“Oh my aching knees!”

...an Evidence-based Guide to the Evaluation and Treatment of Overuse Knee Injuries in College Health.

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Learning Objectives

• Define the common causes of non-traumatic knee pain encountered in a college health care setting
• Identify the typical history associated with each cause of knee pain
• Describe the physical examination that is appropriate for each cause of knee pain
• Discuss the evidence-based treatment options for each cause of knee pain
**SORT (Strength of Recommendation Taxonomy)**

**A Recommendation** based on consistent and good-quality patient-oriented evidence.**
Examples:
- Systematic review or meta-analysis of high-quality studies
- High-quality randomized controlled trial of treatment†
- High-quality diagnostic cohort study §
- Validated clinical decision rule for diagnostic approach
- All-or-none study §

**B Recommendation** based on inconsistent or limited-quality patient-oriented evidence.**
Examples:
- Systematic review or meta-analysis of lower-quality studies or studies with inconsistent findings.
- Lower-quality clinical trials
- Cohort study of treatment
- Retrospective cohort study of prognosis
- Case-control study

**C Recommendation** based on consensus, usual practice, opinion, disease-oriented evidence, or on case series for studies of diagnosis, treatment, prevention, or screening.
Examples:
- Consensus guidelines
- Usual practice or expert opinion
- Disease-oriented evidence using only intermediate or physiologic outcomes
- Case series
Knee pain (unilateral or bilateral)

Trauma?

Yes
- Another lecture altogether

No
- Proceed to the next slide
I think it may have started...

I think I might have twisted it during a run...

Maybe it was from...
Differential Diagnosis: non-traumatic sources of knee pain in young adults

Anterior Knee Pain: Patellofemoral Pain Syndrome (PFPS), patellar tendinopathy, prepatellar bursitis

Medial Knee Pain: Symptomatic medial plica, Pes Anserine bursitis

Lateral Knee Pain: Iliotibial band syndrome
Patellofemoral Pain
Patellofemoral Pain Syndrome (PFPS)

**Synonyms:** runner’s knee, anterior knee pain, retropatellar pain Syndrome, lateral facet compression syndrome (*not* chondromalacia)

**Epidemiology:** females > males (2:1), most commonly in the 2nd 3rd decade of life

- Prevalence: 20% of adolescents
- Perhaps the most common diagnosis in Sports Medicine
- Accounts for 10% of all orthopedic/sports medicine clinic visits
- Most common knee injury among runners
Patellofemoral Pain Syndrome (PFPS)

**Clinical History:**
- Gradual or acute anterior knee pain
- Unilateral or bilateral
- Worse with running, squatting, prolonged sitting (*theatre sign*) and ascending/descending stairs
- Pain is typically underneath or around the patella
- Pain is typically achy, but may be sharp
- May describe “buckling” or “giving way” i.e. *pseudoinstability*
- May complain of “popping” or “catching”
Patellofemoral Pain Syndrome (PFPS)

The Theatre Sign

Knee pain experienced upon rising after prolonged sitting (theatre, lectures halls, long car rides)
Patellofemoral Pain Syndrome (PFPS)

Pseudoinstability

Perceived instability due to

pain inhibiting proper

contraction of the

quadriceps
Patellofemoral Syndrome
Etiology

- **Overload:** increased physical activity, new exercise program, ↑ BMI, history of sedentary lifestyle
- **Malalignment:** leg length discrepancy, excessive or inadequate foot pronation, muscular tightness, abnormal patellar mobility, large Q angle, muscle weakness or imbalance (i.e. vastus medialis and hip abductors).
- **Trauma:** Direct/Indirect trauma
Jacobs S, Burton B. Injuries to runners: A study of entrants to a 10,000 meter race. AJSM. Vol 14, No. 2 1986.
Patellofemoral Pain Syndrome Examination

- Patellofemoral compression test
- Patella facet tenderness
Patellofemoral Pain: Malalignment
Advanced Examination

- Leg length discrepancy
- Gait analysis
- Popliteal angle
- Q angle
- Abnormal patellar mobility
- Muscle weakness/imbalance
Acute Phase:
Activity Modification. Can maintain aerobic fitness with bike, pool, water running.

