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Surgical treatment results for flexible flatfoot in adolescents

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ABSTRACT

Objective: Idiopathic flexible pes planus (IFPP) is a common foot problem in adolescents and young adults. Hypothesis for the present study was that combination of procedures for IFPP can achieve results in adolescents and young adults that are as good as those seen in adult-acquired pes planovalgus (AAPP) treatment in adults.

Methods: A total of 21 feet of 18 patients (10 boys, 8 girls) with mean age of 15.6 years underwent surgical reconstruction for flatfoot deformity. Symptomatic patients who had been unresponsive to conservative treatment were included in study group. Mean follow-up time was 39.2 months. American Orthopedic Foot and Ankle Society (AOFAS) scores were calculated for all patients, and based on final results, all families were asked whether or not they would elect to have the surgery again in same circumstances.

Results: All procedures were performed by the same surgeon: lateral column calcaneal lengthening osteotomy on 21 feet; percutaneous lengthening or gastrocnemius recession for Achilles tendon on 21 feet; medializing calcaneal osteotomy on 15 feet; flexor digitorum longus tendon transfer on 15 feet; medial cuneiform opening wedge osteotomy on 5 feet, spring ligament plication on 3 feet, and accessory navicular bone excision on 2 feet.

Preoperative mean AOFAS score increased significantly from 56.76 to 95.29. All parents stated that they were satisfied with surgery results and would choose to have the same surgery performed again.

Conclusion: Soft tissue and bony procedures used for reconstruction of AAPP can be used safely for IFPP in adolescents and young adults.

Level of clinical evidence: Level IV, Therapeutic study.

Idiopathic flexible pes planus (IFPP) is a common foot problem in adolescents and young adults.[1] Although IFPP resolves spontaneously in most cases, surgery may be necessary if conservative treatment fails.[2] Surgical indications, timing, and procedures for IFPP remain controversial.[3,4]

Management of symptomatic IFPP begins with education of the patient and parents.[1] Foot orthoses, stretching, shoe modifications, activity modifications, manipulation, serial casting, weight regulation in obese patients, and medications for pain relief and inflammation are conservative treatment modalities.[2,5]

Symptomatic IFPP patients who are unresponsive to conservative treatment and have symptoms such as pain or early deformation of the shoe may be candidates for surgical treatment. Although there is still no consensus about indications, efficacy, or type of procedure for surgical IFPP reconstruction, there are several options for surgical treatment in adolescents and young adults. Several authors recommend use of arthroereisis, while others prefer to use osteotomy or soft tissue procedures.[6,7]

Osteotomy combined with soft tissue procedures is rarely performed on young patients,[8,9] but there are several arguments that perhaps it should be.[10] Present study hypothesis was that combined procedures for IFPP can achieve results in adolescents and young adults as good as those seen in adult-acquired pes planovalgus (AAPP) treatment in adults.

Patients and methods

Patients with symptomatic, flexible, idiopathic flatfoot were included in this retrospective study. Institutional review board approved the study, and written, informed consent was obtained

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from all study participants. Between June 2005 and January 2013, 18 patients with 21 affected feet (10 boys, 8 girls), who had mean age of 15.6 years (range: 9–25 years), underwent surgical reconstruction for flatfoot deformities at university hospital. Postoperative follow-up was conducted at 6, 12, and 24 weeks. After last follow-up, all patients were called annually. Mean total follow-up time was 51.2 months (range: 13.7–104.6 months). All procedures were performed by the same surgeon. Procedures were: lateral column calcaneal lengthening (LCL) osteotomy in 21 (100%) feet, percutaneous Achilles tendon lengthening or gastrocnemius recession in 21 (100%), medializing calcaneal osteotomy in 15 (71.4%), flexor digitorum longus tendon (FDL) transfer in 15 (71.4%), medial cuneiform opening wedge (Cotton) osteotomy in 5 (23.8%), spring ligament plications in 3 (14.3%), and accessory navicular bone excision in 2 (9.5%) feet. For autograft, preferred material to be used for LCL osteotomy was bone harvested from iliac crest, but in 7 patients, tricortical allograft was used due to parent preference.

All patients had received conservative treatment for at least 12 months, including methods such as custom-made insoles and Achilles tendon stretching exercises. Patients and their parents were educated about natural course of condition by the senior surgeon. Patients who were still symptomatic after conservative treatment period of 12 months and who had radiographic changes like increased talonavicular uncoverage, decreased calcaneal inclination and talo-first metatarsal angles were accepted as candidates for surgery. Radiographic measurements were taken with standing anteroposterior (AP) and lateral radiographs (Fig. 1a and b). Patients with tarsal coalitions and congenital vertical talus were excluded from the study.

