A brief review of the Aging Knee

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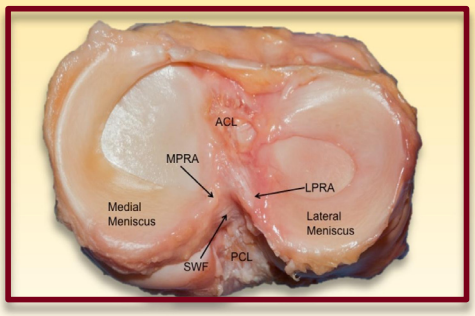

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Types of Injuries

- Acute Muscle Injuries:
  - Contusions
  - **Strains**
  - Lacerations
- Overuse Injuries
  - **Tendinosis**
  - Stress Fractures

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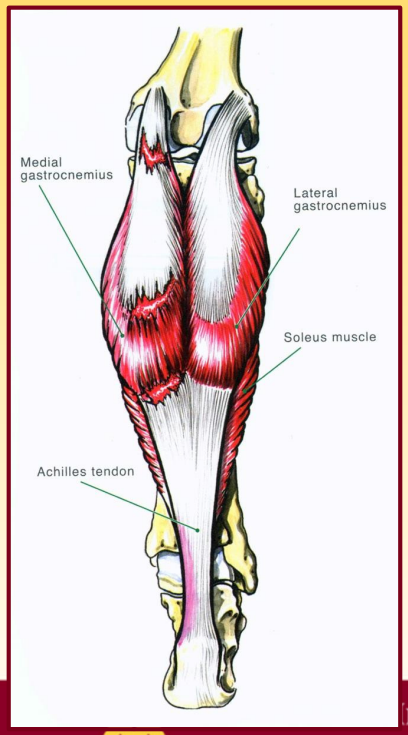
Muscle Strains
(Stretch induced muscle injury)

- Indirect injury to muscle
- Most common action is sudden deceleration or acceleration
- (?) due to decreased flexibility of the sarcomere at this level.



Muscle Strains
(Stretch induced muscle injury)

Most commonly in muscles that:

(a) cross 2 joints and

(b) have a relatively high content of fast twitch muscle fibers

(e.g.) hamstrings, rectus femoris, medial head of the gastrocnemius muscle.

(c) muscles that have dual innervation

(e.g.) adductor magnus, upper ext. muscles

Three Phases of Muscle Injury Healing

Inflammatory phase

Marked hematoma post injury, myofibrils contract

↓

Reparative phase

Regeneration of myofibers, production of connective scar tissue

↓

Remodeling phase

Maturation of regenerated myofibers, reorganization of scar tissue

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0363-5465/88/1602-0123$02.00/0
THE AMERICAN JOURNAL OF SPORTS MEDICINE, Vol. 16, No. 2

AJSM, 1988

The role of warmup in muscular injury prevention*

MARC R. SAFRAN, MD, WILLIAM E. GARRETT JR, M
ANTHONY V. SEABER,† RICHARD R. GLISSON, AND BETH M. RIBBE

*From the Duke University Medical Center, Orthopaedic Research Labo
Durham, North*

- Greater length change before failure
- More tension before failure
- Requires more force to failure
- Relative increase in elasticity

Muscle Strains (Stretch induced muscle injury)

- Predisposition to muscle strain
  - strength imbalance
  - decreased flexibility
  - fatigue / overuse / inadequate recovery
  - immobilization
  - previous injury
  - inadequate warm-up
  - faulty technique / biomechanics

Muscle Strains (Stretch induced muscle injury)

- Protective effects against muscle strains:
- Muscle strengthening
  - especially eccentric
  - muscle stretching and flexibility
  - warm up

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Muscle Strains (Stretch induced muscle injury)

- Use of NSAIDs is controversial.
- Early studies suggested that NSAIDs might delay muscle regeneration in a strain injury.
- More recent studies show no detriment due to NSAID use, however there was also no help in improving the clinical course of this injury.
- Use of NSAIDs for pain management only is recommended.

Overuse Injuries bone/tendon/cartilage?

- Overuse injury: a repetitive submaximal/subclinical trauma that over-exceeds tissue's clinical responsiveness → pain/ movement dysfunction.
- Altered neuromotor control is often associated
- Restoration of neuromuscular control is the main treatment goal:

  muscle strengthening /improved body movements
- .

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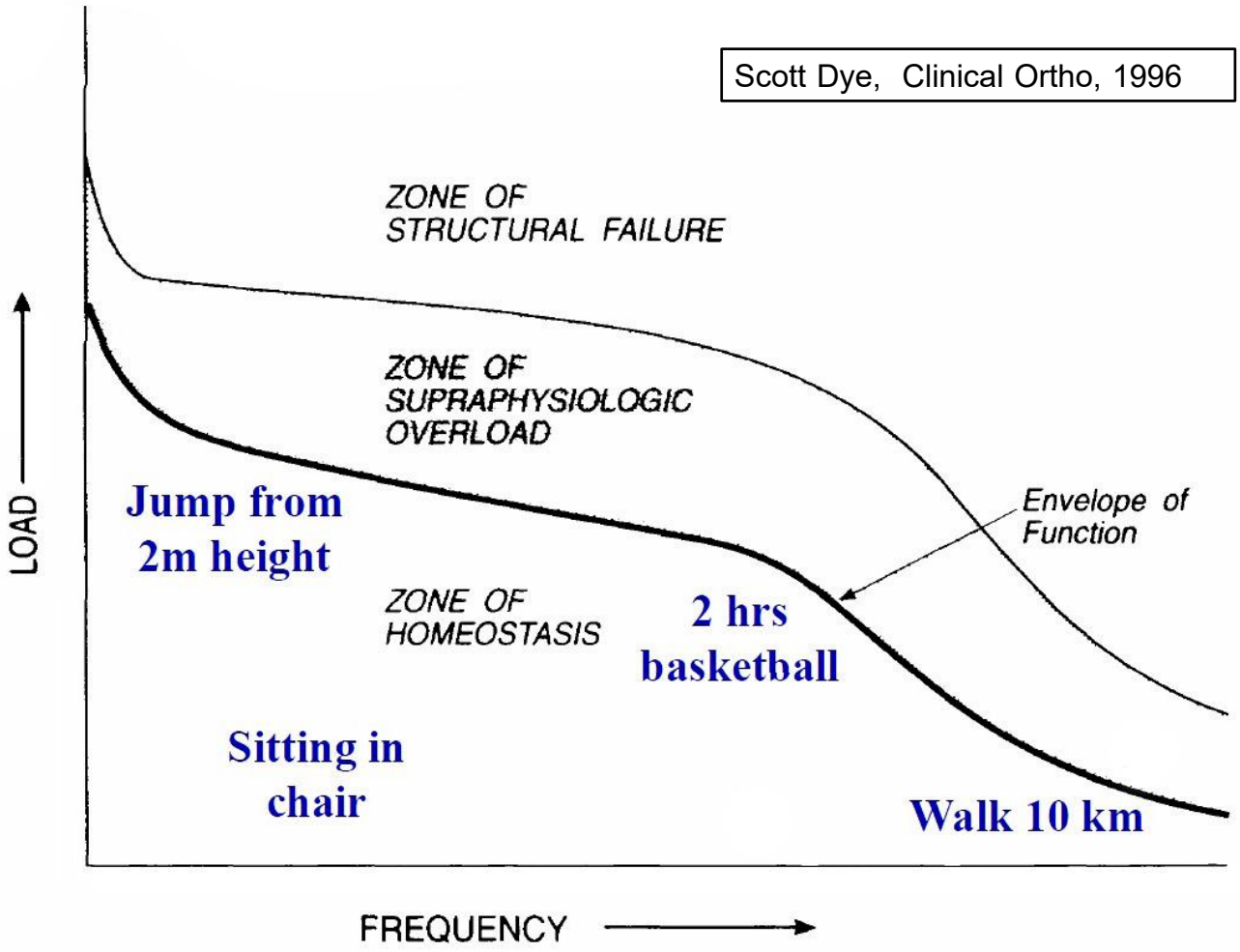

Tendonitis / Tendinosis

Landmark publication by Kraushaar and Nirschl (1999).

