Patellofemoral Problems

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Patellofemoral Disorders

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Introduction

- Common complaint...often frustrating for the athlete / PT or ATC / MD
- Many differential diagnoses
- Plethora of new ideas and literature last decade

Anatomy: Extensor Mechanism

- Quadriceps...
  VMO, VLO, RF
- Medial patellofemoral ligament (MPFL)
- Lateral retinaculum
- Patellar tendon
- Tibial tubercle
- Patella
- Femoral trochlea

Patellar Contact Area

- Contact: Begins 10°-20°
- Location...
  - Distal 1/3 to proximal 1/2 of patella with flexion
- Size...
  - Increases 20°-90°
  - Never > 1/3 patella

Patellar articular cartilage

- Thickest proximally and laterally

Patellar Contact Area

- Pressure ↓ with flexion
- Maximal at 60°- 90°
- Patellar articular cartilage
- Thickest proximally and laterally
**Patellar Tracking**

**Femoral Contact**
- $0^\circ$ - Lies laterally
- $20-90^\circ$ - Trochlear groove
- $>90^\circ$ - Laterally over LFC
- $135^\circ$ - Covers LFC

**Patellofemoral Forces**
- Level walking: $0.5 \times BW$
- Stairs: $3.0 \times BW$
- Running: $5.0 \times BW$
- Deep knee bend: $7.5 \times BW$

**Patellar Classification (Wiberg)**

- **Type I (10%)**
  - Facets same
  - Symmetric
  - Concave facets

- **Type II (65%)**
  - Medial $<$ Lateral
  - Lateral - concave
  - Medial - convex

- **Type III (25%)**
  - Medial $1/4$ Lat.
  - Lateral - flat
  - At risk!

**Medial Patellofemoral Ligament (MPFL)**

**Anatomy**
- Deep to vastus medialis
- Superficial to capsule

**Femoral origin**
- “Saddle” - add. tubercle & medial epicondyle

**Patellar insertion**
- Medial proximal 2/3

**Biomechanics**
- Draws patella into trochlea $0^\circ$ – $20^\circ$
- Loosens after patella in trochlea
- Checkrein to lateral subluxation (50-60%)
- Anterior fibers attached to VMO

**Conlan, JBJS '93**

**Lateral Retinaculum**

- Superficial layer
  - Oblique retinaculum
  - Vastus lateralis
- Deep layer
  - Epicondylar patellar
  - Deep transverse ret.
  - Patellotibial band
**Patellofemoral Pain**

**History**
- ? Dislocation / Instability
- ? Dull or sharp
- ? Crepitation
- ? Swelling
- ? Where in flexion arc

**“Miserable Malalignment”**
- Alignment / Rotation
- Femoral anteversion
- Genu valgum
- Tibial torsion
- Don’t forget the feet!

**Q Angle**

**Standard Technique**
- Supine
- ASIS – Patella – Tubercle
- Normal: 15°
- Abnormal: > 20°
- Slight flexion to avoid underestimation of angle

**Physical Exam**
- Observe tracking
- “J” sign
- Measure Q angle
- Careful palpation
- Quad flexibility
- Ligamentous laxity ?

**Radiographic Evaluation**

**Insall-Salvatt**
- IS ratio: 0.9-1.2 nl
- Alta >1.2  Baja < 0.8
- Poor reliability

**Blackburn-Peel**
- Patellar articular surface
- Distance to tibial plateau
- Patella / trochlea relationship
- More consistent
Radiographic Evaluation

Lateral View

- Shallow trochlea
- Crossing sign

Merchant View

Congruence Angle

- Angle BAC, bisected by reference line
- >150 deg is abnormal

Sulcus Angle

- If apex of ridge... 
  - medial to bisector (-)
  - lateral to bisector (+)

Merchant View

Normal

- Angle abnormal if...
  - >16 degrees

- Subluxation...
  - patellar apex lateral to bisector of femoral sulcus angle

CT Scan

- Mid-Patellar transverse cuts @ 15°, 30°, 45°
- Static test - no dynamic influence
- Helps to predict successful result for LRR

Shea & Fulkerson, Arthroscopy '92

TT-TG Distance

(Tibial Tubercle - Trochlear Groove)

- MRI (cuts in extension)
- Center of tibial tubercle
- Deepest point trochea
- Ni: 13mm  Abnl: >20 mm*

* Indication for distal realignment procedure
Anterior Knee Pain

Differential diagnosis
- HNP L3-4 level
- Hip pathology
- Tumors
- Regional pain syndrome
- Etc.

