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Original Research Article

Early Flap Reconstruction for Clinically Immature Post-Burn Contractures: A Prospective Observational Study

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Abstract

Background: Post-burn contractures remain one of the most disabling long-term sequelae of burn injuries, particularly when they involve functionally important anatomical regions such as the neck, axilla, upper limb, and hand. Conventional surgical management recommends delaying contracture release until complete scar maturation, followed by reconstruction using split-thickness or full-thickness skin grafts. Although widely practiced, skin grafting is associated with secondary contraction, prolonged splintage, intensive rehabilitation, and recurrence of contracture. Flap reconstruction offers vascularized tissue with superior elasticity and durability, potentially permitting earlier intervention and reducing recurrence. However, evidence supporting flap reconstruction in clinically immature scars remains limited.

Objective: To evaluate the functional outcomes, postoperative complications, and recurrence rates following early release of clinically immature post-burn contractures reconstructed with local and regional flaps.

Materials and Methods: A prospective observational study was conducted in the Department of Burns and Plastic Surgery at a tertiary care teaching hospital between January 2018 and December 2019. Patients presenting with clinically immature post-burn contractures requiring surgical release and considered suitable for flap reconstruction were prospectively enrolled. Scar immaturity was determined using clinical parameters including erythema, pigmentation, tenderness, pruritus, pliability, and blanching on pressure rather than time elapsed since burn injury. Demographic characteristics, burn details, anatomical distribution of contractures, reconstructive procedures, postoperative complications, functional outcomes, and recurrence were recorded during a one-year follow-up period.

Results: Thirty-two patients completed the study. The mean age was 20.66 ± 12.72 years (range: 4–55 years). Females constituted 56.3% of the study population. The neck (28.1%) and axilla (21.9%) were the most frequently affected anatomical sites. The most commonly performed procedures included Z-plasty, multiple Z-plasty, and V-Y advancement flap reconstruction. Functional improvement was achieved in all patients throughout the follow-up period. Minor complications included marginal flap-tip necrosis and partial flap loss requiring secondary split-thickness skin grafting in a limited number of cases. No patient developed complete flap failure, deep wound infection, or recurrence of contracture during the one-year follow-up.

Conclusion: Early release of selected post-burn contractures with flap reconstruction in clinically immature scars appears to be a safe and effective reconstructive strategy. Careful patient selection combined with meticulous surgical planning provides durable soft tissue coverage, excellent functional recovery, minimal postoperative morbidity, and a low risk of recurrence. Early flap reconstruction may therefore represent a valuable alternative to conventional delayed reconstruction in appropriately selected patients.

Keywords: Post-burn contracture; Burn scar; Immature scar; Flap reconstruction; Early contracture release; Reconstructive surgery; Burn rehabilitation.

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Introduction

Burn injuries continue to represent a major public health challenge worldwide and are particularly prevalent in low- and middle-income countries, where delayed access to specialized burn care, inadequate rehabilitation services, and socioeconomic constraints contribute substantially to long-term disability [1]. Among the late sequelae of burn injuries, post-burn contractures remain one of the most frequent and functionally disabling complications [2]. Contractures commonly affect highly mobile anatomical regions, including the neck, axilla, elbow, wrist, hand, and lower limb joints, resulting in restricted range of motion, impaired activities of daily living, cosmetic deformity, psychological distress, and diminished quality of life [3].

The development of post-burn contractures is closely related to prolonged wound healing, deep dermal or full-thickness burns, infection, delayed grafting, and inadequate physiotherapy or splintage during the acute phase of treatment [4]. Scar contraction occurring across joints or flexion creases progressively limits mobility and may eventually lead to severe deformity if not addressed appropriately [5]. Consequently, surgical reconstruction remains an essential component of comprehensive burn rehabilitation [6].

Traditionally, surgical release of post-burn contractures has been postponed until complete scar maturation, generally between 12 and 18 months following injury [7]. This practice is based on the belief that immature scars possess greater biological activity and therefore carry a higher risk of recurrence following reconstruction [8,9]. After contracture release, the resulting defect is most commonly resurfaced using split-thickness or full-thickness skin grafts because of their technical simplicity and broad applicability [10].

Despite their widespread use, skin grafts possess several inherent limitations when applied over mobile joints and functionally important areas [11]. Secondary contraction remains one of the principal disadvantages, often necessitating prolonged splintage, pressure garment therapy, intensive physiotherapy, and, in some cases, secondary reconstructive procedures due to recurrent deformity [12,13]. Furthermore, grafted skin frequently lacks the elasticity, thickness, and durability required to withstand repeated movement across joints, thereby compromising long-term functional outcomes [15].