- electron microscopy sections of human lateral epicondyle tendons clinically identified as ***tendinitis***
- demonstrated that there was a conspicuous absence of cells associated with inflammation ***"tendinitis"*** (a term implying inflammation)
- successfully demonstrated that the underlying pathology, instead, represented a chronic degenerative condition referred to as ***"tendinosis"***

Tendinopathies

- Current explanation is protein synthesis…. Production (repair) cannot keep up with degradation
- Results in negative balance ('abusive' training)

Tendinopathies

- Tendon core has only limited renewal capacity.
- Graduated strength training, along with gentle stretch, best treatment for tendinopathies.
- Robust evidence the eccentric training has (+) effect on regional tendinopathies, esp. patella and achilles tendon.

Cartilage

Cartilage

- smooth, white material that lines our joints (like the shiny end of a chicken bone)
- present in every joint, thicker in our large joints
- avascular (without a blood supply)
- minimal ability to repair itself w/ similar type tissue

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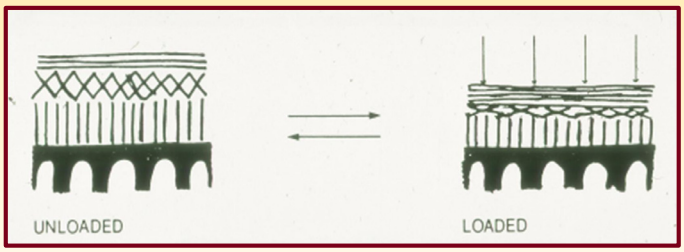
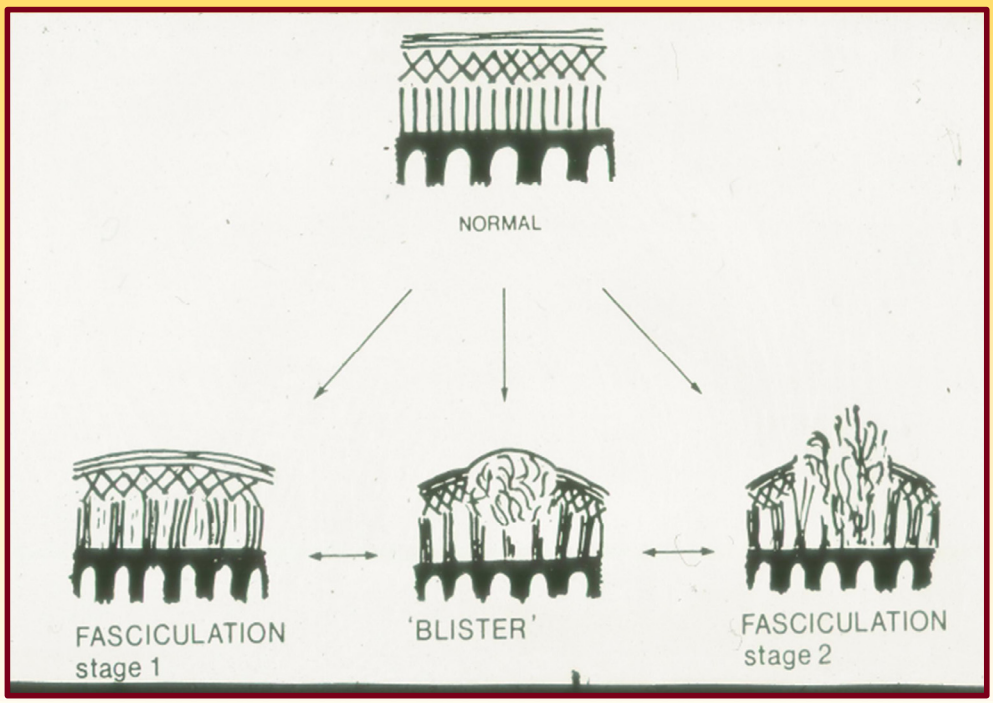
Cartilage

- main function is to provide near frictionless surface for joint motion
- secondary function is shock absorbency



Etiology Cartilage Lesions



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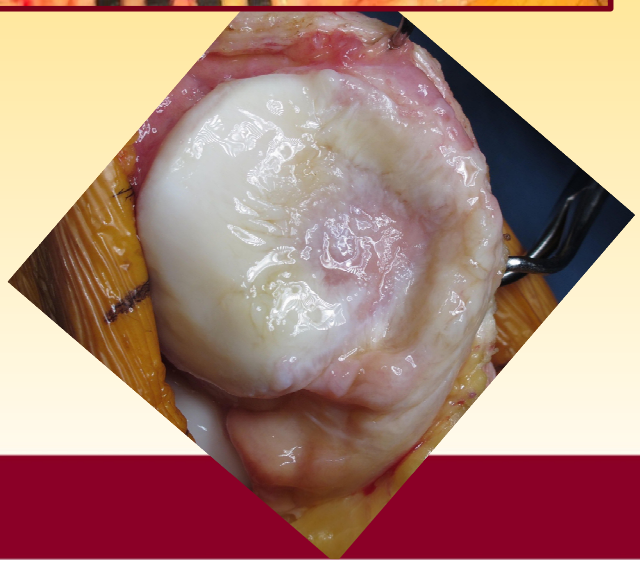
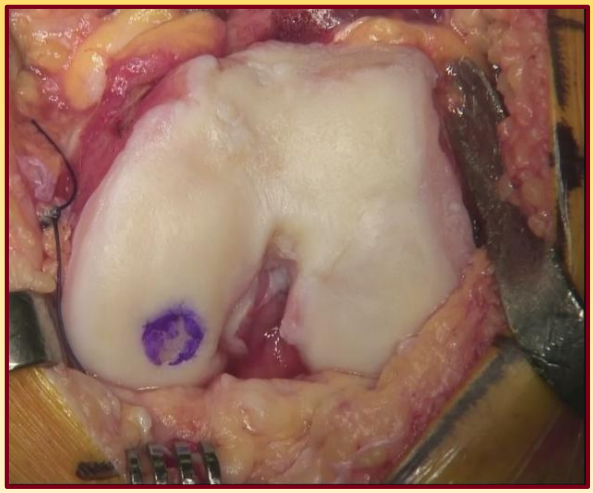
Cartilage

- The tissue we know the least about
  - When is loading favorable / destructive
- Acute exercise can alter cartilage thickness (water)
- Loaded area become compressed, overall volume does not change much. Likely shifting of water





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Cartilage

- Cartilage undergoes atrophy (thinning) under reduced loading conditions (postoperative immobilization and paraplegia).
- Cartilage under increased loading (as encountered by elite athletes) is not associated with increased average cartilage thickness.
- Findings in twins. suggest a strong genetic contribution to cartilage morphology / health.

Eckstein F.; et al.; J Anat, 2006

Focal Cartilage Defects

- Microfracture
- Osteochondral Autograft Transfer (OATs)
- Matrix Autologous Chondrocyte Implantation–MACI;
- Osteochondral Allograft Transplantation–OCA

Limited publications concerning return to athletic endeavors.

