First Time Patella Dislocation

MIZZOU

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Disclosures

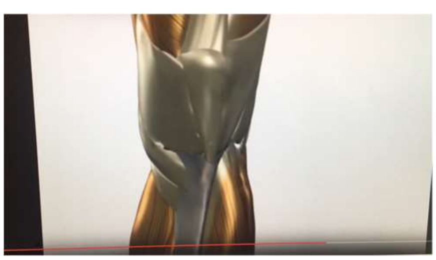
- Committees: AAOS Sports Medicine/Arthroscopy Chairman, AOSSM Publication, AANA Health Policy, ISAKOS Knee/Joint Preservation, ACL Study Group Membership Committee
- Editorial Board: Arthroscopy Journal, American Journal of Orthopedics, Current Orthopedic Practice
- Research Support: Arthrex, RTI, Zimmer, Cartiheal
- Consultant: Arthrex, RTI, Vericel, Conmed, Moximed, Ceterix
- Advisory Boards: Vericel, RTI, Neotis

SSL1

- Special Thanks to Jackie Brady

First Time Patella Dislocation

- Evolving and controversial topic



Slide 2

SSL1 Sherman, Seth L., 9/7/2018

International Patellofemoral Study Group

Case Vignette

- 26M soccer athlete
- 14yo F volleyball athlete

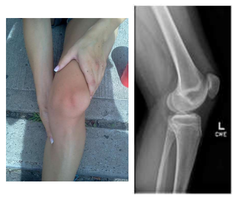
First time patella dislocations without loose bodies or osteochondral fracture

Case Vignette

- 26M soccer athlete, first time patella dislocation
  - Contact mechanism
  - No prior event
  - Normal bony alignment parameters
    - Normal patella height (CD ratio 1.1)
    - No trochlea dysplasia
    - Normal TT-TG
    - No patella tilt

Case Vignette

- 14yo F ,volleyball athlete, first time patella dislocation
  - Non-contact event
  - Prior dislocation event on opposite knee
  - Abnormal bony parameters
    - Patella alta (CD ratio 1.3)
    - Trochlear dysplasia (Dejour B)
    - Lateralized force vector (TT-TG 17)
    - Patella tilt (21 degrees)



Questions to Consider

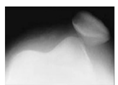
- Is the natural history of each condition the same?
- Should our treatment plan be the same?

Incidence highest in young females

- *Nietosvaara JPO 1994*: 43/100,000 <16 y/o
- *Fithian AJSM 2004*: 5.8/100,000
  - **Adolescent women: 33/100,000**
- *Waterman J Knee Surg 2012*: 2.29/100,000
  - Peak incidence **15-19 y/o**
- *Saunders Sports Health 2017*: 23.2/100,000

Background

- Sports related 61-72%
- High index of suspicion
  - Majority will spontaneously reduce


Initial Management

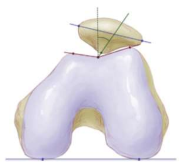
- No consensus on early mobilization and weightbearing
  - Immobilization in flexion
    - Impractical-> atrophy and stiffness, DJD
  - Early brace protection, ROM as tol, WBAT with crutches
    - Aspirate hemarthrosis prn

Imaging

- Standard X-ray series including mechanical axis view
- MRI
  - r/o osteochondral fracture/loose body
  - Relevant anatomy for risk stratification

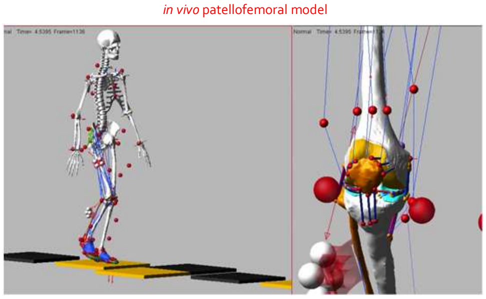
Risk Factors for Recurrence

- Carefully evaluate for and measure risk factors for recurrence
  - Normal vs. abnormal bony architecture

