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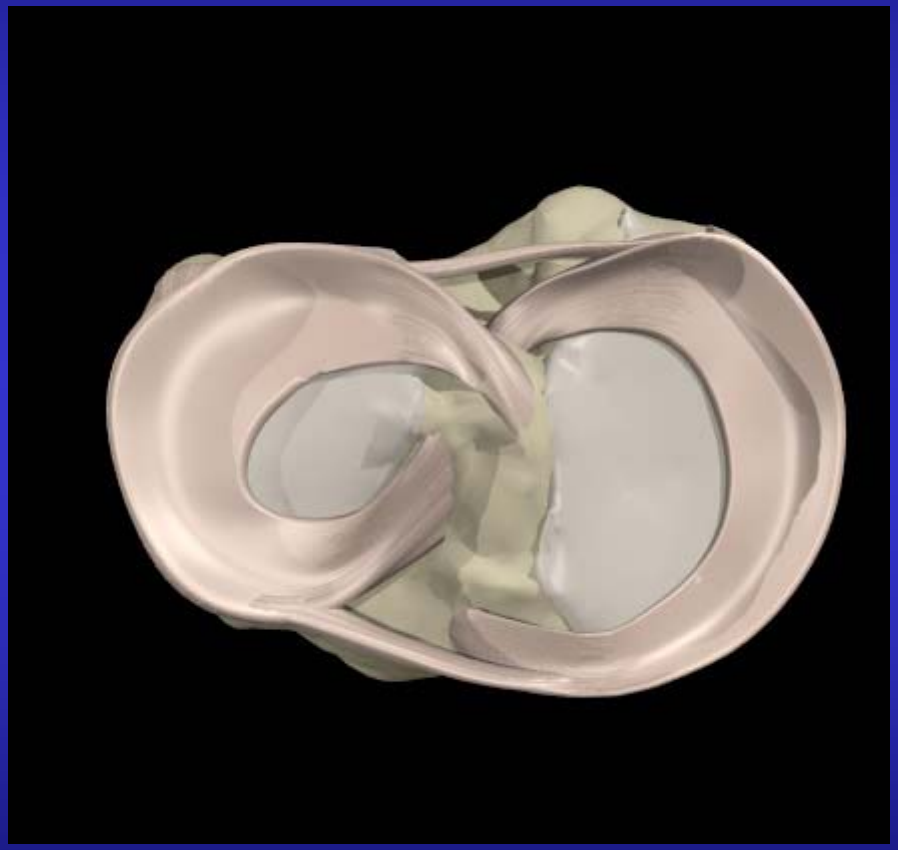
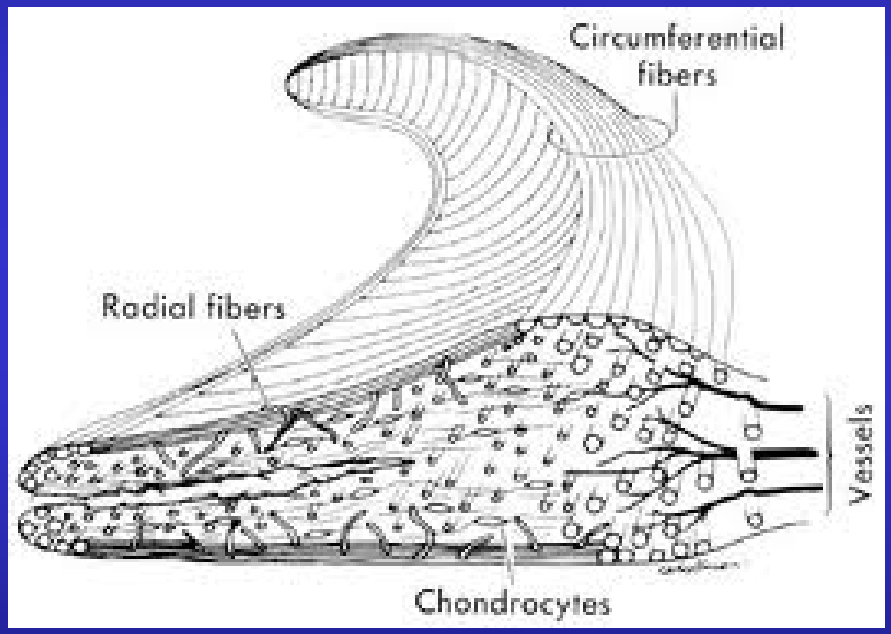
Meniscus





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Structure

- Type I collagen
  - strong in tensile stress
  - Oriented in a circumferential direction
  - Prevent radial extrusion
  - Maintain structural integrity during load bearing
- Lateral meniscus more important in weight bearing
- Medial meniscus contributes to joint stability
- Fairbank 1948 showed load bearing function