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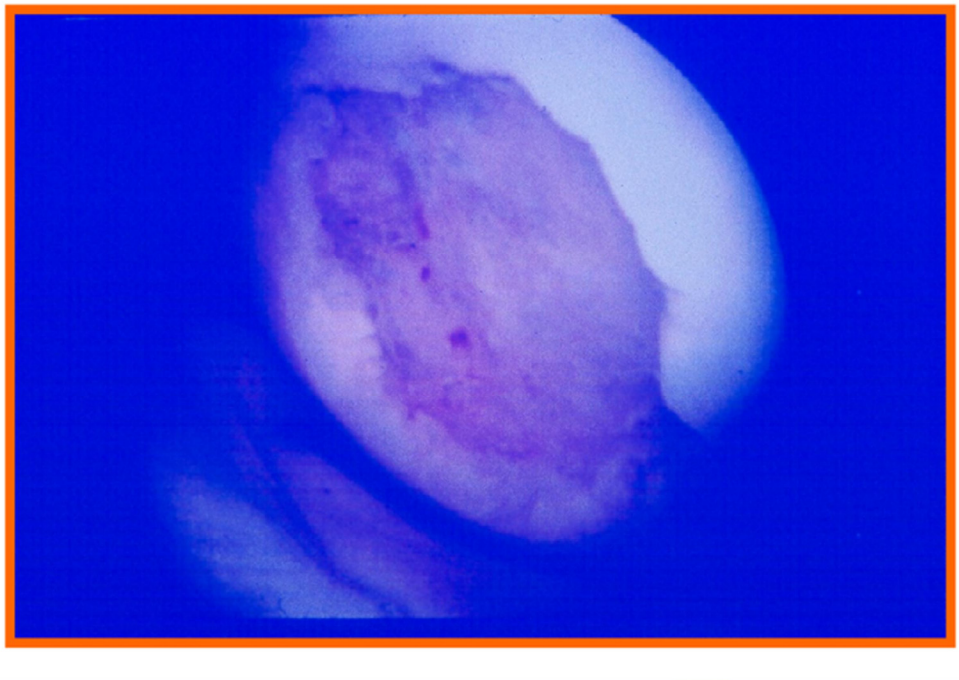
Chondral Injury

Lesions > $2cm^2$



Regenerative Rx.

- Emerging theories in regenerative medicine specific treatments including:
  - prolotherapy
  - platelet rich plasma (PRP)
  - autologous mesenchymal stems cells (MSCs)
  - alpha 2 macroglobin
  - human tissue derived allograft products.

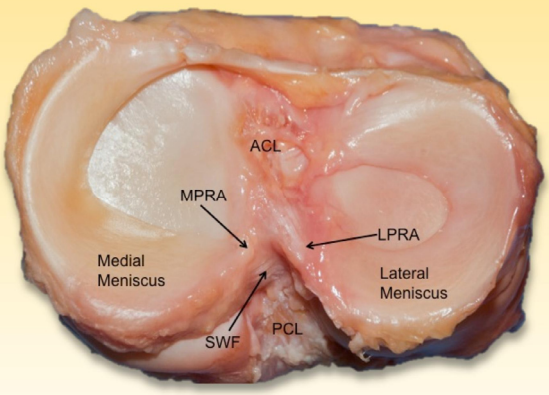
Mulvaney, et al., Endurance and Sports Medicne,2018

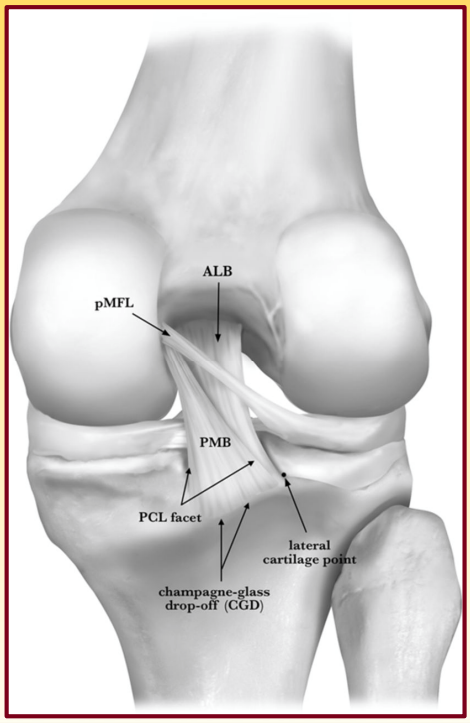
Regenerative Rx.

- Tendon: clinical trials most robust in the literature
- Cartilage : clinical trials 1º on Osteoarthritis
- Muscle: spotty use in the literature
- *Chronic Disease: most common applications*
- *Acute Injuries: investigational at this time*

Meniscus Anatomy

- 65-70% water content
- 90% *TYPE I* collagen





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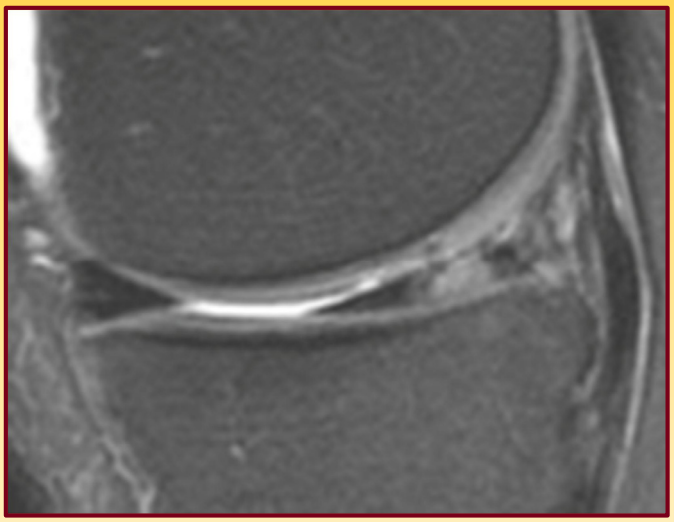
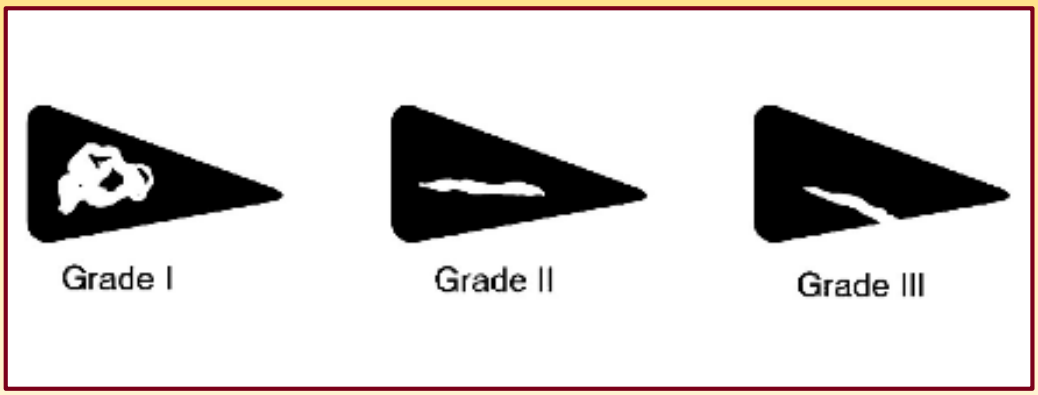
Meniscus Tear Imaging



