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Radiologic Interpretation of the Pelvis and Hips
Orthopedic Medicine Practice
April 22, 2017
Seattle, Washington

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Financial Disclosure

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Correct imaging analysis and clinical correlation are key to determining a proper hip pain treatment

• The correct hip pain diagnosis is essential to obtaining and pursuing the right treatment.
• Both physical and radiological examinations are conducted to diagnose hip joint pain.
• The current thinking is that without an official reading by an experienced radiologist, subtle X-ray findings (e.g., tears, infections, systematic diseases, tumors, etc.) may remain undetected until such time as an abnormality has progressed to the point where a non-imaging specialist may identify it.
Correct imaging analysis and clinical correlation are key to determining a proper hip pain treatment

• Delays in diagnosis add to medical cost and may considerably affect treatment and ultimate patient outcome.

• However, IROM skilled physicians are being trained to interpret their patient’s imaging studies in order to help patients and families understand their hip pain and all of the treatment options available.
Pelvis and Hip

Normal osseous anatomy

- Hip is ball and socket joint stabilized by osseous intrinsic anatomy
Acetabular labrum: ring closed by transverse ligament (intrinsic ligamentous stabilizer)
Pelvis and Hip

Pubofemoral ligament

Ant. inf. iliac spine

Iliofemoral ligament

Ischiofemoral ligament

Greater trochanter

Lesser trochanter

Ligaments
Pelvis and Hip
Pelvis and Hip
Pelvis and Hip
Pelvis and Hip
Pelvis and Hip

Anatomy of the Pelvis

OBTURATOR FORAMEN
Anatomy of the Pelvis

Pelvis and Hip

OBTURATOR FORAMEN
Pelvis and Hip

Anatomy of the Pelvis

BONY ANATOMY

ISCHIUM

SUPERIOR PUBIC RAMI

INFERIOR PUBIC RAMI

Anatomy of the Pelvis

SI JOINTS

BONY ANATOMY
Pelvis and Hip

Anatomy of the Pelvis

ILIUM

SACRUM

PUBIC SYMPHYSIS

PUBIC BONE
Pelvis and Hip

Anatomy of the Pelvis
ANTERIOR LIGAMENTS

Anterior Longitudinal Ligament
Pelvis and Hip

Anatomy of the Pelvis

POSTERIOR LIGAMENTS

LIGAMENTS

Anterior Longitudinal Ligament

Anterior Longitudinal Ligament

Iliolumbar Ligament
Pelvis and Hip
Pelvis and Hip

Anatomy of the Pelvis
POSTERIOR LIGAMENTS
Pelvis and Hip

Hip and Groin Pain

1. Articular
2. Ligamentous
3. Osseous/Tendino-osseous
4. Paratendinious/Bursal
5. Muscular
1. **Articular Injury**

A. Hip ligament insufficiency/tears

B. Labral tears

C. Femoroacetabular Impingement (FAI)

D. Osteochondral Injuries

E. Transient Bone Marrow Edema
Pelvis and Hip

A. Intrinsic Hip Ligaments
A. Intrinsic Hip Ligament Injury

- Isolated Lig. Teres injury (rare)
- Subtle Subluxation (fall on flexed knee with hip abducted - rugby)
- Posterior acetabular fracture
- Only 5% diagnosed without arthroscopy

Pelvis and Hip

Extrinsic Hip Ligaments

- Anterior inferior iliac spine
- Iliopubic eminence
- Iliofemoral ligament
- Intertrochanteric line
- Pubofemoral ligament
- Ischiofemoral ligament
Extrinsic Hip Ligament Injury

• Iliofemoral Ligament Injury (common following dislocation/subluxation)

• Predisposes to Osteoarthritis

Boutin, Newman MRI Clins NA 2003;11:255
Pelvis and Hip

Iliofemoral Ligament Injury
1B. Labral Injury

- Non-specific symptoms
- Predispose to OA
- Sport- Repetitive Direction Change
- MR arthrography >> Conventional MRI
  Sensitivity 90%; Accuracy 91%
- Paralabral Cyst- increases specificity

*Czerny et al AJR 1999;173:345*
Acetabular Labrum

- Fibrocartilaginous tissue
- Contiguous with acetabular (hyaline) articular cartilage
- Synovial recess between labrum and capsule
Labral tear classification

