Thank You

- Thanks to RUSH 2016 SPORTS MEDICINE SYMPOSIUM for the kind invitation to present at this course

- It is indeed an honor and privilege to be invited to participate and share information.

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AOSM - Hall of Fame Award, 2013

Disclosures:

- Associate Editor, Sports Health
- Publisher-Book Royalties
- Human Kinetics-Book Royalties
- North American Seminars-DVD Royalties

No Conflicts

Examination of the Knee

Casual interest in the knee for the last 51 years since I started as a student athletic trainer in 1965!!!

Disclosures:

The following companies have provided research equipment support to Biodynamics & Human Performance Center-AASU:

Arthrometrics, Atlanta, GA.

Biodex, Shirley, N.Y.

CDM Sport/Monitored Rehab Systems, Fort Worth, TX.

DS2 Rehab Systems, Missouri City, TX.

ERMI, Atlanta, GA.

ExerTools, Petaluma, CA.

Innovative Sports Inc, Chicago, IL.

TheraBand, Hygenic Corporation, Akron, OH.

No Conflicts
Examination of the Knee

This is an article that we published 38 years ago in the Physician and SportsMedicine that was used for CME's for physicians.

At that time it was “state of the art”, and it’s interesting how much of that art has stayed the same, with of course, some changes!

Subjective Examination and History of the Knee Complex

Subjective Exam Components

- Demographic information
- Location of symptoms
- Dominant arm
- MOI
- History: present & past
- Behavior of symptoms: rest, ADL's, work, sports, AM/PM

Differential Diagnosis

Systems review and differential diagnosis

Subjective Exam Components

- Diagnostic tests & Imaging Studies
- Lab tests
- Medical systems review: questionnaire and interview (Differential DX.)
- Meds
- Previous treatments
- Previous functional status
- Patient's goals
Functional Testing Algorithm - Knee - 2016

- Sport Specific Testing
- Lower Extremity Functional Tests
- Functional Hop Tests
- Functional Jump Tests
- OKC Isokinetic Testing
- CKC Isokinetic Testing
- Sensorimotor System Testing: Balance/Proprioceptive Testing
- KT 1000 Tests
- Special Tests – ONLY 175 + 1
- Basic Measurements

FTA Specific Guidelines

- LEFT - M:1:30; F:2:00 minutes
- HOP - < 10% Ht.; < 10% bilat. Comp.; Norms/ various hops
- JUMP - < 15% / Ht.; Norms
- OKC Isokinetics - < 25% bilateral comparison/ other criteria
- CKC Isokinetics - < 30% bilateral comparison
- Kinesthetic/Balance Testing - Bilat comp
- KT 1000 - < 3 mm bilateral comparison
- Basic Measurements - < 10% bilateral comparison

EXAMINATION IS KEY TO TREATMENT PROGRAM

Basic Measurements

- Time/ soft tissue healing
- VAS (0-10 scale)
- Anthropometric measurements
- AROM, PROM
- Special Tests
- Qualitative & Quantitative Movement Assessment
- Knee Rating scales: IKDC, etc.

We still have not answered this Question?

- Biologics and “mother nature” and the:
  - Neoangiogenesis
  - Maturation
  - Ligamentization

Functional Testing Algorithm

TIME:
Soft tissue healing from the injury or from a post-surgical condition

Basic Measurements

- MD Clearance & Approval
- Time/ soft tissue healing
- VAS (0-10 scale)
- Anthropometric measurements
- AROM, PROM
- Special Tests
- Qualitative & Quantitative Movement Assessment
- Knee Rating scales: IKDC, etc.
We need similar types of outcomes regarding the biology of healing. We can't hurry "mother nature"; although we are trying with all the biologics!!!

Perhaps wait for 3-6 more months to allow the biologics to "do their job"....

