Cycling Mechanics

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Epidemiology

• 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
Biomechanics of Pain

• 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
Bicycle Related Injuries

• Non traumatic 85% of the time
• Common injury sites
  – Knee
  – Neck
  – Low back
  – Hands
  – Buttock
  – Perineum

Dettori, Norvell Sports medicine 2006
Bike fit

- Heel on the pedal
- Level pelvis
- Crank arm parallel to seat tube
- Knee should be straight
  - Anterior knee pain
    - Higher the seat
  - Lateral knee pain
    - Lower seat
Goals of the fit

• Efficiency
• Comfort
• Current issues
• Course, demands of race/event
• Individual differences
What you Should ask Yourself?

• How do I use the Biker’s body in front of me today?
  – “Fit the Bike to the Rider”
  – Use evaluation to define constraints of the rider
  – Apply the limits found with ROM, strength and flexibility for that days fit

• What needs to be altered to be able to seek the desired position?
  – “Fit the Rider to the Bike”
  – ID issues with ROM, Strength, Flexibility, technique that need to be addressed to reach the desired position
Bike Fit

- Tools needed
- Warm up 10 minutes
- Accommodate for structure
- Address Contact points
- Take measurements that are rider specific
- Address rider flaws
- If change is made must go through and remeasure
Bike Fit

• Contact points
  – Saddle
    • Height
    • Fore/Aft
    • Tilt
  – Pedals
    • Rotation
    • Fore/Aft
    • Wedge/Shim
    • Medial/lateral
  – Bars
    • Height
    • Width
    • Reach
Cleat Alignment

• Fore/Aft
  – Adjust on shoe, anterior on shoe=posterior

• Rotation
  – Match alignment orientation

• Width
  – Spacers
Saddle Height

- Pelvis observation
- Ankle observation
- Knee angle when pedal is furthest from hip joint (usually parallel with seat tube)
- 25-40 degrees
- Mountain vs. road
Saddle Fore/Aft

- Usually with anatomical landmarks (KOPS, knee over pedal spindle)
- Neutral = Tibial tuberosity
- Anterior = Fibular head
- Posterior = Patella
- Take rider, aero, course into account
Handle bar adjustment

• Frame size
• Stem length
• Some say level with saddle to up to 4 inches lower
• Trunk angle 25-45 degrees but quite variable
Posture considerations

• Pelvis Neutral
• Posterior tilt
  – Hard to get low
  – What does it do to hip power?
• Anterior pelvic tilt
  – Long and low

Take ind. Differences for bar drop and reach
Areo Bars

- Bar fore and aft
- Bar Tilt
- Bar Width
Areo Bars

• Fore/Aft
  – Shoulder perpendicular
  – Pads 2-4 inches distal to the elbow
  – Increase = Increase trunk activation
Aero Bars

- Bar width “stacking”
  - Wide
    - Easier breathing
    - Comfort
    - Stability and handling
  - Narrow
    - Decrease breathing ability
    - Compensated scapula
    - Increase neck strain
Aero Bar

- Tilt
  - Up
    - Improved aero
    - Increase elbow wt.
    - Hard to pull with hill climbing
  - Level/slight down
    - If down too much increase trunk strain
Road vs. Tri Bike

Image courtesy of Cervelo.com
On the bike exercise

- Need stable base
- Posture position
- Watch sway
- 1 arm bike
- 1 leg bike