Electronic Appendix

Experimental Flatfoot Model

For each paired specimen, one side was randomly designated as the mild flatfoot experimental model (mild model) and the contralateral foot was designated as the severe experimental flatfoot model (severe model). In the intact foot (control), all tendons, including the posterior tibial tendon, were loaded. In the flatfoot model, the posterior tibial tendon was rendered incompetent by applying no load to this unit. In the mild model, the medial and superior aspects of the talonavicular capsule and the spring ligament were transected. In the severe model, transection was done, as described previously[23], on the medial, superior, and inferior aspects of the talonavicular capsule; the spring ligament; the long and short plantar ligaments; the talonavicular portion of the superficial deltoid ligament; and the talocalcaneal interosseous ligament.

Medializing Calcaneal Osteotomy and Flexor Digitorum Longus Transfer

A medializing calcaneal osteotomy was performed on all specimens by making an oblique lateral heel incision parallel to the peroneal tendons and posterior to the sural nerve. Dissection was carried to the lateral periosteum of the calcaneus. The superior border of the calcaneal tuberosity anterior to the retrocalcaneal bursa and the inferior border of the calcaneus anterior to the plantar calcaneal tuberosity were freed of soft-tissue attachments, preserving the Achilles insertion. A transverse osteotomy was made at an angle of approximately 45° to the sole of the foot in line with the skin incision. A bicortical osteotomy was then performed with a sagittal saw in a transverse plane from lateral to medial. The tuberosity was translated medially 1 cm as measured with a ruler for consistency. No dorsal or plantar translation was performed. The osteotomy was then secured with use of two 7.3-mm cannulated screws (Synthes, Paoli, Pennsylvania), as described previously[24].

We simulated a healed flexor digitorum longus transfer by loading the previously unloaded posterior tibial tendon at 22 N and unloading the flexor digitorum longus tendon. Laxity of the flexor digitorum longus tendon and its respective cable pulley system was ensured. The posterior tibial tendon was thoroughly dissected and was freed of its capsular extensions and all proximal attachments. It was left intact distally only to its anatomic attachment on the navicular to simulate the effect of the flexor digitorum longus transfer to the navicular. This simulated flexor digitorum longus transfer was performed instead of an actual transfer to avoid introducing tendon fixation variables such as suture loosening, suture pullout, or bone tunnel-tendon interface problems.

Reconstructive Procedure: Subtalar Arthroereisis

A subtalar arthroereisis was performed on all specimens. The MBA (Maxwell-Brancheau arthroereisis) titanium-alloy interference screw (Kinetikos Medical, Carlsbad, California) was used in accordance with the manufacturer's recommended technique. In the arthroereisis procedure, the interference screw implant maintains the distance between the lateral shoulder of the talus and the angle of Gissane, shifting the calcaneus into a more varus orientation. It also partially obstructs eversion movement, which prevents the calcaneus from moving into a valgus position. As a result, the talus sits in a position that is less plantar flexed and less medially rotated and the navicular is less abducted.

Exposure was through a 1-cm lateral incision over the sinus tarsi between the calcaneus and the lateral aspect of the talus. A guidewire was placed in the sinus tarsi. Progressively larger blunt-tipped cannulated spacers were placed within the sinus tarsi for sizing, blocking increasing amounts of hindfoot eversion until deformity was decreased without creating forefoot supination as determined with visual inspection. A trial implant reflecting the diameter of the tapered spacer was then placed in the sinus tarsi to confirm deformity correction, and this was followed by placement of the permanent implant of the same diameter. The implant was placed 4 mm medial to the lateral edge of the talar neck as seen on the anteroposterior radiograph.

