The Incorporation of Allogeneic and Autogenous Bone Graft in Healing of Lateral Column Lengthening of the Calcaneus

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Lateral column calcaneal lengthening as described by Mosca is a widely accepted technique for the correction of hindfoot valgus and pes planus. It is performed with both allogeneic and autogenous bone graft. The purpose of this study was to evaluate the incorporation of these 2 types of bone graft in this procedure.

A retrospective review of all lateral calcaneal lengthenings performed by 4 pediatric orthopaedic surgeons over a 10-year period was conducted. Radiographs at the last follow-up visit were independently examined by 3 reviewers. Incorporation of the bone graft was determined by 2 criteria: (1) presence of continuity of trabecular lines between graft and native bone, and (2) inability to distinguish the boundary between bone graft and native bone. A consensus or majority opinion (2 out of 3 reviewers) was considered positive for graft incorporation.

Thirty-five lateral column lengthenings in 26 patients were reviewed, 30 of which used allograft bone and 5 autograft. Ninety-seven percent of the allograft cases and 80% of the autograft cases were incorporated at final follow-up. There was 1 case of graft failure in each of the 2 groups. Follow-up in the allograft failure was 6 weeks; the autogenous failure 7.2 years. Interrater reliability was good (kappa=0.61, $P < .0001$*). No adverse events or complications were noted with the use of allograft bone in this series.*

Allogeneic bone graft is rapidly integrated into native bone and is a desirable substitute to autogenous bone for use in lateral column lengthenings, avoiding any patient morbidity from graft harvesting. Level of Clinical Evidence: 2. (The Journal of Foot & Ankle Surgery 47(4):283–287, 2008)

Key Words: allograft, calcaneal lengthening, pes planus, pes pronovalgus

Pes planus, or flatfoot, is a condition characterized by a constellation of deformities culminating in loss of the longitudinal arch of the midfoot during weight bearing. Principal findings include valgus deformity of the hindfoot, excessive supination of the forefoot, and a relative shortening of the lateral column of the foot compared with the medial column. Symptoms resulting from this deformity include pain (especially with weight bearing), formation of callosities and ulcerations, and difficulty with shoe wear. The majority of patients can be treated effectively with over-the-counter or custom-molded orthoses especially if the condition is flexible. However, in instances where the deformity is rigid or symptoms are not improved by conservative measures, operative intervention is occasionally necessary (1).

Lateral column lengthening has largely replaced arthrodesis as the treatment of choice for painful planovalgus feet unresponsive to conservative treatment. The procedure, described by Dillwyn Evans (2) in 1975 and modified by others (3), particularly Mosca (1, 4), since uses a calcaneal osteotomy with insertion of a tricortical bone graft to lengthen the lateral column of the foot. By lengthening of the lateral column, the primary deformities of flexible flatfoot (valgus, eversion, and dorsiflexion of the calcaneus and abduction and dorsiflexion of the navicular on the talus) are corrected without the adjacent joint degeneration that accompanies arthrodesis (2, 4) (Figure 1).

The initial procedure described by Evans (2) used autogenous bone graft for the structural lengthening of the lateral column. Much research has been focused in recent years on

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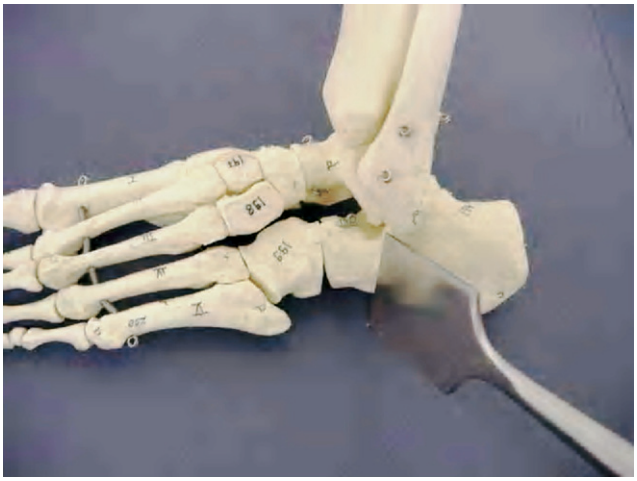

FIGURE 1 Osteotome demonstrating position and direction of the osteotomy.

FIGURE 2 Lateral postoperative radiograph demonstrating amalgamation of allograft.

FIGURE 3 Lateral postoperative radiograph demonstrating failure of amalgamation of allograft.

the benefits and risks of allogeneic bone graft in comparison to autogenous bone graft especially in relation to surgery of the spine (5–9). However, the clinical results of the rapidity and quality of bone graft incorporation for surgeries of the foot (in particular lateral column calcaneal lengthening) have not been well studied. The purpose of this study was to evaluate the incorporation of allogeneic and autogenous bone grafts in healing of lateral column calcaneal lengthening in children.

Materials and Methods

The operative experiences of 4 pediatric orthopedic surgeons were retrospectively reviewed. Since 1994, these surgeons used the calcaneal lengthening osteotomy as described by Mosca's (4) modification of the Evans technique (2) for correction of the deformity. All calcaneal osteotomies were evaluated intraoperatively and, if necessary, K-wire/Steinmann pin or staple fixation was used (according to surgeon preference) to prevent displacement of the structural graft and/or the distal calcaneal fragment. All procedures were performed at the Children's Hospital Medical Center of Akron in Akron, Ohio, between December 1994 and November 2003.

Radiographs of the operated foot at the last follow-up visit were reviewed by 3 independent blinded examiners. Each radiograph was carefully evaluated for signs of amalgamation of the graft bone with the host bone. Assessment of the incorporation of the bone graft was determined by 2 criteria: (1) presence of continuity of trabecular lines between graft and native bone and (2) inability to distinguish the boundary between the previously placed bone graft and the host bone. The examiner's reading was recorded for each case without knowledge of the other examiners' results or of the type of bone graft used. A positive result was recorded if either a consensus or a majority opinion concurred on the amalgamation of the bone graft with the native bone (Figures 2 and 3).

Results

The average length of follow-up in this study was 3.6 years (range was 6 weeks to 11.1 years). Forty-six cases of severe, symptomatic planovalgus feet in 36 patients were corrected. Ten of the patients had bilateral severe symptomatic flatfeet requiring bilateral surgical correction. A minimum of 6 weeks' follow-up was required for inclusion. Ten patients (1 bilateral) were lost to follow-up. The remaining 35 procedures in 26 patients were available for review in this study. Thirty cases used freeze-dried allogeneic bone graft (either femoral or iliac crest), whereas the remaining 5 cases used autograft.