

PRIMARY CARE HAWAI'I CONFERENCE

June 22–26, 2026

Kaua'i, Hawai'i

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20 hours
AAFP
CME Credit

Strategies for Preventing and Managing Cycling Injuries

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Sports Medicine/P.M.&R.

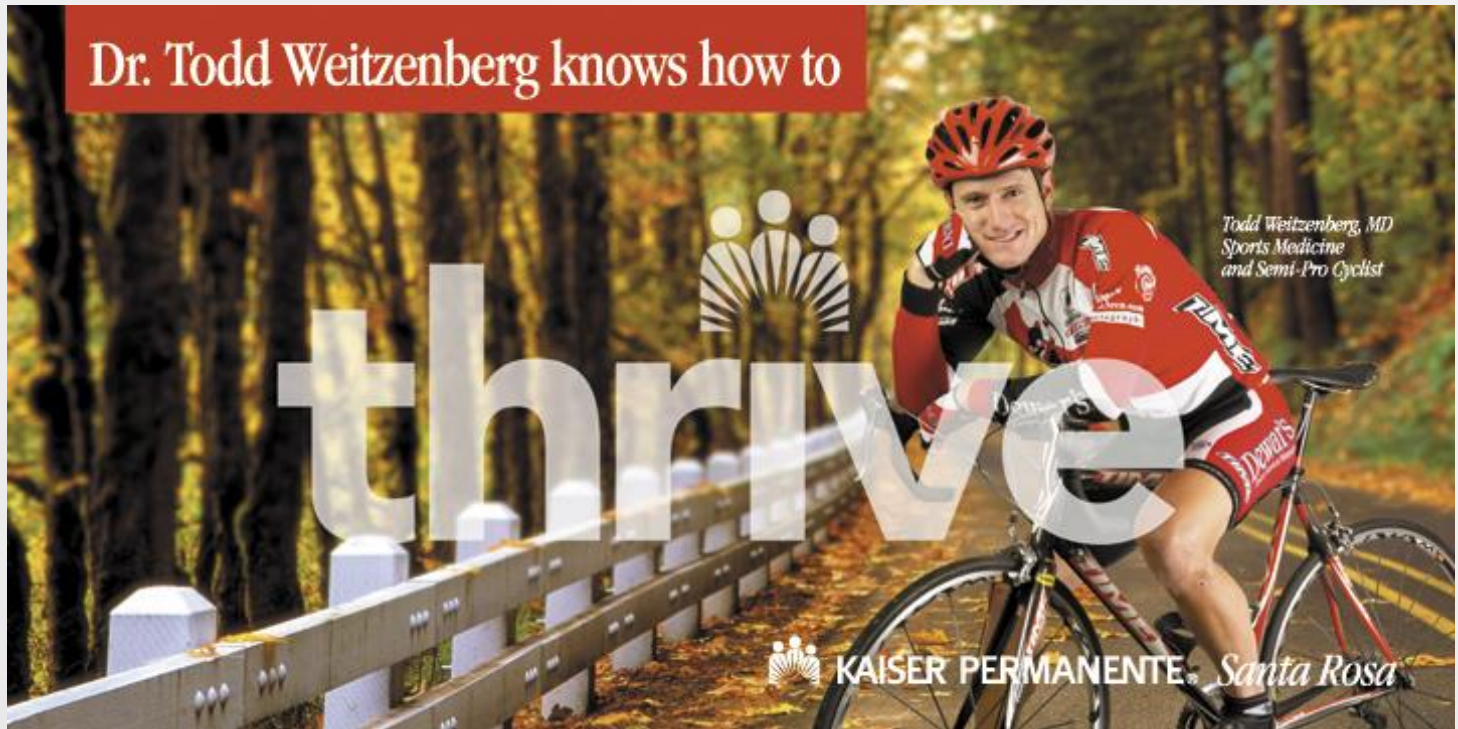
Kaiser Permanente Santa Rosa, CA



Disclosures:

- **Dr. Todd Weitzenberg has no relationships to disclose.**





Objectives

- Understand the biomechanical aspects of bicycle fit.
- Understand common overuse cycling injuries.
- Be able to analyze and modify a cyclists' bike fit and biomechanics to prevent and treat injury.



Acknowledgments: Dr. Massimo Testa



- UC Davis Sports Medicine Sports Performance Center 2000-2001.
- 28 Tour De France
- 15 World Championships
- World and National Professional Cycling Team MD and Coach
- Intermountain Health, Park City Utah.





Int.J.Sports Med.16 (1995)201-206

- ***Overuse injuries*** among rec. cyclists (Non-comp. Events)
 - selected at random, questionnaire
- 294 male/ 224 female
- 85% 1 or more, 39% med. Tx.
 - 48.8% Neck
 - 41.1% Knee
 - 36.1% Groin/Buttocks
 - 31.1% Hands
 - 30.3% Back



Am.J.Sports
Med. 24
(1996)744-753

- ***Overuse injuries*** among rec. cyclist in long-dist. bike tour
- Questionnaire, mean age=39
- 1638 riders: 85 acute / 76 overuse
- Overuse injuries:
 - 33 knee
 - 11 hand/wrist
 - 9 foot
 - 6 achilles tendon
 - 5 upper leg
 - 5 lower leg
- **Inexperience and lack of pre-ride conditioning are risk factors for overuse injuries**

Journal of Science and Cycling:

Injuries Caused by Poor Biomechanical Fit in Cycling: A Narrative Review; 22 December 2025

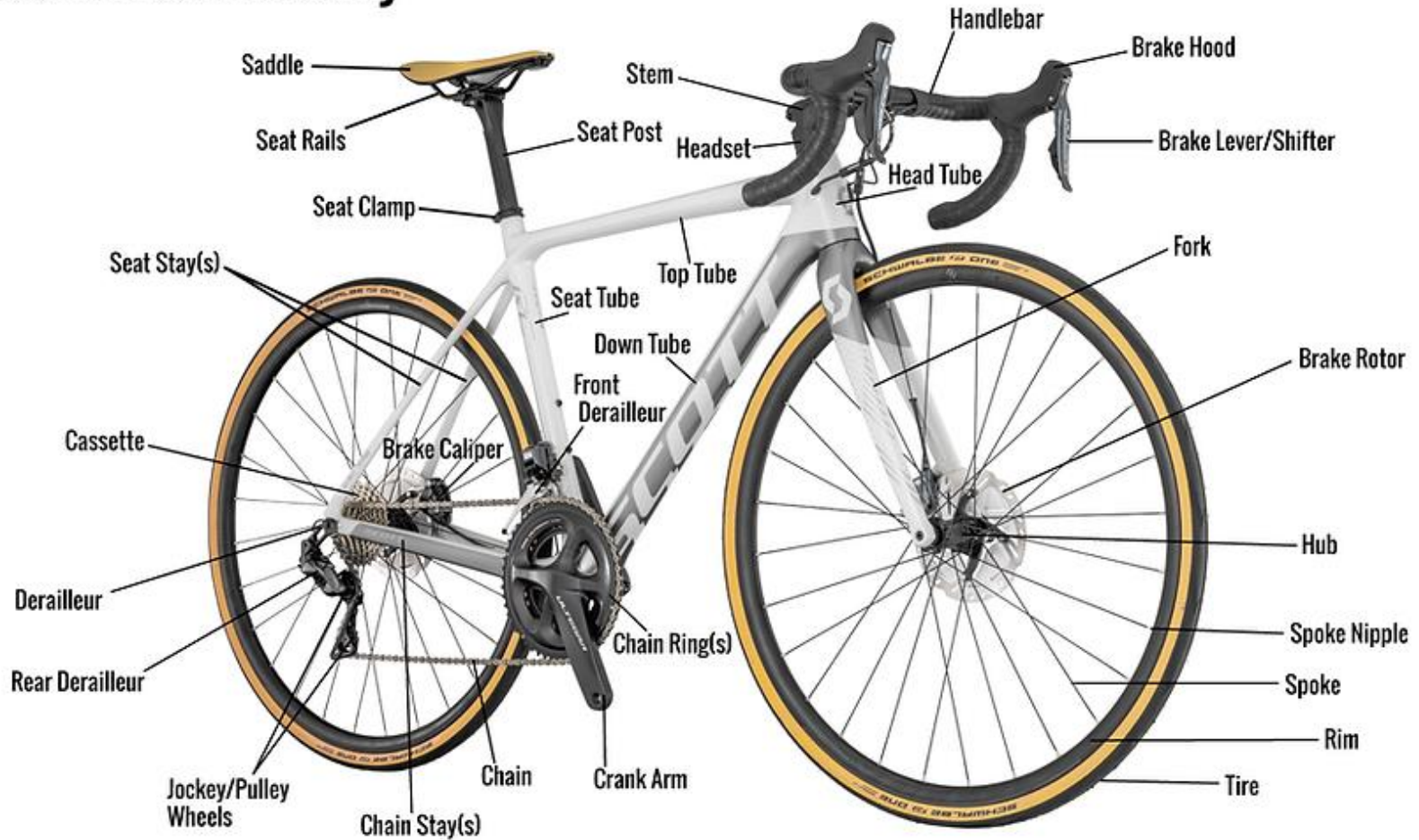
- Most common injuries:
 - Knee
 - 25-60%, women > men
 - Lower back
 - More common in professional/high level
 - Neck/shoulders
 - Hip/thigh
 - Achilles
 - Genital region