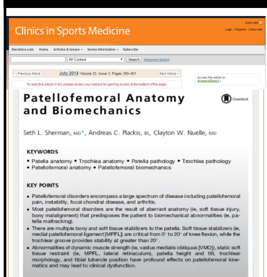


Biomechanics Refresher Course

in vivo patellofemoral model



Applied Anatomy/Biomechanics



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Patellofemoral Anatomy and Biomechanics

Seth L. Sherman, MD*, Andreas C. Plackis, BS, Clayton W. Nuelle, MD

KEYWORDS

- Patella anatomy • Trochlea anatomy • Patella pathology • Trochlea pathology
- Patellofemoral anatomy • Patellofemoral biomechanics

KEY POINTS

- Patellofemoral disorders encompass a large spectrum of disease including patellofemoral pain, instability, focal chondral disease, and arthritis.
- Most patellofemoral disorders are the result of aberrant anatomy (ie, soft tissue injury, bony malalignment) that predisposes the patient to biomechanical abnormalities (ie, patella maltracking).
- There are multiple bony and soft tissue stabilizers to the patella. Soft tissue stabilizers (ie, medial patellofemoral ligament [MPFL]) are critical from 0° to 20° of knee flexion, while the trochlear groove provides stability at greater than 20°.
- Abnormalities of dynamic muscle strength (ie, vastus medialis obliquus [VMO]), static soft tissue restraint (ie, MPFL, lateral retinaculum), patella height and tilt, trochlear morphology, and tibial tubercle position have profound effects on patellofemoral kinematics and may lead to clinical dysfunction.

Patella Height

- Patella Alta
  - Longer to stabilize in groove-> INSTABILITY

Patella Height

- Patella Alta
  - Caton-Deschamps
  - Patellotrochlear Index

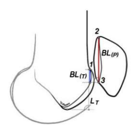
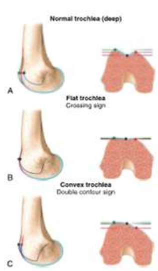


Fig. 1 Patellotrochlear index measurement[4].: BL_P Baseline patella (*2* superior most aspect of articular cartilage to *3* inferior most aspect); BL_T: Baseline trochlea (length of trochlear articular surface from *1* superior most aspect with respect to *3* the inferior most aspect of the articular patellar cartilage using a right angle and parallel lines); *Ratio* BL_T BL_P calculated in percentages; L_T Length of trochlear cartilage (superior most aspect to inferior most aspect of trochlea using a *vertical line*)

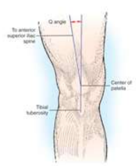
Trochlear Dysplasia

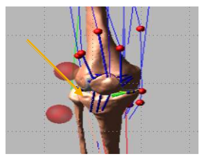


Normal | Trochlea Dysplasia

Lateralized Force Vector

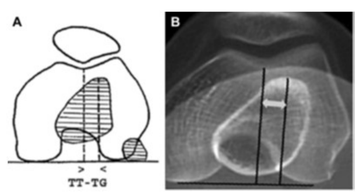
- Estimated by the Q angle



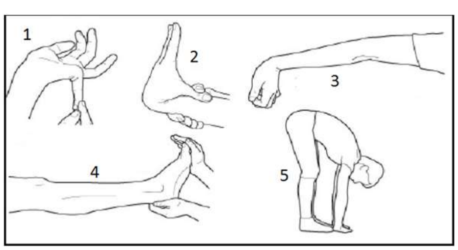


Lateralized Force Vector

- Quantified by the Tibial Tubercle-Trochlear Groove Distance (TT-TG)



Many other factors at play …



Many other factors at play…

Many other factors at play…

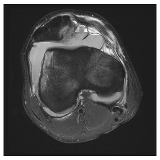
- Personal history of contralateral dislocation
- Family history of patella instability

Medial Patellofemoral Ligament

- Primary restraint to lateral translation of the patella from 0-30 °
  - Torn in 99% of patella dislocation events (~250N)
    - Location of tear variable

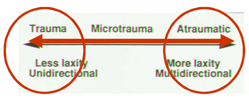
Chondral/Osteochondral Injury

- Stanitski and Paletta *AJSM* 1998: 71%!