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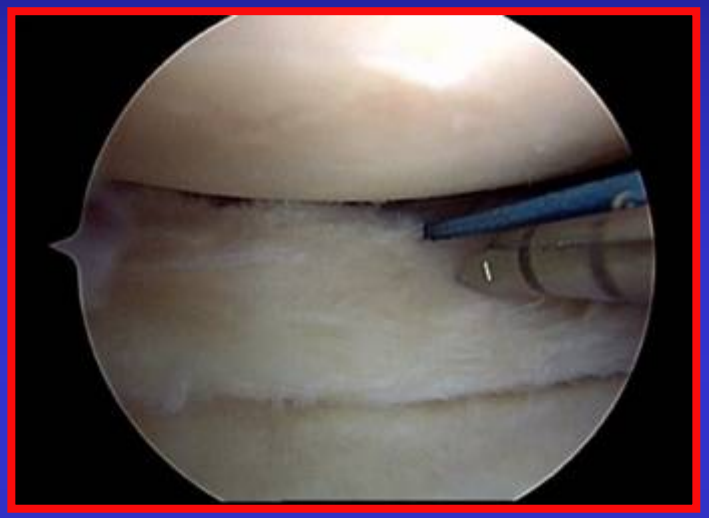
Meniscal Injuries

- Incidence 61 / 100,000
- Broadly classified
  - Acute
  - Degenerative
- Patients over 65
  - 60% incidence of degenerative changes with no symptoms



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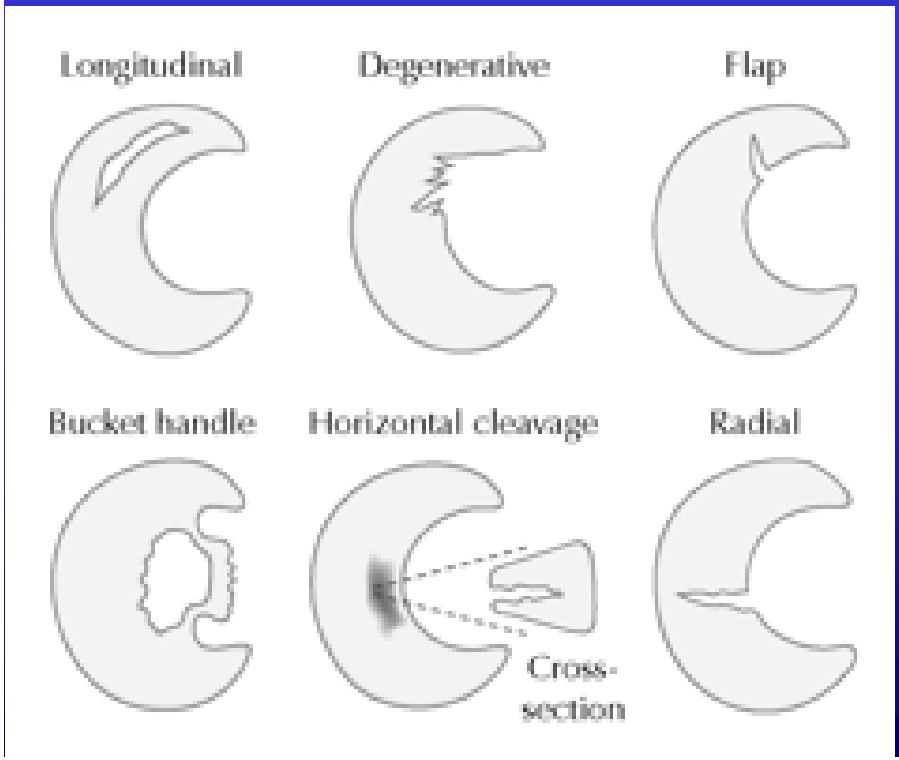
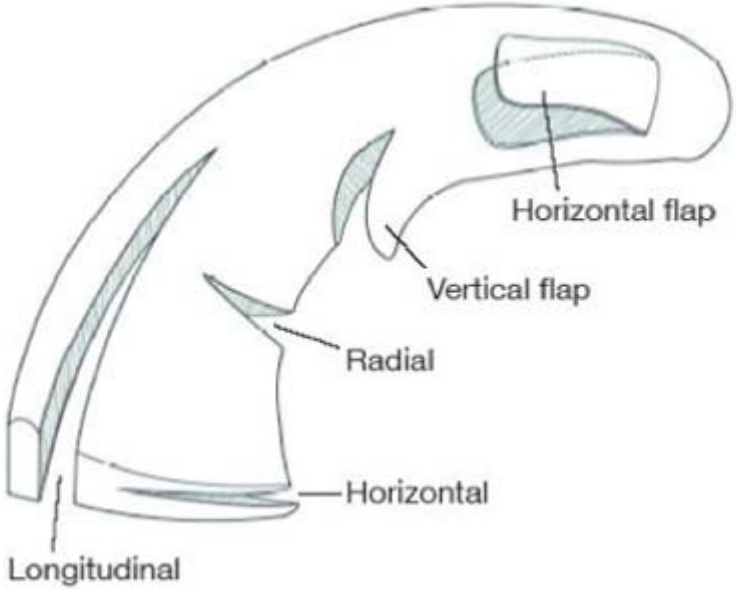
Meniscus tear types



