

A Prospective Study of Surgical Management of Post Burn Contractures of the Neck**Rakesh Kumar Simha¹, Erugurala Mahendar², Sura Anitha³, Baliram Chikte⁴, Arige Subodh Kumar⁵**¹Department of Plastic Surgery, Gandhi Medical College, Secunderabad, Telangana.²Associate Professor, Department of Plastic Surgery, Gandhi Medical College, Secunderabad Telangana³Associate Professor, Department of Plastic Surgery, Gandhi Medical College, Secunderabad, Telangana.⁴Associate Professor, Department of Plastic Surgery, Gandhi Medical College, Secunderabad, Telangana⁵Professor, Department of Plastic Surgery, Gandhi Medical College, Secunderabad, Telangana.

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Abstract:**Background:** Post-burn neck contracture is a prevalent issue in burn reconstructive surgery. Releasing the contracture and providing suitable coverage for the exposed area presents a significant challenge. These contractures severely impact patients by causing functional limitations and aesthetic disfigurements, leading to cosmetic, functional, and social problems.**Methods:** Patients diagnosed with post-burn scar contracture of the neck through clinical examination were included in the study after being informed about the nature of the condition and the available treatment options. Various presentations, complications, treatment options, and their results were analyzed.**Results:** Scar excision and skin grafting were the most frequent surgical approaches (90%) for treating neck contractures. included scar excision with flap reconstruction (10%) and multiple Z-plastics (10%). These might be used for specific cases. Skin graft loss was the most frequent complication (15%), primarily affecting patients who underwent scar excision and skin grafting. The majority of patients (75%) achieved significant improvement in neck extension (>110 degrees) after treatment, indicating restored mobility. While the majority of patients (55%) reported satisfactory cosmetic results after surgery, a combined 40% were pleased or very pleased, suggesting positive outcomes in many cases.**Conclusion:** Post-burn scar contractures significantly impact active individuals, particularly those with limited resources. Surgical reconstruction offers the best outcomes. For type A contractures, a supraclavicular flap is ideal. Type B contracts may require both flap and skin grafting, while type C benefits from release, skin grafting, splinting, and dedicated post-operative care. Flap coverage, whenever possible, yields superior function with less splinting and complications compared to grafting alone.**Keywords:** Post-burn contractures, Skin grafting, Splinting.

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Introduction

Burn trauma constitutes the second most common cause of trauma-related deaths after vehicular accidents, both in developing as well as the developed world [1]. With evolution, man has lost the ability to regenerate compound organs and has only the relatively simple, and often unsatisfactory, substitute of wound healing by collagen deposition to restore physical continuity [2]. Contraction is the active biological component of wound healing that decreases the dimension of the involved connective tissue. Contracture is the result of the process of contraction. This process may lead to severe functional and aesthetically incapacitating contractures, such as burn scar contractures. Post-burn contractures are perhaps the most dreaded and distressing morbidity in patients surviving major

burns [3]. The reconstruction of the burn patient is often a long process requiring multiple procedures. Restoring function has a higher priority than improving cosmetic appearance. However, cosmetic reconstruction also helps improve the patient's daily activities, function, or return to their job [4].

The term 'Burns Rehabilitation' encompasses the physical, psychological, and social aspects of care, as burn patients often face challenges in one or all of these areas post-injury. Reconstructive techniques follow a hierarchy, known as the reconstructive ladder, ranging from simple procedures like Split Skin Grafts to complex tissue transfer by Microvascular surgery [5, 6]. Patients enduring the physical and psychological pain of

burn injuries and disfigurement require a special level of care, involving not only technical expertise but also significant time, understanding, and compassion from the surgeon. An optimistic attitude from the surgeon is essential for the patient's physical and emotional rehabilitation, though it must be balanced with realism [7]. The current study aimed to determine and recommend the ideal skin cover for post-burn scar contracture release defects, considering both functional and cosmetic outcomes.

Material and Methods

The study was done at Gandhi Hospital and Medical College, Secunderabad, Telangana. A clearance from the Institutional Ethical Committee was taken for conducting the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

Patients diagnosed with post-burn scar contracture of the neck through clinical examination were included in the study after being informed about the nature of the condition and the available treatment options. Various presentations, complications, treatment options, and their results were analyzed.