NSAIDs. Limited evidence supports their use short term (2-3 weeks) SORT: B

Modalities: Although Ice is likely effective at reducing pain, no evidence supports US, iontophoresis, phonophoresis or e-stim.
Patellofemoral Pain Syndrome Treatment

Recovery Phase:

- **Supervised Physical therapy** more effective than home exercise program.  SORT: B
- **Stretching.** Quad/Hamstring/Iliotibial band  SORT: C
- **Hip Abductor strengthening.**  SORT: B
- **Quadriceps strengthening.**  SORT: A
- **Core Stability**  SORT: C
Patellofemoral Pain Syndrome

Treatment

Adjunctive Therapy:

• Foot orthotics  SORT B
• Bracing and patellar taping  Inconclusive
  Some researchers feel a particular subgroup may benefit from bracing
• Intra-articular corticosteroids and glycosaminoglycans  No evidence
Design: single-blind, randomized controlled trial of 1500 UK army troops during 14 week basic training.

Intervention: group performed daily 4 closed kinetic chain quad/gluteal strengthening exercises plus 4 static stretches of the quadriceps, ITB, hamstring, and gastrocnemius.

Outcome measure: incidence of anterior knee pain during the training period.

Results: Incidence of PFS:
1.3% vs. 4.8% (p<0.01)

Conclusions: Daily preventative exercise can reduce the incidence of anterior knee pain in military recruits.

Iliotibial Band Syndrome
Iliotibial Band Friction Syndrome

• **Anatomy:** the IT band is a continuation of the tendinous portion of the tensor fascia lata (TFL) muscle, crossing the knee at the lateral femoral epicondyle and inserting at Gerdy’s tubercle on the lateral tibia.

• **Epidemiology:** most common cause of lateral knee pain in runners, accounts for up to 22% of all lower extremity injuries.
Iliotibial Band Friction Syndrome

Etiology

Posterior edge of ITB impinges on the lateral femoral epicondyle just after foot strike ($\approx 30^\circ$ flexion).

Repetitive irritation leads to chronic inflammation, esp. beneath the posterior fibers which are thought to be tighter against the epicondyle.
**Iliotibial Band Friction Syndrome**

**History**

**Pain:**
Vague lateral knee pain progressing to a sharp, burning focal area of pain 2cm superior to the lateral joint line

**Activity:**
Initially hurts toward the end of a run or several minutes into the run; progressing to pain with ambulation and while sitting or resting
Iliotibial Band Friction Syndrome
Risk Factors

Running Factors:
• High weekly mileage
• Excessive running in the same direction on a track
• Downhill running
• Abrupt increase in running (frequency or distance)

Biomechanical Factors:
• Tight IT band
• Weak hip Abductors
• Leg length discrepancy
Iliotibial Band Friction Syndrome
Examination

Noble compression test

Ober test
Iliotibial Band Friction Syndrome
Advanced Examination

- Leg length discrepancy
- Trendelenburg test

Figure 4 – The 1-leg standing balance test (A) is used to assess a patient’s core strength and stability. A positive Trendelenburg test result (B) indicates inability to control the posture and suggests proximal core weakness.
Iliotibial Band Syndrome: Treatment
Acute Phase

- Rest
- Ice
- NSAIDs
- Corticosteroid Injection

SORT B
Iliotibial Band Friction Syndrome
Treatment
Subacute Phase

Increase the length of the TFL/ITB complex

Treat myofascial restrictions along the lateral thigh and femur (foam roller)
Emphasis of gluteus medius strengthening is useful in treatment.

Iliotibial Band Friction Syndrome
Treatment
Strengthening Phase

SORT B
Iliotibial Band Friction Syndrome
Return to Running (RTR)

- Most patients can RTR once they can perform strengthening exercises with proper form and without pain
- Run QOD for the first week
- Avoid hills for first few weeks
- Gradually increase distance and frequency over the next 3-4 weeks
Patellar Tendinopathy
Patellar Tendinopathy

**Synonyms:** patellar tendinitis, jumper’s knee, patellar tendon overuse syndrome, patellar tendinosis (pathologic diagnosis)

**Epidemiology:** males > females (2:1), typically presents in the early to mid twenties, with a range from 15-45yrs
- Prevelance: 8.5% of non-elite athletes
- Encountered in athletic patients whose sporting activities involve repetitive sudden ballistic motion of the knee
- Typical sports: basketball, volleyball, track and field (esp. jumping events), football, soccer, tennis. Also now seen in newer exercise workouts (P90X, Insanity, Crossfit)
Patellar Tendinopathy

Clinical History:
• Generally has an insidious onset
• Dull, achy pain develops after activity
• Generally becomes localized to the inferior pole of the patella
• May be precipitated by an increase in frequency or intensity of repetitive ballistic movements of the knee
Patellar Tendinopathy: Clinical Classification

Phase 1: Pain after practice/competition
Phase 2: Pain at the start of activity disappearing after the warm up and reappearing after activity
Phase 3: Pain during and after activity, athlete unable to participate in sport
Phase 4: Complete tear of patellar tendon