- Traumatic vs degenerative
- Intrasubstance vs detachment
- Staging 0 – 3

Stage 0
Normal triangular labrum
Normal recess
Pelvis and Hip

- Stage 1A
  - Increased intralabral signal

- Stage 2A
  - Contrast extends into labrum

- Stage 3A
  - Labral detachment

- B subtypes
  - Hypertrophied labrum without paralabral recess
• Triangular 69.2%
• Round 15.8%
• Flat 12.5%
• Absent 2.5%
Pelvis and Hip

Paralabral cysts
Labral Injury

- Paralabral Cyst - increases specificity

*Czerny et al AJR 1999;173:345*
Labral Injury

- Paralabral Cyst - increases specificity

*Czerny et al AJR 1999;173:345
Pelvis and Hip

Gluteus Minimus

Gluteus Medius
Pelvis and Hip

Normal MR Anatomy-Sagittal Lateral->Mid

Labrum

AllS-Rectus Femoris

Iliofemoral Ligament
Normal MR Anatomy - Sagittal p2
Mid -> Medial

Pelvis and Hip

Iliopsoas tendon

Transverse acetabular ligament
Pelvis and Hip

1C. Femoroacetabular Impingement (FAI)

- Hip flexion, adduction, internal rotation
- Abnormal head-neck morphology
  1. pincer
  2. cam
  3. mixed
- Subcortical edema or cyst formation
- Ant-sup labral tear
- Ant-sup acetabular cartilage abnormality

Kassarjian et al Radiology 2005;236
Siebenrock et al JBJS 2003;85:278
Pelvis and Hip

Femoroacetabular Impingement (FAI)

Ito et al JBJS 2001; 83:171
Schmid et al Radiology 2003;226:382
Siebenrock et al JBJS 2003;85:278
Femoroacetabular Impingement (FAI)

Ito et al JBJS 2001; 83:171
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Siebenrock et al JBJS 2003;85:278
Pelvis and Hip

Femoroacetabular Impingement (FAI)
Figure 6. Herniation pit. (a) AP radiograph of the right hip shows a well-circumscribed, round lucent area (arrow) in the superolateral portion of the femoral neck. (b) Lateral radiograph of the groin shows the anterior location of this area (arrow). (c) Axial T1-weighted fat-saturated magnetic resonance (MR) arthrogram shows fluid signal intensity within the herniation pit.
Definition
• Abnormal contact between acetabular rim and femur

Causes
• Abnormal morphology of the proximal femur
• Abnormal morphology of the acetabulum
• The patient, subjecting the hip to excessive and supraphysiologic range of motion

Result
• Early osteoarthritis of the hip
Pelvis and Hip

Femoroacetabular Impingement
Pelvis and Hip

Femoroacetabular Impingement

Pincer

Cam
Pelvis and Hip

Cam Impingement: Pistol Grip Deformity
Pelvis and Hip

Normal femoral neck

Waist deficiency of ant. femoral neck

Cam Impingement
Pelvis and Hip

Pincer Impingement

Mechanism: Acetabular cause
- Contact between acetabular rim and femoral head-neck junction

"Classic" Imaging finding
- General ‘overcoverage’ (coxa profunda / protrusio)
- Local anterior ‘overcoverage’ (acetabular retroversion)

"Classic" Patient
- Middle-aged women
Pelvis and Hip

Pincer Impingement: deep acetabulum

Protrusio acetabuli: “the deep acetabulum”
Relative prominence of anterior acetabular
Pelvis and Hip

Pincer Impingement: acetabular retroversion

Acetabular retroversion
Pelvis and Hip

Acetabular retroversion

- Crossover (or 8) sign
- The anterior rim of the acetabulum is lateral to the posterior rim on the first axial image that includes the femoral head
1D. Osteochondral injuries

- Repetitive microtrauma
- Subclinical shearing/impaction injury
- Subtle hip instability - contact sports
- often superomedial femoral head

Weaver et al AJR 2002;178:973
Overdeck, Palmer Sem Musculoskeletal Radiol 2004;8:41
Pelvis and Hip

Osteochondral injuries
Pelvis and Hip

Osteochondral injuries

MR Arthrography
1E. Transient Bone Marrow Edema

- Self limiting bone marrow edema and synovitis in the hip
- Osteopenia and insufficiency fractures
- Young males following sports injury
- Pregnancy, middle age F>M
- May be a continuum to ischemic necrosis (AVN)
- Treated with bisphosphonates to speed recovery
Pelvis and Hip