Road Bike Anatomy



Road Bike Anatomy



Mountain Bike Anatomy



Mountain Bike Anatomy



Bicycle Fit

- Frame size
- Saddle height
- Saddle type
- Foot/pedal/cleat position
- Seat tube angle
- Saddle fore-aft position
- Upper body position



Frame Size

“Bike shop” or “crotch clearance”

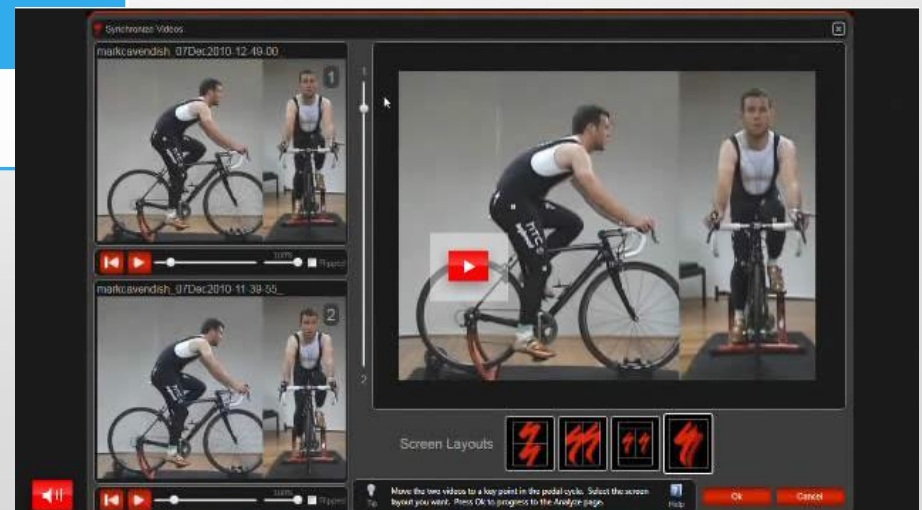
- Stand over top tube
- 1-2 in. road/touring bike
- 3-6 in. mountain bike

“Fit Kits”

- Frame size and position based on body measurement

Hi-Tech Computer

- 3D computer analysis



Optimal Saddle Height



Full knee extension with heel placed on pedal at 6 o'clock



Power output and caloric expenditure studies:

100% of trochanteric height



Formulas based on inseam(cm):

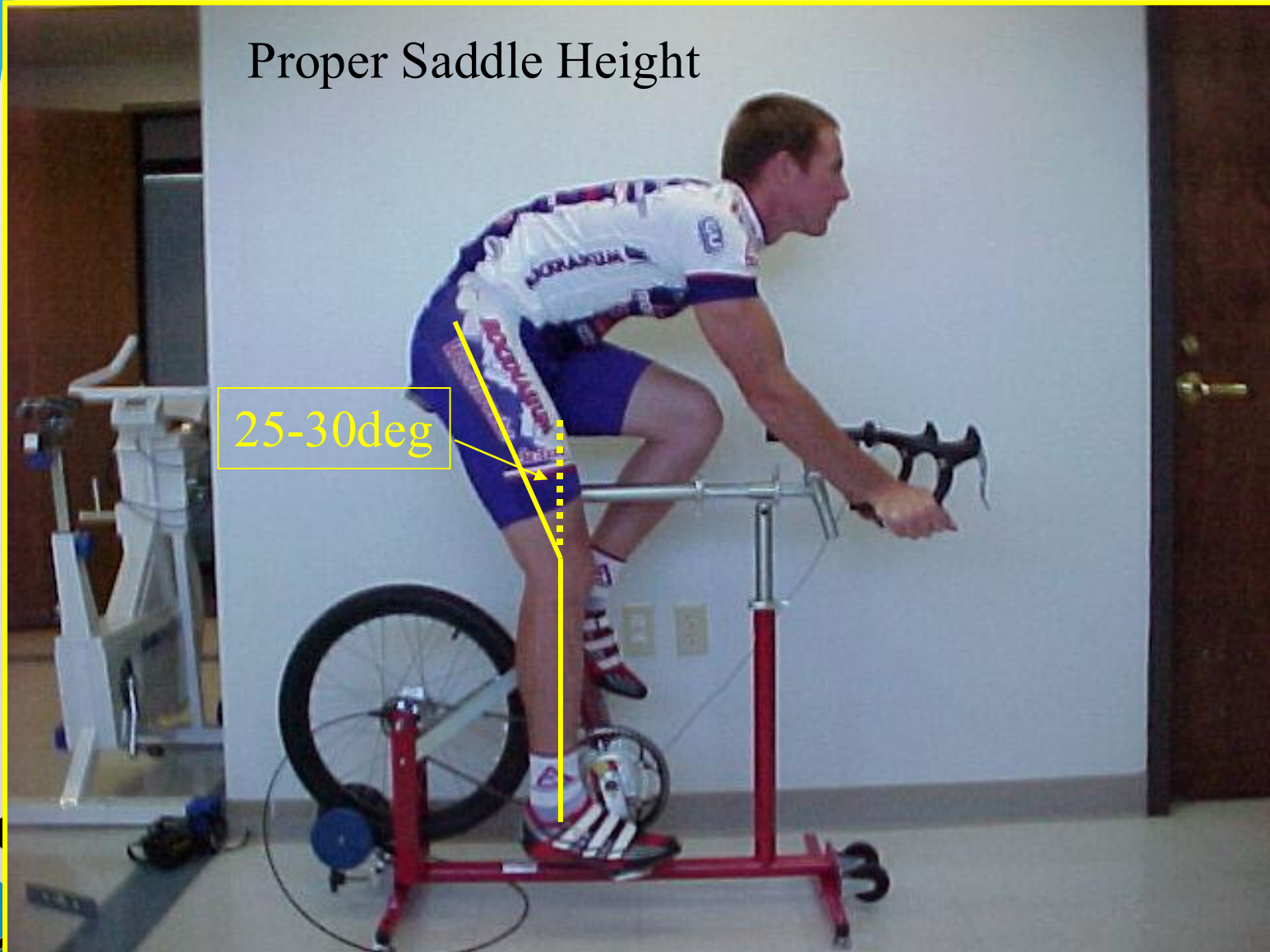
Hamley et.al.(1967)
inseam x 1.09

Lemond/Guimard(1987)
inseam x 0.883 (-3mm clip less)



