



Bone Health Basics and Updates

IPAS FALL CME CONFERENCE
October 27, 2026

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Disclosures

- Jaime Bonner, MSN, ARNP: No disclosures



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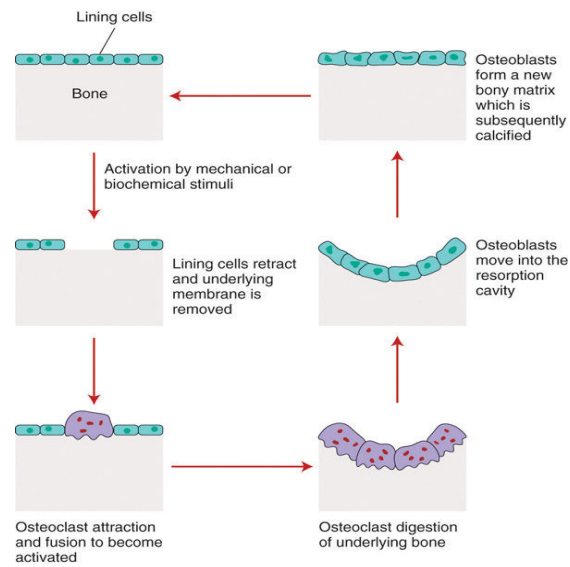
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Objectives

- Participants will be able to:
 - Discuss bone health changes across the lifespan, methods of bone density evaluation, lifestyle interventions to optimize bone health, and medication options for fracture risk reduction
 - Discuss the impact of cancer and cancer treatment on bone health
 - Discuss the impact of GLP-1 agonists on bone health and other bone health current topics

Bone Modeling and Remodeling

Osteoblast and Osteoclast Function



IOWA
HEALTH CARE

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Bone Changes Across the Lifespan

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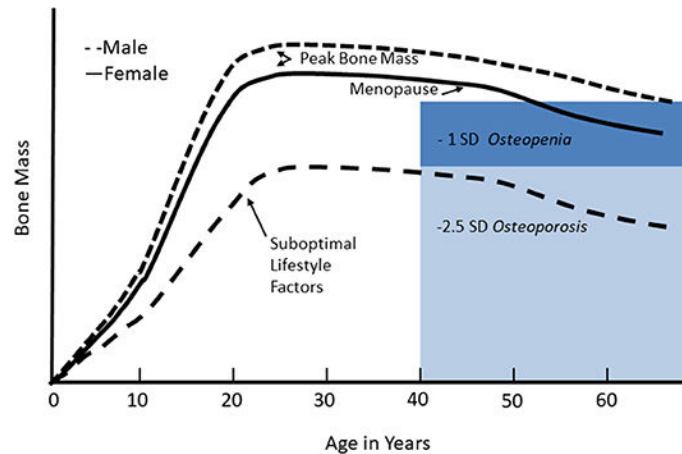
Early Development

- Fetal period
 - Skeletal mineralization starts in 1st trimester and peaks in 3rd trimester
 - Pre-term infants at risk for low BMD that can persist
- Early childhood
 - Constant modeling and remodeling causes bone growth and BMD acquisition

On-Going Development

- Puberty
 - Crucial time for BMD acquisition
 - Total bone mass doubles during this time
- Early adulthood
 - BMD acquisition continues into early 20s
 - Greater BMD acquisition in childhood and early adulthood delays onset of osteoporosis and fracture risk

Perimenopause and Menopause



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Optimizing BMD Acquisition and Maintenance

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Nutrition Priorities

- Adequate dietary calcium and vitamin D intake with supplementation when needed
- Adequate dietary protein intake
 - Special attention to people with food insecurity, eating disorders or other intake limitations
 - Special attention to people following vegan diets
 - Special attention to people with malabsorption
- Achievement and maintenance of moderate body weight

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Activity Priorities

- Frequent weight bearing exercise/activity starting in early childhood and continued lifelong
- Active play for children
- Purposeful weight bearing exercise for teens and adults with sedentary lifestyles
- Higher intensity exercise (jumping, running, dancing, etc.) provide greater BMD benefits in appropriate people
- Caution with some yoga/Pilates movements with known osteoporosis

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Other Lifestyle Priorities

- Smoking cessation
- Alcohol only in moderation (fewer than 3 servings per day)
- Limit carbonated beverages
- Consider limiting caffeinated beverages

