Quantitative Morphological Analysis of the Capsulo-Osseous Layer of the Distal Iliotibial Band

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<th>Name</th>
<th>Disclosures</th>
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<td>Mark Abbott</td>
<td>I have no financial conflicts to disclose.</td>
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<td><strong>Support received from:</strong> Smith and Nephew</td>
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Introduction

- Anterolateral rotational laxity of the knee has been shown to persist following anterior cruciate ligament reconstruction.

- The iliotibial band (ITB) and its deep capsulo-osseous layer (COL) have been implicated as key restraints against internal rotation\(^1,2\) and damage to the COL correlates with anterolateral rotational laxity\(^1\).

- While a lateral extra-articular tenodesis (LET) may be used to help restore function to a damaged COL, the kinematic properties of the COL throughout knee range of motion (ROM) are not yet known.
To quantify the kinematic behavior of the deep COL of the distal ITB throughout knee flexion

We hypothesized that the COL of the ITB would behave in a non-isometric fashion through knee range of motion, with increases in length and decreases in width and area occurring at higher flexion angles.
Methods

Specimen Preparation

• Ten cadaveric knee specimens
  - Mean (SD) age = 81 (5.80) years
  - Mid-femur to toes
  - Dissected to expose the deep COL of the distal ITB (CoITB)

• Radio-opaque beads (800 µm) were embedded into bony landmarks and at CoITB femur and tibia attachments

• Beads were also inserted along the length of the anterior and posterior coITB at 12.5%, 25%, 50%, and 75% of the total length.
Methods

Experimental Setup and Protocol

- Lateral fluoroscopic images were taken every 15° of knee flexion from 0° to 105° using a C-arm
- Coordinates of the beads, throughout ROM, were obtained using ImageJ
- The length and width of the COL at each flexion angle was determined by measuring the linear distances between the center of the beads
- The linear distance between the COL origin on the distal femur and its insertion on Gerdy’s tubercle at each flexion angle was measured
Results

Length Changes

**Anterior Border**

- 0%-12.5%
- 12.5%-25%
- 25%-50%

**Posterior Border**

- 50%-75%
- 75%-100%

- **At 30°-75°**, the increases in length of the anterior border were attributed to significant increases at 0%-12.5% of the total length compared to 0°
- **At 75°-105°**, the 0%-12.5% and 12.5%-25% segments increased significantly compared to 0°
- **The significant increases in the posterior border at 75°-105°** only occurred in the at 0%-12.5% and 12.5%-25% of the total length compared to 0°
Results

Width Changes

- The width at 25% increased significantly at 105° of flexion.
- The width at 50% significantly decreased at 60°-105° compared to 0° of flexion.
- The width at 75% significantly decreases at 45°-105° compared to the 0° condition.
There was a significant increase in the distance between the coITB attachment on the distal femur and Gerdy’s tubercle from 60°-105° of knee flexion, compared to 0° of flexion.
Discussion and Conclusions

• The coITB behaved in a non-isometric fashion, with significant increases in length occurring at flexion angles greater than 15°

• These changes in length were non-homogenous across the different regions of the coITB that were investigated, with the greatest changes occurring in the proximal segments (0-25%)

• In addition, significant decreases in width occurred with increasing flexion angle
• Interestingly, we observed that the epicondyle acted as a “hump” and that the colTB remained anterior at low flexion angles and moved posteriorly as flexion angles increased.

• This contradicts the notion that the lateral femoral condyle acts as a fulcrum.

• Characterizing the degree of flexion at which the colTB exhibits higher tension is important at the time of graft fixation in an LET -fixation without proper tension may result in persistent anterolateral rotational laxity post-surgery.