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Original Research Article

Reconstruction of post burns facial contractures and deformities: an Indian perspective

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ABSTRACT

Background: Reconstruction of facial burns contracture is one of the most important surgeries in cosmetic and reconstructive surgery. This study was aimed to assess the different modalities used in facial reconstruction and their outcome.
Methods: This retrospective study involved 20 patients with extensive burning facial scars. Patients were treated with different reconstructive modalities like split/full thickness skin grafts or flaps etc. Outcome of different modalities as per the area of face involved, graft taken up and complications were analyzed.
Results: Majority patients were of age between 20-30 years. 72.22% patients had other associated burn injuries with facial involvement. Most patients (18, 90%) were treated after 9 months post burns duration. All patients had multiregional involvement on face but cheek being the largest unit, was most commonly involved (18, 90%) followed by involvement of oral commissure and lips in 8 (40%) and orbital region in 7 (35%) patients. Full thickness skin graft (FTSG) and split thickness skin grafts (STSG) were most commonly performed procedures. Patient with forehead scarring was treated with abdominal tube transferred in stages. Two patients with eyelid ectropion treated with release and STSG. Gillies up and down forehead flap were used for nose reconstruction due to non-availability of tissue expanders. Linear scars on chick not fitting in relaxed skin tension line were treated with excision and primary "z" plasty. Hypertrophic scar of ear was excised and STSG was applied. Common complications included hyperpigmentation and hypopigmentation, contour distortion and obliteration of labiomental sulcus.
Conclusions: Facial reconstructive procedure for burns scars should be selected based on region of face involved. Skin grafting is an effective method for reconstruction especially in areas with non-availability of advanced treatment modalities.

Keywords: Burn, Facial deformities, Reconstruction, Scar

INTRODUCTION

Burns is a major challenge to all plastic and reconstructive surgeons. With revolution in burns treatment and establishment of specialized burns treatment center, survival rate of burns patients has increased significantly.[1] Only survival of the patient from burns injury does not guarantee a return of normal life. The post-burn scars are inevitable. Except for superficial burn injuries, all burn patients are bound to heal with scars and contractures and deformities. Well planned initial treatment in specialized center under guidance of plastic surgeon definitely decreases post burn deformities.[2] In our country most of the burns patients cannot receive primary treatment in well-developed burn center; as a result they may end up having unacceptable

deformities. Despite advances in the overall management of burn injuries, severe post-burn contractures continue to be a formidable foe for reconstructive surgeons in developing countries.[3]

Face is one of the common sites affected with burns and post buns deformities. The skin of face and neck is commonly exposed to flame burns, boiling water, steam, and caustic agents.[4] In a review conducted in a large burns unit Dowling, Foley and Moncrief reported that nearly 60% of all patients admitted had facial burns.[5,6] Plastic surgery procedures for burned face deformities are categorized as urgent reconstructions, intermediate reconstructions, essential procedures, and late elective reconstructions. Flap coverage of exposed bone or cartilage, a graft to protect an exposed eye, or a release operation to allow the mouth to open for eating or for access for anaesthesia or dental care are initial urgent steps in reconstruction and should be performed in the acute phase. Neck release and lip or eyelid ectropion repair are essential reconstructive procedures which should also be performed early. Reconstruction of some parts of the face of aesthetic importance, e.g. resurfacing of the face, reconstruction of eyebrows, lips, nose, and ear, as well as reconstruction of alopecic parts of the scalp, are reconstructive procedures which can be performed electively, after scar maturation.[7] Once contractures develop, correction of both functional and aesthetic deformities is almost always indicated.

The main purpose of reconstruction surgery is replacement of the scar with healthy skin, having good texture, thickness, and color with the most similarity to the area around the scar. Maximizing functional and aesthetic outcomes by surgical reconstruction can help patients to return to their previous status as soon as possible.[8] Even with the proper treatment and care given, some patients do not achieve complete cure in terms of functional mobility. As the treatment is prolonged, costly and difficult even in experienced hands the patients' satisfaction is always less with the treatment of burns contractures. This study was conducted in order to review the experience gained and the difficulties encountered in the reconstruction of post-burn face deformities and to evaluate the results of various reconstruction procedures.

