

Original Article

A comparative study of tissue expansion and free parascapular flaps in extensive facial burn scar reconstruction

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Received March 29, 2017; Accepted June 6, 2017; Epub July 25, 2017; Published July 30, 2017

Abstract: Background: Large post burn scars are a very difficult problem to treat. Available methods include skin grafts and tissue expansion. The reconstructive method used should be tailored according to individual patient rather than following a textbook approach in each. Patients and Methods: A retrospective analysis was done of cases with extensive facial burn scars in whom secondary reconstruction was done with either free parascapular flap cover or tissue expansion and flap advancement following facial burn scar excision by a single surgeon (GSK) in Department of Burns, Plastic and reconstructive surgery. Results: A total of 15 patients with free parascapular flap and 15 patients with tissue expansion followed by flap advancement were analyzed in the group. There were no free flap failures, but 2 patients required skin graft at donor site. In patients undergoing tissue expansion, minor complication was noted in 1 patient. Conclusion: Tissue expansion is a useful technique in reconstruction of post burn scars, but has its limitations, especially in patients with extensive burns in head and neck region with limited local tissue availability. Parascapular free flap may provide a good alternative option for reconstruction in such cases.

Keywords: Parascapular flap, tissue expansion, facial burn scar management

Introduction

The scars that result from facial burns present a unique challenge to the reconstructive surgeon with a dual responsibility of restoring satisfactory functional as well as aesthetic outcomes [1]. Less extensive procedures such as Z-plasties, local flaps and full thickness skin grafts are useful in addressing limited scars in burn reconstruction, but more challenging is the extensive facial burn scar crossing multiple aesthetic units, requiring large areas of coverage with no adjoining normal skin available [2-4].

Tissue expansion has been an important and valuable armamentarium for the reconstructive surgeon. But, in patients with extensive burns in the head and neck region, limited donor site availability may be an issue. Involvement of the neighbouring areas in these patients may require the use of multiple expanders as well as periods of serial tissue expansions thus further

prolonging the treatment course. Also, their use is conditional on patient affordability due to their high cost.

Free flaps had in the past, limited role in the management of burn reconstruction but with the recent advances in the design of these flaps, their use has seen a tremendous increase in the management of a number of post burn sequelae.

The advantages of parascapular flaps for their use in facial scar reconstruction include a reliable and consistent vascular pedicle of good length and large caliber, minimal functional morbidity at the donor site and better color match of the back skin for facial resurfacing in patients with limited donor site availability [5].

A search of literature shows a number of studies on the role of tissue expanders and microsurgical reconstruction in burn scars of the head and neck region but no study shows the comparison of the two.

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Table 1. Microvascular procedure related complications

Complications	Number of patients (N=15)
Total flap necrosis	nil
Partial/marginal necrosis	nil
Arterial/venous thrombosis requiring re-exploration	nil
Donor site complications	2

Table 2. Expander related complications

Complications	Number of patients (N=15)
Infection	Nil
Hematoma	Nil
Skin necrosis	1
Expander leakage	Nil
Expander exposure secondary to wound dehiscence	Nil

Patients and methods

A retrospective study was done on patients operated for secondary reconstruction of burn scars of the face, which included 15 patients with tissue expansion followed by local flap advancements and 15 patients with free parascapular flap reconstructions in Department of Burns, Plastic and Reconstructive Surgery, SMS Hospital, Jaipur between 1st January, 20-14 and 31st December, 2015 and a follow-up of 12 months.

All patients were operated by the senior author (GSK). Patients treated with other surgical techniques, those with primary reconstruction and patients treated with expander placement for other indications were excluded from the study.

Criteriae included in the study were: 1. Average length of hospital stay (primary procedure); 2. Flap complications associated with microvascular procedure. [Table 1]; 3. Expander related complications [1) expander site infection. 2) exposure of the expander secondary to wound dehiscence 3) expander leakage 4) skin necrosis 5). seroma 6). Hematoma] [Table 2]; 4. Total duration of treatment (the mean interval between implant placement and reconstructive procedure); 5. The number of operative procedures required; 6. Appearance (Figures 1 and 2).

