Building Bone Density-Research Issues

Helping to Regain Bone Density

QUESTION 1
What are the symptoms of Osteoporosis?

Who is at risk?

Symptoms

- ***Bone Fractures***

- Osteoporosis
  - 1,500,000 fractures a year
  - Kyphosis
    - Loss of height –stooped position
  - 300,000 HIP Fractures

OVERVIEW

- Definition and Risks
  - Disease – Fragile Bones
  - Osteoporosis
    - Porous bone
  - No symptoms
    - Fracture
- Women 4 timed Men
- 24,000,000 women

OVERVIEW

- Bone Anatomy and Physiology
  - Muscle support
  - Protection of Organ
  - Mineral Storage
- Cortical Bone – Trabecular Bone
- Bone Remodeling

Question 2
What are the key age factors?

OVERVIEW

- Key Age Factors
  - Teens to 30
  - 30 to 50
  - Older than 50
    - Post menopause

OVERVIEW

- Key Age Factors
  - Teens to 30
    - Building
  - 30 to 50
    - Slow loss
  - Older than 50
    - Post menopause

OVERVIEW

- Key Age Factors
  - Teens to 30
    - Weight bearing Exercise
    - Calcium intake
    - NO smoking

OVERVIEW

- Key Age Factors
  - Adults 30 – 50
    - Slow loss
    - Exercise
    - Non – smoking
- Idiopathic Osteoporosis
  - Osteoporosis Int. 2005
  - Some blood chemical levels lower
  - Women and men

Smoking

Smoking and fracture risk: a meta-analysis

Osteoporosis, Int, 2005 16 155-162

Smoking

- Study 59,232 men and women (74% w)
- Fracture 1.25 smokers to non-smokers
- Fracture 1.13 BMD considered
- Highest Risk Hip fracture (1.84)
- Higher risk for Men

Effect of age, weight & Lifestyle factors on calcaneal quantitative ultrasound in premenopausal women

Calif. Tissue Int. (2004) 74(4) 317-21

Effect of age, weight & Lifestyle factors

- Bone Stiffness Positive
  - Outdoor activity
- Bone Stiffness Negative
  - # of pregnancies
  - Chronic use of drugs
  - Smoking
  - Subjective Health Status

OVERVIEW

- Post menopause
  - Bone density screening
  - Exercise
  - Medications

Factors that effect Osteoporosis Potential

- Uncontrollable Factors
  - Family History
  - Age
  - Race
  - Gender
- Controllable Factors
  - Activity
  - Diet
  - Medication

Lifestyle Choices

- Exercise
  - Weight bearing
- Body Weight
  - “Extreme” weight loss at 50 (>10%)
- Smoking

Diet

- Calcium & Vitamin D
  - 1500 mg/day
  - 8-ounce milk 300 mg
  - 5 – 15 minutes sunlight
- Soy
- Others
  - Protein
  - Sodium
  - Coffee

Do medications help?

Drugs –Choice?

MEDICATIONS

- Alendronate (Fosamax)
- Raloxifene (Evista)
- Risedronate Sodium (Actinel)
- Hormone Therapy

MEDICATION
Alendronate (Fosamax)

- Class of drugs – bisphosphonates
- Action – Bone cells
- Taking Fosamax
  - First thing in morning
  - Full glass of water
  - upright position Minimum 1/2 hour preferably one hour
  - Same time before first food, beverage, or medication of the day.

MEDICATION Side Effects Alendronate (Fosamax)

- Side effects are uncommon
  - Abdominal or musculoskeletal pain,
  - Nausea,
  - Heartburn,
  - Irritation of the esophagus.

MEDICATION
Raloxifene (Evista)

- Standard use

MEDICATION
Risedronate Sodium (Actinel)

- Taking Medication:
  - First thing in morning
  - Full glass of water
  - ½ hour before food or beverage
  - Remain upright

MEDICATION
Hormone Therapy

- Higher Risk factors

DETECTION

- Individual Fractures
- BMD
- Duel energy x-ray absorption DEXA
- Location Effects

Research

Can detection be done effectively?

BMD: The Problem
Osteoporosis Int. 2005 16: 1013-1015

- Considered the “wrong” measure
  - 3-D to a 2-D (average Bone mineral/area of bone shadow
- Bone Mineral Content (BMC) better
- Desire for STRENGTH

Research

Can detection be cheaper?

