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Expanded Super-Thin Flaps in Reconstruction of Face and Neck Contractures

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ABSTRACT

Background: Thicker skin flaps were claimed for long time to have higher survival rates. The skin of the flap gets blood supply via sub dermal vascular network supplied by perforator vessels. We tried to estimate the effect of defattenning and thinning on pre expanded skin to fabricate flaps and evaluate the survival rate, aesthetic and functional outcome.

Patients and Methods: Ten patients selected prospectively and they were presented by post burn contractures in the face and/or neck and seeking more aesthetic appearance.

Results: Reconstructed contractures were replaced by healthy skin highly matched with the surrounding in colour and texture.

Conclusion: Super-thin flaps can be a good reconstructive option in surgical management of face and neck contractures.

INTRODUCTION

It is known that, thermal trauma remains one of the real problems of modern medicine because of its heavy clinical course, the difficulties of treating the victims, the high mortality rate, and the sometimes unacceptable results of treatment **[1]**. The scars are usually either hypertrophic or keloid, or they belong to an indeterminate group. Keloids and hypertrophic scars are fibroproliferative disorders resulting from abnormal wound healing **[2]**. It is clear that disfigurement, facial injury in particular, is related to difficulties in interactions and is associated with other psychosocial problems. But hidden burns might also provoke serious problems in social life. People who have sustained a burn injury are at risk of developing certain psychopathology, in particular depression and anxiety disorders **[3]**. In the past, numerous modalities have been applied in contracture treatment with differing results. We can say that a successful treatment is based on clinical findings and the type of scar. No therapy can remove scars completely, hypertrophic scars and keloids can often also cause pruritus, dysesthesia and pain, and can form strictures **[4]**. Clinical observations found that the nearer the flaps locate with original defect, the more similar colour can be obtained **[5]**.

Perforator flaps have been developed to reduce the sacrifice of donor structure and to enable versatile design or thickness as required **[6]**. The concept of the "super-thin" flap was presented by Hyakusoku et al., in 1994. This flap is sometimes called the subdermal vascular network flap. Such very thin flaps have been used for the reconstruction of contour-sensitive areas such as the face and neck **[7]**. In 2002, a version of this flap was introduced, the main feature of which was a primary radical debulking of the superficial adipose tissue up to the level of subdermal plexus **[8]**. Super thin flaps may be:

a- Skin pedicled dependent (capillary perforators) random pattern.

b- Perforator dependent:

- Direct cutaneous perforator DC-p; from the proximal vessel.
- Septocutaneous perforator SC-p.
- Musculcutaneous perforator MC-p; from the proximal vessel through the muscle.
- Musculocutaneous perforator MC-p; sprouted from the muscle **[16]**.

The clinically proven super-thin flaps are classified into six types; Type N0A1, Type N1A0, Type N2A0, Type N0A2, Type N1A1, Type N1A2. A number of microvascular-anastomosed pedicles (always a vascular pedicle); N, number of non-anastomosed pedicles (skin, subcutaneous, muscular, or vascular pedicle); subscript numbers = number of that type of pedicle in the flap **[17]**.

The advantages of tissue expansion are compelling. Tissue is always available from local site without involving transfer over any great distance.

The best possible color and texture matching is ensured when the tissue expanded is adjacent to the defect. Sensation is preserved and the expansion site can be closed without problem **[9]**. In our study we have tried to make use of tissue expansion to produce a prefabricated pedicled flap and adding the technique of super thinning to fashion a reliable colour and contour matched flap.

PATIENTS AND METHODS

Ten cases were selected, six males and four females ranging between eight to thirty years old. They were presented by post burn contractures in the face and neck and seeking reconstruction.

Table (1): Details about the patients selected.

Patient	Age/sex/skin colour	Cause of burn	% TBS
No: 1	8y/male/white	Boiled liquid	13%
No: 2	8y/male/brown	Boiled liquid	5%
No: 3	22y/female/white	Gas explosion	50%
No: 4	23y/female/white	Flame burn	30%
No: 5	30y/female/fair	Contact burn	1%
No: 6	16y/female/fair	Flame	15%
No: 7	17y/male/fair	Flame	25%
No: 8	24y/male/white	Contact	2%
No: 9	22y/male/brown	Boiled liquid	7%
No: 10	27y/male/white	Flame	29%

Surgical planning of the intervention after proper evaluation of the scar. Decision taken for reconstruction by using pre expanded super-thin flaps.

Surgical technique:

After estimation of the scar and nearby area searching for normal skin supplied by perforators and respecting the vascular territories, determination of the area to be expanded and the design of the flap done with proper choice of the expander regarding the shape and size. Insertion of expander in the proper direction and using the incision of the insertion nearby the preformed scar as possible. Regular follow-up and injecting 20-50cc saline into the expander every 4-7 days interval for 15-60 days. Removal of the expander and fashioning the flap to cover the defect left after excision of the contracted scar. Debulking the flap to be super-thinned by removing the capsule, fibrous tissue and subcutaneous fat to conserve the subdermal vascular network supplying the flap. Placing the flap with reconstruction of the defect and primary closure of the donor site.

