descending branch of the transverse cervical artery and its subfascia vascular plexus, could be formed long enough to

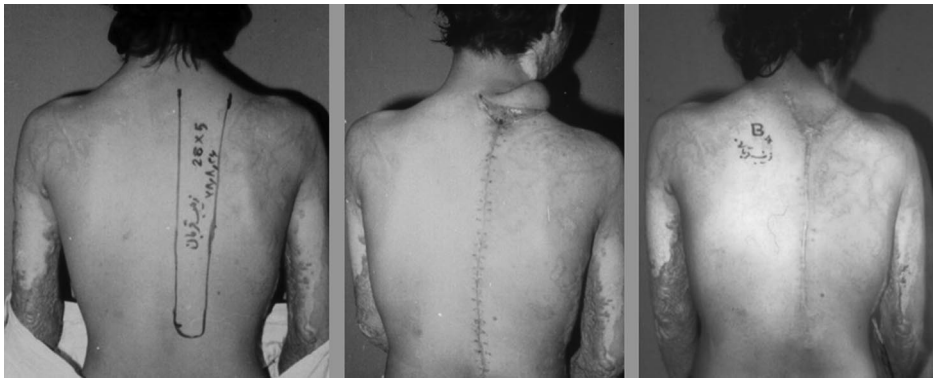

FIGURE 7. A, Flap outline. B, Immediately after elevation. C, Donor site scar 4 months postoperation.

reach the opposite side of the neck and safely transfer to the midface. The flap, when based on the subfascia vascular plexus, provides a reliable alternative for the reconstruction of complicated wounds in the cervical and midface regions.

The vertical trapezius fasciocutaneous flap is valuable in head and neck reconstruction. It offers thin, pliable tissue and a long arc of rotation to reach virtually any defect in the midface and neck. This flap provides reliable coverage for posterior trunk, cervical, and midface defects with a hidden donor site camouflaged in the posterior thoracic wall. The hairless nature of the attached skin is another advantage. Compared with free flaps, both techniques have similar donor site morbidity and may need multistage thinning procedures.

The shortcomings of this procedure are that it is restricted to multiple operations for delaying and insetting of the flap.

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