



THE KNEE

Michael McMurray, PT, DPT, OCS, FAAOMPT

Orthopaedic Manual Physical Therapy Series
Charlottesville 2017-2018



Prior to the Exam

- Health History Questionnaire

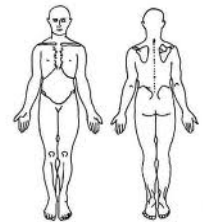
Prior to the Exam

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



Prior to the Exam

- Medications
- Body Chart
- Functional Questionnaires



Questionnaire	Indication	MCID	Comments
Knee Injury and Osteoarthritis Outcome Score (KOOS)	Hip and Knee OA/post TKA	Pain: 22.39; Stiffness: 29.12; Physical Function: 13.11; Other: 14	Extension of the WOMAC
International Knee Documentation Committee Questionnaire	Knee Ligament Injury	11.5	Combination of self report and examination findings
Lysholm Knee Score	Ligament and Meniscal Injuries	10	Evidence for usefulness inconclusive
Cincinnati Knee Rating System	Nonspecific Knee Conditions	Pain: 2.45; Swelling: 2.86; Partial Giving Way: 2.82; Full Giving Way: 2.30	Combination of self report and examination findings
Knee Outcome Survey (KOS)	Nonspecific Knee Conditions	8.87	Reliable/Valid/Responsive for fxnal limitations for the knee
Lower Extremity Function Scale (LEFS)	All Lower Extremity Conditions	9	Valid for all lower ext conditions, excellent test retest reliability

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

SAURABH P. MEHTA, PT, PhD^{1*} • ALLISON FULTON, MS²PT³ • CEDRIC QUACH, MS⁴PT⁵
 MEGAN THISTLE, MS⁶PT⁷ • CESAR TOLEDO, MS⁸PT⁹ • NEIL A. EVANS, DPT, OCS, CSCS^{10*}
MARCH 2016 | VOLUME 46 | NUMBER 3 | JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY

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

 Orthopaedic Manual Physical Therapy Series 2017-2018 www.vompti.com

Subjective

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

 Orthopaedic Manual Physical Therapy Series 2017-2018 www.vompti.com

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

 Orthopaedic Manual Physical Therapy Series 2017-2018 www.vompti.com

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 (ie lumbar radic)
 - Previous trauma, surgery
 - Treatment received and effect



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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 Tib/Fib
 - Meniscus
- Medial Knee
 - Meniscus
 - Soft Tissue
 - Plica
 - Ligamentous
 - Medial patellar facet
 - Medial compartment of tibiofemoral joint



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com



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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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

Journal of Orthopaedic & Sports Physical Therapy

Josef H. Moore, PT, PhD, SCS, ATC¹
 Donald J. Goss, PT, MPT, OCS, ATC²
 Richard E. Raine, PT, DSc, OCS, ATC³
 Thomas M. DeBorja, MD⁴
 Lynn E. Mansfield, MD⁵
 Douglas W. Fellows, MPT⁶
 Dean C. Taylor, MD⁷



Orthopaedic Manual Physical Therapy Series 2017-2018

pti.com

Do We Need It?

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

S. Décarv^{1,2}, M. Falah³, B. Pelletier⁴, P. Frémont⁵, J. Martel-Pelletier⁵, J.-P. Pelletier⁵, D. E. Feldman¹, M.-P. Sylvestre⁵, P.-A. Vendittoli^{2,4} and F. Desmeules^{1,2}

- 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



Orthopaedic Manual Physical Therapy Series 2017-2018

Décarv et al. BMC Musculoskeletal Disorders (2017) 18:445
 DOI 10.1186/s12891-017-1799-3

www.vompti.com

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

Ali Guermazi professor of radiology¹, Jingbo Niu research assistant professor of medicine², Daichi Hayashi research assistant professor of radiology³, Frank W Roemer associate professor of radiology⁴, Martin Englund associate professor, epidemiologist⁵, Tuhina Neogi associate professor of medicine and epidemiology⁶, Piran Altabadi professor of radiology⁷, Christine E McLennan project manager⁸, Pascal T Faloutsos professor of medicine and epidemiology⁹
 BMJ 2012;345:e5339 doi: 10.1136/bmj.e5339 (Published 29 August 2012)