RESULTS AND DISCUSSION

As burns may cause emotional, aesthetic and functional sequelae, extended or hypertrophic scar contractures especially in the head and neck region are usually difficult to be reconstructed using local tissues. Pre-expanding the surrounding normal skin was tried in this study and it was found that expansion provides skin of similar local characteristics and minimizing the donor site morbidity **[10,11]**.

Table (2): Reconstructive proedures and outcomes.

Patient	Reconstructed area	Flap used	Flap survival	Donor site	Complication
No: 1	Lt. face	Sternomastoid perforator flap	Complete	Closed primary	–
No: 2	Lt. face	Sternomastoid peforator (SCM)	Loss of distal 1cm	Closed primary	Scar hypertrophy
No: 3	Rt. lower face & neck	Transverse cervical artery perforator (TCAP)	Loss of distal 1cm	Closed primary +skin graft	Necrosis of parts of distal edges need debridement
No: 4	Lt. lower neck	Superior thyroid artery perforator (STAP)	Complete	Closed primary	Extrusion of the expander after 17 days
No: 5	Lt. upper neck	STAP	Complete	Closed primary	–
No: 6	Lt. lower neck	Occipital artery perforator (OAP)	Complete	Closed primary	Reluctant flap
No: 7	Rt. face	STAP	Complete	Closed primary	–
No: 8	Lt. lower face	TCAP	Complete	Closed primary	–
No: 9	Lt. upper neck	TCAP	Complete	Closed primary	–
No: 10	Lt. neck	Occipital artery perforator flap	Complete	Closed primary	Necrosis of distal tip need debridement

Fig. (1): Young boy 8y with post burn scar in left cheek, rectangular 150cc tissue expander placed in the left side of the neck along the sternomastoid muscle.

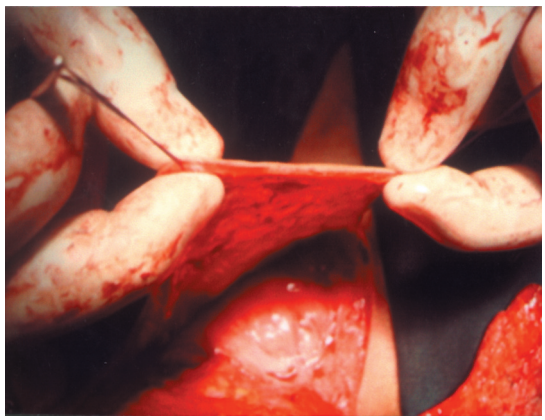

Fig. (2): Intraoperative view of the same patient demonstrating the raised flap after superthinning.

Fig. (3): Intraoperative view of the same patient after placement of the superthin flap to reconstruct the defect left after excision of the contracture.

Fig. (4): One week postoperative view of the same patient after removing the stitches and the shaping of the pliable flap. The angulation of lower jaw is noted.

Fig. (5): Preoperative view of a female 22y, post burn contracture is noted in the side of face and neck.

Fig. (6): Tissue expander (rectangular, 350cc) placed in the back of the patient in order to prefabricate a superthin flap dependant upon occipital artery.

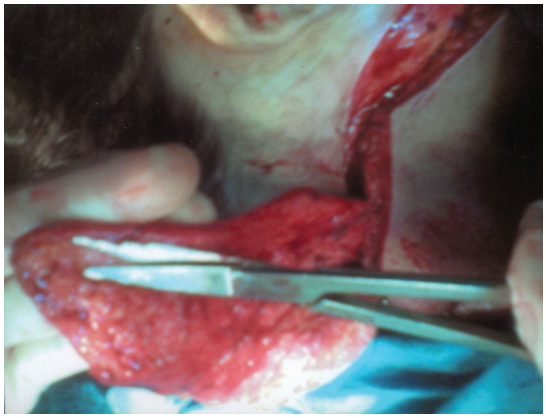

Fig. (7): Intraoperative view demonstrating thinning of the flap upto the (SVN-subdermal vascular network).

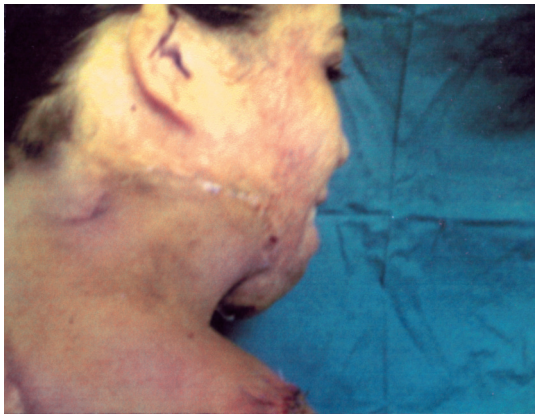

Fig. (8): Postoperative view of the same patient demonstrating placement of the super-thin flap to reconstruct the side of lower face and neck after scar excision.

Fig. (9): Preoperative view of 30 year old female with upper neck post burn old scar.

Fig. (10): The same patient one month after reconstruction of the upper neck scar by super-thin flap based on the suprathyroid perforator artery.

