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Purpose

This study was conducted to show the effectiveness of extra-osseous talotarsal fixation with *HyProCure*® in reducing the forces acting on the middle and anterior talocalcaneal joints and subsequentially on the medial column structures of the foot.

Background

The stability of the talocalcaneal articulations is crucial for proper foot function. The subtalar joint is responsible for the conversion of vertical forces from the weight of the body above into horizontal forces in the lower extremities. The subtalar joint also dictates the movements of the midtarsal joints and forefoot motion. Anteriomedial dislocation of the talus on the calcaneus leads to an abnormal transfer of forces onto the navicular as well as the middle and anterior calcaneal facets. These excessive forces place significant strain not only on the supporting osseous structures but also on the soft tissues of the medial column such as the spring ligament, medial band of the plantar fascia and posterior tibial tendon.

This internal dynamic pathologic talar dislocation (partial) has been shown to be the primary etiology for the majority of disorders within the foot and ankle. Stabilization of the subtalar joint is of extreme importance to normalize the joint forces and thereby reduce the strain on the osseous structures and soft tissues of the medial column.

Methods

- Five fresh-frozen human foot cadaver specimens that exhibited anteriomedial dislocation of the talus on the calcaneus were selected, potted and mounted to the testing fixture. Joint load sensors were inserted into the posterior, middle and anterior talocalcaneal articular facets. The tibial segment was internally rotated to produce maximum pronation of the subtalar joint using a biaxial materials testing machine.
- The forces were measured across the posterior, middle and anterior talocalcaneal joint facets before and after placement of the *HyProCure*® extra-osseous talotarsal fixation device.

Results

- Talar displacement lead to decreased forces acting on the posterior facet and increased forces acting on the middle and anterior facets.
- *HyProCure*® stabilization maintained the posterior facet articulation and decreased forces acting on the middle and anterior facets.
- The mean $\pm$ 1 SD forces in the posterior talocalcaneal joint increased from **795.88** $\pm$ 106 N to **1,004.86** $\pm$ 72.41 N ($P < 0.05$, two-tailed paired *t* test).
- The mean $\pm$ 1 SD forces at the anterior talocalcaneal joint decreased from **520.15** $\pm$ 127.18 N to **394.56** $\pm$ 73.83 N ($P < 0.05$), due to the maintenance of the contact area posteriorly upon the insertion of *HyProCure*®.

> *HyProCure*® **stabilized forces on the posterior talocalcaneal facet resulting in a** **24%** **decrease in excessive forces acting on the middle & anterior talocalcaneal facets.**

Clinical Significance & Conclusions

- Anteriomedial dislocation (partial) of the talus on the calcaneus results in an anteriomedial shift of forces that should be passing through the posterior talocalcaneal joint rather than on the middle and anterior talocalcaneal joints.
- Extra-osseous talotarsal joint fixation with *HyProCure*® stabilized the forces on the posterior talocalcaneal facet and decreased the forces acting on the middle and anterior talocalcaneal joints.
- Reduction of excessive abnormal forces acting on the middle and anterior talocalcaneal joint should also lead to decreased strain on the osseous structures and soft tissues of the medial column of the foot.
- This paper proves the importance of stabilization of talocalcaneal joint dislocation. *HyProCure*® reduces the pathologic forces acting on and leading to the secondary deformities associated with the medial column of the foot.