- 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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

MRI features	Age group (years)			
	≥50-60 (n=316)	≥60-70 (n=249)	≥70 (n=145)	P value
Osteophytes	68 (215/316)	78 (193/249)	80 (116/145)	0.007
Cartilage damage	61 (193/316)	74 (183/249)	80 (116/145)	<0.001
Bone marrow lesions	48 (150/316)	55 (137/249)	58 (84/145)	0.06
Synovial thickening and joint effusion	32 (102/316)	39 (97/249)	41 (60/145)	0.10
Attrition	29 (91/316)	35 (86/249)	35 (51/145)	0.20
Subchondral cysts	19 (61/316)	29 (71/249)	32 (47/145)	0.004
Meniscal lesions	17 (55/316)	24 (60/249)	36 (52/145)	<0.001
Ligamentous lesions	7 (22/316)	10 (24/249)	14 (20/145)	0.06

Table 2 | Prevalence of MRI features (standard definition)* stratified by sex, pain status, and BMI. Figures are numbers (percentage) of participants

MRI features	Sex			Knee pain				BMI			
	Overall (n=710)	Women (n=383)	Men (n=317)	Pain (n=296)	No pain (n=408)	P value	<25.0 (n=222)	≥25.0-3 (n=278)	>35 (n=204)	P value	
	Any abnormality	631 (89)	346 (88)	285 (90)	0.43	188 (61)	430 (88)	0.20	193 (87)	249 (90)	184 (90)
Osteophytes	524 (74)	281 (72)	243 (77)	0.12	158 (53)	363 (72)	0.22	154 (69)	208 (75)	157 (77)	0.18
Cartilage damage	492 (69)	273 (70)	219 (69)	0.91	149 (50)	333 (68)	0.27	153 (69)	185 (68)	139 (68)	0.89
Bone marrow lesions	371 (52)	213 (54)	158 (50)	0.25	121 (40)	242 (50)	0.03	117 (53)	149 (54)	103 (51)	0.79
Synovitis	259 (37)	139 (36)	120 (38)	0.49	78 (26)	175 (36)	0.60	88 (40)	99 (36)	69 (34)	0.43
Attrition	228 (32)	124 (32)	104 (33)	0.72	78 (26)	147 (29)	0.24	84 (38)	79 (28)	63 (31)	0.07
Subchondral cysts	179 (25)	106 (28)	71 (22)	0.12	63 (21)	114 (23)	0.04	59 (27)	69 (25)	50 (25)	0.86
Meniscal lesions	167 (24)	87 (23)	110 (35)	<0.001	42 (14)	120 (25)	0.24	56 (25)	72 (26)	38 (19)	0.14
Ligamentous lesions	66 (9)	31 (8)	35 (11)	0.15	22 (7)	43 (9)	0.44	17 (8)	25 (9)	23 (11)	0.43

Imaging in Asymptomatic Knees

Abnormal Findings on Knee Magnetic Resonance

Imaging in Asymptomatic NBA Players

Brion E. Wolczak, MPT, ATC
Patrick C. McCulloch, MD
Richard W. Kang, BS
Anthony Zolozny, MD
Fred Tedeschi, ATC
Brian J. Cole, MD, MBA

J Knee Surg. 2008;21:27-33.

MR Imaging of the Knee: Findings in Asymptomatic Collegiate Basketball Players
Nancy M. Major¹
Clyde A. Helms
AJR 176, September 2002

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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

-Gail Deyle 2015



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Diagnostic Imaging Reveals Pathology

The Clinical Examination Provides Relevance

-Gail Deyle



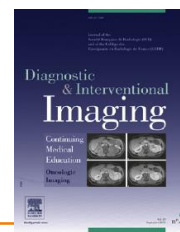
Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Imaging of meniscus and ligament injuries of the knee

