

# Treatment of Pseudoarthrosis After Minimally Invasive Hallux Valgus Correction

Marco Cianforlini, Cristina Rosini, Mario Marinelli, Luigi de Palma

Department of Orthopaedic, Clinical Orthopaedics, School of Medicine, Università Politecnica delle Marche, Ospedali Riuniti, Ancona, Italy

## INTRODUCTION

Minimally invasive subcapital osteotomy of the first metatarsal is indicated for correction of mild to moderate hallux valgus deformities with a valgus angle (HVA)  $\leq 40^\circ$  and an intermetatarsal angle (IMA) of  $10\text{-}20^\circ$ . A Kirschner wire is used to help guide and stabilize the correction. The osteotomy is performed through a 3-5 mm incision using a corticotomy technique and no associated soft tissue procedures. Advantages include shorter operation time and hospital stay, fewer complications, and earlier weight-bearing.<sup>[1]</sup>

Giannini *et al.*,<sup>[2]</sup> reported the outcomes and 36-month follow-up data (range: 22-52 months) of the first 54 consecutive feet treated with their minimally invasive simple, effective, rapid, and inexpensive technique. They measured HVA, IMA, and distal metatarsal articular angle on the x-rays before and after the operation. All but four patients (7.4%) were satisfied with their outcome. The postoperative clinical evaluation, based on the American Orthopedic Foot and Ankle Society (AOFAS) score, gave a mean score of 81, with 64.8% excellent results (35 feet), 18.5% good results (10 feet), 9.2% fair results (5 feet), and 7.4% poor results (4 feet). All osteotomies healed well,

## ABSTRACT

**Objective:** Treatment of mild and moderate hallux valgus deformities. **Discussion:** Minimally invasive technique enables surgeons to treat mild and moderate hallux valgus deformities with excellent and good results in the majority of patients. Nonunion of first metatarsal, moreover, has only rarely been reported. **Summary:** We describe the essential steps of a surgical technique for the treatment of nonunions after miniinvasive subcapital first metatarsal osteotomy reconstructed using a tricortical iliac crest bone graft.

**Key words:** Bone graft, hallux valgus, miniinvasive, osteotomy, pseudoarthrosis

with radiographic evidence of callus formation after an average of 3 months. Remodeling was documented for all metatarsal bones, including those exhibiting marked offset at the time of osteotomy.<sup>[3]</sup> Magnan *et al.*, described the results of 118 consecutive percutaneous subcapital distal osteotomies (82 patients; mean follow-up 35.9 months) for mild to moderate hallux valgus deformity and reported a mean AOFAS score of  $88.2 \pm 12.9$ . Complications included three recurrent valgus deformities (2.5%), eight stiff first metatarsophalangeal joints (6.8%), and a deep infection that resolved with antibiotic therapy (0.8%). The majority of patients (91%) were satisfied with the operation.

A large body of data supports the claim that minimal access techniques enable correction of 80-90% of hallux valgus deformities solely via hallux manipulation without removal of the eminence or open lateral release yielding more than 90% excellent and good results.<sup>[2,4,5]</sup> Nonunion is rarely reported. We describe our operative technique for nonunion following minimally invasive subcapital osteotomy of the first metatarsal [Figure 1a and b].

## DISCUSSION

The procedure involves the use of a tricortical iliac crest autograft to restore the length of the first metatarsal and its proportion to the lesser metatarsals, aligning the center of the first and second metatarsal heads so that they lie on the same line.

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**Address for correspondence:** Dr. Marco Cianforlini, Clinical Orthopaedics, School of Medicine, Università Politecnica delle Marche, Ospedali Riuniti, via Conca 71/60126, Ancona, Marche, Italy.  
E-mail: [marco.cianforlini@libero.it](mailto:marco.cianforlini@libero.it)

The patient is placed supine, with a small sandbag under the pelvis. The donor site on the ipsilateral iliac crest and the site of the miniincision on the dorsomedial aspect of the foot are marked with a surgical pen. The two operative fields are then separately prepared and draped. A tourniquet is applied at mid thigh.