In contrast, flap reconstruction provides well-vascularized tissue with superior elasticity, thickness, and resistance to secondary contraction16. Local and regional flaps maintain their intrinsic blood supply, permitting stable soft tissue coverage while preserving mobility and contour [17,18]. Because of these biomechanical advantages, flap reconstruction has become increasingly favored for contractures involving the neck, axilla, hand, elbow, and other highly mobile anatomical regions where durable reconstruction is essential for sustained functional recovery [19,20]. Recent advances in reconstructive surgery have generated increasing interest in performing contracture release before complete scar maturation in carefully selected patients. Early surgical intervention has the potential to reduce the duration of disability, facilitate earlier rehabilitation, prevent progression of deformity, improve functional recovery, and accelerate social reintegration [21]. However, concerns regarding recurrence, wound healing, and flap survival in clinically immature scars have limited widespread acceptance of this approach [22]. Current evidence supporting early flap reconstruction remains relatively sparse, and most published studies consist of retrospective case series with limited follow-up.

An important consideration in contemporary burn reconstruction is that scar maturity should not be determined solely by the interval elapsed since burn injury. Scar maturation is a dynamic biological process influenced by burn depth, wound healing characteristics, infection, patient age, rehabilitation compliance, and individual variations in collagen remodeling [23]. Clinical assessment of scar maturity including scar colour, vascularity, tenderness, pruritus, pliability, and blanching response provides a more reliable basis for surgical decision-making than chronological age alone [24,25].

The present prospective observational study was undertaken to evaluate the clinical outcomes of early release of post-burn contractures reconstructed using local and regional flaps in patients with clinically immature scars.

Specifically, the study assessed demographic characteristics, anatomical distribution of contractures, reconstructive techniques employed, postoperative complications, functional recovery, and recurrence following one year of follow-up. We hypothesized that, in appropriately selected patients, early flap reconstruction would provide durable tissue coverage, facilitate early mobilization, reduce recurrence, and achieve satisfactory long-term functional outcomes without increasing postoperative complications.

Materials and Methods

Study Design and Setting: This prospective observational study was conducted in the Department of Burns and Plastic Surgery at a tertiary care teaching hospital between January 2018 and December 2019. The study was designed to evaluate the clinical outcomes of early surgical release of post-burn contractures reconstructed using local and regional flap techniques in patients with clinically immature scars. The study protocol was reviewed and approved by the Institutional Ethics Committee before patient recruitment. Written informed consent was obtained from all adult participants. For pediatric patients, consent was obtained from parents or legal guardians prior to enrolment.

Study Population: Patients presenting to the Burns and Plastic Surgery outpatient department with post-burn contractures causing functional impairment were screened for eligibility. Patients demonstrating clinically immature scars and considered suitable candidates for flap reconstruction were prospectively enrolled. Unlike conventional practice, eligibility was determined primarily by clinical scar characteristics rather than the duration elapsed since burn injury, recognizing that scar maturation varies considerably among individuals depending upon burn depth, wound healing, infection, age, rehabilitation, and individual biological factors.

Inclusion Criteria

Patients fulfilling all of the following criteria were included:

- Post-burn contracture associated with clinically immature scar tissue.
- Functional limitation requiring operative release.
- Availability of adjacent healthy, pliable tissue suitable for local or regional flap reconstruction.
- Patients willing to undergo surgery and comply with scheduled postoperative follow-up.

Exclusion Criteria

Patients were excluded under the following circumstances:

- Mature post-burn scars planned for conventional reconstructive procedures.
- Extensive surrounding scar tissue precluding flap reconstruction.
- Active wound infection at the operative site.
- Significant uncontrolled systemic illness rendering surgery unsafe.
- Patients unwilling or unable to complete the planned follow-up schedule.

Preoperative Clinical Assessment: All patients underwent comprehensive preoperative evaluation, including detailed history, physical examination, and functional assessment.

The following baseline variables were recorded:

- Age
- Sex
- Burn etiology
- Total body surface area (TBSA) burned
- Time interval between burn injury and reconstruction
- Anatomical site of contracture
- Severity of deformity
- Functional limitation
- Availability of adjacent donor tissue

Scar maturity was evaluated clinically using multiple parameters rather than relying exclusively on chronological age of the scar.

The clinical assessment included:

- Persistent erythema or hyperpigmentation
- Pain or tenderness
- Pruritus
- Scar pliability
- Scar softness
- Blanching on pressure

No single clinical feature was considered diagnostic of scar immaturity. Instead, operative planning was based on an overall clinical assessment performed by the treating reconstructive surgeon.

Operative Technique: All surgical procedures were performed under appropriate anesthesia using standard aseptic precautions.