M. Faruch-Bilfeld, F. Lapegue, H. Chiavassa, N. Sans*

Diagnostic and Interventional Imaging (2016) 97, 749–765



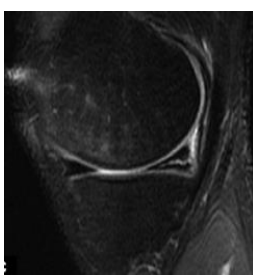
Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Meniscus Imaging



Normal Meniscus



Horizontal Meniscal Fissure

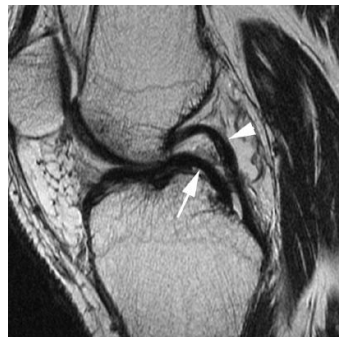
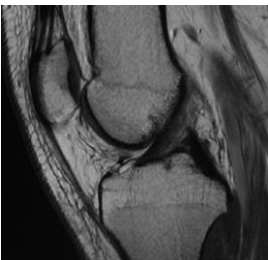


Figure 6. Bucket handle appearance of the medial meniscus with "double PCL" sign. Sagittal PD-weighted view with fat suppression: the dislocated meniscal fragment (arrow) is located beneath the normal PCL (arrowhead) and forms a pathognomonic "double PCL" appearance.

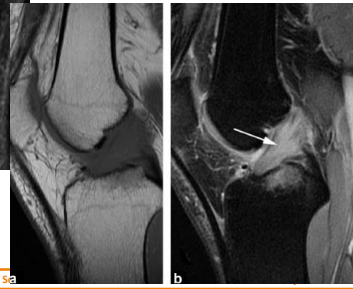
ACL

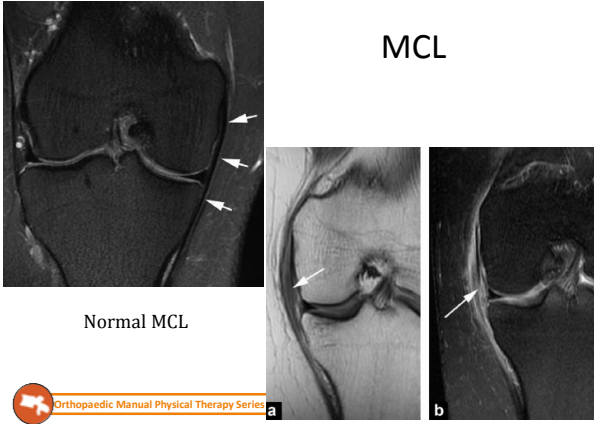


Normal ACL



ACL





MCL

Normal MCL

Orthopaedic Manual Physical Therapy Series

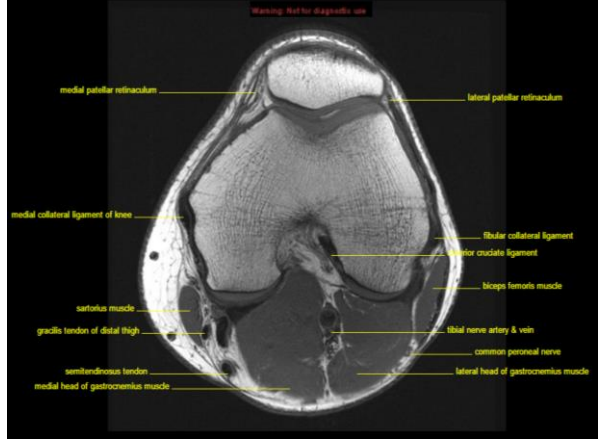
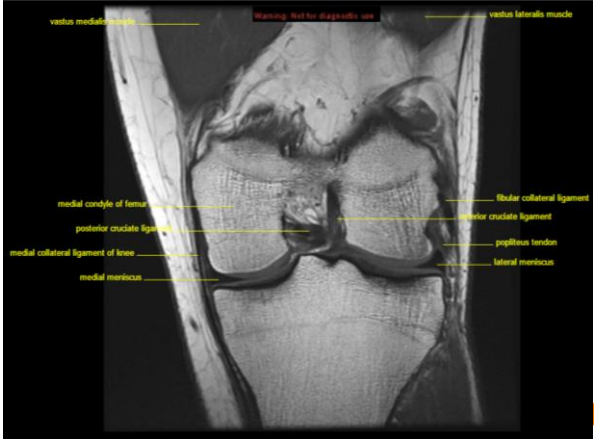


