External fixation for phalangeal and metacarpal fractures

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From 1987 to 1993 we treated 33 patients with 29 phalangeal and seven metacarpal fractures by external fixation using a mini-Hoffmann device. There were 27 open and 25 comminuted fractures. In 12 patients one or more tendons was involved.

The mean follow-up was 4.4 years. Complications occurred in ten fractures; two required repositioning of the fixator. All the fractures healed. The functional results after metacarpal fractures were better than those after phalangeal fractures and fractures of the middle phalanx had better recovery than those of the proximal phalanx. Twenty-eight of the 33 patients were satisfied with their result.

External fixation proved to be a suitable technique for stabilising unstable, open fractures with severe soft-tissue injuries.

Phalangeal and metacarpal fractures are common: from 1987 to 1993, totals of 2407 patients with phalangeal and 1554 with metacarpal fractures were treated in our Accident Department.

Most of these fractures can be treated conservatively, but in a relatively small number of patients with unstable fractures operative treatment is indicated. There are two types of fixation: internal according to AO standards, and external for a selected group with open unstable fractures or severe soft-tissue injuries. The use of an external device reduces further damage to the delicate soft tissues and bone, allows wound care and enables exercise of the finger joints at an early stage. There have been few reports of the use of external fixation for these injuries.

Patients and Methods

From 1987 to 1993, 33 such patients (27 men and 6 women) with 36 fractures were treated by external fixation. Their mean age was 35 years (15 to 69). Most had blunt injuries; nine were caused by traffic accident, nine by machinery, ten by falling or cutting objects, two by physical violence, one by a gunshot wound, one by a fall and one by an explosion. In 30% of the cases the dominant hand was involved. The distribution of the 29 phalangeal and seven metacarpal fractures is shown in Figure 1; the proximal phalanx of the ring finger was more often involved than that of the other fingers. There were several types of fracture; 25 were comminuted, six transverse, three oblique, one spiral and one intra-articular. There were 27 open fractures and 25 with severe soft-tissue injuries. In 12 patients, one or more tendons was partially (> 50%) or completely divided.

Our retrospective study reviewed the functional results in a group of patients with phalangeal or metacarpal fractures and either open wounds or severe soft-tissue injuries treated by external fixation.

Fig. 1
The distribution of 36 fractures in 33 patients.
All the patients had an early operation using a mini-Hoffmann device for external fixation (Fig. 2). Debridement of the necrotic tissue after provisional reduction was followed by insertion of the pins, with positioning determined by eye and image intensifier. A small incision was made on the lateral side of the fractured bone except in one patient with a fracture of the third metacarpal in whom the pin was inserted as far laterally as possible. The pin-hole track was predrilled in the transverse plane of the bone. Two pins were inserted, one proximal and one distal to the fracture. The pins were then provisionally connected by a bar and the fracture reduced. In most cases, simple traction was sufficient, and after reduction the pins were fixed firmly to the connecting bar. A very unstable fracture required more than two pins; this applied to 10 of the 36 fractures.

If the pins interfered with the soft tissues, they were bent in a dorsal direction through an angle of 40 to 60° (Fig. 2). The skin wounds were not closed and, after operation, the injured hand was immobilised in plaster for ten days to six weeks, according to a set protocol of ten days for an isolated soft-tissue injury, three weeks for a flexor tendon lesion, and six weeks for a complete extensor tendon lesion. The patients were discharged as soon as soft-tissue healing allowed, having been taught standard pin care. Follow-up visits at weekly intervals allowed inspection of the wounds and checks of the stability of the device. Radiographs were taken immediately after surgery and at one to two weeks and four weeks to check the position and healing. When the bone had healed, the external fixator was removed.

Mobilisation of the injured hand began after the plaster splint had been removed, and if movement did not return rapidly, physiotherapy was used. Patients were discharged from follow-up when improvement in function had reached a plateau. Recovery was scored on the basis of the total active range of movement of each injured finger separately, using the scoring system of Duncan et al13 for total active movement. This adds the active flexion of the metacarpo-phalangeal, proximal interphalangeal and distal interphalangeal joints, then subtracts the sum of the extension deficits at these three joints (Table I).