Following complete release of the contracture, reconstruction was individualized according to:

- Anatomical location
- Size of the post-release defect
- Severity of contracture
- Availability and quality of adjacent healthy tissue
- Functional requirements of the affected region

The reconstructive procedures performed included:

- Single Z-plasty
- Multiple Z-plasty
- Five-flap Z-plasty
- V-Y advancement flap
- Y-V advancement flap
- Horizontal advancement flap
- Local advancement flap
- Lateral arm flap
- Abdominal flap
- Mucosal advancement flap
- Combined flap procedures where required

Whenever complete flap coverage was not feasible, the remaining raw area was resurfaced using an intermediate-thickness split-thickness skin graft.

Representative Surgical Procedure: A representative case involved a patient with severe post-burn cervical contracture associated with lower lip ectropion. Preoperative examination demonstrated adequate, healthy skin over the right supraclavicular region, permitting reconstruction using a supraclavicular artery flap.

Figure 1 illustrates a representative patient with a post-burn cervical contracture associated with lower lip ectropion before surgical intervention.

Following complete release of the cervical contracture, a central neck defect was created (Figure 2A). The flap was designed using planning in reverse technique based on the course of the supraclavicular artery, a branch of the transverse cervical artery (Figure 2B). Flap elevation was performed carefully while preserving the vascular pedicle (Figure 2C). The supraclavicular artery and its paired venae commitante were identified and protected throughout flap elevation (Figure 2D). After adequate mobilization, the flap was rotated and inset without tension to reconstruct the cervical defect (Figure 2E).

A suction drain was placed beneath the flap, and the donor site was resurfaced using an intermediate-thickness split-thickness skin graft (Figure 2F).

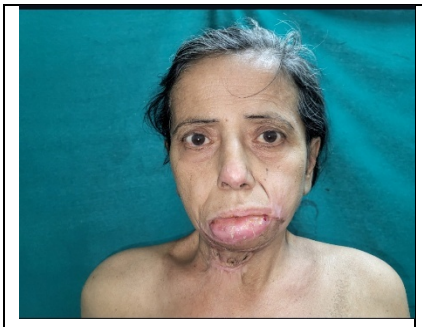


Figure 1: Preoperative



Fig 2A: Intraoperative



Fig 2B: Intraoperative



Fig 2C: Intraoperative



Fig 2D: Intraoperative



Fig 2E: Intraoperative



Fig 2F: Intraoperative

Postoperative Management: Standard postoperative protocols were followed for all patients. Postoperative care included:

- Regular wound inspection and dressing changes
- Appropriate antibiotic therapy when indicated
- Adequate analgesia
- Limb elevation where applicable
- Monitoring of flap vascularity

Flap viability was assessed clinically by evaluating:

- Colour
- Capillary refill
- Temperature
- Tissue turgor
- Evidence of venous congestion

Physiotherapy was initiated once flap viability had been established, usually within the early postoperative period depending on the reconstructed anatomical site. Splintage was prescribed selectively for patients requiring additional protection during rehabilitation. Pressure garments and scar management protocols were instituted according to institutional practice once wound healing had been completed. Representative immediate postoperative photographs are shown in Figures 3A and 3B.



Fig 3A: Postoperative



Fig 3B: Postoperative

Follow-up Protocol: Patients were followed prospectively for one year after surgery. Clinical evaluations were scheduled at: 1 month, 3 months, 6 months and 12 months at each visit, patients underwent standardized assessment of:

- Flap viability
- Wound healing
- Scar quality
- Range of motion
- Functional recovery
- Postoperative complications
- Requirement for secondary procedures
- Recurrence of contracture

Representative long-term postoperative outcomes are illustrated in Figures 4A and 4B.



Fig 4A: Follow up



Fig 4B: Followup

Outcome Measures

Primary Outcome: The primary outcome was functional improvement following contracture release.

Functional assessment was performed clinically according to the anatomical region involved.

Examples included:

- Neck extension
- Shoulder abduction
- Elbow extension
- Finger mobility
- First web-space opening
- Hand function
- Oral commissure opening where applicable

Secondary Outcomes: Secondary outcome measures included:

- Complete flap survival
- Marginal flap-tip necrosis
- Partial flap loss
- Wound infection
- Wound dehiscence
- Requirement for secondary skin grafting
- Recurrence of contracture during one-year follow-up

Recurrence was defined as any clinically significant loss of postoperative correction associated with deterioration in functional range of motion requiring further intervention.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics.