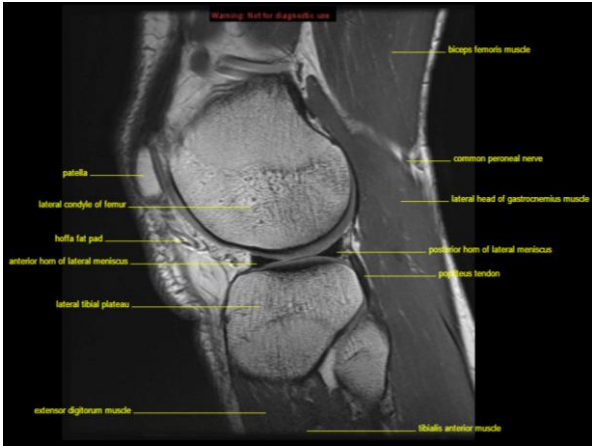
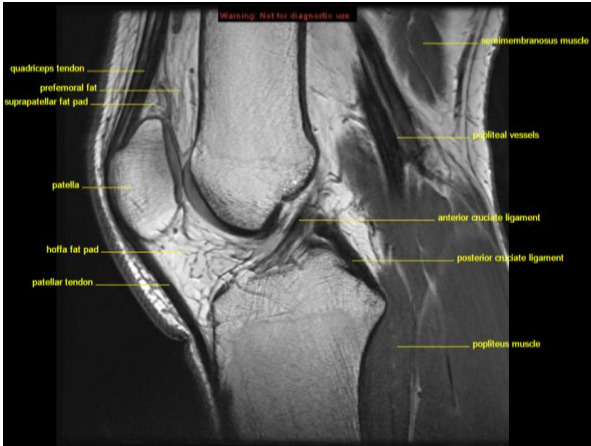
“Normal” MRI Resource

<http://xrayhead.com>

Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com





Diagnostic accuracy and reproducibility of the Ottawa Knee Rule vs the Pittsburgh Decision Rule²⁷

Tung C. Cheung MD^a, Yeliz Tank MD^{b,*}, Roelf S. Breederveld MD, PhD^a, Wim E. Tuinebreijer MD, PhD^a, Ely S.M. de Lange-de Klerk MD, PhD^c, Robert J. Derksen MD, PhD^b

American Journal of Emergency Medicine 31 (2013) 641-645

A knee x-ray series is only required for knee injury patients with any of these findings:

- 1) age 55 years or older
or
- 2) isolated tenderness of patella^a
or
- 3) tenderness at head of fibula
or
- 4) inability to flex to 90°
or
- 5) inability to bear weight both immediately and in the emergency department (4 steps)^{a,b}

^aNo bone tenderness of knee other than patella.
^bUnable to transfer weight twice onto each lower limb regardless of limping.

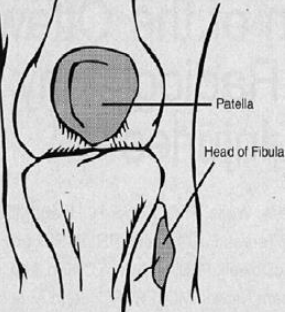


Fig. 2. Ottawa Knee Rule.