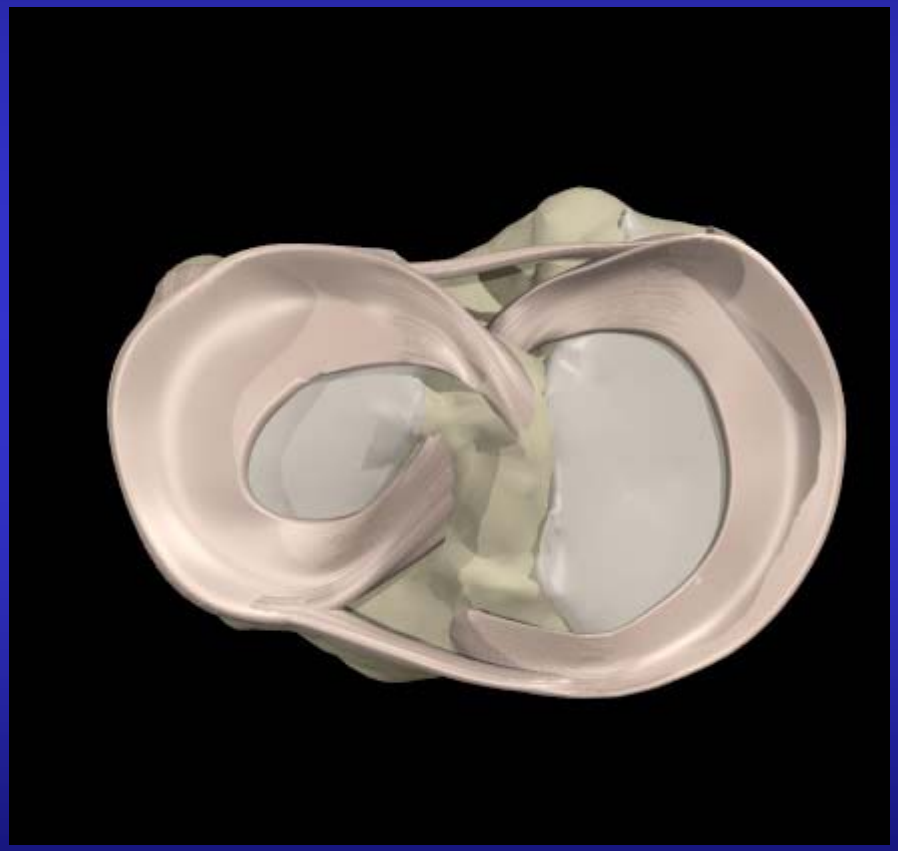


Meniscal Function

- Load transmission
  - 45 – 50% load transmitted to menisci in extension
  - 85% load transmitted to menisci in flexion
  - Medial side, MM and MTP share load
  - Lateral side, LM takes 80% load

Meniscal Function

- Lateral meniscus covers 76% of the articular cartilage
- Medial meniscus covers 60%



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Load Transmission

- Removing MM decreases contact area MFC by 50 – 70%,

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- Removing LM 45 – 50% decrease in contact area,