Identifying postmenopausal women with osteoporosis by calcaneal ultrasound, metacarpal digital x-ray radiogrammetry and phalangeal radiographic absorptiometry: a comparative study

Osteoporosis Detection

- Quantitative Ultrasound (QUS)
  - 67.5% sensitivity
- Digital X-ray radiogrammetry
  - 76.9% sensitivity
- Phalangeal Radiographic absorptimetry (RA)
  - 82.9% sensitivity

How else may we work against Osteoporosis? (And get a kick out of it)

Exercise

EXERCISE I

- Effects when young
- Effects for Middle age
- Effects for post-menopausal

Recent Research

Can exercise help children's bone density?

Osteoporosis International (2005) 16:1225-1232

Diet and exercise during growth have site-specific skeletal effects: a co-tiwn control study

- Effects on peri-pubertal and post-pubertal
  NOT pre-pubertal
- Hour/week differences in exercise
  - 1.2% total body Bone Mineral Content (BMC)
  - 1.4% leg BMC
  - 0.5% spine BMC
  - 0.1% cortical Thickness
- Protein intake (1 gram) 0.4% in arm BMC

Recent Research

Can exercise help the bone density for premenopausal women?

Effects of high-impact exercise on bone mineral density: a randomized controlled trail in premenopausal women

Osteoporosis, Inc. (2005) 16 191-197

Effects of Impact exercise

- Femoral neck and Trochanter
  - No loss of BMD exercise
  - -1.1% Control group
- MEAN trochanter BMC
  - No loss of BMD exercise
  - -7.7% control group
- Fall with fractures
  - 6 Exercise Group
  - 16 Control Group

Recent Research

Can exercise help elderly woman?

Effects of impact exercise on bone mineral density in elderly women with low BMD: a population-based randomized controlled 30-month intervension

Osterporosis Int. 2006 17: 109-118

Effects of high-impact exercise on bone mineral density

- Femoral neck BMD
  - 1.1% versus -0.4%
- Intertrochanteric BMD
  - 0.8% versus -0.2%
- Total femoral BMD
  - 0.1% versus -0.3%

Effects of high-impact exercise on bone mineral density

- L1 vertebra
  - 2.2% versus -0.4%
- Lumbar vertebra L2 – L4
  - No exercise effects

Resent Research

Can exercise help the spine of a postmenopausal women over a 3 – year period?

The bones are just not the same

Exercise maintains bone density at spine and hip EFOPSS: a 3-year longitudinal study in early postmenopausal women

Osteoporosis Int. 2006 17: 133-142

Spine

Exercise maintains bone density at spine and hip – 38 months

- DXA lumbar spine
  - 0.8% versus -3.3%
- QCT trabecular bone
  - 1.1% versus -7.7%
- QCT cortical bone
  - 5.3% versus -2.6%

Exercise maintains bone density at spine and hip – 38 months

- DXA total hip
  - -0.2% versus -1.9%
- DXA distal forearm
  - -2.8% versus –3.8%
- QCT cortical bone
  - 5.3% versus -2.6%

Exercise maintains bone density at spine and hip – 38 months

- DXA lumbar spine – between group
  - 4.1%
- QCT trabecular bone– between group
  - 8.8%
- QCT cortical bone – between group
  - 7.9%

Exercise maintains bone density at spine and hip – 38 months

- DXA total hip – between group
  - 2.1%
- DXA distal forearm – between group
  - 1%

Exercise maintains bone density at spine and hip – 38 months

- Spine
  - Pain frequency and intensity reduced

Resent Research

Can we just exercise at home and solve our bone mass problems?

Predictors of compliance with a home-based exercise program added to usual medical care in preventing postmenopausal osteoporosis: an 18-month prospective study

Osteoporosis Int. (2005) 16: 325-331

Hone-based exercise programs

- 18 month compliance rate
  - 17.8%
- Factors
  - Contraindication for hormone replacement
  - General physical function

What happens when the problems are not solved?

Bone Problems

- Kyphosis
  - Spinal Hump
- Wrist Fractures
- Spinal Fractures
- Hip Fractures

Don’t fall – No fractures

Fall Prevention

- Be careful!
  - Time
  - Surfaces
  - Contact Surfaces
- Exercise