All the procedures were performed under general anesthesia and expanders inserted in subcutaneous pocket (subgaleal pocket in scalp

area), under standard aseptic conditions. Tissue expansion began within two weeks, depending on the wound condition; i.e., when the wound was completely closed and had no signs of inflammation or infection. The patients were followed up with weekly outpatient visits and expander filled until the skin blanched and caused pain and discomfort to the patient. The expanders were expanded to approximately 25% more than the expander volume and at the end of this duration, patient was planned for expander(s) removal and flap advancements.

For the free flap, the ipsilateral donor site was generally selected so that positioning on the operative table was favorable. The facial unit to be excised was marked at its peripheral margins. A template of the facial defect pattern was cut into a transparent film sheet and centered over the donor site and positioned for optimal vascularity. Key landmarks were marked on the template to orient flap to the excised facial unit. The facial scar was then excised. Standard technique was followed for flap harvest, according to the template made pre-operatively. Before the detachment of the flap and prior to ligation of the vessels, the flap is everted all the vessels marked and the fat in between the vessels is judiciously trimmed up to sub-dermal level, giving a thin flap. The pre-patterned flap was transposed to the recipient site and “tacked” at key sites to retain the orientation of the facial pattern.

The superficial temporal vessels or facial vessels were used as recipient vessels and the anastomosis performed under microscope.

Results

In the patients with free flap coverage, there was no flap failure in our series. Average operating time was 3.5 h, ranging from 3 to 5 h. No significant donor site morbidity was found in immediate, postoperative and follow-up period.

The average length of hospital stay in patients undergoing free flap cover was 7 days (range 7-10 days). 2 patients required split skin graft

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Figure 1. Extreme left: Harvested parascapular flap; Centre: pre-operative photograph; Top right: Post-operative with healed flap; Right bottom: Intra-operative photograph following scar excision.



Figure 2. Extreme left: Harvested parascapular flap; Centre: Intra-operative photograph following scar excision; Top right: Pre-operative photograph; Right bottom: Post-operative photograph.

at the donor site which healed well. 4 of the initial 10 patients of free flap, required secondary procedure in the form of flap debulking to improve facial contour, which was done on an average after 3 months of the primary procedure.

A total of 15 patients required 21 tissue expanders (multiple expanders in 4 patients), followed by expander removal and flap advancement. Only 1 patient had marginal skin necrosis, which was managed with debridement and primary closure. The average time for post-

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operative stay in the hospital following expander insertion was 5 days (range 4-8 days). Expansion was started 14 days after the operative procedure, with regular OPD visits. The average duration of expansion was 77 ± 3 days at the end of which the patient was operated with flap advancement. Re-expansion was required in 2 patients, because of the extensive area of head and neck that was involved with the burn and the consequent paucity of donor site.

Regarding the satisfaction level of our 15 patients with free parascapular flap coverage, subjective assessment by the patients revealed that 14 patients were satisfied with the final appearance and the remaining 1 patient was not fully satisfied with the results.

All 15 patients in the expander group were satisfied with the final outcome at the end of the operative procedure.

After the 10th post-operative day, once the sutures were removed, all patients were advised regular massage and face mask application.

Discussion

The severely disfigured burned face is a challenge for the reconstructive surgeon. The complexities of thick hypertrophic plaques of scar, ambiguities on facial planes, functional burn contractures, architectural distortions and aesthetic disfigurement compel excellence in planning and execution of the restorative process [4]. Classically, the teaching has been to use the simplest method available in the reconstructive ladder first. This may be applicable for the management of an open wound, but may not be the best approach in burn reconstruction because there are often other considerations, both functional and aesthetic, in addition to the wound closure issue which are to be weighed upon by the treating surgeon [6]. Thick STSGs or FTSGs have traditionally been considered the mainstay of treatment providing the best functional and aesthetic outcomes post burn reconstructive surgery [7-9]. However, incomplete graft take, that may occur in these patients due to poor underlying bed, results in recurrent scarring and pigment imbalances with a reduced aesthetic outcome [6]. Burns of the face often have simultaneous involvement

of the surrounding regions of head and neck, thus resulting in a limitation of the donor site availability for local flaps [10]. Many methods have been applied for face and neck reconstruction, including perforator flaps [11], conventional free flaps and expanded free flaps [12]. Each method has its own advantages, disadvantages and indications. For example, perforator flaps are thin, but the survival area is small and manipulation is difficult. Conventional flaps are easy to manipulate, but thick. Expanded free flaps are large, but multi-staged operations are needed. Advantages and disadvantages of each of these methods should be compared before selection [13].