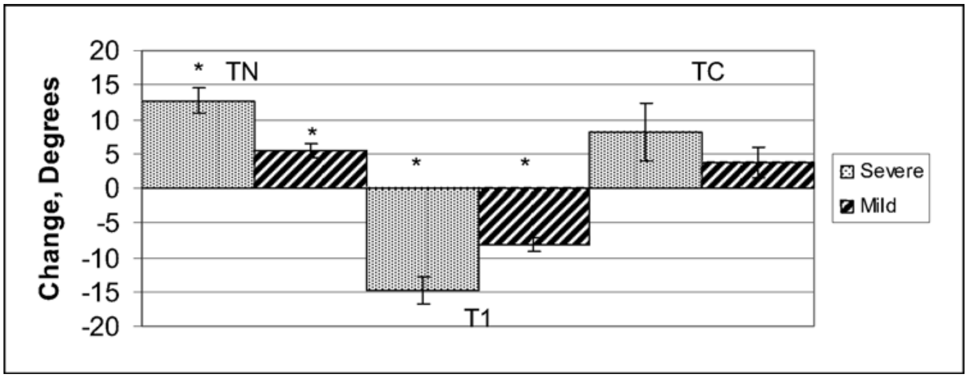

Fig. E-1A

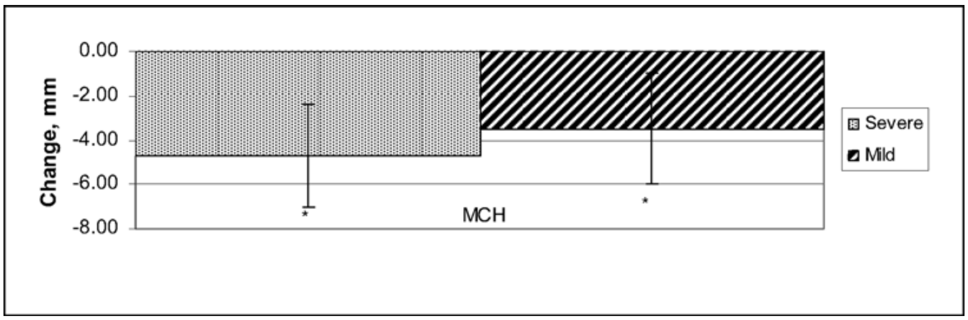

Fig. E-1B

Mean deformity created in the mild and the severe model in terms of angles (Fig. E-1A) and medial cuneiform height (Fig. E-1B). TN = talonavicular angle, T1 = talar-first metatarsal angle, TC = talocalcaneal angle, and MCH = medial cuneiform height. An asterisk indicates a significant difference compared with the intact foot at the $p \leq 0.05$ level. The error bars show the standard error of the mean.

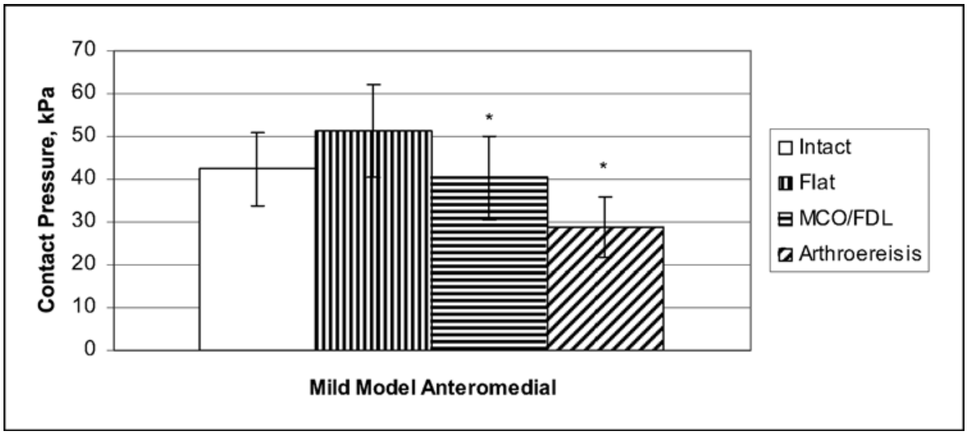

Fig. E-2A

Figs. E-2A through E-2D Change in contact pressure after sectioning (Flat), after a combined medializing calcaneal osteotomy and flexor digitorum longus transfer (MCO/FDL), and after a medializing calcaneal osteotomy and flexor digitorum longus transfer combined with an arthroereisis. An asterisk indicates a significant difference compared with the flatfoot state at the $p \leq 0.05$ level. The error bars show the standard error of the mean. **Fig. E-2A** Anteromedial pressure change in the mild model.