METHODS

This was a retrospective study conducted on 20 patients with extensive post-burn scars on their face and neck areas that had undergone reconstruction surgery in the Department of Plastic Surgery of a tertiary care teaching hospital from western India. Study protocol was approved by the institutional ethics committee and written informed consent was obtained from all patients.

The study included all patients of either gender and all ages who presented with post-burn contractures following management of their acute burn injuries to the plastic department. Patients with chemical burns of the eyelids and those who had undergone some surgical intervention for their post-burn contractures at other hospitals were excluded.

Initial assessment and diagnosis were based on a thorough history, a physical examination, and laboratory investigations. Structured case record form was used to collect patient's data like socio-demographic profile, type of burn injury, total body surface area burned, duration post burn and the health care facility where acute burn management had been provided. Also, how the initial burns were managed including range of motion (ROM) exercises, whether physiotherapy/anti-deformity splintage was instituted, whether any surgery had been performed, the time lapse between burn injury and presentation with post-burn contractures, and the site of the contractures were also noted.

Patients who needed surgery under general anaesthesia were admitted as in-patients, while those who underwent surgery under local anaesthesia were discharged after 6-8 hours of observation post-op. The aims of surgical management were to ensure complete release of the contracture, to resurface the raw areas with skin grafts, i.e. split thickness skin grafts (STSG)/full thickness skin grafts (FTSG) or flaps, and to restore normal ROM. The standard management protocol of elective release of mature contractures, according to the standard principles of the reconstructive ladder was followed. In the immediate post-op phase, the released and resurfaced areas were dressed in ties over dressings, and splinted in anti-contracture position. Once the wounds healed, a rehabilitation regimen was started, consisting of physiotherapy, ROM exercises, massage, compression garments, and nocturnal neck collars (in cases of neck contracture) for six months. The outcome of surgery was measured in terms of graft take/flap survival, restoration of function, and early recurrence within three months.

Graft take was assessed by gross inspection day 5 post-op and graded as Good (if ≥95% graft was taken by the defect surface area), Fair (if 80%-95% graft was taken), and Poor (if <80% graft was taken). The restoration of function was measured by employing a quality grading system comparing the post-operative functional status to the preoperative morbid status. Function was stratified into Poor (no or minimal functional improvement), Satisfactory (modest to near normal functional improvement), and Excellent (completely normal function restored). Patients were called for follow up initially once a week then every 15 days for 3 months and then monthly for 6 months.

Statistical analysis

Data were subjected to statistical analysis using Microsoft excel 2007. Various descriptive statistics were used to calculate frequencies, percentages, means, and standard deviation. Numerical data, such as age, were expressed as mean±standard deviation, while categorical

data, such as the anatomic site of the burns and causes of burns, were expressed as frequencies and percentages.

RESULTS

The demographic details of burns patients are shown in Table 1. Highest incidence of post burns deformities was found in 20-30 years of age group with equality in male to female ratio. More unmarried patients were there as compare to married patients. Most common cause of burns injury was flames followed by scalds in children and chemical and electrical burns in industrial accident or assault. Seven patients were having isolated facial burns while rest 13 patients had associated other burns injuries. Most of the patients (18,90%) were treated after 9 months post burns duration. Two patients were treated before 9 months and indication for early surgical intervention were psychological disturbance in one and discomfort due to drooling of saliva in other.

Table 1: Demographic parameters of the patients (n = 20).

Parameter	No. of patients
Age in years	
<10	2
11-20	3
21-30	9
31-40	4
41-50	1
>50	1
Gender	
Male	10
Female	10
Marital status	
Unmarried male	6
Unmarried females	7
Married male	4
Married female	3
Mode of injury	
Flame	16
Scald	2
Chemical	1
Electrical	1
Associated with other injuries	13
Isolated injury	7
Post burns duration	
<9 months	2
>9 months	18

Most of the patients were having multi regions involvement on face but cheek being the largest unit, was most commonly involved (18,90%) followed by involvement of oral commissure and lips in 8(40%) and orbital region in 7 (35%) patients as shown in Table 2.

Different modalities used for the treatment and reconstruction were analyzed (Table 3).

Table 2: Region wise and type of facial deformities (n = 20).

