

Techniques in Foot and Ankle Surgery

Internal Fixation of Displaced Intra-articular Fractures of the Hallux Through a Dorsomedial Approach A Technical Tip

Abstract: *Phalangeal fractures of the toes represent common injuries of the forefoot. In the hallux, most fractures occur at the distal phalanx and frequently result from a direct crushing type of injury. Intra-articular fractures of the hallux are usually treated nonoperatively, except when the fragments are displaced and the joint is incongruent. Displaced fractures treated nonoperatively can result in degenerative arthritis of the interphalangeal joint, causing pain and range of motion limitation, hindering gait and weightbearing. The aim of this study was to present an option of operative approach in the treatment of displaced interphalangeal joint fractures of the hallux, along the medial border of the extensor hallucis longus tendon. It is our understanding that this approach minimizes injury to the soft tissue envelope, allowing a rigid fixation and early weightbearing and range of motion.*

Levels of Evidence: *Level V: Expert opinion*

Keywords: digital and sesamoid fractures; forefoot; big toe joint pain; foot surgery techniques; diagnostic and therapeutic techniques

Phalangeal fractures of the toes are common and represent 3.6% to 8% of all lower extremity injuries.^{1,2} The hallux is the most frequently injured toe and its fracture account for 38% to 56% of all toe fractures.³

Complications following fractures of the lesser toes are rare, even in the setting of residual malalignment and loss in range of motion of the involved toe. The hallux, on the other hand, plays important roles in the gait, weightbearing, and balance, and nonoperative treatment of displaced intra-articular fractures can lead to significant long-term pain and disability.^{4,5} Surgical treatment indication

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is controversial,^{6,7} but anatomic reduction and rigid internal fixation are usually the treatment of choice if displacement is greater than 2 mm, if the fracture is open, or if it represents a displaced physeal injury.⁸ Decision regarding operative approach and method of fixation is usually based on the surgeon experience, fracture pattern, and size of fragments.^{9,10}

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The aim of this technical tip study was to describe an alternative operative approach in the treatment of displaced interphalangeal joint (IPJ) fractures of the hallux through a longitudinal

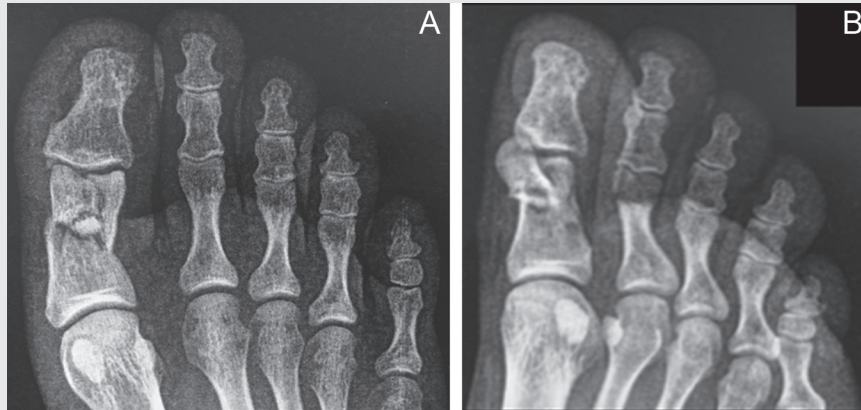
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Figure 1.

Bicondylar fracture of the proximal phalanx of the hallux with a valgus deformity. Anteroposterior (A) and oblique views (B).



paratendinous incision along the medial border of the extensor hallucis longus (EHL) tendon. This approach minimizes injury to the soft tissue envelope and offers good visualization of the IPJ. It allows anatomic reduction and rigid internal fixation, avoiding detachment or tenotomy of the EHL tendon with decreased chances of IPJ stiffness.

Surgical Technique

The surgical indication for open reduction and internal fixation through a dorsomedial approach of the IPJ was displaced (>2 mm) bicondylar fractures of the proximal phalanx of the hallux. All patients had a history of crushing-type traumatic injuries to the great toe, more specifically a direct trauma by a heavy object dropped on their foot. This approach could also be indicated in the treatment of displaced monocondylar or physeal fractures of the proximal phalanx of the hallux.

1. Surgical procedure is performed under regional anesthesia with a nonsterile thigh tourniquet. The patient is positioned supine on a radiolucent operating table. Figure 1 represents one example of a displaced IPJ intra-articular fracture of the proximal phalanx of the hallux.

