The Interrelationship Between Anterior Cruciate Ligament Tibial Footprint and Anterolateral Meniscal Root Insertions:
Quantitative and Positional Analysis Using 3-D Computed Tomography Images

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I have no financial conflicts to disclose
Introduction

The Interrelationship Between Anterior Cruciate Ligament Tibial Footprint and Anterolateral Meniscal Root Insertions

Bony/Anatomical Landmark for Tibial tunnel drilling of ACL-R

- The ALMR is broadly attached to the lateral side of the ACL tibial footprint
- Boundaries between ACL and ALMR are unclear

Medial intercondylar eminence
Anterior Ridge (Parson’s Knob)
Med/Lat intercondylar tubercle
Anterior Horn of Lateral Meniscus (ALMR)

Tensho AJSM 2014
Shimodaira Arthroscopy 2015
Shimodaira Arthrosc Tech 2017

Laprade CM AJSM 2014
Fujishiro KSSTA 2017
Introduction

Iatrogenic injury of the ALMR at ACL reconstruction


Location of the tibial tunnel aperture affects extrusion of the lateral meniscus following reconstruction of the anterior cruciate ligament. Kodama Y et al. J Orthop Res. 2016

Purpose

- To evaluate quantitative and positional differences between the ACL tibial footprint and ALMR insertion

- To investigate an intraoperative landmark to estimate their boundaries
Materials and Methods

33 non-paired knees with intact ACL from adult cadaveric specimens (20 males, 13 females)

The ALMR was cut at half-width in the longitudinal direction to the root attachment and divided into the following two parts:

Inner fiber: IF
Outer fiber: OF

Fujishiro et al KSSTA 2017
Materials and Methods

Each fibers were peeled off from articular side

Micro-computed tomography (μCT) was subsequently performed
Material and Methods

- Distance (AMOF, ACLOF, PLOF, AMIF, ACLIF and PLIF),
- relative positional relationship between OF/IF insertion and AM/ACL/PL center

were evaluated
AM – OF: 7.4±1.5mm
ACL – OF: 8.2±1.4mm
PL – OF: 10.3±1.9mm

*NS*
Results

**AM – IF** : 8.0±1.3mm
**ACL – IF** : 6.3±1.0mm
**PL – IF** : 6.3±1.2mm
Results

The center of the OF/IF was almost located laterally to the ML center of the MIT and LIT.
40.7% of the ACL and 63.2% of the ALMR were overlapped

Laprade CM AJSM 2014

A continuity between the ACL and OF, the IF forms the lateral border of the ACL

Fujishiro KSSTA 2017

The presence of a special structure called a transitional between the ACL and ALMR

Furumatsu Connect Tissue Res 2016
Discussion (ALMR injury at ACLR)

- The bone tunnel construction at the ACL footprint center decreases the area of ALMR and decreased pull-out strength
  
  LaPrade CM et al. AJSM. 2015

- A single-bundle reconstruction constructing a large bone tunnel at the center caused a higher risk of damage to the ALMR
  
  Watson JN et al. KSSTA. 2015
  

A case in which the extrusion of the lateral meniscus is caused by damaging the ALMR during ACL reconstruction

Furumatsu T et al. JOS. 2016

Tunnels less than 5 mm from the lateral reference point had an extrusion of the lateral meniscus under postoperative MRI for double bundle reconstruction

Kodama et al. JOR 2016
The ACL tibial footprint and ALMR are in close proximity, particularly the AM and OF, PL and IF, and ACL center and OF/IF.

The OF is variable, exhibiting proximity in some cases

the center of the OF/IF was located laterally to the ML center of the medial and lateral intercondylar tubercle (MIT/LIT)

The midpoint between the MIT and LIT was a useful intraoperative landmark to estimate the boundary of these structures