Proper Saddle Height

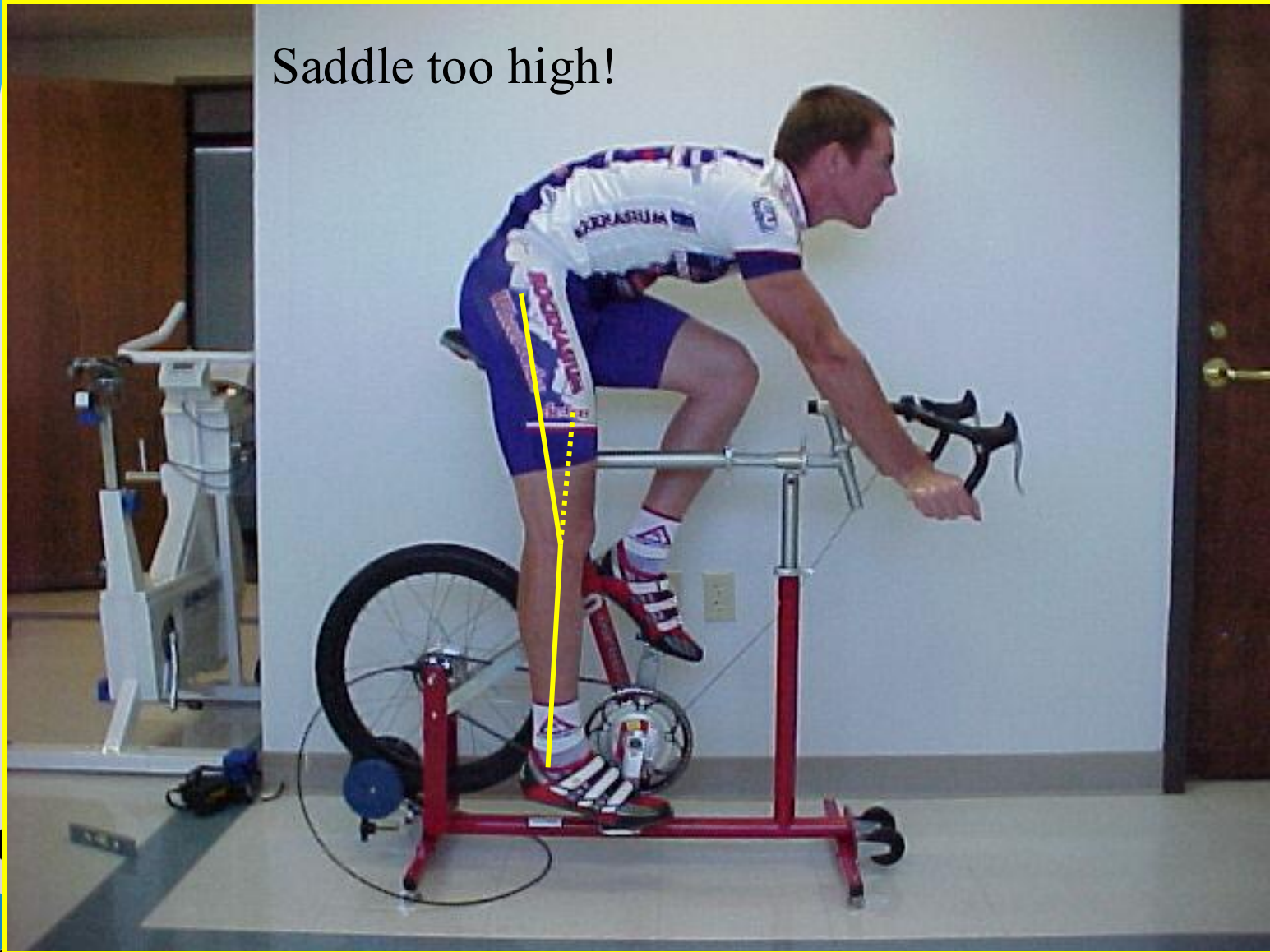
25-30deg



Saddle too low!



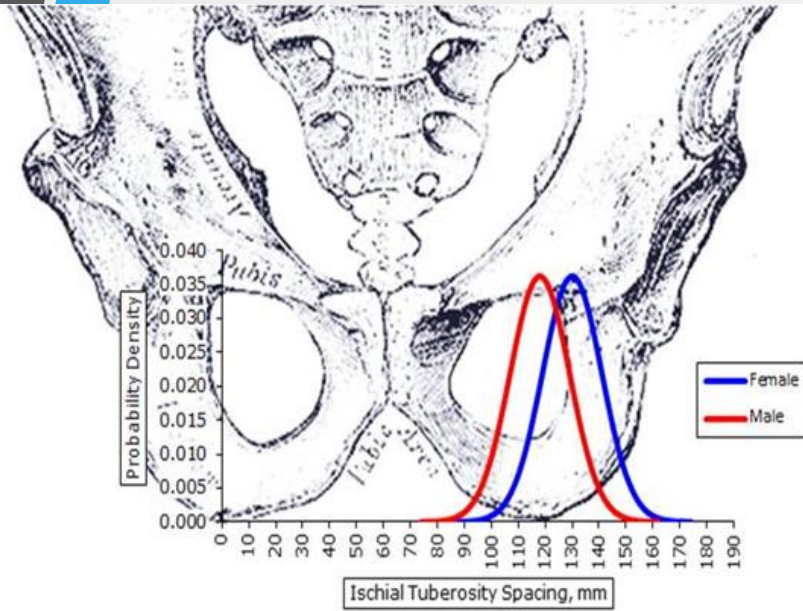
Saddle too high!





Saddle Position

- Start level, adjust to comfort
 - Nose-up: increased perineal pressure.
 - Nose-down: increased load/pressure on UE's
- Saddle selection varies by individual anatomy and preference
- Fit ischial tuberosities to pressure bearing regions of saddle



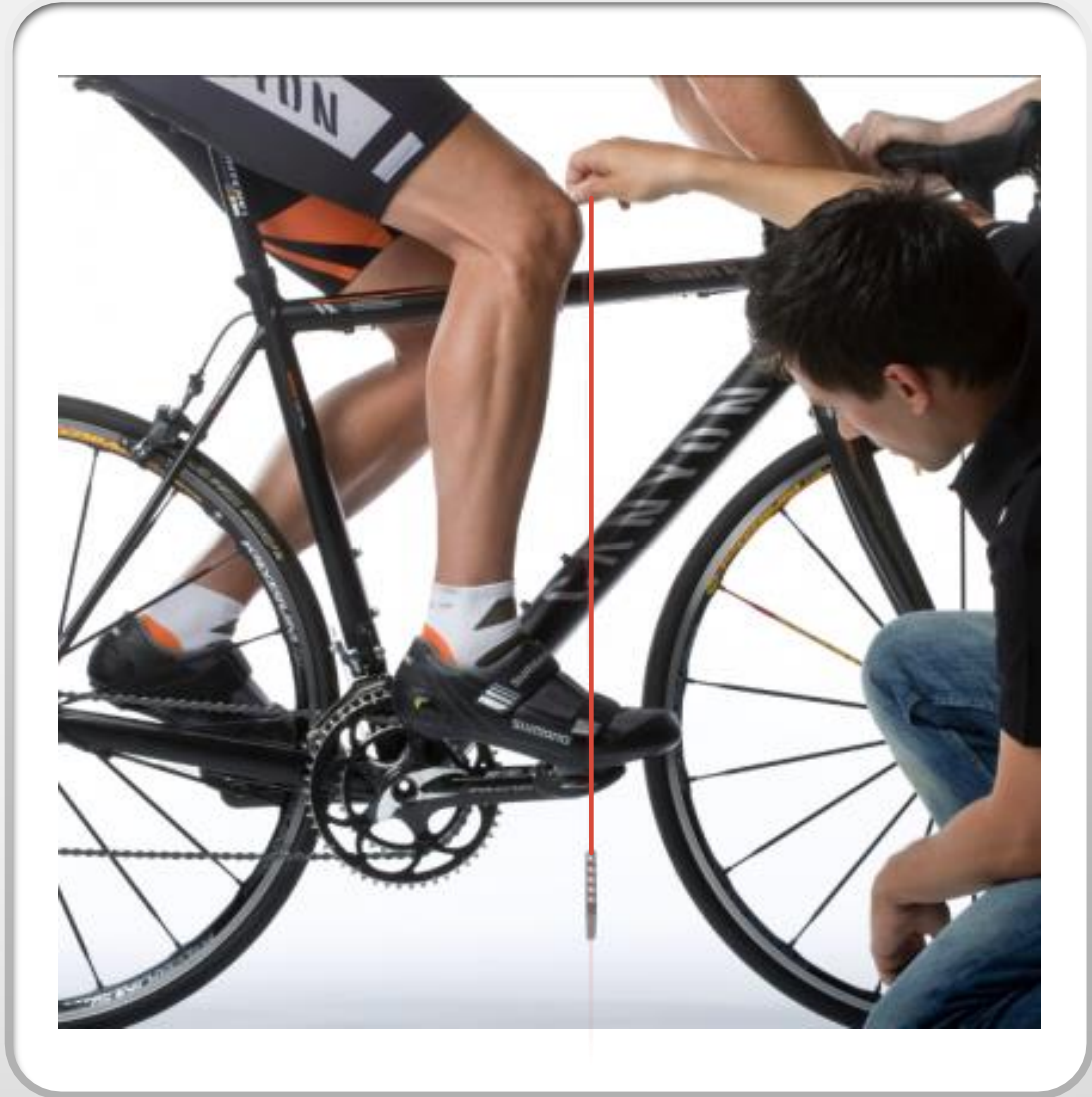
Foot-Cleat Position

- Widest portion/"ball" of foot over pedal axel
- Observe position of foot relative to knee during gait
- Influenced by malleolar torsion
- Rotational Adjustment Device(RAD)
- Float?