Regions	No. of patients affected	Treated patients
Forehead	12	7
Orbital region	5	5
Eyebrow	3	0
Eyelid ectropion	2	2
Eyelid scarring	2	0
Nose	5	2
Alar rim retraction	2	0
Scarring	1	0
Subtotal loss	2	2
Cheek	18	12
Lip, chin and oral commissure	8	8
Upper lip ectropion	1	1
microstomia	2	2
Lower lip and chin scarring	7	7
Ear	6	4
Hypertrophic scar	1	1
Subtotal loss	3	1
Total loss	2	2

Forehead

one patient with bad scarring was treated with abdominal tube which was transferred to forehead in stages. All other patients were having forehead scarring associated with involvement of other facial units requiring early treatment (Figure 1).

Figure 1: Forehead repair.

Orbital region

Eyebrow

Eyebrow loss was not causing any functional problem and other eyebrow deformities causing functional problems were treated earlier with staged reconstruction.

Eyelids

Two patients with eyelid ectropion were treated with release and split thickness skin graft, upper arm was utilized as donor site and deformity was overcorrected. Patient having scarring without functional loss did not opt for reconstruction.

Nose

Patients with minimum alar rim retraction and patch of hypertrophic scar were left untreated because patients were not worried about them and didn't give consent for the procedure. Patient with lower two third loss was having lowly set hairline with unscarred forehead. Non-availability of tissue expander has compelled to go for nose reconstruction in that patient with the help of Gillies up and down forhead flap.

Other patient with severe facial burns was having scarred forehead, so TAGLIACOZZI arm tube was utilized to reconstruct the lower two third of nose in stages. Both these patients lining was provided with the local hinge flap and no skeletal support was given primarily.

Figure 2: Nose repair.

Table 3: Type of reconstructive surgery modality used.

Modality/procedure	Forehead	Eyelid	Nose	Cheek	Lip and oral commissure	Ear	Total
Excision and suturing	-	-	-	2	1		3
Staged excision and suturing and reconstruction	1	-	-	2	-	1	4
Excision and skin grafting with FTG	-	-	-	1	3		4
Excision and skin grafting with STG	-	2	-	1	1	1	5
Excision and flap cover (local)	-	-	2	2	-	-	4
Excision and flap cover (distant)	-	-	-	3	-	-	3
Release and vermilion advancement	-	-	-	-	1	-	1
Prosthesis	-	-	-	-	-	1	1
Non-operative	4	5	3	1	1	-	14

Cheek

linear scar in or very near and parallel to relaxed skin tension line were excised and primarily closed. Patients with linear scar not fitting in relaxed skin tension line were treated with excision and primary closure with primary "z" plasty. Full thickness skin graft was used in one patient, while split thickness skin graft was used in large scar on bilateral cheeks.

Patients with large cheek scars with unscarred nearby cheek and neck were treated with local rotation advancement flap on faciocervical region by taking advantage of loose and mobile face and neck skin. Patients with non-availability of local skin were treated with deltopectoral flaps.

Lip, chin and oral commissure

lower lip and chin scarring was the common deformity. Modality of treatment commonly adopted was excision and full thickness skin grafting harvested from groin. Microstomia was released with simple incision and vermilion advancement. Postoperative physiotherapy was advised to stretch oral commissure. Simultaneously total aesthetic unit of lower lip and chin was replaced except in

one patient, having lower lip ectropion with drooling of saliva. This patient was operated with premature scar to correct ectropion and thick STG was used as temporary method. All patients used postoperative pressure garments for 9 months.

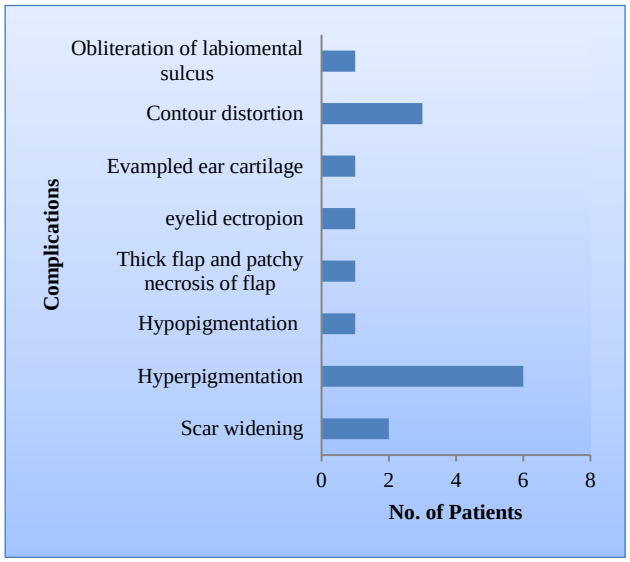

Figure 1: Complications and sequale.