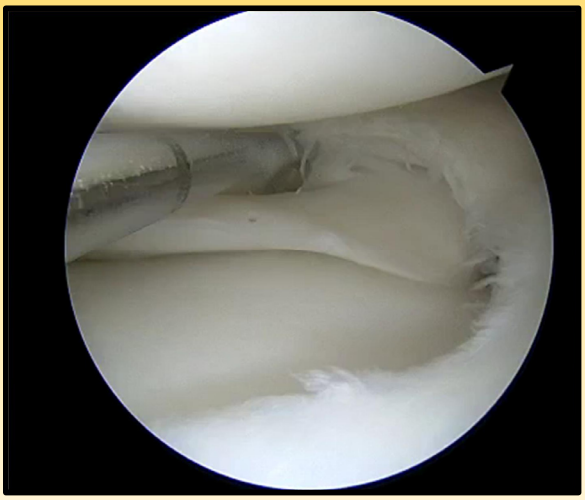
- Xrays:
  - joint space
- MRI
  - 90% accurate
    - False + in children – rely on physical exam
    - False + in asymptomatic patients
      - 36% at age 45

Meniscus Tear

- MRI Classification

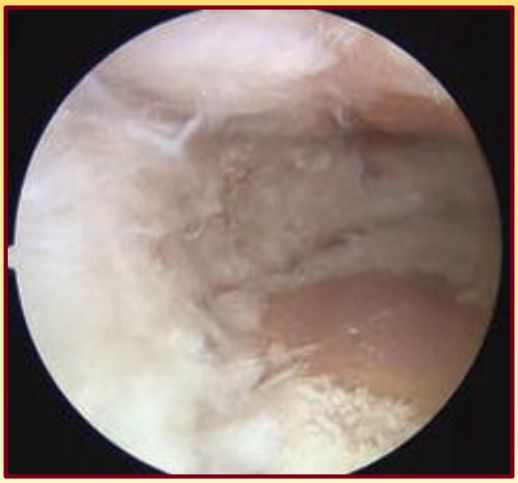


Meniscus Tears



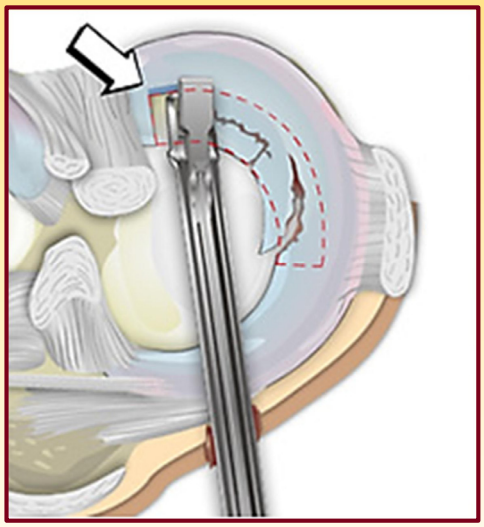
Meniscectomy – Total

- *Avoid if possible!*
- Contact area reduced by 75%
- Peak load increased by 235%
- ACL graft force increases 33-50%
- Post-meniscectomy arthritis

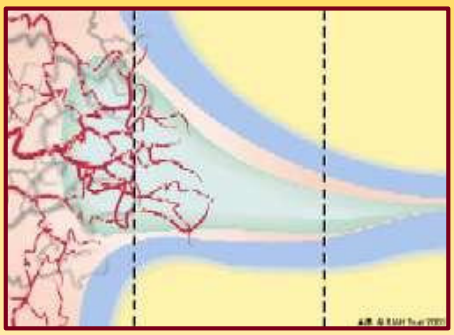


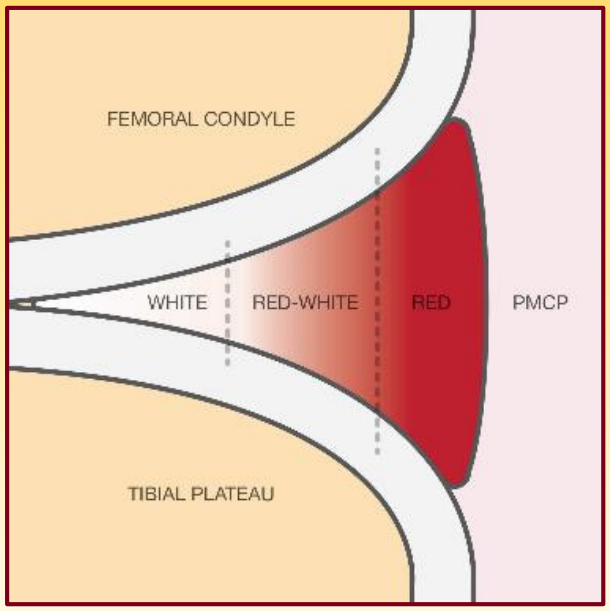
Meniscectomy – Partial

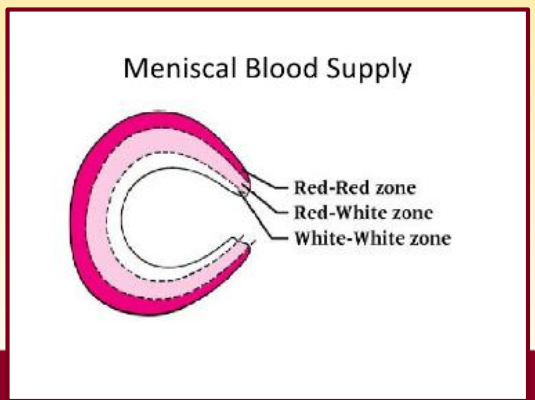
- Retains *some* meniscal function
- Prevents peak concentration of forces
- Even small rim may provide some A-P stability *Preserve as much meniscus as possible*