Saddle: Fore-Aft Position

- KOPS (knee over pedal spindle)
- Requires proper saddle height and correct cleat position
- Pedals at 3 and 9 o'clock position
- Plumb line from patella should intersect center of pedal spindle
- Very controversial!
- A good start...



Upper Body Position

= Saddle fore-aft + reach + stem

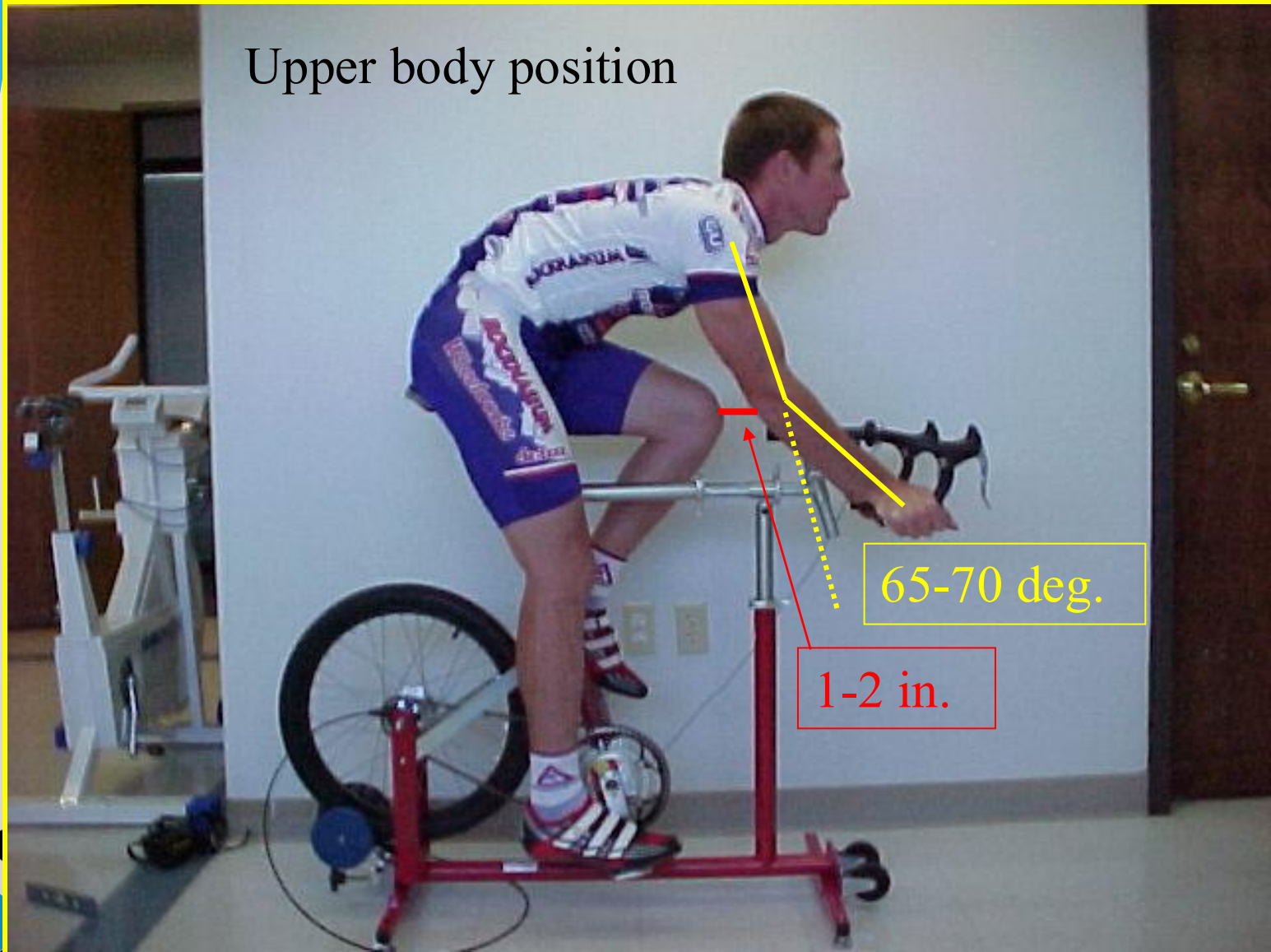
Reach = tip of saddle to center of transverse portion of bars

Bar width = shoulders width
(acromion-to-acromion)

End Point:

- 1-2in. b/w elbow-knee with hands in drops
 - (pedals at 3-6 o'clock)
- 65-70 deg angle at elbow
 - (hands in drops)

Upper body position



65-70 deg.

1-2 in.



Pedaling Biomechanics: Knee

- **Power Phase: Knee Extends**
 - Adduction/Medial patellar moment
 - Normal valgus angulation of distal femoral condyles
 - Disparity in curvature of condyles,
 - Pronation moment of foot and internal rotation of tibia
 - Patella angles closer to top tube

