

Z-Plasty with Skin Grafting for Post-Burn Contracture - Study of 30 Cases

Golder, B^{1*}, Kabir, H², Sohelullah, M³

¹Dr. Biswajit Golder, Associate Professor, Department of Surgery, Sheikh Sayera Khatun Medical College Hospital, Gopalganj, Bangladesh

²Dr. Md Humayun Kabir, Associate Professor, Department of Orthopedics, Sheikh Sayera Khatun Medical College Hospital, Gopalganj, Bangladesh

³Dr. MD Sohelullah, Assistant Professor, Department of Surgery, Sheikh Sayera Khatun Medical College Hospital, Gopalganj, Bangladesh

DOI: [10.36347/sjams.2022.v10i06.005](https://doi.org/10.36347/sjams.2022.v10i06.005)

| Received: 19.05.2022 | Accepted: 24.06.2022 | Published: 07.08.2022

*Corresponding author: Golder, B

Associate Professor, Department of Surgery, Sheikh Sayera Khatun Medical College Hospital, Gopalganj, Bangladesh

Abstract

Original Research Article

Introduction: Postburn contracture is a very common problem in case of undertreated and neglected cases of burns involving the flexor surface of joints of limbs. Satisfactory treatment of postburn contracture needs surgical excision of scar followed by Z-plasty. In case of a severe contracture of joints, Z-plasty is combined with skin grafting for the tension-free treatment of post-burn contracture. **Methods:** The study was conducted in Sadar Hospital, Sunamgonj and several private clinics in selected districts during the period from 2008 to 2020. **Thirty** (30) patients with contractures involving flexor surface of Elbow, Knee, and Metacarpophalangeal joints of hands of mild to severe degrees and various durations were treated with Z-plasty plus Split thickness Skin grafts. The operated limbs were immobilized with POP casts. Perioperative Parenteral Antibiotics were prescribed along with adequate Analgesics, Antiulcerants and vitamins, and proper nutrition. Both the operative sites (Recipient and donor areas) were examined by check dressing after the 7th to 14th postoperative days. **Result:** 5 and 12 patients had complications like infection, flap tip necrosis, and recurrent contractures respectively. But overall results were satisfactory in terms of joint extension, mobility, cosmetic appearance, and patient satisfaction. Very naturally in case of severe contractures, full correction was not possible by single-stage operation. **Conclusion:** Tension-free flap must be used in patients with mild to severe contractures. Combining skin Grafting with Z-plasty is easy and has better results than Z-plasty alone. It is recommended in patients of Z-plasty with intraoperative flap tension.

Keywords: Contractures, Z-plasty, Scar, Skin Restoration.

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INTRODUCTION

Scar contracture after burn injury is a very common incident in neglected and undertreated and maltreated burn patients in our country. It commonly affects the flexor surface of limbs. The Elbow, Knee, and Metacarpophalangeal and interphalangeal joints of hands are more commonly affected joints having an incidence between 21% and 40% [1]. These contractures significantly affect the mobility of joints and thereby impair daily activities and movements. It affects flexor surfaces commonly and more severely than extensor surfaces. An important issue in deep burn is understanding skin restoration principles. It depends on proper grafting site selection and applying the skin flap restoration procedure in the proper position [2]. In severe burns, the contractures are usual because of

scarring of healing sites that were not properly immobilized by splints during healing. The splinting of affected joints must be continued several months after complete healing of the skin because the process of scar contraction which is responsible for post-burn contractures continues for variable periods after the incidence of burn. The degree and severity of contractures can be minimized although not fully prevented during the initial months of healing afterburn by proper immobilization of limbs by splinting. Depending on the function loss, depth of tissue involvement, and duration of scar, the contractures can vary greatly. Therefore surgical interventions should be tailored separately for each patient. There are many surgical techniques for the reconstruction of scars of antecubital, popliteal, and palmar contractures including

scar release and skin graft, Z-plasty and V-Y plasty, double rectangular flap, and lateral and medial arm/thigh flaps. Some of them are complex and accompanied by ugly donor sites and occasional sacrifice of either the radial or the ulnar artery. Scar release and skin grafting require prolonged splinting to reduce the risk of graft failure and recurrence of scar contracture. In some patients, scar contracture recurs after Z-plasty and V-Y plasty. Recurrent tearing will lead to simple chronic contracture. Many patients with elbow and knee contractures experience recurrence after Z-plasty. Some of them are not satisfied with the release and skin graft because of restriction of movement. One cause of scar formation and recurrence is because of lack of skin elasticity around the affected joints due to tension in the flap edges and tips. Although many surgeons are aware of the consequences of the closure of skin edges with tension, they close the Z-plasty with tension causing necrosis of tissue with resultant scar formation and recurrence of contractures. The study was aimed to observe the efficacy, functional improvement, and cosmetics in patients who were operated on with Z-plasty plus skin grafting.

