Bone Health in Cyclists

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UW Health Cycling Symposium
February 17, 2009

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University of Wisconsin Sports Medicine
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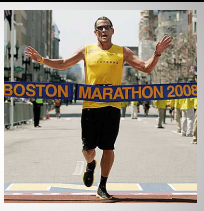
Overview

- Bone physiology
  - How do we build bone?
- Bone density in athletes
  - Are there sport-specific effects?
- Effects of resistance training on bone
  - Does it increase bone density?
- A pitch for not pedaling
  - How do I improve my bone health?

Bone Health in Cyclists

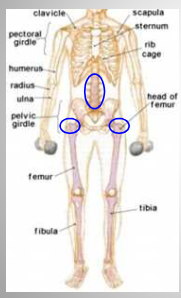


It's not about the bike

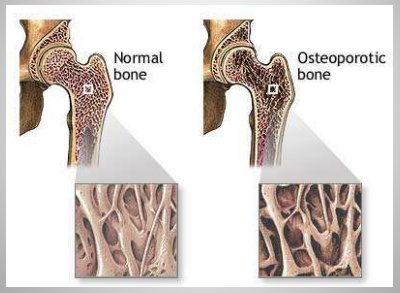
Key Terms

- Bone Mineral Density (BMD)
  - amount of minerals (Ca, P) in volume of bone
  - bone mass, bone density
- D(E)XA scan: Dual-Energy X-ray Absorptiometry
- Osteopenia/Osteoporosis: low bone mass

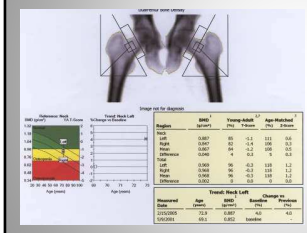
BMD and DXA Scan

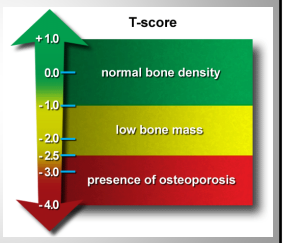


Osteoporosis



DXA Scan

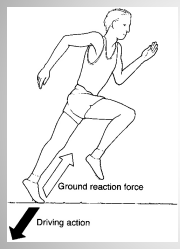




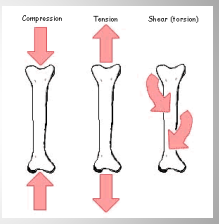
Key Terms

- Impact or weight bearing (WB) = non-weight supported
- No impact or non-weight bearing (NWB) = weight supported
- Resistance training
  - any method of training used to resist, overcome or bear force (strength training, weightlifting)
- Ground reaction force (GRF):
  - force exerted on body by ground
- Mechanical strain:
  - when force is applied to bone, it deforms
  - amount of deformation relative to original length = strain

GRF and Strain



If body pushes down/backward
→ ground reaction force is up/forward



mechanical strain

Bone Physiology

How do we build bone?

Building Bone

Bone formation ⇐⇒ Bone resorption

- Mechanical strain helps maintain balance ---> bone remodeling
- Internal strain
  - muscular forces
- External strain
  - impact or "loading"

Building Bone

Internal strain

- Pull of muscle at attachment site bends bone
- Stimulates bone formation, if….
  - High magnitude (muscular force)
  - High rate (muscular contraction)
  - Irregular distribution

Skeletal muscle pulls against the bone,

Building Bone

External strain

- GRF produces longitudinal loading or compression of bone
- Strain in WB ↑ proportionally with GRF

- Most important stimulus for bone formation
- Sports that build bone involve:
  - large ground reaction forces
  - jumping, landing, running

Losing Bone

- Bed rest
- Weightlessness

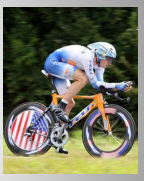
- Sports ?
- Weight-supported sports
  - ➢CYCLING

Seated pedaling at 250 W and 90 rpm places < ½ body wt on pedals

Building Bone in Cyclists

- Minimal impact
- Fixed body position
- Repetitive muscular strain pattern
- Lower magnitude (endurance/tempo)

✓ Exceptions: standing, sprinting



•Muscle forces in cycling insufficient:
- ➢to achieve net bone formation
- ➢to overcome NWB effects on bone

Building Bone: Summary

- BMD adapts
  - ➢positively to loading
  - ➢negatively to lack of loading
- NWB exercise: minimal effect on BMD
- WB exercise: greatest effect on BMD

❖ Cycling is a poor bone building stimulus

BMD in Athletes

Are there sport-specific effects?

