Prior to the Exam

• Health History Questionnaire

Prior to the Exam

• Patient Profile
  – Age
  – Occupation/Rec. activities
  – Family history
  – Previous injuries/symptoms

Prior to the Exam

• Medications
• Body Chart
• Functional Questionnaires
Subjective

- History of Current Complaint
  - Injury
    - Mechanism
    - Direction of force
    - Area/Severity of immediate pain
    - Swelling site and onset
      - Fast
        » Hemarthrosis
        » Infracapsular Injury (ACL, PCL, Capsule)
      - Slow
        » Intracapsular or Extra-Capsular
        » Menisci, collaterals, quad/patellar tendon, patellar
    - Feeling of tearing or popping

Measurement Properties of the Lower Extremity Functional Scale: A Systematic Review

- Excellent test-retest reliability
- Excellent responsiveness
- Minimal Detectable Change=6 points
  - True Change
- Minimal Clinically Important Difference=9 points
  - Clinically Meaningful Change

Subjective

- Gradual/Insidious
  - Area first affected
  - Related factors
    - New or altered activities (new job, new gym workout)
  - Contributing factors
    - Previous knee surgery
    - Current hip pathology
    - Hypermobility (dancer/gymnast)
    - Current/Previous foot issues
Subjective

– Progression of Symptoms
  • Direction
  • Localized vs non specific
  • Presence of crepitus, deformity, instability
  • Rate/Amount of recovery since onset

– Past History
  • History of referred symptoms (e.g., lumbar radic)
  • Previous trauma, surgery
  • Treatment received and effect

Subjective

– Current Symptoms
  – Area of Symptoms
    • Knee pathology is typically local, suspect referral if in a vague pattern
      – Possible referral from SIJ, hip
      – Anterior knee may be L2,3,4
      – Posterior knee may be L5-S2
    • Tibiofemoral Joint
      – Typically deep
      – Pain may spread distally, rarely proximally
      – Ligament, tendons, and menisci typically hurt locally
      – OA hurts at joint line, deep posteriorly, infrapatellar, or over fat pads
      – Plica hurts at medial knee

Subjective

• Anterior Knee
  – Supra or Infrapatellar fat pad
  – Quad/Patellar Tendon
  – Patellofemoral joint

• Posterior Knee
  – Soft tissue
  – Baker’s Cyst
  – DJD
  – Meniscus

• Lateral Knee
  – Lateral patellar facet
  – ITB
  – Ligamentous
  – Superior Tili/Fib
  – Meniscus

• Medial Knee
  – Meniscus
  – Soft tissue
  – Plica
  – Ligamentous
  – Medial patellar facet
  – Medial compartment of tibiofemoral joint

Subjective

• Behavior of Symptoms
  – Relate restricted activities to mechanics involved
    • Will help to plan objective exam and expectations for findings
    • Routine activities
      – Walking
        – Surface, incline/decline, distance prior to onset
      – Stairs
      – Ascending/Descending
      – Squatting
      – Kneeling
      – Running/Jumping/Hopping
      – Sit to stand transfers
      – Prolonged sitting/standing
Subjective

– “Special” Questions
  • Locking/Catching
    – Differentiate true locking vs pain inhibition
      » Consistent mechanism?
      » Meniscal/Loose Body
      » Patellofemoral
  • Giving Way/Buckling
    – Establish position or movement
      » Straight plane walking: Patellar Instability
      » Cutting Movements: ACL, PCL, Capsule
      » Descending Stairs: Quad Inhibition
    – May be due to ligamentous instability, meniscal injury, patellofemoral tracking disorder or neurological
  • Crepitus/Clicking
    – Location
    – Consistent position
    – Painful vs nonpainful

Subjective

• Swelling
  – Location
  – Pattern
• Easing Factors
  – Stationary vs movement
    » Arthritic: Increased symptoms with prolonged positions, also with too much activity
  – Brace or support
• Daily Pattern
  – Daily pattern of symptoms

Imaging

PT Decisions and Imaging

• Reveal type and extent of injuries and/or pathology
  – Correlation of pathology to patient presentation
  – Requires extensive physical exam
• Facilitates clinical decision making
  – Helps to limit uncertainty
• Not an absolute
Do We Need It?

