Magnetic resonance imaging (MRI) is a common modality to assess the thickness of hip cartilage to stage osteoarthritis (OA). Clinical MRI sequences often have reduced out-of-plane resolution and lack adequate signal to noise to image the thin cartilage of the hip. We sought to deploy and validate the accuracy of a 3D dual echo steady state (DESS) MR arthrography protocol with hip traction to image acetabular cartilage.

Physical measurements of cartilage thickness were used as the reference standard to assess accuracy. 3D DESS MRI scans of four intact cadaver hips were obtained before and after cores of cartilage were harvested from the acetabulum; the two MRIs were spatially aligned to reference positions of the cores. The thickness of cartilage cores was measured under microscopy. Using automatic and semi-automatic segmentation, 3D reconstructions of acetabular cartilage were generated from the images. Using Bland Altman plots, physical measurements were compared to those from the 3D reconstructions.

With traction, MR images qualitatively demonstrated excellent separation between acetabular and femoral cartilage layers; good signal contrast between subchondral bone, cartilage, and saline facilitated nearly automatic segmentation. Using both segmentation techniques, acetabular cartilage thickness from the 3D reconstructions could be estimated within ~0.5 mm of the physical measurements with 95% confidence.

The chosen 3D DESS protocol accurately measures acetabular cartilage thickness. As a nearly automatic segmentation process, 3D reconstructions from 3D DESS could be used for pre-operative planning to treat hip abnormalities.