### Results

The mean follow-up was 4.4 years (2.3 to 8.2), and there were no general complications. The device had been removed at a mean of 5.8 weeks after a phalangeal fracture (3 to 11) and 6.1 weeks after a metacarpal fracture (2 to 12).

Ten fractures showed complications during the period of fixation: in six patients one of the pins became loose, in two part of the device interfered with the soft tissues of the adjacent finger, in one the device restricted movement of the adjacent finger and in one the fracture became displaced.

In five patients, loosening of a pin was managed by removal of the device because the fractures had healed. In one case, loosening resulted in displacement of the fracture, which required surgical revision.

Interference with other fingers was seen only before we had made it our policy to bend the pins. The patient with a displaced fracture required re-reduction at a second operation.

The mean period of treatment for phalangeal fractures was seven months and for metacarpal fractures five months. All fractures healed without further operation and no patient developed reflex sympathetic dystrophy. There were no sinuses after removal of the pins.

**Table II.** Results of treatment in 29 phalangeal fractures and seven metacarpal fractures

<table>
<thead>
<tr>
<th>Finger</th>
<th>Phalangeal</th>
<th>Metacarpal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Good</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Fair</td>
<td>3</td>
<td>-</td>
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<tr>
<td>Poor</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
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Radiographs before (a) during (b) and after (c) treatment.
extensor and flexor tendons, and partial amputation was later performed at the request of the patient. Twenty-eight patients were satisfied with the final result.

Discussion

Most phalangeal and metacarpal fractures are treated conservatively. Patients with unstable fractures require operative reduction and stabilisation to obtain the optimal position for bone healing and to allow early movement. In all our cases the fractures were open and/or accompanied by severe soft-tissue injuries.

We used external fixation to help to avoid any additional injury to the bone and soft tissues. The technique is relatively simple, and even greater precision is added by the use of an image intensifier. The best site for pin introduction is easily chosen. Predrilling with a drill guide has the advantage that the site and direction of the pins are better controlled. An image intensifier is sometimes necessary because of the brittle nature of the phalanges and metacarpals: what may seem to be a perfect drill-hole may lead to incorrect pin placement if it is not checked by the image intensifier. In 23 of our patients two pins gave sufficient stability to maintain position and to allow exercise (Fig. 3). The insertion of pins in a transverse plane helps to obtain the broadest hold on bone and is important. Another advantage of this method of treatment is that it prevents further injury to extensor or flexor tendons and other delicate soft tissues. The transverse plane of the pins may hinder the patient or restrict exercise, but this was solved by bending the pins through an angle of 40 to 60° which did not jeopardise the reduction or the stabilisation, and prevented interference with the soft tissues (Fig. 2).

The most common complication was loosening of the pins, which may be due to technical failure, poor quality bone or to the other injuries, but our numbers were too small to allow any firm conclusions. Loosening did not affect the outcome in our series since four of the six patients involved had a good or excellent functional result. In only one loosening, combined with displacement of the fracture, was further operative reduction needed. All loose pins were removed early; this may be the reason why there were no sinuses or sequestration.

Most of the fractures were of the proximal phalanges, confirming the experience of other authors.13 Nine fractures of the middle phalanges healed with a better functional result (eight were excellent or good) than those of the proximal phalanges (12 excellent/good, 3 fair, 6 poor) and this has also been reported previously.14 Metacarpal fractures gave better functional results than phalangeal fractures because of the difference in the type of injury and function. Again this has been noted by others.9,12

External fixation provides an adequate basis for bone healing, but does not guarantee good functional outcomes. These seem to depend on the severity of accompanying soft-tissue injuries,9,12 as shown by our fair or poor results in six patients in whom a phalangeal fracture was associated with tendon injuries.

External fixation is an adequate alternative treatment for unstable phalangeal and metacarpal fractures which are open or accompanied by severe soft-tissue injuries.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References