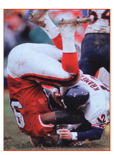
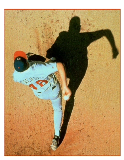



Borrow Concept from the Shoulder

TUBS
Traumatic
Unilateral
Bankart
Surgery



AMBRI
Atraumatic
Multidirectional
Bilateral
Rehab
Inferior Capsular Sx

Over simplification

- High energy dislocation / contact injury
  - Normal anatomy
    - Hemarthrosis
      - Risk of osteochondral injury
    - Lower risk of recurrent instability
      - Higher risk of <u>ACUTE</u> fracture fixation or loose body removal
- Low energy dislocation/ non-contact injury
  - Abnormal anatomy
    - Less swelling
    - Higher risk of recurrent instability
      - Lower risk of <u>ACUTE</u> osteochondral injury requiring imminent surgery

Current Treatment Paradigm

- Majority of first time patella dislocations without fracture or loose body are treated **NON-OPERATIVELY**

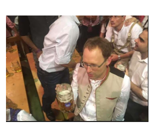
Rates of Recurrence

- 17-71%

  - *Fithian et al AJSM 2004*
  - *Palmu et al JBJS 2008*
  - *Seeley et al JPO 2012 (pediatric)*
  - *Balcarek et al KSSTA 2013*
  - *Jaquith and Parikh JPO 2015 (pediatric)*
  - *Lewallen et al J Knee Surg 2015*

Non-operative Treatment of 1st Time Dislocation

- *Magnussen et al KSSTA 2017*
  - Mean 3-year follow-up of first-time dislocators treated non-operatively
  - 26.4% returned to activities without limitations
    - 86.8% cited their patellar dislocation



Cost-Effectiveness Model

- *Nwachukwu et al, AJSM 2017*
  - QALY = Quality-Adjusted Life Year
  - Non-op tx least costly but least effective
  - Immediate surgery and delayed surgery both effective
    - Immediate surgery = highest QALY gains within 10-year time horizon

Risk Factor Stratification of 1st Time Dislocation

- *Balcarek et al KSSTA 2013: 66%*
  - Age ≤ 16 years
  - Contralateral instability
  - Trochlear dysplasia
  - Patella alta > 1.2
  - TT-TG ≥ 16 mm
  - Patellar tilt > 20°
  - 4 or more points: OR 4.88 compared with ≤ 3 points

Risk Factor Stratification

J Pediatr Orthop. 2017 Oct/Nov;37(7):484-490. doi: 10.1097/BPO.0000000000000674.

Predictors of Recurrent Patellar Instability in Children and Adolescents After First-time Dislocation.

Jaquith BP[1], Parikh SN.

- Multivariate risk factor analysis
  - Patella alta (CD>1.45)
  - Trochlear dysplasia
  - Skeletal immaturity
  - Contralateral patella dislocation
- The presence of all 4 multivariate risk factors had a predicted risk of recurrence of 88%
- The presence of any 3 risk factors had a predicted risk of about 75% and the presence of any 2 risk factors had a predicted risk of about 55%.

