Dynamic external fixator for unstable intra articular fractures of Proximal Interphalangeal Joint (PIP): "Suzuki " frame

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Abstract

Proximal Interphalangeal joints of finger fractures are quite common, and management plans for these injuries, either conservative or surgical, find it always challenging to achieve the full range of movements. Various surgical procedures achieve a good radiological outcome that do not always match clinical outcomes as they are prone for stiffness. Dynamic external fixator famously known as "Suzuki" frame provide a stable fixation but also maintains mobility of the joints from day one. We present our method of dynamic external fixator in a case of middle phalanx fracture.

Background

The PIP joint is critically dependent on non-osseous structures for its stability. The joint capsule is reinforced on the radial and ulnar sides by the collateral ligaments. On each side, the Proper Collateral Ligament [PCL] passes from a tubercle on the proximal phalangeal head to the middle phalangeal base. The Accessory Collateral Ligament [ACL] is volar to the PCL and attaches to the volar plate and the flexor sheath (Fig. 1). The Volar Plate [VP] is a fibrocartilaginous structure attached to the lip of the volar middle phalanx base, proximally held by the checkrein ligaments that attach to the periosteum and A2 pulley on either side. In addition, the central slip and flexor digitorum superficialis (FDS) insertion are also stabilizers of the PIP joint. The PCL, ACL, VP and the central slip collectively form a ligamentous box all around the PIP joint that affords stability in the dorso-palmar plane, the radio-ulnar plane and the rotational plane.

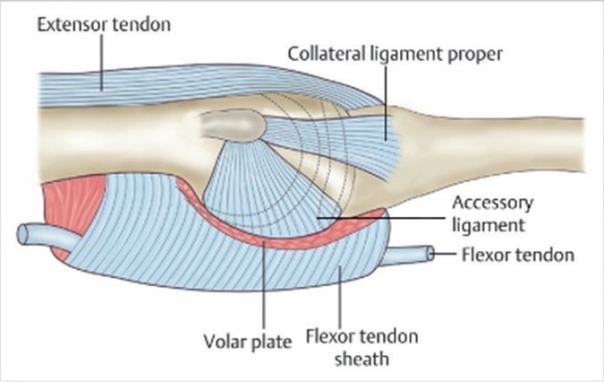

Fig. 1. Anatomy of PIP joint.

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 [1].

The goal of dynamic external fixation in PIP fracture dislocations would be to ensure joint reduction throughout a functional range of joint mobilization. As already mentioned, longitudinal traction along the finger counteracts the proximal pull of the central slip. The dorsal dislocating pull of the extensor is countered indirectly by ligamentotaxis, mostly by tension in the FDS insertion. Traction also brings the extensor and flexor systems closer to one another, which tends to hold the middle phalanx in place. Shortening of the collateral ligaments is also prevented by adequate traction.

Case Presentation

We present a case of 40-year-old gentleman with injury to his right hand, who had a fracture of base of middle phalanx of 5th finger (Fig. 2). Planned for a closed External Fixator application. Intraoperative reduction was checked under image intensifier (Fig. 3) and external fixator applied (Fig. 4). To produce a dynamic traction we needed good quality rubber band which holds on for at least 3-4 weeks, so we devised our own method of traction using foleys catheter cut pieces (Fig. 5) which were very sturdy and could impart enough traction as well. Post operatively patient was able to mobilise his finger except for the PIP joint. At 4 weeks radiograph showed union in progress and fixator was removed and mobilisation was started. At 10 weeks patient had recovered full range of movements and was pain free (Fig. 6).

Fig. 2. Pre op x ray intra articular fracture middle phalanx 5th finger.

