

# Surgical Modalities for Post Burn First Web Space Contracture Reconstruction

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**Abstract:** **Background:** For plastic and reconstructive surgeons, soft tissue reconstruction of the first web space remains a challenge. Hand burns frequently result in first web space adduction contractures. Many reconstructive techniques are employed, and research into more effective techniques is ongoing. **Objective:** To assess the outcome of various methods for covering the defect after the release of the first web space post burn contracture. **Materials and Methods:** 24 patients with ages ranging from 4 to 55 years; 17 males and 7 females were admitted to our hospital during the period from June 2020 to May 2022. All patients were suffering from post - burn first web space contractures. The patients underwent a variety of surgical procedures. **Results:** Full range of motion achieved in most patients using skin grafting followed by 5 - flap Z plasty. **Conclusions:** Surgical correction of first web space contractures in the form of flaps, followed by skin grafts, has resulted in significant functional improvement in our experience. The severity of the contracture determines the outcome. In our experience, functionally limiting recontracture is uncommon, and it is best avoided with appropriate therapy.

**Keywords:** Contracture; Skin Grafting; 5 - flap Z Plasty; First web space reconstruction; Post Burn

## 1. Introduction

Despite the superior treatment presently accessible, the early beginning of physiotherapy techniques, and the early surgical treatment of extensive burns, first web contracture after deep hand burns is nevertheless common [1]. Scars and contractures around joints were prevalent after severe burns, and they restricted movement [2]. Deep heat burns caused skin and soft tissue damage, resulting in adduction contracture. It was caused by a burn contracture of the web space or by the thumb being held in an adducted and extended position for an extended period of time, shortening the adductor pollicis [3].

To release the contractures and reinstate the full range of motion, reconstructive surgeries were frequently required [2].

Many techniques for managing web space local flaps have been described, including Z - plasty, Y-V plasty and their variants, four - flap and five - flap techniques; first dorsal metacarpal flap, posterior interosseous forearm flap, reversed flow radial forearm flaps or reversed ulnar forearm flaps, microsurgical anterolateral thigh flap, and skeletal traction [4].

## Patients and Methods

There are 24 patients in this study. Their ages ranged from 4 to 55 years old, and they were admitted to our hospital between June 2020 and May 2022, with 17 males (70.8%) and 7 girls (29.2%) suffering from post - burn contracture of the first web area. At another institution, 40% of the patients were operated on for contracture relief. 20 cases of unilateral hand contracture (83.3%) and four of bilateral hand contracture (16.7%) were among the 28 cases of initial web

contracture in our patients (as in Table 1). The procedures for bilateral issues were not performed at the same time).

Smoking history, diabetes mellitus, and vascular disease were all documented, as was an X - ray examination of the underlying bony framework.

**Preoperative evaluation:** Inclusion criterias: The deformity was examined anatomically, as well as the underlying structures and the condition of the surrounding tissues. Opposition, palmar abduction, and thumb extension range of motion are all assessed. The depth of web space was also evaluated.

**Laboratory investigations:** All patients had a complete blood picture, partial prothrombin time, and thromboplastin concentration time. Renal function tests, liver function tests, blood sugar level tests, and ECG were performed on patients over the age of forty.

Patients' written consent was obtained prior to surgery after they were informed of the benefits and potential side effects of the procedure.

Preoperative broad spectrum antibiotics in the form of Cefotaxime in divided doses of 50 - 180 mg/kg and Sulbactam/Ampicillin in divided doses of 150 mg/kg were given IV 2 hours prior to surgery. All procedures were carried out under general anesthesia. The patient's position on the table had been predetermined. The operation was

carried out with the aid of a tourniquet. All patients had the soft tissue component of their contractures released, usually by incision in the case of palmar contractures and excision of contracted scar tissue in the case of dorsal contractures.

The patients were divided into groups based on how they covered the defect after complete release of the contractures, which was determined by the condition of the skin around the defect, adductor muscle contracture, fibrosis, or joint exposure after release. In our study we used modalities such as split skin grafting, five flap z plasty, and pedicled groin flap.

