Characterization of the Sealing Function of the Hip Labrum in Functional Activities

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Introduction

- The acetabular labrum improves hip joint stability by augmenting femoral head coverage\(^1,2\) and maintaining negative intra-articular pressure\(^3-7\).

- The sealing function of labrum also regulates the transfer of synovial fluid between the central and peripheral compartments, thereby assisting in separation of the articular surfaces, and allowing some load to be borne by fluid pressurization\(^3,8\).

- Although the labrum performs a sealing function when the hip is in extension, many functional activities place the joint in positions which disrupt joint congruency.

- As such, the sealing function of the acetabular labrum may vary in response to joint position during normal functional activities.
The present study was undertaken to test the hypothesis that the relative position of femur and acetabulum affects the ability of the acetabular labrum to restrict fluid transport between the central and peripheral compartments of the hip.
Methods

- Six fresh cadaveric hip joint specimens (4 male, 2 female) were obtained from donors of average age 45.5 ± 16.1 years (range 25-63 years).
- Specimens were dissected free of the overlying soft tissue, leaving the capsule and labrum intact.
- The femur and iliac wing were potted separately in casting resin, and placed in a loading apparatus which allowed angulation of the femur in all three cardinal planes.
Methods

- The relative positions of the pelvis and femur were continuously measured with a 12 camera motion analysis system.
- Catheters were inserted into the central and peripheral compartments of each hip via the ilium and the proximal femur and attached to electronic transducers to allow independent monitoring of compartment pressures during testing.
- After application of an axial load of 0.5 BW, saline (PBS) was introduced into the central compartment of the hip at a constant rate of 45ml/min via an automated pumping system.
- During pressurization, fluid transfer past the labrum was confirmed by a rise in pressure within the peripheral compartment.
The sealing capacity of the labrum was measured in 10 functional positions of each hip corresponding to sequential stages of gait, stooping, and pivoting.
Results

- The average peak central compartment pressure at failure of the labral seal was higher during pivoting (24.7 ± 1.9kPa) than gait (14.1 ± 1.1kPa; p = 0.033) or stooping (10.6 ± 3.6kPa; p = 0.011).
Discussion

- The ability of the acetabular labrum to restrict fluid transport between the central and peripheral joint compartments is affected by hip joint position.

- Specifically, positions which place the hip joint in high degrees of flexion combined with internal rotation increase the ease of fluid transport from the central to the peripheral compartment when compared to neutral or external rotation positions.

- Our results reveal the importance of joint positions incurred during functional activities on the sealing function of the labrum.

- This suggests that activities that place the hip in repetitive flexion and internal rotation may increase the risk of degenerative changes due to compromised labral function in retaining synovial fluid within the joint.
Conclusion

- Functional activities which place the hip in high degrees of flexion combined with internal rotation disrupt the sealing ability of the acetabular labrum and, thus, may be detrimental to the overall health of the hip joint.


