INTERNAL FIXATION OF THE METACARPALS AND PHALANGES

P. BURGE
Nuffield Orthopaedic Centre, Oxford, UK

SUMMARY
Techniques and instrumentation for open reduction and internal fixation (ORIF) in the hand have improved considerably in recent years (1). Developments in design and optimisation of implant rigidity have improved the surgeon's ability to provide stable fixation and have reduced the bulk of plates and screw heads that may interfere with tendons and other soft tissues (2). But the best clinical results of ORIF continue to depend on careful patient selection, precise surgical technique and use of the correct implant. **Riv Chir Mano 2006; 3: 301-305**

KEY WORDS
Internal fixation, metacarpals, phalanges

Interfragmentary screw fixation is an excellent method for the unstable long oblique or spiral metacarpal shaft fracture. The fracture length should be at least twice the bone diameter and at least two screws are required. Since fixation depends more on the number of active threads that engage the bone than on the screw diameter, three small screws are stronger than two large ones. Whether lag screw fixation is superior to percutaneous pinning remains unclear for these fractures in the phalanges.

Involvement of more than 20% of the articular surface and displacement of more than 1-2 mm are general indications for ORIF of articular fractures, with some exceptions such as mallet fracture. Fixation of difficult periarticular fractures has been enhanced by the recent availability of small locking compression plates that are stable against angulation.

Indications for plate fixation of metacarpal fractures include multiple fractures (Fig. 1), multifragmentary articular or periarticular fractures, multifragmentary fractures with shortening or rotation, fractures with segmental bone loss and severe open injuries (3). Fractures of the border metacarpals (index and small) are inherently less stable than the middle and ring rays because there is soft-tissue support on only one side. Healing of plated metacarpal fractures may be slow and fatigue fracture of the plate is a risk that can be minimised by use of a plate of adequate strength.

Internal fixation of metacarpal fractures is facilitated by the thick soft-tissue envelope, but in the phalanges the subcutaneous fat is thin and there is no muscle cover. The mid-shaft of the proximal phalanx is nearly enveloped by tendons, with the dorsal aponeurosis covering almost two thirds of the circumference. Whereas the strong flexor tendons can often overcome stiffness of the PIP joint in extension, the weaker extensor muscles may have difficulty in overcoming adhesion to the large dorsal area of contact with bone. Indications for plate fixation are more restricted than in metacarpal fractures, but include periarticular (4), comminuted and open phalangeal fractures (Fig. 2).

Corrispondence: Peter Burge FRCS, Nuffield Orthopaedic Centre, Oxford OX3 7LD, UK - Tel. 44-1865-227477
Fax 44-1865-227740 - E-mail: peter.burge@ndos.ox.ac.uk

Figura 1. *Closed comminuted shaft fractures of the long and ring metacarpals, with shortening and angulation (A) requiring plate stabilisation (B).*

A primary objective of ORIF is the provision of stability that permit the immediate active movement that maintains the mobility of the gliding tissue planes in the hand. The exercise programme is easier if ORIF is performed within 24 hours of injury, before the suppleness of the soft tissues has been reduced by post-traumatic oedema. When ORIF is performed at five days or more after injury, the finger is already stiff and it is much more difficult to regain good movement.

In severely comminuted fractures, ORIF may be difficult, frustrating or impossible. The additional trauma of surgery can be detrimental to recovery of motion (5); a procedure that fails to stabilise the fracture does not permit early movement and carries all the risk of surgery without the benefits. In these cases, some other method such as traction, external fixation or gentle protected mobilisation may be appropriate.

Concomitant with the improvements in plates and screw design, surgeons have refined the application of simpler methods. Intramedullary pinning using the "bouquet" technique (6) has widened the indications for operative stabilisation of the metacarpal shaft and neck in which the fracture is stable to axial forces (Fig. 3). This technique is quicker, simpler and cheaper than plate fixation.

A thorough understanding of potential complications is crucial to successful internal fixation. Pitfalls are greater with the smaller implants, and include unrecognised comminution, fragmentation of small bone pieces, difficulty in concentric drilling of gliding and threaded holes, and inaccurate screw length measurement.

Figura 2. *Grade 1 open comminuted intra-articular fracture base proximal phalanx of ring finger (A) stabilised primarily with T-plate and interfragmentary screws (B), with excellent restoration of active flexion (C).*

Figura 3. *Intramedullary pin fixation of angulated ring and small metacarpal fractures that are stable to axial forces.*

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