The miniincision is performed and the nonunion site is cleared and identified [Figure 2a]. Possible scar tissue from the previous procedure may prevent adequate visualization of the dorsal nerve. The dissection should not extend to the lateral aspect of the first metatarsal head, to avoid potential injury to the vascular supply of the distal stump. The proximal and distal stump are gently curetted to obtain two concave surfaces that will accommodate the graft. The diaphyseal canal is cleaned of fibrous tissue and reamed to host the proximal peg.

The bone graft is harvested. Graft preparation is a key step. The tricortical autograft measures between 20 and 35 mm, depending on the bone length to be restored. Cortical bone is removed on two sides,

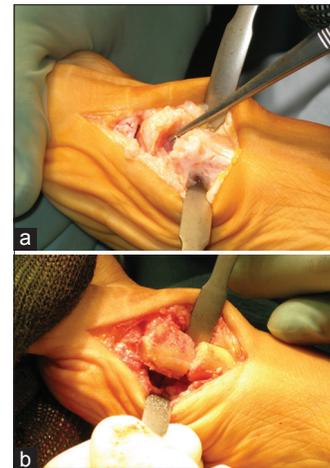
exposing the trabecular bone [Figure 2b]. The graft is then shaped to fit the surfaces of the proximal and distal stump [Figure 3a and b] firmly inserted and finally fixed with a 3.5 mm compression screw from medial proximal to distal lateral [Figure 4a and b].

Graft size is designed to obtain maximal hallux lengthening without impairing wound closure or the vascular supply to the toe. Tenotomy may be required to correct the length of the extensor digitorum longus of the first ray. A regional popliteal nerve block may be applied during admission and removed before discharge.

The patient is discharged on the 2<sup>nd</sup> or 3<sup>rd</sup> postoperative day. A short leg cast is applied for 12 weeks and walking is allowed after its removal. Low molecular weight heparin (4000 IU/day) is given for 12 weeks. Radiographs are taken at 4 weeks and 3 and 6 months [Figure 5a and b], until radiographic healing is documented.



**Figure 1:** Computed tomography: Axial (a) and Sagittal (b) Scans documenting the nonunion site after subcapital osteotomy of the first metatarsal



**Figure 2:** Intraoperative photographs: (a) Nonunion site (b) The proximal peg is inserted into the metatarsal shaft



**Figure 3:** Intraoperative photographs: The graft (a) Before and (b) After modeling



**Figure 4:** Plain radiographs: Postoperative anteroposterior and oblique views of the proximal peg firmly fitted into the metatarsal shaft

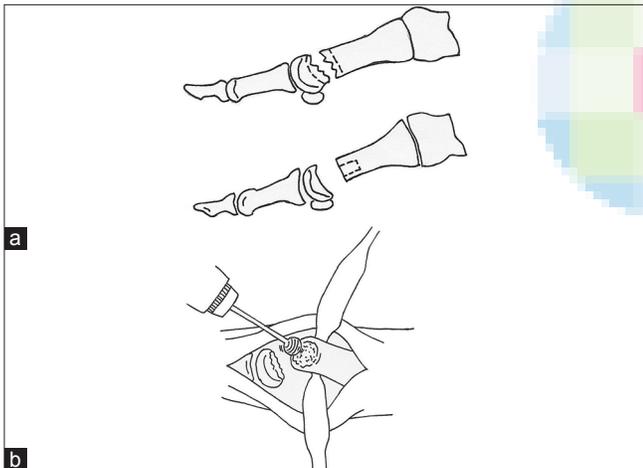
## SUMMARY

The surgical procedure can be summarized into five steps which are as follows:

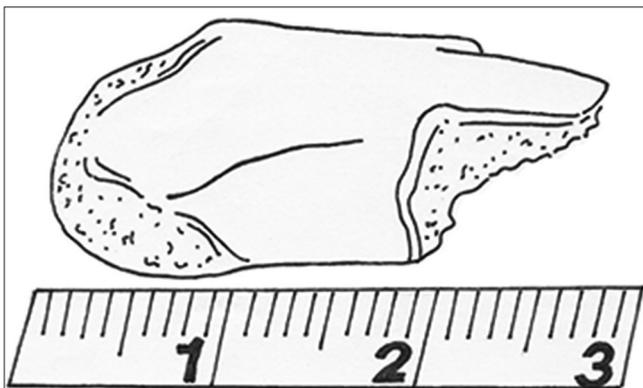
- Dorsomedial incision and identification of nonunion site [Figure 6a and b]
- Curetting of nonunion site to obtain two concave surfaces that will accommodate the graft [Figure 7a and b]