Operative technique

All patients were operated on under general anesthesia in supine position. First, Achilles tendon examination was made using Silfverskiöld test to determine selection of gastrocnemius recession or percutaneous Achilles lengthening. Once Achilles procedure was completed, harvesting of autologous bone graft from iliac crest was performed in autograft cases.

When Achilles procedure and graft harvest were complete, thigh tourniquet was inflated. LCL was chosen as first step because forefoot abduction and talonavicular coverage was insufficient in all patients. Osteotomy site was located approximately 1.5 cm proximal to calcaneocuboid joint, and before osteotomy was completed, calcaneocuboid joint was temporarily stabilized with K-wire. Lamina spreader was used to determine adequate graft size. Usually, 8–11 mm grafts were sufficient, depending on degree of deformity. After application of graft, K-wire or cannulated screw was used in retrograde fashion to stabilize graft.

Following LCL procedure, hindfoot valgus was checked clinically. If it persisted, then medializing calcaneal osteotomy was performed. Subsequent to osteotomy, posterior fragment was displaced medially to achieve at least 8–10 mm of displacement, and fixation was achieved with 1 or 2 cannulated screws.

FDL tendon was then transferred. It was placed at level distal to Henry's knot, as described by Haddad and Mann,[11] and prepared tendon was passed through hole in navicular bone and sutured to itself under tension. Before harvesting FDL tendon, spring ligament and posterior tibial tendon (PTT) were examined. If loose, spring ligament was plicated with 2 non-absorbable, braided sutures. Minimal PTT degeneration was noted in <50% of the patients; no PTTs were sacrificed.

If supination deformity of forefoot remained, next step was Cotton osteotomy. Required distraction was determined under fluoroscopy and graft was placed at osteotomy site.

For patients with accessory navicular, resection of accessory bone was followed by fixation of PTT with suture anchor. Before fixation of PTT, spring ligament was checked for rupture; if it was ruptured, tendon fixation was performed after spring ligament repair. When all incisions were closed, bulky cotton padding and short leg splint were applied.

Postoperative care

Patients were not permitted to bear weight for 6 weeks. At 6 weeks, when adequate consolidation was observed at osteotomy sites, temporary fixation materials were removed and patients were allowed to bear weight, as tolerated, in walking boot for 4-week period (Fig. 2a and b). At postoperative week 10, patients were told to wear sports shoes and return on week 12 for follow-up X-ray. On AP radiograph, talonavicular coverage, talocalcaneal, and talo-first metatarsal angles were measured. Talocalcaneal angle, talo-first metatarsal angle, talohorizontal angle, and calcaneal inclination were measured on lateral radiographs. In addition to radiographic measurements, AOFAS hindfoot and ankle scores were calculated for all patients preoperatively and at final follow-up examination.

Patients and their parents were asked whether they were pleased with surgery results and whether they would choose to undergo the surgery again in similar circumstances (Fig. 3a, b, c). Wilcoxon signed-rank test was used to compare numerical parameters in statistical analysis and $p < 0.05$ was accepted as statistically significant. Pillai's Trace test was used for repeated

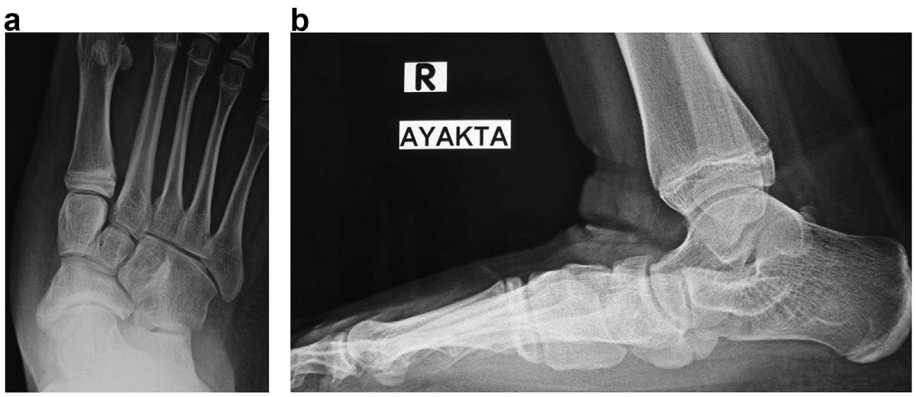

Fig. 1. a. Preoperative anteroposterior x-ray of foot. Notice accessory navicular bone. **b**. Preoperative lateral x-ray of foot. Notice accessory navicular bone and talar sag.

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