Pediatric ACL Injury is Associated with Increased Lateral Tibial Slope: A Case-Control Study with MRI Measurements of 152 Patients

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Affiliations

INTRODUCTION

- ACL injuries are increasing in pediatric population (1)
- ACL tears are a devastating injury with potential for long-term sequelae
- Increased posterior tibial slope → increased anterior translation of the tibia with weight-bearing → increased strain on ACL (2,3)
- Increased tibial slope in lateral compartment associated with increased risk of ACL rupture in adults (4,5)
- Existing studies that evaluate tibial slope in children limited by utilization of plain x-ray and low subject enrollment (6,7)

OBJECTIVES

1. To use MRI to accurately measure lateral tibial slope (LTS) and medial tibial slope (MTS) on the true surface of the immature chondroepiphysis to investigate for associations between tibial slope and ACL injury in a large pediatric population using a case-control design
2. To investigate the relationship between posterior tibial slope and age

METHODS

- Retrospective review of 76 pediatric patients (age 17 or younger) with non-contact ACL injuries between 2011 and 2013.
- Age and gender-matched controls who had knee MRIs for “pain” selected in 1:1 ratio for comparison
- See figure for magnetic resonance images depicting method used to measure medial and lateral tibial slopes

RESULTS

- Age and gender of cases and controls. Medial and lateral posterior slopes for subjects and corresponding P Values.

<table>
<thead>
<tr>
<th>Age</th>
<th>Case (yr)</th>
<th>Control (yr)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.9 ± 2.3 (2.0, 21.7)</td>
<td>14.9 ± 2.3 (2.0, 21.7)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Gender [M: F]</td>
<td>46%</td>
<td>46%</td>
<td>1.0</td>
</tr>
<tr>
<td>Medial Slope</td>
<td>3.39 ± 2.33 (0.90, 10.60)</td>
<td>3.68 ± 2.25 (1.33, 10.80)</td>
<td>0.48</td>
</tr>
<tr>
<td>Lateral Slope</td>
<td>5.66 ± 2.58 (1.30, 12.37)</td>
<td>3.38 ± 1.90 (1.17, 15.50)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>MTS/MTS</td>
<td>3.39 ± 0.83 (1.56, 1.51)</td>
<td>0.78 ± 0.53 (0.68, 0.90)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

- Receiver operating characteristic analysis of LTS used to determine threshold value that might predict elevated risk of ACL injury

- An LTS cutoff of > 4º resulted in a sensitivity of 76% and specificity of 75% for predicting ACL injuries in this cohort

- Increased LTS associated with ACL rupture in pediatric and adolescent patients (5.7 ± 2.4º vs. 3.4 ± 1.8º)
- No difference in LTS between ACL-injured and control knees (5.4 ± 2.2º vs. 5.1 ± 2.3º)
- LTS/MTS ratio significantly increased in ACL-injured group (driven by noted differences in LTS)
- Posterior tibial slope decreased, or flattened, with increasing age
- Threshold value of > 4º resulted in a sensitivity of 76% and specificity of 75% for predicting ACL injuries in this cohort

CONCLUSIONS

REFERENCES


SPEARMAN CORRELATION ANALYSIS OF SUBJECT AGE VS. LATERAL SLOPE

SPEARMAN CORRELATION ANALYSIS OF SUBJECT AGE VS. MEDIAL SLOPE

SPEARMAN CORRELATION ANALYSIS OF MEDIAL AGE VS. MEDIAL SLOPE

SPEARMAN CORRELATION ANALYSIS OF MEDIAL AGE VS. MEDIUM SLOPE

SPEARMAN CORRELATION ANALYSIS OF LATERAL AGE VS. LATERAL SLOPE

BIC CIRCUS FOR COMPARISON

PRODUCTS/DEVICES

PRODUCTS/DEVICES

PRODUCTS/DEVICES

PRODUCTS/DEVICES

PRODUCTS/DEVICES

PRODUCTS/DEVICES