

MULTILIGAMENT INJURIES: CLINICAL AND IMAGING ASSESSMENT

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DIAGNOSIS FUNDAMENTAL FOR TREATMENT SELECTION AND ALGORITHM OF TREATMENT

- ✓ **X-RAY**
- ✓ **MRI**
- ✓ **CT**
- ✓ **ARTERIOGRAPHY**

Brand 2004

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CLASSIFICATION OF KNEE DISLOCATION

Classification	Associated ligamentous injury
KD-I	Dislocation without both cruciates involved
KD-II	Dislocation with bicruciate disruption only
KD-III	Dislocation with bicruciate + posteromedial or posterolateral disruption
KD-IV	Dislocation with bicruciate + posteromedial and posterolateral disruption
KD-V	Dislocation with fracture
KD-V1	Dislocation without both cruciates involved
KD-V2	Bicruciate disruption only
KD-V3M	Bicruciate + posteromedial disruption
KD-V3L	Bicruciate + posterolateral disruption
KD-V4	Posteromedial and posterolateral disruption

Schenk 1994

Wascher 2000

Stannard 2004

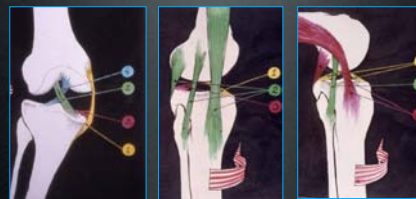
- ✓ **MULTILIGAMENT: 2 OF 4**
- ✓ **KNEE DISLOCATION: 3 OF 4**

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COMBINED INSTABILITY

- ACL +** **MCL (FREQUENT)**
LCL (RARE)
- PCL +** **PMC (RARE)**
PLC (FREQUENT)



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PREOPERATIVE CLINICAL EVALUATION IKDC SCORE

**Classification of the
lesion**



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PHYSICAL EXAMINATION

Structure	Test
ACL	Lachman, pivot shift
PCL	Posterior drawer, posterior sag sign
MCL	Valgus stress at 30° of flexion
LCL	Valgus stress at 30° of flexion
PMC	Slocum test
PLC	External rotation dial testing, posterolateral drawer

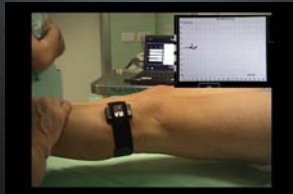
Miller 2010

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SUGGESTIONS

- ✓ **COMPARE WITH CONTRALATERAL KNEE**
- ✓ **PAIN AND MUSCLE CONTRACTION TAKEN INTO ACCOUNT**
- ✓ **EVALUATION UNDER ANESTHESIA FOR FINAL DECISION**



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ACL LESION

LACHMAN



- ✓ **SENSITIVITY 85%**
- ✓ **SPECIFICITY 94%**

PIVOT SHIFT



- ✓ **SENSITIVITY 24%**
- ✓ **SPECIFICITY 98%**

Benjaminse 2006

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ANTERIOR DRAWER TEST



- ✓ **SENSITIVITY 92%**
- ✓ **SPECIFICITY 91%**

RELIABLE JUST IN CHRONIC CONDITIONS

Benjaminse 2006

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COMBINED LESIONS MAY AFFECT PIVOT SHIFT EXAMINATION

Soft-tissue Factors	Effect on Pivot Shift	Mechanism
ITB tightness	Decreases	Restricts subluxation
ITB looseness	Decreases	Allows internal rotation throughout range of motion so that there is no shift
MCL laxity	Decreases	Limits compression of lateral compartment with valgus stress
PLC	Increases	Increases external rotation
Medial meniscectomy	Increases	Increases anterior translation
Bucket-handle meniscus tear	Decreases	Blocks extension
Flexion contracture	Decreases	Prevents extension

ITB = iliotibial band, MCL = medial collateral ligament, PLC = posterolateral corner