Inclusion Criteria:

1. Burns of at least 6 months duration
2. Patients aged over 14 years
3. Both sexes
4. Contractures secondary to thermal and chemical burns
5. Associated hypertrophic scars and keloids

Exclusion Criteria:

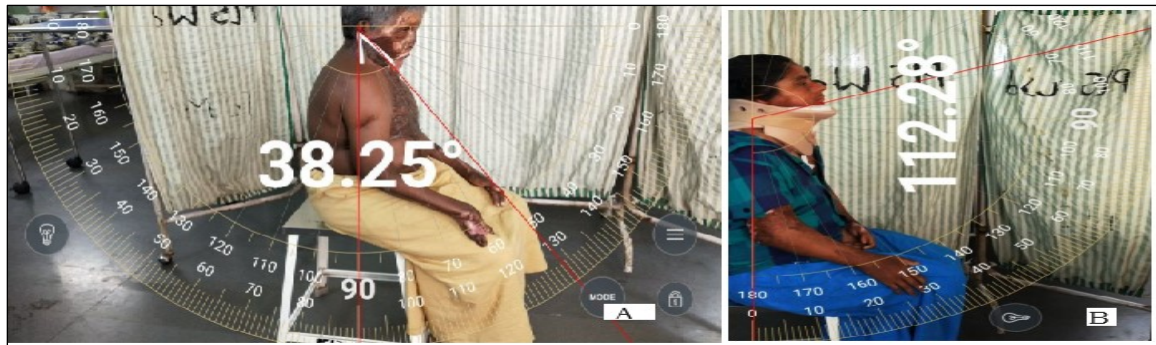
1. Acute burns
2. Burns in children (under 14 years)
3. Associated post-traumatic or post-inflammatory contractures
4. Contractures secondary to electrical burns

Factors Assessed were Type of Scar Contracture: Linear Scar, Broad Scar. Type A: Involving the anterior or lateral surface. Type B: Involving the anterior and one lateral side. Type C: Involving the anterior and both lateral sides. Range of Motion: Restricted neck movement in upward and lateral directions, graded accordingly. Type of Skin: The

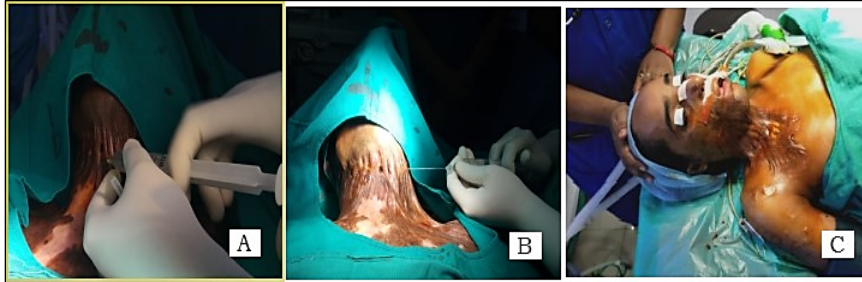
contracted skin can be hypertrophic or keloidal. The scar is assessed for maturity. Signs of an immature scar include stiffness, tenderness, and erythema, which are better avoided until maturation. The nature of the surrounding skin is also examined to aid in planning the type of flap.

Surgical Technique in Brief: The severity of the contracture, surrounding healthy tissue availability, and range of motion limitations were analyzed. The area for grafting is marked, and the type and amount of donor skin are determined. Common donor sites for neck grafts used are from the thighs, buttocks, and abdomen. General anesthesia was used to ensure patient comfort and minimize movement during surgery. The skin was sectioned, and the scar tissue is released causing the contracture. This involved Z-plasty and other techniques to lengthen the contracted area. A thin layer of skin (split-thickness graft) from the chosen donor site was harvested. In some cases, a full-thickness graft might be needed for better cosmetic outcomes. The harvested skin is meshed (expanded with small cuts) to better cover the recipient area. The graft is then carefully placed over the exposed area created by contracture release and secured with sutures or staples. The grafted area is covered with a sterile dressing and bandages to protect the graft and promote healing. Regular dressing changes and monitoring of the grafted area are crucial to prevent infection and promote successful healing. Gentle exercises were recommended to gradually improve range of motion and prevent scar contracture recurrence. A special splint was used to prevent scar tissue from reforming. Patients were advised to sleep with minimal neck flexion for healing and to begin neck and shoulder exercises after two weeks. Follow-up was done for fifteen days followed by one month, three months, 6 months, and 1 year.