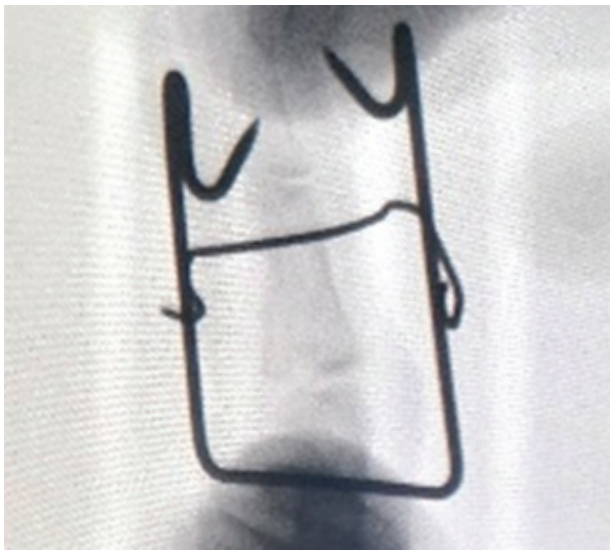

Fig. 3. Intra Op image showing fracture reduction after fixator application.

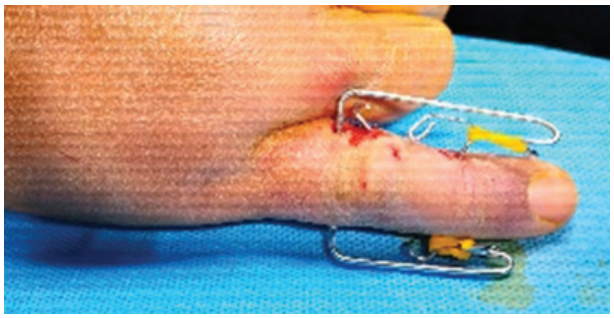

Fig. 4. Suzuki Frame.

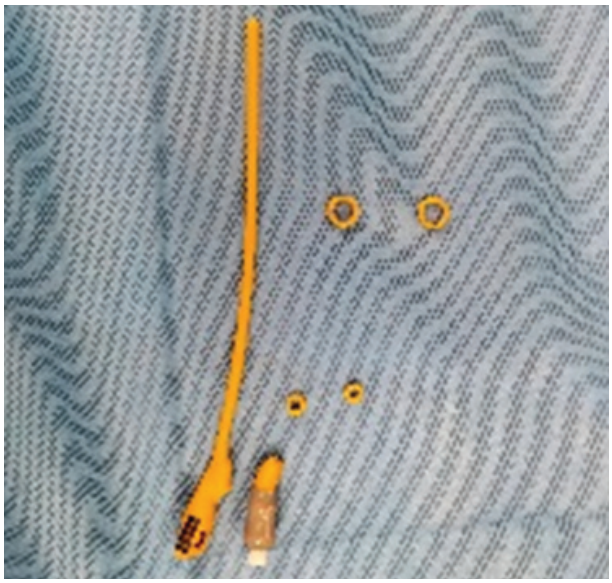

Fig. 5. Foleys catheter cut pieces used as Traction bands.

Fig. 6. 3 months post OP clinical picture.

Discussion

Swanson et al observed that fractures of the hand can be complicated by deformity, from no treatment, stiffness from over-treatment, and both deformity and stiffness from poor treatment [2]. The primary objectives of phalangeal fracture treatment are to restore anatomy, preserve function, minimize recovery time and expedite return to activity. The preferred treatment restores anatomy, minimizes soft tissue injury, and enables mobilization of the injured digit as soon as fracture stability permits. Phalangeal fractures lead to quite a lot of disability and loss of productivity [3].

Phalanx fractures are always tricky in terms of management, anatomic reduction can be achieved with open reduction manuvers but ends up in stiff joints. Closed reduction procedures seldom achieve anatomic reductions leading to malunion and stiffness. Dynamic external fixation technique is really a boon for phalanx fractures in addressing both issues of reduction and avoiding stiffness.

References

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[3] Van Onselen EB, et al. Prevalence and distribution of hand fractures. J Hand Surg Br. 2003;28.