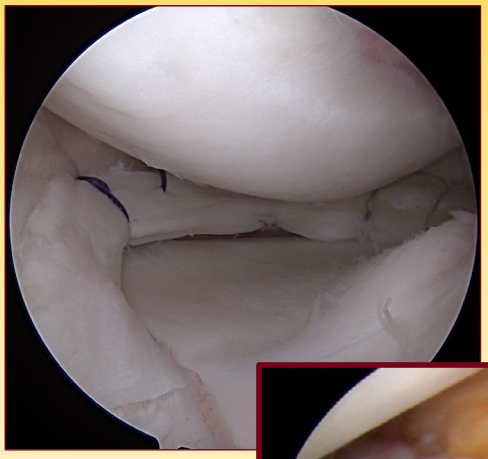
Meniscal Zones

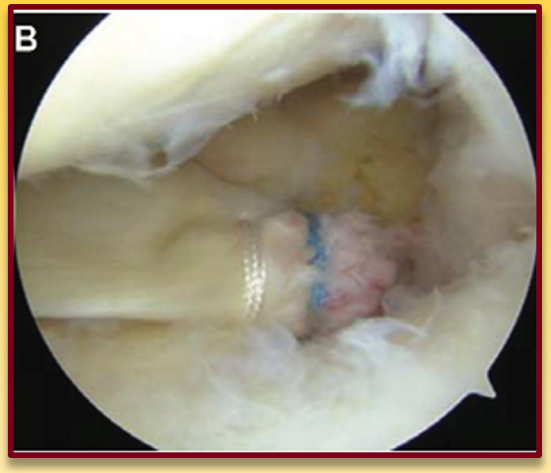


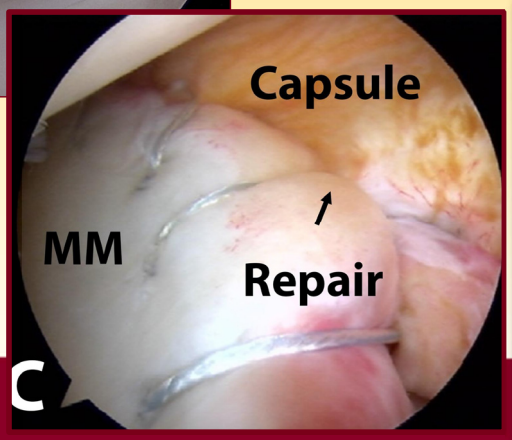




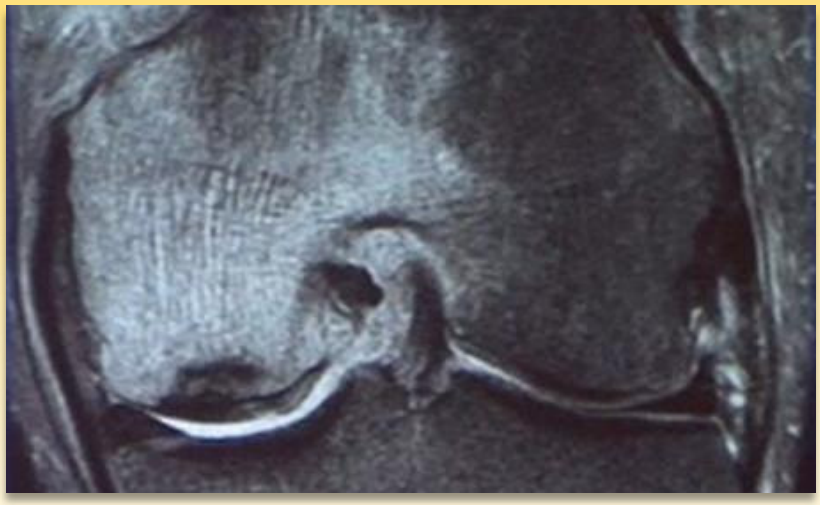
Meniscus Repair







Bone Edema



Cartilage Wear / Arthritis

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Physical exam

- Alignment
  - Correctible vs fixed
- Range of Motion
  - Flexion contracture
  - Reduced flexion
- Stability
  - 'pseudolaxity'

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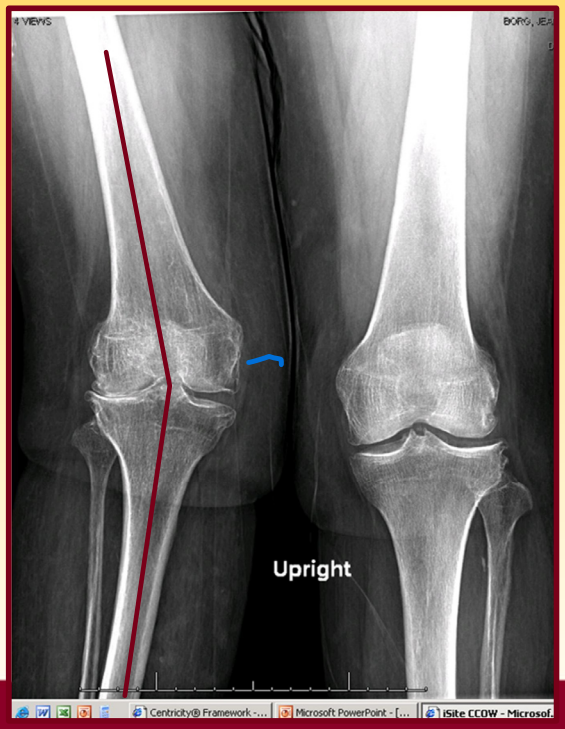
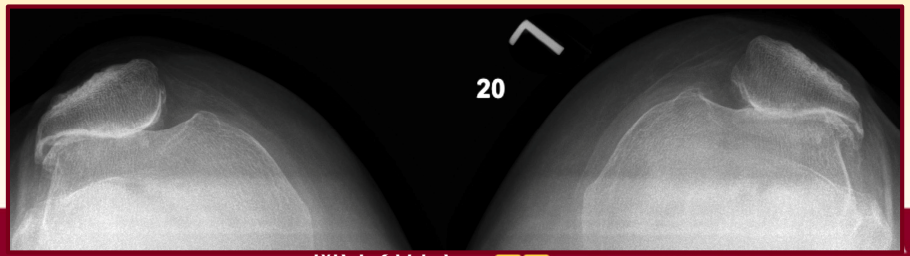
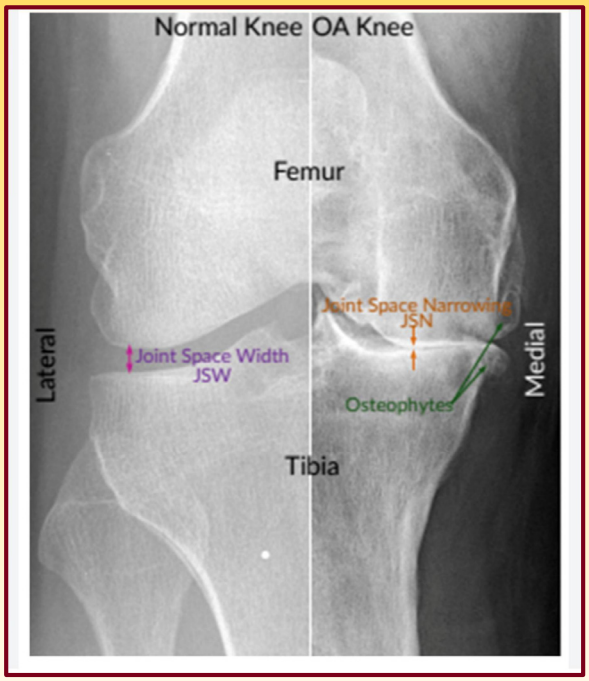
X-rays : *Weight bearing*