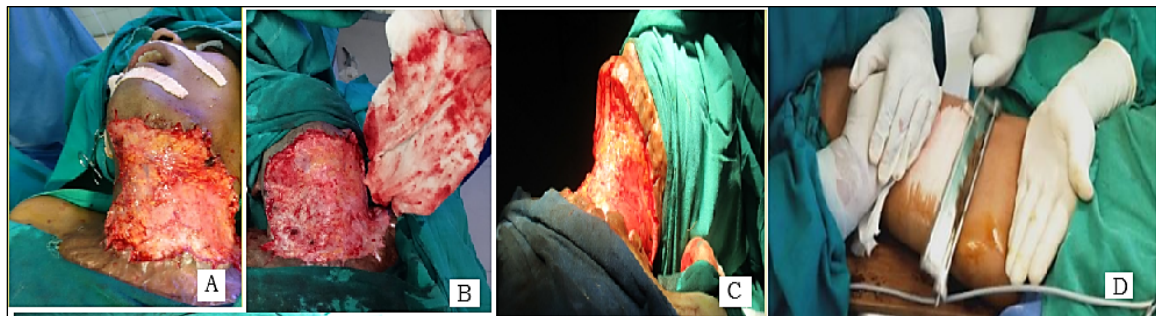
Statistical Analysis: All the available data was uploaded to an MS Excel spreadsheet and analyzed by SPSS version 21 in Windows format. The Chi-square and Fisher exact tests were used to compare qualitative variables. One-way ANOVA was employed to compare means between categorical and numerical data. A significance level (p-value) of less than 0.05 ($p < 0.05$) was adopted for interpreting the test results.



A & B : Measurement of neck contractures



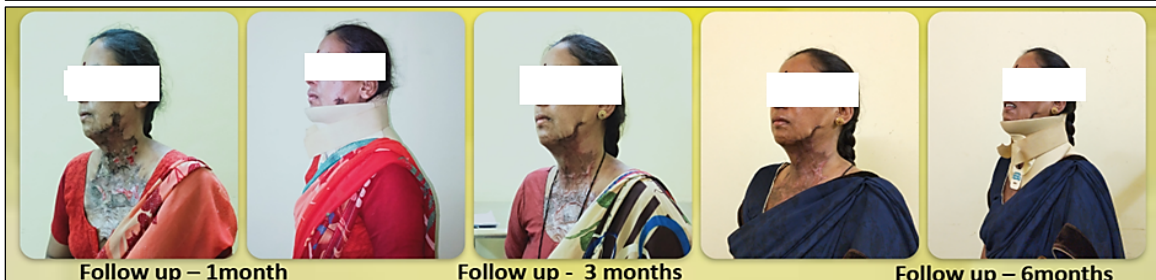
A & B : With prior release under Tumescent Anesthesia
C : Without prior release



A: Scar tissue Excision
B: Hemostasis
C: Back cuts fish tails
D: Intermediate thickness SSG
E: Sheets placed in horizontal manner
F & G : Tie over Bolster dressing



A; Supine with neck extension (shoulder Bolster); B: Primary Dressing POD-5; C: Splintage



Follow up – 1month

Follow up - 3 months

Follow up – 6months

Results

The number of patients included in our study was 20. Analysis of age distribution showed that the highest number or amount of the patients fell within the 24-35 year age group- 30% (6 patients). The second group recorded was the patients above 45 years old (30% or 6 patients). 3 (12%) patients were aged between 14 to 25 years. Notably, the gender distribution had a higher presence of

females. They comprised 11 male patients (55%) and 9 male patients (45%). The presenting scar tissue was further classified according to type. Type B scars, characterized by their flat and smooth appearance, emerged as the most prevalent type, affecting 45% (9 patients) of the study population. Type C scars, which are typically elevated and irregular, were found in 30% (6 patients) of the participants. Figure 1 provides a representation of these scar classifications.