- Comparison of PTs, GP’s and orthopedists for diagnostic accuracy vs MRI
  - Diagnostic accuracy between PTs and orthopedist and significantly greater than non orthopedic providers (~80%)

Clinical Diagnostic Accuracy and Magnetic Resonance Imaging of Patients Referred by Physical Therapists, Orthopaedic Surgeons, and Nonorthopaedic Providers

Prevalence of abnormalities in knees detected by MRI in adults without knee osteoarthritis: population based observational study (Framingham Osteoarthritis Study)

- Prevalence of "any abnormality" was 89%
- Osteophytes most common abnormality (74%)
  - Followed by cartilage damage (69%) and bone marrow lesions (52%)
- Prevalence of "any abnormality" high in painful (97%) and non painful (88%) groups

Do We Need It?

- Patients were independently evaluated and triaged by a PT and an ortho or sports med MD
- High diagnostic agreement and triage concordance between PT and MD

Diagnostic validity and triage concordance of a physiotherapist compared to physicians’ diagnoses for common knee disorders

Prevalence of “any abnormality” was 89%
- Osteophytes most common abnormality (74%)
  - Followed by cartilage damage (69%) and bone marrow lesions (52%)
- Prevalence of “any abnormality” high in painful (97%) and non painful (88%) groups
Imaging in Asymptomatic Knees

Abnormal Findings on Knee Magnetic Resonance Imaging in Asymptomatic NBA Players

- Bone Marrow Edema 25%/41%
- Patellar Tendon Signal 39%/41%
- Articular Cartilage 100%/35%
- Joint Effusion 28%/35%
- Meniscal Pathology 10%/12%

Key Principals of Diagnostic Imaging

- Do No Harm
  – XR exposes pt to radiation
  – Iodine affects kidney
- Use imaging only when positive findings will alter the intervention
- Images are a small component of the greater patient examination
- Images are special tests and therefore need the context of the rest of the examination

Diagnostic Imaging Reveals Pathology

The Clinical Examination Provides Relevance

-Gail Deyle

Imaging of meniscus and ligament injuries of the knee

M. Faruch-Blifeld, F. Lapecque, H. Chiavassa, N. Sans*
Diagnostic and Interventional Imaging (2016) 97, 749–765
Meniscus Imaging

Normal Meniscus

Horizontal Meniscal Fissure

ACL

Normal ACL

ACL
MCL

“Normal” MRI Resource

http://xrayhead.com
Diagnostic accuracy and reproducibility of the Ottawa Knee Rule vs the Pittsburgh Decision Rule

Tung C. Cheung MD, Yevis Tank MD, PhD, Bavo S. Broersma MD, PhD, Wim E. Tuinstraengard MD, PhD, Elly S.M. de Lange-de Kleef MD, PhD, Peter J. Dvoski MD, PhD

A knee x-ray series is only required for knee injury patients with any of these findings:
1) age 55 years or older
2) isolated tenderness of patelloa
3) tenderness at head of fibula
4) inability to bear weight for 10 s
5) history of fall or blunt trauma mechanism
6) inability to walk 40 steps or more

Fig. 1. Pittsburgh Decision Rule.

Fig. 2. Ottawa Knee Rule.
Knee Imaging Rules

• Pittsburgh Rules more specific (60% vs 27%) and better interobserver agreement
• Equal Sensitivity (99%)
• Pittsburgh Rules can be used for all ages, Ottawa rules not designed for patients under 13.
• Ottawa rules better validated across a wider sample of adult patients

Differential Diagnosis

• Referral
  – Knee pain can be referred from lumbar spine, SIJ or hip
  – Differential Diagnosis
    • Lumbar radiculopathy/DDD
    • SIJ dysfunction
    • Slipped femoral capital epiphysis
    • Femoral Neck Stress Frx: medial knee pain
    • Osteochondritis dessicans
    • Legg-Calve-Perthes Dz
    • Osgood-Schlatters

Medial Knee Pain

• Vastus Medialis

Lateral Knee Pain

• Vastus Lateralis
Posterior Knee Pain

- Popliteus
- Plantaris
- Hamstring

Osteochondritis Dissecans

- Separation of articular cartilage from subchondral bone
- Presentation
  - Age 10-20
  - Male > Female
  - Femoral Condyles 75% of cases
- Cause not totally understood
  - Possibly due to strenuous, repetitive stress
  - Genetic
  - Endocrine Disorders
  - Ischemia

Osteochondritis Dissecans

- Symptoms
  - Gradual worsening, starts as a mild ache at knee
  - Commonly swollen and painful to the touch
  - Difficulty with weightbearing/gait/prolonged standing
- Treatment
  - Based on stage of disorder
  - More progressed (unstable) surgery is indicated
  - Physical therapy for lesser stages (stable)