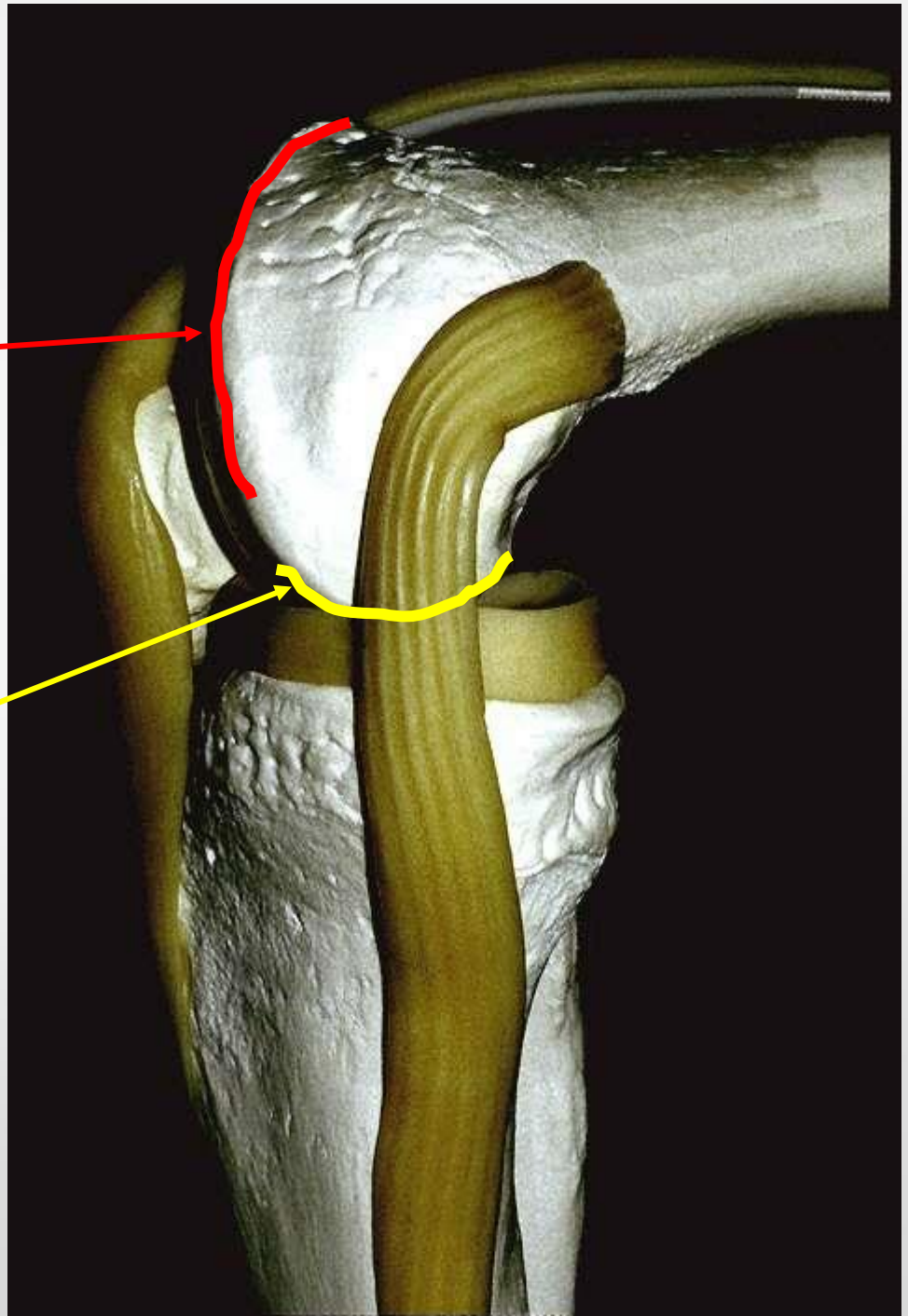
Pedaling Biomechanics: Knee

- **Recovery Phase: Knee Flexes**
 - Abduction/Lateral patellar moment
 - Posterior surface of femoral condyles more nearly symmetrical
 - Re-supination of foot and external rotation of tibia
 - Patella angles away from top tube