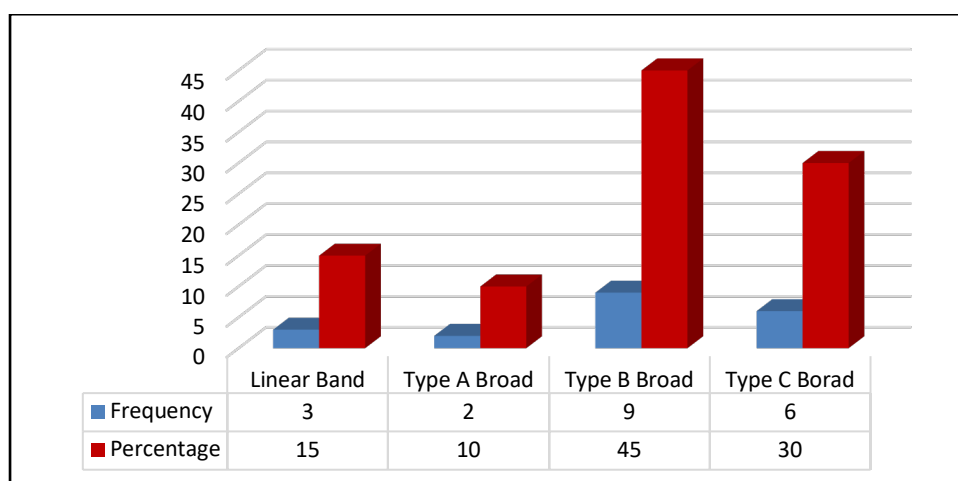


Figure 1: Distribution of the type of scars in cases of the study

Table 1 shows the presence of scars in various body regions in addition to neck contractures, among 20 patients participating in the study. Beyond neck contractures, the majority of patients (85%) had scars in at least one additional body region. Hands were the most commonly affected area (50% of patients), followed by the armpit (axilla, 40%), and elbows (30%). A smaller proportion of patients had associated scars on the

face and chest (breast) - both at 20%. Only a small group (15%) had neck contractures as the sole location of scarring. This shows that post-burn contractures of the neck are frequently accompanied by scarring in other areas of the body. This widespread scarring pattern indicates the potential for extensive functional limitations beyond just neck movement.

Table 1: Distribution of associated scars in cases of the study

	Frequency	Percentage
Neck Alone	3	15
Face	4	20
Axilla	8	40
Elbow	6	30
Hand	10	50
Breast	4	20

Table 2 depicts the details of the types of surgical procedures used to address neck contractures in the study involving 20 patients. Scar excision and skin grafting was the most frequently performed procedure (18 patients, 90%). This suggests it might be the standard approach for treating neck

contractures in this study. Less common procedures included scar excision with flap reconstruction (1 patients, 5%) and multiple Z-plastics (1 patients, 5%). These techniques were used in specific cases or when skin grafting is not suitable.

Table 2: Showing the distribution of procedures done

Procedure	Frequency	Percentage
Scar Excision and Skin grafting	18	90
Scar excision and flap	1	5
Multiple z plasties	1	5

Table 3 depicts the various complications encountered following surgical procedures for neck contractures in patients included in the study. Skin graft loss was the most frequent complication observed, affecting a total of 3 patients (15%) who underwent scar excision and skin grafting (based on information from Table 2). Two patients (10%) experienced partial graft loss (>10% but less than

or equal to 25% of the grafted area). One patient (5%) had a significant loss (>25% of the grafted area). One patient (5%) developed recurrent contractures after the initial procedure. Flap loss (for patients who received flap reconstruction), hypertrophic scarring, and the need for secondary procedures were not observed in this study population.

Table 3: Distribution of complications in the cases of the study

Complications		Frequency	Percentage
Graft Loss (out of a total of 18 cases)	> 10 %	2	10
	> 25%	1	5
	> 50%	0	0
Recontracture		1	5
Hypertrophic scar		0	0
Secondary procedures		0	0

Table 4 summarizes the neck extension capabilities of patients following treatment for neck contractures in the study. The majority of patients (75%, or 15 out of 20) achieved a significant improvement in neck extension, with movement exceeding 110 degrees. This suggests that the treatment procedures were effective in restoring

neck mobility in most cases. A smaller proportion of patients (15%, or 3 patients) had moderate improvement, with neck extension ranging between 90 and 110 degrees. Only 2 patients (10%) had limited improvement, with neck extension remaining below 90 degrees.

Table 4: Neck Extension Range of Motion after treatment

Neck Extension Degree	Frequency	Percentage
> 110	15	75
90 - 110	3	15
< 90	2	10

The majority of patients (55%, or 11 patients) reported a satisfactory level of cosmetic outcome. A smaller proportion of patients were very pleased with the cosmetic results (excellent 2 patients, 10%) and good (6 patients, 30%). A small number of patients (5%, or 1 patient) were dissatisfied with

the cosmetic appearance (bad) (table 5). While a significant portion of patients (55%) expressed a satisfactory level of satisfaction, a combined 40% reported good or excellent outcomes, suggesting a positive perception of cosmetic improvement in a substantial number of cases.