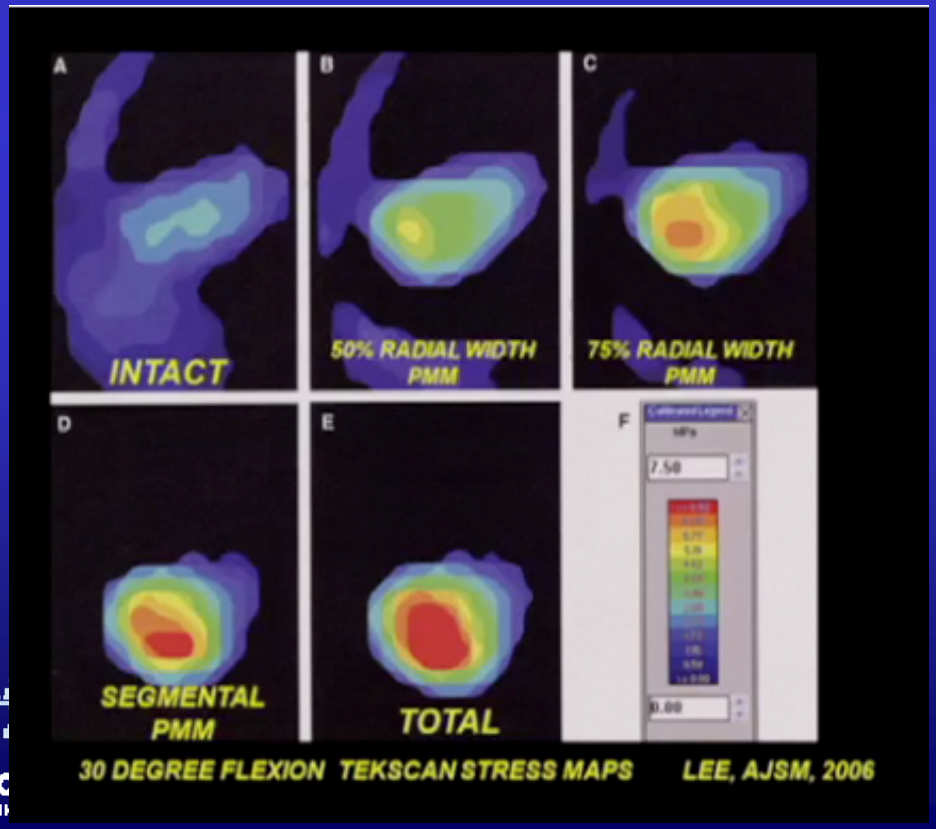
Load Transmission

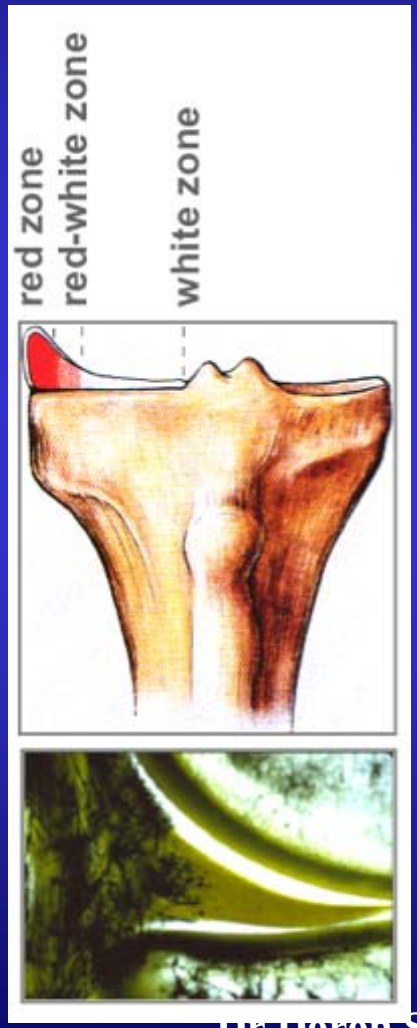
- Removing MM decreases contact area MFC by 50 – 70%, double stresses on MTP

- Removing LM 45 – 50% decrease in contact area, 235 – 335% increase in local contact pressures

Partial menisectomy not benign

- Removing inner third
  - Contact area decreased 10%
  - Contact stress increased 65%





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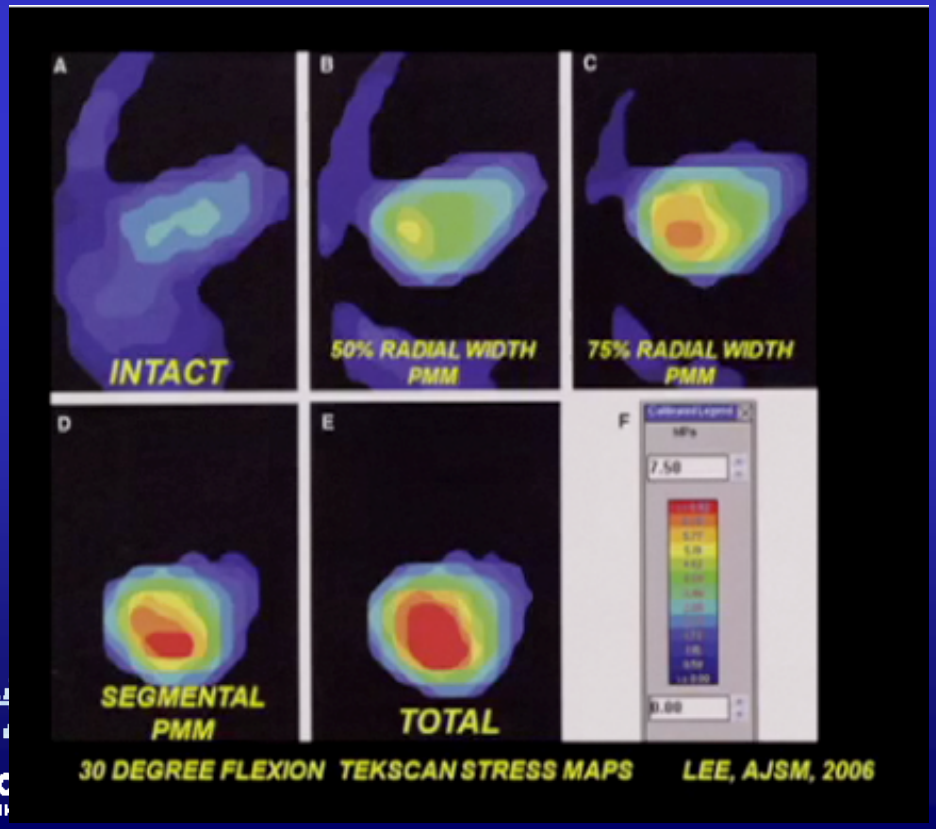

