Contribution of the anterolateral complex to rotational stability of the knee: a biomechanical analysis

THOMAS NERI 1,4*
Dane Dabirrahmani2
Aaron Beach1
Samuel Grasso1
Sven Putnis1
Takeshi Oshima1
Joseph Cadman2
Brian Devitt3
Myles Coolican1
Brett Fritsch1
Richard Appleyard2
David Parker1

1 Sydney Orthopaedic Research Institute, Sydney, Australia
2 Faculty of Medicine and Health Sciences, Macquarie University, Sydney, Australia
3 OrthoSport Victoria, Melbourne, Australia
4 Inter-university Laboratory of Human Movement Science, EA 7424, Univ Lyon, France
Declaration of Interest

I declare that in the past three years I have:

- held shares in: no
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- received institutional support from: no

Signed: Thomas Neri
Introduction & aims

The individual functions of the extra-articular structures of the anterolateral complex (ALC) including the anterolateral ligament (ALL), the anterolateral capsule, and the iliotibial band Kaplan fibres, in the setting of the anterior cruciate ligament (ACL) deficient knee, are still controversial and unclear. Their potential individual contribution to the residual anterolateral rotational laxity after an isolated ACLR requires further investigation.

Objective: evaluate the contribution of ALC injury, and specific injuries to its individual anatomical components, to rotational instability in ACL-deficient knees.
Method

**Specimen preparation**

- A total of 10 cadaveric knees (5 half body)
- dissection protocol previously published
- without damaging the lateral structures

The anterolateral ligament: Anatomic implications for its reconstruction

Thomas Neri\textsuperscript{a,b,w}, Fabien Palpacuer\textsuperscript{b}, Rodolphe Testa\textsuperscript{b}, Florian Bergandi\textsuperscript{c}, Bertrand Boyer\textsuperscript{a}, Frederic Farizon\textsuperscript{a,b}, Remi Philippot\textsuperscript{a,b}

\textsuperscript{a} Department of Orthopaedic Surgery, University Hospital of Saint-Etienne, Saint-Etienne, France
\textsuperscript{b} Univ Lyon - UJM Saint-Etienne, Inter-university Laboratory of Human Movement Science, EA 7424, F-42202, Saint-Etienne, France
\textsuperscript{c} Laboratory of Human Anatomy, Faculty of Medicine, University Hospital of Saint-Etienne, University of Saint-Etienne, Saint-Etienne, France
Method

**Experimental set-up**

- Protocol previously validated
- 3D optoelectronic system: **Motion Analysis®**, 5 HD cameras
- Complete knee kinematic analyses
Method

Experimental set-up

- Bone markers (tibia and femur)\textsuperscript{8,9}
- Every knee had a CT scan before the assessment to do a 3D modelling -> bone and joint landmarks\textsuperscript{10}
**Method**

**Experimental set-up**

- **Kinematics**: Extension to 90° of flexion
- By controlling the rotation (IR, NR, ER)
- with a *Dynamometric torque rig* -> 5 Nm
Method

**Data Acquisition**
For each parameters: 3 series of 3 repetitions

Data analysed: $^{11,12}$

- Kinematic from 0 to 90° of flexion in forced internal rotation (IR)
- AP translation at 30° and 90° of flexion (anterior tibial load = 90 Nm)
Method

Conditions of testing

1 – Intact knee

2 - ACL section

3A - ALC section (ALL+Anterolateral capsule)

3B - Proximal + Distal Kaplan Fibres section

• Testing was first performed in ACL-intact. After ACL sectioning, sectioning was randomly performed for the ALC anatomical components, either ALL plus anterolateral capsule or Kaplan fibres (distal and proximal)

• The kinematics motion relating to each procedure was compared to the intact knee.
### Internal Rotation (IR)

<table>
<thead>
<tr>
<th>conditions</th>
<th>Effect (compare to intact)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACL section</td>
<td>↑ tibial IR (P&lt;0.05)</td>
</tr>
<tr>
<td>ALC (ALL+ AL capsule) section</td>
<td>↑ tibial IR (P&lt;0.05)</td>
</tr>
<tr>
<td>Kaplan fibres section</td>
<td>↑ tibial IR (P&lt;0.05)</td>
</tr>
</tbody>
</table>

At 30° of flexion ALL-capsule sectioning led to significantly greater internal rotation when compared with Kaplan fibres sectioning.

At higher flexion angles (50° to 90°), the effect of Kaplan fibres sectioning on increased internal rotation was greater than ALL-capsule sectioning.
**Results**

AP translation

- **P<0.001**
  - ACLprimary stabilizer

- **P>0.05**
  - No additional effect of ALC or KF section
**Conclusion**

**ALC:**
- Additional IR control in the ACL deficient knee
  -> At 30° of flexion +++
- No control of anterior tibial translation

**Kaplan Fibres**
- Additional IR control in the ACL deficient knee
  -> after 50° of flexion +++
- No control of anterior tibial translation

By highlighting the increased rotational knee laxity with combined ACL and anterolateral complex knee injuries, these findings suggest that these extra articular injuries should be taken into account when managing patient with ACL deficient knee, with consideration given to addressing the injuries to these structures as well as the intra-articular reconstruction 13,14,15,16.
References


