FUNCTIONAL HALLUX LIMITUS:
A PREDISPOSING FACTOR FOR ACL INJURIES.

BIOMECHANICS AND TREATMENTS

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DISCLOSURES

No financial relationships to disclose
FUNCTIONAL HALLUX LIMITUS (FHL)

DEFINITION
Limitation of the dorsal flexion of the first MTP joint while the ankle is in maximal dorsal flexion

CLINICAL DIAGNOSIS
Positive Stretch test

The test is done in 3 steps:
A: In plantar flexion of the ankle, be sure that there is no restriction of the mobility of the 1st MP joint
B: Place firmly the ankle in dorsal flexion by pushing under the metatarsal heads
C: Push the first toe backwards

Test positive if the dorsal flexion of the first MP joint is not possible (fig C)
ANATOMY AND BIOMECHANICS

BLOCKADE OF THE NORMAL TRACKING (« Tenodesis effect »)

Flexor Hallucis Longus tendon unable to glide

Critical zone

The retro-talar tunnel covered posteriorly by the retro-talar retinaculum (pulley)
FHL IMPLICATIONS

DETAILS THE NORMAL GAIT PATTERN
Sagittal plane blockade with « dominos » effect
Excessive supination at heel strike (fig A)
Hyperpronation in late stance and push-off (fig B)

ABRUPT TRANSITION FROM SUPINATION INTO PRONATION LEADS TO A MEDIAL COLLAPSE OF THE KNEE IN LATE STANCE

Because of the synchronism between pronation and internal tibial rotation, the knee is forced to a corkscrew movement

Background of the cause-effect relationship between FHL and ACL injury
ACL RUPTURE: RISK FACTORS & MECHANISMS

PIVOT OR PIVOT-CONTACT SPORTS
Football, baseball, soccer, ski, and basketball up to 78% of sports-related injuries.

THE MOST FREQUENT MECHANISM OF INJURY
Non-contact injuries
«Knee-in & Toe-out» alignment (Kobayashi 2010)
Sudden deceleration, pivoting and landing manoeuvres

IN NON-CONTACT INJURIES, FHL IS PRESENT IN 96% OF CASES IN ACL TEARS
(Unpublished personal data in a prospective study on more than 300 cases)
FHL TREATMENT

CONSERVATIVE MANAGEMENT
Specific protocol with proprioceptive rehab program including core strengthening, selective stretching exercises, foot core, ...
Specific proprioceptive insoles

SURGERY
Endoscopic release of the Flexor hallucis longus (Fhl) tendon in the retro-talar tunnel

Before and after section of the retrotalar retinaculum (pulley)
### PROSPECTIVE STUDY

#### ACL RECONSTRUCTION AND Fhl (Flexor hallucis tendon) TENOLYSIS

135 patients divided in 6 groups

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>LCA + FHL</td>
<td>34</td>
</tr>
<tr>
<td>LCA + meniscectomy + FHL</td>
<td>43</td>
</tr>
<tr>
<td>LCA revision + FHL</td>
<td>10</td>
</tr>
<tr>
<td>LCA + FHL in two stages</td>
<td>25</td>
</tr>
<tr>
<td>LCA bilateral + FHL in 2 stages</td>
<td>15</td>
</tr>
<tr>
<td>LCA + FHL + varia (HTO, PUC, ALL,....)</td>
<td>8</td>
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Single-bundle ACL reconstruction, by use of an autologous quadrupled hamstring graft (Semi-T)

<table>
<thead>
<tr>
<th>Data Collection</th>
<th>Satisfaction Scale (EuroQol EQ-5D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre- and post-op Data Collection</td>
<td>Gait Analysis (static, postural and dynamic)</td>
</tr>
<tr>
<td></td>
<td>WinTrack Platform by Medicapteurs Sensors: 12288 200 images/sec</td>
</tr>
</tbody>
</table>

#### Detailed Areas of Measurement

1. Hallux
2. First Metatarsal Head
3. II-V Metatarsal Heads
4. Heel
The time of support in dynamic conditions under the first metatarsal head improved significantly after surgery (4.5 months follow-up).

The foot becomes a more stable structure for balance and gait.
The statistically significant decrease of lateral forces illustrates a smoother transition in pronation-supination and the restoration of the physiologic synchronism in rotation during gait.
| Comparison of Rotatory Stability After Anterior Cruciate Ligament Reconstruction Between Single-Bundle and Double-Bundle Techniques | • 5 years fu  
• 43% pivot shift after single bundle reconstruct.  
• 16% after double bundle reconstruction |
| --- | --- |
| Quantitative Assessment of Rotatory Instability After Anterior Cruciate Ligament Reconstruction | • 1.3 years fu  
• 40% pivot shift in MRI |
| Influence d'une ligamentoplastie extra-articulaire latérale sur les résultats de la reconstruction du LCA avec le ligament patellaire avec 7 ans de recul | • 7 years fu  
• 38% positive pivot shift for isolated ACL reconstruction  
• 21% after ACL recon with lateral reinforcement |
| Giraud et al, Rev Chir Orthop, 2006 | |
CONCLUSIONS

ACL tear is not a misfortunate momentarily injury occurring by accident.

A better understanding of the biomechanical principles affecting the lower limb as a whole is mandatory.

Based on our patient cohort, FHL could be perceived as a predisposing factor to ACL tears.

Arthroscopic FHL release can be considered as an efficient and safe treatment providing satisfactory results.