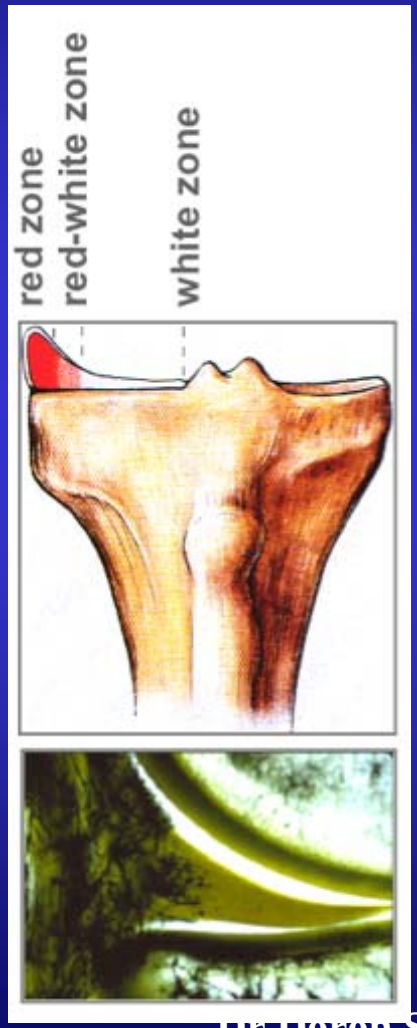

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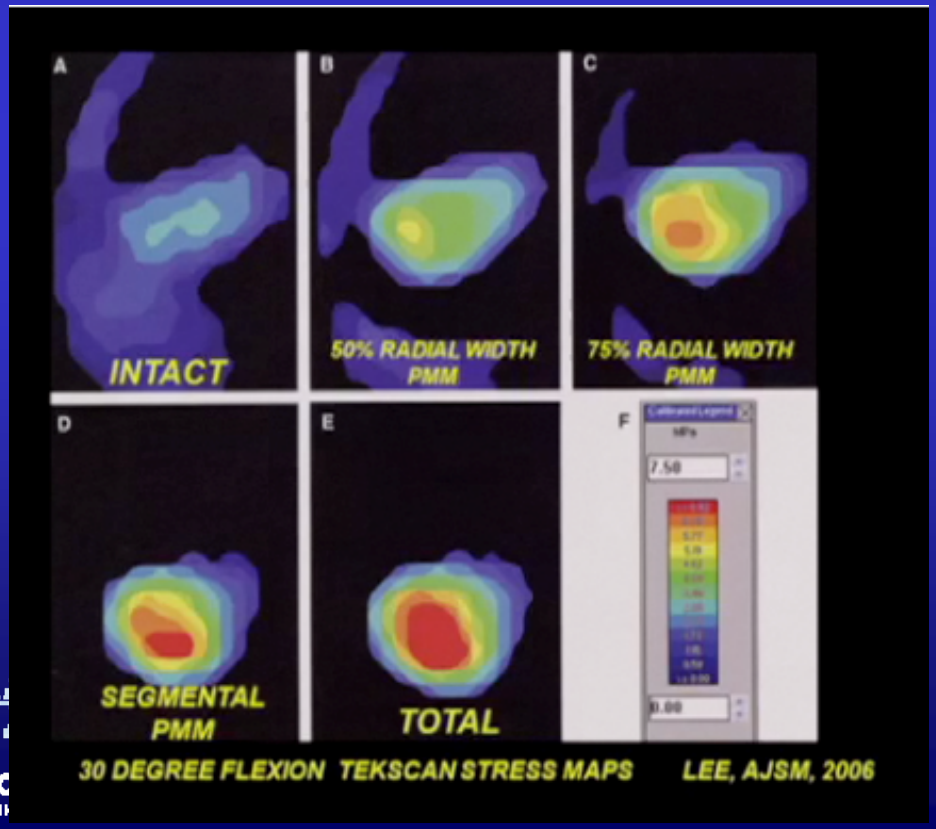

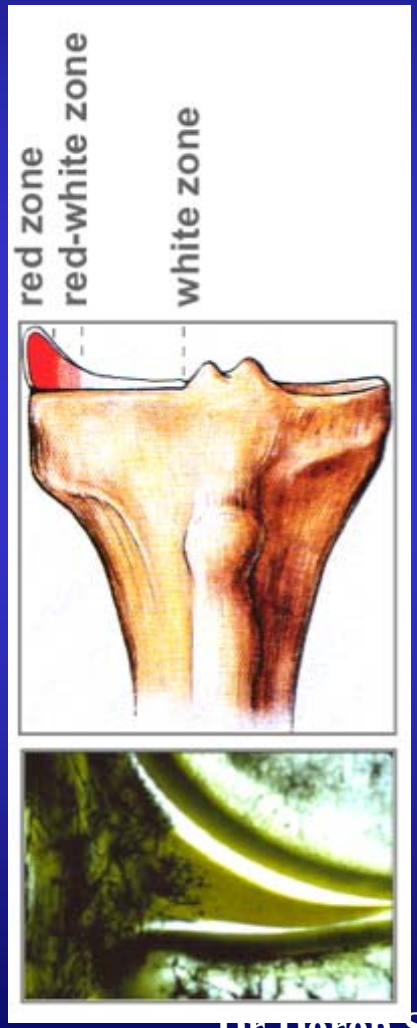

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Tear Location

- Tears posterior horn common
  - Increased transmitted load during physiologic rollback with flexion
- Resection posterior horn medial meniscus reduces external rotational stability even if ACL intact

