ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 02 | February - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

SUZUKI FRAME APPLICATION IN PROXIMAL INTERPHALANGEAL JOINT FRACTURES

Orthopaedics

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ABSTRACT

In 1994, Suzuki et al proposed the pins-and-rubbers traction system, a new dynamic distraction technique for difficult complex intra-articular fractures of the digits of the hand. From February 1999 to April 2003, we used the Suzuki frame for 15 complex fractures of the proximal interphalangeal joint of the fingers. The mean follow-up period was 18 months. Four patients missed their follow-up. In the remaining 11 patients, the mean active range of motion achieved following treatment was 84° in the proximal interphalangeal joint finger injuries.

KEYWORDS

Suzuki frame, intra-articular digital fractures, fracture-dislocation PIP joint

INTRODUCTION

Complex fracture-dislocations or comminuted intra-articular fractures with joint surface misalignment are challenging hand injuries. The ideal combination of anatomic reduction and stable fixation of the fracture fragments, followed by early mobilization to prevent joint stiffness, is the ideal treatment. Suboptimal treatment of these injuries can lead to the difficult complications of joint stiffness, pain, and degenerative arthrosis. Of the many and varied treatment modalities available, those involving distraction-mobilization of the involved joint to maintain articular integrity through capsuloligamentotaxis (traction on capsular and periarticular soft tissues resulting in reduction of displaced fracture fragments) seem logical and relatively noninvasive. The early devices were often unwieldy and difficult to fabricate until Suzuki et al1 in 1994 described a new and compact skeletal traction system for comminuted intra-articular fractures and fracture-dislocations of the proximal interphalangeal joint (PIPJ) of the hand, the pins-and-rubbers traction system (PRTS).

MATERIALS AND METHODS

The study was conducted in bone and joint surgery hospital, Srinagar jammu and Kashmir.From January 2021 to december 2021, 06 patients in our unit had a Suzuki frame applied for complex finger fractures. . Of the remaining 06 patients, 4 had a comminuted PIPJ fracture and 2 a PIPJ fracture-dislocation. 3 of the fractures occurred playing cricket, 2 due to fall of heavy object, and 1 due to skip and fall . The most common injured finger was the middle finger (4 cases). The mean age was 30 years (range, 18 –52) and there were 5 men and 1 women. The mean time between injury and surgery was 1day. All operations were performed under digital-block anesthesia .External traction was applied for 4 weeks under the supervision of the hand therapists. The mean follow-up period was 06 months. Surgical

Technique:

The technique used for the application of the Suzuki frame was exactly as described by Suzuki et al in their original paper. A long 1.2-mm-diameter Kirschner wire is inserted transversely through the skeleton proximal to the fracture as close as possible to the axis of rotation of the involved joint. This is the "axial traction pin." A shorter thinner wire (eg, 0.9- or 1.0-mm diameter) is placed in the skeleton distal to the fracture. This is the "hook pin." The ends of both pins are bent into hooks , so that rubber bands can be applied on both sides of the finger to apply traction.

The strength of the elastic traction can be adjusted by the thickness and a number of the elastic bands used. All the wires must be parallel to the axis of the finger. The 2 K-wire device is suitable for comminuted fractures .For dorsal fracture-dislocations of the PIPJ of the fingers, a third type of pin, the "reduction pin" (0.9- or 1.0-mm diameter) is inserted through the base of the dorsally displaced middle phalanx. The 2 ends of this short pin are bent upwards so that this pin lies underneath the limbs of the axial traction pin, producing a palmar-directed force on the displaced fragment.

