

## THERAPY

## The use of titanium miniplates in arthrodesis of the interphalangeal joints and a metacarpal neck fracture

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### Abstract

Fractures of the metacarpals and phalanges are the most common fractures of the upper extremity. Hand fractures can be complicated by deformity because of no treatment, stiffness due to overtreatment, and both due to inappropriate treatment.

“Boxer’s” fractures of the fifth metacarpal neck are rarely seen in professional boxers, they are far more common in people who hit solid objects such as walls. Controversy exists regarding the optimum treatment.

General indications for arthrodesis of hand joints of the hand include pain, instability, or deformity combined with a loss of motor control or bony stock sufficient to support arthroplasty. When all previous attempts to restore painless motion fail, arthrodesis of the joint becomes the method of choice. The most commonly arthrodesed finger joints are distal interphalangeal (DIP), proximal interphalangeal (PIP) and the interphalangeal (IP) joint of the thumb. The position of joint arthrodesis should be individual depending on the patient’s needs. (*Fig. 13, Ref. 6*).

**Key words:** internal osteosynthesis with miniplates, fractures of the hand, arthrodesis of IP joints, miniosteosynthesis, Martikan, titanium miniplates.

Until the early years of the 20th century all hand fractures were managed conservatively. Even today, the majority of these fractures can be successfully managed by nonoperative techniques. Certain fractures require operative fixation. Fractures at the level of PIP are most frequently associated with loss of movement (1, 2). Regardless of the selected treatment, the aim is a full and rapid restoration of hand function. Titanium miniplates made of titanium, which has a modulus of elasticity approximating that of bone, are now available. Plates for the metacarpals and phalanges are of low profile, easy to contour and cut, and available in a variety of configurations (3). The idea of miniplating is derived from maxillofacial trauma surgery and was adapted for in hand surgery. We used miniplates from a Slovak producer Martikan, who has experience in the field of dental implants and miniplates for over 15 years. Fractures and arthrodeses were treated by open reduction and screw-plate osteosynthesis according to the AOSIF-technique. Using these implants and the technique of open reduction or with an additional autologous bone graft offers the possibility to start active motion therapy immediately after the operation.

### Surgeries

The first patient was born in 1974 – suffered a crush accident of the PIP joint of the left hand third finger, in a car door with severe damage to the soft tissue, extensor tendon, destruction of the middle phalanx base, PIP joint within ligaments and dorsal skin defect, treated first conservatively with splinting and an adaptation suture to the damaged tissues, thereafter arthrodesis of the PIP joint in the desired position of approximately 30 degrees of flexion was performed (Figs 1, 2, 3), the spongiosa of the resected bone was used to fill the small gap between the fused bones.

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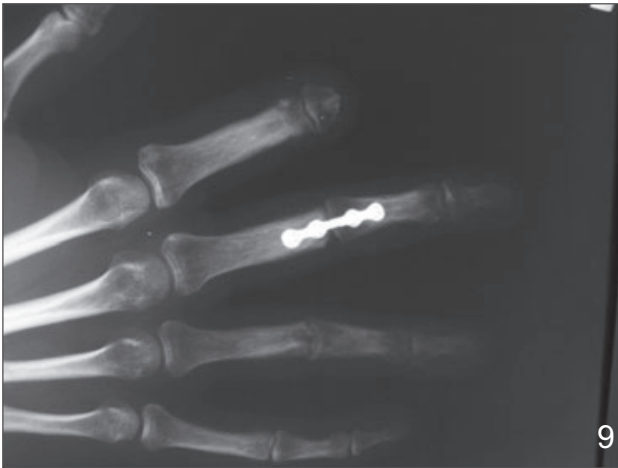
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The second patient was born in 1950 – suffered crush injury due to fall of a piece of a furniture during transportation directly on the IP joint of his right thumb which resulted in destruction of the IP joint and severe damage of soft tissues, but the sensation and blood supply was preserved, it was treated conservatively (Fig. 4). The healing process was complicated with infec-

tion and sequestration of bone (Fig. 5). After healing arthrodesis of the proximal and distal phalanx in the desired position of approximately 45 degrees of flexion was performed to force grasp (Figs 6 and 7).

The third patient was born in 1976 – suffered an accident with a circular saw, which lead to amputation and soft tissue



destruction of the II<sup>nd</sup> finger of his left hand distally to the basis of the medial phalanx and to abrasion of PIP joints within soft tissue and extensor tendon defect of the III<sup>rd</sup> and IV<sup>th</sup> fingers. The replantation of the II<sup>nd</sup> finger remnant was not possible and the III<sup>rd</sup> and IV<sup>th</sup> fingers were treated with an adaptation suture to the damaged tissues, extensor tendon and splinting. The pa-

tient refused free II<sup>nd</sup> toe joint transfer to the hand and therefore arthrodesis with crossed Kirchner wires was performed in the IV<sup>th</sup> finger and with the titanium miniplate in the III<sup>rd</sup> finger in the desired position of approximately 30 degrees to allow early postoperatively motion therapy (Figs 8 and 9).



The fourth patient was born in 1977 – suffered a fracture of the neck of the Vth metacarpal bone of his right hand due to fall during inline skating, treated unsuccessful twice elsewhere, healed in volar angulation of approximately 40 degrees with pseudoclawing, pain in the palm (he works with computer) and shortening of the bone due to resection and postoperative resorption of the bone (Figs 10 and 11).

### Results

A full and painless motion has been achieved in the patient with corrective osteotomy of the metacarpal neck (Figs 12 and 13), even with a shortening of the 5th metacarpus due to previous attempts to reduce the fracture and in patients with arthrodeses of the IP joints a stable, painless and effective motion of the affected finger (thumb). There were no patients with wound healing disturbances, with delayed healing or bone healing resulting in non union and no patient showed signs of reflex dystrophy. To allow full range of motion the miniplate from the Vth metacarpus was removed.

### Discussion

*Open reduction of metacarpal neck fractures.* In most cases closed metacarpal neck fractures (especially of the ring and small finger) should be treated by non operative techniques. Reduction of metacarpal fractures is indicated in case of “pseudo-

clawing” or in case of rotational deformity. Should open reduction be necessary, crossed Kirschner pins, dorsal tensions band wire with a supplemental Kirschner pin or laterally applied minicondylar or “T” plate, which is a last resort (3) especially in cases of the failure of previous methods of treatment are used.

*Arthrodeses of the IP joints.* Arthrodesis of finger joints should be considered when all previous attempts to restore painless effective motion fail (1) or the joint, especially ligaments and articular surfaces are irreversibly damaged.

Although widely used in the treatment of metacarpal fractures, plate fixation in phalangeal fractures remains controversial. Increased potential for infection and added soft tissue trauma leading to increased joint stiffness have been cited as important negative factors (4). The patients suitable for the use of internal miniplates should be selected carefully. Traditional wiring techniques are certainly useful in complex hand injuries, despite this fact, internal osteosynthesis with miniature plates and screws has definite indications in cases requiring stable and rigid internal fixation. This technique provides good bone healing and allows to start active motion therapy immediately after surgery (5). The future could be in the use of bioabsorbable miniplates which provide satisfactory biomechanical support comparable with that of titanium (6) and do not require later removal.

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