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CASE REPORT
Reconstructive

Effectiveness of Skin Graft in the Chest for Postburn Cervical Contractures

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Summary: Skin grafts (SGs) offer a simple and reliable means of correcting postburn cervical contractures. However, their use has a high risk of contracture recurrence, as proper postoperative care is often difficult to perform. Splinting and pressure therapy are challenging in the neck, which has complex multidirectional mobility and contains critical structures. In contrast, the upper chest area, which also contributes to neck extension, has a relatively plane surface and rigid subcutaneous tissue, and is likely to be a more reliable site for pressure application. Here we report a case with good restoration of neck extension after using a split-thickness SG (STSG) only in the upper chest. A 22-year-old man with third-degree burns survived with the use of multiple SGs. Nine years later, he lacked a healthy donor site for a full-thickness SG or flap surgery. Although a split-thickness SG on the neck was performed for restricted cervical extension, severe contracture of the skin graft developed due to failure to continue postoperative pressure therapy. As a last resort, further surgery with a split-thickness SG was performed in the upper chest after releasing the contracture. With continued, successful postoperative pressure therapy, contracture of the skin graft was minimized. According to our survey of healthy volunteers, chest skin mobilization contributes to about 30% of cervical extension. This suggests that SG use in the chest is a reasonable option to reliability and effectively address restricted neck motility due to postburn contracture when a healthy donor site for a full-thickness SG or flap surgery is unavailable.
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Among multidisciplinary surgical approaches for postburn cervical contractures, skin grafts (SGs) are often a preferred option because they offer a simple and reliable means of correcting burn scar contractures, and are feasible for use in patients with a paucity of donor sites for flap surgery.[1,2] However, SGs have a high risk of contracture recurrence, and proper postoperative care is required (eg, splinting pressure technique).[3–5] Splinting and pressure therapy are challenging in the neck, which has complex multidirectional mobility and contains critical structures such as the trachea and great vessels.[5,6] On the other hand, the upper chest area, which contributes to neck extension, has a relatively plane surface and rigid subcutaneous tissue, and is likely to be a more reliable site for pressure application. In the present case, we demonstrated improvements in a patient with limited neck extension using a split-thickness SG (STSG) in only the upper chest with minimal contracture recurrence. We also assessed the contribution of chest skin mobilization to neck extension in healthy volunteers.

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CASE REPORT

A 22-year-old man with third-degree burns (60% of total body surface area) survived with multiple SGs. Nine years later, he received an STSG on the neck due to restricted cervical extension, as he did not have a healthy donor site for a full-thickness SG (FTSG) or flap surgery. However, he developed severe contracture of the SG due to failure to continue postoperative pressure therapy. Further surgery using an STSG in only the upper chest was planned. Bilateral fish-tail incisions were made

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horizontally below the sternal notch (Fig. 1A), and the created defect was covered with an STSG (Fig. 1B). With continued, successful postoperative pressure therapy, the contracture of the SG was minimized (Fig. 2). The aesthetic outcome was acceptable, and cervical motility improved. (**See figure, Supplemental Digital Content 1**, which displays the fully-extended position of the neck preoperatively (left) and postoperatively (right). **http://links.lww.com/PRSGO/B839**.)

CONTRIBUTION OF CHEST SKIN TO NECK EXTENSION

Ten healthy volunteers, including five men and five women (mean age, 32 years; range, 27–41 years), participated in this study. According to a report that the normal cervicomental angle ranges from 90 to 120 degrees,[7] we measured the migration length of a skin marking on the sternal notch at a cervicomental angle of 90–120 degrees (I) and calculated the amount of elongation in the

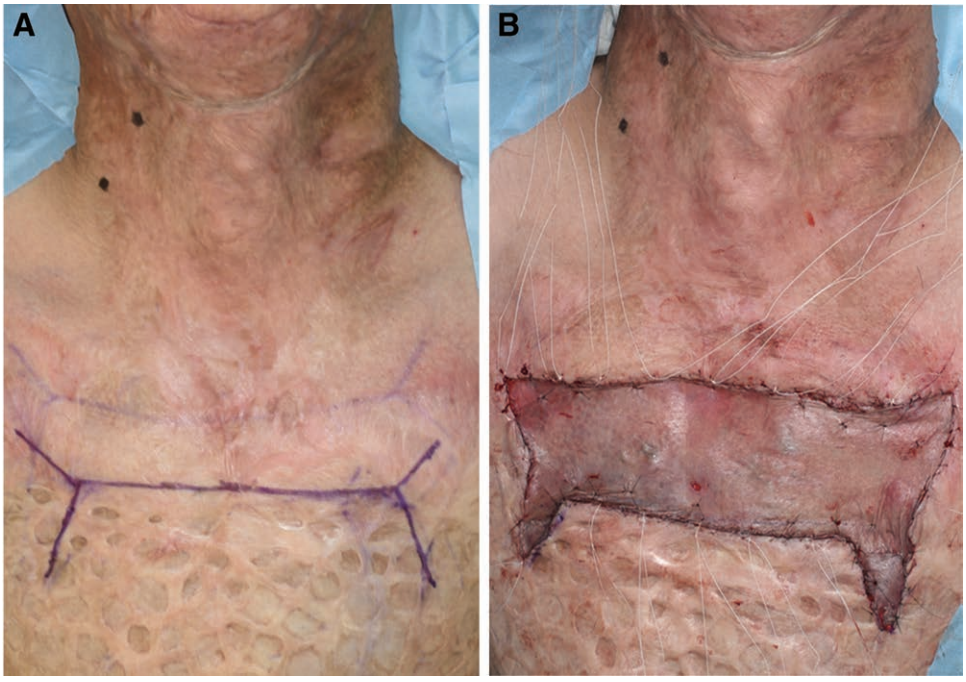

Fig. 1. STSG in the upper chest. Incisional design for release of upper chest contracture (A), and fixation of the skin graft on the defect (B).

