



A COMPARATIVE STUDY OF POST-BURN NECK CONTRACTURE RELEASE AND COVERAGE WITH FLAP VS GRAFT

Plastic & Reconstructive Surgery

Dr. Purabi Priyadarshinee* 3rd yr PDT, Mch Plastic surgery, Department of Plastic surgery, IPGMER Kolkata.
*Corresponding Author

Dr. Monoranjan Sow Assistant Professor, Mch Plastic Surgery, Department of Plastic Surgery, IPGMER, Kolkata.

Dr Arindam Sarkar Prof & H.O.D, Mch Plastic surgery, Department of Plastic surgery, IPGMER Kolkata.

Dr Komal Sharma 1st yr PDT, Mch Plastic surgery, Department of Plastic surgery, IPGMER Kolkata.

Dr. Govind Sharma Senior Resident, Mch Plastic Surgery, Department of Plastic Surgery, IPGMER, Kolkata.

ABSTRACT

Aim: To compare release of post-burn neck contractures and coverage with flap vs graft. **Material and Methods:** A comparative study was conducted in the Department of Plastic & Reconstructive Surgery, IPGME&R, a tertiary care hospital in Kolkata for a period of 15 months among 40 patients admitted in this institute with burn injury as well as those presenting either in the OPD or Emergency unit with post-burn neck contracture. Half of patients randomly underwent flap and half received skin graft. The outcome measures including initial improvement in neck extension, patient's satisfaction with colour, texture, match and recurrent contracture formation rate were assessed. Post-operative management and monitoring was done as per procedure. Physiotherapy and neck splintage was done in case of grafts. Follow-up was done at 2 weeks, 6 weeks, 3 months and 6 months to be carried out along with clinical photography. **Results:** Females were comparatively more as compared to males. Early post op complications were not found in 50% and 40% of the subjects in flap and SSG group respectively. Most common complication in flap group was marginal flap necrosis (30%) while in SSG group, it was mild graft loss (30%). Late post op complications were not revealed in 75% and 60% of the subjects in flap and SSG group respectively. Functional outcome was better in flap as compared to SSG group with statistically significant difference as $p < 0.05$. Good and excellent aesthetic outcome was reported more in flap as compared to SSG group with statistically significant difference as $p < 0.05$. Over-all outcome score was better in flap as compared to SSG group with statistically significant difference as $p < 0.05$. **Conclusion:** Grafts and local flaps are reasonable options for post contracture release; however, flaps are superior. Coverage selection depends on the lost tissue area and exposure of underlying deep structures. Physiotherapy and patient satisfaction are crucial in the outcomes.

KEYWORDS

Physiotherapy, Burn Injury, Flaps And Grafts, Contracture Release, Post-burn Contracture

INTRODUCTION:

Neck contracture and deformities as consequences of burns pose one of the greatest challenges to plastic surgeons in reconstructive surgery [1]. This area is, like the face, a zone exposed to diverse injuries, such as scalds, electrical flashes, splashes, etc. Mento-sternal or even cervico-thoracic contractures cause serious problems, functional and aesthetic. The traction forces caused by burn scar contracture may pull and cause insufficient neck extension, incomplete oral occlusion, cicatricial ectropion and alter tracheal position, which results in difficult intubation that can be life-threatening and can result in multiple serious complications and sequels, which require early surgical correction[2].

Exposed regions like the face and neck are commonly involved in severe burns especially in patients who did not use appropriate protective equipment in occupational accidents. Anterior cervical contractures are characterized by the limitations in the range of neck motion, most noticeably extension. The scar may extend to or involve the face and the chest, thus causing a synechia effect [3]. Physical and aesthetic deformities resulting from this type of disfigurement in exposed areas, such as the face and neck can cause significant depression [4], which affects the patient's quality-of-life. Aesthetic reasons alone would place cervicofacial contractures as a priority for reconstruction[5-6].

The surgical release and resurfacing may be single staged or multistage. The need for prefabrication and expanders is based on the width of the contracting segments and the availability of surrounding supple skin [8-9]. In addition to the neck contractures these patients also have shoulder stiffness, compensatory kyphosis, visual field deficits, lower lip ectropion, incomplete oral occlusion with saliva drooling, feeding and swallowing difficulties, unable to sleep, poor posture, depression, school dropouts, restricted social gathering and overall despondence[7-10].

