Technical note

Distraction with external fixator for contractures of proximal interphalangeal joints

Good outcome in 10 cases

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ABSTRACT We present a new and simple technique for the treatment of proximal interphalangeal (PIP) joint contractures by mini Orthofix external fixator without open surgery. The technique was tested on 10 patients. We found that the fixator is easy to apply and effective in reducing contractures of the PIP joint by soft tissue distraction.

Contracture of the proximal interphalangeal (PIP) joint is a common complication following hand injuries, and is difficult to manage (Bain et al. 1998). The outcome of surgical release is discouraging (Foucher et al. 1993, Koller et al. 1996, Ghidella et al. 2002).

We have previously evaluated the effectiveness of compass PIP hinge external fixator in the management of chronic flexion contracture of the PIP joint without open surgery, with good results. However, the rate of complications including hardware failure was high (Houshian et al. 2002). We now report a new and simple technique for the treatment of stiff PIP joints, and present the outcome in 10 patients.

Surgical technique

A unilateral dynamic external fixation device is placed under fluoroscopic guidance and under local anesthesia (Figure 1). The proximal and distal block fixations are attached to the proximal and middle phalanges, respectively, using one 2-mm threaded Orthofix pin in each phalanx. The pins should be placed parallel to each other and at an equal distance to the centre of rotation in the head of the proximal phalanx (Figure 2). The block and lengthening bar should be placed volarly to gain extension (Figure 3), or applied dorsally to gain flexion. The fixator should be positioned far

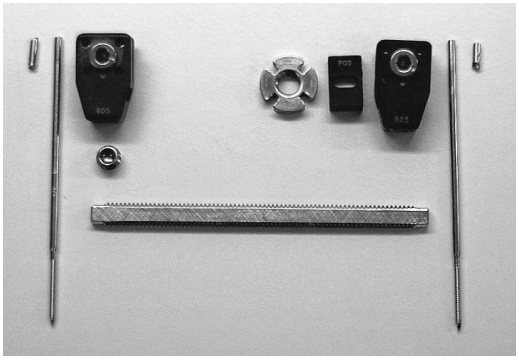

Figure 1. Orthofix M-100 external fixator device

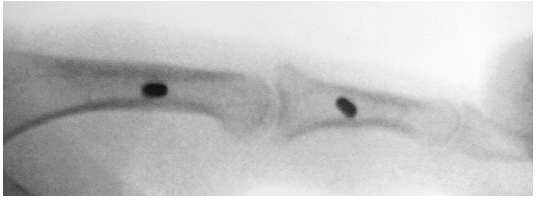

Figure 2. The PIP joint with Orthofix pin placement.

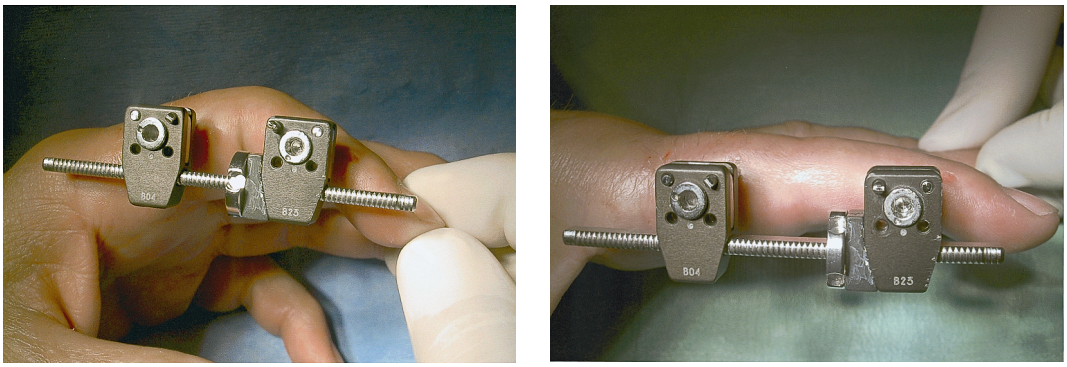

Figure 3. Mini-Orthofix external fixator applied to PIP joint before correction (left), and after correction (right).

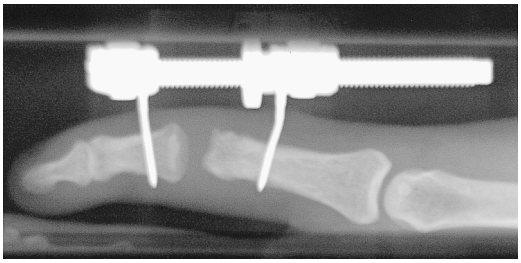

Figure 4. PIP joint showing joint distraction before removal of the device.

enough from the skin to accommodate swelling. The device is equipped with an extension/lengthening nut. The nut is turned 90° by the patient twice daily (one full turn gives 1 mm joint distraction), allowing progressive passive extension or flexion (Figure 4) starting the day after the operation. One thus achieves a combined extension distraction in the case of flexion contracture and flexion distraction in the case of extension contracture. None of the patients received prophylactic antibiotics. The patients were instructed in how to control the Orthofix fixator and skin care to avoid infection. All patients were seen weekly in the outpatient clinic. No hand therapy was applied during distraction. When full extension/flexion or 3–6 mm of joint opening had been achieved, the device was kept for a further 1–2 weeks. In all cases, the device was removed without anesthesia in the outpatient clinic. Dynamic splints (during the night) were continued for 4–6 weeks in order to maintain the extension or flexion.

