

## Bicortical Structural Autograft Harvest During Medializing Calcaneal Osteotomy: Technique Tip

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### Level of Evidence: V, Expert Opinion

**Key Words:** Autograft; Allograft; Calcaneal Osteotomy; Pes Planus

### INTRODUCTION

A structural bone graft is often required when performing procedures associated with flexible planovalgus deformity correction. These procedures are commonly done in conjunction with a medializing calcaneal osteotomy. Associated procedures include lengthening calcaneal osteotomy through the anterior calcaneus, distraction calcaneocuboid arthrodesis, and plantarflexion osteotomies of the medial cuneiform and first metatarsal. The osteoinductive and osteoconductive properties of autografts make it the gold standard when a graft is needed. This structural autograft is most commonly harvested from the iliac crest, however the potential complications and morbidity associated with this procedure has been well highlighted in the literature.<sup>1-4,6-10,12-15,17</sup> Allografts not only are costly, but carry the potential risk of disease transmission. Structural autograft can be taken from the calcaneus itself when a calcaneal osteotomy is performed, thereby avoiding issues related to both iliac crest harvest and allografts. A technically easy procedure is proposed for obtaining a bicortical structural autograft from the calcaneus at the site of the medializing calcaneal osteotomy.

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### OPERATIVE TECHNIQUE

The standard oblique incision for a medializing calcaneal osteotomy is performed over the lateral aspect of the calcaneal tuberosity. The sural nerve is identified and protected. The calcaneal osteotomy is made in line with the longitudinal axis of the calcaneus and perpendicular to the lateral wall. The posterior tuberosity fragment is medialized 5 to 10 mm, depending on the degree of the deformity. The osteotomy is rigidly fixed with two lag screws. Next a periosteal elevator is used to elevate the soft tissue and periosteum from the superior lateral portion of the calcaneus just distal to the medializing calcaneal osteotomy site. The typical size of autograft harvested is 10 mm x 10 mm x 10 mm (Figures 1 to 3). The length of the osteotomy will depend on the location of the medializing calcaneal osteotomy and will be limited anteriorly by the subtalar joint. The height can potentially be the entire height of the calcaneus although this not required. The width of the graft will depend on the distance the calcaneus is medialized and the position of the calcaneal fixation. Generally, approximately 10 mm is available. A marking pen is then used to outline the anticipated cuts. Fluoroscopy can confirm the osteotomy is not entering the subtalar joint. An oscillating saw is used to cut the inferior and distal limbs of the graft. The proximal aspect of the bone block is the lateral overhang from the previously performed medializing osteotomy. Next an osteotome is directed inferiorly from the superior aspect of the calcaneus to the inferior aspect of the graft. The graft can then be carefully levered out of the wound (Figures 4 and 5). The bone block is bicortical and the cortex of the graft should be aligned with the superior and lateral cortex of the lengthening calcaneal osteotomy site, or contoured appropriately for the plantarflexion osteotomy (Figures 6 and 7).

### DISCUSSION

Much has been written about the potential complications and morbidity associated with the harvesting bone from the

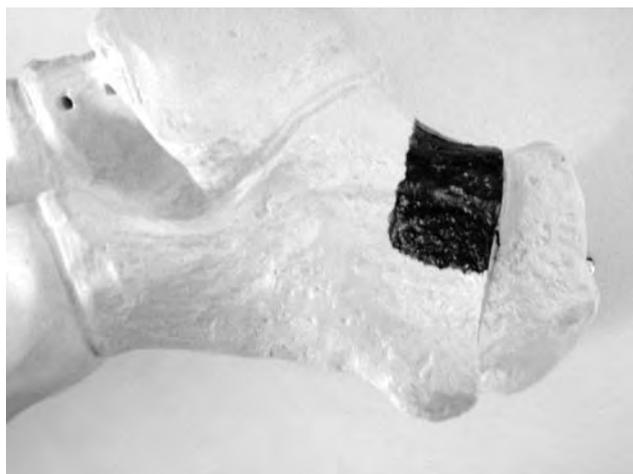


Fig. 1: Black area indicates location of graft.



