Introduction/Purpose:
Currently, no consensus exists regarding the ideal postoperative protocol following surgical fixation of unstable, traumatic ankle fractures. Proponents of postoperative non-weight bearing and immobilization suggest that it is important to reduce the risk of fracture malreduction and hardware failure. Conversely, early motion may be important to avoid joint stiffness and complications associated with prolonged immobilization. The purpose of this study is to assess the biomechanical stability of early weight bearing in operatively treated ankle fractures.

Methods:
Biomechanical testing was performed on twenty-four, fresh-frozen lower extremities. The specimens were divided into the following groups: Group 1 (n=6): bimalleolar ankle fracture; Group 2 (matched pair; n=9): trimalleolar ankle fracture with unfixed, small posterior malleolar fracture (15-20%); Group 3 (matched pair; n=9): trimalleolar ankle fracture with fixed, large posterior malleolar fracture (≥33%). Each specimen was subjected to axial compressive loading at a rate of 3 Hz from 0 to 1000 N for 250,000 cycles to simulate 5 weeks of full weightbearing. A differential variable reluctance transducer was placed across each fracture site to measure the amount of displacement.

Results:
In each group, the average motion at each fracture site was significantly less than 1mm (P < 0.05), with at least 54.5% (range 54.5–92.3%) of the motion occurring within the first 50,000 cycles. In group 1, the average displacement was 0.126mm (SD 0.114) laterally and 0.397mm (SD 0.347) medially. In group 2, the average displacement of the lateral fracture was 0.572mm (SD 0.420), medial fracture was 0.469mm (SD 0.359), and posterior fracture was 0.538mm (SD 0.623). In group 3, the average displacement of the lateral fracture was 0.098mm (SD 0.106), medial fracture was 0.466mm (SD 0.646), and posterior fracture was 0.457mm (SD 0.401). There was no relationship between fracture displacement and bone mineral density.

Conclusion:
This study demonstrates in a cadaveric model that early weight bearing in unstable ankle fracture after open reduction and internal fixation may be feasible without hardware or fracture failure. The amount of total motion at each fracture site was significantly less than 1mm. This study represents a possible first-step in determining the ideal postoperative protocol to achieve the best possible outcomes in patients with unstable ankle fractures. Furthermore, this study provides a firm foundation for future randomized, prospective clinical studies.