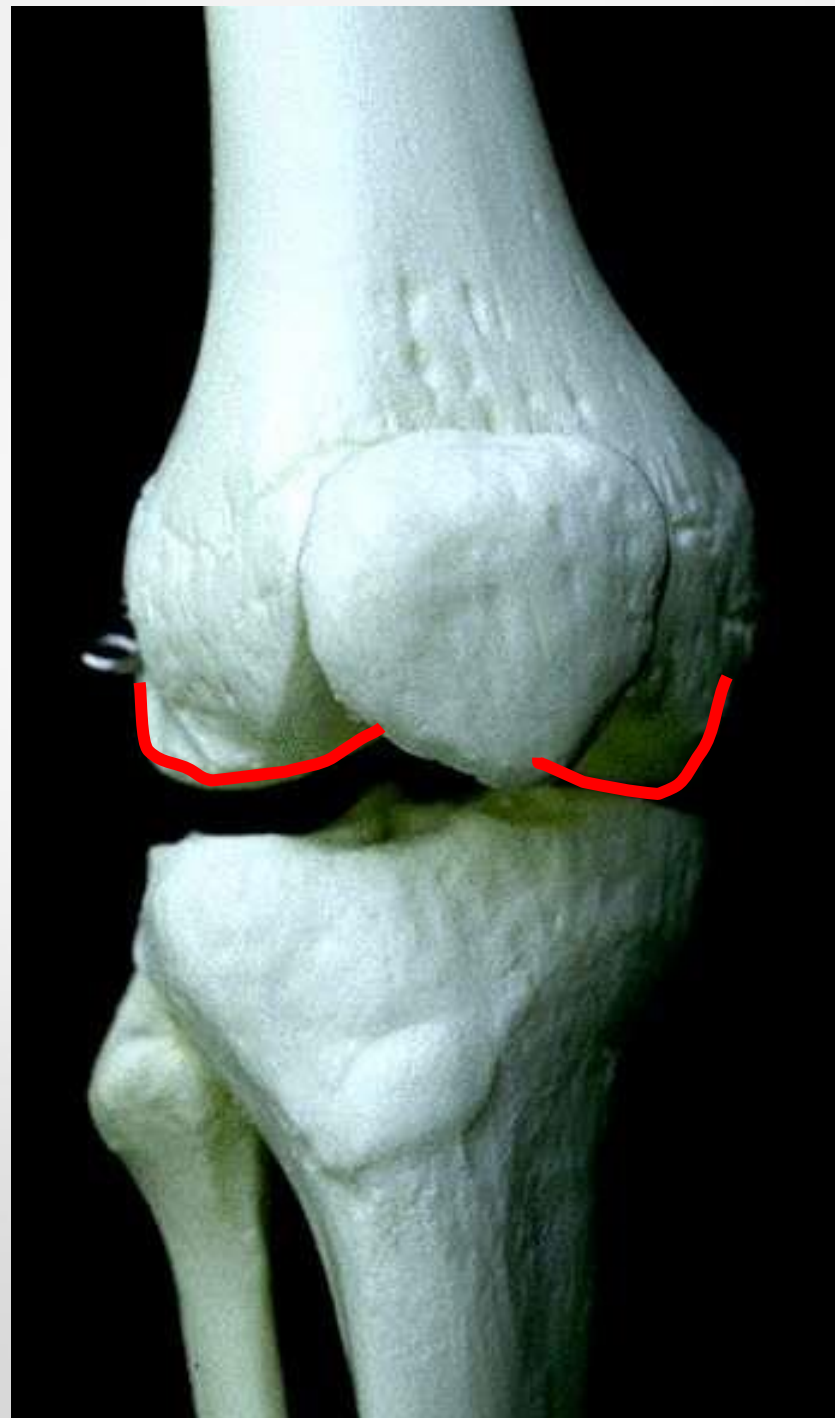
Knee Biomechanics

Distal Femoral condyle surface

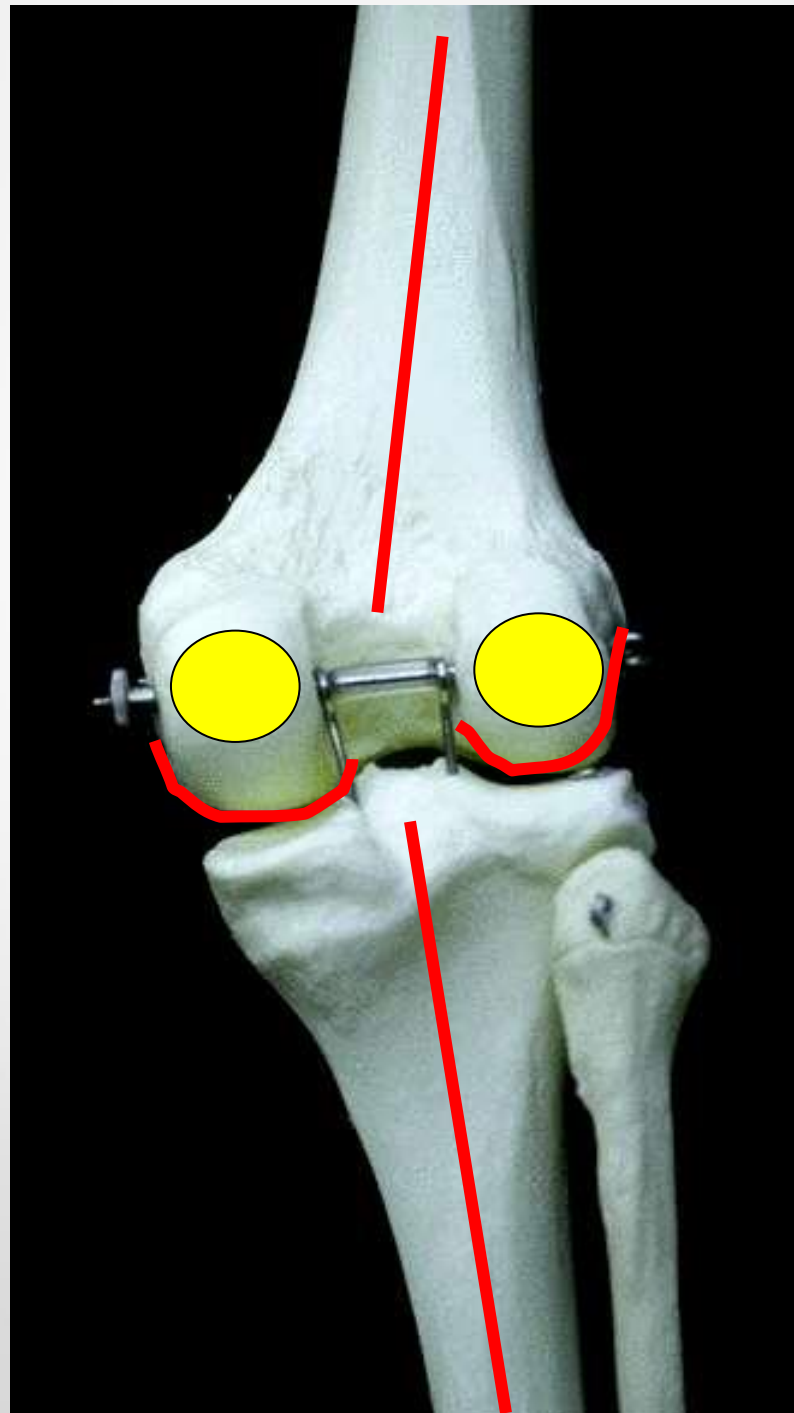
Posterior Femoral condyle surface



Knee Biomechanics



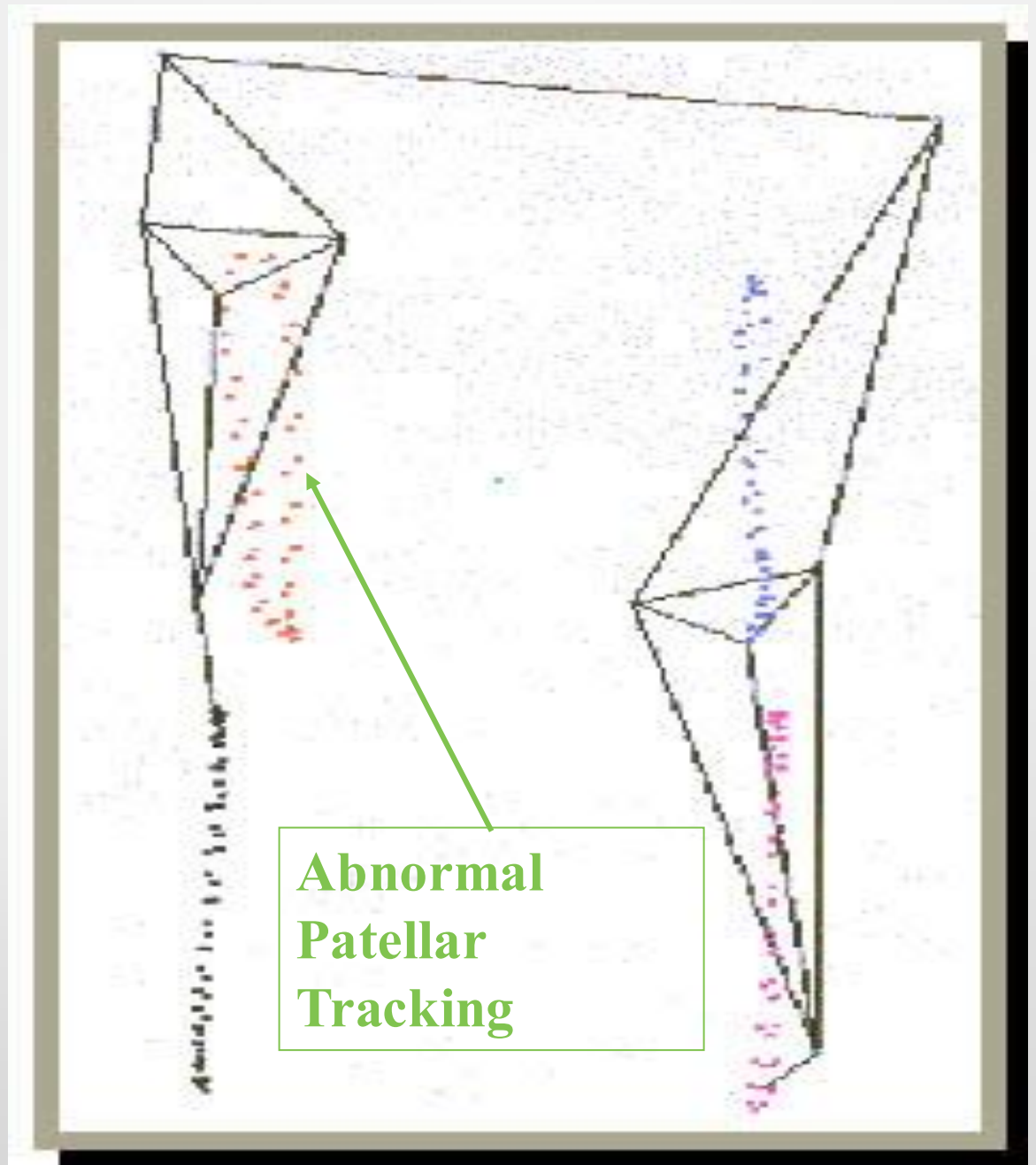
Knee Biomechanics



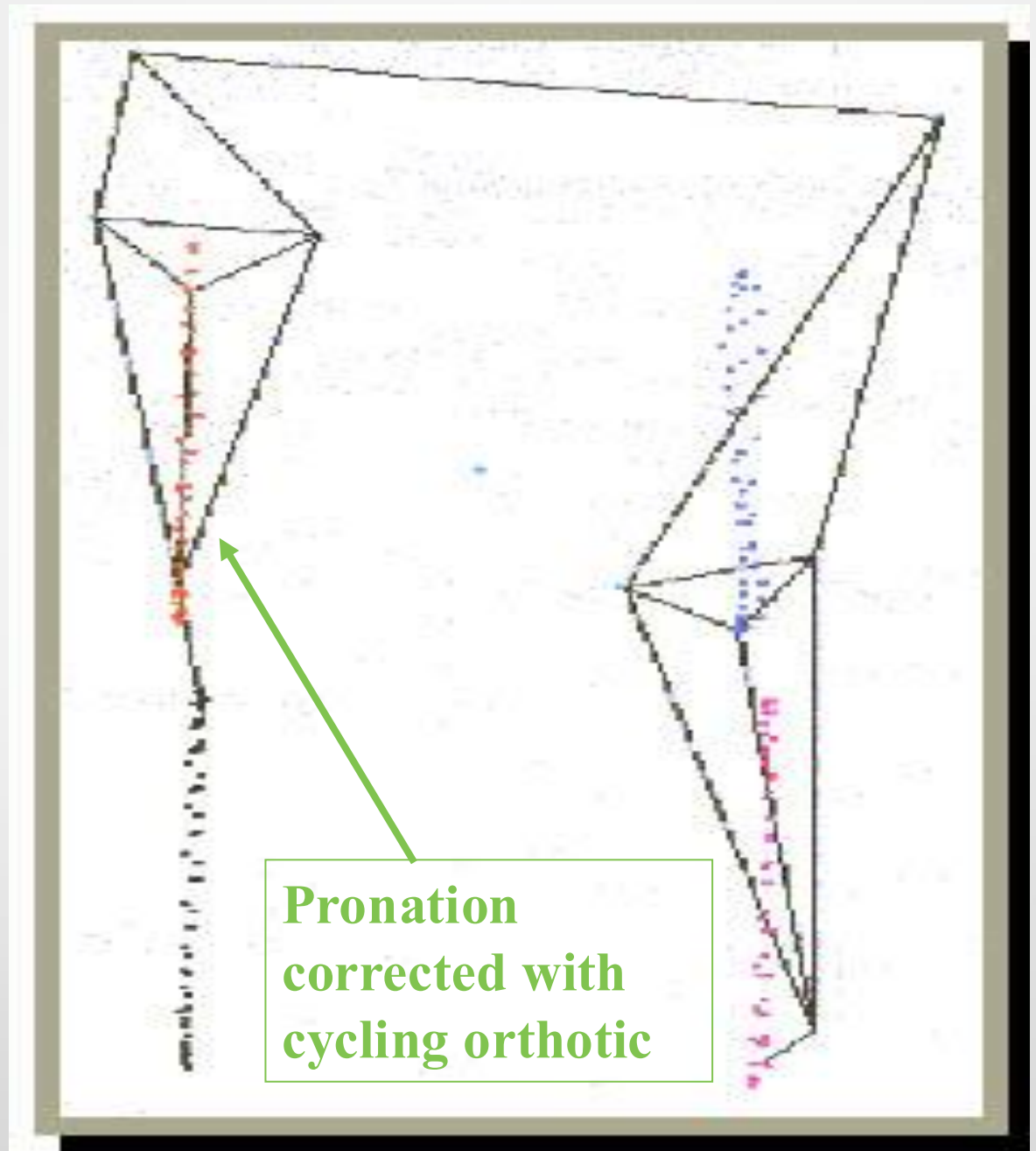


Patellar Tracking Abnormalities

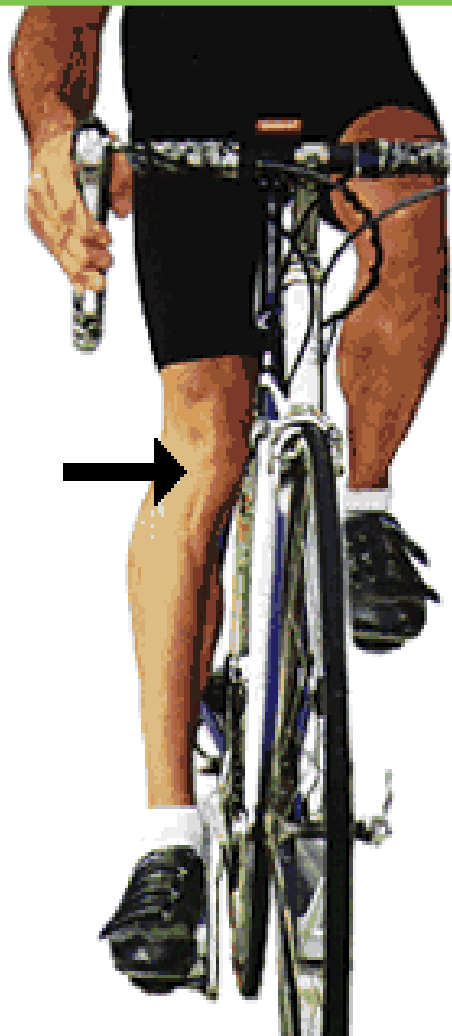
- Increased Valgus Moment at Knee
 - Increased LATERAL deviation of patella
 - Increased Q angle
 - Hyper-pronation of foot with increased internal rotation of tibia



**Abnormal
Patellar
Tracking**



**Pronation
corrected with
cycling orthotic**



Pronation uncontrolled
(knee rotates inward)



Pronation controlled
with orthotic





Knee Overuse Injuries

Clinical Presentation