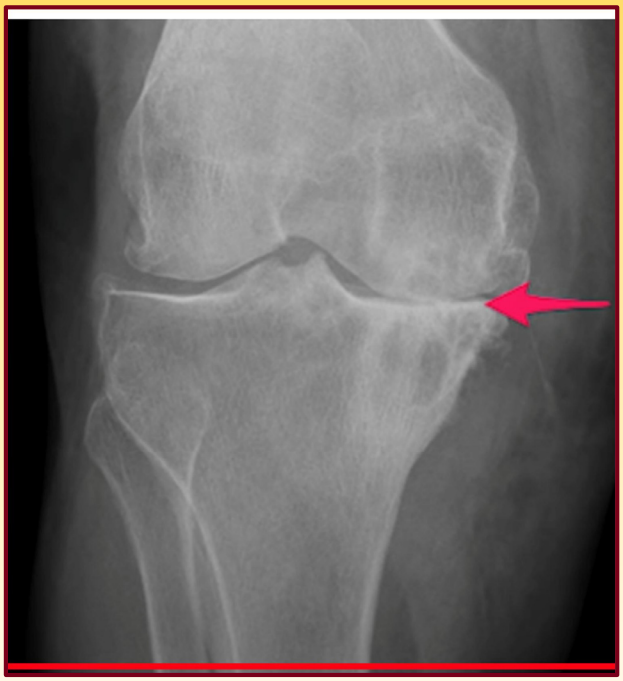


- Alignment
- Joint space narrowing
- Osteophytes : Bone Spurs

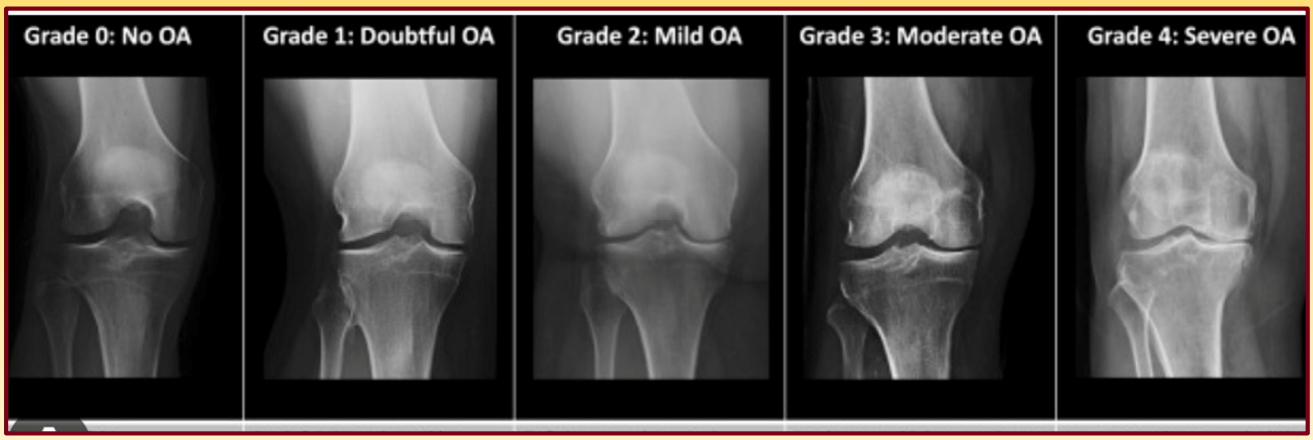


Arthritis on Xrays





Stages of cartilage wear



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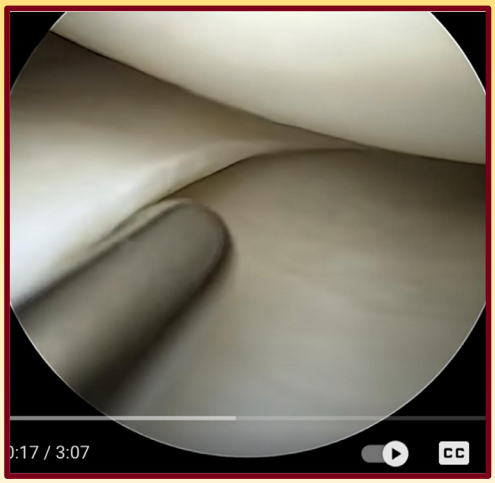
Cartilage: normal to 'wear'



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Bare Bone

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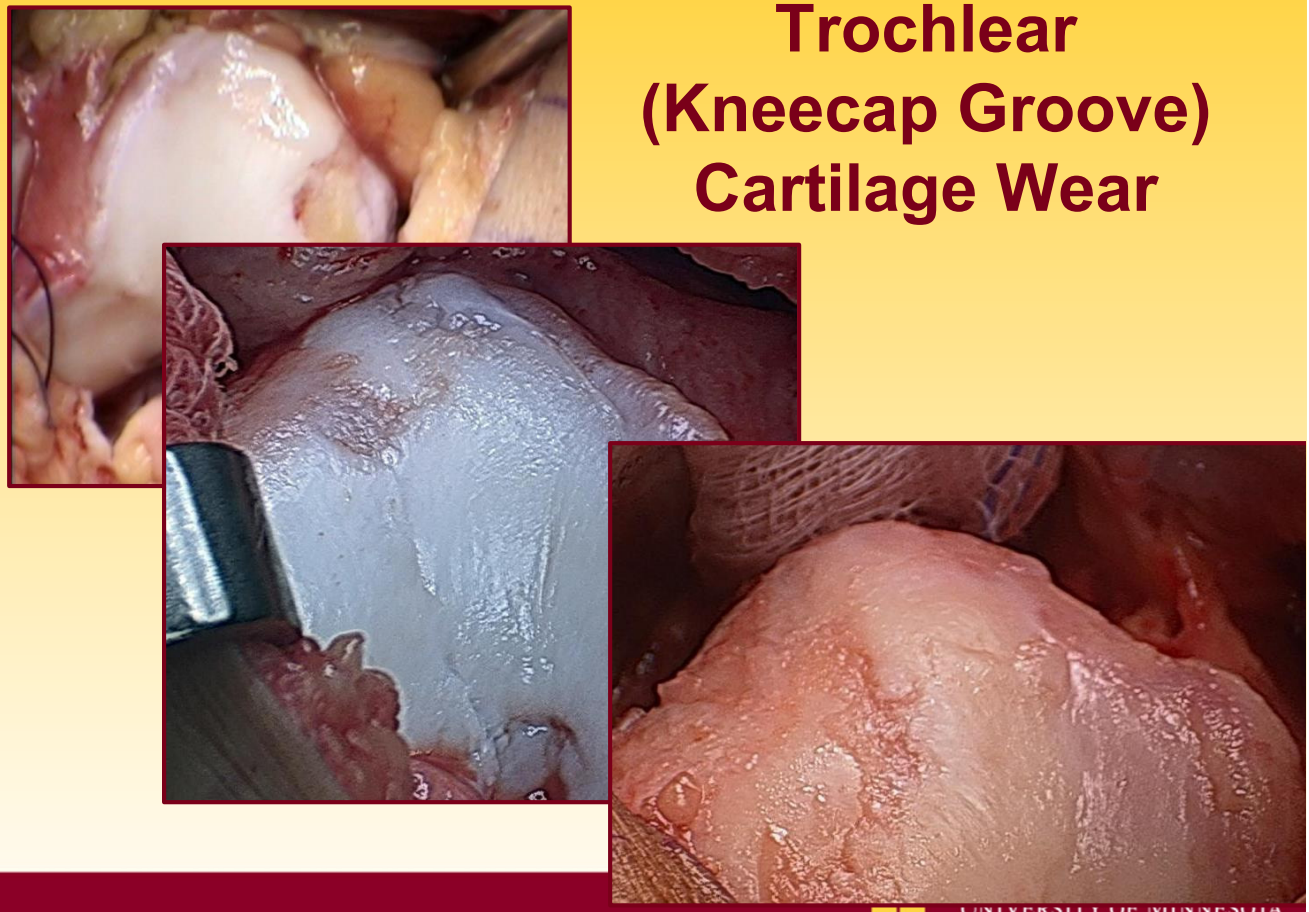
Trochlear (Kneecap Groove) Cartilage Wear



Managing the Arthritic Knee

- Anti-inflammatory medications (orals)
- Glucosamine and chondroitin sulfate
- Activity modification
- Assistive devices for walking (cane/walking sticks)
- Physical therapy/ strength training. (esp. CORE)
- Cortisone injections into the knee joint (how many??)
- Viscosupplementation injections (rooster comb)
- Weight loss (20 %)

JBJS- 1956

Don't Throw Away the Cane *

BY WALTER P. BLOUNT, M.D., MILWAUKEE, WISCONSIN

As the causes of premature death are conquered one by one, man is given a longer
that his forefathers rarely knew,
Gradually we are coming to look
me aids to gracious living rather
eagerly as components of a richer
eans of preventing fatigue and a
tion.