Differential diagnosis
- Prepatellar bursitis
- Patellar tendinitis
- Osgood-Schlatter’s
- Plica
- Neuroma
- OCD
- Osteochondral fx
- Patellar tilt (ELPS)
- Patellar instability
- PF arthritis

Patellar Tilt: “ELPS”
- Tight lateral retinaculum
- Lateral facet forces
- +/- Subluxation
- Median Ridge

Clinical Presentation
- Lateral pain
- Q angle normal
- +/- Effusion
- + Patellar tilt test
- +/- Medial glide

Most respond to conservative treatment

Patellar Tilt

Radiographic progression
- Early patellar tilt
- Progressive arthritis
- Secondary subluxation

Surgical Treatment
- Sxs after 6 months of rehab
- CT Scan helpful to confirm diagnosis & predict results
- Lateral Retinacular Release
- +/- Chondroplasty patella
**Lateral Retinacular Release**

*Literature Review*

- Results: 75-90% success
- Arthroscopic = Open
- Chondral disease . . .
  - Less satisfactory results
- Subluxation . . .
  - Less predictable
- Complications . . .
  - Hemarthrosis 4%
  - Medial subluxation if vastus lateralis violated

*Latterman, J Knee Surg. ‘06
Panni, Arthroscopy ‘05
Aderinto, Arthroscopy ‘02*

**Patellar Instability**

- Acute Patellar Dislocation
- Recurrent Patellar Dislocation
- Recurrent Patellar Subluxation

**Patellar Dislocation in Athletes**

*Clinical Presentation (TONES)*

- T: Traumatic, sports related
- O: Older, Osteochondral fx common
- N: Normal PF alignment / architecture
- E: Equal sex distribution
- S: Single occurrence, single leg

*Hinton & Krishnan*

**Acute Patellar Dislocation**

*History*

- Traumatic dislocation
- Relocation injuries . . .
  - Medial facet patella
  - Lateral femoral condyle
- X-Ray: ? loose fragment

*Physical Exam*

- Hemarthrosis
- Block in ROM
- Medial retinacular tenderness

**Initial Treatment**

- X-ray: no fragment, minimal subluxation
- Immobilize 3-4 weeks
- PT, patellar sleeve
- Return 8-12 weeks
- Recurrence 15-44%

*Fithian, AJSM ‘04*

**Surgical Indications**

- Literature controversial
- Xray:
  - Loose body
  - Missed 50% (Boden, JAAOS ‘97)
- MRI:
  - Osteochondral fragment
  - Location MPFL injury
Acute Patellar Dislocation

**Surgical Treatment**
- Arthroscopic removal
- +/- Repair MPFL avulsion
- +/- Lateral release
- Literature conflicting . . .

Non-op vs Surgery ???

Ahmed, AJSM '00  Nikku, AJSM '05  Christian, Arthroscopy '08

Recurrent Patellar Dislocation

**Surgical Options**
- Proximal - alone
  - MPFL plication
  - +/- Lateral release
  - MPFL reconstruction
- Distal realignment – alone
  - Tibial tubercle transfer
- Combined proximal & distal procedures

MPFL Reconstruction

**Indications**
- Recurrent Instability
- Deficient medial structures
- Normal Q angle
- Normal TT-TG distance

**Contra-indications**
- Pain / Patellar arthrosis
- Malalignment
- +/- Trochlear dysplasia

**Surgical Technique**
- Anatomic placement of the MPFL femoral origin is essential!

Schottle, AJSM '07, AJSM '07

**Results**
- Multiple clinical series
- Low re-dislocation rates
- Longterm f/u lacking
- “Limited but growing evidence - good results for right indications”