Patients and results

10 fingers with PIP joint contractures (8 in flexion and 2 in extension) in 10 patients (9 males) were operated on during 2002 (Table). The mean age of the patients was 40 (22–61) years. The mean time from injury to operation was 2 (0.5–7) years. All patients had been treated with extensive and long-lasting hand therapy and dynamic extension splints, with no or minor effect, before surgery. Preoperative radiographs of the joints revealed no arthrosis.

All patients were reviewed prospectively once a week during the treatment, and 1, 3 and 6 months following removal of the device. Of the 8 fingers with flexion contracture, the mean extension gained by the procedure was 53 (30–75)° and for range of motion as a whole, the mean gain was 54 (30–70)°. For the 2 patients treated for extension contracture, the mean gain in flexion as well as ROM was 25° and 40°, respectively. The fixator was removed after a mean of 31 (17–40) days. The range of motion was reduced in 2 patients by 5° and 10° in the metacarpophalangeal and distal interphalangeal joints, respectively. Superficial pin-track infection occurred in 1 case, which settled within 7 days with oral antibiotics and local wound care. Aseptic pin loosening did not occur. The pin support block of the external fixator was broken in 1 case and replaced with a new one, with no consequence for the final results.

Discussion

A flexion or extension contracture of the PIP joint of a single finger may reduce the functional capacity of the entire hand. Several methods of treatment have been proposed, including dynamic

Clinical data on 10 patients with contracture of PIP joints

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Flexion contracture of PIP joint																		
1	29	1	3	3	1	84	50/100	20/80	20/80	20/100	20/100	30	20	40	1	0	0	0
2	46	1	2	4	0	36	75/100	45/90	10/90	0/90	0/90	65	14	28	0	0	0	0
3	22	1	1	4	0	36	80/90	30/90	30/90	40/90	40/90	40	20	40	1	0	0	0
4	36	2	1	4	0	14	90/90	10/50	20/80	20/80	20/80	60	13	21	1	0	0	0
5	36	1	1	4	0	24	60/90	30/80	20/90	20/90	20/90	40	13	33	1	0	1	0
6	48	1	3	3	0	6	50/75	20/80	0/90	0/90	0/90	65	10	17	0	0	0	0
7	23	1	2	4	0	15	70/90	10/90	10/100	10/100	10/100	70	15	27	0	0	0	0
8	43	1	2	2	0	6	80/90	20/90	20/90	20/90	20/90	60	20	31	0	0	0	0
Extension contracture of PIP joint																		
9	61	1	5	1	0	15	0/10	0/40	0/50	0/50	0/50	40	24	30	1	0	0	0
10	56	1	4	3	1	20	50/55	40/70	40/70	40/70	40/70	25	20	20	0	0	2	1

A Case
B Age, years
C Gender
  1 male
  2 female
D Etiology
  1 fracture dislocation of PIP joint
  2 distortion of PIP joint
  3 fracture of proximal phalanx
  4 replantation
  5 infection
E Digit
  1 index
  2 middle
  3 ring
  4 little
F Previous surgery for contracture
  0 none
  1 tenolysis and capsulotomy
G Injury to surgery interval in months
H ROM before surgery
I ROM at the time of removal of the device
J ROM 1 month after removal of the device
K ROM 3 months after removal of the device
L ROM 6 months after removal of the device
M Final gain at 6 months follow-up
N Duration of distraction, days
O Duration of mini-Orthofix, days
P Pain during distraction
  0 none
  1 slight pain
Q Pain at 6 months follow-up
  0 none
R Complications
  0 none
  1 superficial pin-track infection
  2 broken pin support block from mino-Orthofix
S Satisfy with the result and technique
  0 yes
  1 no

splinting, hand therapy and open extensive soft tissue surgery. The results following soft tissue procedures including capsulotomy and tenolysis are often discouraging. This was noted by Foucher et al. (1993) and Koller et al. (1996) who attributed their poorest results (18–41%) to digital tenolysis and capsulotomy performed around the PIP joint. The main risk to the patient is worsening of the situation if open surgery is unsuccessful (Koller et al. 1996, Schneider 1996). Foucher et al. (1993) noted that the fingers got worse in 12% of cases after tenolysis. Ghidella et al. (2002) reported that the average improvement by open surgery was 8° in 68 PIP joint contractures. By grouping the patients into simple and complex cases, the average improvements were 17° and 0°, respectively. Ghidella et al. (2002) have emphasised that the best results have been achieved in younger patients with a less severe diagnosis, and preoperative maximum flexion contracture of less than 45°.

In our experience, digital tenolysis and capsulectomy often mean more extensive surgery per se, which in turn increases problems associated with rehabilitation, and even then with disappointing results. There have been many reports in the literature of various forms of primary treatment with dynamic tractions for acute fracture dislocation around the PIP joint to avoid contracture, which have shown promising results (Hastings et al. 1993, Inanami et al. 1993, Patel and Joshi 1994).

We have previously used the compass hinge external fixator to gradually extend the PIP joint for chronic flexion contracture as primary treatment in 27 cases (Houshian et al. 2002). The mean ROM gain was 42 (0–80)°. By using the joint distraction technique with Orthofix external fixator, the mean ROM gained was 54°. The overall complication

rate was substantially reduced by using Orthofix. The disadvantage of this technique is infection of the pin site, which may cause pain and discomfort over a short period of time. The mini-Orthofix external fixator offers advantages over extensive soft tissue surgery by being minimally invasive.

No competing interests declared.

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