Fig. 2. Survival of the skin graft in the upper chest with no contracture recurrence 8 months postoperatively. Arrowheads indicate the skin graft.

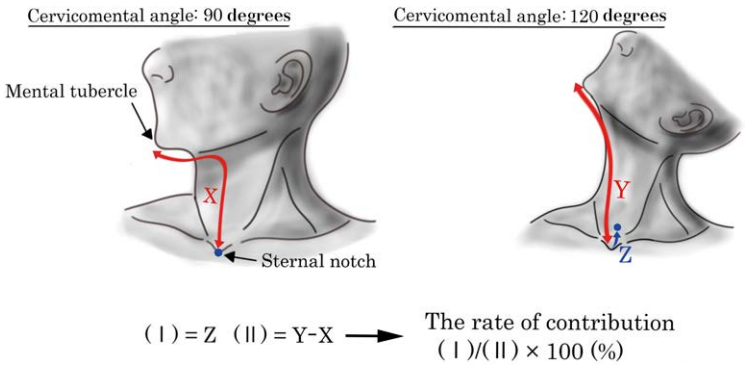

Fig. 3. Schematic of our measurement method. The blue point indicates the skin marking on the sternal notch at a cervicomental angle of 90 degrees, which migrates cranially with cervical extension (blue arrow, Z). Red double-headed arrows indicate the length between the sternal notch and mental tubercle (X). The length increases with cervical extension (Y). The rate of contribution of chest skin mobilization to neck extension was calculated as Z/(Y–X) × 100 (%).

distance between the sternal notch and mental tubercle (II). The rate of contribution of chest skin mobilization to neck extension was calculated as I/II × 100 (%) (Fig. 3). Statistical analysis was performed using Statcel, version 3.

The rate of contribution of chest skin mobilization to neck extension was 29.4 ± 10.5% (mean ± SD), with no significant difference between men and women ($P = 0.97$, Student *t*-test).

DISCUSSION

Patients with severe burn injuries generally have limited skin available to harvest. STSG, rather than FTSG or local flaps, becomes a practical choice for resurfacing after the release of cervical contracture. However, contracture recurrence is more likely with STSG than with FTSG or flaps.[3,6] Moreover, pressure therapy is difficult due to the concave flexor surface of the neck, coupled with the pliability and mobility of neck skin, leading to increased rates of contracture recurrence.[5,6] The rate of contracture recurrence is reported to be around 13%–30% with proper postoperative therapy,[2,7] suggesting that rigorous postoperative therapy is necessary to achieve acceptable results after release of cervical contracture with SGs. However, compliance is a major issue because patients are required to continue postoperative care with splinting and pressure garments for at least 6 months.[2,7] Indeed, as in the present case, some patients do not adhere to postoperative care, resulting in unfavorable aesthetic and functional outcomes.[6] SGs in the chest allow for more reliable postoperative pressure therapy due to the relatively plane surface and steady defect floor, and can potentially lower contracture recurrence rates. SGs in the chest also have better survival rates than SGs in the neck. As a potential complication, however, there is a risk of sternal bone exposition. We demonstrated that chest skin mobilization contributes to about 30% of cervical extension, suggesting that SG use in the chest is a reasonable option to reliably and effectively address restricted neck motility due to postburn contracture.

This study has some limitations. First, the sample size was relatively small. Second, subjects were healthy volunteers and not patients with burn injury. Thus, the contribution rate of chest skin mobilization to neck extension might have been underestimated. Further studies will be needed to clarify the effect of SGs in the chest on postburn cervical contracture. Although the procedure alone might not be feasible for treating severe cervical contractures, it should be taken into consideration as an ancillary method in cases of severe postburn cervical contracture, along with other SGs or flap surgery for resurfacing postrelease defects.

CONCLUSIONS

Chest skin mobilization contributes to about 30% of cervical extension. Use of SGs in the upper chest is a practical and reasonable method for correcting postburn contractures and restoring cervical movements, with relatively easy postoperative therapy and the potential to achieve low contracture recurrence rates.

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All procedures conformed to the principles set forth in the Declaration of Helsinki. This study was approved by the ethics committee of Osaka University, and written informed consent to publish personal and medical information was obtained from the patient.

REFERENCES

1. Goel A, Shrivastava P. Post-burn scars and scar contractures. *Indian J Plast Surg.* 2010;43(Suppl):S63–S71.

2. Mody NB, Bankar SS, Patil A. Post burn contracture neck: Clinical profile and management. *J Clin Diagn Res.* 2014;8: NC12–NC17.
3. Stekelenburg CM, Jaspers MEH, Jongen SJM, et al. Perforator-based interposition flaps perform better than full-thickness grafts for the release of burn scar contractures: A multicenter randomized controlled trial. *Plast Reconstr Surg.* 2017;139:501e–509e.
4. Bunchman HH II, Huang TT, Larson DL, et al. Prevention and management of contractures in patients with burns of the neck. *Am J Surg.* 1975;130:700–703.
5. Kraemer MD, Jones T, Deitch EA. Burn contractures: Incidence, predisposing factors, and results of surgical therapy. *J Burn Care Rehabil.* 1988;9:261–265.
6. Iwuagwu FC, Wilson D, Bailie F. The use of skin grafts in post-burn contracture release: A 10-year review. *Plast Reconstr Surg.* 1999;103:1198–1204.
7. Zhang YX, Wang D, Follmar KE, et al. A treatment strategy for postburn neck reconstruction: Emphasizing the functional and aesthetic importance of the cervicomental angle. *Ann Plast Surg.* 2010;65:528–534.