Suitable tissue coverage is needed after release of contractures at neck which ranges from split thickness skin grafts, local tissue rearrangement with Z-plasty to fascio-cutaneous and myocutaneous

flaps (local/locoregional) and free microvascular flaps. VAC assisted closure or reduction of wound coupled with artificial dermis coverage is also tried and are options of treatment.

Initial assessment and diagnosis will be based on a thorough history and physical examination. Type of neck contracture as per classification of Achauer and Salisbury/Bevin was determined to classify patients. Pre operative and post-operative photography to done with patient's consent to compare functionality and aesthetic outcome. Patients are to be grouped randomly as per intervention taken. Perioperative monitoring, postoperative splintage and follow up at specific time interval are to be carried out.

This study aims at restoration for functional ability with appearance and natural profile by complete release of post-burn neck contractures and coverage by various flaps and skin grafts. Alongside we compared the different aspects of flap and graft coverage which is the main objective so that patients can get the best possible treatment.

MATERIALS AND METHODS:

After getting clearance from the Ethics Committee, the present comparative study was conducted in the Department of Plastic & Reconstructive Surgery, IPGME & R, a tertiary care hospital in Kolkata for a period of 15 months. 40 patients admitted in this institute with burn injury as well as those presenting either in the OPD or Emergency unit and meeting the inclusion and exclusion criteria.

Inclusion Criteria

- Patients with post-burn neck contracture
- Patients less than 65 years of age and greater than 2 yrs
- Patient who gave consent to be part of the studies and willing for follow-up.

Exclusion Criteria

- Patients with infected scars and contracture
- Patients with known severe comorbid diseases.
- Patient already operated in other facilities
- Patient unwilling to participate in the studies or not compliant with

follow-up

Procedure:

Cases were enrolled for the study for first 6 months and they were studied for development of contracture for the next 9 months. After a patient with post-burn neck contracture was received in Emergency, OPD or ward, due treatment protocol and study procedure was undertaken. Alongside treatment, following study procedures were followed:

1. Informed consent for the study was obtained from the patients. In case of children consent was obtained from parents or guardian.
2. Information was collected as per pre-designed proforma which consisted of epidemiological data, mode of burn injury, extent and degree of burn contracture at neck with grades of neck contracture.
3. Operative procedures were undertaken whichever was suitable for the patient.
4. The recruited patients were divided into two equal groups i.e. they underwent treatment either using Flap or SSG.
5. Post-operative management and monitoring was as per procedure.
6. Physiotherapy and neck splintage was done in case of grafts
7. Follow-up at 2 weeks, 6 weeks, 3 months and 6 months to be carried out along with clinical photography.

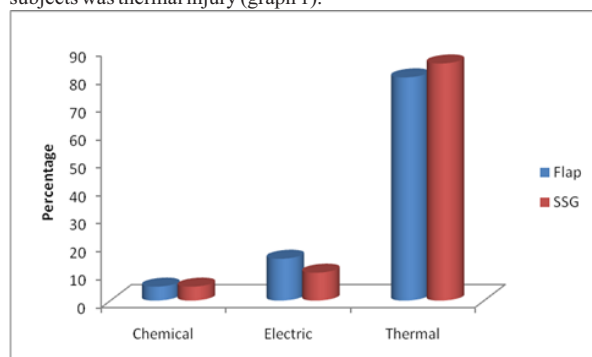
Data was collected and subjected to statistical analysis.

Statistical Analysis:

Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). Difference between two groups was determined using t test as well as chi square test and the level of significance was set at $p < 0.05$.

RESULTS:

In both the groups; females were comparatively more as compared to males. Mean age in flap and SSG group was 30.15 ± 12.05 and 26.20 ± 9.91 years respectively. Most common of burn among the study subjects was thermal injury (graph 1).



Graph 1: Burn among the study groups

Mild, moderate and severe grade of contracture was reported among 0%, 70%, 30% and 30%, 60%, 10% of the subjects in flap and SSG group respectively. Hence severity of grade of contracture was revealed more in flap as compared to SSG group. Band and broad scar was found among 15%, 85% and 55%, 45% of the subjects in flap and SSG group respectively. When type of scar was compared statistically using chi square test, significant difference was found as $p < 0.05$ (table 1).

Table 1: Grade Of Contracture And Type Of Scar Among The Study Groups

Grade of Contracture	Flap		SSG		p value
	N	%	N	%	
Mild	0	0	6	30	0.039*
Moderate	14	70	12	60	
Severe	6	30	2	10	
Type of Scar					
Band	3	15	11	55	0.008*
Broad	17	85	9	45	
Total	20	100	20	100	

*: statistically significant

Preoperative functional grade viz. E1, E2 and E3 was revealed among 0%, 70%, 30% and 30%, 60%, 10% of the subjects in flap and SSG group respectively (table 2).