Transient Bone Marrow Edema
Pelvis and Hip

Transient Bone Marrow Edema
3. Osseous/Tendino-Osseous Injury

A. Osseous injury
B. Stress response/fracture
C. Tendino-osseous injury
D. Apophyseal injury
E. Enthesopathy
F. Tendon avulsion
Osseous Injury

3B. Stress Fracture

- 20% all injuries in sports related trauma
- Normal bone subject to abnormal forces
- Proximal femur, pubic rami, sacrum
- Risk factors
  - female > male 1.5-3.5 : 1
  - declining fitness with age

3B. Stress Fracture

- 20% all injuries in sports related trauma
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Pelvis and Hip

Osseous/Tendino-Osseous Injury

Osseous injury  Stress Fracture
Pelvis and Hip

Osseous/Tendino-Osseous Injury
Osseous injury  Stress Fracture
Osseous/Tendino-Osseous Injury

Osseous injury  Stress Fracture
Pelvis and Hip

Osseous/Tendino-Osseous Injury
Osseous injury  Stress Fracture
Pelvis and Hip

3B. Stress Injury

MR classification

- grade 1 - periosteal oedema STIR/T2
- grade 2 - bone marrow edema STIR/T2
- grade 3 – marrow edema on T1 and STIR/T2
- grade 4 - low signal fracture line
  - correlates with symptoms
  - useful prognosticator for rehab

Yao et al Acad Radiol 1998;5:34
Pelvis and Hip

Osseous/Tendino-Osseous Injury

Osseous injury - Stress Fracture
Pelvis and Hip

3C. Tendino-osseous injury

- Developing skeleton - physis/apophysis
- Stress response
- Apophyseal avulsion
- Mature skeleton - enthesis
- Enthesopathy
- Tendon avulsion
- Tendon and osseous avulsion
Osseous/Tendino-Osseous Injury

3C. Tendino-osseous injury
- Ischial tuberosity
- AIIS
- ASIS
- Pubic symphysis

203 avulsion injuries in adolescent athletes
Rossi, Dragoni Skeletal Radiol 2001;30:127
Osseous/Tendino-Osseous Injury

- Ischial tuberosity
- AIIS
- ASIS
- Pubic symphysis
Osseous/Tendino-Osseous Injury

Tendino-osseous injury
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Osseous/Tendino-Osseous Injury
Tendino-osseous injury
• Ischial tuberosity
• AIIS
• **ASIS**
• Pubic symphysis
Osseous/Tendino-Osseous Injury

Osteitis pubis - Athletic pubalgia

- Chronic athletic groin pain
- Insidious onset 6-12 weeks
- Common in football
  - incidence 14-28% in soccer players
  - 10% acute :18% chronic injuries
  - parasymphysial stress response
  - cleft effusion
  - adductor tendinopathy

Kavanagh et al Semin Musculoskeletal Radiol 2006;10:197;23:472
Robinson, English Semin Musculoskeletal Radiol 2011;15:14
Osseous/Tendino-Osseous Injury

Osteitis

Pubis - Athletic pubalgia

- Ischial tuberosity
- AIIS
- ASIS

Pubic symphysis
Osseous/Tendino-Osseous Injury

Osteitis pubis - Athletic pubalgia

• Ischial tuberosity
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Pubic symphysis
Osseous/Tendino-Osseous Injury

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Pubic symphysis
Osseous/Tendino-Osseous Injury

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- AIIS
- ASIS

Pubic symphysis
Schematics of the pubic symphysis show the common aponeurosis of the rectus abdominis and adductor longus muscles, immediately anterior to the midline of the pubic body.
Sports Hernia
Osteitis pubis - Athletic pubalgia
Sports Hernia

Osteitis pubis - Athletic pubalgia
Osseous/Tendino-Osseous Injury

Tendon/Bursal Overuse Injury

- Overuse/impingement injury
- Bursitis/peritendinitis/tendinopathy
  - iliopsoas
  - iliotibial tract/gluteus
  - common hamstring
- Audible/palpable snapping +/- pain
  - snapping hip syndrome

Overdeck, Palmer Sem Musculoskeletal Radiol 2004;8:41
Pelvis and Hip

Osseous/Tendino-Osseous Injury

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Pelvis and Hip

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  - **common hamstring**
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*Overdeck, Palmer Sem Musculoskeletal Radiol 2004;8:41*
Diminished / disrupted blood supply avascular necrosis (AVN) of subchondral bone