Diagnostic accuracy and reproducibility of the Ottawa Knee Rule vs the Pittsburgh Decision Rule²⁷

Tung C. Cheung MD^a, Yeliz Tank MD^{b,*}, Roelf S. Breederveld MD, PhD^a, Wim E. Tuinebreijer MD, PhD^a, Ely S.M. de Lange-de Klerk MD, PhD^c, Robert J. Derksen MD, PhD^b

American Journal of Emergency Medicine 31 (2013) 641-645

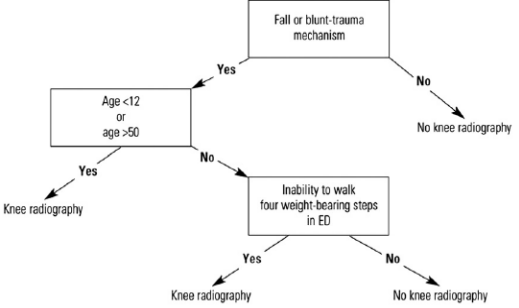


Fig. 1. Pittsburgh Decision Rule.

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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 Fx: medial knee pain
 - Osteochondritis dessicans
 - Legg-Calve-Perthes Dz
 - Osgood-Schlatters

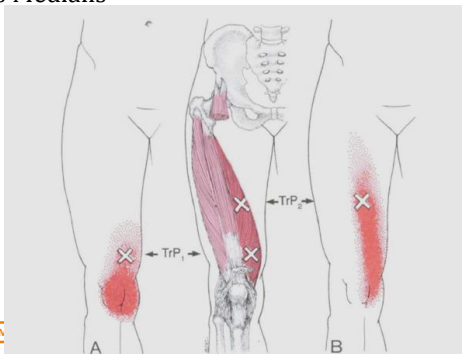


Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Medial Knee Pain

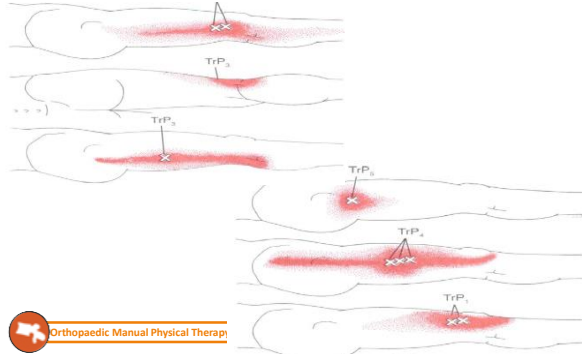
- Vastus Medialis



Orthopaedic Manual Physical Therapy Series 2017-2018

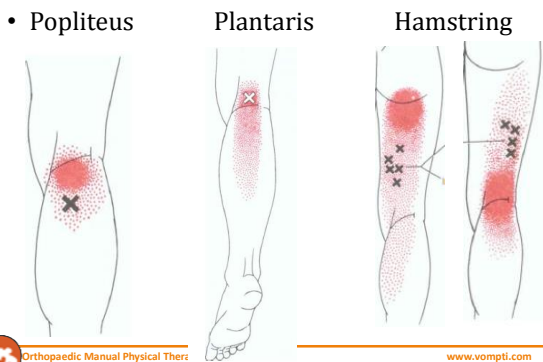
Lateral Knee Pain

- Vastus Lateralis



Orthopaedic Manual Physical Therapy Series 2017-2018

Posterior Knee Pain



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



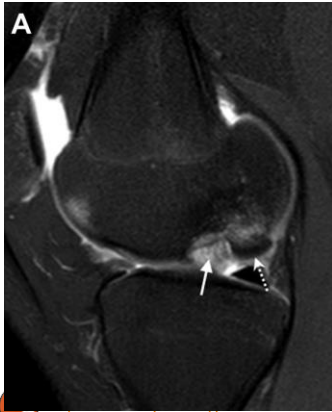
Osteochondritis Dissecans

- 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

Mark V. Paterno, PT, PhD, SCS, ATC^{a,b,c,d,*}, Clin Sports Med 33 (2014) 353-374
 Tricia R. Prokop, PT, MS, CSCS^{a,f}, Laura C. Schmitt, PT, PhD^{a,b,g}

- 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

www.vompti.com



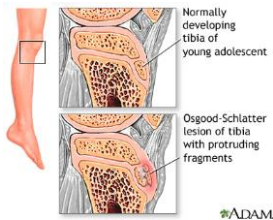
- Healed stable OCD treated with conservative treatment 6 mo after diagnosis

Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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



©ADAM

Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Osgood-Schlatter

- 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

Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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

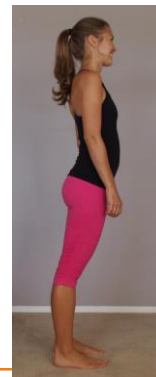


Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Objective

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Functional Testing

The reliability and validity of physiotherapist visual rating of dynamic pelvis and knee alignment in young athletes

Chris Whatman^{a,b*}, Patria Hume^b, Wayne Hing^{a,c} *Physical Therapy in Sport xxx (2012) 1-7*

Kinematics during lower extremity functional screening tests in young athletes – Are they reliable and valid?

Chris Whatman^{a,b*}, Patria Hume^b, Wayne Hing^a *Physical Therapy in Sport 14 (2013) 87-93*

Physiotherapist agreement when visually rating movement quality during lower extremity functional screening tests

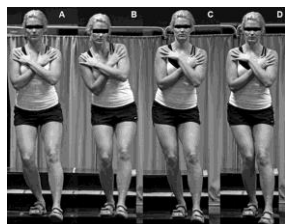
Chris Whatman^{a,b*}, Wayne Hing^a, Patria Hume^b *Physical Therapy in Sport 13 (2012) 87-96*



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Squatting



- Single Leg



- Double Leg

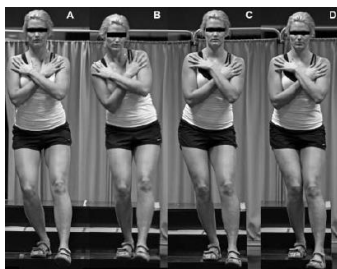
Performance on the Single-Leg Squat Task Indicates Hip Abductor Muscle Function

Kay M. Crossley,^{1,2} PhD, Wan-Jing Zhang,³ MBBS, Anthony G. Schache,¹ PhD, Adam Bryant,⁴ PhD, and Sallie M. Cowan,¹ PhD
 The American Journal of Sports Medicine, Vol. 39, No. 4
 DOI: 10.1177/03635468110395456

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

Criterion	To Be Rated “Good”	
A	Overall impression across the 5 trials: Ability to maintain balance Perturbations of the person Depth of the squat Speed of the squat Trunk posture	Participant does not lose balance Movement is performed smoothly The squat is performed to at least 90° of knee flexion Squat is performed at approximately 1 per 2 seconds
B	Trunk/thoracic lateral deviation or shift Trunk/thoracic rotation Trunk/thoracic lateral flexion Trunk/thoracic forward flexion	No trunk/thoracic lateral deviation or shift No trunk/thoracic rotation No trunk/thoracic lateral flexion No trunk/thoracic forward flexion
C	The pelvis “in space” Pelvic shunt or lateral deviation Pelvic rotation Pelvic tilt (take note of depth of squat)	No pelvic shunt or lateral deviation No pelvic rotation No pelvic tilt
D	Hip joint Hip adduction Hip (femoral) internal rotation	No hip adduction No hip (femoral) internal rotation
E	Apparent knee valgus Knee position relative to foot position	No apparent knee valgus Center of the knee remains over the center of the foot

Single Leg Squat



- A: Good
- B: Poor
- C: Poor Hip/Pelvis
- D: Poor Hip/Knee

SFMA

- FN
– Functional Non Painful
- FP
– Functional Painful
- DP
– Dysfunctional Painful
- DN
– Dysfunctional Non Painful

THE SELECTIVE FUNCTIONAL MOVEMENT ASSESSMENT				
SFMA SCORING	FN	FP	DP	DN
Active Cervical Flexion	FN	FP	DP	DN
Active Cervical Extension	FN	FP	DP	DN
Cervical Rotation/Lateral Bend	FN	FP	DP	DN
Upper Extremity Pattern 1 (MRE)	FN	FP	DP	DN
Upper Extremity Pattern 2 (LRF)	FN	FP	DP	DN
Multi-Segmental Flexion	FN	FP	DP	DN
Multi-Segmental Extension	FN	FP	DP	DN
Multi-Segmental Rotation	FN	FP	DP	DN
Single Leg Stance	FN	FP	DP	DN
Overhead Deep Squat	FN	FP	DP	DN