Physical Exam Findings

Anatomic Variants

Mileage/Intensity

Training Practices

Anterior Knee Pain



CYCLIST PRESENTS
WITH PAIN BEHIND THE
KNEE CAP.



WORSE WHEN USING
BIG GEARS OR
CLIMBING STAIRS.

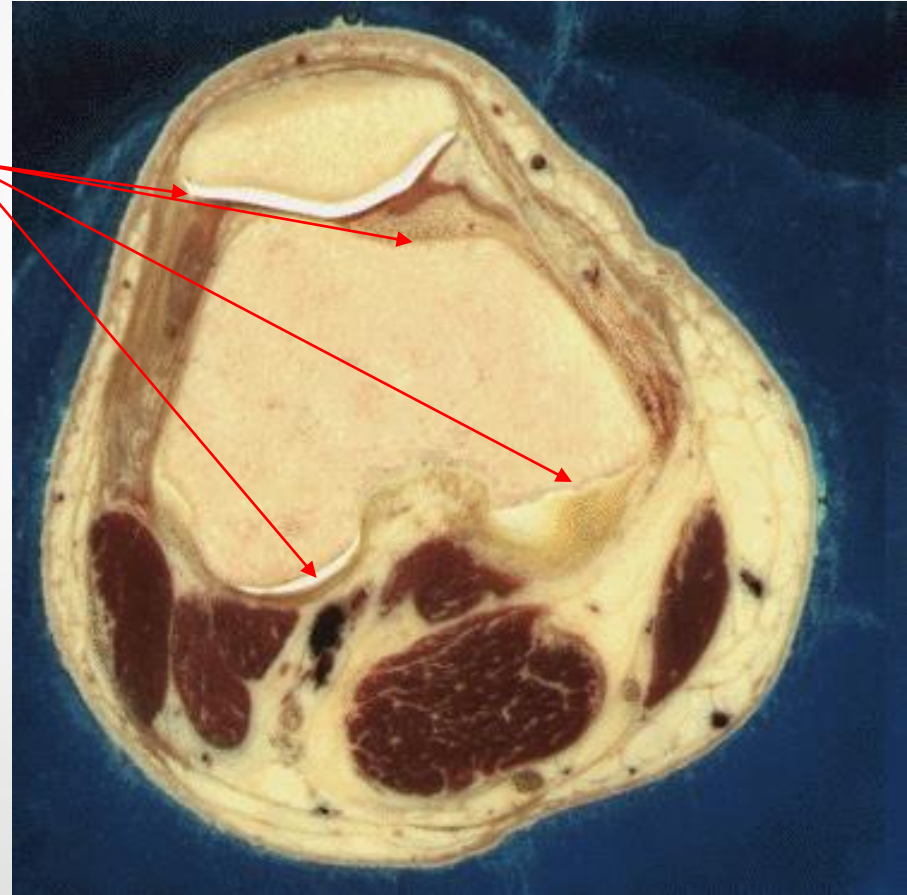
Patellofemoral Pain Syndrome (PFPS), Chondromalacia

- Pathologic changes to the articular cartilage owing to excessive patellar shear forces over the femoral condyles and patellar groove.
- Common early in season
 - Increased mileage
 - Big gears
 - Weights



Chondromalacia

Articular Cartilage



PFPS/Chondromalacia: Treatment

Increase pedal
cadence (90-100
rpm.)

Inc. saddle height

- Low saddle inc.
patellofemoral
loading

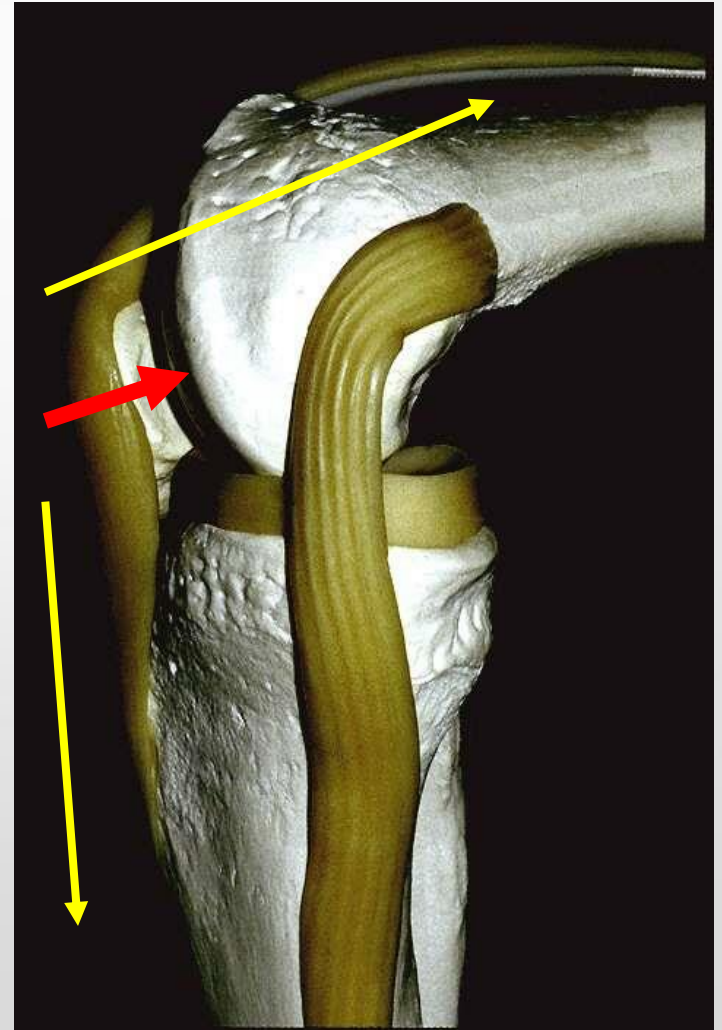
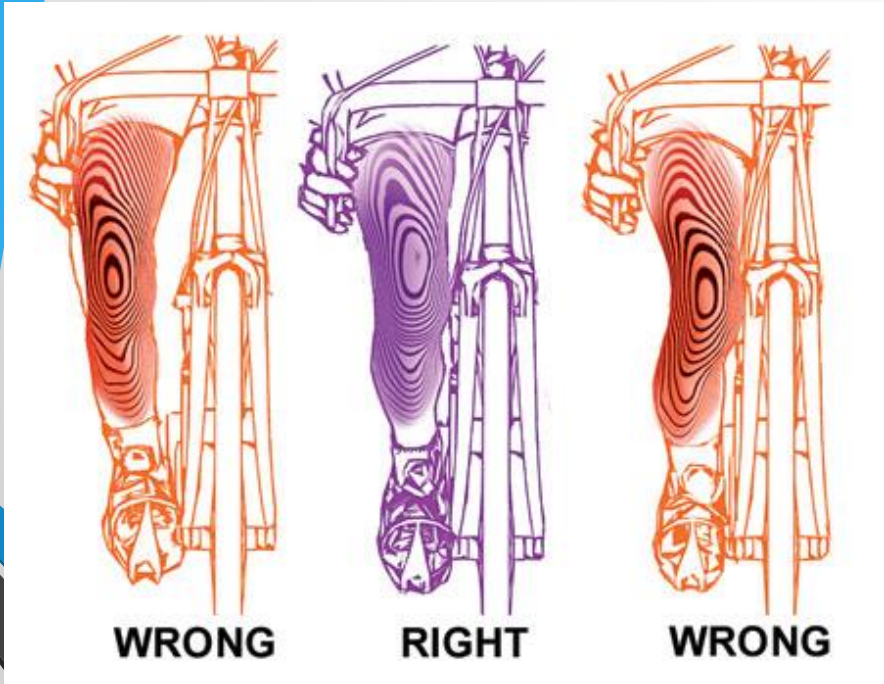
PT

