Articular Cartilage Friction Increases in Hip Joints after Partial and Total Removal of the Acetabular Labrum

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INTRODUCTION
Damage to the acetabular labrum is believed to be a risk factor for osteoarthritis of the hip [1]. However, our understanding of the development of hip osteoarthritis after labral damage is limited, and studies on the effect of acetabular labrum on cartilage degeneration are minimal.

The acetabular labrum has been previously reported to have a sealing function [2], potentially containing joint fluid within the joint space. An injured or torn acetabular labrum may not effectively prevent joint fluid from escaping a compressed joint and could result in impaired lubrication of the articular cartilage surfaces.

The objective of this study was to determine if there is a change in resistance to movement of the hip joint before and after partial labral resection and complete labral resection when the joint is loaded to a physiologic magnitude of cyclic compressive loading. We hypothesized that resistance to rotation of the hip joint would increase after partial and total resection of the labrum.

METHODS
Sample Preparation: We studied 2 cadaveric hips with no evidence of impingement and no gross evidence of osteoarthritis (2 left hips from 70 and 79 year old males). The femur and acetabulum were potted with bone cement in a normal standing position. A pQCT scanner was used to identify the center of the femoral head. The loading axis was then aligned with the center of the femoral head and the direction of joint resultant force of hip during normal walking [3, 4].

Testing Setup: An MTS machine used to create axial loading and angular displacement. The femoral part of the specimen was mounted on a low frictional X-Y table to allow linear translations. The acetabulum was fixed to a torsional load-cell and the load-cell was connected to the MTS piston (Figure 1). The femoro-acetabular joint was completely bathed with saline.

A single cycle of loading consisted of axial compression of the specimen over 3 seconds. Once axially compressed, rotational displacement of 9 degrees was applied over 3 seconds. The axial load was then removed, and the specimen was rotated back to the starting position. One complete cycle took 13 seconds and a total of 10 cycles were applied at each level of axial loading. Only the last 5 measurements were selected to avoid preconditioning errors in early measurements. Each test at a certain labral condition was separated by 5 minutes of unloading to allow the articular cartilage to recover its original thickness. Tests between labral conditions were separated by 15 minutes.

RESULTS
The reproducibility of the measurements was tested by calculating coefficient of variations (CV) of duplicated measurements in each axial loading. Average CVs of the measurements in two specimens were 0.089 and 0.068.

Measurements of rotational resistance in 2 hip joints were displayed in Figure 2. Partial and total removal of the labrum progressively increased resistance to rotation for nearly all of the loading conditions.

DISCUSSION
Resistance to rotation in a loaded hip joint appears to be progressively increased after partial and complete resection of the labrum. It may be that the labrum maintains a low friction environment in the hip joint, possibly by sealing the joint from fluid exudation. Partial and complete removal of the labrum may result in impaired sealing of the joint and progressively increased hip joint friction, a condition that may be detrimental to articular cartilage and lead to osteoarthritides. Testing of additional specimens is currently underway to establish the consistency of these observations.

REFERENCES