Patellar Tendinopathy Examination

- **Palpation of the patellar tendon** just near the inferior pole of the patella (with the knee in extension).
- Apply pressure to the superior patella to tilt the inferior patella anteriorly, allowing for palpation of the tendon origin.
- In symptomatic tendons, the PPV=68%
- Moderate/Severe tenderness is a better predictor of abnormal ultrasound evidence of tendon pathology than absent or minimal tenderness (p<0.001)

• **Decline (30°) squat test** – to test the strength of the quadriceps muscles and to reproduce pain or patellar tendinopathy

• **Single leg squat test** – to assess the strength of the gluteal muscles

• **Assess the strength and endurance of the calf muscles** (calf-raise test) - calf strength and endurance plays an important role in shock absorption of the lower limb during impact activities

• **Observe for quadriceps wasting** (esp. the VMO) – indicates chronicity

• **Assess flexibility** of quadriceps, ITB, hamstrings and calf muscles – muscular tightness increases the load on the patellar tendon.
Patellar Tendinopathy
Etiology

- **Extrinsic factors**: overload (repetitive ballistic knee motion)
- **Intrinsic factors**: malalignment, patella alta, abnormal patellar laxity, and muscular tightness and imbalance.
Patellar Tendinopathy
Etiology

- **Tendinosis**: typically involves the deep posterior portion of the patellar tendon adjacent to the lower pole of the patella
- Characterized by progressive tissue degeneration with a failed reparative response and complete absence of inflammatory cells
- “Mucoid degeneration” is seen grossly: yellow-brown disorganized appearance
Patellar Tendinopathy: Imaging

**Ultrasonography**: readily available, quick, and inexpensive. Tendon examined using high-frequency linear transducer with the knee flexed or semiflexed. Diseased tendon is reflected by decreased echogenicity, tendon thickening, and intratendinous calcification.
MRI: provides high intrinsic tissue contrast that can differentiate normal tendons from abnormal tendons.

- Patellar tendinopathy is characterized by focal increases in signal within the tendon and alteration in tendon size.
Patellar Tendinopathy: Imaging

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<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
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</thead>
<tbody>
<tr>
<td>US</td>
<td>58%</td>
<td>94%</td>
</tr>
<tr>
<td>MRI</td>
<td>78%</td>
<td>86%</td>
</tr>
</tbody>
</table>

Imaging *is not* a gold standard for diagnosis

Positive MRI and Ultrasound findings for patellar tendinopathy have been shown in asymptomatic tendons; conversely symptomatic tendons can have normal imaging.

Numerous authors have shown no correlation between the Severity and of symptoms and tendon appearance on US.
Eccentric muscular contractions impart a greater force on the muscular tendon, it is theorized that tenocytes in the tendon respond to mechanical forces by altering their gene expression patterns, protein synthesis and cell phenotype, which can be used to aid the healing process.

Eccentric exercise: High quality RCT has shown that 12 wk of 25°-decline squats achieved results at 12 months equivalent to the results of open surgery with a well designed rehab program

SORT: A

Patellar Tendinopathy: Treatment

**Steroid injections:** delivered adjacent to the patellar tendon under US guidance reduce walking pain after 1 week, but are significantly inferior to exercised based interventions at 6 mos.

**Extracorporeal shock wave therapy (ESWT):** delivers a pressure wave into the affected tissue. May be an effective modality for off-season athletes, but shows no long term improvement.

Do Not lead to long term improvement and therefore cannot be recommended.

**Platelet-rich plasma:** delivers a cocktail of growth factors and cytokines to the injured area of the tendon, theoretically leading to improved tissue repair. No high quality evidence that PRP injections are useful in patellar tendinopathy, and is best described as unproven and experimental.

**Hyperosmolar dextrose injection, Dry needling and autologous blood injection** also lack high quality evidence to support effectiveness.
Patellar Tendinopathy: Treatment

“Treatment effectiveness is inversely related to the number of available treatment choices”

Medial Plica Irritation
Medial Plica Irritation

**Synonyms:** plica syndrome, symptomatic medial plica

**Epidemiology:** Poorly studied, may be involved in 27% acute anterior knee pain (Brushoj C. Br. J. Sports Med 2008 42: 164-67)

**Anatomy:** well vascularized intraarticular synovial fold over the medial aspect of the knee. Proximally it is attached to the medial quadriceps and genu articularis muscle, spanning medially to attach to anterior horn of the medial meniscus and and the medial edge of the retropatellar fat pad.
Symptoms: pain and “popping” or “snapping” when rising from a seated position. May complain of catching, locking, or pseudolocking (50% of cases)

- Pain with stairs, squating and prolonged sitting

Fig. 1 Intraoperative visualization of medial synovial plica
Plica snap test: roll the medial plica (ribbon like band of tissue between the medial border of the patella and medical femoral condyle) against the medial condyle. It is important to ascertain whether or not the snap test reproduced the patient’s symptoms.