Continuous variables were expressed as:

- Mean ± standard deviation (SD)
- Median with range where appropriate

Categorical variables were summarized using:

- Frequencies
- Percentages

Because this investigation was designed as a descriptive prospective observational study without a comparison group, only descriptive statistical analyses were performed. The results are presented using tables and graphical illustrations to facilitate interpretation of demographic characteristics, anatomical distribution, reconstructive procedures, postoperative outcomes, and functional recovery.

Results

Patient Characteristics: During the study period, 32 consecutive patients with clinically immature post-burn contractures underwent early surgical release followed by flap reconstruction. All enrolled patients completed the planned one-year follow-up and were included in the final analysis. The mean age of the study population was 20.66 ± 12.72 years, with an age range of 4–55 years, indicating that post-burn contractures predominantly affected children, adolescents, and young adults. There were 18 females (56.3%) and 14 males (43.7%), giving a female-to-male ratio of approximately 1.3:1.The mean burned total body surface area (TBSA) was 20.53 ± 9.13%, ranging from 5% to 38%.The interval between burn injury and reconstructive surgery ranged from 1 to 9 months, with a mean duration of 5.31 ± 2.72 months, reflecting the early timing of intervention before complete scar maturation. Most patients (93.8%) had sustained deep dermal burns extending into full-thickness injury, while 6.2% had isolated full-thickness burns.

Table 1: Demographic and Burn Characteristics

Variable	Value
Number of patients	**32**
Age (years), mean ± SD	**20.66 ± 12.72**
Age range (years)	**4–55**
Male	**14 (43.7%)**
Female	**18 (56.3%)**
Female : Male ratio	**1.3 : 1**
Mean TBSA burned (%)	**20.53 ± 9.13**
TBSA range (%)	**5–38**
Mean interval from burn to surgery (months)	**5.31 ± 2.72**
Range (months)	**1–9**

Anatomical Distribution of Contractures: The neck was the most commonly affected anatomical site, accounting for 28.1% of all contractures. The axilla represented the second most frequent location (21.9%). Upper limb involvement predominated overall, with additional contractures involving the fingers, elbow, first web space, and dorsum of the hand. Groin contracture was comparatively uncommon.

Table 2: Anatomical Distribution of Post-Burn Contractures

Anatomical Site	Number	Percentage
Neck	9	28.1
Axilla	7	21.9
Fingers	5	15.6
Elbow	4	12.5
First web space	4	12.5
Dorsum of hand	2	6.3
Groin	1	3.1
Total	**32**	**100**

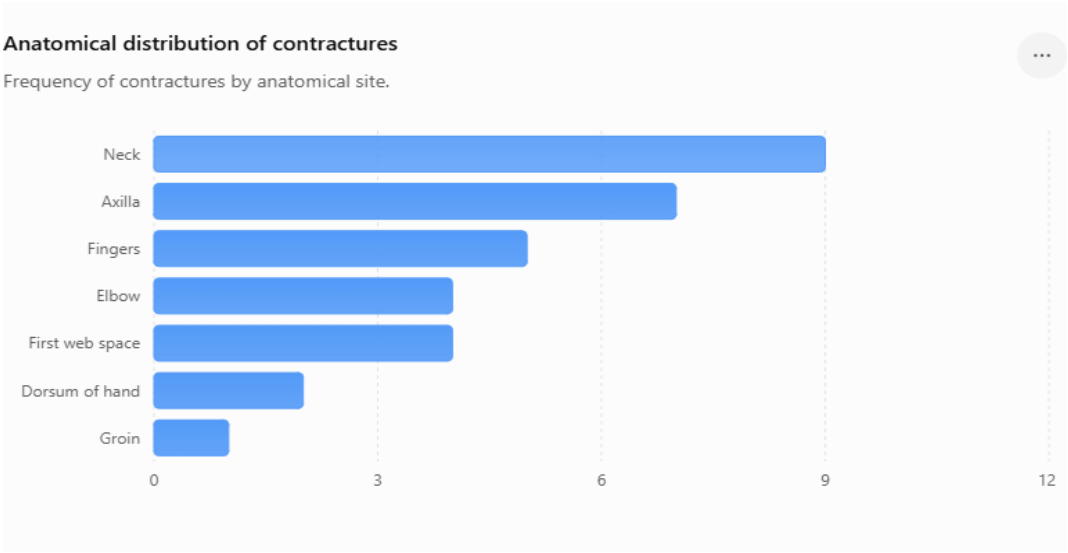


Fig 5: Distribution of contractures according to anatomical location.

Severity of Contractures: Most patients presented with moderate contractures (62.5%), while mild contractures accounted for 18.8%.Moderately severe and severe deformities each represented 9.4% of the study population.