Risk Factor Stratification of 1st Time Dislocation

- *Dahm et.al JKS 2015*
  - Trochlear dysplasia (HR 3.27, p <0.01)
  - Immature physes (HR 2.22, p <0.01)
  - Younger age (HR 1.09, p <0.01)
  - Patella alta (HR 1.61, p=0.02)

Risk Factor Stratification of 1st Time Dislocation

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  - Younger age (HR 1.09, p <0.01)
  - Patella alta (HR 1.61, p=0.02)
  - Sports related injuries (HR 1.97,p <0.01)

Risk Factor Stratification of 1st Time Patella Dislocation

Patella Alta	Trochlear Dysplasia	Younger Than 25 Years	5-year Risk Of Recurrence
√	√	√	70%
	√	√	60%
√		√	34%
√	√		30%
		√	27%
	√		23%
√			11%
			9%

Surgical Treatment Recommended

Non-Surgical Treatment Recommended

Case Vignette

- 26M soccer athlete, first time patella dislocation
  - Contact mechanism
  - No prior event
  - Normal bony alignment parameters
    - No static lateralized force vector (TT-TG 13)
    - Normal patella height (Caton-Deschamps 1.1)
    - No trochlea dysplasia
    - Normal patella tilt

NON-OPERATIVE TREATMENT

Non-operative Treatment

- 'Core to floor' protocol
  - Quad, core, posterior chain (glut, hamstring, hip rotators)
  - Sleeve and/or PS brace
- Functional Progression
  - Neuromuscular imbalance
    - H:Q ratio
    - Dynamic valgus
    - Sport specific

RTP Following Patella Instability


Sports Health: A Multidisciplinary Approach

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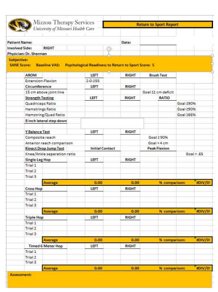
Development and Validation of a Portable and Inexpensive Tool to Measure the Drop Vertical Jump Using the Microsoft Kinect V2

Aaron D. Gray, MD*, Brad W. Willis, MPT, Marjorie Skubic, PhD, Zhiyu Huo, PhD, Swithin Razu, MS, Seth L. Sherman, MD, Trent M. Guess, PhD, Amirhossein Jahandar, BS, Trevor R. Gulbrandsen, BS, Scott Miller, BS, Nathan J. Siesener, BS Show less ^


Mizzou Therapy Services
University of Missouri Health Care

Return to Sport Report

Patient Name: Date:
Involved Side: RIGHT
Physician: Dr. Sherman

Subjective:
SANE Score: Baseline VAS: Psychological Readiness to Return to Sport Score: 5

AROM	LEFT	RIGHT	Brush Test	
Extension-Flexion	2-0-155			
Circumference	LEFT	RIGHT		
15 cm above joint line			Goal ≤1 cm deficit	
Strength Testing	LEFT	RIGHT	RATIO	
Quadriceps Ratio				Goal ≥90%
Hamstrings Ratio				Goal ≥90%
Hamstring/Quad Ratio				Goal ≥66%
8 inch lateral step down				
Y Balance Test	LEFT	RIGHT		
Composite reach			Goal ≥ 90%	
Anterior reach comparison			Goal < 4 cm	
Kinect Drop Jump Test	Initial Contact		Peak Flexion	
Knee/Ankle seperation ratio				Goal > .65
Single Leg Hop	LEFT	RIGHT		
Trial 1				
Trial 2				
Trial 3				
Average	0.00	0.00	% comparison:	#DIV/0!
Cross Hop	LEFT	RIGHT		
Trial 1				
Trial 2				
Trial 3				
Average	0.00	0.00	% comparison:	#DIV/0!
Triple Hop	LEFT	RIGHT		
Trial 1				
Trial 2				
Trial 3				
Average	0.00	0.00	% comparison:	#DIV/0!
Timed 6 Meter Hop	LEFT	RIGHT		
Trial 1				
Trial 2				
Trial 3				
Average	0.00	0.00	% comparison:	#DIV/0!

