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## Case Report

# Distraction assisted management of post burn contracture of hand

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## ABSTRACT

Burns are one of the injuries that causes significant morbidity and reduced quality of life. Despite making up only 3% of the body's surface area, hands are involved in more than 80% of serious burns. Scarring, joint contractures and stiffness are devastating in the upper extremity due to its dependence. In this article, we have used Distraction assisted management is one of the methods for the management of finger webspace contracture release. In this case, we will be using a JESS distractor in the management of web space contracture in the upper extremity.

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## 1. Introduction

Burns are one of the injuries that causes significant morbidity and reduced quality of life.<sup>1</sup> Across the globe more than 18 million people suffer from the sequelae of hand burns. Even if the primary healing is successful, deformity of the hand following burns is the most common cause of skin contracture involving the hand. The factors that contribute to hand deformities involve persistent edema, wound infection, poor positioning, prolonged immobilization, and delayed or inadequate skin coverage.<sup>2</sup> The hand is the most common site for contractures, constituting up to 72% of all contractures. Between 20% and 50% of those with hand burns will demonstrate diminished function and 5% may not be able to perform the activities of daily living. The hand deformities in those who have deeper and long-standing burns not only involves skin contracture but also involve tendon, muscle, and ligament shortening. Among the various treatment

modalities for post-burn contractures like grafting, local or regional flap we have adopted Joshi External Distraction System for soft tissue distraction.

## 2. Case Report

This study was conducted in the Tertiary Care Centre in the Department of Plastic Surgery after getting the department's ethical committee approval. Informed consent was obtained. The subject was a 9-year-old male child who had an accidental scald burn injury of his left upper limb at 2 years of his age. Following this he had left hand middle finger and 3<sup>rd</sup> web space contracture. He underwent contracture release and split skin grafting of left middle finger at 2 years (Figure 1). Now he presents with complaints of inability to move his left middle and ring finger for the past 6 years. Preoperatively the angle between the left middle and ring finger was measured using a goniometer (32<sup>o</sup>) and compared with the normal side (47<sup>o</sup>) (Figure 2). A deficiency of 15<sup>o</sup> was noted in the left side. With informed consent, he underwent horizontal

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uniplanar JESS external fixation (Figure 3). K wires were placed over the proximal phalanx of the middle and ring finger. Distraction was maintained for the next 3 weeks. Meanwhile, he underwent physiotherapy for the other fingers. Post-procedural interdigital angle was noted ( $52^{\circ}$ ) with a gain of  $5^{\circ}$  (Figure 4). Platelet-rich plasma was given at the web space. Postoperatively web spacer static splint was applied to maintain the angle (Figure 5). Postoperatively hand x-ray taken to rule out subluxations or dislocations.



**Figure 1:** Contracture at the left 3<sup>rd</sup> and 4<sup>th</sup> finger and 3<sup>rd</sup> web space at the time of admission



**Figure 2:** Preoperative webspace angle of  $32^{\circ}$  noted



**Figure 3:** Distraction applied using JESS external fixator



**Figure 4:** Post distraction



**Figure 5:** Post operatively self-retaining static splint applied to web space

### 3. Results

Intraoperative and post-operative periods were uneventful for the patient. Post-procedural gain in the webspace angle was noted. Post-procedural interdigital angle was noted ( $52^{\circ}$ ) with a gain of  $5^{\circ}$ . No complications or side effects were noted.

### 4. Discussion

The web space helps with hand movements such as finger abduction, adduction, as well as finger flexion and extension at the metacarpophalangeal joint. Normal web spaces are rectangular with an angle of  $45^{\circ}$  in the distal direction to the palmar direction. The arc of the second to fourth web forms a circle.

Blood supply to the web space is from branches of the dorsal and volar digital arteries.<sup>3–5</sup> Sensation is via the dorsal radial sensory and ulnar sensory branches. The volar innervation of the nets is branched from the common digital nerves, which are the terminations of the median and ulnar nerves. The first web space is mainly by the median nerve and also contributions from the dorsal radial sensory nerve.

The palmar aponeurosis consists of the longitudinal fibers of Legue and Juvar in the distal direction, which bifurcate in the proximal extent of the fingers and merge with the tendon sheaths and tissues around the metacarpophalangeal joints volarly and dorsally. They are the endings of the deep fibers of the palmar fascia. Abduction of the finger is limited by the transverse subcutaneous band of Bourguery, which is part of the natatory ligament. This forms the distal extent of the fabric, and its arcuate fibers form the arches between the fingers. These fibers form the volar digital septum of Grayson and the dorsal digital septum of Cleland.

Post burn contractures affect the arachnoid spaces and lead to major functional and aesthetic deformities. Web contractures are classified according to whether they involve the dorsal web, palmar web, or interdigital space, called burn syndactyly.<sup>6</sup> Depending on the maturity of the scar tissues, they can again be classified as dynamic or static contractures. Subsequently, burn contractures of the arachnoid spaces limit abduction and independent flexion and extension of the fingers. They can also lead to an inversion of the web space with a bad aesthetic appearance. These contractures affect the normal  $45^{\circ}$  back slope and palm-to-finger ratio. Contractures of the web of the index and thumb may involve only the skin, and in chronic conditions may involve fibrosis and shortening of the adductor pollicis muscle.<sup>7</sup> In severe and chronic cases, along with soft tissue contractures underlying bony abnormalities, they also occur.

The external fixator, which works on the principle of ligamentotaxis is an effective and useful device for fixation especially in intraarticular, displaced comminuted fracture and open fracture, where we have to deal with both bony and

soft tissue injury.<sup>8</sup> The Joshi External Stabilizing System (JESS) is a versatile, lightweight external fixator consisting of K wires, distractors, connecting rods (hinged and non-hinged), and various link joints. JESS is a dynamic system that allows the lengthening of the contracted tissues via slow distraction, causing minimal surgical insult.

In this patient, the insult happened when he was 2 years of age and complaints of disability for the past 7 years, so not only the contracture of skin but also the contracture of tendons and ligaments has occurred. In such case, releasing of contractures of skin, tendon and ligaments along with reconstruction with flap is required. Since flap uptake is variable in this site, distraction using external fixator was performed. This leads to sustained stretching of skin, tendons and ligaments through which desirable amount of distraction can be achieved. The disadvantages are osteomyelitis, secondary fracture, and osteoporosis secondary to immobilization. Careful intraoperative and post-operative monitoring was done.

### 5. Conclusion

JESS external fixator helps in achieving adequate distraction in management of post-burn contracture in hand. It can be used as an alternative for hand contracture management where initial treatment modalities like graft, and flap are failed, however, it requires prolonged time.

### 6. Source of Funding

None.

### 7. Conflict of Interest

None.

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