Isometry of LET Grafts Across Tibial Insertion Sites with Cadaveric and Intraoperative Analysis of Femoral Landmark Using Fluoroscopic Guidance

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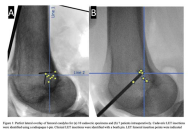
INTRODUCTION: Lateral extraarticular tenodesis (LET) enhances rotational stability and reduces graft failure when added to ACL reconstruction. While optimal femoral placement has been studied, the effect of varying tibial insertion sites on graft length change across flexion angles remains unclear. This study characterizes graft isometry relative to tibial attachment positions using a reproducible femoral landmark identified via intraoperative fluoroscopy.

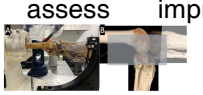
METHODS: Patients who underwent lateral extra-articular tenodesis from a single surgeon were retrospectively reviewed. Intraoperative, true-lateral, x-ray images with the femoral shaft visible and identifiable femoral LET insertion points were analyzed. The LET placement was described relative to the posterior femur and intersection of the posterior femoral condyles. Subsequently, 10 fresh-frozen cadaveric specimens were dissected. The femoral LET insertion points on all specimens were identified by the same surgeon. Three points were then identified on the anterior border, center, and posterior border of the IT Band at Gerdy's Tubercle. Three-dimensional measurements were then collected using a micro scribe (MicroScribe MX Series Digitizer). The LET placement was described relative to the lateral epicondyle, posterior femur, and posterior condyle. The total distance from each tibial insertion to the identified LET point on the femur was calculated at 0, 15, 30, 45, 60, and 90 degrees of flexion.

RESULTS: A total of 7 intraoperative and 10 cadaveric images were assessed, with LET insertion points identified by a single surgeon shown in Figure 1. On cadaveric specimens, the LET insertion was located on average 7.40 ± 1.56 mm proximal and 3.89 ± 2.11 mm posterior to the lateral epicondyle (Table 1). LET graft length changes significantly varied by tibial insertion location at lower knee flexion angles. One-way ANOVA revealed significant differences between anterior, central, and posterior regions at 0° ($p = 0.0004$), 15° ($p = 0.0008$), 30° ($p = 0.0018$), and 45° ($p = 0.0051$), but not at 60° ($p = 0.053$) or 90° ($p = 0.288$). Post-hoc Tukey tests showed anterior insertions had significantly greater length changes than posterior insertions at 0°, 15°, and 30° ($p \leq 0.003$), with similar differences observed between anterior and central regions, while central versus posterior comparisons were not significant (Table 2). The average insertion point distances at 0° and 90° differed significantly for the anterior (10.3 ± 5.09 mm, $p < 0.001$) and central (4.13 ± 5.76 mm, $p = 0.049$) regions, but not posterior (0.94 ± 0.15 mm, $p = 0.152$) (Table 3). Post-hoc analysis indicated significant length change from 0° to 90° between anterior and posterior points ($p = 0.001$), with anterior versus central differences approaching significance ($p = 0.051$).

DISCUSSION AND CONCLUSION:

This study identifies a reproducible femoral LET insertion (~7.4 mm proximal and 3.9 mm posterior to the lateral epicondyle) using fluoroscopy and demonstrates that tibial position significantly affects graft isometry in early flexion. Posterior tibial placement maintains near-isometry, minimizing length variation through 0°–90° flexion. These findings complement prior work showing posterior femoral placement reduces overconstraint, offering a comprehensive approach to graft positioning. Use of posterior tibial fixation may reduce graft tension variability and overconstraint risk, potentially improving clinical outcomes—particularly in high□risk or revision ACL reconstruction. Further clinical correlation is warranted to assess improvements in graft failure rates and patient□reported outcomes.





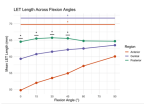


Table 1 LET Femoral Insertion Distance to Femur Landmarks

	Mean ± SD	Maximum	Minimum
Lateral Epicondyle (Distal) mm	7.40 ± 1.56	9.96	5.14
Lateral Epicondyle (Anterior) mm	3.89±2.11	7.15	0.52
Condyle Cartilage Border (Proximal) mm	6.03±1.35	8.00	3.86
% Proximal of Epicondyle to Condyle Border	55.12% ± 8.51	67.73%	43.68%