Lateral versus Medial meniscus: What is the difference?

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Variable level of evidence in this presentation

**Warning!**

**7 Areas of focus**
- Functional anatomy
- Injury patterns
- Traumatic tears
- Total loss
- Partial meniscectomy
- Meniscal repair
- Meniscal transplantation
1. Anatomy and functional differences
Posterior horn takes most load

Lateral moves in flexion

Covers 60% surface

Covers 80% surface

Courtesy of Andrew Amis
Anterior Horn

Anterior to the apex of medial tibial eminence
Anterolateral to the edge of the medial articular cartilage

Smigielski 2015
Posterior Horn

Posterior and lateral from the medial apex of medial tibial spine

Smigielski 2015
Posterior part of medial meniscus:

The superior edge does not attach to the joint capsule.
The inferior part attaches to the tibia through the menisco-tibial ligament.

Smigielski 2015
Mid part of medial meniscus:

The entire part of the meniscus is attached to the joint capsule.

Smigielski 2015
Reminder of load transmission

- **Medial**: 50% of compartment load
- **Lateral**: 70% of compartment load
- **Transmit**
  - 50% of load in extension,
  - 85% of load in flexion
- **Contact area decreases 30-70% following meniscectomy**

Medial v Lateral

Medial meniscectomy:
- Decreases contact area by 50% to 70% and
- Increases contact stress by 100%

Lateral meniscectomy
- Decreases contact area by 40% to 50%
- Increases contact stress by 200% to 300%

Meniscal motion by dynamic MRI

Both move peripherally
Lateral moves more posteriorly
Anterior horns move more than posterior
Meniscal motion

Medial

Lateral
Meniscal motion in deep flexion

Johal, Williams et al. 2005

- Load on fixed medial meniscus in flexion
- Lateral slides away
Result: Biomechanical Differences

- Congruity medial v lateral
- Lateral Smaller articular contact area
- Kinimatics: Lateral larger excursion
2. Patterns of Tears and symptoms
Radial tears: Feature of lateral meniscus
Hidden tears: Ramp lesion MEDIAL
Root tears

Lateral/Medial different implications
Varus knee with extrusion
Horizontal tears

Clinical outcomes of open meniscal repair of horizontal meniscal tears in young patients

Nicolas Pujol · Yohann Bohu · Philippe Boisrenoult · Ali Macdes · Philippe Beaufils

KSSTA 2013

Medial : Lateral  2 : 1
3. Traumatic meniscal tears
Meniscal tears in knee injury

Overall Figure

- Acute meniscal tears:
  - Medial 55-60%
  - Lateral 40-45%
  - Bilateral 5%

Meniscal tears in knee injury

In ACL deficient knees:

- **Acute injuries: Lateral more common**: Short tears in vascular zone
  - Medial 25-45%
  - Lateral 31-65%

- **Chronic injuries: Medial more common**: Longer tears, more unstable, or complex. Increase rate over time

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Meniscal tears in knee injury

**In Children**

- **Stable knees:** Medial 70% Lateral 30%
  - Medial tears mainly vertical 78% and peripheral on PM wall 75%
- **ACL tears:** up to 70% associated with meniscal lesion
  - Mainly Lateral, vertical tear posterior segment
  - Chronic tears: more medial tears

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4. Results of ‘TOTAL’ menisectomy

Clear Data on Natural history after total meniscectomy lacking
Meniscectomy leads to symptomatic OA knee

16% TKR

132-fold increase in the rate of total knee replacement in comparison to their geographical and age-matched peers

Medial / Lateral (in survivors):
- No difference in Grade of OA
- Medial Trend LOWER IKDC score 59 v 69 (P=0.16 ns)
Older studies

Lateral meniscectomy

- significantly more knee function deterioration,
- Lower Lysholm scores (P=0.03),
- higher rate of instability (P=0.02)


5. Results of ‘partial’ menisectomy
90 soccer players, mean age 23

42 lateral:
- RTP 7 weeks
- AE’s 69% Pain and swelling
- Re-operation 7%

48 medial:
- RTP 5 weeks
- AE’s 8%
- Re-operation 0%
Lateral:
- Most Mid zone, middle third
- Complex pattern
- Radial 29%

Medial:
- Most J Posterior/Mid zone, outer third
- Vertical orientation
- Radial 6%
- More volume removed

Conclusion: Lateral slower and more trouble
4 RCTs, 2 prospective cohorts, and 23 retrospective cohorts

Radiographic OA: Lateral v Medial 7 studies
- 4 Lateral higher
- 2 no difference
- 1 Medial higher (60% v 33%)

Retrospective comparative study: 10 yr min F/U
362 Medial and 109 Lateral
Satisfaction: Medial 95% Lateral 95.5%
Free of symptoms: Medial 86% Lateral 80%
X-Ray changes: Medial 22% Lateral 39% (other compartment normal)
Lateral reduced activity level (P<0.001)
The rate of repeat surgeries for osteoarthritis was less than 0.2%
RCT 164 pat BTB or ST graft 1995-1997
134 pat after 14 y 57% medial OA (KL ≥ 2)

Strongest risk factor for OA was meniscus resection
- Medial Odds Ratio 4.2,
- Lateral Odds Ratio 5.1

Odds Ratio for OA
- Same in repair group as intact menisci
  4.3 in Resection vs Repair (CI 1.1-16) p=0.03
6. Results of meniscal repair
Conclusion:
Meniscal repairs: higher reoperation rate but better long-term outcomes.