Table 3: Severity of Contractures

Severity	Number	Percentage
Mild	6	18.8
Moderate	20	62.5
Moderate–Severe	3	9.4
Severe	3	9.4

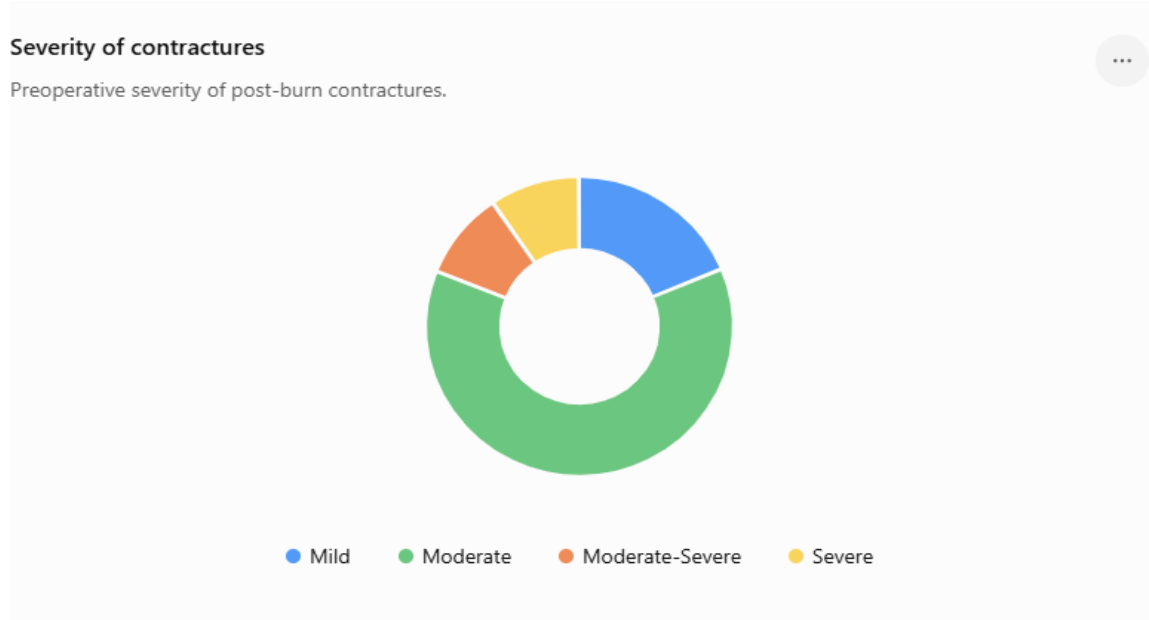


Fig 6: **Distribution of contracture severity before operative intervention. Moderate contractures represented the largest subgroup.**

Reconstructive Procedures: The reconstructive procedure was individualized according to anatomical site, defect size following contracture release, tissue availability, and functional requirements. Z-plasty was the most frequently performed reconstructive technique (25%).Multiple Z-plasty and V-Y advancement flap reconstruction each accounted for 15.6% of procedures. Other techniques included local advancement flaps, lateral arm flaps, abdominal flaps, five-flap Z-plasty, rectangular advancement flaps, and combined flap procedures.

Table 4: Flap Procedures Performed

Procedure	Number	Percentage
Z-plasty	8	25.0
Multiple Z-plasty	5	15.6
V-Y advancement flap	5	15.6
Local advancement flap	3	9.4
Combined flap procedures	4	12.5
Lateral arm flap	2	6.3
Abdominal flap	2	6.3
Five-flap Z-plasty	2	6.3
Rectangular advancement flap	1	3.1
Total	**32**	**100**