Ear

Hypertrophic scar involving helix and anthelix was excised and spilt thickness skin graft was applied using upper arm as donor site. One patient with adherent ear lobule was treated by release and thick spilt thickness skin graft over posterior aspect. Unilateral total loss was reconstructed in stages with costal cartilage insertion. Patient with bilateral total loss was given preference of stage reconstruction or prosthesis and patient had preferred prosthesis.

Table 4: Outcome of patients assessed by graft take up and functional improvement.

Parameter	Response		
Graft take up (5th post-operative day by gross examination)	**Good (≥95% take up)**	**Fair (80-95% take up)**	**Poor (<80% take up)**
	15	5	-
Functional improvement*	**Excellent**	**Satisfactory**	**Poor**
	3	16	1

*Functional improvement: excellent (completely normal function restored), satisfactory (modest to near normal functional improvement) and poor (no or minimal functional improvement)

Improvement in patient as assessed by graft taken up on 5th postoperative day is shown in table 4. Total 15 (75%) patients had graft taken as 'good' (i.e. ≥ 95% graft take up by defect surface area) by gross examination. Functional restoration as assessed by patients' perception, showed satisfactory and excellent improvement in 16 (80%) and 3 (25%) patients respectively (Table 4).

Complications and sequales

As shown in Figure 1, excision and coverage with skin graft has led to hypopigmentation of the part and in chin region patient had obliterated labiomental sulcus. One patient with excision and coverage with distant graft has hyperpigmentation and other had hypopigmentation following patchy superficial necrosis. In two patients flap had led to contour distortion. Nose reconstruction with arm tube has end up having thick, hyper pigmented large nose. Unilateral reconstructed ear had crumbled cartilage.

DISCUSSION

Burns is one of the common presentations in emergency department especially in low and middle-income countries. If not given proper treatment in initial period, burns injury often convert into burns scar and contractures. Such contractures are not only disfiguring but are also reduces functional capacity of the individual and associated with huge stigma. Different modalities of treatment have been used in the management of such burns scars and contractures like excision and reconstruction, skin grafting spilt thickness or full thickness etc. Controversy still exists regarding which method of reconstruction should be used and how long they should be continued.[2] Therefore, present study was aimed to analyse different treatment modalities used in the management of facial burns contractures and its outcome.

In the present study, most patients were relatively young. The socio-economic implications of such disabling conditions are even more devastating given the economically productive age of the victims. Several published studies have described a similar frequent involvement of younger individuals.[9-11] We had equal incidence in males and females which is similar to study by Paul et al.[9]

Flame burns were the commonest underlying type of burn injury in our study. Flame burns most commonly resulted from accidents due to leakage of natural gas used as domestic fuel for heating/cooking purposes, to clothing catching fire in the kitchen, to accidents with LPG gas cylinders, and to exploding CNG cylinders in vehicles. All these causes of flame burns are preventable with simple actions based on government commitment and public awareness.

In our study, we operated on contractures which had been developing for at least one year. As a general rule, we do not operate on post-burn contractures during the active phase of healing and scarring because the immature scar is not only highly vascular but also carries a high risk of subsequent re-contracture. The maturity of a scar is

determined by gross inspection and palpation. If the scar is no longer hyperaemic but instead soft and supple, it is considered mature. Usually a scar becomes mature in a year. Authoritative publications have pointed out several exceptions to this general rule of not operating on immature scars, such as incapacitating neck contractures with inability to look forwards, severe microstomia interference with adequate nutrition and orodental hygiene, crippling contractures of the hand, and bilateral knee contractures.[12,13]

