MOVEMENT IMPAIRMENTS OF THE KNEE

Presented by:
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Objectives

- Define movement impairments
- Identify movement impairments of the knee and common contributing factors
- Examine common Movement Impairment Syndromes (MIS) of the knee using patient examples & case studies
Movement Impairments

- APTA defines impairments as “abnormalities of structure or function”
- Biomechanical dysfunctions of a joint or contiguous joints that lead to musculoskeletal pain or injury
- Guides Tx: Cause vs. Source

Common Mov’t Impairment Seen in Young Female Athletes

Dynamic Knee Valgus (DKV)
- Hip (femoral) adduction + IR
- Knee abduction (valgus)
- Knee (tibial) ER
- Foot eversion

PATIENT EDUCATION -

JOSPT 2012;42(6):573.
### Literature on Movement Impairments - ACL -

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Journal/Publication</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Hewett et al.</td>
<td>Am J Sports Med 2005</td>
<td>Female athletes with knee valgus &gt;8° during jump landing more likely to have non-contact ACL injury than those with &lt;8°</td>
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<tr>
<td>Hewett et al.</td>
<td>NAJSPT 2010</td>
<td>4 Neuromuscular imbalances associated with non-contact ACL injury in female athletes: Ligament, Quadriceps, Trunk, &amp; Leg dominance</td>
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<tr>
<td>LaBella et al.</td>
<td>Pediatrics 2014</td>
<td>Non-contact ACL - decelerating DKV during athletic maneuvers</td>
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<td></td>
<td><a href="http://aap.org/cosmf">http://aap.org/cosmf</a></td>
<td>RCTs of ACL prevention programs: &quot;plyometric training combined with technique training &amp; feedback to athletes regarding proper form, common components that effectively reduced injury rates.&quot; Up to 72% reduction in &lt; 18 y/o</td>
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### Literature on Movement Impairments - PFPS -

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<tr>
<th>Author(s)</th>
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<tr>
<td>Baldon et al.</td>
<td>JOSPT 2014</td>
<td>FST = hip strengthening AND LE + trunk movement control ex. superior to quadriceps strengthening alone, More eccentric hip Abd/HS strength &amp; more trunk mm. endurance, Lesser ipsilateral trunk lean, contralateral pelvic drop, hip Add &amp; knee Abd (valgus) &amp; greater hip flexion excursion during SL squat</td>
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Take Home Message from Literature³⁻⁸

- Address strength: posterolateral hip, core, quads; distal factors (ankle/foot) prn
- Focus: motor control & learning
- Treatment & prevention

What’s the point?⁹,¹⁰

- Improper mov’t patterns cause injury or pain
- Training proper mov’t patterns can reduce pain, improve mechanics, and prevent injury
- Trend in research……..trend in practice
- Sahrmann & associates system to classify mov’t impairments into syndromes = good fit in pediatric + adolescent sports med PT
"Syndromes are based on mov’t directions or alignments that cause pain & are associated with mov’t impairments."

Correction of the mov’t impairment decreases or eliminates symptoms - confirms syndrome.

7 Categories (for the knee) are:

- Tibiofemoral Rotation Syndrome
  - With Valgus
  - With Varus
- Tibiofemoral Hypomobility Syndrome
- Knee Extension Syndrome
  - With Superior Glide Syndrome
- Knee Hyperextension Syndrome
- Patellar Lateral Glide Syndrome
- Tibiofemoral Accessory Hypermobility Syndrome
- Knee Impairment Syndrome
Case Study #1

- 16 y/o female soccer & field hockey player c/o B knee p! X 2 mo. – worse with running, jumping, squatting, & prolonged sitting
- p! is 1° ant., but “kind of moves around”
- Denies swelling, locking, or buckling
- Hx of B MTSS – resolved with PT – continues HEP, shoes, orthotics
- Goal is to return to field hockey conditioning this summer

Q: Is knee neutral relative to the transverse plane?  
Q: What are your clues?

- Vertical creases of hamstrings – are they in line in the frontal plane? Is popliteal crease horizontal or oblique?
- Squinting patellae?
- Pes planus?
Q: Is femur neutral to frontal plane?
Q: Pes planus, pes cavus, or neutral?^6

- Hip adduction
- Pes planus (can do more specific biomechanical exam (not shown)).

Q: Dynamic valgus or varus?
Q: Femoral IR or ER?
Q: Tibial IR or ER?

