Not Your Typical Ex-Fix: A Novel Approach to Cavus Foot Reconstruction Utilizing a Unique Midfoot Osteotomy and External Fixation with Gradual Distraction and Multiplanar Correction

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Purpose

This report describes a successful cavus foot reconstruction on a 24 year old male with congenital equinocavovarus. The described technique is highlighted by a midfoot distraction osteotomy through the body of the cuneiforms and cuboid, along with a Dwyer osteotomy, Steindler stripping, percutaneous TAL, and external fixation using a Taylor spatial frame.

Methods

This patient experienced pain with ambulation and physical activity since childhood without relief from conservative treatment. He refrained from exercise for wellness and recreational purposes for the prior four years due to discomfort, leading him to seek surgical correction. X-rays and CT imaging were obtained which showed the multiplanar deformity with an increased Meary's angle, an increased calcaneal inclination angle, and forefoot varus bilaterally. Clinically, he presented with a high medial arch, mild hammertoes due to extensor substitution, moderate forefoot adduction, equinus, and a rigid rearfoot result during the Coleman block test. After lengthy discussion, he chose to undergo surgical correction on his left foot first so that he could drive post-operatively.

The patient underwent a percutaneous modified Hoke TAL, Steindler stripping, a Dwyer closing wedge osteotomy along with the midfoot distraction osteotomy with application of an external fixator with gradual correction struts. The unique midfoot osteotomy was performed within the frontal plane through all of the cuneiforms and the cuboid, leaving an intact hinge at the dorsal cortices.

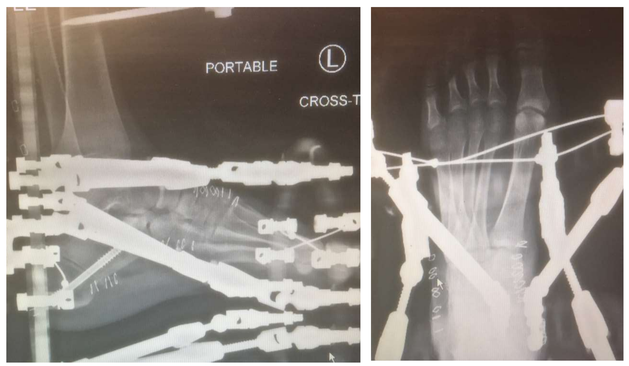
The external fixator consisted of tibial and forefoot half-rings connected to a tibial plate in a butt-style Taylor Spatial hexapod with gradual correction struts. Post-operatively, struts 1-4 were manually adjusted by the patient from postoperative days 10-17 to dorsiflex the forefoot, achieving distraction at the osteotomy site mainly in the sagittal plane. From days 17-30, all six struts were manually adjusted to pronate the forefoot at the midtarsal joints and to compress the lateral column to abduct the forefoot, with the guidance of the gradual correction software. The frame was in the corrected position from days 30-69 before it was removed.

Figure 1. Preoperative clinical picture

Figure 2. Postoperative clinical picture

Figure 3. Postoperative clinical pictures

Figure 4: Immediate Postoperative x-rays



Results

Post-operatively the patient was non-weightbearing to the left lower extremity for almost 11 weeks, transitioned to protected weightbearing in a cast and CAM boot for 4 weeks, and transitioned to sneakers at week 15. Physical therapy, with inclusion of the Graston technique, was initiated when the patient transitioned to protected weightbearing. Correction of the patient's deformity was noted clinically and radiographically after the gradual correction was finalized. Post-operatively the calcaneal inclination angle decreased from 32.5 to 27.8, the Meary's angle decreased from 25.4 to 19.8, and Hibbs angle increased from 110 to 123. Clinically, the patients hammertoes reduced, the forefoot and rearfoot were corrected out of varus, and the forefoot adduction was reduced. The patient relayed minimal postoperative pain, no complications, and return to normal daily activities without discomfort.

Discussion/Literature Review

The complexity of this deformity type requires careful surgical planning with consideration of soft tissue and osseous involvement along with other extrinsic factors. Neuromuscular disorders are a common etiology of equinocavovarus deformities, adding another layer of attention to procedural selection. The patient presented underwent an EMG and blood work after a neurology consultation, ruling out any neuromuscular disorder. Nevertheless, the goal of any cavus reconstruction should be to obtain reduction of the deformity at its apex, leave the patient with a painless plantigrade foot, and minimize recurrence and complications. Previous literature describes algorithms to aid in procedure selection, suggesting the most severely rigid deformities will benefit most from Ilizarov gradual correction[1]. Other reasons for gradual correction with an external fixator are to correct a multiplanar deformity at multiple levels and to decrease the risk of neurovascular and soft tissue complications[2]. This midfoot osteotomy is rare in the literature with many other osteotomies being described more commonly. The Japas midfoot osteotomy, Cole midfoot closing wedge, and U or Y shaped rearfoot osteotomies are historically described. Reproducible results with good outcomes have been reported using Taylor spatial frames with gradual correction using midfoot osteotomies[3]. This specific midfoot osteotomy was chosen to reduce the amount of future arthritis and allow safe correction at the apex of the deformity. The use of external fixation, along with adjunctive procedures, is highly beneficial with a trained surgeon for the challenging and multiplanar equinocavovarus foot deformity.

References

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