Warren 2008
Miller 2010

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PCL EVALUATION TESTS

POSTERIOR DRAWER



POSTERIOR SAG

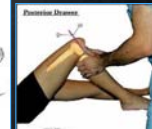


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POSTERO LATERAL COMPARTMENT EVALUATION ALGORITHM

- ✓ **FULL LENGTH X-RAY (VARUS EVALUATION)**
- ✓ **CLINICAL TEST:**
 - ✓ **EXTERNAL ROTATION RECURVEMENT TEST**
 - ✓ **VARUS STRESS AT 30°**
 - ✓ **DIAL TEST AT 30° AND 90°**
 - ✓ **POSTERO-LATERAL DRAWER TEST**
 - ✓ **REVERSE PIVOT SHIFT**
 - ✓ **VARUS THRUST DURING GAIT**

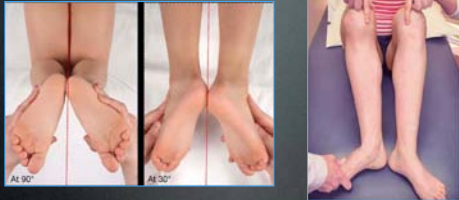


La Prade 2002

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DIAL TEST AT 30° AND 90°

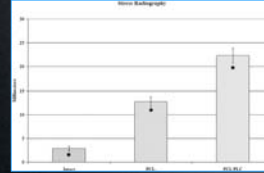


- > 15° ASYMMETRY AT 30° → ISOLATED PLC
- > 15° ASYMMETRY AT 30° and 90° → PCL+PLC

Grood 1988
Miller 2010

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POSTERIOR STRESS RADIOGRAPHS



<10.0 mm DISPLACEMENT → PCL LESION

>10.0-12.0 mm DISPLACEMENT → PCL+PLC LESION

Sekiya 2008
Schulz 2007
Menetrey 2007

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VARUS STRESS RADIOGRAPHS

Lesion Type	12-Hen Moment	Combined Applied Varus Stress	P Value
Isolated	8.87 (6.37 to 13.37)	6.73 (7.38 to 12.20)	<0.0001
Posterior cruciate ligament	10.00 (7.51 to 14.50)	12.43 (9.94 to 15.94)	<0.0001
Posterior lateral ligament	10.00 (7.51 to 14.50)	12.43 (9.94 to 15.94)	<0.0001
Posterior cruciate ligament	10.00 (7.51 to 14.50)	12.43 (9.94 to 15.94)	<0.0001
Posterior cruciate ligament	10.00 (7.51 to 14.50)	12.43 (9.94 to 15.94)	<0.0001
Isolated	10.00 (7.51 to 14.50)	12.43 (9.94 to 15.94)	<0.0001



SIDE TO SIDE DIFFERENCE > 2.7mm → III LCL

SIDE TO SIDE DIFFERENCE > 4.0mm → LCL + PLC

La Prade 2008

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MCL BIOMECHANICS

CUTTING STUDIES:

- ✓ prox sMCL PRIM. REST. for VALGUS-STRESS
- ✓ dist sMCL PRIM. REST. for E-R at 30° flex
- ✓ POL+ dist sMCL PRIM. REST. for I-R all flex ang
- ✓ menisco-tibial dMCL PRIM. REST. for I-R (0-30°)
- ✓ menisco-fem. dMCL PRIM. REST. for I-R (20-90°)