2. A dorsomedial longitudinal approach (2-3 cm) is performed along the medial border of the EHL tendon, and centered over the middle portion of the proximal phalanx diaphysis (Figure 2). During dissection, care is taken to avoid damage to the dorsomedial cutaneous nerve (DCN). The EHL tendon is retracted laterally and the DCN medially.
3. The IPJ is exposed and the articular surface is reduced anatomically using a delicate fine-tip chisel and a point-to-point clamp (Figure 3). The paratendinous approach is particularly advantageous because it allows direct and almost complete visualization of the IPJ without detachment of the EHL tendon.
4. Provisional fixation is performed from lateral to medial using a 1.5-mm K-wire to maintain the articular surface reduction (Figure 4).
5. After assuring anatomical reduction of the articular surface and closed reduction of the diaphyseal alignment, a 2.0-mm low-profile locking plate is placed medially fixed by 2.0- and 2.3-mm screws, including lag screw connecting the articular fragments (Figure 5). The plate was contoured perfectly to adapt the shape of the medial aspect of the proximal phalanx. The compression

Figure 2.

Dorsomedial longitudinal approach performed along the medial border of the extensor hallucis longus tendon and exposure of the interphalangeal joint.



screw can be inserted outside or through the plate.

6. The wound is irrigated and the incision closed in a layered fashion with 4.0 absorbable suture in the deep tissues and a 4.0 nylon suture in the skin (Figure 6).

Discussion

There are a few reports in the literature addressing the surgical

Figure 3.

Reduction of the distal fragments using a point-to-point clamp: Clinical (A) and anteroposterior fluoroscopic view (B).

**Figure 4.**

Temporary K-wire fixation of the articular fragments.

**Figure 5.**

Definitive fixation with a lag screw connecting the articular fragments and a 2.0-mm locking plate and screws positioned medially.

**Figure 6.**

Sutured wound and final clinical alignment of the hallux.



treatment options for displaced intra-articular fracture of the hallux in the adult population and no single procedure has been established as the gold standard.⁵ After an extensive literature search using electronic databases (Cochrane Central Register

of Controlled Trials, PubMed, MEDLINE, AMED, Embase) the authors were not able to identify any study describing specific surgical techniques in the treatment of hallux fractures, including intra-articular fractures of the IPJ.

In 2004, Mittlmeier and Haar⁹ showed that a miniplate represented a good option in the treatment of fractures of the proximal phalanx of the hallux. In 2005, Salleh et al¹⁰ also showed the efficacy of low-profile mini plate or a K-wire fixation in the treatment of

Figure 7.

Range of motion of the interphalangeal joint after 12 months. Maximum plantarflexion (A) and dorsiflexion (B).



fractures of the IPJ. However, both reports did not describe possible approaches and fixation techniques according to the patterns of the fractures. Only Schenck and Heckman,¹¹ in 1995, mentioned about a dorsolateral approach for fractures of the IPJ of the hallux. The use of a dorsomedial approach for fusion of the IPJ in the setting of osteoarthritis is well established but there is no description in the literature for its use in the treatment of proximal phalanx intra-articular fractures.¹²

We have performed this surgical treatment in 3 patients with displaced bicondylar fractures of the proximal phalanx of the hallux caused by crushing injury of the great toe. All patients were followed for at least 18 months. At 3-month follow-up, they were able to resume working and return to sports activities. After 12 months, patients were completely asymptomatic. Physical examination revealed mild limitation of the IPJ range of motion (less than 30% when compared with the contralateral foot) (Figure 7). Eighteen months after the surgical treatment all patients remained painless and without limitations.

There were no complications associated, including skin necrosis, wound dehiscence, and prominent hardware. Although it is a small sample and the follow-up is short, we believe that the dorsomedial approach allows

Figure 8.

Anteroposterior radiograph at 12-month follow-up demonstrating complete healing of the fracture, excellent articular surface contour, and toe alignment.



anatomic reduction of the joint and a rigid internal fixation with low aggression to the adjacent soft tissue, without the need to detach or make a tenotomy of the EHL tendon (Figure 8). It also allows early weightbearing and joint mobilization.

On the basis of our 3 cases, we concluded that a dorsomedial approach should be considered in the

surgical management of displaced intra-articular fractures of the IPJ. It showed to be reliable regarding adequate exposure of the joint, fracture reduction, and fixation and soft tissue preservation which can prevent postoperative joint pain and stiffness. All patients were asymptomatic and returned to their preinjury level of activities, and had minimal limitation of the IPJ range of motion. Further prospective studies are needed with a larger population and a long-term follow-up, comparing possible operative approaches and methods of fixation. [FAS](#)

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