ACL Quad Tendon Graft Healing

Then we return him back to sports.
Physical (Objective) Examination of the Knee

Functional Testing Algorithm - Knee

- Objective, quantitative (and qualitative), systematic testing and rehabilitation method to safely and rapidly progress a patient from immediate post injury/post-op to return to full functional activities and return to play in sports

Physical Examination/Tests & Measurements

- Observation/position
- Gait Evaluation
- D & Q Movement Assessment
- Referral/related joints
- Neurological Exam
- Sensation, reflexes
- Kinesthetic/propropioceptive Balance
- Neuropathology
- Palpation
- AKOM
- Physiological PROM
- Accessory Jt. Play PROM
- KT 1000
- Flexibility Tests
- ROM (Might: HND)
- Special Tests
- Computerized isokinetic testing
- Functional Testing
- Imaging Studies
- Lab Studies

Physical Examination of the Knee

- 1) Most physical exam tests should be referenced back to the original description
- 2) Sensitivity
- 3) Specificity
- 4) Likelihood ratios
- 5) PPV
- 6) NPV

Functional Testing Algorithm - Knee

- Progression to the next higher level of testing difficulty is predicated upon passing the prior test in the series...

- Each successive test and its associated training regimen places increasing stress on the patient while at the same time decreasing clinical control

- So how does it really work?

Functional Testing Algorithm - Knee

- We can rehabilitate patients faster than ever because by testing them, we always know where the patient is in the rehab program and can focus the interventions specifically on the patient's particular condition and status
Physical Examination/Tests & Measurements
- Observation/posture
- Gait Evaluation
- Neurological Exam
- Sensation, reflexes
- Kinesthetic/proprioceptive Balance
- Palpation
- AROM
- Physiological PROM
- Accessory/Jt. Play PROM
- KT 1000
- Flexibility Tests
- RROM (ROM/ROM)
- Special Tests
- Computerized isokinetic testing
- Functional Testing
- Imaging Studies
- Lab Studies

Observation & Posture

Gait Evaluation

Q & Q Movement Assessment

Regional Interdependency

TOTAL BODY INTERDEPENDENCY

If movement is one integrated pattern, regardless of its complexity,
then we must evaluate and treat
- The TOTAL PATIENT

Basic Measurements
- Qualitative & Quantitative Movement Assessment:
- Step Down Tests:

Performance Tests
- Single Leg Step Down
- Analysis

KT 1000 Tests

Foot's Foot Posture Photo

Qualitative Movement Analysis of the Entire Kinematic Chain in all Planes of Motion
Referral / Related Joints

Axial Spinal “Clearing” Tests
- Lumbar Spine
- AROM
- PROM - End ROM
- MMT - Mid ROM
- Special Tests
- SI Joint

Appendicular Peripheral Joint “Clearing” Tests
- Hip
- Proximal Tib-Fib Joint
- Ankle
- Foot

Neurological Exam-Sensorimotor System Testing
- Balance
- Sensation - dermatomes etc.
- Reflexes
- Neurodynamic testing
- MMT
- Kinesthesia/Proprioception

Knee Kinesthetic Testing
- Balance
- Angular Joint Replication
- End ROM Reproduction
- Threshold to Sensation of Movement

It has been my clinical observation (performance motion assessment) that after a LE injury, individuals do not bear weight equally during double-leg exercises, especially on the injured leg.
**ACL-R**
- More flexion \( \Rightarrow \) WB on ACL-R side
- More external weight \( \Rightarrow \) WB on ACL-R side

3 months: unweighted ACL-R side
6 months: unweighted ACL-R side
12 months: normalized WB - ACL-R side

Majority of patients felt like they were performing equal WB on both legs

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**ACTIVE ROM:**
1) Quantitative-Goniometry
2) Qualitative

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**Flexibility Tests - Lower Extremity**
(Length Tests - MT Unit)

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**ACCESSORY MOVEMENTS**
**JOINT PLAY MOVEMENT**
**COMPONENT MOVEMENTS**
(Included in Special tests)

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**Special Tests**

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**Knee Evaluation Criteria**
**Examiner:**
Degree of laxity (translation)
- End feel
- Hysteresis
- Crepitis/ grating
- locking/ pseudo-locking
- clunk/ click

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**Springy Rebound Compliance - Hysteresis**

- Elastic hysteresis:
  
  A simple way to understand it is in terms of a rubber band with weights attached to it. If the top of a rubber band is hung on a hook and small weights are attached to the bottom of the band one at a time, it will get longer. As more weights are loaded onto it, the band will continue to extend because the force the weights are exerting on the band is increasing. When each weight is taken off, or unloaded, it will get shorter as the force is reduced. As the weights are taken off, each weight that produced a specific length as it was loaded onto the band now produces a slightly longer length as it is unloaded. This is because the band does not obey Hooke’s law perfectly. The hysteresis loop of an idealized rubber band is shown in Fig. 3.
Knee Evaluation Criteria