Tissue expansion for the reconstruction in burn scars is a very valuable option, providing a regional source of skin but the involvement of the neighbouring tissue with burn scar may be a limiting factor for its use. Besides, it is (at least) a two-stage procedure, and the limited donor site availability often necessitates frequent re expansions [14]. In addition, it has a substantial complication rate, ranging from 13% to 20%, and studies suggesting a higher complication rate in the use of expanders for treatment of burn scars, which can often require the premature removal of the expander and abandonment of the procedure [15, 16].

In a study by Chun and Rohrich [17] the operative time for placement of the expanders ranged from 40 to 180 minutes and the average time for full expansion was 86 days. The major complication rate in their study was 12%, and the minor complication rate was 32%. A study by Bozkurt et al [18] in 2008 to study the complications of expanders in burn reconstruction showed minor complications in 18.6% and major complications in 9.8% of cases. These complications also resulted in failure of tissue expansion of 7.8% of their cases. The complication rate with the use of expanders in our study, though shows better results than these studies.

The prolonged and painful period of expansion with regular visits to the hospital, requires a lot of patience on the part of patients, who have already undergone a long period of treatment.

An often overlooked aspect is the high cost of expanders to the patient, which is a significant

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deterrent for its use in a number of patients visiting the public hospitals in this part of the world.

Scars obtained from tissue expansion may stretch and hypertrophy over time as a result of the phenomena of 'tissue stretch-back' which is the ability of expanded tissue/tissue stretched over a long period to contract back immediately after the tension is relieved or to shorten slowly over time. This may also result in distortion of the mobile units on face [19].

The first free flap for burn care was performed in 1975 [20] and in 1997 total face reconstruction was performed with a bilateral free scapular flap [21]. Disadvantages of the use of free flaps for post burn facial scars are their thickness and the resultant lack of facial expression, intra-operative change in position of the patient and a longer operative time, compared to other simpler methods. It is often difficult to find distant tissue that is thin and pliable enough for facial reconstruction, however, recent advances such as flap prefabrication [22] prelamination [23] preexpansion [24, 25] chimeric flaps [26] and "super-thin" flaps [27] have increased the quality of free flaps. These advances have allowed the use of thinner, customized flaps with better color, thickness, and texture match to the recipient sites, leading to their more frequent use in burn care [28].

The senior author has previously published results of free parascapular flap in a case series of 22 patients of hemifacial atrophy and hemifacial microsomia [21]. Encouraged with the excellent results obtained in facial contouring in these patients, and considering the advantages of this flap, this study further cements the increasing role of microsurgery in burn reconstruction. In a study by Rose E H to describe the aesthetic reconstruction of the severely disfigured burned face, and as observed in long term follow-up of patients by senior author himself, the distant tissue gradually attains the colour hue of the face due to environmental influences [4].

Conclusion

Facial burn scar reconstruction has an important role in the treatment of post burn sequelae, especially with its attendant wide ranging social implications. Tissue expansion has an estab-

lished role in management of post burn deformities but has its own set of limitations and complications. The wider scar obtained after tissue expansion and the need for serial expansions in coverage of large areas are a distinct disadvantage in these patients.

The advantages of the use of free parascapular flap are (more or less) a single stage transfer, advantage of coverage of large areas of scars in a single procedure, good facial symmetry with thin flaps which do not require subsequent de-bulking, inconspicuous and distant donor site scars, less economic burden to the patient and a shorter interval for the final appearance thus offering the patient a good option for cutting short the reconstructive period and an early union to active social life.

It seems free parascapular flaps may provide a superior alternative to tissue expansion in patients with extensive areas involved with burn scars.

Disclosure of conflict of interest

None.

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