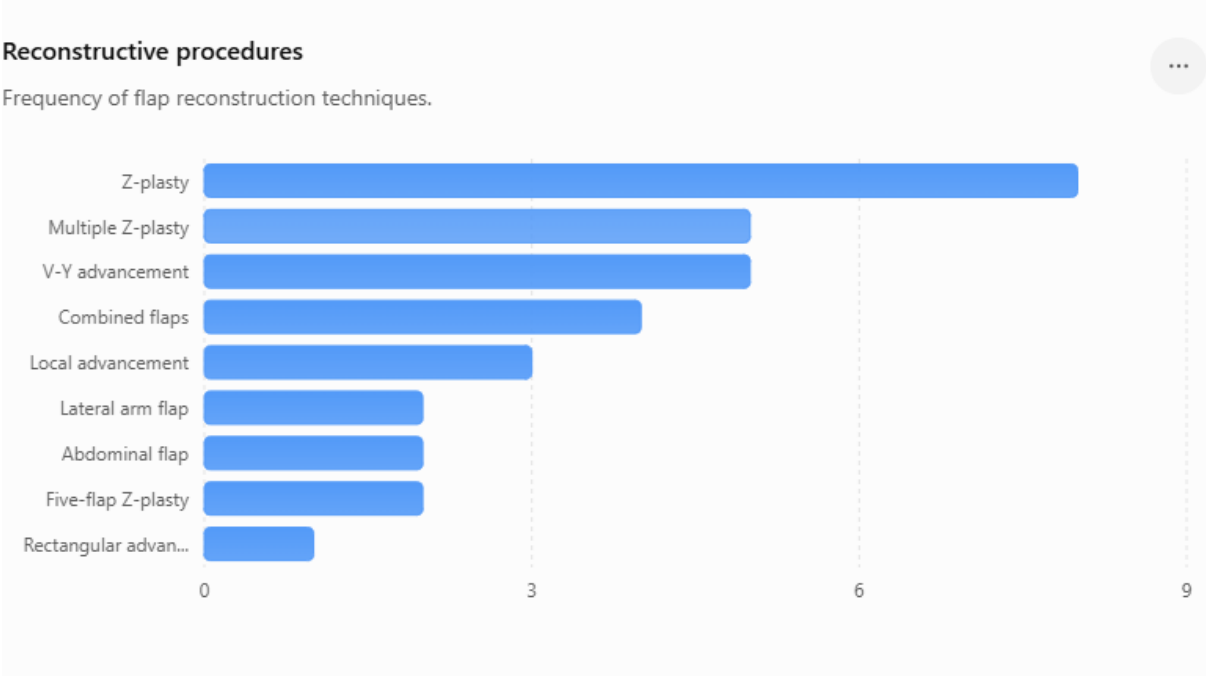


Fig 7: Types of reconstructive procedures performed following release of clinically immature post-burn contractures.

Postoperative Outcomes: Overall postoperative outcomes were excellent. All reconstructed flaps survived completely, yielding a 100% flap survival rate. Functional improvement was achieved in every patient during follow-up. Minor complications occurred in a limited number of patients. Marginal flap-tip necrosis developed in four patients (12.5%), while three patients (9.4%) required secondary split-thickness skin grafting for residual defects or partial flap loss.

Importantly, no patient developed: Complete flap loss, deep surgical site infection, Procedure-related mortality or recurrent contracture during one-year follow-up.

Table 5: Postoperative Outcomes

Outcome	Number (%)
Good functional outcome	32 (100)
Complete flap survival	32 (100)
Marginal flap-tip necrosis	4 (12.5)
Secondary skin grafting	3 (9.4)
Major flap loss	0
Wound infection	0
Contracture recurrence	0