- Patient -
- Patient c/o pain (reproduction of the symptoms)
- Patient c/o apprehension (feeling that the PFJ is ready to subluxate/ dislocate)

Special Tests

- Orthopedic Physical Assessment
- Magee, Dj
- > 175 special tests for the Knee ?????????????
- We'll discuss and demonstrate an algorithm-based exam for the special tests which is clinically efficient

Corroboration of multiple tests to identify consistency in the clusters of signs & symptoms = clinical diagnosis

Algorithm Based Exam

Physical Examination of the Knee-Effusion Tests - 6

- Ballottement Test/Ballotable Patella or Patella Tap Test (SEN:83)(SP:49)(+LR:1.6)
- Sweep Test (Wipe, Brush, Bulge, Stroke Test)
- Fluctuation Test
- Indentation Test
- Peripatellar Swelling Test
- Palpable fluid wave

Physical Examination of the Knee-Milking Test/ Fluid Wave

Physical Examination of the Knee-PF Ballotment Test

Physical Examination of the Knee-PF Tests - 32

(SEN:83) (SP:49) (+LR:1.6)
### Physical Examination of the Knee-Patelloc-Femoral Tests

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Positive Likelihood Ratio</th>
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<tr>
<td>Patellar Apprehension Test</td>
<td>70</td>
<td>92</td>
<td>2.3</td>
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<tr>
<td>Patellar Grinding Compression Test</td>
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<td>95</td>
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<tr>
<td>PF Lateral Tilt</td>
<td>54</td>
<td>69</td>
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<tr>
<td>PF Superior Tilt</td>
<td>19</td>
<td>83</td>
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<tr>
<td>PF Medial Glide</td>
<td>54</td>
<td>69</td>
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<tr>
<td>PF Lateral Glide</td>
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<tr>
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<td>Patellar Mobility Testing</td>
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<td>PF Rotations</td>
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<td>McConnell Test for Orientation</td>
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<td>2 Quadrants-WNL</td>
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<tr>
<td>PF Passive Tracking Test</td>
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</table>
Physical Examination of the Knee—PF Active Tracking

- PF Active Tracking

(SEN:25) (SP:100)

Physical Examination of the Knee—PF CKC-AROM Tracking

- PF CKC-AROM Tracking

Physical Examination of the Knee—PCL Tests - 19

- PCL Tests
- Posterior Drawer Test (Noulis' Thesis, 1875)

Reverse Pivot Shift (Jakob Test) (PLRI) (SEN:26-58) (SP:94-95) (+LR:5.2-9.67)

Posterior (Reverse) Lachman's Test/Trillat's Test (SEN:62) (SP:89) (+LR:5.64)

Dial Test (Tibial External Rotation Test)

Anterior Abrasion Sign (SEN:7-14) (SP:NA)

Fixed Posterior Subluxation

Proximal Tibial Percussion Test

Posterior Functional Drawer Test

Loomer's Test (PLRI)

Dial Test (PLRI/PCL)

Standing Apprehension Test

Posterior Medial Displacement Test (PMRI)

It is important to establish the starting reference position so we do not mis-interprete the tibial translation (10mm = Normal) (Step-up is lost = + PCL injury)

Physical Examination of the Knee-SAG/Godfrey's Test

(SEN:46-100) (SP:100)

Physical Examination of the Knee—Clancy's Step-Up Test

10 mm

Step-Up - WNL

Physical Examination of the Knee—Recurvatum Test

- Recurvatum Test

(SEN:3.39) (SP:99) (+LR:3.0)
Physical Examination of the Knee

PCL TESTS

Posterior Drawer Test

Recommended a 70° knee angle position

Meniscus can act as “chock blocks”

Physical Examination of the Knee--Posterior Drawer Test

When positioning the knee at 70°, oftentimes, the tibia will sag posteriorly due to gravity. When the Post Drawer Test is performed, no posterior translation occurs; because the tibia is already posteriorly subluxated. Therefore, the test may appear negative because there is no posterior displacement.

Physical Examination of the Knee

PCL TESTS

Posterior Drawer Test

PROBABLY MOST IMPORTANT CONCEPT IN EXAMINATION!

