Natural Approaches to Bone Health

Dr. Michael Long ND BSc & Dr. Katie McKeown ND BSc
Section I

BONE PHYSIOLOGY
Boney Fun Facts

- We are born with 300 bones, but are left with 206 at adulthood
- 160 of your bones are in your hands and feet (54 in each hand, and 26 in each foot)
- Most commonly broken bone?
  - Clavicle
- Strongest bone?
  - Femur – and it’s hollow!
- All of your bones are connected with one exception: the hyoid
- Smallest bone?
  - Stapes (in the ear), and happens to be the only bone fully grown at birth
- Number of red blood cells made per minute by bone marrow: 2 million
- We grow a completely new skeleton every 7 years!
Function of Bone

• Support – provides structural framework for the body
• Protection – protects our internal organs (brain, spinal cord, heart, etc.)
• Mineral Storage
• Red Blood Cell formation
Bone Structure

- Spongy bone
- Compact bone
- Articular cartilage
- Epiphyseal line
- Periosteum
- Medullary cavity
- Diaphysis
- Proximal epiphysis
- Distal epiphysis
- Yellow bone marrow
- Compact bone
- Periosteum
- Perforating (Sharpey’s) fibers
- Nutrient arteries

Copyright © 2004 Pearson Education, Inc., publishing as Benjamin Cummings.
Growing Bone

Bone growth occurs at the Epiphyseal Line (aka growth plate)
Bone Remodeling

- Remodeling: replacing old bone with new bone
  - Recall: we re-grow our entire skeleton every 7 years!

The bone remodelling process.
Bone is continuously remodelled at discrete sites in the skeleton in order to maintain the integrity of the tissue. During this process, old bone is resorbed by osteoclasts and replaced with new osteoid, secreted by osteoblasts. First osteoclasts are activated, and the resorption phase takes approximately 10 days. Following resorption, unclassified macrophage-like cells are found at the remodelling site in the intermediate, or reversal phase. Osteoblast precursors are then recruited, which proliferate and differentiate into mature osteoblasts, before secreting new bone matrix. The matrix then mineralises to generate new bone and this completes the remodelling process. Copyright BTR©
Bones Changes with Aging

- Birth → Adolescence: bone growth > bone loss
- Young Adults: bone growth = bone loss
- Middle Age: bone growth < bone loss
  - i.e. bone is reabsorbed more than it is formed
- Women more affected than men
  - Smaller bones to start with
  - Greater hormone changes (menopause)
Effects of Bone Aging

1. Bone Demineralization
   - Increased loss of calcium and other minerals
   - Loss of hardness of bone

2. Brittle Bone
   - Decreased protein synthesis
   - Loss of flexibility of bone
Measuring Bone Density

- DEXA Bone Scan: measures bone density by calculating the amount of energy to send x-rays through your bones
- A T-Score is given based on the scan results
Osteoporosis

- Osteoporosis: literally ‘porous bone’
  - Occurs when bone removal far outpaces bone growth
  - Diagnosis occurs when bone density falls below a threshold
- Demineralized and brittle bone can become a high fracture risk
  - Main areas: hip, wrist, vertebrae
Dreaded Femoral Neck Hip Fracture
Quick Osteoporosis Risk Calculation

• Simple self assessment tool
• Osteoporosis Chance = Age – Weight (kg)
  – If >20: 50-60%
  – If 0-20: 15-20%
  – If <0: <5%
Section II

IMPROVING BONE MASS

www.ontariohealth.org
Bone Health Goals

1. Enhance bone mass
   - Increase mineralization (harden bone) and tensile strength (flexible bone)

2. Prevent fractures
Bisphosphonates:  
*Bone Building Drugs*

• Decrease bone breakdown
• But do they work?
  – Yes! When taken for three years:
    • 50% reduction in vertebral fractures
    • 40% reduction in hip fractures
• Many considerations:
  – Lots of potential side effects
  – Annoying to take: must be taken on an empty stomach first thing in the morning, no food or laying down for 30 minutes
Pharmaceutical Trickery

• What does a 50% reduction in fractures actually mean?
  – Risk of a fracture in the next 3 years if you have osteoporosis and don’t take a drug: 3%
  – Risk of a fracture in the next 3 years if you have osteoporosis and take a drug: 1.5%
  – 3% $\rightarrow$ 1.5% is a 50% reduction!

• Always weigh pros and cons with your doctor!
Calcium & Vitamin D

• Reduce fracture risk by 15-30%
  – Not as good as bisphosphonates, but fewer potential adverse effects
  – Calcium and Vitamin D must be used together
    • No benefit when taken individually
    • Common Dosing: 1500mg Calcium, 800 IU Vitamin D
Calcium in the Diet

• Milk right?
  – Maybe not!
  • People who drink 2+ glasses of milk per day have the same fracture risk as people who drink 0-1 glasses
  • Countries with the lowest milk consumption have the lowest rates of Osteoporosis (Asia, Africa, Latin America)
  • Countries with the highest milk consumption have the highest rates of Osteoporosis (Northern Europe and USA)
Best Calcium Source

- Leafy Green Vegetables
  - Cooked collard greens
  - Spinach
  - Rhubarb
  - Broccoli
  - Green beans
  - Almonds
  - Kale
  - Turnip greens
  - Okra
  - Swiss chard
Strontium

- Replaces calcium in the bone matrix
- Best evidence for Strontium Ranelate (not currently available in Canada)
- Fracture reduction
  - Vertebral Fractures: 40%
  - Hip Fractures: does not appear to help
Prevention in Key

• Daily weight bearing exercise
• Quitting smoking
• Eating a diet rich in leafy greens (make hard bones) and lean protein (make flexible bone)
• Reducing alcohol (2 drinks/day max) and coffee (3 cups/day max)
• Minimize tripping/falling hazards in the home (loose rugs, cords, adequate lighting, grab bars in bathroom, etc.)
Unit 3
855 St David St N
Fergus, ON
N1M 2W3

T: 519-787-4100
F: 519-787-4105

info@ontariohealth.org
www.ontariohealth.org

Upcoming Lectures/Appearances:

To be announced

Today’s lecture is available for download on our website.