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Screening for Osteoporosis and Low Bone Density

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Ways to Screen

- FRAX tool
 - Validated in people 40-90 yrs old
 - Elevated risk (MOF >8.4%) indicates need for further evaluation
- DXA
- Opportunistic methods
 - Current or past fragility fracture
 - Osteopenic on radiographs
 - Low bone density on CT

Who to Screen

- Per USPTF
 - Women 65 years and older
 - Women under 65 with elevated FRAX risk
- Strongly consider early screening in patients with
 - Family history of osteoporosis or fragility fracture, personal fracture history
 - Early menopause
 - History of bone toxic medication use
 - History of or current eating disorder
 - History of bariatric surgery
 - Tobacco or alcohol use disorder
 - Chronic illness (endocrine, rheumatologic, oncologic, etc)

How Often to Repeat DXA

- Every 2 years in osteopenia
- Every 1-2 years in osteoporosis
- With significant health change and more than 2 years since most recent DXA
- Every 1-2 years on aromatase inhibitors, androgen deprivation therapy or long-term corticosteroids

Medication Options for Osteoporosis

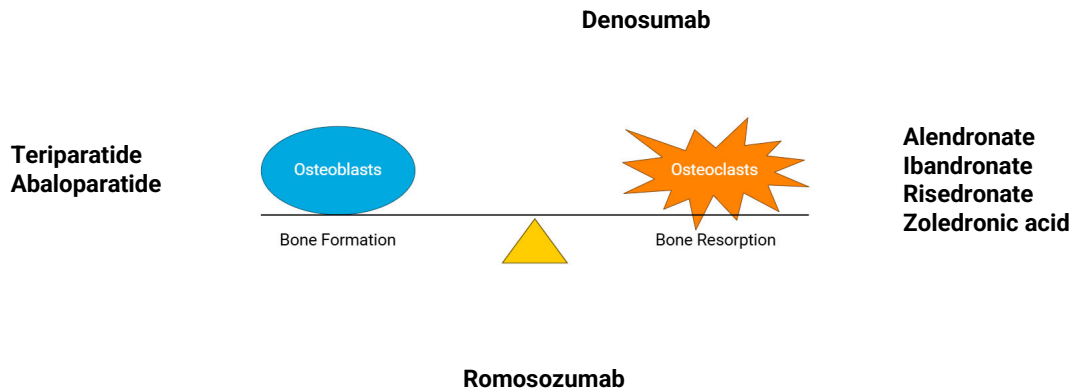
Treating Osteoporosis

- Goal of treatment is reducing fracture risk
- Optimize lifestyle factors first and always!
- Consider secondary causes of osteoporosis (hyperparathyroidism, hyperthyroidism, malabsorption, multiple myeloma, etc) in severe or unexpected osteoporosis

Medication Types

- Antiresorptives
 - Denosumab
 - Bisphosphonates (alendronate, ibandronate, risedronate, zoledronic acid)
- Anabolics
 - PTH analogs (teriparatide, abaloparatide)
 - Sclerostin inhibitor (romosozumab)

Where what works.....



Treat to Target: Choosing First Line Therapy

“Instead of first-line bisphosphonate treatment for all patients, selection of initial treatment should focus on reducing fracture risk rapidly for patients at very high and imminent risk, such as in those with recent fractures. Initial treatment selection should also consider the probability that a BMD treatment target can be attained within a reasonable period of time and the differential magnitude of fracture risk reduction and BMD impact with osteoanabolic versus antiresorptive therapy.”

ASBMR/BHOF Task Force on Goal-Directed Osteoporosis Treatment, 2024

Who is at Very High Risk?

- Fracture in previous 12 months
- Multiple fractures
- Fractures while on osteoporosis therapy
- Fractures while on bone toxic drugs
- T score <-3.0
- FRAX 10-year risk MOF >30% or hip fracture >10%
- High fall risk

Expected Increase in T Score by Agent(s)

Lowest baseline T-score that permits >50% of women to achieve a T-score > -2.5 in approximately 3 yr.