SFMA

Multi-Segmental Rotation		L				
		R				
Single Leg Stance		L				
		R				
Overhead Deep Squat						

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



Multi-Segmental Rotation Primary Secondary RIGHT LEFT

RIGHT LEFT Pelvis Rotation < 50 degrees _____

RIGHT LEFT Trunk/shoulder < 50 degrees more than pelvis _____

RIGHT LEFT Spinal/Pelvic Deviation _____

RIGHT LEFT Excessive Knee Flexion _____

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



Single Leg Stance Primary Secondary RIGHT LEFT

RIGHT LEFT Eyes Open Standing < 10 seconds _____

RIGHT LEFT Eyes Closed Standing < 10 seconds _____

RIGHT LEFT Loss of Height _____ .com

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



Overhead Squating Primary Secondary

Loss of Shoulder Flexion _____

Thoracic Flexes _____

Hips Don't Break Parallel _____

Orthop Sagittal Plane Deviation of Lower Extremity Rt. _____ Lt. _____

Objective

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Objective

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Objective

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

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/Extension with abd/Flexion with add
 - Pt supine, support lateral femur against chest
 - Passively flex knee to end range
 - Take out to ~10-20deg 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/abduction movement
 - Move proximal hand to medial tibia, distal hand to medial malleoli and repeat causing extension/adduction movement



Passive Physiological Motion

- Tibial IR/ER at 90deg
 - Pt supine, knee flexed to approx 90deg
 - 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



Orthopaedic Manual Physical Therapy Series 2017-2018 www.vompti.com

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



Orthopaedic Manual Physical Therapy Series 2017-2018 www.vompti.com

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



Orthopaedic Manual Physical Therapy Series 2017-2018 www.vompti.com

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



Orthopaedic Manual Physical Therapy Series 2017-2018 www.vompti.com

Passive Accessory Motion

- Superior Tib-Fib A-P/P-A
 - Pt sidelying 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

Systematic Review

The reliability and validity of assessing medio-lateral patellar position: a systematic review

Toby O. Smith^{a,*}, Leigh Davies^a, Simon T. Donell^b

Manual Therapy 14 (2009) 355-362

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

The validity of clinical measures of patella position

Islay McEwan^a, Lee Herrington^{b,c,*}, Jeanette Thom^d

Manual Therapy 12 (2007) 226-230

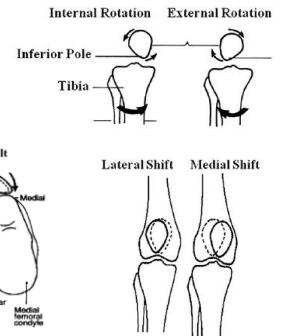
- Strong validity and intrarater reliability



Patellar Assessment

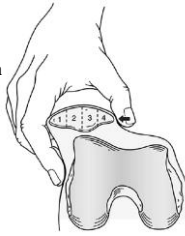
- Position Assessment

- Tilt
- Rotation
- Shift



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

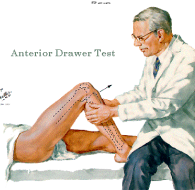
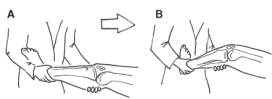


Objective

- 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

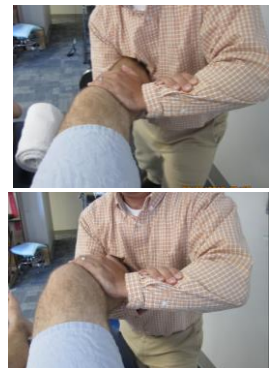
ACL

Pivot Shift



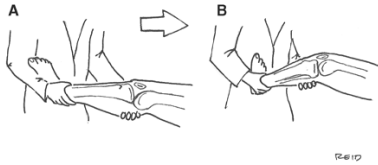
Pivot Shift

- 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 20deg flexion the tibial plateau will relocate
- Positive test is a thud or clunk of lateral tibia posteriorly