METHODS

This prospective multi-hospital study was conducted at the 250 Bed Sadar Hospital, Sunamganj, and other private clinics in Sunamganj district during the period from 2008 to 2020. A total of 30 patients with mild to severe flexion contractures of elbow, knee, and MCP and IP joints who were operated on in the study hospital were included in the study. The severity of contracture was evaluated by extension loss, burnt

area percentage around the joint, scar thickness, contracture width, and uncircumferential scar. Informed consent was obtained from the participants or their guardians, and ethical approval was obtained from the ethical review committee of the study hospital. All patients were investigated thoroughly for fitness of operation. Appropriate antibiotics were prescribed for those who had an infection of operation sites. Pre-operative anemia was corrected by hematinics +/- blood transfusion. All surgeries were carried out under regional anesthesia-sub arachnoid block for contractures of the knee and brachial plexus block for upper limbs. Prophylactic antibiotics were given intravenously just before starting the operation. In all cases, elliptical incisions were made along the long axis of contractors and fibrous scars were removed (escharotomy), then this incision was converted into a Z-shaped incision by extending incision from both ends of the initial longitudinal incision on alternate medial and lateral sides having an angle of 60 degrees with an initial incision. Length of extensions on alternate sides must be equal to the length of longitudinal incision-any inequality in the length of 3 limbs of Z will result in a dog ear during suturing-correction which needs an additional extension of incisions to the appropriate side. Then skin flaps with adequate soft-tissue were elevated from deep tissue preserving neurovascular supply. After that, the flaps were turned and stitched without tension using 4-0 proline sutures giving a shape of Z. To avoid tensionless suture partial thickness skin drafts were taken from the front of either thigh (donor site) and sutured between flaps of Z (recipient site) (Figure-1)



Figure 1: a) Z-Plasty b) Z-Plasty with skin grafting

After completing the suture the wounds were covered with sofratulle and wet gauze and cotton and covered by another layer of dry gauze and cotton and finally wrapped with a sterile roll bandage. The operated site was immobilized in a tension-free position. The donor site was dressed in plenty of cotton wool with adequate pressure to ensure hemostasis. All patients were followed up daily and dressings were

changed after 7 days and both donor and recipient sites were examined for hematoma, seroma, wound infection, necrosis of margins of grafts and total rejection of graft, pressure necrosis of sutures due to tight stitching, and scar formation (pigmentation, firmness and elevated wound borders)

Inclusion Criteria

- Non-circumferential scar-involving less than 75% of the circumference.
- Flexion and extension lag of more than 30%.
- No joint ossification is evident by clinical and radiological examination.

Exclusion Criteria

- Being younger than 5 years and older than 70 years
- Taking steroids and chemotherapies and anti-coagulants e.g. aspirin
- Having joint ossification
- Having infection of operative sites
- Having suspected malignant transformation of burn scar i.e. curling's ulcer
- Having co-morbid illnesses e.g. uncontrolled D.M., HTN, uremia, cardiovascular disease
- Having PVD e.g. atherosclerosis and Buerger's disease

RESULTS

In this study, 30 patients of different ages, sex, and sites were enrolled and operated by Z-plasty with skin grafting. All patients were admitted into the hospital/clinic until full recovery and got equal care-IV fluid for nutrition for initial 24hours, injectable antibiotics, analgesics, and anti-ulcerates were prescribed for the first POD. Oral feeding was started from the 2nd POD along with oral medications (antibiotics, analgesics, and anti ulcerants). Several patients developed post-operative complications like pyrexia, vomiting, severe pain at operation sites, and early wetting of bandages which were managed accordingly i.e. antipyretics for fever, antiemetics for vomiting, more powerful analgesics and sedatives for severe pain, early change of dressing, culture of wound swab and antibiotic sensitivity and change of antibiotics in the necessary state.