- Causes:
  - Trauma
  - Corticosteroid use
  - Alcoholism
  - Hemoglobinopathies
- Wedge-shaped subchondral ischemic focus
- Anterolateral weight bearing femoral head
- Non-traumatic AVN is bilateral in 50-80% of cases
- Trauma may lead to unilateral AVN
- MRI most sensitive and specific imaging modality
- Involvement of > 50% of the weight bearing surface indicates poorer prognosis
Avascular necrosis (AVN)

Pelvis and Hip

Diminished / disrupted blood supply a necrosis of subchondral bone

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Table 2. MR Staging of Femoral Head AVN

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>T1 SIGNAL INTENSITY</th>
<th>T2 SIGNAL INTENSITY</th>
<th>HISTOPATHOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>High</td>
<td>Intermediate</td>
<td>Fat</td>
</tr>
<tr>
<td>B.</td>
<td>High</td>
<td>High</td>
<td>Subacute Blood</td>
</tr>
<tr>
<td>C.</td>
<td>Low</td>
<td>High</td>
<td>Fluid and/or Edema</td>
</tr>
<tr>
<td>D.</td>
<td>Low</td>
<td>Low</td>
<td>Fibrosis</td>
</tr>
</tbody>
</table>
• Stage 0: normal imaging
• Stage 1: Positive bone scan / MR
• Stage 2: Mottled femoral head / sclerosis / cyst / osteopenia
• Stage 3: Crescent sign lesions + depression femoral head
• Stage 4: Flattening articular surface
  Joint space narrowing
  Secondary acetabular changes
Pelvis and Hip

Transient osteoporosis of the hip

- Progressive hip pain
- Middle-aged men and during third trimester pregnancy
- Self-limiting
- Resolution of symptoms after 6 to 10 months
- Osteoporosis can be severe enough to cause an insufficiency fracture
Pelvis and Hip

Occult, stress and insufficiency fractures

- **T1**
  - Low signal fracture line
- **STIR**
  - High signal edema and hemorrhage
Avulsion fractures

Pelvis and Hip

- Ischial tuberosity - Hamstrings
- ASIS - Sartorius
- AIIS – Rectus femoris

- Usually in athletes
- Excessive eccentric contraction
- Adults, bone usually not involved
- In children, avulsion of apophysis

- T1WI – involved tendon often lax
- T2WI – hyperintense edema and fluid
Pelvis and Hip

Insufficiency fracture sacrum
Pelvis and Hip

Muscle strain

• Musculotendinous junction typical
• Rectus femoris and hamstrings most common

• **First degree** – minor fiber disruption
  – Interstitial edema, with or without hemorrhage
• **Second degree** – partial tear without retraction
  – Hematoma with intra- and extra muscular fluid
• **Third degree** – complete tear

• T1WI: often no abnormality
• T2WI: Hyperintense edema and hemorrhage within muscle
Schematics of the pubic symphyse show the common aponeurosis of the rectus abdominis and adductor longus muscles, immediately anterior to the midline of the pubic body.
Pelvis and Hip

“Sports Hernia” Muscle strain
Pelvis and Hip

Osteitis pubis, adductor dysfunction
Pelvis and Hip

Hockey, myotendineus
Pelvis and Hip

Complete tear of the rectus femoris with edema at the musculotendinous junction (arrows)

- T1WI: often no abnormality
- T2WI: Hyperintense edema and hemorrhage
Pelvis and Hip

Hamstring tendinosis

Biceps femoris, semitendinosus and semimembranosus
Pelvis and Hip

Hamstring tendinosis
Pelvis and Hip

Trochanteric bursitis

STIR demonstrating high signal adjacent to the greater trochanter indicating trochanteric bursitis.
Pelvis and Hip

Iliopsoas bursitis

- Hyperintense iliopsoas bursal distension medial to the right iliopsoas tendon.
- Anterior convexity
- Tear-drop morphology
Pelvis and Hip

Basic Hip Terminology

HIP ADDUCTORS:
1. Pectineus
2. Adductor brevis
3. Adductor longus
4. Adductor magnus
5. Gracilis

MEDIAL MUSCLES
Pelvis and Hip

Basic Hip Terminology

EXTERNAL ROTATORS:
- Piriformis,
- Quadratus femoris,
- Obturator internus,
- Superior gemellus
- Inferior gemellus.