Table 2: Preoperative Functional Grade Among The Study Groups

Functional Grade	Flap		SSG		p value
	N	%	N	%	
E1	0	0	6	30	0.039*
E2	14	70	12	60	
E3	6	30	2	10	
Total	20	100	20	100	

*: statistically significant

Early post op complications were not found in 50% and 40% of the subjects in flap and SSG group respectively. Most common complication in flap group was marginal flap necrosis (30%) while in SSG group, it was mild graft loss (30%). Late post op complications were not revealed in 75% and 60% of the subjects in flap and SSG group respectively. Most common complication in flap group was linear contracture (15%) while in SSG group, it was recurrence (25%) as shown in table 3.

Table 3: Post Op Complications Viz Early And Late Among The Study Groups

Post op complications (Early)	Flap		SSG	
	N	%	N	%
None	10	50	8	40
Flap Loss	1	5	0	0
Marginal flap necrosis	6	30	0	0
Mild graft loss	0	0	6	30
Mild wound infection	2	10	0	0
Partial flap necrosis	1	5	0	0
Partial graft loss	0	0	3	15
Subtotal graft loss	0	0	3	15
Post op complications (Late)				
	N	%	N	%
None	15	75	12	60
Linear contracture	3	15	2	10
Recurrence	0	0	5	25
Residual contracture	1	5	1	5
Residual raw area	1	5	0	0

Secondary intervention was required among 4 and 6 subjects in flap and SSG group respectively. Secondary intervention viz. release & SSG, scar release with z plasty and SSG was reported among 5%, 10% and 5% of the subjects respectively in flap group. In SSG group; repeat SSG was the secondary intervention. 100% functional outcome was achieved in 75% and 30% of the subjects in flap and SSG group respectively. Hence functional outcome was better in flap as compared to SSG group with statistically significant difference as $p < 0.05$. Poor aesthetic outcome was found in 20% subjects of SSG group. Good and excellent aesthetic outcome was reported more in flap as compared to SSG group with statistically significant difference as $p < 0.05$ (table 4).

Table 4: Functional And Aesthetic Outcome Among The Study Groups

Functional outcome	Flap		SSG		p value
	N	%	N	%	
80-90%	5	25	14	70	0.002*
100%	15	75	6	30	
Aesthetic Outcome					p value
	N	%	N	%	
Poor	0	0	4	20	0.006*
Average	4	20	5	25	
Good	14	70	10	50	
Excellent	2	10	1	5	

*: statistically significant

Over-all outcome score was better in flap as compared to SSG group with statistically significant difference as $p < 0.05$ (table 5).

Table 5: Over-all Outcome Score Among The Study Groups

Over-all outcome score	Flap		SSG		p value
	N	%	N	%	
3	0	0	5	25	0.007*
4	5	25	9	45	

5	15	75	6	30	
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*: statistically significant

DISCUSSION:

Burn scar contractures do not go away on their own, but they may improve with the passage of time, with physiotherapy, and with splinting. If persistent the person may need the contracture to be surgically released. Techniques may include local skin flaps (z-plasty) or skin grafting (full thickness or split thickness) [11]. A split-thickness skin graft (STSG) is a skin graft including the epidermis and part of the dermis. Another option is Flap covering. A flap is a portion of tissue that can be dissected, elevated, and inset into a nonanatomic position as a consequence of its vascular supply and outflow. A skin flap consists of skin and subcutaneous tissue that survives based on its own blood supply. Skin flaps are classified by the source and pattern of that blood supply [12]. Hence the aim of the present study was to compare the outcome of post-burn neck contracture release and coverage with flap vs graft.

In the present study; females were comparatively more as compared to males. Mean age in flap and SSG group was 30.15±12.05 and 26.20±9.91 years respectively. Similar female dominance was revealed by Mohamed Issa et al [13] in their study. The mean age was 23.95 (range 8-38). Muhammad Saaq et al [14] in their study also observed more frequent affliction of females with neck post-burn contractures. Similar predominant affliction of females was also reported by other studies. For instance, Mody et al [15] from India, Loghmani et al from Iran and Ismail et al from Egypt have reported more frequent involvement of women with neck post-burn contractures. The exact explanation to this is not known, however, it may reflect the household practices of women in these societies and hence, their high vulnerability to sustaining flame burns in their primitive style kitchens.

