A Biomechanical Assessment of Gluteus Maximus and Tensor Fasciae Latae Transfer in Abductor Mechanism Deficiency After Total Hip Arthroplasty: A Cadaveric Study

Kohei Kono, Ryosuke Nishimura, Tatsuhiko Kutsuna, Naohiko Mashima, Masaki Takao

INTRODUCTION:

Abductor mechanism deficiency following total hip arthroplasty (THA) is an uncommon but devastating complication that leads to reduced abductor strength, abnormal gait, and a high risk of dislocation. Reconstructive procedures using muscle transfers—such as gluteus maximus (GM) and tensor fasciae latae (TFL) transfers—have been proposed as surgical options; however, their individual biomechanical roles and appropriate clinical indications remain unclear.

This study aimed to (1) evaluate the effectiveness of GM and TFL transfers in restoring joint stability in abductor-deficient hips after THA, (2) clarify the functional contributions and indications for these transfers.

METHODS:

Seven Thiel-embalmed cadaveric normal hip joints underwent THA via a posterolateral approach using a CT-based navigation system.

We sequentially created an abductor deficiency model by resecting the gluteus medius and minimus muscles along with the capsular ligaments. Subsequently, we performed GM transfer followed by TFL transfer.

Using the navigation system, we measured hip range of motion (ROM) and femoral head translation under standardized conditions after each procedural step as indicators of soft tissue tension and joint stability. All measurements were repeated twice per specimen under each condition, and the mean values were used for analysis.

Comparisons were made across five procedural states: (1) native hip, (2) post-THA, (3) abductor-deficient model, (4) post-GM transfer, and (5) post-GM+TFL transfer.

Statistical comparisons between procedural stages were performed using repeated-measures one-way ANOVA with the Tukey-Kramer post hoc test for multiple comparisons. A p-value < 0.05 was considered statistically significant.

RESULTS:

Following gluteus maximus (GM) transfer, there was a significant decrease in maximum hip flexion range of motion (ROM) (Fig. 1; $p = 0.0018$).

In addition, internal rotation ROM at 30° of hip flexion significantly decreased following GM transfer (Fig. 2; $p = 0.025$).

After tensor fasciae latae (TFL) transfer, external rotation ROM significantly decreased across all tested hip positions (−10°, 0°, 10°, 30°, and 60° of hip flexion; $p = 0.019$, 0.001, <0.0001, <0.0001, and <0.0001, respectively) (Fig. 3).

Femoral head translation under both axial and lateral traction was significantly reduced after the combined GM and TFL transfers. At 60° of hip flexion, femoral head translation was significantly reduced in both axial and lateral directions (Figs. 4 and 5; $p = 0.035$ and 0.022, respectively). At 30° of hip flexion, a significant reduction was observed in the lateral direction only (Fig. 5; $p = 0.015$).

DISCUSSION AND CONCLUSION:

This biomechanical study clarifies the functional roles of GM transfer and TFL transfer in reconstructing the deficient abductor mechanism following THA.

GM transfer prevents excessive internal rotation and limits flexion, while TFL transfer restricts excessive external rotation.

Combining both transfers significantly enhances resistance to femoral head translation, potentially reducing the risk of dislocation in abductor deficiency cases.

Based on these findings, GM transfer may be most beneficial in cases with posterior dislocation, whereas TFL transfer may be suited for anterior dislocation cases. In cases with persistent multidirectional laxity during traction, a combined both transfers should be considered to maximize joint stability.

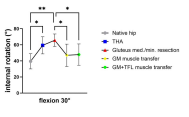


Figure 2.
Hip internal rotation range of motion (ROM) at 30° hip flexion under each procedural condition.

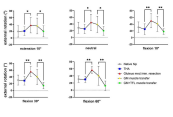


Figure 3.
Hip external rotation range of motion (ROM) under each procedural condition.

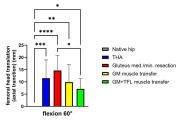


Figure 4.
Femoral head translation under axial traction at 60° of hip flexion across each procedural condition.

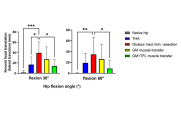


Figure 5.
Femoral head translation lateral traction at 30° and 60° of hip flexion across each procedural condition.

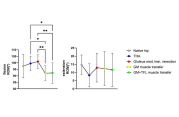
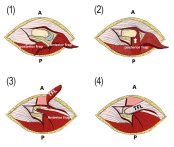


Figure 1.
Hip flexion and extension range of motion (ROM) under each procedural condition.



Surgical Procedure of Gluteus Maximus and Tensor Fasciae Latae Muscle Transfers