“The posterior drawer test..., and its accuracy is increased when results are combined with other tests....

(CORROBORATIVE TESTING)

Physical Examination of the Knee--Anterior Instability Tests

Lachman's Test (Ritchie/Trillat/Lachman-Trillat) (SEN:63-99)(SP:42-100)(+LR:2.15-11.3)

Stable Lachman's Test

Drop Leg Lachman Test

Maximum Quadriceps Lachman Test

Active Lachman's Drawer Test

Anterior Drawer Test (SENIOR-95)(SP=55-100)(+LR:1.6-8.3)

90-90 Anterior Drawer Test

Sitting Anterior Drawer Test

Anterior Drawer Test in ER (AMRI)

Anterior Drawer Test in IR (ALRI)

Pivot-shift (SEN:6-93)(+LR:10.3)

Flexion-Rotation Drawer Jerk Test of Hughston (Reverse pivot-shift test)

Physical Examination of the Knee--Anterior Drawer Test

First described by Segund in 1879

Physical Examination of the Knee--ACL Tests - 19

Lachman's Test (Ritchie/Trillat/Lachman-Trillat) (SEN:63-99)(SP:42-100)(+LR:2.15-11.3)

Active Lachman's Test

Maximum Quadriceps Lachman Test

Active Lachman's Drawer Test

Anterior Drawer Test (SENIOR-95)(SP=55-100)(+LR:1.6-8.3)

90-90 Anterior Drawer Test

Sitting Anterior Drawer Test

Anterior Drawer Test in ER (AMRI)

Anterior Drawer Test in IR (ALRI)

Pivot-shift (SEN:6-93)(+LR:10.3)

Flexion-Rotation Drawer Jerk Test of Hughston (Reverse pivot-shift test)
Physical Examination of the Knee

ACL TESTS
Anterior Drawer Test
It is important to establish the starting reference position so we do not misinterpret the tibial translation (false positives with PCL insufficiencies)
(10 mm step-up)

ACL TESTS
Knee - 70°
Anterior Drawer Test - limitations:
Meniscus can act as "chock blocks"
Effusion
Pain
Patient comfort
Only checks the AMB of ACL

The data suggest that the anterior drawer test becomes increasingly more sensitive as the secondary restraints of anterior stability are lost

Lachman Test

Noulis' Thesis, 1875
Century
Torg, et.al. AJSM, 1976 later !!!

Several "Hybrid variations":
8 modifications of the Lachman's Test:
Physical Examination of the Knee - Pivot Shift

ACL TESTS
Pivot Shift Test
The pivot shift is both a clinical phenomenon that results in a complaint of a giving way of the knee and a physical sign that can be elicited on examination of the injured knee.

At approximately 20-30° ROM, there is a pivoting of the tibia on the femur (ALRI). ITB "slips" over the lateral femoral epicondyle.

Sensitivity: Acute & Chronic injuries: 35% - 98%
Under anesthesia: 98%
Specificity: Acute & Chronic injuries: 98%

Several modifications: hip positions, knee positions, tibial rotations

A positive pivot shift test in a conscious patient may reflect the patient's inability to protect the knee, which may suggest that these patients are less likely to respond to non-operative treatment.

Physical Examination of the Knee - Jerk Test

Physical Examination of the Knee - Flexion-Rotation Drawer

Physical Examination of the Knee - Rotary Instability Tests - 30
Physical Examination of the Knee

**Anteromedial Rotary Instability Tests**

- Slocum Test with External Tibial Rotation (AMRI)
- Lemaire's anteromedial Jolt Test (T Drawer, Y Test)
- Dejour Test

**Anterolateral Rotary Instability Tests**

- Slocum Test with Internal Tibial Rotation (ALRI)
- Lateral Pivot Shift Test of MacIntosh
- Active Pivot Shift Test
- Lax I Test
- Jerk Test of Hughston
- Crossover Test of Arnold
- Lemaire's Jolt Test
- Nakajima Test
- Huyes Flexion-rotation drawer test
- Flexion-extension valgus test
- Mertens Test

