ISAKOS

International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine

11th Biennial ISAKOS Congress • June 4-8, 2017 • Shanghai, China

Paper #87

A Biomechanical Comparison of Fifth Metatarsal Jones Fracture Fixation Methods - What is the Ideal Construct?

Neil Leon Duplantier, MD,
Ronald Jacob Mitchell, MD, UNITED STATES
Aaron Stone, MS, UNITED STATES
Steve Zambrano, BS, UNITED STATES
Domenica Delgado,
Bradley S Lambert, PhD, UNITED STATES
Michael R Moreno, PhD, UNITED STATES
Joshua David Harris, MD, UNITED STATES
Patrick C. McCulloch, UNITED STATES
David M Lintner, MD, UNITED STATES
Kevin E Varner, MD, UNITED STATES

Houston Methodist Orthopedics & Sports Medicine
Houston, Texas, UNITED STATES

Summary:
Intramedullary screw fixation techniques remain as the most utilized construct for the treatment of Jones' fractures despite reports of non-union and re-fracture. The authors are not aware of any other biomechanical studies comparing this plate construct to an intramedullary screw construct.

Abstract:
Introduction:

Fifth metatarsal base fractures of the metaphyseal-diaphyseal watershed junction (Jones fractures) are commonly treated with surgical fixation in athletes. Intramedullary screw fixation remains the most utilized construct despite reports of non-union and refractures. This paper compares the biomechanical strength of an intramedullary screw with a plantar-lateral plating construct applied to simulated Jones fractures in paired cadaver foot specimens.

Methods:

Twelve pairs of male cadaver feet (mean age 58) were separated into 2 groups (plate or screw) to conduct contralateral comparative testing of two devices with equally numbered right and left feet in each group. For each fifth metatarsal, an osteotomy was created 2.5cm distal to the proximal tuberosity aimed for the articulation between the fourth and fifth metatarsals to simulate a Jones fracture. The plate group underwent fixation with a 3.0mm 4-hole low profile titanium locking plate placed plantar-laterally. The screw group underwent fixation with a 40 or 45mm X 5.5mm partially-threaded solid titanium intramedullary screw. The osteotomy and fixation were performed leaving all ligamentous and tendinous attachments in place to simulate a surgical procedure. After fixation, the metatarsals were excised for biomechanical testing.

Cyclic cantilever failure testing was conducted using a gradient-fatigue method (force applied at gradually increasing peak-loads). Sinusoidal loading forces at a constant frequency of 0.25Hz were applied to the metatarsal increasing by 2.5 pound-force (lbf) increments per 10 cycles. Testing was concluded once each specimen had completed the prescribed cycles or experienced mechanical failure of the implant or bone. Failure mode, number of cycles to failure (CTF), peak-failure load (PFL), gap width (GW), and video data were recorded. The T-test was used to compare the two groups with a $P<.05$ set for clinical significance.

Paper #87

Results:

The failure mode in both groups occurred at the bone-implant interface. No significant difference was found between the plate and screw groups with regard to CTF (21.5 vs 21 P=0.49), PFL (18.5 lbf vs 9 lbf, P=0.33), or GW (1.2mm vs 5.7mm, P=0.13) respectively reported as means.

Discussion:

This biomechanical investigation suggests planter-lateral plating is a viable option for management of Jones fractures. Although not statistically significant, larger PFL and smaller GW were recognized in the plate group compared to the screw group. This may hold clinical importance in both primary and revision Jones fracture treatments. The authors are unaware of any prior biomechanical studies comparing plantar-lateral plating and screw fixation for the treatment Jones fractures.

Significance:

Intramedullary screw fixation techniques remain as the most utilized construct for the treatment of Jones' fractures despite reports of non-union and re-fracture. The authors are not aware of any other biomechanical studies comparing this plate construct to an intramedullary screw construct.