**Figure 5:** Plain radiographs: Weight-bearing (a) and Lateral (b) Views documenting graft viability

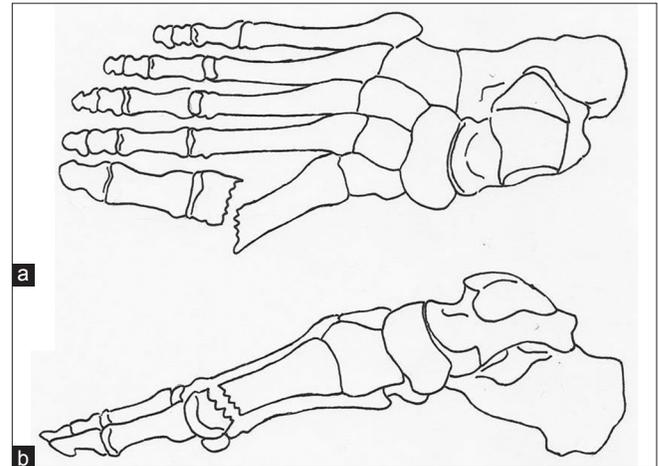


**Figure 7 (a and b):** Curetting of nonunion site

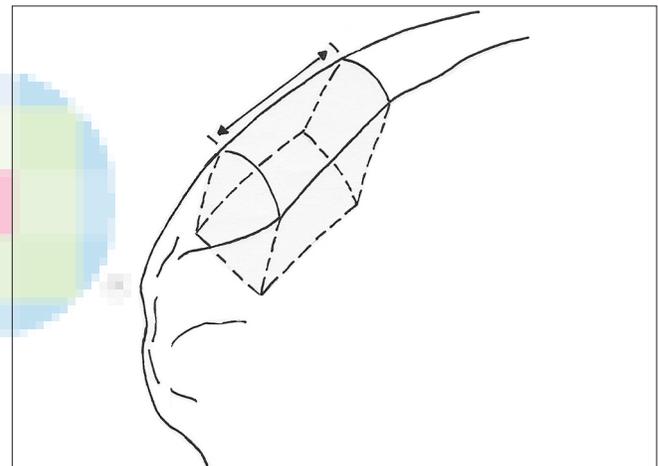


**Figure 9:** Round shape of the distal end of the graft

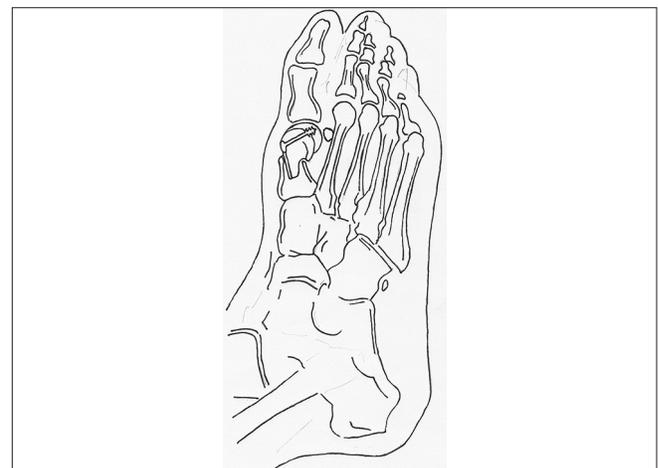
- Collection of an ipsilateral iliac crest tricortical autograft measuring 20-35 mm [Figure 8]
- Graft fashioning, with a convex distal surface and a small proximal peg [Figure 9]



**Figure 6 (a and b):** Identification of nonunion sites



**Figure 8:** Tricortical autograft from ipsilateral iliac crest



**Figure 10:** The proximal peg is shaped for firm placement into the metatarsal shaft and the graft is fixed with a 3.5 mm compression screw from medial proximal to distal lateral

- The peg is firmly inserted into the metatarsal shaft and the graft is fixed with a 3.5 mm compression screw from medial proximal to distal lateral [Figure 10].

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