The PCL

- largest intra-articular ligament
- extrasynovial structure
- 32 to 38mm long
- Cross-sectional area of 11mm²
- bony insertion sites 3-times larger than midsubstance
- longitudinally orientated collagen fibers most narrow in midsubstance fanning out at the attachments femoral more than tibial
- based on ligament function - AL and PM bundle

PCL

• Femoral Attachment

Attaches to roof and medial side wall of notch

Curves from wall to roof

Anterolateral fibers run in sagittal plane to notch roof

Posteromedial fibers run obliquely from medial femoral condyle to posterior aspect of tibia

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The most anterior ('highest') point in the notch
Anterolateral bundle from 9 to 12 o'clock
Adjacent to cartilage
Posteromedial bundle from 7 to 9 o'clock
The most posterior ('lowest') point in the notch

Arthroscopy
• AL bundle inserts on anterolateral aspect of intercondylar notch
easily visualized on standard arthroscopic image
• PL bundle inserts posteriorly
  – seen inferomedially on arthroscopic view

PCL
• Tibial attachment

Anterolateral bundle attaches proximal to edge of 'shelf'
Posteromedial bundle attaches over edge of 'shelf'
Most-posterior fibres dissipate periosteally
The most-posterior fibres of the PCL wrap over the edge of the 'shelf'
and dissipate into the periosteum distally
Left knee viewed from posterolateral aspect, lateral femoral condyle removed

- Posteromedial bundle attaches to side wall of notch
- Anterolateral bundle attaches to roof of notch
- Artificial split between bundles
- Posterior-oblique fibres
- Posteromedial bundle overlays anterolateral

Biomechanics of PCL

- Posterior translational and rotational stability – tensile strength, complex orientation of fibers
- Tensile strength is highest of knee ligaments AL 1620N, PM 258N
- Underestimation for young healthy population???

95% of posterior stability between 30 and 90 degrees of flexion

- The posteromedial fibres are tight in the extended knee
- Rather resistance against hyperextension than posterior draw because of proximal-distal direction of fibers
- They slacken when the knee starts to flex

In the extended knee, the posteromedial bundle is aligned to resist hyperextension, but not posterior draw

The anterolateral bundle is slack, and takes a curved path. This is seen in MRI.
When the knee starts to flex, the posteromedial attachment moves towards the tibia, slackening the fibres.

As the knee flexes, the anterolateral bundle becomes tight and swings up to a steeper orientation.

In deep knee flexion, the anterolateral bundle becomes steeper and meets the roof of the notch. The PCL is vulnerable to impingement against the tibia in hyperflexion.

In deep flexion, the posteromedial bundle becomes tight and well-aligned to resist posterior draw.

Sagittal MRI scans of the cadaver knee from full extension to 120°.

Percentage contributions of the two bundles (aPC and pPC) of the PCL and of „other structures“ to resisting 6mm posterior tibial translation, across the range of knee flexion.
Rupture of the posterolateral structures caused posterior tibial draw laxity at 100N to increase greatly in the extended knee, but only a little at 90 degrees knee flexion and tibial external rotation laxity at 5Nm torque to increase greatly in the extended knee, but only a little at 90 degrees knee flexion (I.Hijazi et al. unpublished)

**Meniscofemoral Ligaments**

**MFLs**

- 2 distinct structures with variable incidence
- Connect posterior horn of lateral meniscus to intercondylar notch
- Anchor to lateral meniscus??
- Secondary restraint to posterior tibial translation??

**Meniscal Tear??**

**MFL**

- Ligament of Humphrey aMFL 74%
- Ligament of Wrisberg pMFL 69%
- 50% with both
- Several anatomical variations – „false pMFL“ – oblique fibers of PM bundle
- Thickness varies considerably
Posterior menisco-femoral ligament of Wrisberg (pMFL)

Femoral attachment proximal to PCL on side wall of notch

Distal attachment to posterior horn of lateral meniscus

71-100% of knees have at least one MFL

The aMFL may be large and have a wide femoral attachment...

..or it may be thin (or absent!). The aMFL fibres always slant across the vertical PCL fibres.

The pMFL slants across the posterior aspect of the PCL. It is necessary to confirm that the distal attachment is to the meniscus, otherwise this may be oblique PCL fibres.
Biomechanics of MFLs

- Control the movement of the posterior horn of the lateral meniscus
- Last suggested protection against meniscal tears
- Lee et al. could not confirm association between presence or absence of MFLs and lateral meniscal tears (MRI scans of arthroscopically proven meniscal tears)

Biomechanics of MFLs

- Substantial contribution to resisting posterior tibial drawer in intact and PCL-deficient knees
- Division of MFLs in PCL-deficient knee increases posterior translation between 15° and 90° of flexion
- No effect of rotational laxity
Gupte C; JBJS 2003: The meniscofemoral ligaments: secondary restraints to the posterior drawer

"...to close to the center of rotation"

THANK YOU!