Fig. 3: Black area indicates location of graft.



Fig. 2: Black area indicates location of graft.

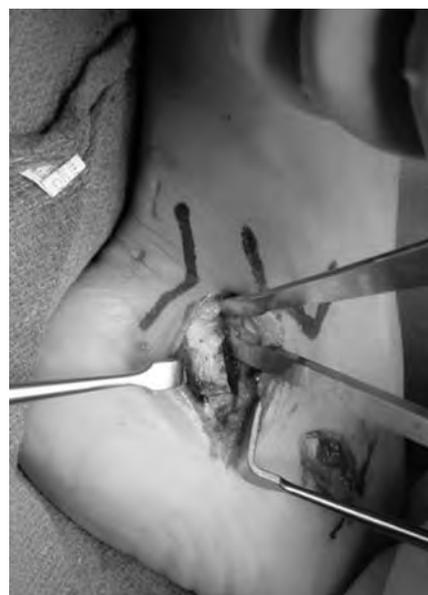


Fig. 4: Bicortical bone block being levered from wound.

iliac crest. Anterior bone grafts have been shown to have significantly greater complication rate compared to posterior grafts.<sup>1</sup> In a classic article by Younger and Chapman concerning complications, iliac crest harvest had an overall complication rate of 26%.<sup>17</sup> Gupta et al. in a review of the literature showed a 31% complication rate in 1,020 patients.<sup>7</sup> The most prevalent of these complications is donor-site pain. The rate of persistent pain greater than one year has been reported between 2.8% and 27%<sup>7,13</sup> with a trend for the pain to gradually improve with time.<sup>6</sup>

Nerve injuries including neuromas and numbness due to injury to the lateral femoral cutaneous nerve occur.<sup>2,4,8,10,12,13,17</sup> Although rare, vascular injury has been reported and is more common with posterior iliac harvesting.<sup>14</sup> Wound issues may also result from iliac graft

harvesting. The rate of hematomas has been reported from 2.4% to 6.7%.<sup>4,8</sup> Wound infections will occur in 1% to 3% of cases.<sup>8,9,11</sup> Other donor-site complications include hernia, gait disturbance and fractures.<sup>2,3,8,9,12,15</sup>

The technique described is performed through an already established incision and requires limited further exposure. Although no complications related to the procedure have been encountered, several possible complications exist. The sural nerve is in close proximity and care must be taken to



**Fig. 5:** Bicortical bone block obtained from calcaneus.



**Fig. 6:** Bone block placed in lengthening calcaneal osteotomy.



**Fig. 7:** Lateral radiograph of incorporated bone block in lengthening calcaneal osteotomy.

remain on bone with the periosteal elevator when gaining exposure to the graft site. Typically this procedure is performed in less than five minutes, and therefore excess or prolonged retraction of the sural nerve or skin is avoided. Although not observed there is a potential for wound issues as a larger cavity in the wound is created and more bleeding cancellous bone is exposed after harvesting. Care should be taken when creating the vertical distal limb of the graft. If made too distal the subtalar joint can be penetrated. Fluoroscopy can be used during this portion of the procedure if needed.

Allografts are also often used when structural bone blocks are needed. These have the potential of disease transmission, and also lack osteoinductive properties. Although the exact rate of disease transmission from allografts is unknown only a handful of cases have ever been reported, therefore this complication is extremely unlikely.<sup>17</sup> The true importance of osteoconductive properties in bone grafts in foot and ankle surgery are unknown. Allografts have been shown to have equal union rates to tricortical autograft in lateral column lengthening and other reconstructive foot and ankle procedures in some studies.<sup>5,11</sup> Another concern with allografts is their substantial cost. A structural allograft of this size is approximately \$900 in my community.

## CONCLUSION

A technique is described to harvest bicortical structural bone graft from the calcaneus when performing a medializing calcaneal osteotomy. This technique avoids the extra cost of an allograft and potential complications associated with both allografts and autografts. It is most useful when bone blocks less than 1 cm<sup>3</sup> are required and in children where rapid incorporation of the graft can be expected.

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