Physical Therapy Management of Patients with Osteochondritis Dissecans: A Comprehensive Review

- Joint protection interventions/ROM/Flexibility/Open chain therex initially x 4-6 weeks
- Progress to closed chain and functional therex as lesion heals
**T2 Weighted Image of 15 year old with unstable OCD**
- Solid Line: focal defect
- Dashed Arrow: Fragment

**Healed stable OCD treated with conservative treatment 6 mo after diagnosis**

---

**Osgood-Schlatter**
- Painful irritation to anterior tibial tubercle
- Age of Presentation
  - Boys age 12-15
  - Girls age 8-12
  - Boys>Girls
- Symptoms
  - Painful swelling at anterior tibial tubercle
  - Mild and intermittent initially
  - Severe and constant in acute phase
  - Leg pain or knee pain
  - Worsens with running, jumping, stairs or direct contact (kneeling)
  - Bilateral in 20-30% of cases

**Findings**
- Tenderness and prominence in area of tibial tuberosity
- Reproduced with resisted knee extension
- Anterior mass may be only finding following resolution of acute phase

**Treatment**
- Ice
- Reduced activity
- NSAID's
- Physical Therapy
  - Strengthening/ flexibility of quads, hamstrings, ITB, gastroc/soleus
  - Quadriceps strengthening progression low intensity-high intensity

**Prognosis**
- Full recovery in 90% of patients without surgery
- Symptoms may continued intermittently for 12-24 months
Pre-Objective Exam

• Establish hypothesis and differential diagnoses to guide objective exam
• Red Flags or Yellow Flags?
• Prioritize Structures to be examined
  – Clearing exams of adjacent joints
  – Neuro exam?
• Begin to determine extent of objective exam based on SINS

Objective

• Standing
  – Observation
    • Knee/Hip angles
    • Feet position
    • Scars/deformities
    • Atrophy/bruising

Functional Testing

– Gait Analysis
  • Walking/Running
– Squatting
  • Single Leg
  • Double Leg
– Trunk Rotation
– Heel Raises
– Double/Single leg hop tests
– Step down test
– Swing Test

Functional Testing

The reliability and validity of physiotherapist visual rating of dynamic pelvis and knee alignment in young athletes
Chris Whatman,*, Patria Hume†, Wayne Hing‡ Physical Therapy in Sport 14 (2013) 1-7

Kinematics during lower extremity functional screening tests in young athletes — Are they reliable and valid?
Chris Whatman*, Patria Hume†, Wayne Hing‡ Physical Therapy in Sport 14 (2013) 87-93

Physiotherapist agreement when visually rating movement quality during lower extremity functional screening tests
Chris Whatman*, Wayne Hing‡, Patria Hume† Physical Therapy in Sport 13 (2012) 87-96
Squatting

- Single Leg
- Double Leg

• 5 Trials
• All requirements met for 4/5 to be “Good”

<table>
<thead>
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<th>DP</th>
<th>DN</th>
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Single Leg Squat

- A: Good
- B: Poor
- C: Poor Hip/Pelvis
- D: Poor Hip/Knee
Single Limb Stance
- Feet together, arms by sides
- Lift one leg to 90deg flexion
- Hold position for 10sec
- Repeat with eyes closed
- Look for loss of height or arms to flail
- Some increased sway with eyes closed is normal

Multi Segmental Rotation
- Feet together, arms at sides
- Rotate as far as possible without moving feet
- Pelvis must rotate more than 50deg
- Shoulders must rotate more than 50deg
- No loss of height

Overhead Deep Squat
- Feet shoulder width apart and straight
- Extend arms overhead
- Patient descends as deeply as possible into squat
- Heels remain on floor, head and chest facing forward and arms overhead
- Hands should remain the same width (anterior view) and should stay behind toes (lateral view)
- Knees should remain in neutral
Objective

- Lumbar Clearing
  - AROM/Quadrant
- Special Testing (as needed)
  - Meniscus
    - Thessaley
    - Ege's

Objective

- Sitting
  - Myotomal/Reflex/Sensation exam
    - If warranted
  - Slump Test
    - If warranted

