Biomechanical Study of Screw Fixation and Plate Fixation of a Posterior Malleolar Fracture in Osteoporosis
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Introduction/Purpose: Purpose of this research is to biomechanically compare the screw-fixed and plate-fixed posterior malleolar fracture in osteoporosis patients with fatigue loading system and space motion system in simulation gait cycle. And to give a theory evidence on how to choose an internal fixation in osteoporosis patients with posterior malleolus fracture.

Methods: 36 matched cadaveric pairs lower limbs (T<-2.5) were prepared to simulate Haraguchi I posterior malleolus fracture and randomized into two groups. Models of group A were fixed with two paralleled 4.0mm titanium partial thread cancellous screws from posterior to anterior. Models of group B were fixed with plate. Furthermore, 4 different conditions of gait cycle were simulated as follows: 1. specimen was loaded with 3.2 body weight (BW) at dorsiflexion angle of 12°; 2. Start-up phase: dorsiflexion angle of 5°, 3.6 BW; 3. neutral position, 3.6 BW; 4. maximum plantar flexion, angle of 12°, 4.5 BW. At the end of repeatedly loading, the displacement of fracture fragment (X) was measured with space motion system.

Results: At 12° of dorsiflexion and 15° of plantar flexion, there was a significant difference of X between A and B group, no matter the S and H. When ankle was dorsiflexion of 5°, X of group A was more great than that of group B except A3a/B3a and A1b/B1b. At neutral positon, there was significant difference of X in all the groups except group A2b and B2b.

Conclusion: Compared with 2 paralleled 4.0mm calcaneus screws from posterior to anterior, plate can provide stronger fixation for osteoporosis patients with posterior malleolus fracture. But both of the two methods cannot provide stable fixation for osteoporosis patients with posterior malleolus fragment S>1/3 and H>19.3mm.

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