International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Our Experience with the Use of Joshi External Stabilization System (JESS) in the Management of Post-Burn Contractures of the Hand

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Abstract: ***Contractures are frequently seen complication of flame as well as electric burns. Once contracture develops it is seldom manageable non-operatively. A variety of options are available for the management of post-burn contractures including Z-plasty, skin grafts, local flaps, regional flaps, distant flaps, free flaps, and cross-limb flaps. Immobilization in the post-operative period followed by physiotherapy and splintage is essential for function recovery. The Joshi External Stabilization System is a fixation system consisting of K wires, distractors and connecting rods. Here we present a series of thirty cases of post-burn contractures with release and split skin grafts followed by application of a JESS fixator.***

Keywords: Joshi External stabilisation system , Post Burn contracture

1. Introduction

Burns are the most common cause of skin contracture in the hand[1]. Several functionally limiting sequels can follow deep thermal injury to the hand[2]. Infants rolling into unprotected fires or explosions of poorly made stoves are the most common causes of these burns in developing countries. Failure to seek medical help, inadequate medical care and inadequate post-healing care are common causes of burn contractures [3]. The thin, highly mobile dorsal skin, the sensory-enriched palmar skin and the delicately balanced musculotendinous systems are all at risk with a hand burn[4]. Post burn contractures are commonly seen sequelae of burn injuries to the hand[1] and can range from finger contractures to metacarpophalangeal joint and wrist contractures Post burn scarring and contractures affect the function as well as aesthetic appearance of hand and remain most frustrating complication of a hand burn[11]. If contractures or scarring affect the dominant hand, as they do on most occasions, the vocation and there by the economic status of the patient suffer. Appropriate choice of procedures and timing of surgery followed by supervised physiotherapy can be a boon for a burns survivor[12]. Although at initial presentation only skin is involved with time the soft tissue is also involved leading to the need for capsulotomies and tendon lengthening procedures. A variety of therapeutic methods such as skin grafting, z-plasties, local flaps, regional flaps, island flaps, free flaps have been reported for treatment of post burn hand deformities. Each technique has its advantages and drawbacks.. Even so recurrence of contracture is a common complication. The Joshi external stabilization system is a dynamic system constructed using consisting of K wires, distractors, and connecting rods (both hinged and nonhinged) along with various link joints[2] and can be used as an external fixator. It can be used for gradual distraction of joints with less surgical invasion as compared to an Illizarov fixator. Here we present a series of 30 cases of post burn contractures which were managed by release and split skin graft with the application of JESS.

2. Materials & Methods

We conducted a retrospective anlaysis of 30 old post burn cases with history of burn ranging from 3 months to 12 years back who presented to us from November 2013 to December 2015. Only patients with hand contractures which were classified as Grade III and Grade IV according toMcCauley's severity grade[3], were included in the study. The age of the patients ranged from 12 years to 42 years. There were 13 cases of flame burn and the rest were as a result of electric burn injuries. 7 had contractures limited to the interphalangeal joints, 2 patients had isolated injury of the first metacarpophalangeal joint and the rest of the cases had contractures at multiple joints with four patients presenting with contractures at the wrist joint in addition to the interphalangeal and metacarpophalangeal joints. All patients were managed by release of contractures and a split skin graft which was followed by the application of an appropriately placed JESS fixator. The fixator was kept in place for a period of four to six weeks which was followed by hand physiotherapy and splintage with regular follow up. Functional outcome was evaluated by measuring the range of motion in affected joints findings and scaled as good if there was improvement of more than 75% of normal range for that joint. It was graded poor if improvement is less than 50% of normal range. In between these two was graded average recovery.

Figure 1: Contracture in middle finger

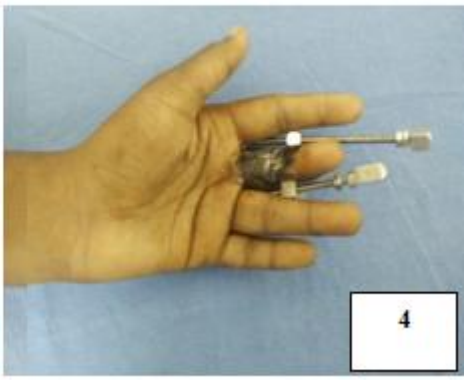
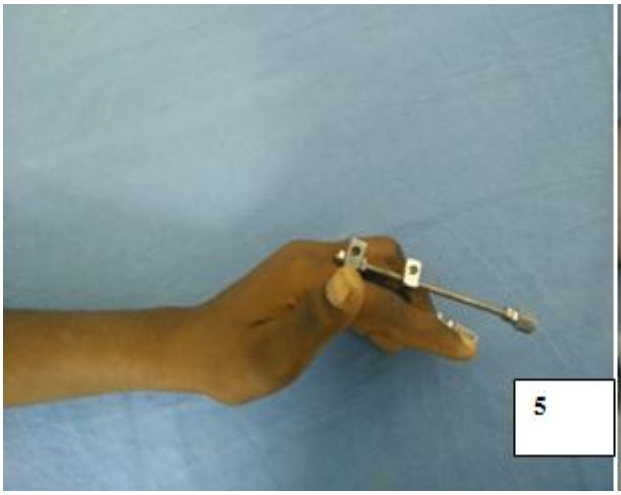