*Postoperative care:* The dressing had to be comfortable, well - padded, and not too tight; the limb had to be elevated slightly above the level of the heart if the defect was covered with skin graft or z - plasty; and the flap had to be monitored (color, capillary refilling, and temperature of the flap) if the defect was covered with groin flap.

*Rehabilitation:* Splinting and positioning, supervised motion, and the use of pressure garments and dressings were the available options. We started full active motion with therapy after 2–3 weeks, regardless of the reconstructive procedure performed after FTSG, as soon as the graft showed good results. This is not done in the case of a groin flap covering the defect. In the event that the defect was covered with a groin flap, the patients were not allowed to walk for two weeks. Defatting of bulky tissue was postponed for at least six months.

16 dorsal (Photo 1 - a) and 2 palmar edge contracture; medial adduction contracture (2 cases) and total burn contracture (8 cases).

5 - flap Z plasty or dorsal transposition flap (10 cases) accounted for 35.7 percent of the cases in the study, with tip necrosis in two cases healed by secondary intention, flap sloughing in one case, and skin graft coverage in another (Table 1).

The defects covered by skin grafts (12 cases) account for 42.8 percent of the defects in the study, covered by split thickness skin grafts (Table 1).

Pedicled groin flap and defatting of the flap after at least 6 months' interval (6 cases) were used to bridge the defect, accounting for 21.5 percent of the cases in the study (Table 1).

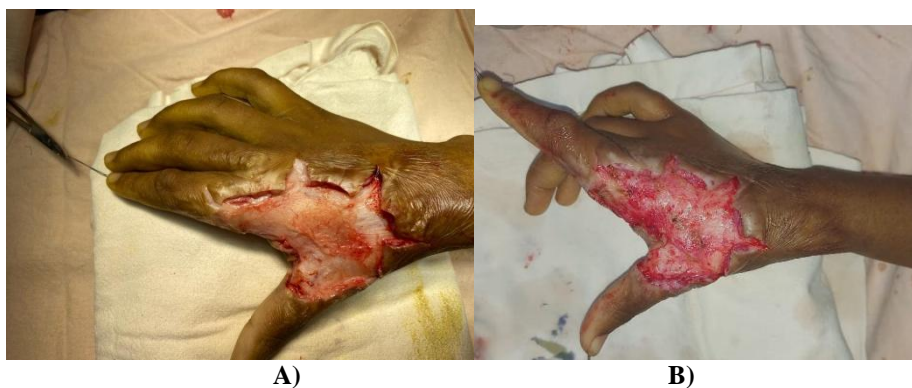
The outcome measuring the web's depth was improved. In the majority of cases, range of motion in palmar abduction (Photo 2 - a) and thumb extension abduction (Photo 2 - b) was improved. In most cases, the range of opposition was also improved.

## 2. Results

### Case 1



Photo 1: Pre - Operative: A) Dorsal view B) Palmar view





C)

Photo 2: Intra - Operative: A) On contracture release B) Thumb in full abduction C) Split thickness graft application

**Case 2**



A)

B)

Photo 3: Pre - Operative: A) Left hand first web space edge contracture B) 5 - flap Z plasty planned



A)

B)

Photo 4: Intra - Operative: A) Raising of flap B) Post complete release and inset of flap

**Case 3**



Photo 5: Pre - Operative: A) First web space contracture palmar view B) First web space contracture lateral view