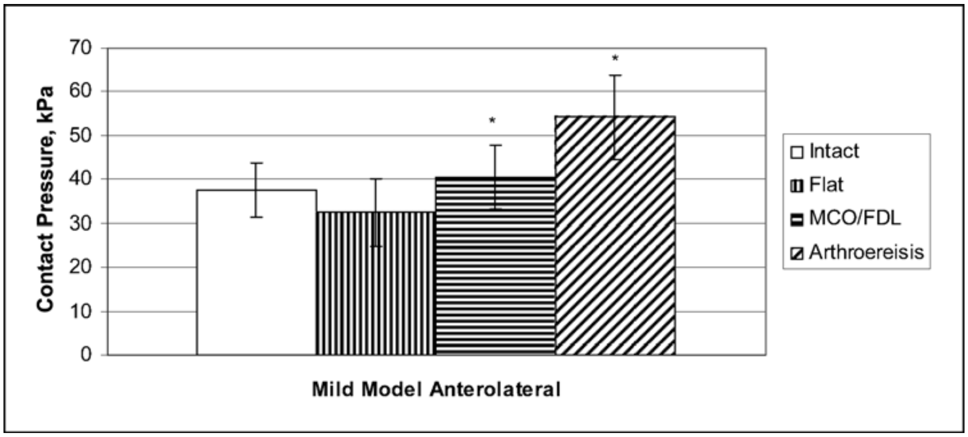

Fig. E-2B

Anterolateral pressure change in the mild model.

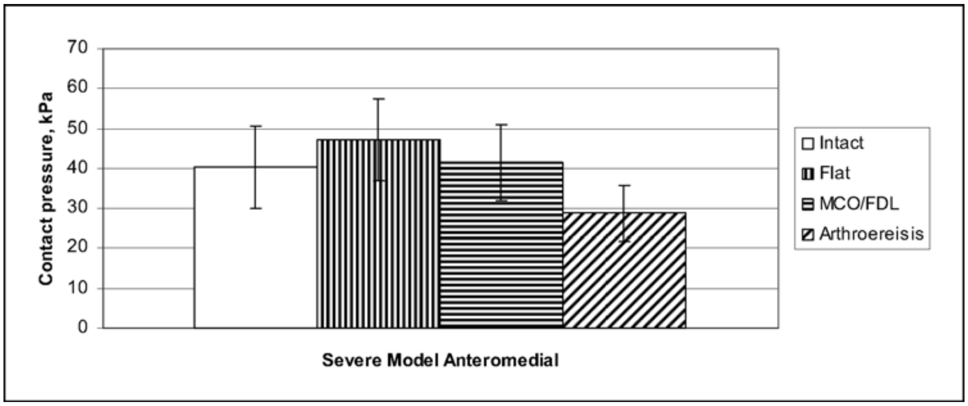

Fig. E-2C

Anteromedial pressure change in the severe model.

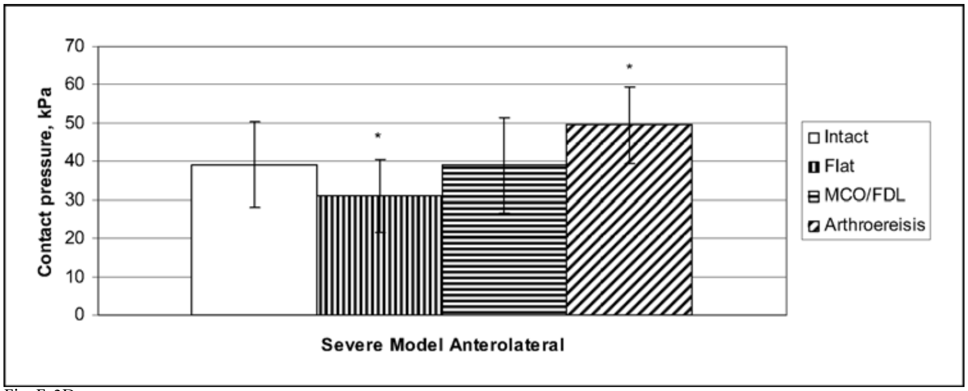

Fig. E-2D

Anterolateral pressure change in the severe model.