Does Ligamentum Teres Contribute to Hip Stability?

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Introduction: The function of the ligamentum teres (LT) remains controversial. Recent clinical studies have reported microinstability in an LT torn hip suggesting the LT has a possible role in providing hip stability. The purpose of this cadaveric study is to investigate the role of LT as a hip stabilizer with a special interest in its contributions to range of motion and femoral head translation. We hypothesized that relative to the native hip joint with and intact capsule, the resected LT will increase range of motion and femoral head mobility.

Methods: Right hips from 8 fresh-frozen cadavers were acquired from 5 male and 3 female donors with a mean age of 63 years at the time of death. Hip joint arthroscopy and radiographic examinations were performed each specimen prior to the experiment to confirm the survival of ligamentum teres and to identify any bony abnormalities. After removal of all pericapsular soft tissue, the pelvis was mounted on a custom testing fixture that allows for flexion/extension, internal/external rotation and abduction/adduction of the hip joint. Six-degree of freedom electromagnetic motion tracking sensors (Polhemus, Colchester, VT) were attached to pelvis and femur to measure hip rotation angle and femoral head translation. Torques across the hip joint were also collected. Anatomical coordinate systems were defined according to International Society of Biomechanics standards. External and internal rotation torque was applied along mechanical axis of the femur using a digital torque wrench. The axial rotation angle and femoral head position were identified at 2.5Nm of joint torque. The axial rotation range of motion was tested at 6 different flexion angles (10° extension, neutral, 30°, 60°, 90° and 110°). Also, to recreate extreme conditions, external rotation range of motion was also measured with the hip in 90° of flexion, 30° of adduction and up to 4.0 Nm of torque along the axial rotation axis. The tests were repeated after resection of the ligamentum teres through contyloid fossa, leaving the capsule intact. The results were compared between intact and LT transected conditions.

Results: Compared to the intact hip, the LT resected hip did not show significant difference in external or internal rotation range of motion at any of the flexion angles tested (Figure 1). Also, throughout the entire range of motion, no significant difference was observed in femoral head translation. In extreme conditions where the LT was predicted to have maximum excursion, the torque/axial rotation relationship showed no difference between intact and LT resected conditions (Figure 2).

Discussion: The function of ligamentum teres is still not clear and different theories have been suggested for its function. A recent study reported mechanical property of LT to be similar to that of anterior cruciate ligament. Also a high association rate between LT tear and labral tear has lead to a hypothesis that patients with LT tear may develop microinstability. In this study, axial rotation and femoral head translation were measured and compared to investigate the role of the LT as a hip stabilizer. The results show no significant difference between the intact hip and LT resected hip. This
finding was consistent even when the LT was in its tightest condition. The finding in this study indicates that the LT's role in hip stabilization is limited when the capsule is intact. 

**Significance:** This study shows that for patients with normal anatomy and an intact acetabular capsule, the ligamentum teres does not play a significant role in stabilizing hip joint within the physiologic range of motion.

Figure 1. a) Comparison of external rotation range of motion between the intact hip and hip with a resected ligamentum teres. b) Comparison of external rotation range of motion between the intact hip and hip with a resected ligamentum teres.

Figure 2. The graph demonstrates the continuous measurement of external rotation position and applied axial torque. (Red line: intact hip joint, Blue line: LT resected hip).
Fig 2

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