Bracing/Taping

Avoid hills, big
gears, weights

Appropriate
training base

Arch Supports



Anterior- Inferior Knee Pain



CYCLIST PRESENTS
WITH PAIN BELOW
KNEE CAP.



GREATEST PAIN
DURING POWER
PHASE.

Patellar Tendonitis

- Excessive angular traction on patellar tendon while pedaling
- Valgus alignment of knee
 - Inc. tibial IR and pronation
- Sudden increase in mileage or hill intervals



Patellar Tendonitis: Treatment

Raise Saddle

- Saddle too low or too forward

Limit float to 5 deg +
Orthotics to correct
pronation (dec.tibial IR)

Focal ice massage, cross
friction massage

PT/Stretching/Eccentrics

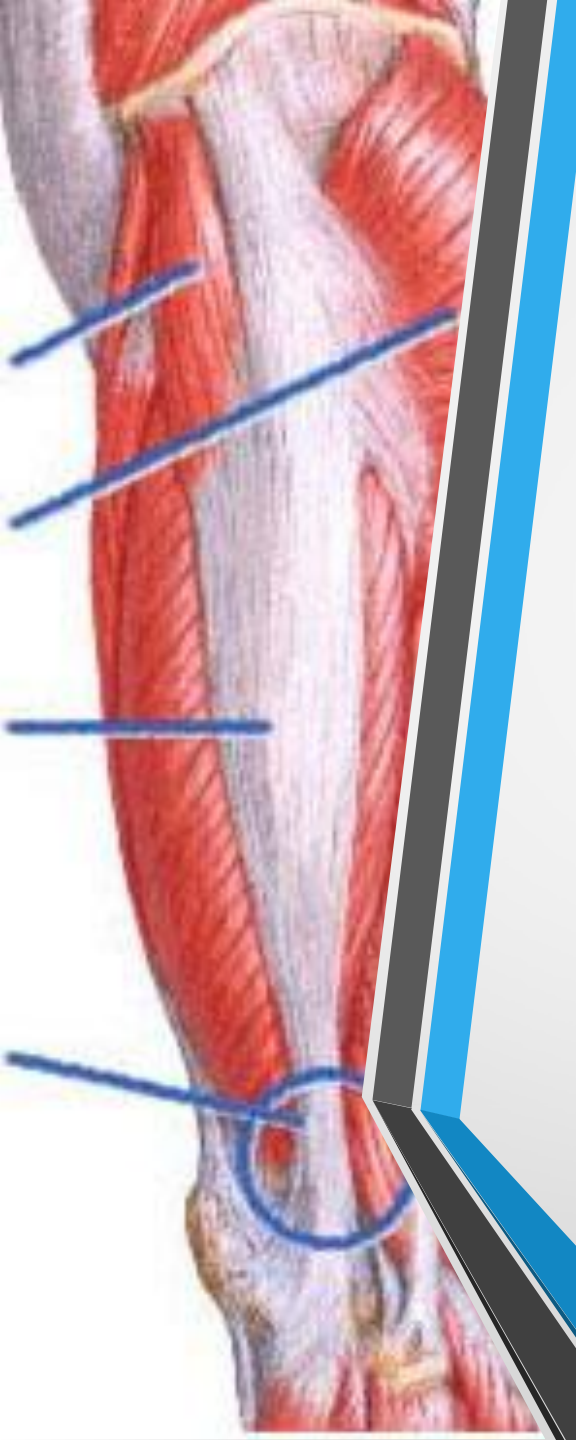
Avoid weights, big gears,
hills, fixed gear bikes

Patellar Tendonitis

- Encourage Rest!
- Difficult overuse problem, often requires prolonged conservative treatment
- Steroid injections not proven to be effective, risk of tendon rupture.
- MSK US
- Biologics?

Lateral Knee Pain

- Cyclist presents with sharp-stabbing pain on outside of knee.
- Worse with pedaling
- Radiates up outside of thigh and down into outside of calf



Iliotibial Band Friction Syndrome

- Repetitive friction of ITB across lateral femoral condyle
- Contact most pronounced at 30 deg. Flexion
- ITB moves ant.(power phase) and post. (recovery phase)
- Posterior fibers most susceptible

Iliotibial Band Friction Syndrome

- Contributing Factors:
 - Varus knee
 - Tight ITB
 - Prominent lat. femoral condyle
 - Hills, big gears, low cadence
 - Weight lifting
- PEx: + Nobel's Test



Iliotibial Band Friction Syndrome: Treatment

Lower saddle, move forward

- Inc. height and aft saddle inc. extension/friction forces

Limit float 5 deg. + orthotics (dec. IR of tibia)

Stretching

Hip Abduction Exercises

Adequate training base

Iliotibial Band Friction Syndrome

- Aggressive stretching, friction massage, ice massage
- Limit training until pain dec.
- NSAIDS
- Corticosteroid injections
- Surgical release of distal fibers in recalcitrant cases



Medial Knee Pain

- Cyclist complains of pain along inferior/medial aspect of knee

DDx: Medial Knee Pain

- Pes Anserine Bursitis
- Medial Synovial Plica
- Must also consider:
 - PFPS
 - Chondromalacia



Pes Anserine Bursitis

- Pain on inferior/medial aspect of knee
- Saddle too high or too much cleat rotation
- Decrease saddle height with cleat rotation <5 deg.
- Orthotics: dec. IR/valgus moment
- Rest/Ice/NSAIDs
- Corticosteroid injection

Medial Synovial Plica

- Medial popping with each pedal stroke
- Severe TTP medial patellar margin
- 70% of population have plica
- Produces friction, “saws” against medial femoral condyle and patella
- Saddle too low or too forward



Posterior Knee Pain

- Cyclist complains of pain on back of knee near fibular head.
- Recently started using clipless pedals.



Biceps Femoris Tendinitis

- Point tenderness of tendinous attachment of the biceps femoris at the fibular head
- Pain to palpation/strumming of distal biceps tendon
- Pain with resisted knee flexion



Biceps Femoris Tendonitis

- Saddle too high or too aft
 - Neutral saddle position(KOPS)
 - 30 deg. knee flexion
- Cleats toed-in
 - Adjust to natural gait alignment
- Varus knee
 - Spacers between pedal-crank arm
- Leg-length discrepancies
 - Adjust saddle to longer leg, correct short leg.

Summary

Biomechanical aspects of bicycle fit and pedaling mechanics are very complicated.



Overuse injuries in cycling are common.



Analyze and modify a cyclist's bike fit and biomechanics to prevent and treat injury.

Dr.Todd's Cauldron

- Science + Witchcraft
- A cheap bike that fits is better than an expensive bike that doesn't.
- Get the best fit you can afford \$
- Use science to get close, then adjust to comfort.
- If it hurts STOP and make adjustments.



• Thank You!

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