Objective

- Supine
  - Palpation
    - Superior tib/fib
    - Patellar poles
    - Infrapatellar/Suprapatellar bursae
    - Medial/Lateral Joint Lines
  - Hip Clearing
    - PROM/AROM all planes
    - EABER
    - FADIR
  - SLR test if warranted
  - Tibiofemoral Joint
    - AROM/AROM with overpressure
      - Flexion
      - Extension
      - End Feels

Objective

- Passive Physiological Motion
  - Flexion, flexion with abduction, flexion with adduction
  - Extension, extension with abduction, extension with adduction
  - Tibial IR/ER at 90 deg flexion
  - End Feels
- Passive Accessory Motions
  - A-P
    - Medial/Lateral
    - Rotation
  - Superior Tib-Fib Joint
    - Passive Accessory Motion
      - A-P
      - P-A
Passive Physiological/Accessory Motion

• Goal
  – Reproduce concordant sign
  – Localize dysfunction through different planes of testing
  – Can use prolonged holds or repeated movements
  – Be aware of end feels and guarding

Passive Physiological Motion

• Flexion/Flexion with add/Extension with add
  – Pt supine, support lateral femur against chest
  – Passively flex knee to end range
  – Take out to ~10-20° short of available range
  – Firmly stabilize femur with one hand, other on distal tibia
  – Flex again while directing heel toward greater trochanter
  – Repeat again while directing heel toward groin

Passive Physiological Motion

• Extension/Extension with abd/Extension with add
  – Pt supine, support ankle with one hand, other hand interthenar eminence at tibial tubercle
  – Extend knee by sidebending trunk
  – Move interthenar eminence to lateral tibia, and support ankle at lateral aspect
  – Extend knee again causing a extension/adduction movement
  – Move proximal hand to medial tibia, distal hand to medial malleolus and repeat causing extension/adduction movement

Passive Physiological Motion

• Tibial IR/ER at 90°
  – Pt supine, knee flexed to approx 90°
  – Passively internally rotate tibia
  – Repeat for external rotation
Passive Accessory Motion

- **Anterior-Posterior**
  - Pt supine, knee in open packed position on a bolster
  - Place both thumbs on tibial tubercle and wrap hands around proximal tibia
  - Direct force posteriorly moving tibia on femur

Passive Accessory Motion

- **Posterior-Anterior**
  - Pt supine, knee flexed to 60-80deg of flexion
  - Grasp around proximal tibia with thumbs on tibial tubercle while sitting on foot to stabilize
  - Move tibia in anterior direction on femur

Passive Accessory Motion

- **Medial-Lateral Shear**
  - Pt supine, knee flexed 10-20deg on bolster
  - **Medial**
    - Grasp medial aspect of distal femur and lateral aspect of proximal tibia
    - Stabilize femur while applying medially directed movement of tibia on femur
  - **Lateral**
    - Grasp lateral aspect of distal femur and medial aspect of proximal tibia
    - Stabilize femur while applying laterally directed movement of tibia on femur

Passive Accessory Motion

- **Rotation**
  - Pt supine, knee flexed to approx 90deg, foot stabilized by sitting on it
  - Grasp lateral half of tibia with one hand, stabilize femur with other
  - Apply an anterior and laterally directed movement of tibia on femur
  - Repeat by applying posterior and medially directed movement with same hand holds
  - Repeat on other side for anterior/lateral and posterior/medial
Passive Accessory Motion

- Superior Tib-Fib A-P/P-A
  - Pt side-lying with involved side up, knees bent and pillow between knees
  - Stand behind pt and place thumbs on posterior aspect of head of the fibula
  - Produce posterior to anterior movement of fibula on tibia
  - Move to in front of pt, repeat by placing thumbs on anterior aspect of head of fibula and produce anterior to posterior movement

Patellar Assessment

- Intra-rater reliability is good
- Inter-rater reliability is variable
- Validity is good to moderate

The validity of clinical measures of patella position

Ilsay McEwan, Lee Herrington, Jeanette Thom

- Strong validity and intrarater reliability
Patellar Mobility Assessment

• Superior/Inferior
  – Pt supine, knee in open packed position
  – Place apex of patella in interthenar eminence
  – Align forearm with shaft of femur
  – Apply inferior glide of patella
  – Repeat for superior glide

• Medial/Lateral
  – Pt supine, knee in open packed position
  – Stand on lateral side of knee
  – Grasp patella and move in a lateral direction
  – Repeat for medial glide