Examination

- Isolated meniscal tears do not cause recurrent swelling
- If the knee is swollen there is almost certainly chondral damage

Imaging

- Always start with a plain xray
- MRI
  - 30% of asymptomatic contralateral knees have torn menisci on MRI – Am J Rheum 2003
  - 76% matched control volunteers with tears JBJS 2003
  - 13% healthy volunteers under 45yrs - Clin Orthop Rel Res 1992
  - 36% over 45yrs had tears – Clin Orthop Rel Res 1992
- Check that the MRI correlates with clinical symptoms

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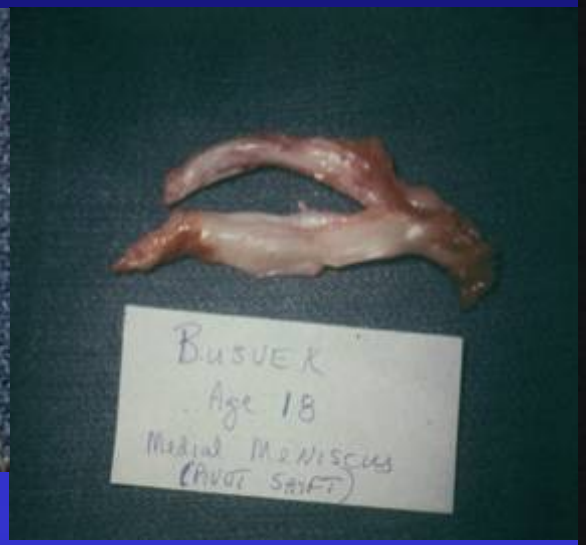