Griffith, AJSM, 2009

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VALGUS STRESS TEST



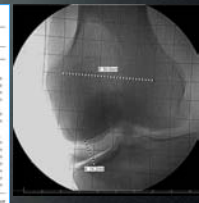
VALGUS STRESS TEST AT 30° MCL LESION
IN FULL EXTENSION MCL+ACL

Miller 2010

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VALGUS STRESS RADIOGRAPHS

Position Angle Applied Load	0°	30°	60°	90°
	10 N vs.	10 N vs.	10 N vs.	10 N vs.
	Medial Axis Line Gapping (mm ± standard deviation)	Medial Axis Line Gapping (mm ± standard deviation)	Medial Axis Line Gapping (mm ± standard deviation)	Medial Axis Line Gapping (mm ± standard deviation)
Isolated	8.8 ± 0.5	7.8 ± 0.3	6.4 ± 0.5	7.4 ± 0.3
Posterior MCL	9.2 ± 0.5	8.2 ± 0.5	6.8 ± 0.5	7.8 ± 0.5
ACL	11.2 ± 0.5	10.2 ± 0.5	8.8 ± 0.5	9.8 ± 0.5
Isolated MCL	10.4 ± 0.5	9.4 ± 0.5	8.0 ± 0.5	9.0 ± 0.5
ACL	12.4 ± 0.5	11.4 ± 0.5	10.0 ± 0.5	11.0 ± 0.5
PCL	10.4 ± 0.5	9.4 ± 0.5	8.0 ± 0.5	9.0 ± 0.5
Isolated	8.8 ± 0.5	7.8 ± 0.3	6.4 ± 0.5	7.4 ± 0.3
Posterior MCL	9.2 ± 0.5	8.2 ± 0.5	6.8 ± 0.5	7.8 ± 0.5
ACL	11.2 ± 0.5	10.2 ± 0.5	8.8 ± 0.5	9.8 ± 0.5
Isolated MCL	10.4 ± 0.5	9.4 ± 0.5	8.0 ± 0.5	9.0 ± 0.5
ACL	12.4 ± 0.5	11.4 ± 0.5	10.0 ± 0.5	11.0 ± 0.5
PCL	10.4 ± 0.5	9.4 ± 0.5	8.0 ± 0.5	9.0 ± 0.5
ACL	12.4 ± 0.5	11.4 ± 0.5	10.0 ± 0.5	11.0 ± 0.5



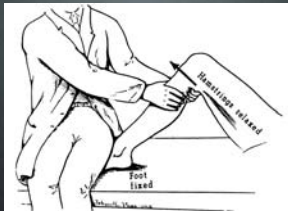
AT 20° > 3.2mm → GRADE III MCL

ISOLATED MCL OPEN ALSO IN EXTENSION

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SLOCUM TEST



PMC INJURY DRAWER TEST WITH 15° EXTERNAL FOOT ROTATION

Slocum 1968

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CLASSIFICATION OF POSTERO LATERAL INSTABILITY

Class	Physical Examination Findings	Corresponding Injury
PLI A	Increased external rotation only	Popliteofibular ligament and popliteus tendon
PLI B	Increased external rotation and increased varus laxity of approximately 5mm at 30° knee flexion	Popliteofibular ligament, popliteus tendon, and LCL
PLI C	Increased external rotation and gross varus laxity of 10 mm at 30° of knee flexion	Popliteofibular ligament, popliteus tendon, LCL, lateral capsule, and ACL/PCL

Fanelli 2007

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CLASSIFICATION OF POSTERO MEDIAL INSTABILITY

Class	Physical Examination Findings	Corresponding Injury
PMI A	Increased anteromedial or posteromedial rotation only	Posteromedial capsule
PMI B	Increased anteromedial or posteromedial rotation, combined with valgus laxity with firm end point	Posteromedial capsule and superficial medial collateral ligament
PMI C	Increased anteromedial or posteromedial rotation, combined with valgus laxity with no firm end point	Posteromedial capsule, superficial medial collateral ligament, medial and/or

Fanelli 2007

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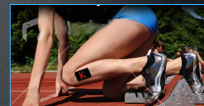


CONCLUSIONS

- ✓ ACCURATE PRE-OPERATIVE EVALUATION
- ✓ ACCURATE INTRAOPERATIVE EVALUATION (TO DETERMINE THE SURGICAL STRATEGY AND EVALUATE KINEMATIC FINAL PERFORMANCE)
- ✓ ACCURATE POST-OP. FUNCTIONAL EVALUATION



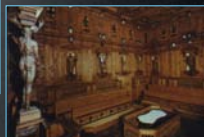
FUNCTIONAL ASSESSMENT



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**ISTITUTO ORTOPEDICO RIZZOLI
III CLINICA ORTOPEDICA**



THANK YOU

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