Assessment:

RTP Following Patella Instability

Table 1
International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine Criteria for RTP After Patellofemoral Instability
(Source: International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine)

• Complete radiographic healing of bone if bony surgery is involved
• Full or near full range of motion
• No knee effusion
• No complaints of knee pain or knee instability
• Satisfactory core strength and endurance
• Completed neuromuscular training/proprioception
• Acceptable control with dynamic activities
• Limb Symmetry Index greater than 85% on hop tests
• Adequate performance with a physical therapist during sport-specific drills simulating the intensity and movement patterns of the given sport
• Athlete demonstrates a psychological readiness to return to sport (SANE score greater than 80 of 100)

Case Vignette

- 14yo F ,volleyball athlete, first time patella dislocation
  - Non-contact event
  - Prior dislocation event on opposite knee
  - Bony alignment parameters
    - Lateralized force vector (TT-TG 17)
    - Patella alta (CD ratio 1.3)
    - Trochlear dysplasia (Dejour B)
    - Patella tilt (21 degrees)

OPERATIVE TREATMENT

More questions than answers…

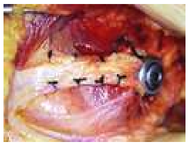
- Non-operative
  - Faster return
  - No surgical risk
  - Risk of recurrent instability on chondral/ligament status?
- Operative
  - Reduced recurrence rates
  - Surgical morbidity (i.e.stiffness)
  - Longer time to return
  - Functional outcomes and RTP?

Any Role for MPFL Repair?

- Consider acute MPFL repair in patients with ostechondral fracture/loose body AND
  - Normal underlying anatomy
  - Good tissue quality
  - Distinct zone of injury (patella or femur)
- No role for MPFL repair in risk stratification of patients for first time surgery without loose body or fracture
  - Abnormal underlying anatomy and risk of failure

Role for Acute MPFL Repair?

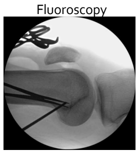
- Acute repair does NOT reduce recurrence rates
  - Christiansen *Arthroscopy* 2009
  - Sillanpaa *AJSM* 2008
  - Hing *Cochrane Data*



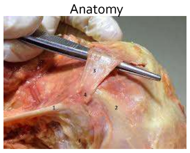
MPFL Reconstruction

- *Bitar AJSM 2012*: MPFL reconstruction reduces recurrence (35% vs 0%)

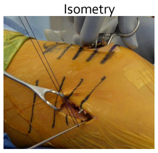
Fluoroscopy



Anatomy



Isometry



Acute Surgical Management

- No current role for bony surgery for 1st time patella dislocation
  - Worry about MPFL isometry in severe cases (CD 1.5, TT-TG>20)
  - Consider guided growth in high risk skeletally immature patients

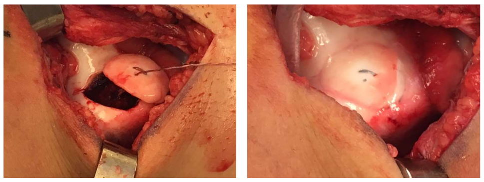
Clear Surgical Indications

- Irreducible dislocations
- Large chondral or osteochondral fractures
- Loose bodies

Case example: First time patella dislocation and LFC osteochondral fracture

- 13yo autistic male s/p patella dislocation
  - Internal fixation LFC
  - Physeal sparing MPFL/ LRL

Case Example: Cartilage Only Fixation



Patellar Instability Management

A Survey of the International Patellofemoral Study Group

- *Liu et al, AJSM 2017*
  - Consensus statement:
    - If addressing cartilage injury in first-time dislocator, address patellar instability concurrently
    - No lateral release in isolation for patellar instability

Does all this make any sense?

Conclusions

- Management of the first time patella dislocator is evolving
- Still treating the vast majority without osteochondral fracture or loose body non-operatively
  - Risk stratification discussion with patient/family
  - Enrolling in prospective studies (i.e. JUPITER, PAPI)
- If fixing or removing fragment, add soft tissue stabilization
- Isolated MPFL reconstruction is gold standard surgical treatment

Thanks!

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- www.mizzousportsdoc.com