Fig. 2 Medial synovial plica palpation (Plica snap test)
Medial Plica Irritation
Etiology

**Biomechanical:** poor quadriceps tone, tight hamstrings

**Post-operative:** after arthroscopy for medial compartment pathology

**Inflammatory:** intraarticular effusions can decrease the viscosity of the synovial fluid and predispose to plica symptoms.
Medial Plica Irritation Treatment

Physical Therapy: 6-8 week program with focus on quadriceps strengthening and hamstring flexibility  SORT C

Intraarticular corticosteroid injection: if P.T. fails or is too painful to fully participate in P.T.  SORT C

Arthroscopic surgery: only if conservative measures fail. May be useful if the plica is acting as a shelf on the medial femoral condyle and causing erosion of the articular cartilage  SORT C
Pes Anserine Bursitis
Anserine bursa: can be found 6cm below the medial jointline and between the insertion of the MCL and conjoined tendon.

Symptoms: focal, aching pain, typically worse at night and with climbing/descending stairs

Risk Factors: Abnormality in gait, overload, and osteoarthritis
Conservative measures:  RICE
(avoid crossing legs, pillow b/t knees at night for comfort)

**NSAIDs:** Short trial of nonselective NSAIDs superior to placebo when treating bursitis.  SORT C

**Corticosteroid injection:** if above fails.  Studies shown superiority over NSAIDs when treating olecranon/subacromial bursitis.  SORT C
Prepatellar Bursitis
Prepatellar bursitis: inflammation of the largest knee bursa between the patella and overlying skin

**Symptoms:** pain and swelling over the anterior knee

**Risk Factors:** trauma, direct pressure and friction from repetitive kneeling (i.e. housemaid’s knee), *infection*

**Exam:** Fluid is extraarticular and knee ROM is *preserved*
Prepatellar bursitis

Conservative measures: PRICE
(Protection: knee pad)

Aspiration and drainage: mandatory if septic bursitis is suspected

NSAIDs: short course in conjunction with PRICE: SORT C

Corticosteroid injection: should be considered if recurrent nonseptic bursitis or there is chronic bursal thickening:
SORT C
Osteochondritis Desicicans
Osteochondritis dessicans (OCD): is a condition in which a segment of the articular cartilage (with underlying subchondral bone) gradually separates from the articular surface.

**Symptoms:** pain with activity, intermittent swelling and possible locking of the knee

**Epidemiology:** 29 per 100,00 cases of adolescent/young adult men (18 per 100K females); ¾ cases involve the lateral aspect of the medial femoral condyle
Osteochondritis Dessicans

**Etiology:** Unknown, theories include: family history, repetitive microtrauma, growth abnormalities, and ischemia

**Exam:** Tenderness along the affected femoral condyle, may be accompanied by a joint effusion

**Treatment:** Unstable or displaced OCD lesions may benefit from surgery: SORT C
# In Summary

## Knee Overuse Injuries

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<th>Condition</th>
<th>Diagnostic Examination</th>
<th>Treatment (Supported by the literature)</th>
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<td>Patellar compression test</td>
<td>NSAIDs, Formal PT, Hip Abductor/Quadriceps/Core strengthening, stretching, foot orthotics</td>
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<td>Facet tenderness</td>
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<tr>
<td>Patellar tendinopathy</td>
<td>Palpation of the patellar tendon (knee in ext.)</td>
<td>Eccentric strengthening exercises</td>
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Bits & Pieces

A few words about the evidence behind footwear
Shock absorption characteristics of running shoes

After 250-500 miles of running, shoes retain less than 60% of their initial shock absorption capacity

2 large studies of military recruits assigned to a specific shoe type based on foot arch shows no reduction in running injuries.

A recent systematic review provides the same conclusion.

**SORT B**

Foot Orthotics

Can prevent running injuries in military recruits  SORT B
Likely reduce the risk of stress fracture in military trainees  SORT B
Have been shown to reduce the pain associated with PFPS and pes cavus  SORT B

Minimalist Shoes/Barefoot running

Pros: shorter running stride and lower impact mid to forefoot strike (as opposed to heel strike in cushioned shoes)
Cons: less cushioning while running on hard surfaced

No controlled to date shows negative or positive effects on running or reduction of injury rates.

Questions?

Jacobs S, Burton B. Injuries to runners: A study of entrants to a 10,000 meter race. AJSM. Vol 14, No. 2 1986.


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