KNEE PAIN IN CYCLISTS

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Objectives

- Review epidemiology of knee pain
- Discuss etiology and the biomechanics of knee pain utilizing current literature/evidence
- Review commonly seen knee injuries
- Discuss treatment strategies
Approximately 85% of all recreational cyclist sustain an injury
60% of cycling injuries occur in the knee
  - Anterior knee pain
  - Patellar tendonitis
Epidemiology

- Overuse injuries most common, traumatic event second
  - Improper training
  - Improper bike fit

- Cycling is a repetitive activity
  - 1 hour = 5400 pedal revolutions
  - Can result in microtrauma or overuse injuries
  - Knee most common location or overuse injury
Causes

- Training error
- Bike fit
- Pedaling mechanics/Technique
- Muscular imbalances
Novice vs. Elite

**NOVICE**

- Greater variability b/n pedal strokes
- Greater variability b/n riders
- Greater amplitude of muscle activity
- Greater amplitude and duration of muscle activity
- ↓ coordination of sagittal plane motion

**ELITE**

- Consistent patterned movements at hip and knee
- Greater ankle ROM throughout pedal cycle
- Less motion in frontal and transverse plane at knee

Training Error

- Too much
- Too soon
- So wrong
Why is knee pain so prevalent in cyclists?

- Low level repetitive loading
- Bike fit
  - Bike anatomy
  - Rider anatomy
- Driving moments – muscle forces
- Non driving moments – varus/valgus, internal/external axial
Bike Fit

- Commercialized
- Standardized
- Dynamic?
- Individualized?
Common Knee Diagnosis

- Patellofemoral pain
  - Compression force
  - Shear force

- Patellar tendon pain

- Iliotibial band syndrome
Evidence Based Analysis
Frontal Plane - knee

- 24 cyclist (14 no injury hx/10 injury hx)
- Video analysis of frontal and sagittal planes
- Measured shank (tibia compared to ankle) angle
- Comparison of groups

Frontal Plane - knee

NO INJURY GROUP

- Mean shank angle neutral
- Speed of frontal plane mvmt same
- Greatest shank abduction - 83°

INJURY GROUP

- Mean shank angle in abduction
- Greatest shank abduction - 88°
- Increased DF angle throughout pedal cycle

24 cyclist (14 no injury/10 injury)
Video analysis of frontal and sagittal planes
Measured knee flexion angles
Comparison of groups

Found no differences in knee flexion angles
Does not support low saddle height increases risk of knee injury!

8 cadaver legs
- Tested at 60° and 90° knee flexion
- 3 loads placed
  - Internal moment (femur)
  - Varus moment (tibia)
  - Combined
- Measured patellofemoral joint
  - Contact area
  - Contact pressure

Results

Internal knee moments and combined moments significantly increased mean contact area and force to patella.

Contact area appeared more sensitive to the internal than varus moment.

No effect on mean contact pressure.
11 healthy subjects
3 different riding positions
  - Natural
  - Dorsiflexed
  - Plantarflexed
Measured muscle activity and efficiency
Found

- DF riding position increased gastroc activity and increased energy expenditure
- PF riding position increased biceps femoris activity

- DF riding position places eccentric load to gastroc which may absorb energy produced at knee

- Eliminating DF during power phase may reduce muscle fatigue and maximize load placed through the pedal

Foot

- 15 subjects with varying foot angle positions on pedal
  - 10° inverted
  - 5° inverted
  - Neutral
  - 10° everted
  - 5° everted
- Measured varus/valgus and internal/external knee moments

Results

Peak varus and average varus/valgus knee moments are related to foot angle

Foot eversion decreased both varus moment during power stroke

How can we reduce knee pain in cyclists?

- Based on research - Control the frontal plane
- Reduce medial knee positioning (shank abduction)
  - Fit
  - Riding Technique
  - Strength
Dynamic Fit

- Pedal width
- Foot position
  - Float
  - Cant
- Seat height
Video
**Pedaling Technique**

- Optimal cadence = 88-95+ rpm
  - Spinners – low gear, high cadence
  - Gear Mashers – high gear, low cadence… increased risk of knee injury in this group

- Use entire pedal cycle

- Toe down
Pedaling Technique

Clock Analogy

- **1-10** – rolling barrel with bottom of foot. Push pedal forward over top of apex
- **10-7** – push down, easiest and most natural position
- **7-5** – scraping mud off bottom of shoe
- **5-1** – “de-weight” the pedal
Pedaling Technique

Cadence Work

- Easiest way to smooth out pedal inefficiencies is to increase cadence = neuromuscular re-education
- Keep toe down, NO bouncing in the saddle
- “Spin ups”
  - Lower resistance pedal until you just start to bounce in saddle. Back off rpm slightly or control buttocks
- Progressions
  - Change in rpm without change in resistance
Isolated Leg Drills

- Resistance is key – should be easy to keep high cadence, hard so pelvis isn’t bouncing
  - Right leg over barrel
  - Left leg over barrel
  - Right leg scrap mud
  - Left leg scrap mud
Muscular Imbalances