	Total Hip	Lumbar Spine
Alendronate	-2.7	-3.0
Denosumab	-2.8	-3.1
Romosozumab/Alendronate	-2.9	-3.5
Abaloparatide/Alendronate	-2.9	-3.5
Romosozumab/Denosumab	-3.1	-3.7

Osteoanabolic Agents

Teriparatide

Forteo

- PTH (1-34) analog
- Increases osteoblast activity
- Daily SQ injection
- 1-2 years continuous treatment
- May cause hypercalcemia
- May increase nephrolithiasis risk
- Not used in hyperparathyroidism
- Follow with dmab or bisph

Abaloparatide

Tymlos

- PTHrP (1-34) analog
- Increases osteoblast activity
- Daily SQ injection
- 1-2 years continuous treatment
- May cause hypercalcemia
- May increase nephrolithiasis risk
- Not used in hyperparathyroidism
- Follow with dmab or bisph

Romosozumab

Evenity

- Sclerostin inhibitor
- Increases osteoblast activity and inhibits osteoclast activity
- Monthly set of 2 SQ injections given in clinic
- May cause hypocalcemia
- Not used in patients with MI or stroke in previous 12 months
- Follow with dmab or bisph



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Antiresorptive Agents

Denosumab

Prolia, Stoboclo, others

- RANK-L inhibitor
- Decreases osteoclast formation
- SQ injection every 6 months
- May cause hypocalcemia, risk higher with renal dysfunction
- ONJ/AFF risk
- Rebound BMD density loss and vert fracture risk
- Have an off-ramp!

Alendronate

Fosamax

- Bisphosphonate
- Decreases osteoclast activity
- Weekly pill
- Need adequate renal function
- May cause hypocalcemia
- ONJ/AFF risk
- Consider treatment holiday after 3-5 years

Zoledronic Acid

Reclast

- Bisphosphonate
- Decreases osteoclast activity
- Annual IV infusion
- Need robust renal function
- May cause hypocalcemia
- ONJ/AFF risk
- Consider treatment holiday after 3-5 years



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Endocrine Society, UpToDate

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Take Home Points

Correct hypovitaminosis D and secondary hyperparathyroidism prior to starting medications

Bisphosphonates for 3-5 years

Consolidate denosumab with alendronate or zoledronic acid

Consider anabolics first in those with very high fracture risk (recent or multiple fractures, very low T score, very high FRAX risk)

Consider secondary causes of osteoporosis in severe or unexpected cases



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Oncology Bone Health

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Bone Health in Cancer Care

- Chemotherapy, immunotherapy and endocrine therapy can all decrease bone density
- Aromatase inhibitor therapy for breast cancer and androgen deprivation therapy for prostate cancer cause bone loss **2-4 times greater** than expected age-related bone density loss
- Myeloma cells increase osteoclast activity and decrease osteoblast activity overall, not just at lytic lesion sites
- Many malignancies cause osseous metastases that speed osteoclast activity, creating lytic lesions and increasing local fracture risk

Lifestyle Optimization

- Calcium and D3 supplementation
- 1,200mg dietary calcium daily
- Adequate daily protein intake based on individual factors
- Patient-appropriate weight bearing activity
- Smoking cessation
- Alcohol only in moderation

Medications

- If your patient has osteopenia/osteoporosis related to AIT or ADT
 - May be prescribed denosumab (Prolia) or a bisphosphonate (often zoledronic acid) for BMD preservation and improvement
- If you patient has multiple myeoloma
 - Very likely are prescribed oncology doses of zoledronic acid (Zometa)
- If your patient has solid tumor malignancy with osseous metastases
 - Very likely are prescribed oncology doses of denosumab (Xgeva) or zoledronic acid (Zometa)

How Can You Support?

- Ask about nutrition, protein supplements and drinks very useful when appetite is low
- Ask about calcium and D3 supplementation
- Encourage smoking cessation and alcohol moderation
- Understand bone targeted agents
 - Prolia and Reclast are used to protect BMD with AIT and ADT
 - Xgeva and Zometa are oncology doses given to reduce fracture risk at sites of lytic metastases
 - Risks, contraindications, side effects very similar between dosing structures
- Consider ONJ with jaw/dental pain and AFF with hip, groin, thigh, knee pain

GLP-1 Agonists and Bone Health

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Fracture Paradox in T2DM

BMD often normal or increased in T2DM

T2DM increases fracture risk

Factors outside BMD may contribute

- Decreased bone quality
- Impaired microarchitecture
- Obesity, greater fall force
- Other metabolic factors
- Increased fall risk