**Posteromedial Rotary Instability Tests**

- Hughston Posteromedial Drawer Test
- Posteromedial pivot shift test

**Posterolateral Rotary Instability Tests**

- Pivot Shift Test
- Jakob Test (Reverse pivot shift maneuver)
- External Rotation Recurvatum Test
- Jerk Test
- Loomer's PLRI Test
- Bouquet external hypermobility test
- Tibial External Rotation Tests
- Hughston Posterolateral Drawer Test
- Dial Test (Tibial External Rotation Test)
- Dynamic posterior shift test
- Active posterolateral drawer sign
- Arcuate Spin Test
- Standing Apprehension Test
- Prox Leg Maneuver

**Medial Stability Tests**

- Valgus stress test at 0°
- Valgus stress test at 30° (SEN: 78-100, SP: 49-100, +LR: 1.8-2.3)
- Hughston's Valgus stress at 0°
- Hughston's Valgus stress at 30°
- Swain Test
- Apley's Distraction Test with ER
- Apley's Distraction Test with ER with DDV (Davies Dynamic Version)

**MCL Valgus Stress Tests - 7**

- Torn MCL
- 0° Extension: MCL, capsule, ACL, PCL, PMOL, etc. (MCL-57%)
- 30° Flexion: MCL (MCL-78%)
Physical Examination of the Knee-
MCL Valgus Stress Test

Physical Examination of the Knee-Apleys Distraction Test

Physical Examination of the Knee-Apley's Distraction-DDV

AMA Nomenclature - Knee Instability Testing
- Classification of knee instability testing:
  - Grade I: mild sprain
  - Grade II: moderate sprain
  - 1+ - 1.5 mm more laxity
  - 2+ - 6-10 mm more laxity
  - Grade III: severe sprain
  - 3+- > 10 mm more laxity

Clinical Pearl - MCL Valgus Stress Testing
- When performing a valgus stress test,
  - Start by “closing the joint” first -
  - Reason is to approximate the joint surfaces so one can palpate the joint line opening and kinesthetically feel the amount of motion

Clinical Pearl - MCL Valgus Stress Injury
- Think about a PF subluxation also as a potential additional injury and a co-morbidity

Clinical Pearl
- MCL Valgus Stress Injury
Physical Examination of the Knee

LCL Varus Stress Tests

- Varus stress test at 0°
- Varus stress test at 30° (SEN:100) (SP:20)
- Hughston's Varus stress at 0°
- Hughston's Varus stress at 30°
- Apley's Distraction Test with IR
- Apley's Distraction Test with IR with DDV (Davies Dynamic Version)

Lateral Stability Tests

- Varus stress test at 0°
- Varus stress test at 30° (SEN:100) (SP:20)
- Hughston's Varus stress at 0°
- Hughston's Varus stress at 30°
- Apley's Distraction Test with IR
- Apley's Distraction Test with IR with DDV (Davies Dynamic Version)

Physical Examination of the Knee

VARUS STRESS TESTS

- 0° Extension: LCL, capsule, ACL, PCL, PLC, etc. (LCL-55%)
- 30° Flexion: LCL (LCL-69%)

Need to be particularly aware of PLC injuries and the potential for rotational movements of the tibia

Physical Examination of the Knee

Meniscus Tests

- Joint Line Tenderness (SEN:27-93) (SP:13-97) (+LR:1.2-31.0)
- McMurray's Test (SEN:14-88) (SP:20-100) (+LR:0.82-9.3)
- Dynamic McMurray's Test
- Apley's Grinding Test (SEN:13-81) (SP:56-100) (+LR:0.80-5.9)
- Apley's Grinding Test with ER with DDV (Davies Dynamic Version)
- Bounce Home Test/Forced extension (SEN:36-47) (SP:67-86) (+LR:1.2-2.9)
- Flexion Block/Forced Flexion (SEN:44-77) (SP:41-68) (+LR:1.0-1.6)
- Steinman's I Point Tenderness Displacement Test (SEN:29-86) (SP:83-88) (+LR:3.88-7.17)
- Steinmann II Sign
- Boehler Test
- Payr Test (SEN:54) (SP:44) (+LR:0.96)
- Axial Pivot-shift test (SEN:71) (SP:83) (+LR:4.2)
- Dynamic test (SEN:85) (SP:90) (+LR:8.5)
- Medial-Lateral Grind Test
- Figure 4 Test (SEN:100) (SP:0)
- Ege's Test (SEN:64-67) (SP:81-90) (+LR:3.5-6.4)
- Thessaly Test at 0°/Disco Test (SEN:31-92) (SP:40-97) (+LR:1.3-30.0)
- Thessaly Test at 5° (SEN:27-81) (SP:91-96) (+LR:6.8-16.5)
- Childress Test/squat/duck waddle (SEN:55-68) (SP:60-67) (+LR:1.7)
- Finochietto Jumping Sign
- O'Donoghue's Test
- Modified Helfet Test
- Test for retreating or retracting Meniscus
- Bragard's Sign
- Anderson Medial-Lateral Grind Test
- Passler Rotational Grind Test
- Cabot's Popliteal Sign
- Thessaly Test at 20°

