

8:52 am – 8:57 am

Ankle Joint Contact Mechanics Are Altered by Syndesmotic Injury and Reductions

Jeremy LaMothe, MD, PhD (*New York, New York*)

Josh R. Baxter, PhD; Susannah Gilbert, MS; Conor Murphy, BA; Mark C. Drakos, MD

Summary

Syndesmosis injuries may result in an incongruous ankle joint. However, ankle joint contact mechanics with syndesmotic injuries and reductions are poorly understood. The purpose of this research was to assess global tibial plafond contact mechanics in a syndesmotic injury model with reductions performed without a reduction clamp, with a reduction clamp, and with a suture-button construct. It was found that syndesmotic disruption caused changes in global contact mechanics, and no reduction technique was able to restore normal contact mechanics.

Introduction

Introduction: Syndesmotic injury may lead to posttraumatic ankle arthritis and poor patient outcomes. Biomechanical studies suggest that tibiotalar joint incongruity may affect ankle joint contact mechanics (1). Accordingly, syndesmotic reduction may alter contact mechanics, and syndesmotic reduction has been shown to be a functional outcome predictor in patients with syndesmotic injury (2). Although peak contact stresses may be altered with joint incongruity, factors other than the stress magnitude may play a role in the development of ankle arthritis (3). Ankle joint contact mechanics in syndesmotic injuries and reductions remains poorly understood.

Purpose: The purpose of this study was to assess global tibial plafond contact mechanics in a syndesmotic injury model with reductions performed without a reduction clamp, with a reduction clamp, and with a suture-button construct.

Methods

Methods: Ten cadaveric lower leg specimens without deformity with undisturbed proximal tibiofibular joints were used. Legs were dissected of skin and soft tissue. Anterior and posterior tibiotalar arthrotomies were performed to allow insertion of an ankle pressure sensor (Tekscan 5033). All ligaments were undisturbed. Proximal tibias were secured to a custom fixture that was attached to a materials testing system, and the foot was placed on a flat base-plate on a low-friction plastic surface. A 400N axial load was applied, and a 350 N force was applied to a canvas strap attached to the Achilles tendon resulting in a total force application across the joint of 750N. Tibial plafond contact area and total force was measured in the intact, disrupted, and reduction situations. The syndesmosis was reduced/secured with a 4.0 mm tetracortical screw with a thumb gauging the congruence of the distal anterior tibiofibular joint, with a large reduction clamp with the ankle in neutral dorsiflexion, and with a suture-button construct (TightRope, Arthrex).

Results

Results: Syndesmotic disruption resulted in a decreased tibial plafond joint force and contact area (Figure 1). Although syndesmotic reduction without a clamp was able to restore significantly more joint force than the reduction clamp or tightrope, all reduction methods were unable to restore total joint force to the uninjured level. Tibial plafond joint contact area was significantly greater when no clamp

was used for joint reduction compared to the disrupted, clamp reduction and TightRope reduction conditions (Figure 1). However, all methods of reduction were unable to restore the tibial plafond contact area to intact levels.

Conclusion

Discussion: Syndesmotic disruption resulted in decreased joint force and contact area, both of which were not recoverable with syndesmotic reduction. The thumb reduction technique performed slightly better than the clamp reduction and suture-button construct reductions. Decreased contact area and force with disruption implies that other structures are receiving more load (e.g. medial and lateral gutters). Conclusions: Syndesmotic disruption caused changes in global contact mechanics, and no reduction technique was able to restore normal contact mechanics.

References:

- 1 Ramsey JBJSAm 1976 58(3):356;
- 2 Weening JOT 2005 19(2):102;
- 3 Vrahas JOT 1994; 8(2):159

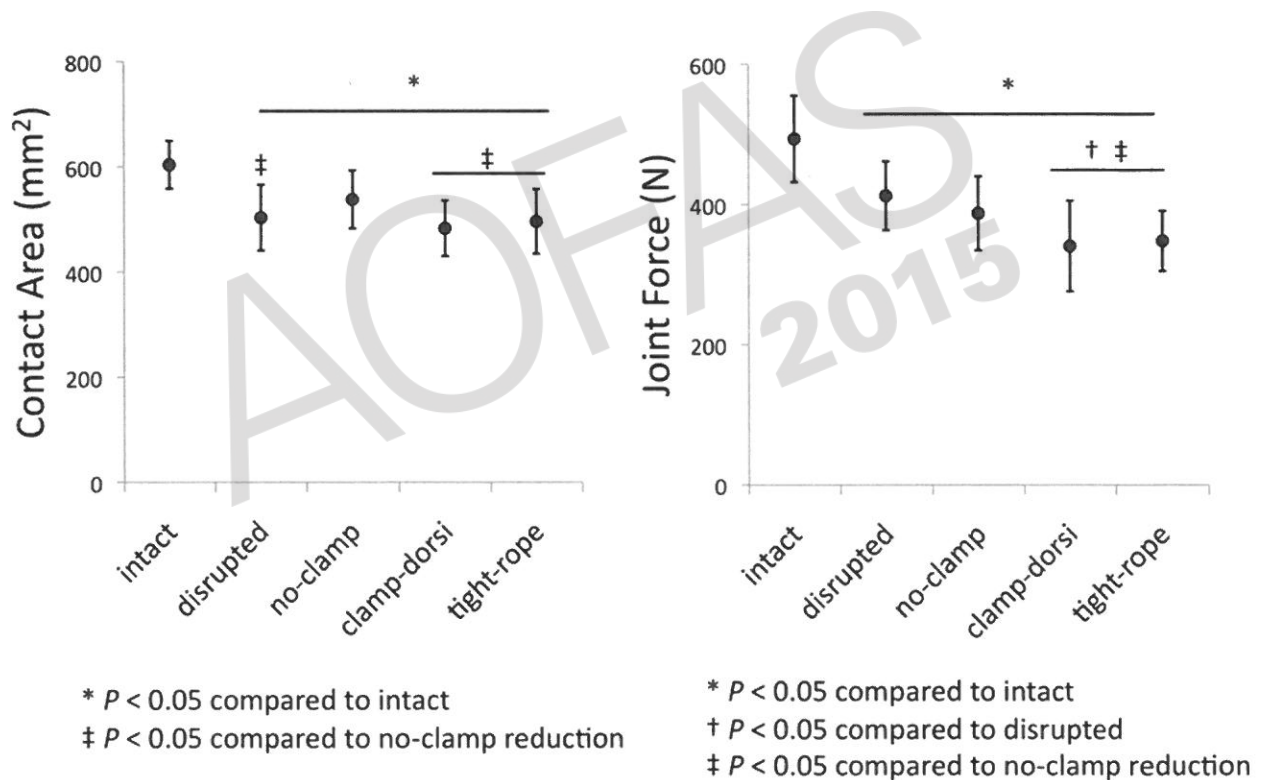


Figure 1. Tibial plafond joint force and contact area in the intact and disrupted syndesmosis, and three reduction conditions.