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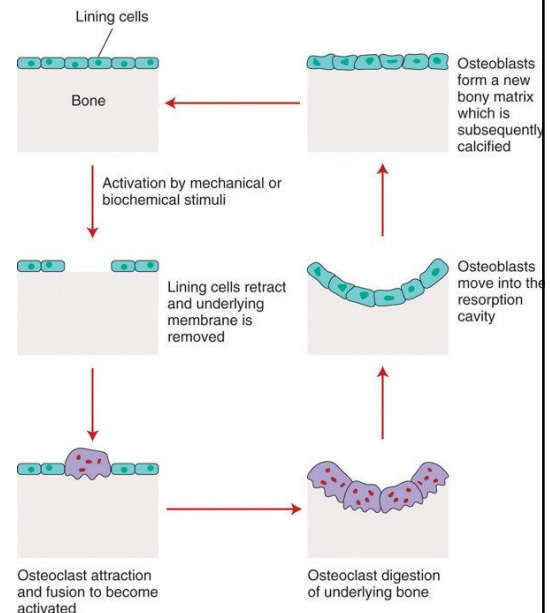
GLP-1 and Bone Physiology

GLP-1 receptors present on osteoblasts and osteocytes

Preclinical data suggest GLP-1 RAs may:

- Promote osteoblast differentiation
- Inhibit osteoclast activity

Human fracture risk data mixed



Associations of Semaglutide With Skeletal Outcomes in People With Obesity, With and Without Type 2 Diabetes: A Target Trial Emulation

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Keywords: GLP-1 receptor agonists | major osteoporotic fractures | obesity | osteoporosis | semaglutide | type 2 diabetes

ABSTRACT

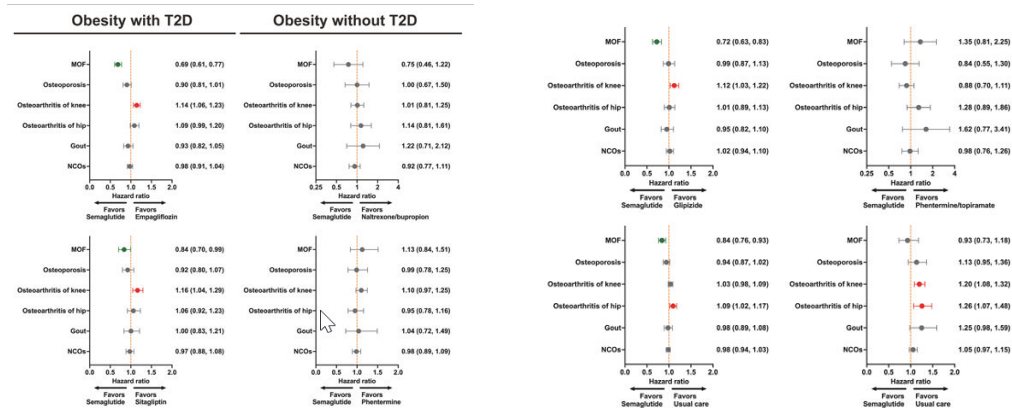
Aims: To evaluate the associations between semaglutide initiation and long-term skeletal outcomes in people with obesity, stratified by type 2 diabetes (T2D) status, using target trial emulation.

Materials and Methods: This retrospective cohort study used the TriNetX federated electronic health record network. People with obesity initiating semaglutide were matched 1:1 via propensity score matching (215 covariates) to those initiating active comparators or usual care. The with-T2D cohort ($n = 19824$ – 93519 matched pairs per comparison) was followed for 3 years; the without-T2D cohort ($n = 10323$ – 56225 pairs) for 2 years. **The primary outcome was major osteoporotic fracture (MOF). Secondary outcomes included osteoporosis diagnosis;** exploratory outcomes included osteoarthritis and gout.

Results: In the with-T2D cohort, semaglutide initiation was associated with a lower risk of MOF compared with empagliflozin (HR 0.69; 95% CI 0.61–0.77), glipizide (HR 0.72; 0.63–0.83) and usual care (HR 0.84; 0.76–0.93). In the without-T2D cohort, no significant associations with MOF were observed across any comparison (all $p > 0.05$). Osteoporosis risk did not differ significantly in most comparisons in either cohort. Exploratory analyses of osteoarthritis and gout showed inconsistent patterns across comparators.