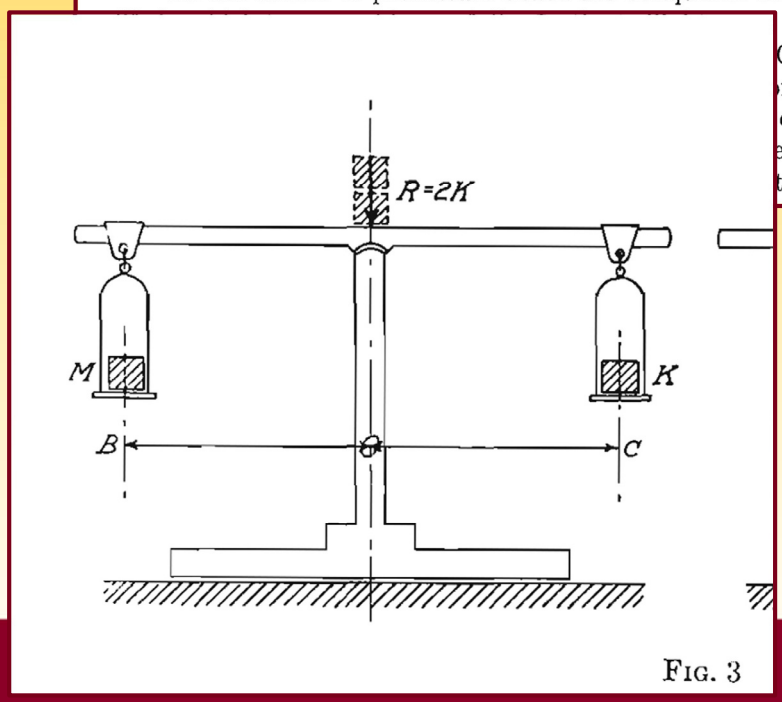


FIG. 3

40% ↓ Hip force

Climbing ↓ Quad Strength

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When Surgery Is Recommended

- Pain or stiffness* that limits everyday activities
  walking, climbing stairs, getting in & out of chairs
- Pain at rest, either day or night
- Chronic knee swelling w/ no improvement (non-op)
- Knee deformity — a bowed leg or knock knees
- Failure to substantially improve with other treatments
- Loss of knee motion* that restricts stair climbing.

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PAIN !!!

Limited Motion

Limited Activities

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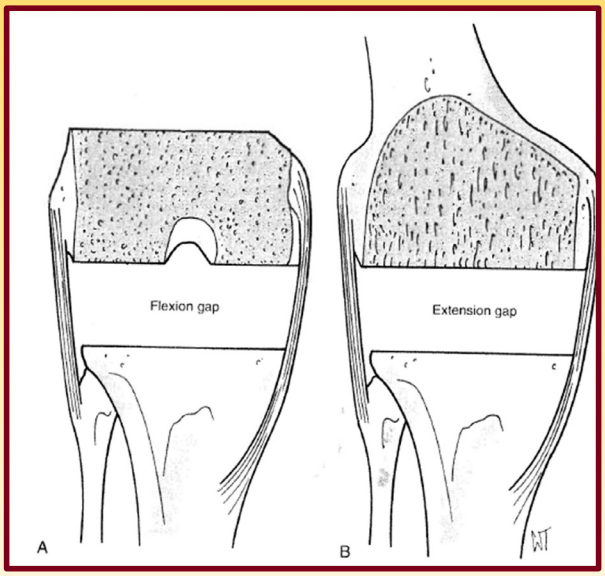
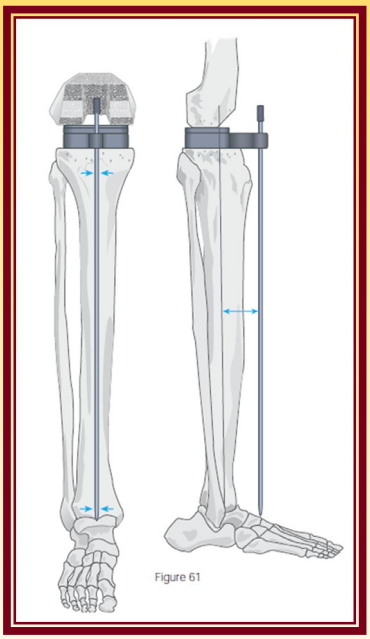
Femoral Cuts



Tibial Cut



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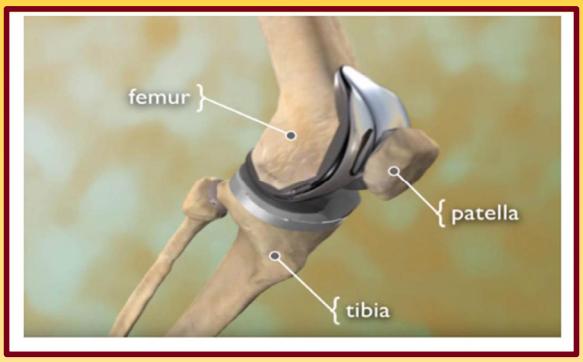
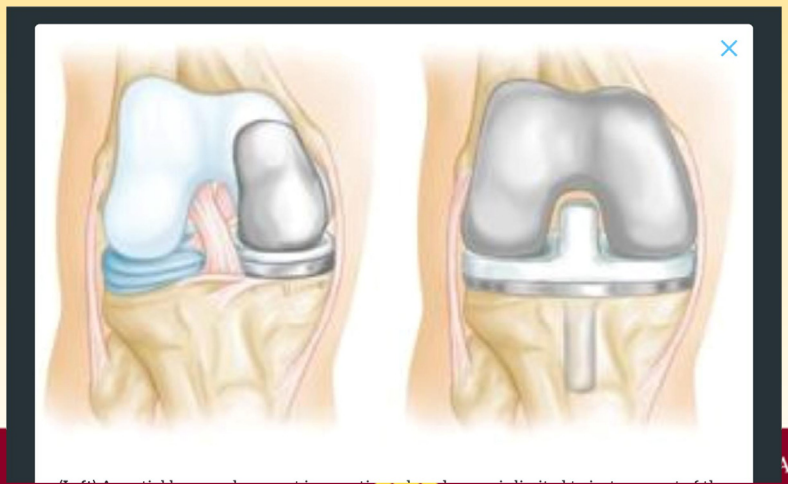


'Total' Knee vs. Partial



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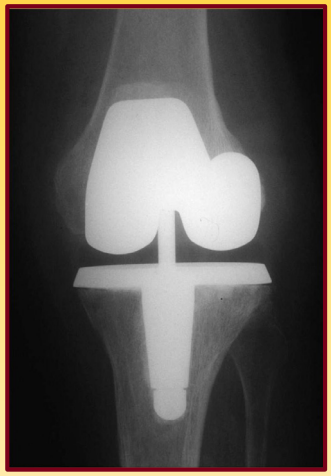
Xray



Surgical Optimization (MHFV)

	Optimized	Discussion
• Hemoglobin	>12.0	≤12.0
• Hemoglobin A1c	<8.0	≥8.0
• BMI	18.5-45.0	<18.5-≥45.0

(opioid use, smoking cessation, ETOH)

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Risks of the procedure

- Early
  - •Bleeding
  - •Infection
  - •Blood clots in the legs or lungs
- Late
  - •Loosening or wearing out of the prosthesis
  - •Fracture
  - •Continued pain or stiffness (115º knee motion)
  - •Infections

Setting Expectations

- Pain reduction
- Improvement in activities of daily living
- Some improvement in motion
  (extension more than flexion)
- Realistic activities : unlimited walking, swimming, golf, driving, light hiking, biking, ballroom dancing, and other low-impact sports.

- most surgeons advise against high-impact activities:
  running, jogging, jumping, or other high-impact sports

Does not give you back your youth !

Hip vs Knee

- A hip replacement is a much less painful operation. People are on crutches for a while, and then their hips feel nearly normal.

- It takes six months to a year to recover from total knee surgery, and even then, the knee just doesn't feel normal.

Knee & Hip Replacement a growing crisis in Health Care

- @ 790,000 total knee replacements and 450,000 hip replacements are performed annually in the U.S.

