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Axial Loading Cross Screw Fixation for the Austin Bunionectomy

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ABSTRACT

The Austin procedure has become a common method of osteotomy for the correction of hallux abductovalgus when indicated. The V-type configuration is intrinsically stable but not without complications. One complication encountered is rotation and/or displacement of the capital fragment. We present the use of an axial loading screw in conjunction with a dorsally placed compression screw. The benefit to this technique lies in the orientation of the axial loading screw, because it is directed to resist the ground reactive forces while also providing a second point of fixation in a crossing screw design. In a head-to-head biomechanical comparison, we tested single dorsal screw fixation versus double screw fixation, including both the dorsal and the axial loading screws in 10 metatarsal Sawbones® (Pacific Research Laboratories Inc, Vashon, WA). Five metatarsals received single dorsal screw fixation and five received the dorsal screw and the additional axial loading screw. The metatarsals were analyzed on an Instron compression device for comparison; 100% of the single screw fixation osteotomies failed with compression at an average peak load of 205 N. Four of five axial loading double screw fixation osteotomies did not fail. This finding suggests that the addition of an axial loading screw providing cross screw orientation significantly increases the stability of the Austin osteotomy, ultimately decreasing the likelihood of displacement encountered in the surgical repair of hallux abductovalgus.

The surgical correction of hallux abductovalgus has become a mainstream procedure. Although many surgical procedures are indicated and widely used, the Austin bunionectomy is a common method of osteotomy chosen by many surgeons (1). Austin and Leventen (2) first described the Austin bunionectomy in 1962 and later published in 1981, the report titled, "A New Osteotomy for Hallux Valgus." This V-type configuration is intrinsically stable but not without complications. One complication encountered is rotation with displacement of the capital fragment (Fig. 1). This can result in malunion or nonunion and require additional treatment, including additional surgery (3–9). Internal fixation techniques have reduced the frequency of these complications, but they continue to frustrate surgeons even today.

Originally, when Austin and Leventen (2) first introduced the Austin bunionectomy, they described the osteotomy as stable and proposed that it did not require fixation. However, surgeons have encountered displacement of the osteotomy, and, as a result, several methods of fixation have been described, including Kirschner wires, staples, bioabsorbable pins, monofilament stainless steel wire, plate fixation, and screw fixation (5,6,9–15).

We propose a method of fixation for the Austin bunionectomy involving an axial loading screw (ALS). The benefit to this technique lies in the orientation of the screw, because it is directed to resist ground reactive forces (Fig. 2). Also, this screw provides a second or cross screw compression configuration when combined with the traditional single screw described by Clancy et al (1) in 1989.

Using Sawbones® (Pacific Research Laboratories Inc, Vashon, WA) for simulation, we tested the ALS combined with the single dorsal screw in a cross screw technique and compared it with the single dorsal screw fixation. In other areas of the foot, 2 screw fixation has been cited as being a superior technique, ultimately decreasing complications by providing better fixation and increasing the biomechanical advantage (16).

The purpose of the present study was to determine the difference in biomechanical stability between single screw fixation and the axial loading double screw fixation. Our hypothesis was that the cross screw compression technique involving the ALS would demonstrate superior capital fragment stability.

Patients and Methods

In a head-to-head comparison, we tested the Austin bunionectomy in 2 groups of first metatarsal Sawbones®. Each group consisted of 5 first metatarsals. Single screw fixation served as our control group (Fig. 3*A*). The experimental group received the ALS double compression fixation configuration (Fig. 3*B*). All 10 metatarsals were analyzed

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Fig. 1. Anteroposterior radiograph demonstrating capital fragment rotation and displacement of osteotomy and fixation after Austin bunionectomy.

using an Instron 8500 plus system tension/compression device (Instron, Norwood, MA) for strength analysis (Fig. 4). Video imaging was used to analyze osteotomy failure. (Supplemental Video 1 is available at www.jfas.org.) The metatarsals were obtained from a single company. All the metatarsals were prepared by one author. An osteotomy guide was used to ensure consistency of the osteotomies. A 60° V-cut osteotomy was created with a sagittal saw. The apex was placed 10 mm proximal to the articular surface and centered concentrically on the metatarsal head. A guidewire was placed from dorsal to plantar, crossing the dorsal wing of the osteotomy in a perpendicular

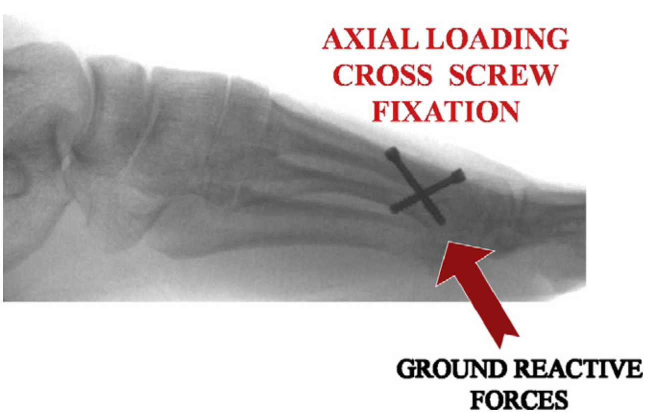

Fig. 2. Lateral radiograph depicting single screw fixation combined with ALS. ALS oriented to resist ground reactive forces and also provide a second point of fixation.