In the present study, the most common reconstruction procedure used was skin grafts (45%) followed by flap reconstruction (35%) which coincides with existing literature.[12-16] Skin grafts are one of the most commonly performed surgical procedures in developing countries like India due to different limitations of the health care system. We prefer to employ thick sheet STSGs as far as possible because, they have a good take up rate and also provide moderate colour match. We try some over-correction of the defect with graft in order to provide for the inevitable secondary contraction of the skin graft subsequently. Free flap transfer procedures are also being performed where microsurgical skills and technologies are available to achieve better functional and cosmetic results. In our study, we did not use dermal substitutes or tissue expanders. In developed countries these newer adjuncts to surgery are routinely being employed and yield superior results.[17]

The long-term results have shown that flaps perform better than full-thickness skin grafts in providing a safe and effective method to resurface post-burn scar contractures in the face with better aesthetic results.[18] However, randomized controlled trials for the scars of the face had not been published to determine which technique had the best effectiveness in post-burn contracture release. Besides, because of the relative lack of objective data on outcomes, individualized reconstructions pertaining to each unique aesthetic region of the face should be performed. The most problematic late outcomes that Philip et al. identified after facial burns included gaps between grafts and hairline, eyelid ectropion, nose asymmetry, and marked hypertrophic scarring around the lip.[18]

We have also evaluated the different modalities used according to area of the face involved in burns contractures. The primary objective of the eyelid burns contracture management is preservation of eyesight followed by prevention of further complications and aesthetics restoration.[19] In the present study, one patient had eyelid ectropion. To correct ectropion, the upper eyelid should be released at the level of the supra-tarsal fold, and the lower eyelid should be released at the sub-ciliary margin. And then, they are reconstructed using full-thickness skin grafts or local flaps such as laterally based cutaneous flaps or reverse flow nasolabial flaps.[20] In the present study, we could not perform such flap procedures as surrounding tissue was not available because of severe burns and facial scarring. Therefore, temporoparietal fascial flap based on temporal arteries in periorbital reconstruction has been widely accepted including eyebrow reconstruction with hidden scars.[21] The island flap including a reverse flow flap can provide an optimal result for the eyelid contracture with minimal donor site morbidities.[22]

Nasal reconstruction is usually based on the residual functional and aesthetic problems. The forehead flap with or without expansion is usually used for reconstruction of non-graftable nasal.

Defect but local flaps can be difficult sometimes due to lack of adjacent tissue. Several researchers had described use of free flaps for nasal reconstruction.[23] Reconstruction of the nasal tip, columella, and alae by free flaps derived from the base of the helix can serve as a good functional and aesthetic option. The structural similarities between the nasal alar and the auricular helix have allowed the use of free helical composite grafts to reconstruct small nasal defects of less than 2.0 cm. Such grafts have problems like dimentions, viability, atrophy etc which makes success difficult in most cases.[24]

The lip deformity after burn injury leads to functional problems like interference with eating, speech and also aesthetic appearance is affected. It can be associated with scarring of oral commissures which limits opening of mouth also. In such cases, sufficient skin and soft tissue are needed by transplant to the lip and chin area. Various reconstruction methods have been tried for burns contractures of lip.[25] Usually uptake rates for skin grafts around mouth should be low because of difficulties of complete rest and prevention from food and fluid. Regarding the lip reconstruction in burn cases, free flap covering based on an aesthetic unit is frequently better than local flaps in the aspect of its texture. Reconstruction of labio-mental sulcus relatively seems to be difficult as reported in our study also even with proper technique, one patient developed obliteration of the sulcus.

Overall, this study has highlighted the commonly used methods in reconstruction of facial burns contractures. Few limitations of the study included small sample size and single center. Also, being a Government Institute, some limitations in the availability of newer techniques and materials also existed so we could not study role of growth factors, artificial dermis, tissue expanders etc.

CONCLUSION

Full-thickness skin grafts and local flaps produce satisfactory outcomes when performed for the reconstruction of burn contracture defects by experienced surgeons. Treatment algorithms can be invented which can be used to assist reconstructive surgeons in selecting appropriate reconstructive methods following release of burn scar contractures. These algorithms can be an attempt to simplify the approach to burn contracture

reconstruction. Advantages and disadvantages of these different modalities should be considered and compared before deciding the treatment option for the given patient.

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