Table 1: Age distribution of patients

Age in years	<10	10-20	20-30	30-40	40-50	50-60	>60
Number of patients	10	6	4	2	4	3	1
Percentage	33%	19.98%	13.32%	6.66%	13.32%	10%	3.33%

Table 2: Sex distribution of patients

Sex	Number of patients	Percentage
Male	18	60%
Female	12	40%

Table 3: Joint involvement

Joints involved	Number of patients	Percentage
Elbow joint	16	53.33%
Knee joint	4	13.33%
MCP and ICP joint	10	33.33%

Table 4: Complications after Surgery

Type of complication	Number of patients	Percentage
Fever	12	40%
Wound infection-donor sites	10	33.33%
Wound infection-recipient sites	15	50%
Flap tip necrosis	5	16.66%
Hypertrophic scar/keloid	12	40%
Recurrent contracture	12	40%
Reduction of joint function	3	10%

Fever within 48 post-operative hours was managed by simple antipyretics without changing antibiotics. Fever after 48 hours signifies post-operative wound infection and was managed by changing to a higher group of antibiotics. Cases of wound infection (fowl smelling dressing +/- fever) were managed by changing antibiotics according to results of culture and sensitivity of wound swab and frequent change of dressing and observing strict aseptic procedure. The hypertrophied scar was managed by pressure bandage and local steroids in absence of infection-either topical

or intralesional. Recurrent contractures were kept under observation and physiotherapy was advised to restore mobility of joints-some of which needed revision surgery along with those severe contractures which could not be corrected fully by single-stage operation.

DISCUSSION

Although z-plasty was combined with skin-grafting in this study, flap-tip necrosis could not be fully avoided because post-burn contracture tissues are tough

with less vascularity and elasticity compared to normal skin and have a potential to be ischaemic and necrotic. In my present study, 5 cases (16.66%) suffered from this complication which resulted in longer healing time and recurrent fibrosis. This was similar to the results obtained by Chen and colleagues [3]. Reduction of joint function was observed in 3 patients (10%) which were lower compared to the results obtained by Wei and colleagues [4]. High tension wound closure and flaps made from old burn scar tissue result in flap tip necrosis and consequent local infection leading to scar, discomfort, and tightness in the long run. Foyatier and colleagues [5] used flaps with full-thickness skin for burn treatment. Grishkevich applied the skin flap technique in the thoracic and axillary areas in patients with scars tightly encircling or surrounding the joints with large flexion contractures and reported acceptable results [6]. In severe burn injuries with joint capsule involvement island flap, pedicle flap and the free flap can be used. Gachie and Casolie [7] used orthopedic treatment to rectify joint contracture where only skin flaps and grafts were used. Ezoë and colleagues reported venous congestion as the main cause of graft failure (8). Uygur and colleagues used V-Y flaps and Rhomboid flaps while we used rotational flaps for contracture treatment [9]. Anticubital contractures may be mild, moderate, or severe. Release or excision of mild contracture may be feasible, but in advanced contractures release of contracture will result in soft tissue deficits that are too large for primary closure; in which case skin grafts can be used to resurface wound gaps between flaps. Later are generally repaired using simple or modified Z-plasty or a transpositional flap technique [10]. Doing Z-plasty combined with grafts prevents secondary surgeries in most cases. In moderate antecubital and popliteal contractures, large soft tissue defects appear after releasing the scar that crosses the joint or exposes vital structures which are managed by a variety of local adipofascial flaps and regional flaps that recruit uninjured tissues from the upper arm and forearm [11]. Local fasciocutaneous flaps become the mainstay for elbow reconstruction and provide supple skin, but they can result in an unhealthy donor site and occasional sacrifice of either the radial or ulnar artery [12]. Perhaps the most essential surgery in post-burn contracture is the Z-plasty, although in burn cases it has a high risk of flap tip necrosis. This can be avoided by using partial Z-plasty with a 90-degree angle. In our study, we used Z-plasty (60-degree angle) and skin grafts for antecubital and popliteal contracture covering these two areas, because, in case of large flap donor site morbidity, the occasional sacrifice of radial and ulnar arteries and recurrence of scar contracture may occur. Our findings showed better results with Z-plasty plus skin grafting than where large flaps are used alone. After rotation of flaps of Z-plasty, elliptical gaps appear between the flaps which are covered with partial-thickness skin grafts which are stitched with limbs of "Z" (Figure-1). Late postoperative results are very

much satisfactory and amazing in respect of functional and cosmetic and preventing recurrent contractures.

Limitations of the study

The sample size of the study was very small. So, the finding may not be reflected the whole scenarios.

CONCLUSION

There are various techniques to release post-burn contractures which should be individualized depending on the severity of contracture, scar thickness and width, and availability of donor skin areas. Although many surgeons do Z-plasty and repair skin under tension, some cases result in failure, as the burn scar tissue lack elasticity and vascularity compared to normal skin. This problem can be avoided to a greater extent by Z-plasty without tension combined with skin grafts. Efforts of correction of severe contracture in a single stage are sure to fail-staged procedure i.e. z-plasty in several sittings at the interval of 4 to 6 months produces better results.

Funding: No funding sources

Conflict of Interest: None declared

Ethical Approval: The study was approved by the Institutional Ethics Committee

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