• Patellar Glide Test
  – Normal = excursion of ½ patella

Objective

• Supine cont’d
  – Muscle Length Testing
    • Hamstrings
    • Gastroc/Soleus
    • Hip external rotators
  – Special Testing
    • ACL
      – Lachman
      – Anterior Drawer
      – Pivot Shift
    • PCL
      – Posterior Drawer
      – Posterior Sag Sign
      – Quadriceps Active Test

Pivot Shift

• Pt supine with knee extended
• One hand holds ankle, other hand applies medial rotation force at tibia
• Slowly flex knee maintaining rotation
• As reach about 20 deg flexion the tibial plateau will relocate
• Positive test is a thud or clunk of lateral tibia posteriorly
**Pivot Shift**

- Sens .24
- Spec .98
- +LR 8.5
- -LR .9

*Rule in ACL Tear*

---

**Lachman’s Test**

- Pt supine with knee flexed to 15deg
- Stabilize at distal femur with one hand, grasp behind proximal tibia with other hand
- Apply anterior tibial force to prox tibia
- Positive if greater anterior displacement of tibia compared to other side or empty end feel

---

**Lachman Test**

- Sens .85
- Spec .94
- +LR 1.2
- -LR .2

*Helps rule out the presence of a torn ACL*

---

**Anterior Drawer Test**

- Pt supine, knee flexed to approx 90deg with foot flat
- PT sits on pt’s foot, grasp behind prox tibia with thumbs palpating at tibial tuberosities
- Apply anterior tibial force
- Positive if greater anterior translation compared to other side or empty end feel
Anterior Drawer

- Sens .55
- Spec .92
- +LR 7.3
- -LR .5

• Rule in ACL Tear

PCL

Quadriceps Active Test

- Sens: 98%
- Spec: 99%
- +LR: 98
- -LR: .04

• Most specific test for PCL rupture

Quadriceps Active Test

- Pt supine with knee flexed to 90
- Pt’s thigh should be relaxed, PT stabilizing foot
- Have pt slide foot gently down table to initiate quadriceps
- Will see anterior displacement of tibia
**Posterior Drawer Test**
- Pt supine, knee flexed to approx 90° deg with foot flat
- PT sits on pt’s foot, grasp behind prox tibia with thumbs palpating at tibial tuberosities
- Apply posterior tibial force
- Positive if greater posterior translation compared to other side

**Posterior Sag Sign**
- Pt supine with knee flexed to 90° deg and hip flexed to 90° deg
- Make sure pt is relaxed in the position
  - Possible false negative with increased muscle tone
- Positive if tibia is positioned posterior
  - Possible false negatives with hx of Osgood Schlatters

**Posterior Sag Test**
- Sens: 79%
- Spec: 100%
- +LR: 34.1
- -LR: .21

**Posterior Drawer Test**
- Sens: 90%
- Spec: 99%
- +LR: 90
- -LR: .1

*Helps rule out the presence of a torn PCL*
**Posterolateral Corner**

**Assessment**

- Cluster
  - Posterior drawer test in ER
  - Prone ER test
  - ER Recurvatum test

- Reliability and specificity not tested

**Posterior Drawer with ER at 30/90**

- ER tibia and apply posterior force
- If normal at 90 but excess at 30 suspect PLC injury
- Positive if tibia rotates excessively compared to other side
- If rotates and subluxes posteriorly or excess motion at 30 and 90 suspect PCL injury

**External Rotation Recurvatum Test**

- Pt supine in a relaxed position
- Pick up pt's leg by great toe
- Watch for hyperextension and tibial ER compared to other side
Prone ER Test at 30 and 90

- Pt prone, clinician grasps distal leg, flexes knee and ER tibia
- + if ER exceeds 10º of other leg
- + at 30 but not at 90º = isolated PLC injury
- + at both = concomitant PCL

Objective

- Sidelying
  - Strength Testing
    - Glut strength testing
  - Muscle Length Testing
    - Hip flexor
    - Omer’s
  - Superior Tib-Fib Passive Accessory Motion
  - Neurodynamics
    - Modified slump if needed

Objective

- Prone
  - Strength Testing
    - Quad
    - Hamstrings
    - Hip IR/ER
  - Muscle Length Testing
    - Quad
    - Hip flexor
  - Neurodynamic Testing
    - Prone Knee Bend
  - Clearing Exam
    - Lumbar ps (central and ups)
    - Lumbar palpation
  - Special Test
    - PLC
      - Prone ER Test

<table>
<thead>
<tr>
<th>Rule In</th>
<th>Rule Out</th>
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<tr>
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