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## 2D and 3D Measurements of Osteoarthritis Joint Space Width have Good Agreement in Radiographically Normal Knees but Poor Agreement with Advancing Kellgren-Lawrence Grade: Data from the Osteoarthritis Initiative

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**Background/Purpose:** Joint Space Width (JSW) remains the current gold standard in OA structure modification trials, however MRI studies have suggested JS narrowing represents a group of pathologies [1]. We aimed to assess the agreement between sensitive measurements of 3DJSW and standard radiographic 2DJSW to further explore conceptually what inter-bone distance represents, using a large OA knee cohort.

**Methods:** Analyses were performed on 5622 knees from the Osteoarthritis Initiative. Femur and tibia bones were automatically segmented using active appearance models (AAMs). 3D JSW measurements were taken from 1700 points on the medial tibial plateau across the medial tibiofemoral joint (mTFJ), generating an average measurement (3DJSW<sub>mean</sub>); radiographic 2DJSW was generated centrally using a trainable algorithm-based software tool. 3DJSW was compared to radiographic 2DJSW at a fixed radiographic location. SPSSv21 was used to generate Bland Altman plots and used linear regression to measure agreement between the methods.

**Results:** Bland Altman plots for 2D vs 3D measurements of JSW demonstrated good agreement in radiographic structurally normal knees (Kellgren-Lawrence (KL) grade 0 variation in bias=0.14 per mm; bias at 5mm = -0.36; limits of agreement (LoA) width = 2.89; see Figure 1a) but as KL grade increased and mean JSW decreased, the variation in bias with mean JSW increased and limits of agreement widened (KL4 variation in bias=0.96 per mm; bias at 5mm = -1.30; LoA width: 4.42; see Figure 1b) with a breakdown of the relationship between the 2D and 3D JSW measurements.

**Conclusion:** JSN comprises various pathologies that are not visualised in radiographs (which consolidate these changes into a single projection) including asymmetric cartilage loss and meniscal extrusion. Although X-ray assessment of JSW provides a comparable measure of inter-bone distance for normal knees, there is increasing discrepancy between 2D and 3DJSW with increasing KL grade. In KL4 knees, poorer agreement between the methods is seen at lower average JSWs. This suggests that radiographs underestimate JSW when compared to MRI when structural change is most advanced. When radiographs demonstrate 'bone on bone' changes, MRI is able to discern differences in JSW.

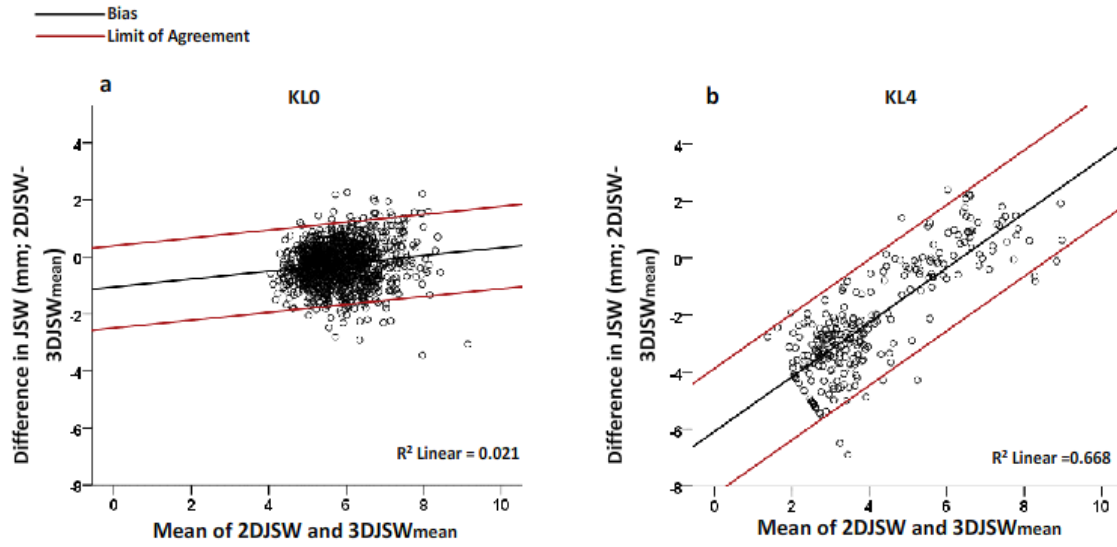


Figure 1 - Bland Altman Plot of Fixed Radiographic JSW vs 3DJSW<sub>mean</sub>.

[1] Hunter et al. Arthritis Rheum 2006;54(8): 2488–2495.