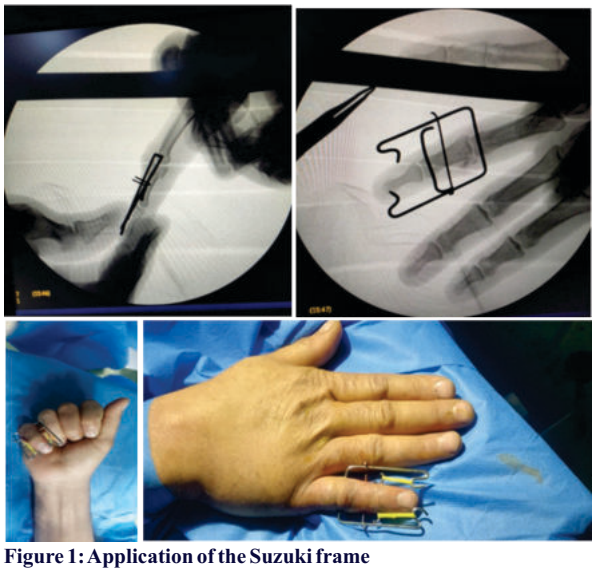

Figure 1: Application of the Suzuki frame

Postoperative Care

All Patients were discharged on the day of surgery . patients were advised about pin-site care before discharge. Patients were followed up clinically and radiologically every week for 4 weeks. "Overdistraction" was easily recognizable on x-ray and rectified by adjusting tension in the elastic bands. Active mobilization was started as soon as possible postoperatively. Patients underwent physiotherapy twice weekly for 4 weeks, at which point the device was removed (in the dressing clinic and without the need for anesthesia). Patients continued to receive physiotherapy every 2 weeks for an additional 4 – 6 weeks or until no further improvement was detected.

RESULTS

The final follow-up period was at 06 months. There was 1 case of pin site infection that was treated successfully with oral antibiotics, without removal of the frame. The device was tolerated by patients, without any major complaints. The mean total active range of motion was 84 degrees (range, 50 –105°). Radiologic evidence of post-traumatic osteoarthrosis was seen in one. All patients were pain-free except for one. All the other patients were happy with the functional results of the treatment with the Suzuki frame.

DISCUSSION

The treatment of complex intra-articular fractures affecting the hand remains controversial. This is possibly because there is no universally accepted method of treatment that can produce predictably good results in every case. Patients are understandably intolerant of an unsatisfactory result following treatment of their injury if they develop significant problems with pain and stiffness of their hands. Of the many different treatment modalities that have been suggested for these injuries, open reduction and internal fixation2 or distraction-mobilization would seem to be the most attractive options as both methods allow early mobilization, which usually prevents joint stiffness. However, open reduction and internal fixation is most successful in 2-part fractures without comminution and large fracture fragments (this is unusual, and most fractures are more comminuted than this). Even in ideal circumstances, the surgical dissection involved in fixing these fractures increases the tissue trauma load and may further increase any joint stiffness and functional Impairment resulting from the injury.3,4

Most of the other available techniques, such as a static splintage, dorsal extension block splintage and closed reduction with K wire fixation involve immobilizing the joint for a significant period of time. This is usually considered to be undesirable by most hand surgeons.

Nevertheless, early mobilization of a damaged joint is likely to promote osteochondral remodeling and reduce the formation of intra- and periarticular adhesions, reducing the incidence of stiffness and late joint contracture.8 In addition "traction" capsuloligamentotaxis also prevents collapse of fracture fragments and contractures of the collateral ligaments and volar plate, thus further reducing the risk of joint stiffness.3 Therefore, for complex intra-articular fractures involving the hand, distraction-mobilization using some form of external device would theoretically appear to be a better alternative to any therapeutic alternative that involves immobilization. Many different external dynamic splintage devices have been described, usually for the treatment of fracturedislocation and intra-articular fractures of the PIPJ of the finger. We used the Suzuki frame to treat comminuted intra-articular fractures and fracture-dislocations of the PIP joint of the fingers. The results are comparable with the results of other studies1, 3, 18, 19 (Table 2).

Table 2: Review of studies after the application of Suzuki frame

Studies	No. of cases	Mean follow-up (Months)	Mean active range of motion
Suzuki et al. 19941	5	13.1	80º
De Soras et al. 199718	11	9.7	84º
Duteille et al. 200319	13	18	85.9º
Majumder et al. 20033	13	20	74º
Present study	6	6	84º

In our study, we had a functional total mean range of PIPJ motion of 84.5 degrees. Closely looking the results, we see that the fracture-dislocation injuries have a better joint movement than the comminuted fractures, 95 degrees as opposed to 80 degrees.. one of our patients developed radiographic evidence of osteoarthritis but with no pain.

CONCLUSION

The Suzuki frame is a distraction-mobilization device that uses the principles of capsuloligamentotaxis and early mobilization to achieve articular realignment and healing. The device is capable of treating a wide range of complex intra-articular fractures involving the hand, including the interphalangeal joint (IPJ) fractures of the fingers and IPJ, metacarpophalangeal joint (MCPJ), and first carpometacarpal joint (CMCJ) fractures of the thumb.1,21 Most patients can be treated under local anesthesia.

Although pin-tract care is important, infection can be controlled with oral antibiotic therapy if it develops. The Suzuki frame is usually well tolerated, although we recommend covering the sharp end of the device with small squares of Elastoplast to prevent scratches or other injuries or problems dressing/undressing. Regular physiotherapy or occupational therapy supervision postoperatively is required to optimize the results and to identify and treat early problems such as joint contractures or infections.

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