Table 5: Patient satisfaction with cosmetic outcome

Cosmetic Acceptance	Frequency	Percentage
Excellent	2	10
Good	6	30
Satisfactory	11	55
Bad	1	5

Discussion

Postburn contractures of the neck are a recognized sequela of thermal injuries and pose a significant functional challenge [8]. The unique anatomical features of the anterior cervical region contribute to this complication. The loose, thin nature of the skin in this area makes it susceptible to deep burns, while the concave flexor surface extending from the chin to the sternum promotes scar contracture during wound healing [9]. These contractures can severely restrict the range of neck motion (cervical range of motion), leading to functional limitations

in daily activities such as eating, speaking, and maintaining personal hygiene. In extreme cases, compromised cervical range of motion can even contribute to oral incontinence secondary to lower lip ectropion [10]. Based on the reported classifications in this study, scar contractures were divided into four types. The most common type is Type B scar contracture, occurring in 45% of cases (N=9). Type C scar contracture is seen in 30% of cases (N=6). The less severe Type A contracture is found in 10% of cases (N=2). The rarest form, the linear band variety, appears in 15% of cases (N=3).

This indicates that most patients experience severe neck burns involving at least the anterior and lateral sides.

Additionally, the majority of patients required moderate to high levels of tissue replacement. Schwarz et al. [11] and Stern PJ et al. [12] observed that the extent of release achievable from a procedure is influenced by the patient's age, the age of the burn injury, and the severity of the deformity. Among the 20 patients, neck involvement alone was noted in only 3 cases (15%), indicating that isolated neck involvement is rare and typically occurs with other affected areas. About 50% of the patients (10 cases) had associated hand burns, as hands are often in a protective position during burns. The axilla was the next most commonly involved area, with 8 cases (40%). The face was affected in 4 cases (20%), and the breast in 4 cases (20%), reflecting these regions' vulnerability. These contractures are commonly treated in separate sessions [13]. Regarding treatment, 90% (n=18 patients) underwent scar excision and split-thickness skin grafting (SSG). For all patients with linear band contracture (1 case), multiple Z-plasty was performed. Additionally, 15% (1 patient) required flap cover following scar excision. Most patients required SSG due to larger defects necessitating extensive tissue replacement. The availability of adjacent tissue for flap cover is often limited. Greenhalgh et al. [14] reported a 62% success rate with skin grafting, while our study achieved a graft take of over 90%.

Complications and graft loss were minimal. Two patients (10%) experienced more than 10% graft loss, and one patient had over 25% graft loss. One patient required re-grafting, while the remaining cases were managed conservatively. The minor losses were mainly due to difficulty in achieving immobilization and minor hematomas. Recontracture occurred in 10% of the patients (2 cases). Postoperative neck splinting significantly contributed to the low recontracture rate, although achieving a 100% success rate should be the goal. Carmichael et al. [15] reported a 69% recurrence rate of contractures at an average of 17 months post-treatment, whereas our study had a contracture rate of only 10%.

We achieved good functional results in 75% (15 patients) of our cases, with neck extension greater than 110 degrees. About 10% of patients had neck extensions less than 110 degrees, and another 10% had poorer results with angles less than 90 degrees. However, Devi et al. [16] reported achieving neck extension greater than 110 degrees in all cases. Cosmetic acceptance was surprisingly high among the patients. A majority of 11 patients (55%) rated their cosmetic results as satisfactory, 6 patients (30%) rated them as 'good,' and 2 patients (10%)

rated them as 'excellent.' Only one patient was unhappy, rating the result as 'bad.' The higher satisfaction ratings can be attributed to two factors: firstly, the most common age group was 24 to 35 years, often post-marriage, and secondly, a high tolerance among the working, lower socioeconomic group, who prioritized functional recovery. However, young unmarried girls were less satisfied with the cosmetic results. We have recommended adjuvant therapy for them to improve the appearance of their scars.

Conclusion

In conclusion, post-burn scar contractures significantly impact active individuals, particularly those with limited resources. Surgical reconstruction offers the best outcomes. Skin grafting is a simple, reliable and safe operation however, it has disadvantage of hypertrophy and recurrence of contracture. Most important aspect of management is the splintage. Patience and meticulous aftercare are crucial for successful reconstruction. This approach offers significant functional improvement and satisfaction for both patients and surgeons.

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