Figure 2, 3, 4: JESS Construct in finger contracture

3. Results

Of the 30 cased operated 21(70%) patients had good functional outcome and 6(20%) had average outcome. The outcome was poor in 2(6.67%) patients inspite of physiotherapy and splintage. One (3.33%) patient had a partial loss of graft and had to be reoperated. The contracture recurred in twelve(40%) cases, five with good outcome, four with average outcome and three with poor outcome and a second surgery was needed in these cases as well.



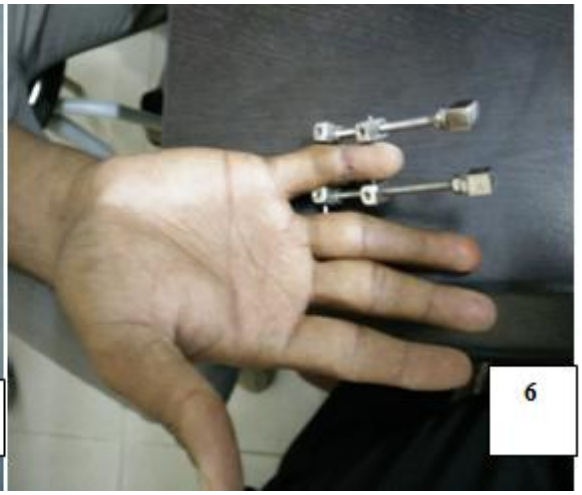


Figure 5 &6: JESS construct

Figure 7: Post JESS Result

4. Discussion

The surface area of the hand is less than 5% of the total body surface area[6] but any limitation in hand movement can be severly crippling and represents a major functional impairment[7]. Post burn contractures are extremely common[2] and once contracture has developed there is little non surgical treatment for reversal of the process. According to Kucan and Bash stress well-described reconstructive ladder should be followed, with the choice of treatment being the simplest method that will correct the defect[9]. The relevant reconstructive methods are Z-plasty, skin grafts, local flaps, regional flaps, distant flaps, free flaps, and cross-limb flaps with complexity increasing from the first to the last. In our study we included only those cases which were managed by a contracture release and split skin grafting.

Contracture release was performed using a fish mouth incision[5]. Pensler et al., compared full thickness skin grafts with split thickness skin grafts for reconstructing the palms of 25 children with follow up between 3 and 9 years duration[10]. Their results showed that 1.2 operations per hand were required for the split thickness graft group and 1.3 per hand for the full thickness group. Since there was no significant difference in the reoperation rates between full thickness and split skin grafts we used split skin grafts because of better uptake. Our series had only one partial rejection of the graft.

In the present study 90% cases had good or average outcome which is comparable to other studies with the application of an external fixator. The reoperation rate of 40% is also comparable to studies involving release of contracture and split skin grafting.

Also, the Joshi's External Stabilisation System frame is ideally suited for the fractures and mangled hand. This JESS external fixation technique represents a viable option in the management of open intercondyler fractures of the distal humerus. External fixation is indicated in comminution, bone loss, associated soft tissue injury or loss, infected non-union. Advantages being it preserves length, allows access to bone, soft tissue, percutaneous insertion, direct manipulation of fracture is avoided. Intramedullary devices are used for transverse and short oblique fractures. It does not require special equipment, it is easy to insert and requires minimal dissection, and disadvantages are rod migration and rotational instability.

5. Conclusion

In conclusion, contracture release and split skin grafting followed by application of appropriate external fixator using JESS has comparable results to the same followed by a conventional fixator. The use of JESS however is technically simpler and economically feasible even at peripheral centres. Therefore, the use of SSG followed by JESS fixator can be used as a method for correction of post-burn contractures. The role of splintage and physiotherapy however is paramount in the success of the procedure.

Table 1: Classification of burn contractures based on McCauley's severity grade

McCauley's grade	*Number of hands*	*Percentage (%)*
Grade III A	16	53.33
Grade IIIB	2	6.66
Grade IIIC	1	3.33
Grade IVA	5	16.67
Grade IVB	3	10
Grade IVC	3	10
Total	30	100

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