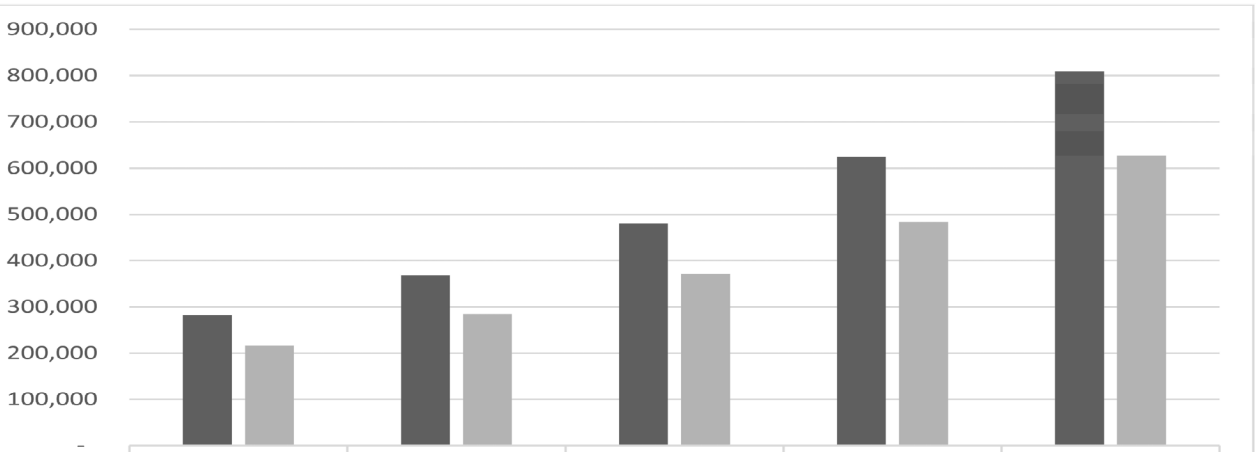
- Surgical population is getting younger

- Patients are pushing the envelop of activities and

- estimate are 4.0 million U.S. adults currently live with a TKR : 4.2% of the population ≥ 50 y/o

Total Knees by the numbers:

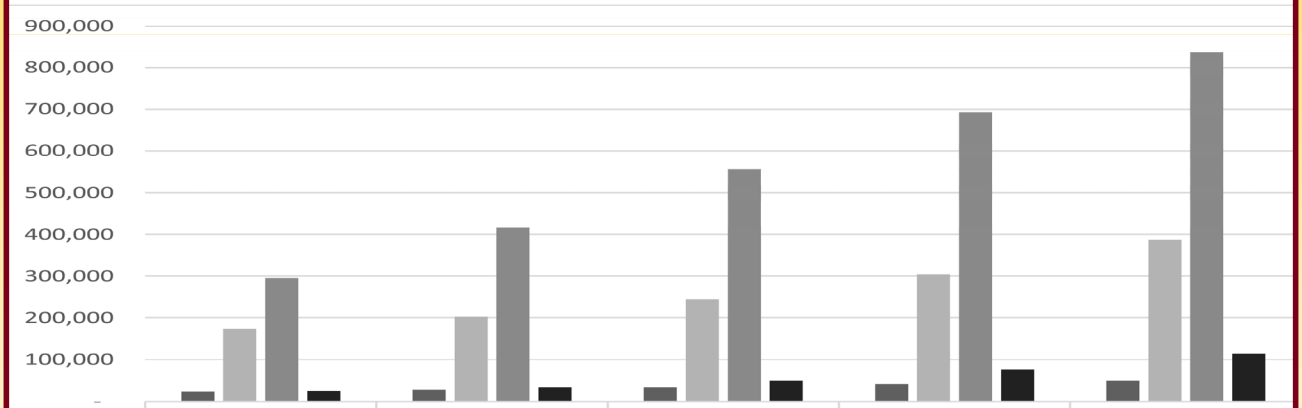
A. Sex



	2020	2025	2030	2035	2040
Female	281,342	368,259	480,630	624,816	809,188
Male	217,030	284,411	371,439	483,264	626,887

Total Knees by the numbers:

B. Age



	2020	2025	2030	2035	2040
< 45	22,874	28,040	34,130	41,278	49,707
45-64	172,880	203,223	244,260	304,884	387,881
65-84	295,466	416,824	556,437	692,397	836,349
85+	25,207	33,657	49,343	77,324	114,198

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Revisions

For Revision TKA:

- infection
- aseptic loosening
- unexplained pain

For Revision THA:

- periprosthetic fracture
- Infection

Compared to primary Total Joints, Revision surgeries:

- increased rates of complications
- longer length of hospital stay
- prolonged surgical time
- higher blood loss w/ increased need for transfusion
- higher rates of prosthetic joint infections

Revision Rates

- Knee: ten-year survival rate 95.6%.
  - Age 46-50: 22.4%
  - decreased linearly with increasing age to
  - Age 90-95: 1.15%
  - Young males, aged 46 -50 years (25.2%).

- Hip revisions:
  - 21% were re-revised within 15 years
  - 22% of second revisions were revised w/in 7yrs.
  - 22% of third revisions revised within 3 years.

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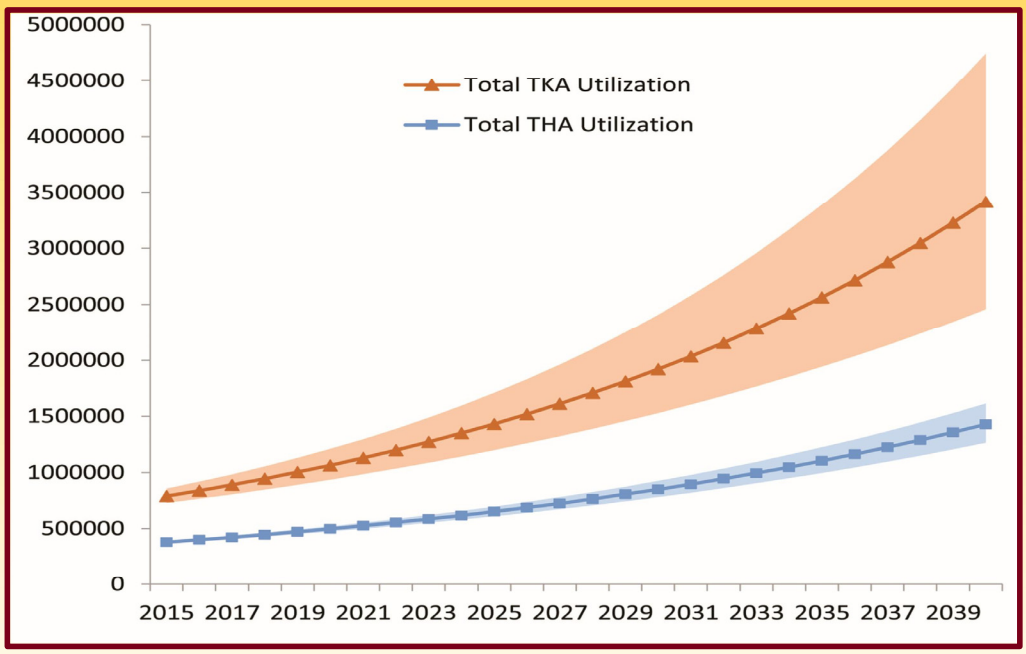
Projected Revision Rates

- By 2040:
  - rTHAs were projected to be 43,514 and
  - rTKAs were projected to be 115,147

- By 2060:
  - rTHAs was projected to be 61,764
  - rTKAs were projected to be 286,740

Projected Revision Rates



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THANK YOU

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