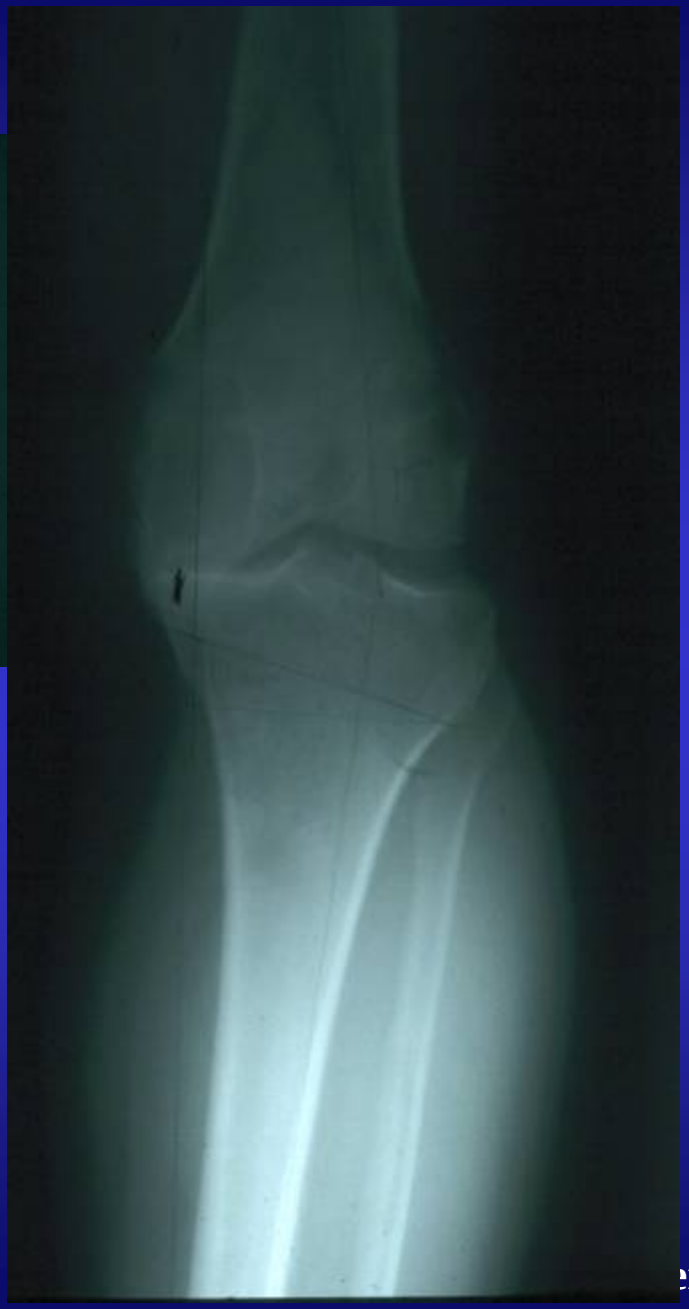

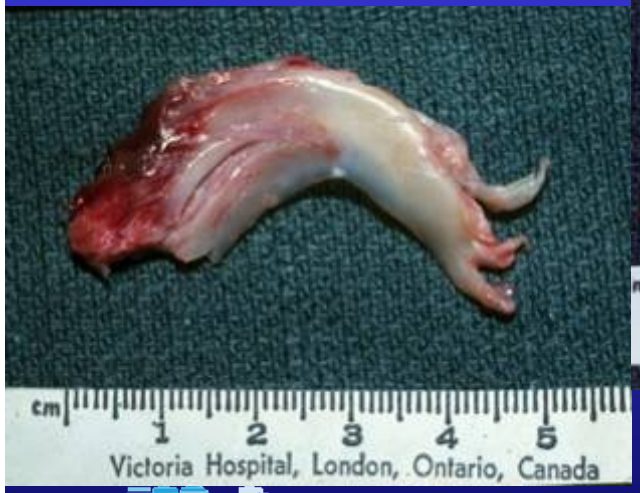

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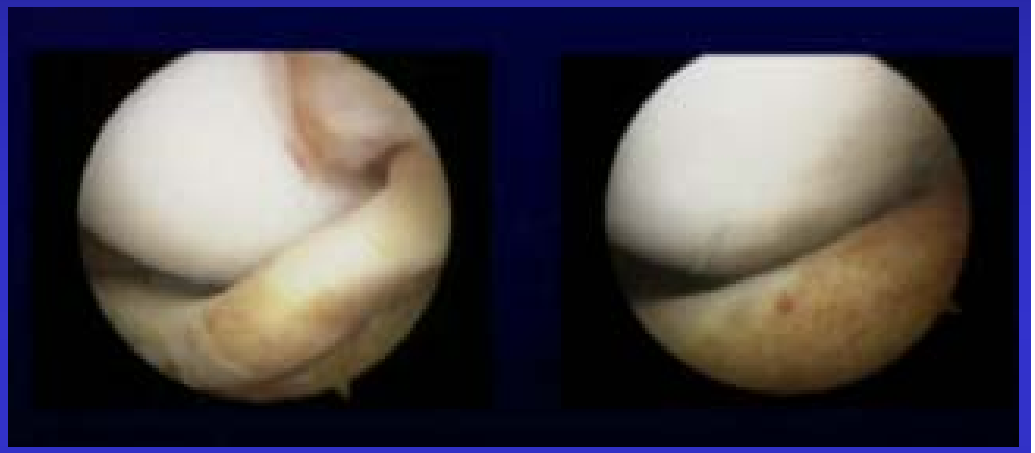
Results

- Worse in
  - Older patients
  - Females
  - Chondral damage



It isn't the menisectomy that causes the OA, once the meniscus tears it is no longer functioning as a shock absorber

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Meniscal repair

- First described by Annandale in 1885
- King did work on blood supply in dogs 1936

- Meniscus takes 4 months to heal visually at 2nd look scope
- Takes 12 weeks to be 60% healed (in goats)
- Takes 24 weeks for normal biomechanics

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Does ‘repair’ change the outcome?

Results of Menisectomy??

- YES - 12% patients very bad at 12 years
  - 88% good or excellent at 15 years
  - If take >50% of meniscus xrays worse at 12 years
  - Lateral side recover more slowly but long term the same in some studies and worse in others

Poor outcome after menisectomy

- Risk Factors
  - Total Menisectomy
  - Removal of peripheral meniscal rim
  - Lateral menisectomy
  - Degen tear
  - Chondral Damage
  - Hand OA (poor genetics)
  - High BMI

» Salata AJSM 2010

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Shelbourne 7yr F/Up –

He Doesn't believe in repair

- Lateral Meniscal Tears
- 350 cases
- Treatment:
  - Abrasion and trephination
  - FWB and Full ROM rehab
- 96% overall IKDC rating of normal or nearly normal

Indications

- Complete vertical longitudinal tear >10mm long
  - Tears closer to the periphery heal better
- Within peripheral 1/3 of meniscus
- Within 3-4mm of the menisco-capsular junction
- Unstable tear that can be displaced
- No 2ndary degeneration or deformity
- Active patient
- Stable knee

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ACL injury and meniscal tear

- The MOON cohort - 1014 ACL R/C
  - 36% medial meniscal tears
    - 31% repairable
  - 44% lateral meniscal tears
    - 12% repairable

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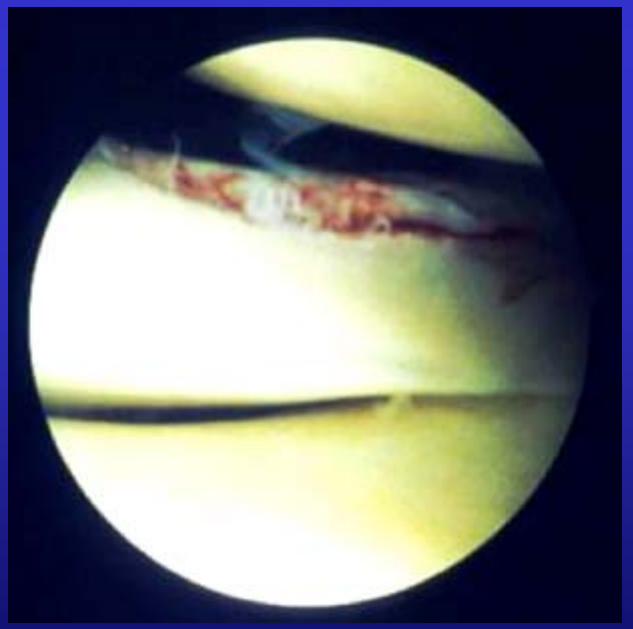
Unstable knee??

