Comparison of Locking Compression Plate versus Non-locking Plate with Compression Screw for First Metatarsophalangeal Fusion

JOHN KARBASSI MD, HANBING ZHOU, MD, PHILIP AURIGEMMA, MD, SCOTT PASCAL, BA, BRIAN BURROUGHS, MD, PHD, JOHN WIXTED, MD, ABHAY PATEL, MD

Department of Orthopedics and Physical Rehabilitation
University of Massachusetts Medical School
Worcester, Massachusetts
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I have a potential conflict with this presentation: Implants for this study were donated via a research grant by Synthes, Inc.
Introduction

- Traditionally the treatment of end stage first metatarsophalangeal (MTP) joint arthritis has been arthrodesis.
- Despite the wide array of fusion constructs, reports of nonunion in the literature range from 0-30%.
- Potential complications of this procedure include infection, nonunion, delayed union, malunion, metatarsal stress fractures, and local pain arising from the hardware.
- For these reasons, clinicians continue to seek fixation methods that will allow patients to have faster fusion times and earlier weight bearing.
Introduction

- The strongest fixation method reported in the literature up to this point has been application of a dorsal plate with a compression lag screw.
- Recently, there has been development of new compression/locking plate systems for midfoot and forefoot joints.
- This study compares the biomechanical strength of an MTP compression/locking plate construct to the known standard of a dorsal non-locking plate and a compression lag screw.
Methods

- Twelve matched pairs of cadaver feet were obtained for this study.
- Six matched pairs were used to compare the standard 2.7 mm non-locking dorsal plate with a 3.5 mm lag screw to the dorsal 2.7 mm locking compression plate with a lag screw.
- The remaining six matched pairs were used to compare the non-locking dorsal plate with a 3.5 mm compression screw to the dorsal 2.7 mm locking compression plate only.
Schematic Diagram of Study Design

Twelve Matched Pairs of Cadaver Feet

- Six Matched Pairs of Cadaver Feet
  - Six Feet with Non-locking Plate and Compression Screw
  - Six Feet with Locking Plate and Compression Screw
- Six Matched Pairs of Cadaver Feet
  - Six Feet with Non-locking Plate and Compression Screw
  - Six Feet with Locking Plate Only
Comparison of Fusion Constructs
Methods

- A material testing system (MTS) machine was used to apply loads to the MTP joints which allowed for measurement of displacement and stiffness of the various constructs.
- The initial stiffness of the fixation was calculated from the force-displacement curves and defined as the initial slope of these curves.
- The initial contact position of the load cell and the end position at maximum load were recorded.
Results

- The data from the MTS machine was transmitted to a desktop computer for statistical analysis.
- The locked/compression plate construct had less joint displacement and higher stiffness than the control (p<0.05).
- Locked plate with lag screw construct was stiffer than control (p<0.05), but displacement was not statistically significant.
This study compares a novel locked/compression plating system for MTP fusion to the gold standard of non-locking plate and lag screw fixation. The results suggest that locked/compression plating alone is the strongest and stiffest construct for first MTP fusion.
Discussion

- The results of this biomechanical study have implications with respect to determining the most cost-effective and efficacious method of foot fusion.
- Prospective studies in the future will better answer the question of clinical outcome superiority among fusion constructs.
References