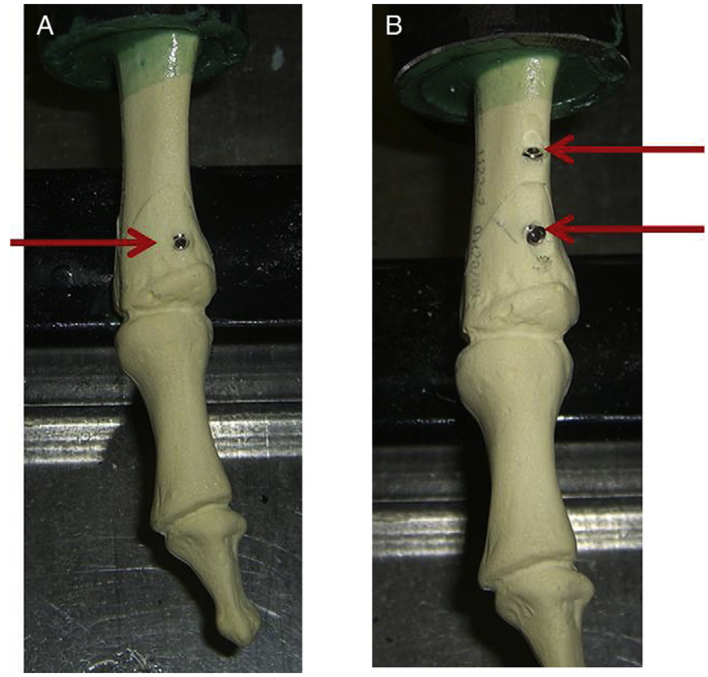

Fig. 3. (*A*) First metatarsal Sawbones® with Austin osteotomy fixated with single screw. (*B*) Same fixation and osteotomy with addition of ALS to form double screw crossing configuration.

fashion directed from distal to proximal. A 3.0 × 18-mm partially threaded cannulated headless compression screw was inserted across the osteotomy.

In the experimental ALS group, the same technique as described above was performed. After placing the first screw, a second guidewire was then placed from the dorsal to plantar direction, crossing the plantar wing of the osteotomy, directed from proximally to distally and oriented to resist axial loading. A 3.0 × 30 mm partially threaded cannulated headless compression screw was inserted across the osteotomy

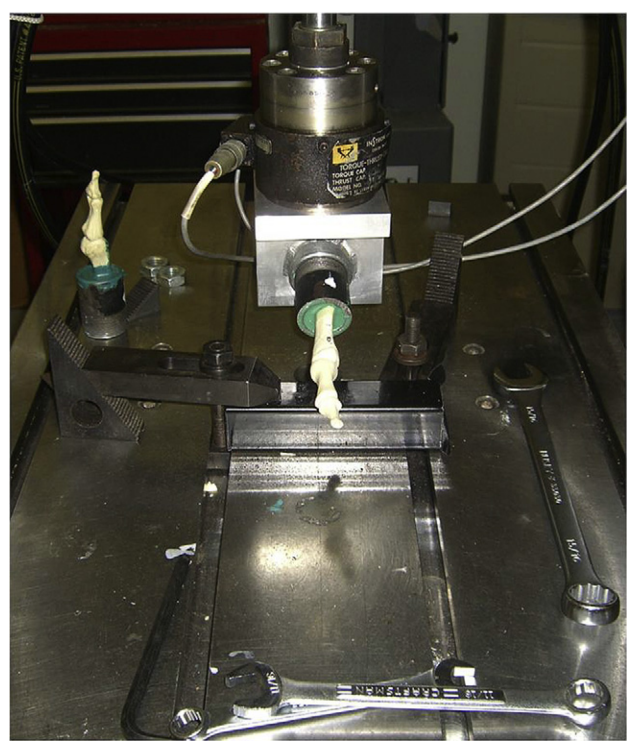

Fig. 4. Metatarsal interfaced with Instron 8500 tension/compression device demonstrating compression block placement under capital fragment.