Conclusions: **Among people with obesity and T2D, semaglutide initiation was associated with a lower risk of MOF over 3 years compared with other glucose-lowering agents and usual care. This association was not observed in people with obesity without T2D.** These findings support further investigation of the skeletal effects of GLP-1 receptor agonists.

Results of Huang, Et al.



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GLP-1 Agonists and Fracture Risk

Diabetes Treatment

May provide fracture risk reduction
T2DM-associated metabolic risk factors present
Uses diabetes dosing
Weight loss not primary goal

Obesity Treatment without Diabetes

Mixed results, overall, no significant impact on fracture risk
Diabetes-related factors not present
Using weight loss dosing
Weight loss is primary goal
Potential for muscle and bone mass loss

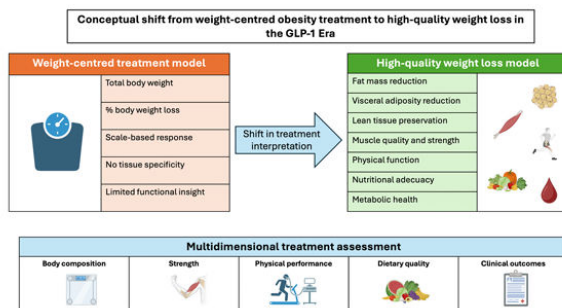
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Preserve Lean Mass During Weight Loss

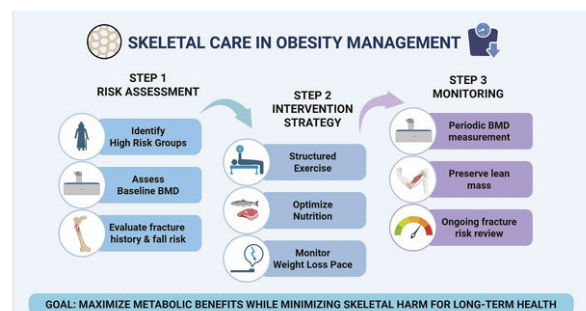
- Weight loss poses risk of muscle and bone tissue loss
- Obese older adults may have pre-existing sarcopenic obesity with current or impending functional decline
- Further lean mass loss speeds functional decline and increases fall risk
- Balance fat loss with lean mass preservation

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Models for Lean Mass Preservation During Weight Loss



Proposed weight loss model by Sanches-Haro, et al.



Proposed weight loss model by Kim & Cho

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Nutrition During Weight Loss

- Protein is most important nutritional component
- Assure minimum protein intake 1.2gm/kg/day
- Spread protein intake throughout the day
- Maximize meal and snack opportunities with suppressed appetite
 - Eat several times throughout the day
 - Protein at every meal/snack
 - Eat protein-rich foods first

Exercise During Weight Loss

Protein intake alone preserves lean mass

Protein intake + resistance training preserves/improves muscle function

Aerobic exercise important for fat loss but inadequate to preserve muscle function

Whole-body resistance training at least 2-3 times per week



Strategies to Optimize Resistance Training

Respect co-morbid conditions limiting exercise capacity

Start with low barrier exercise (chair or water exercise)

Address social barriers (home plan with minimal equipment)

Structured support

Consistent monitoring

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Other Bone Health Hot Topics

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Bone Health Hot Topics

Weighted vests

- Mixed results, not shown to be better for bones than regular walking and lifting weights
- If resources are limited, spend your money on hand weights and walking shoes

Vibration plates

- Benefit bone in people who CANNOT BEAR WEIGHT (astronauts, wheelchair users)
 - Not shown to be better for bones than regular walking and lifting weights
 - High magnitude vibration can harm bone

Bone Health Hot Topics

K₂

- Some promising studies
- Bone health experts/guidelines do not yet recommend D₃ + K₂ over D₃ alone

Various other supplements and nutrition recommendations

- In general, simpler is better
- Calcium and D3 have strong data supporting bone health benefits
- Dietary calcium and protein have strong data supporting bone health benefits
- Some supplements have lab or animal data but no or inconclusive human data
- Financial toxicity – spend resources on proven interventions

Questions?

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— Thank you



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