Hautama, CORR '98, Nomura, Arthroscopy '03, Teige, Orthopedica '04, Gomes, Arthroscopy '04, Deie, AJSM '11, Buckens & Saris, AJSM '10
**MPFL Reconstruction**

**Complications**
- Patellar fracture
- Anisometric grafts
- Stiffness
- Over-tightening !!!
- PF Arthrosis

*Bowers & Stein, OTSM '10*

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**Recurrent Patellar Subluxation**

**Clinical Presentation (LAACS)**
- L: Laxity, Low age at 1st dislocation
- A: Atraumatic
- A: Abnormal PF alignment
- C: Chronic, Contralateral
- S: Sex dependent - females

*Hinton & Krishn*

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**Patellar Subluxation**

**Clinical Presentation**
- “Giving way”
- + Apprehension
- ↑ Lateral glide
- ↑ Q Angle > 20°

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**Patellar Subluxation**

**Operative Treatment**
- Lateral release alone is unpredictable
- MPFL reconstruction
- Tibial tubercle transfer
  - Elmslie-Trillaux
  - Fulkerson (AMTTT)

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**Patellar Subluxation**

**Normal Merchant**
- Apex patella medial
- Normal PF joint

**Abnormal Merchant**
- Apex patella lateral
- Lateral PF narrowing

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**Anteromedial Tibial Tubercle Transfer**

“Fulkerson Osteotomy”
- Articular lesions . . .
  - distal and lateral patella
- AMTTT shifts load . . .
  - proximal and medial
- Results . . .
  - 80-90% satis. @ 2yrs
  - But ...70-75% @ 5 yrs

*Fulkerson, AJSM '90*

*Morshuis, Clin Orthop'90*
**Fulkerson Osteotomy (AMTTT)**

**Modified Fulkerson Osteotomy in Athletes**

*Tjoumakaris, Bradley, AJSM '10*

- N = 34 athletes (41 knees)
- All dislocation & patella alta
- AMTTT & distal advancement
- All had LRR, No MPFL recon.
- 97% returned to athletics
- 1 recurrent dislocation (E-D syndrome)

**Dashboard Knee**

- Impaction at 90° flexion
- Proximal patellar injury
- No malalignment
- No lateral release
- Scope debridement: +/- helpful
- Anteriorization . . .
  may worsen symptoms!

**Patellofemoral Arthritis**

**Clinical Presentation**

- Post-traumatic
- Posterior instability
- S/P patellofemoral surgery
- Crepitation & effusions
- Entire patellofemoral joint
Chondromalacia

**Outerbridge Classification**

- **I** - Softening
- **II** - Fibrillation (<1/2”)
- **III** - Fissuring bone (>1/2”)
- **IV** - Exposed bone

Patellofemoral Arthritis

**Surgical Options**

- Scope debridement
- Maquet procedure
  - “anteriorization”
  - transfers forces proximally
  - 30-60% success @ 5yrs
- “Steep” Fulkerson ...
  - with bone graft

Patellofemoral Arthroplasty

**Clinical Results**

- 80-90% Good & Excellent
- Follow-up: 5 to 17 years
- Minimal or no pain
- Complications low

Koolman, JBJS Br ’03
Lonner, AAGS ’04
Merchant, J Arthroplasty ’04

Patellofemoral Arthroplasty

**Clinical Results**

- N=25, Custom prosthesis
- Average age 45 yrs
- Follow-up 73 mos (32-119)
- G&E 100% (18E, 7G)
- No pain, no re-operations
- Cost +30%, 8 weeks delivery

Sixto & Sarin, JBJS ’06
Patellofemoral Arthroplasty

Surgical Technique

Summary
- Isolated PF Arthritis
- < 55 years of age
- Modern designs...
  - improved results
  - more predictable results
- Revision to TKA good results

Thank You

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