MENISCUS TESTS

Hey, Practical observations in Surgery, 1803, was the first to describe the "internal derangement of the knee"
Physical Examination of the Knee
- Recurvatum Test
  (SEN: 36-47) (SP: 67-86) (+LR: 1.2-2.9)

- Steinman’s Point Pressure Test
  (SEN: 29-86) (SP: 83-88) (+LR: 3.88-7.17)

- Mc Murray’s Test
  (SEN: 14-88) (SP: 20-100) (+LR: 0.82-9.3)

- McMurray’s Dynamic Test
  (SEN: 13-81) (SP: 56-100) (+LR: 0.80-5.9)

- Apley’s Compression Test
  (SEN: 13-81) (SP: 56-100) (+LR: 0.80-5.9)

MENISCUS TESTS
- Apley Grind Test
  “Surgeon leans well over the patient and with his whole body weight, compresses the tibia downward onto the couch. Again he rotates powerfully....”

OUCH !!!

- No one test is predictive for diagnosis of meniscal tear
- Presence of ACL pathology will render test less effective
- Joint line tenderness, pain with forced hyperflexion (Steinman’s Test), and positive Mc Murray’s together provide best predictor of meniscal tear

Very few tests by themselves are absolutely accurate, therefore the “clusters of signs and symptoms” and using the constellation of exam findings and the corroboration of tests are the key to a good examination and diagnosis.
Physical Examination of the Knee - Plica Syndrome Tests

Medial Patellar Plica Test (SEN:90)(SP:89)(+LR:8.38)
Medial Plica Shelf Test
Medial Plica Test
Rotation Valgus Test
Holding Test
Plica/ Patellar Stutter Test
Hughston's Plica Test
Patellar Bowstring Test
Mediapatellar Plica Test (Mital-Hayden Test)

Physical Examination of the Knee - Miscellaneous Tests

Tests for Osteochondral Lesions
Wilson's test
Proximal Tibiofibular Joint Instability
Fibular Head Translation Test
Patellar tendons/ ligament length test
ILB Syndrome
Noble's Compression Test
Renne's Test
Hughston's Plica Test
Patellar Bowstring Test
Mediopatellar Plica Test (Mital-Hayden Test)

Miscellaneous Tests

Wilson's test
Proximal Tibiofibular Joint Instability
Fibular Head Translation Test
Patellar tendons/ ligament length test
ILB Syndrome
Noble's Compression Test
Renne's Test
Hughston's Plica Test
Patellar Bowstring Test
Mediopatellar Plica Test (Mital-Hayden Test)

Physical Examination of the Knee - Miscellaneous Tests

Flexibility Tests - Cross Innex
Thomas Test
Ober's Test
Modified Ober's Test
Ely's test
Knee Angle Measurements
Q-Angle/ Patellofemoral Angle Test
Tubercle Sulcus Angle (Q-Angle at 90 )
A-Angle
Daniel's Quadriceps Neutral Angle Test
Bayonet Sign
Functional test for Quadriceps Contusion
Test for Inns Extension Contracture (Heel Height Difference)

Functional Testing Algorithm - Knee - 2016

Competitive Athletes
- Sport Specific Testing
- Lower Extremity Functional Tests
- Functional Hop Tests
- Functional Jump Tests
- OKC Isokinetic testing
- CKC Isokinetic Testing
- Sensorimotor System Testing: Balance/ Proprioceptive Testing
- KT 1000/ 2000
- Basic Measurements

Recreational Athletes
- General Orthopaedic Patients

General Orthopaedic Patients
- KT 1000/ 2000
- Basic Measurements

Summary And Conclusions

Thank You