Treatment of Osteoporosis

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Definition of Osteoporosis

A disease characterized by low bone mass and micro-architectural deterioration of bone tissue leading to enhanced bone fragility and a consequent increase in fracture risk.

*World Health Organization (WHO), 1993*

![Normal bone](image1.png) ![Osteoporosis](image2.png)
**Actions**
- Cell effect
- Bone Effect
- Target
- Agents

**Antiresorption**
- Osteoclast
- Stabilisation
- High turnover
- Estrogen
- Calcitonin
- SERMs
- Bishosphonates

**Formation**
- Osteoblast
- Increase
- Low turnover
- Vitamin D
- Fluoride
- Anabolic Steroids
- PTH and PTH$_{RP}$
- Growth hormone

- **Strontium Ranelate**
- **Physical Activity**
- **Calcium**
- **Hip Protectors**
- **Balloon Kyphoplasty**

**•** Calcium
**•** Hip Protectors
**•** Balloon Kyphoplasty
RISK FACTORS: CONTROL

- Smoking
- Alcohol
- Avoidance of dairy products
- Lack of exercise
- Caffeine
- Too many carbonated (“soft”) drinks
- High protein diet
- $PO_4$
- Childless

2 or more YES
ETIOLOGY

Age 1% loss / yr
E 50-65 yr → Trab bone loss 2-3%

<table>
<thead>
<tr>
<th>Inactive osteoblasts</th>
<th>Active osteoblasts</th>
<th>Osteoid tissue</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="inactive osteoblasts" /></td>
<td><img src="image2" alt="active osteoblasts" /></td>
<td><img src="image3" alt="osteoid tissue" /></td>
</tr>
</tbody>
</table>

Osteoclasts

1 2 3 4
Precision

Accuracy
Biphosphonates
General structure of pyrophosphate and bisphosphonates
How Bisphosphonates Work in Osteoporosis

Bone Mineral Density

Bone Turnover

Bone Strength

Fracture Risk

Maintained or improved microarchitecture and mineralization
HOLICK'S DATA RECOMMENDS

Hands, arms and faces
suberythermal doses of
sunlight 10-15 min. two
or three times weekly.
7-DEHYDROCHOLESTEROL (Provitamin D) → CHOLECALCIFEROL (Vitamin D₃) → 1ST HYDROXYLATION (liver) → 25-HYDROXYCHOLECALCIFEROL → 2ND HYDROXYLATION (kidney) → 1,25-DIHYDROXYCHOLECALCIFEROL
Calcium
# DAILY CALCIUM REQUIREMENTS

<table>
<thead>
<tr>
<th>Age</th>
<th>Daily / mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-9</td>
<td>800</td>
</tr>
<tr>
<td>10-18</td>
<td>1200</td>
</tr>
<tr>
<td>19-menopause</td>
<td>1000</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>1200 - 1500</td>
</tr>
<tr>
<td>Breast feeding</td>
<td>1200 - 1500</td>
</tr>
<tr>
<td>Men</td>
<td>1000</td>
</tr>
</tbody>
</table>
# CALCIUM SUPPLEMENTATION

<table>
<thead>
<tr>
<th>Calcium Supplement</th>
<th>% Ca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Carbonate</td>
<td>40</td>
</tr>
<tr>
<td>Calcium Sulphate</td>
<td>36</td>
</tr>
<tr>
<td>Calcium Phosphate</td>
<td>30</td>
</tr>
<tr>
<td>Calcium Lactate</td>
<td>18</td>
</tr>
<tr>
<td>Calcium Gluconate</td>
<td>9</td>
</tr>
<tr>
<td>Calcium Malate</td>
<td>30</td>
</tr>
</tbody>
</table>
Structure of estradiol and raloxifene
The Seven Dwarves of Menopause

Itchy, Bitchy, Sweaty, Sleepy, Bloated, Forgetful & Psycho
Anabolic Steroids
Parathyroid Hormone
Strontium ranelate

5-[bis(carboxymethyl)amino]-2-carboxy-4-cyano-3-thiopheneacetic acid distrontium salt.
A dual mode of action on bone metabolism

BONE FORMATION

- STRONTIUM RANELATE
- REPPLICATION

Pre-OB

OB

OB

OB

+ BONE-FORMING ACTIVITY

BONE matrix

BONE RESORPTION

Pre-OC

Differentiation

Bone-resorbing activity

- STRONTIUM RANELATE

PHYSICAL ACTIVITY

Weight bearing exercise
After school activities
Top ways children ages 6 through 8 say they spend their time after school:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watch non-cable TV</td>
<td>77%</td>
<td>80%</td>
</tr>
<tr>
<td>Play outside</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>Play at home</td>
<td>57%</td>
<td>59%</td>
</tr>
<tr>
<td>Do homework</td>
<td></td>
<td>48%</td>
</tr>
<tr>
<td>Read</td>
<td>37%</td>
<td>43%</td>
</tr>
</tbody>
</table>

Source: M/E Marketing & Research, U.S. News & World Report
BONE APPosition AND DEMolition ARE DUE TO STRESS ELICITED BY FUNCTION
GROWTH HORMONE
External hip protectors are designed with a view to dispersing the weight of a blow from the neck of the femur during a fall or impact to the hip.
The hard but flexible shells of the protectors cover and protect the neck of the femur. The design of the shell respects the principles of blow dispersion and absorption which, combined with a larger contact surface, means that the shock of a blow is transferred from the shell to the softer tissue surrounding the neck of the femur.
Birthday Boy, they say our bodies are over 70% water...