DEEP POSTERIOR L MUSCLES
Pelvis and Hip

Basic Hip Terminology

EXTENSORS:
- Gluteus maximus
- Hamstrings:
  - Long head of biceps femoris, (short head is only a knee flexor)
  - Semimembranosus
  - Semitendinosus

SUPERFICIAL POSTERIOR MUSCLES
Pelvis and Hip

Basic Hip Terminology

FLEXORS:
- Iliopsoas:
  - Psoas major
  - Psoas minor
  - Iliacus muscle
- Rectus femoris
- Sartorius

ANTERIOR MUSCLES
Pelvis and Hip

Sacroiliac Joint Dysfunction and Pain Anatomy

Posterior Sacroiliac Ligaments

Piriformis Muscle

Sciatic Nerve

Lumbosacral Plexus

Longissimus Thoracis M.
Ilio-costalis Muscle
Piriformis Muscle
Sacroiliac Joint Dysfunction and Pain
Differential Diagnosis of SI Joint Pain:

1. Trochanteric Bursitis
2. Piriformis Syndrome
3. Myofascial Pain
4. Lumbosacral Disc Herniation and Bulge
5. Lumbosacral Facet Syndrome
6. Lumbar Radiculopathy
7. Cluneal Nerve Entrapment
Pelvis and Hip

Sacroiliac Joint Dysfunction and Pain
Causes of Sacroiliac Joint Pain:

1. Leg Length Discrepancy
2. Mechanical Dysfunction
3. SI Joint Infection
4. Ankylosing Spondylitis
5. Crystal Arthropathy
6. Pyogenic Arthropathy
7. Post-Spinal Fusion
8. Stress Fractures of the Sacrum
Piriformis Syndrome

Anatomical Variations of the Sciatic Nerve

The sciatic nerve is composed of the tibial and peroneal divisions which are usually bound together but sometimes may divide as they pass the piriformis muscle.
Piriformis Syndrome
Anatomical Variations of the Sciatic Nerve
Four Types of Variations
**Piriformis Syndrome**

**Anatomical Variations of the Sciatic Nerve**

- Normal relationship with the sciatic nerve passing beneath the piriformis muscle.

- Peroneal division of the sciatic nerve passes over the muscle and the tibial division passes beneath the undivided piriformis muscle.

- Piriformis divided into two parts with the peroneal division of the sciatic nerve passing between the two parts of the piriformis muscle.

- The entire nerve passes through the divided piriformis muscle.
Pelvis and Hip

Anatomy of the Pelvis

SUPERIOR GLUTEAL ARTERY & NERVE

PIRIFORMIS MUSCLE
- SUPERIOR GEMELLUS M.
- OBTRURATOR INTERNUS M.
- INFERIOR GEMELLUS M.

SCIATIC NERVE
Pelvis and Hip

Anatomy of the Pelvis

- Superior Cluneal Nerves
- May cause pain from entrapment

About 6 cm

Superior Gluteal Artery & Nerve

- Piriformis Muscle

- Superior Gemellus M.
- Obturator Internus M.
- Inferior Gemellus M.

Sciatic Nerve
Pelvis and Hip

Anatomy of the Pelvis

Piece Goods Often Go On Quilts
Hip Intra-articular Injection
Pelvis and Hip

Perineural Prolotherapy

Anatomy of the

SUPERIOR CLUNEAL NERVES
MAY CAUSE PAIN FROM ENTRAPMENT
About 6 cm

SUPERIOR GLUTEAL ARTERY & NERVE

PIRIFORMIS MUSCLE

SUPERIOR GEMELLO M.

OBTURATOR INTERNUS M.

INFERIOR GEMELLO M.

SCIATIC NERVE

SUPERIOR CLUNEAL NERVES
MAY CAUSE PAIN FROM ENTRAPMENT
About 6 cm

SUPERIOR GLUTEAL ARTERY & NERVE

PIRIFORMIS MUSCLE

SUPERIOR GEMELLO M.

OBTURATOR INTERNUS M.

INFERIOR GEMELLO M.
Pelvis and Hip

Prolotherapy
“Sweet” Caudal

Pelvis and Hip
Pelvis and Hip

MRI of the HIP – Imaging checklist

- Femur – osteonecrosis, fractures or edema
- Cartilage surfaces – fissures, fraying, thinning or defects
- Joint recesses – chondral debris or foreign bodies
- Labrum – tears, detachment, fraying or degeneration
- Acetabulum – shallow contour?
- Muscles and tendons – tears or strains
- Trochanteric or iliopsoas bursitis?
- Check the symphysis pubis, superior / inferior pubic rami, ilium, sacroiliac joints and sacrum on large FOV coronal images
MRI of the HIP
Pelvis and Hip

- Yellow / fatty marrow
  - T1 hyperintense
  - T2 intermediate
- Red / hematopoietic marrow
  - T1 and T2 intermediate because of higher water content
- Conversion to yellow marrow in apo- / epiphysis of the femur in first year
Abnormal femoral torsion

Linked to osteoarthritis in the knee as well as to patellofemoral and hip pain.
Patellar instability - the patellar tendon exerting a laterally directed force on the patella.

