

## Weight-bearing MRI for analysis of knee OA

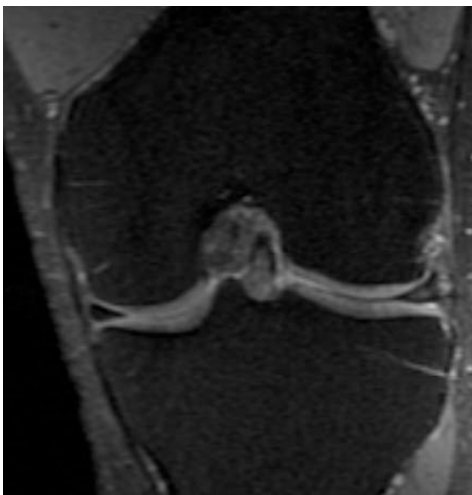
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Joint space narrowing (JSN) as measured by X-ray is the current gold standard for measuring osteoarthritis (OA) progression and, hence, is a key biomarker for the study of disease modifying OA drugs (DMOADs). However, studies using JSN require on the order of two years and 250 subjects per treatment arm, making it difficult and expensive to test DMOAD compounds. It was believed that MRI, with its 3-D images and soft tissue contrast, would permit a more sensitive biomarker for OA progression. Several studies have acquired MRI data and have focused on cartilage analysis. Preliminary results of global cartilage measures from these studies indicate that cartilage regression as measured from MRI is not more sensitive than joint space width (JSW) as measured from X-ray. Thus the question remains: Why does 3-D MRI not yield more information regarding disease progression than 2-D projection X-ray?

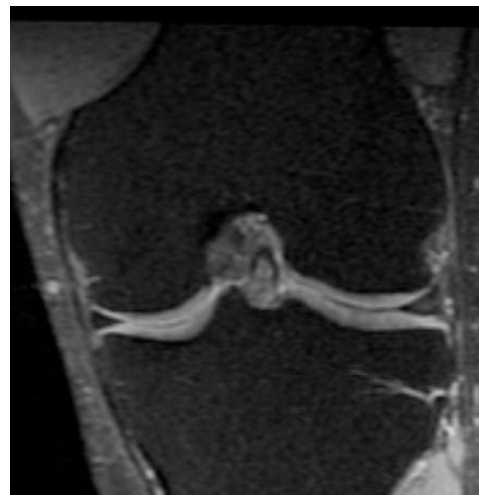
The likely answer is one of the following: (1) change in cartilage may not be the primary determinant of JSN and the meniscus should also be evaluated; or (2) the X-rays are taken while the subject is standing up but the MRI is taken while the subject is lying down, which would result in compression on the joint tissues during X-ray but not during MRI. By acquiring MRI with a load on the knee similar to standing, we can begin to understand which components of the knee compress during standing and how these various components change in a diseased state.

The three objectives of this study are as follows: (1) to determine which joint components (i.e., cartilage and meniscus) demonstrate the greatest changes between weight-bearing and non-weight-bearing protocols; (2) to determine if additional information gained from weight-bearing images can explain the difference in JSW between weight-bearing X-ray and traditional non-weight-bearing MRI; and (3) to determine if changes seen in weight-bearing MRI can identify changes that occur during the biological process of OA and, hence, be indicative of a more sensitive biomarker.

Using a specially designed MRI compatible loading system currently available at UCSF, we can acquire MRI images of the knee during weight-bearing conditions at 50% of body weight and then acquire the same sequences during a traditional non-loaded condition. Likewise, the X-ray will be acquired using the Lyon schuss method and can be acquired in both a loaded and unloaded manner. Subjects with varying levels of OA as well as controls will help to determine if loaded MRI yields more information regarding disease progression than 2-D projection X-ray.



**Healthy Unloaded MR FSE**



**Healthy Loaded @ 50% BW MR FSE**