Result PM v Repair
- Short term (0-4 years) 1.4% v 16.5%
- Long term (>10 years) 3.9% v 20.7%

Result by side
- Lateral Repair: Lower reoperation rate (23v29%)
- Lateral partial meniscectomy: Higher reoperation rate (1.4 v 0.5%)
Lateral vs. Medial Meniscus Surgery

Lateral Meniscus Surgery

- Partial Lateral Meniscectomy
- Isolated Lateral Repair
- Lateral Repair with ACLR

Re-operation Rate

- 0-4 years: 0.9%
- 4-10 years: 6.5%
- >10 years: 23%

- Avg. rate: partial lateral meniscectomy

Medial Meniscus Surgery

- Partial Medial Meniscectomy
- Isolated Medial Repair
- Medial Repair with ACLR

Re-operation Rate

- 0-4 years: 0%
- 4-10 years: 3.0%
- >10 years: 29.9%

- Avg. rate: medial meniscal repair with ACLR

Follow-up

WARWICK orthopaedics
9609 meniscal repairs between 2003 and 2010 (2223 Lat, 2261 Both)
Median F/U 3 yrs

Result
8.9% overall frequency of subsequent meniscectomy:
Lower if:
- Concomitant ACL repairs (HR 0.67)
- Isolated Lateral
- Older age (>30)
- High volume surgeon (>24 a year) (HR 0.71)

Conclusion:
Repairing a meniscus is a safe and effective procedure in the long term.
13 studies
- Medial failure 24.2% (17-36%)
  - Higher in 4 studies
- Lateral failure 20.2% (7-43%)
  - Higher in 3 studies

Trend to lower failure in lateral
P=0.17 on random-effects model
918 meniscus repair

SÖS & Capio Artro Clinic 1999-2011

Median 23 y (12-60)
58% male
62% Medial menisci
62% Associated ACL inj
Failure = resection within 3 years
29%

**Significant difference**
- Medial > Lateral
- Arrows > Sutures
- Isolated > combined ACL

**No Significant difference**
- Patient age
- Age of injury
- Vascularised zone

Lateral better than Medial

Courtesy of Karl Eriksson

Stockholm Sports Trauma Research Center
Medial vs Lateral

Survival functions

Time to failure (days)

17% failure lateral

35% failure medial

Yellow = both (4% of study)

\[ p = 0.000 \]
\[ HR = 3.006 \]

Cox regression

Courtesy of Karl Eriksson
7. Meniscal transplantation
35 Eligible studies (update on El-Attar 2011)

- 1,332 patients (1,374 knees)
- 587 medial / 657 lateral allografts
- Outcome tool: PROMS at final follow up
- Mean follow-up 5.1 years
- Failure rate: 10.6% at 4.8 years (KR or removal)
- Complication rate: 13.9% at 4.7 years.

Insufficient data on Medial v Lateral
Personal series Coventry UK

200 Meniscal transplants

- Mean age 30 (8-55)
- Lateral: 75% Medial 25% (ns male female)
- Male: 65%
- Right knee: 58%
Analysis 125 >1yr follow up

Lateral 75%

Failure (Revision or removal or Uni/TKR)
- Lateral 7/92 (7.6%)
- Medial 6/19 (31%)

Survival Curve
- Lateral 89%
- Medial 62%

Significant on regression analysis
Grade of wear most important
Clinical Results

IKDC Pre-Op to 2 year

Preop | 2y
-------|-----
NSD    | NSD

Lateral | Medial
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Other reports

- Lateral failure less than Medial
  - Stone 2013
  - Van Arkel 2002
  - Cole 2006
No significant difference out to 16yrs
Medial 11/39 (28%) at 6 yrs
Lateral 10/61 (16%) at 4.8 yrs
Lateral vs Medial: Courtesy of Peter Verdonk 2015 Results

No difference

Lateral

Medial
Messages: Data to inform patients

- Anatomical differences:
  - Medial: tethered and sees more load when ACL damaged.
  - Lateral: larger takes more load
- Loss is worse for Lateral (xray changes)
- Partial meniscectomy: lateral reduced activity
- Back to sport easier and quicker for medial
- Repair is better for lateral
- Transplantation seems better for lateral
- Lacking good data on natural history of total loss and prediction of OA
Better if you lose meniscus

Better if you repair or replace meniscus
Thank you for your attention