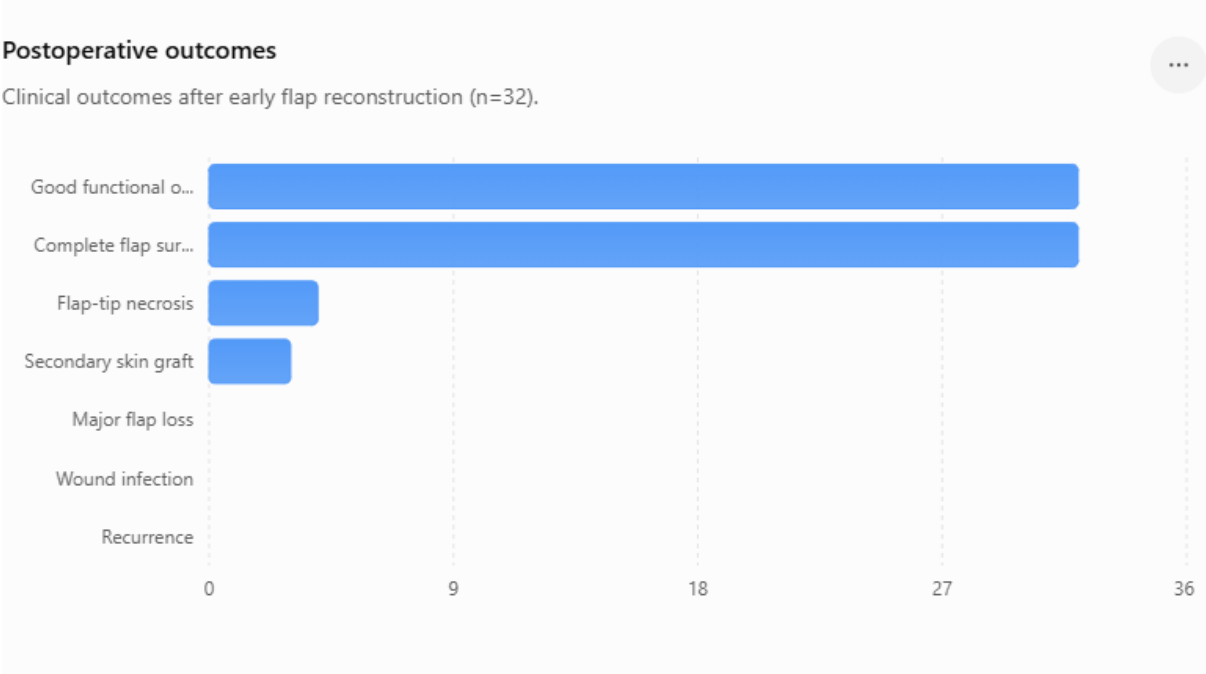


Fig 8: Postoperative complications and clinical outcomes following flap reconstruction. Excellent flap survival with minimal morbidity was observed.

Functional Recovery: Progressive functional improvement was observed throughout the follow-up period. Patients with cervical contractures demonstrated substantial restoration of neck extension.

Axillary contractures showed significant improvement in shoulder abduction. Patients undergoing elbow reconstruction regained satisfactory elbow extension. Individuals treated for finger and first web-space contractures achieved improved hand opening, grasp, and functional mobility. Patients reconstructed for oral commissure deformities experienced improved mouth opening and oral competence. No deterioration in postoperative function was observed during the one-year follow-up.

Follow-up: All patients attended scheduled postoperative reviews at: 1 month, 3 months, 6 months and 12 months. Clinical assessment during follow-up included: Flap viability, Wound healing, Scar quality, Range of motion, Functional recovery, Need for secondary procedures and Recurrence Stable flap coverage and progressive functional recovery were maintained throughout the follow-up period.

Table 6: Follow-up Schedule

Follow-up	Clinical Assessment
1 month	Wound healing, flap viability, ROM
3 months	Functional improvement
6 months	Scar maturation and ROM
12 months	Final functional assessment and recurrence

Discussion

Post-burn contractures continue to represent one of the most challenging sequelae of burn injuries, particularly in developing countries where delayed presentation, limited access to specialized burn care, inadequate rehabilitation, and socioeconomic barriers contribute to long-term disability. Contractures involving the neck, axilla, upper limb, and hand significantly impair functional independence and quality of life, often affecting patients during their most productive years.

The present prospective observational study evaluated the outcomes of early release of clinically immature post-burn contractures reconstructed with local and regional flaps. The findings demonstrate that carefully selected patients can achieve excellent functional recovery with minimal complications and no recurrence during one year of follow-up.

The study population consisted predominantly of children, adolescents, and young adults, with a mean age of 20.66 years. This observation is consistent with the epidemiology of burn injuries in low- and middle-income countries, where domestic

accidents involving open flames, hot liquids, and unsafe cooking practices disproportionately affect younger individuals. Functional disability occurring at this age has profound implications for education, employment, and social reintegration. Early restoration of mobility therefore has benefits extending beyond physical recovery, contributing to improved psychosocial well-being and long-term socioeconomic outcomes.

A slight female predominance was observed in the present series. Although the study was not designed to investigate gender differences, this distribution may reflect the greater exposure of women and girls to domestic cooking activities in many regions. Similar demographic trends have been reported in burn epidemiology studies from developing countries, although the relative proportions vary according to geographical and cultural factors.

The neck and axilla were the most frequently affected anatomical sites, together accounting for approximately half of all contractures. These regions are particularly susceptible because they span highly mobile joints and naturally heal under tension. Failure to maintain appropriate positioning, splintage, and physiotherapy during wound healing predisposes to progressive scar shortening and deformity. Contractures affecting these areas can markedly restrict cervical extension, shoulder abduction, and upper limb function, emphasizing the importance of timely surgical correction.

A distinctive feature of the present study is the emphasis on clinical assessment of scar maturity rather than relying exclusively on the interval elapsed since burn injury. Conventional reconstructive practice generally recommends postponing surgery until scars have matured completely, often 12–18 months after injury.

However, scar maturation is a dynamic biological process influenced by burn depth, wound healing, infection, patient age, genetic factors, and compliance with rehabilitation. Clinical parameters such as vascularity, erythema, tenderness, pruritus, pliability, and blanching provide a more individualized assessment of scar behavior than chronological age alone. The favorable outcomes observed in this study support the concept that carefully selected clinically immature scars can be reconstructed successfully without waiting for complete maturation.

The principal finding of this investigation is that early contracture release combined with flap reconstruction achieved excellent functional outcomes in all patients. Progressive improvement in joint mobility was observed throughout follow-up, including restoration of neck extension, shoulder abduction, elbow extension, hand function, and oral commissure mobility where appropriate. These findings suggest that early restoration of normal anatomy facilitates rehabilitation before prolonged immobilization and adaptive soft tissue shortening become established.