Intra - Operative: C) Release of palmar contracture with skin graft application



**Table 1:** Overview of surgical modalities used for 28 Reconstructed Hands with post burn first web space contractures

No	sex	Age	Etiology	Anatomical position of the scar	Method of reconstruction	Complications
1	male	43	Thermal Burn	Right Edge Dorsal	Skin Grafting	none
2	male	11	Thermal Burn	Right Edge Dorsal	Skin Grafting	none
3	female	55	Thermal Burn	Left Edge Dorsal	5 Z - Plasty	Tip necrosis
4	male	30	Flame Burn	Right total Dorsal	Skin Grafting	none
5	female	22	Thermal Burn	Bilateral total burn	Groin flaps	none
6	male	9	Thermal Burn	Right Edge Dorsal	Skin Grafting	none
7	male	4	Flame Burn	Left Edge Dorsal	Skin Grafting	none
8	male	45	Thermal Burn	Right Edge Dorsal	5 Z - Plasty	none
9	female	11	Thermal Burn	Right Edge Dorsal	Skin Grafting	none
10	female	19	Flame Burn	Right total burn	Skin Grafting	none
11	male	25	Thermal Burn	Right Edge Dorsal	5 Z - Plasty	none
12	male	36	Thermal Burn	Right total burn	Groin flap	none
13	male	45	Flame Burn	Right Edge Dorsal	5 Z - Plasty	none
14	male	52	Thermal Burn	Left Edge Dorsal	Skin Grafting	Partial take
15	male	19	Thermal Burn	Right Edge Dorsal	Skin Grafting	none
16	female	12	Flame Burn	Left total burn	Skin Grafting	none
17	male	34	Thermal Burn	Right Edge Dorsal	5 Z - Plasty	Sloughing of flaps
18	male	29	Thermal Burn	Left Edge Dorsal	5 Z - Plasty	none
19	male	19	Thermal Burn	Right Edge Dorsal	Skin Grafting	none
20	male	16	Thermal Burn	Left total burn	Groin flap	none
21	female	23	Thermal Burn	Right edge dorsal	Skin Grafting	none
22	male	39	Thermal Burn	Left Edge Dorsal	5 Z - Plasty	none
23	female	48	Thermal Burn	Right edge dorsal	5 Z - Plasty	none
24	male	37	Flame Burn	Bilateral total burn	Groin flaps	none

### 3. Discussion

Soft tissue reconstruction of the first web space remained a challenge for plastic and reconstructive surgeons. Skin defects of the first web space created after the release of post - burn contractures could be covered by skin graft, fascial Pedicled flaps, distant flaps, or free flaps, depending on the patient's general condition and the conditions of the local wound and donor site [5].

In our study dorsal commissural contracture was (57.1% of the total number); palmar (7.1%), and total contracture (35%) but edge contractures in the study done by Grishkevich, [6] dorsal commissural contracture was (82% of the total number); palmar, (11%), and total contracture, (7%).

Split skin grafting is obligatory used in certain cases especially in pediatric patients. [7] Advantages with this relatively simple method include the ability to release multiple joints at the same sitting. But disadvantages of skin grafting hypertrophic scar, contracture of graft lead to recurrence that require re - release, partial take, the patient would require physiotherapy and splintage to maintain joint motion after release and donor site morbidity [8]. In our study, there were two cases partial take from seven cases but Rawat, et al [7] had partial graft loss in two patients from 16 patients which were treated with split thickness skin grafts.

Several local flaps were used to reconstruct the resultant defects of the web space. However, local flaps might remain inadequate for reconstruction, when defects were extremely large or deep with exposed bones, tendons or vessels such as electrical burns [9].

Although more recently developed local fasciocutaneous and free flaps had overshadowed the use of Pedicled flaps,

Pedicled flaps continued to have an important place in the reconstructive first web space surgery [10].

In our study there were two cases showing tip necrosis and one case sloughed but in series of Gumus and Yilmaz (17), there was no necrosis appeared in the z plasty flaps and all flaps had survived totally. Gumus and Yilmaz [11]. avoided any elevation of flaps for the movement so its blood supply did not compromise, making the flaps safer so avoiding tip necrosis of z plasty flaps. On the other hand, Rawat, et al [7]. elevated z - flaps tip necrosis seen in one patient, which healed secondarily with minimal scarring, and without recontracture.

The groin flap's drawbacks were that it is thick and needs prolonged immobilization until separation. Our results were consistent with those of Koshima et al., [12]. who performed a groin flap in the coverage of 65 patients with post - burn deformed dorsum of the hand.

However, in our study release and grafting along with splintage remained the most common surgical modality which is also a time proven method. Flap coverage had the advantage of preventing re - contracture, chances of which were higher in cases operated with release and split thickness skin graft.

### 4. Conclusion

Surgical correction of first web space contractures, in our experience, resulted in significant functional improvement. The severity of the contracture determined the outcome. In our experience, functionally limiting recontracture is uncommon, and it is best avoided with appropriate therapy.

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