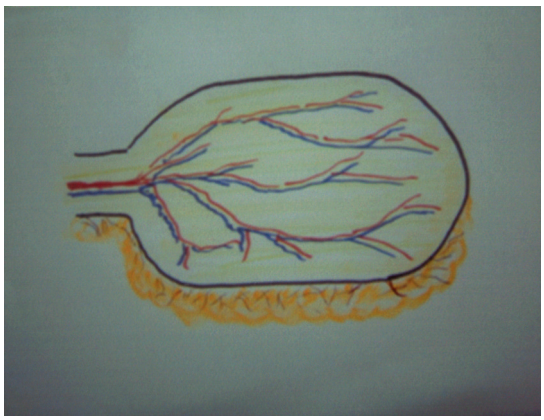

Fig. (11): Diagram demonstrating N1A0 flap. The pedicle contains artery and vein (perforators) supplying the local skin area of the flap.

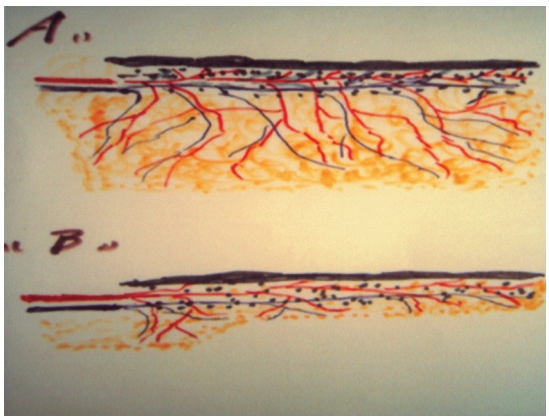

Fig. (12): Diagram demonstrates. “A” the flap before thinning and the distribution of SVN. “B” the super-thin flap after defattenning and preserving the supplying perforator and subdermal vascular network (SVN).

Super-thin flaps can be beneficial in contour-sensitive areas, such as the face and neck, because of requirement of thin pliable skin. When selecting a fatty portion to be a donor site of the flap for reconstructing a portion with relatively little fat such as a neck region, the perforator flap could be made into a thin flap with the removal of fatty tissue **[12]**. It was aimed by tissue expansion of the surrounding skin to increase the vascularity of the flap and collagen synthesis. The undesirable effects of expansion such as temporary disfiguring expander and increased melanin pigmentation disappear gradually post operatively **[13]**. But the disadvantages of being a two-stage procedure, and requiring multiple hospital visits still remain **[14]**.

Developments of dehiscence of the incision after two weeks encountered in one case and dealt with by extraction of the device and using the developed small size flap for reconstruction. Limited local infection, expressed by inflammation of the implant incisions at the end of tissue expansion encountered in one case; this was treated with antiseptic solutions and systemic antibiotic. Seroma developing was prevented by intraoperative placement of suction drains in all cases **[15]**.

There are many variations of super thin flaps as mentioned before. In this study we tried type N1A0 as in Fig. (11), depending upon supporting pedicle; axial random pattern and/or perforator dependant pattern. In two cases we used sternomastoid muscle perforators to raise a pre expanded super-thin flap measuring between 9x12cm and 10x10cm based on wide bases 9cm, 10cm which added axial element to help in survival of the flap. Insertion of the tissue expander in the upper lateral part of neck, it depends on the SCM branches of the occipital artery, post auricular, superior thyroid and thyro-cervical trunk, the skin over the muscle is supplied segmentally by the vessel which enter along its length **[18]** and we observed that it was a reliable flap.

We tried to prefabricate a super-thin flap depending on the perforator of the superficial branch of the transverse cervical artery TCAP in three cases. In one case, insertion of the rectangular 150cc tissue expander was done **[14]**. Placed to expand a local available normal skin in the root of the neck supraclavicularly in order to reconstruct neck disfiguring scar and release contracture, the second operation done two weeks later due to extrusion of the expander, giving small flap used for reconstruction after super thinning. Reconstruction of a scar in the upper neck and face was done in three cases using a super thin flap dependant suprathyroid artery perforator (STAP) Figs. (9,10).

Reconstruction of the lateral part of the head and neck, Occipital Artery Perforator flap (OAP), was used in two case Figs. (5-8) as a single pedicle without need of augmentation, in one case despite ischaemia of the edge which needed debridement, but the rest of the flap remained healthy and pliable **[17]**. Pre-operative and intra-operative identification of perforators coming from the occipital artery or the transverse cervical artery are not indispensable, because there are strong capillary perforator networks exist on the occipital area **[19]**. Elevation of the flap followed by defattenning up to the subdermal vascular network as done during our work was found not be affect survival area. It was noted that the adipose tissue under the subdermal vascular network isn't taught to be necessary for tissue survival throughout the network (Fig. 12) **[20]**.

Conclusion:

Expanded super-thin flaps proved to be very valuable in treating head and neck contractures, defattenning of the flap with preservation of the subdermal vascular network increased the survival area of the flap and enabled fashioning and reshaping of the flap to be in harmony with aesthetic areas in the face and neck. Matching is high between skin of face and neck with the surrounding areas of shoulder, root of the neck and upper back.

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