Pivot Shift

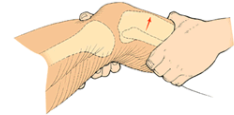
- Sens .24
- Spec .98
- +LR 8.5
- -LR .9



- Rule in ACL Tear

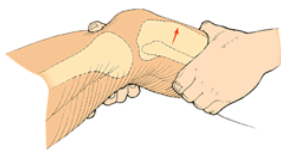
Lachman's Test

- 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

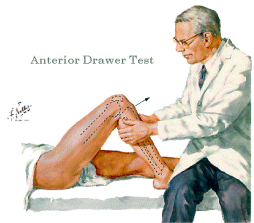
Anterior Drawer Test

- 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

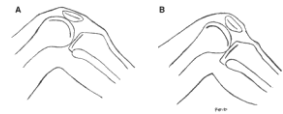
Quadriceps Active Test



Posterior Drawer



Posterior Sag Sign



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



Quadriceps Active Test

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

- Most specific test for PCL rupture



Posterior 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 posterior tibial force
- Positive if greater posterior translation compared to other side



Posterior Drawer Test

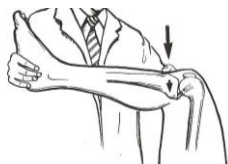
- Sens: 90%
- Spec: 99%
- +LR: 90
- -LR: .1



- Helps rule out the presence of a torn PCL

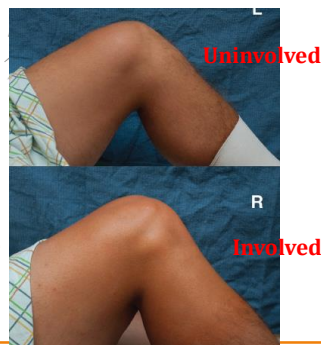
Posterior Sag Sign

- Pt supine with knee flexed to 90deg and hip flexed to 90deg
- 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



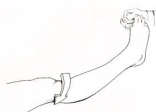
- Rule in presence of a PCL tear

Posterolateral Corner

Prone ER



ER Recurvatum



Posterior Drawer with ER



Assessment

- Cluster
 - Posterior drawer test in ER
 - Prone ER test
 - ER Recurvatum test
- Reliability and specificity not tested



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com



Orthopaedic Manual Physical Therapy Series 2017-2018

www.vompti.com

Posterior Drawer with ER at 30/90

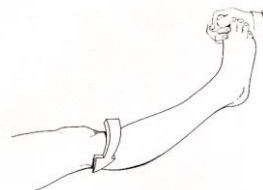
- ER tibia and apply posterior force
- If normal at 90 but excess at 30 suspect PLC injury
- Positive if tibia rotates excessively compared to other side
- If rotates and subluxes posteriorly or excess motion at 30 and 90 suspect PCL injury



Orthopaedic Manual Physical Therapy Series 2017-2018

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



Orthopaedic Manu:

www.vompti.com

Prone ER Test at 30 and 90

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



Objective

- Sidelying
 - Strength Testing
 - Glut strength testing
 - Muscle Length Testing
 - Hip flexor
 - Ober'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 pa (central and upa)
 - Lumbar palpation
 - Special Test
 - PLC
 - Prone ER Test

	Rule In	Rule Out	Best Test
Meniscus	Thessaly Apley's Compression Test McMurray's Joint Line Tenderness	Thessaly	Cluster of Tests
ACL	Pivot Shift Anterior Drawer	Lachman	Lachman with empty endfeel
PCL	Quadriceps Active Test Posterior Sag	Posterior Drawer	Posterior Sag Quadriceps Active Test
MCL	Valgus at 30deg	Valgus at 30deg	Valgus at 30deg
LCL	Varus at 30deg	Varus at 30deg	Varus at 30deg
PLC	Post Drawer with ER at 30deg Prone ER at 30deg ER Recurvatum Test	Post Drawer with ER at 30deg Prone ER at 30deg ER Recurvatum Test	Cluster of Tests