In the present study; mean age in flap and SSG group was 30.15±12.05 and 26.20±9.91 years respectively. Mohamed Issa et al [13] in their study found mean age of 23.95 years (range 8-38) among the study subjects. Several published studies have described similar frequent involvement of younger individuals. For instance, Mody et al [15] from India reported a mean age of 28.2 years (age range of 13-53 years), Loghmani et al [16] from Iran reported mean age of 24.62 years (age range of 12-46 years) whereas, Ismail et al [17] from Egypt reported mean age of 25.5 years (age range of 48-16 years).

Early post op complications were not found in 50% and 40% of the subjects in flap and SSG group respectively. Most common complication in flap group was marginal flap necrosis (30%) while in SSG group, it was mild graft loss (30%). Late post op complications were not revealed in 75% and 60% of the subjects in flap and SSG group respectively. Most common complication in flap group was linear contracture (15%) while in SSG group, it was recurrence (25%). Secondary intervention was required among 4 and 6 subjects in flap and SSG group respectively. Secondary intervention viz. release & SSG, scar release with z plasty and SSG was reported among 5%, 10% and 5% of the subjects respectively in flap group. In SSG group; repeat SSG was the secondary intervention. Ankit Choyal et al [18] in their study too reported more complications in SSG as compared to flap group. They found that infection rate was much more common in grafting techniques (STSG- 31.4% & FTSG - 21.4%). The high infection rate in in grafts may be because it require long standing dressing, which also increases overall post op stay of patients thus causing increased hospital expenses. STSG was more associated with graft loss as compared to FTSG. There was only one case of major graft loss.

Mohamed Issa et al [13] in their study also stated that the rate of complications was higher in the graft subgroup (four cases). The adverse events were as follow; infection (two cases for grafts and one for combined flap/graft group), bleeding (zero case), a slough of the graft (one case had partial distal necrosis). The recurrence rate in the grafted elbows was three folds higher than the elbows reconstructed with flaps. According to Ankit Choyal et al [18], incidence of recontracture in grafts and flaps were 12% and 0%, respectively. In their result analysis, the range of movement was excellent (44.4%) and good (50%) in the flap group; only one case had poor outcomes. These rates differed in the graft group, three cases had poor outcomes, and a significant number (86%) had a satisfactory range of motion. These results are similar to the present study.

Incidence of rejections, graft loss, and contracture rates are higher in grafts than in flaps. Local skin flaps are reliable for soft tissue replacement. Flaps are classified according to composition, transfer method, shape, and blood supply, which is considered the most vital factor for its outcome [19-21].

100% functional outcome was achieved in 75% and 30% of the subjects in flap and SSG group respectively. Hence functional outcome was better in flap as compared to SSG group with statistically significant difference as $p < 0.05$. Poor aesthetic outcome was found in 20% subjects of SSG group. Good and excellent aesthetic outcome was reported more in flap as compared to SSG group with statistically significant difference as $p < 0.05$. Over-all outcome score was better in flap as compared to SSG group with statistically significant difference as $p < 0.05$. The compromise in functional outcome was found to be more in skin grafting patients and it may be because grafts were frequently associated with infection, graft loss, hypertrophy of the graft. Also the outcomes in grafted patients depends upon the compliance of the patients itself and we found that many patients did not follow the splinting and physiotherapy as they were advised.

In a study by Ankit Choyal et al [18], good outcome in terms of colour and texture was associated with Flaps (66%). They observed that Flap group had more no of patients (8 patients 44.4%) with excellent functional outcome as compared to STSG and FTSG with statistical significance ($p = 0.01$). This is in correspondence to the present study. Saaq et al [14] showed good outcomes in 161 patients (84.29%), fair in 13 patients (6.8%) and poor in 17 patients (8.9%). This difference in the outcome as compared to our study may be because the number of flap procedure were more in their study and as we discussed earlier that flaps have better aesthetic outcome. Nikunj et al [22] used mostly STSG and results were good in 59 % cases, fair in 27% cases & poor in 14% cases.

Limitations

- Small sample size.
- Lack of long term followup.

Flaps should be considered for reconstruction. Proper planning of reconstructive procedures, rehabilitation, restoration to preinjury status and return to society are the goals that the treating team hopes to achieve.

CONCLUSION:

The flap was shown to be superior to skin graft in managing post-burn neck contractures. It provided better color-texture match and was associated with no recurrence of contracture formation. Initial improvement in neck extension at three months matched for the two groups; however, recurrent contractures developed in the majority of the skin grafted patients at last follow-up.

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