- SINGLE LEG Squat
- (DKV)Dynamic Knee Valgus
What is the MIS?¹⁰

A) Knee Extension Syndrome
B) Patellar Lateral Glide Syndrome
C) Tibiofemoral Rotation With Valgus Syndrome
D) Tibiofemoral Rotation With Varus Syndrome

Tibiofemoral Rotation With Valgus Syndrome (TFRVAL): Overview¹⁰

- p! w/ tibiofemoral rotation AND valgus
- Pathoanatomical Dx- PFPS, MCL sprains, ITB syndrome, pes anserine bursitis, meniscal injury, hamstring strain, popliteus strain
- See DKV across broad spectrum of athletes
Treatment Overview

- Reduce DKV - Education!
- ↑ recruitment & strength of Hip Ext, Abd, & ER; quads; lower abdominals
- ↑ flexibility of TFL-ITB, RF, HS, calf
- PRICEMM, orthotics/shoes, taping, bracing, cross-training for fitness, manual therapy
- Functional retraining
- RTS & sport specific training

Treatment Ideas

- Hip abd/ER activation (NMR)
- Orthotic w/ NMR
- McDonnell Posterior X tape
- NMR exercises
Case Study #2

- 16 y/o female volleyball player c/o localized L ant. infrapatellar p!
- Onset 1 wk. ago w/ squatting 125 lbs.
- p! aggravated by squatting & jumping
- X-ray: 2 ossicles over the L tibial tuberosity
- Given patellar strap & referred to PT

Exam Findings

- Tibia varum, arches WNL, Patella alta?
- TTP L Tibial Tubercle
- LE ROM WNL. Reduced inf. glide of patella
- MMT: Hip abd/ER: 4+/5. Quads: 5/5 with p!
- Length: short and stiff quads (RF)
- Balance: WNL. HR: WNL.
- DL/SL squats: p! >10+ reps (quad dominance)
- Vertical jump: good mechanics, p! > 20 reps
  - (see references3-5 for proper jump mechanics)
What is the MIS?¹⁰

- A) Tibiofemoral Rotation With Varus Syndrome
- B) Knee Hyperextension Syndrome
- C) Knee Extension Syndrome
- D) Knee Extension With Superior Glide Syndrome

Quad dominance / stiffness
↓’d inferior glide / ↑’d superior glide of patella
Excessive stress → extensor mechanism
De-recruitment / weakness hip extensors
Symptoms aggravated by running/jumping
Anterior knee pain
Pathoanatomical Dx-Patellar Tendinitis, Jumper’s knee, SLJS, OSS, PFPS, AKP, CMP, plica syndrome
Runners, jumping athletes
Treatment Overview

- ↓ stress to anterior knee
- ↑ recruitment / strength of the hip extensors
- ↑ flexibility of quads, 1° RF
- NMR- squats, stairs, running, jumping
- Taping, patellar straps, manual therapy, PRICEMM

Q: What is the matter with this alignment?

- Alignment alone does not classify patient into MIS category
  - Can provide clues and be a contributing factor
  - MIS category: based on mov’t & symptoms
- Genu recurvatum
- Alignment Corrected – does she have structural genu varum?
- Unlock knees and contract butt muscles!
Case Study # 3

- 14 y/o female dancer c/o L anterior knee p!
- Onset 1 mo. ago w/ repeated pliés
- Aggravated by stairs, running in PE class, prolonged sitting, pliés & jumps during dance (ballet & modern)
- MD Dx: L PFPS. Rx: Rest, ice, NSAIDs prn, PT
- Uses OTC knee sleeve at dance (helps)

Case Study #3 Questions

- Q: Varus or Valgus?
- Q: Excessive hip IR?
- Q: Is this good hip ER for ballet?
- Q: Where does she get her turnout for dance?
- Q: Dynamic knee valgus (DKV)?
- Q: Why is Hx important?
What is the MIS Dx?¹⁰

- A) Tibiofemoral Rotation with Valgus Syndrome
- B) Knee Hyperextension Syndrome
- C) Patellar Lateral Glide Syndrome
- D) Tibiofemoral Accessory Hypermobility Syndrome

Could you argue for more than one syndrome?

Treatment¹⁰,¹¹

- Do not W sit!
- Proper knee alignment w/ functional activities
- Stop aggravating dance specific movt’s
- Stretch TFL
- Strengthen EO, PGM, deep hip rotators
- McDonnell Posterior X tape/brace for proprioception
- SL dynamic balance activities
- Gradual return to dance
Contributing Factors to MIS in Pediatric & Adolescent Sports Medicine

**INTRINSIC**
- Age
- Gender
- Muscle performance
- Neuromuscular bias
- Structural variations
- Anthropometrics
- Muscle length/flexibility

**EXTRINSIC**
- Activity level
- Sport activity
- Environment

**References**

Additional References