- Meniscal repair failure rates:
  - ACL deficient knees 46%
  - Stable knees 5%



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Technical aspects

- Vertical mattress
- Non absorbable
- All inside posteriorly
- Inside out more anteriorly

Trephination and clots

- Creating vascular channels by trephination can result in fibrovascular healing in avascular areas of the meniscus
- Adding a fibrin clot to isolated meniscal repairs decreased the failure rate from 61% to 8%.

» Henning Clin Orthop Relat Res. 1990 Mar;(252):64-72.

Stem Cells – Goat Model

- Cut ACL and lateral menisectomy - OA
- Injected mesenchymal stem cells

- Meniscus-like regenerative tissue with collagen type II present as a sign of hyaline matrix formation
- The MSCs were part of the repair tissue.
  - Murphy and Barry 2003

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Synthetic Meniscus –

Still Experimental

- Open to allow tissue ingrowth (high porosity)
- Withstand initial forces (before tissue grows in)
- Stiff and strong as native meniscus
- Mimic the tribology of the native meniscus
- Hold the sutures (tear resistant)
- If degradable:
  - Allow enough time for tissue ingrowth
  - Nontoxic byproducts
  - No foreign body reaction

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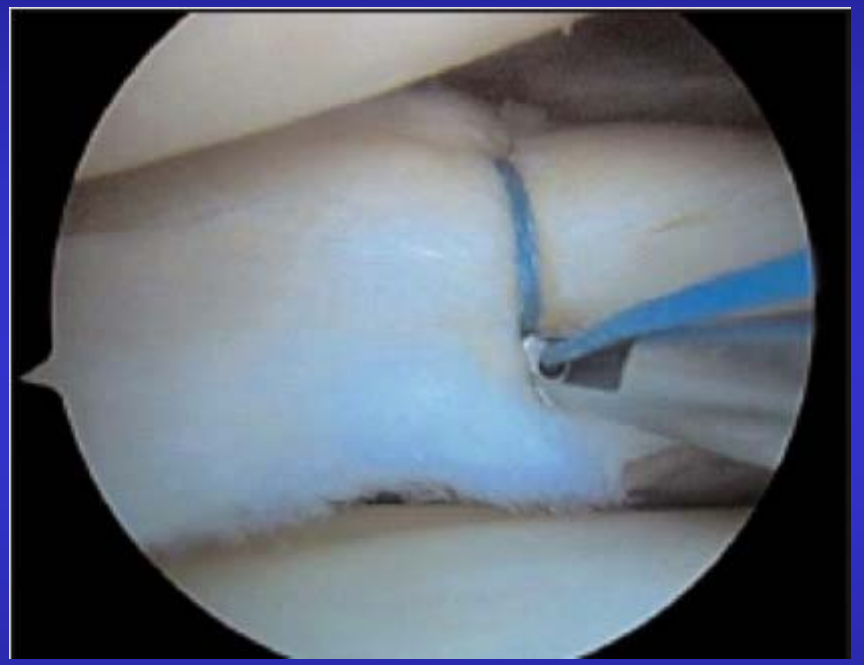
Other options

- Allograft
- Collagen meniscus implant (made from bovine achilles tendon)
- Polyurethane ingrowth implant
- Total synthetic replacement

- Need permission to do these in Australia

Meniscal healing after repair

- Complete
- Partial
- Not healed
- MRI can’t distinguish between successful and ineffective meniscal healing
- Repeat arthroscopy is the gold standard
  - But why do it if no symptoms



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Clinical results

- Clinical follow-up can't differentiate between healed, partially healed, and asymptomatic failures
  - Up to 66% of failed repairs are clinically asymptomatic
  - Some unhealed repairs can be symptomatic
  - Not sure what the long term results will be

- Healed and partially healed - asymptomatic

Rehab – A safe option

- FWB in extension immediately
- $0\text{-}60^0$ - 4/52
  - » Wt bearing at 90^0 flexion =4X higher loads on posterior horn of the meniscus
- $0\text{-}90^0$ - 4-8/52
- Full ROM at 8/52 – no loaded flexion before 3 months
- Running 3/12
- Sidestepping 6 months

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Conclusion

- Save the meniscus when you can
- If in doubt repair or stimulate
- Don’t give them complications
- Rehab carefully but aggressively
- Steep learning curve but very worthwhile

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Thank you

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