This force vector may be quantified with measurement of the Q angle, the angle formed between:
- anterior superior iliac spine
- center of the patella
- tibial tubercle

Q angle greater than 20° is abnormal.
Pelvis and Hip

Facet & Disc Pain
Bursitis
Internal Rotation
Valgus & Hyperextended Knee
Miniscus Pain
Hyperpronation
Subtalor Eversion

Figure 2 - Common Postural Imbalance

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Abnormal femoral torsion has been linked to osteoarthritis in the knee as well as to patellofemoral pain.

- The medial patellofemoral ligament (MPFL) is the "essential lesion" for patellar dislocation.
  - The origin is between the medial femoral epicondyle and the adductor tubercle.
  - The insertion is at the proximal/medial aspect of the patella.
  - The MPFL is superficial to the joint synovium.
Femoral Anteversion (a.k.a. tibial torsion)

The key to “visualizing” the Anteversion Angle is to imagine rotating the femoral shaft such that the Condyles are perfectly horizontal (CH = 0).

The Anteversion Angle would then be equal to the angle between the femoral neck and horizontal (NH).
Femoral Anteversion (tibial torsion):

• Measure the angle of rotation of the femoral necks relative to the femoral condyles, bilaterally.

• Measurement of femoral lengths can be made by calculating the difference in table position at the ends of the femurs.
Pelvis and Hip

Femoral Anteversion (tibial torsion)

- Measure right and left sides individually
- Measure the Neck-Horizontal Angle (NH)
- Measure the Condyle-Horizontal Angle (CH)
- Calculate the Neck-Condyle (NC) angle of the Neck relative to the Condyles (NC = NH − CH)
Femoral Anteversion (tibial torsion)

• Measure right and left sides individually
• Measure the Neck-Horizontal Angle (NH= 30)
• Measure the Condyle-Horizontal Angle (CH= 10)
• Calculate the Neck-Condyle (NC) angle of the Neck relative to the Condyles (NH − CH = NC, 30 -10 =20)
• 20 degrees femoral anteversion (20 = 30 - 10)
Femoral Anteversion (condyle internally rotated)

- Measuring right side
- Measure the Neck-Horizontal Angle (NH of +30)
- Measure the Condyle-Horizontal Angle (CH of -20)
- Calculate the Neck-Condyle (NC) angle of the Neck relative to the Condyles (NH – CH = NC)
- 50 degrees femoral anteversion (+30 - -20 [plus 20] = 50)
Femoral Anteversion and PFD

• There is more to solving the complex puzzle of patellofemoral dysfunction (PFD) than the general consensus that malalignment of the patella in relation to the femur is the cause of PFD.

• Altered soft tissue and inadequate activity and timing of the vastus obliquus musculature are now believed to be the cause of lateral tracking of the patella (in actuality, the patella is getting too much attention).

• The origin of the PFD may be a “malaligned” femur that has resulted from an angulation abnormality in the pelvis.
Pelvis and Hip

Femoral Anteversion and PFD

• The underlying cause and return of symptoms in patients with PFD may be a biomechanical “imbalance” in the ipsilateral or contralateral pelvifemoral joint.

• The imbalance occurs when one or both innominates tilt anteriorly or rotate forward and cause internal rotation of the femur.
Femoral Anteversion and PFD

- Severe malalignment describes the increase hip internal rotation in combination with bilateral patellar subluxation, genu recurvatum, patella alta, increased tibial rotation, tibial varus and compensatory pronation.

- Further up the kinetic chain there is an anteriorly rotated pelvis with compensatory increased thoracic kyphosis, cervical extension and forward head positioning.
Acetabular anteversion measurement technique in the axial plane computed tomographic (CT) section.

- Line B = baseline intersecting the most posterior edges of the iliac bones.
- Line A = line intersecting the anterior and posterior lips of the acetabulum.
- Line C = line perpendicular to line B. $\alpha$ (acetabular anteversion angle) = angle between the lines A and C
The world will always be governed by self-interest: we should not try to stop this: we should try and make the self-interest of crooks a little more coincident with that of decent people.

--Samuel Butler
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