Δ Weightbearing CT Scan After Pilon Fracture Fixation Demonstrates Significant Early Joint Space Narrowing

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Purpose: Intra-articular fractures (IAFs) of the distal tibia reliably develop posttraumatic osteoarthritis (PTOA). We need objective tools that can detect cartilage loss. Weight-bearing CT (WBCT) scan allows for 3- dimensional (3D) assessment of joint space. The purpose of this study was to assess the reliability of a measurement technique and to determine patterns of joint space narrowing at 6 and 12 months after pilon fracture.

Methods: 14 individuals who sustained pilon fractures were enrolled. All subjects underwent bilateral ankle WBCT scans at 6 and 12 months. Three sagittal slices of the CT were selected equally spaced across this width of the distal tibia articular surface. On each sagittal slice, the joint space from the tibia to the talus was measured in 3 locations. Four reviewers used this technique to independently measure joint space on the injured and uninjured ankles at 6-month follow-up with repeated measurements 2 weeks later. The same measurements were performed on the 12-month WBCT scans. Interrater correlation coefficient (ICC) estimates were calculated based on a mean rating ($\kappa = 4$), absolute agreement, 2-way mixed-effects model. Test-retest reproducibility was calculated based on a single rating, absolute agreement 2-way mixed-effect model. An independent-samples Student t-test was used to compare means between measurements of interest, and $P < 0.05$ was deemed statistically significant.

Results: The ICC of the measurement technique was 0.88. The test-retest reproducibility at 2 weeks was 0.8. Figure 1 demonstrates the joint space measured for each region of the ankle. The mean joint space in the uninjured ankles at all points was 2.58 mm, compared to 1.88 mm at 6 months and 1.92 mm at 12 months in the injured ankles ($P = 0.001$). The difference was not significant comparing 6-month to 12-month scans.

Conclusion: Joint space can be reliably measured on WBCT scans in multiple clinically relevant locations of the ankle. Significant joint space narrowing was seen after pilon fracture at 6 and 12 months.

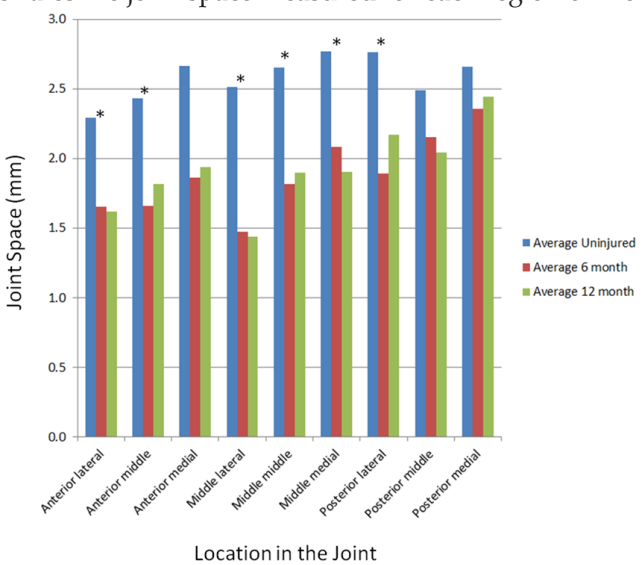

Figure 1: Demonstrates mean joint space at each region comparing uninjured, 6 and 12 months after pilon fracture fixation.
* Indicates significant difference comparing injured to uninjured ankles.

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