The reconstructive strategy was individualized according to anatomical location, severity of deformity, and availability of adjacent healthy tissue. Z-plasty represented the most frequently employed procedure and proved particularly effective for narrow linear contractures with adequate surrounding skin. Multiple Z-plasty provided greater lengthening for more extensive deformities, whereas V-Y advancement and local advancement flaps offered reliable tissue replacement for broader defects. Regional flaps, including lateral arm and abdominal flaps, were reserved for selected patients in whom local tissue availability was limited. This individualized approach reflects the fundamental principles of reconstructive surgery, emphasizing replacement of "like with like" while minimizing donor-site morbidity and preserving function.

An important observation was the excellent flap survival achieved throughout the study. Complete flap viability was maintained in every patient, with only minor complications observed. Marginal flap-tip necrosis occurred in four patients, while three patients required supplementary split-thickness skin grafting.

These complications were managed successfully without compromising the final functional outcome. No patient developed major flap loss, deep wound infection, or procedure-related mortality.

The absence of contracture recurrence during the one-year follow-up period represents one of the most clinically relevant findings of this study. Secondary contraction remains a major limitation of skin graft reconstruction, particularly over joints and other mobile regions. In contrast, flap reconstruction provides vascularized tissue with greater thickness, elasticity, and resistance to contraction. These biomechanical characteristics likely contributed to the durable correction observed in the present series. Furthermore, stable soft tissue coverage enabled early mobilization and physiotherapy, both of which are recognized as essential components of successful burn rehabilitation.

Recent literature increasingly supports the use of flap reconstruction for selected post-burn contractures, particularly those involving the neck, axilla, elbow, and hand. Several authors have demonstrated superior long-term functional outcomes and lower recurrence rates when

compared with skin grafting, particularly in regions subjected to repetitive movement. Although the present study was not designed as a comparative trial, the excellent functional outcomes and absence of recurrence are consistent with these published observations and reinforce the value of flap reconstruction in appropriately selected patients.

Nevertheless, flap reconstruction is not universally applicable. Successful reconstruction requires adequate adjacent healthy tissue, reliable vascular anatomy, meticulous surgical technique, and careful postoperative rehabilitation. Patients with extensive circumferential scarring or insufficient donor tissue may still require skin grafting or more complex microsurgical reconstruction. Consequently, operative planning should remain individualized according to patient characteristics, defect location, and available reconstructive options.

The present study possesses several strengths. It was conducted prospectively, included standardized clinical assessment of scar maturity, and maintained complete one-year follow-up for all enrolled patients. Functional outcomes and complications were systematically documented, providing a comprehensive assessment of early flap reconstruction in clinically immature scars.

Certain limitations should also be acknowledged. The study was conducted at a single tertiary care center and included a relatively small sample size, limiting the generalizability of the findings. The absence of a comparison group undergoing delayed reconstruction or skin grafting precludes direct comparison of treatment strategies. In addition, multiple anatomical sites and flap techniques were included within the same cohort, introducing heterogeneity that limits procedure-specific analysis. Longer follow-up would also be valuable to determine whether the absence of recurrence persists beyond one year.

Future multicenter studies with larger patient populations, standardized functional outcome measures, and comparative analyses between flap reconstruction and skin grafting are warranted. Such investigations would provide stronger evidence regarding the optimal timing of surgery and help define clinical guidelines for early management of immature post-burn contractures.

Overall, the findings of this study support the concept that early flap reconstruction is a safe and effective option in carefully selected patients with clinically immature post-burn contractures. Clinical assessment of scar maturity, meticulous operative planning, and structured postoperative rehabilitation appear to be the key determinants of successful long-term outcomes.

Conclusion

Early release of selected clinically immature post-burn contractures followed by flap reconstruction provides excellent functional recovery with minimal morbidity and durable soft tissue coverage. In this prospective series, flap reconstruction achieved complete flap survival, satisfactory restoration of function, and no recurrence during one year of follow-up.

These findings suggest that carefully selected patients need not routinely await complete scar maturation before reconstructive surgery. Instead, individualized assessment of scar characteristics, combined with availability of healthy adjacent tissue and appropriate flap selection, permits earlier restoration of function while avoiding many of the disadvantages associated with skin grafting.

Although flap reconstruction is not suitable for every post-burn contracture, it should be considered an important reconstructive option for contractures involving highly mobile anatomical regions where long-term durability and preservation of joint movement are essential. Larger comparative studies with longer follow-up are required to establish definitive evidence-based recommendations regarding the optimal timing of reconstruction and selection of reconstructive techniques.

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