The Runner

- GRF produced during running
  - ➢legs = 2-5 x body weight
  - ➢spine = 1.75 x body weight

- Distance for optimal bone formation in legs = 15-20 miles/week
- Lifetime cumulative bone-loading

✓ BMD in runners > cyclists

The Triathlete

- Allocation of training time
- Swimming + cycling < or > running

- Same BMD as runners
- No BMD loss over competitive season

✓Running is protective

The Cyclist

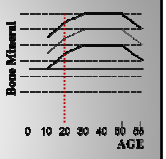
- Less cumulative bone loading over time

❖Total BMD similar to non-exercisers

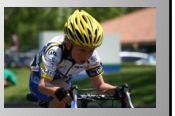
- Body weight distributed horizontally
- 7 x more likely to have osteopenia of spine compared to runners

The Young (Junior) Cyclist

- BMD ↑in adolescence, peaks in 20s
- 90% bone mass present at end of skeletal maturation

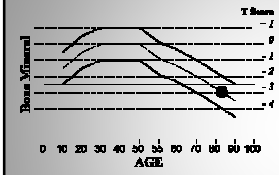


- Peak bone mass largely determines bone mass in older age
- Must sustain loading to maintain bone mass



❖Age at start of training important

The Master Cyclist



- BMD ↓ with age, F>M
- Lower BMD (spine, hip) than non-athletes and younger cyclists

- 2/3 with osteopenia or osteoporosis at spine and hips

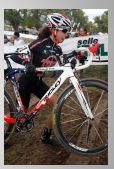
The Mountain Biker

- Ground-induced strain from variable terrain
- Two points of contact (hands/feet)
- Changes in body position
- ↑load at legs via pedals

✓BMD in mtn bikers > roadies

The Female Cyclist

- Estrogen important for bone health
- Intense training → amenorrhea
- Amenorrheic women at risk for impaired bone health



❖Caution in young female cyclists

- Post-menopausal women
  - ➢Greater risk for osteoporotic fractures

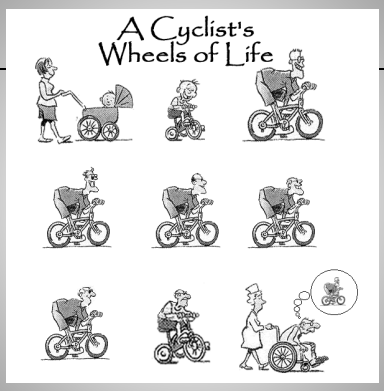
The Competitive Cyclist

- Avoid "unnecessary" WB activity during heavy training periods
- Larger training volume = more time spent resting and recovering
- BMD ↓over competitive cycling season
- Incomplete off-season recovery of BMD
- Sequential years of competitive cycling result in progressive bone loss

The Competitive Cyclist

- Tour de France saying:

"If you are not riding, you should be resting, if you do not have to stand, you should sit, if you do not have to sit, you should lie down."



Resistance Training

Does it build bone mass?

Resistance Training

- Positive correlation between muscle strength/mass and BMD
- Effects on BMD studied in:
  - ➢Adolescents
  - ➢Young adults
  - ➢Post-menopausal women*
  - ➢Older men*

Resistance Training

- Low-moderate-high intensity

- Power lifters have higher BMD than recreational lifters

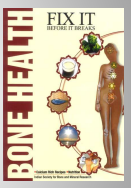
✓Weight training more effectively reduces bone loss than NWB endurance exercise

A Pitch for not Pedaling

How can I improve my bone health?

Improving Your Bone Health

- ✓Do not cycle to the exclusion of other WB activity
- ✓Sustain bone-loading activities throughout life



- Consider DXA to determine BMD
- Consume adequate Calcium, Vit D

Calcium and Vit D

- Calcium in athletes (1500 mg)
- Vit D ↑ Calcium absorption

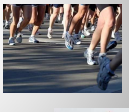
Age	Calcium AI
9-18 y	1300 mg
19-50 y	1000 mg
51+ y	1200 mg

- Fortified in foods
  - Cereal flour
  - Milk-based products
  - Fruit juices and drinks

Food	Calcium (mg)	% DV
8 oz Plain yogurt	415	42 %
8 oz Non-fat milk	302	30 %
1.5 oz Cheese	306	31 %

Time Off the Bike

- Is an important part of training



Take Home Points

- Compressive strain stimulates bone formation
- Cycling is weak stimulus for building bone
- Evidence of low BMD in cyclists of all ages
- Add resistance or WB activity to training

➢For BONE HEALTH

➢Not BIG TROPHIES

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Questions?