A non-pharmacological multimodal approach to bone health and fracture prevention

By: Christina Ziebart, PT, CSEP-CEP, MSc, PhD

Overview

- Background Information about me
- Brief Background of Osteoporosis
- Exercise for Osteoporosis
- Exercise Recommendations
- Fall Prevention Strategies
- Nutrition Recommendations
- Pulling it all Together
Learning Objectives

1. Know the exercise recommendations for people with osteoporosis
2. Know when to start implementing exercise recommendations with clients
3. Be able to provide some fall prevention strategies to clients
4. Have brief understanding of nutrition recommendations for people with osteoporosis

A bit about me

- Currently a post-doctoral fellow at UHN
  - Under the supervision of Dr. Susan Jaglal
  - Studying fracture patterns in people post SCI
- Assistant Professor at Western University
  - Physical Therapy
  - Researching exercise interventions for osteoporosis management
- Previously a PhD student at Western University
  - Under the supervision of Dr. Joy MacDermid
  - Studying the effects of exercise and education after a DRF
- CSEP-CEP with practical experience working with people with osteoporosis
- BoneFit Trained and Instructor
- Mom 😊
Who has Osteoporosis?

Osteoporosis

A decrease in bone mineral density and quality of bone can increase the risk of fracture from low impact incidents like a fall, a sneeze or bending over.

https://www.medicalnewstoday.com/articles/155646.php
Osteoporosis

- Osteoporosis affects 1 in 3 women and 1 in 5 men
- There is a large economic burden associated with osteoporotic fractures
- Fracture risk increases as we age
- Common sites of fracture: Wrist, Hip and Spine
- High mortality rate with Hip and Spine fractures

Management Strategies

- Pharmacological
  - Used for people at moderate or high risk of fracture
  - Managed by a physician
- Non-Pharmacological
  - Exercise
  - Nutrition
  - Falls Prevention Strategies
Therapeutic Goals

Prevent fractures via:
1) fall prevention:
   - mobility, dynamic balance, muscle strength, postural alignment
2) safe movement:
   - postural alignment and body mechanics to protect the spine
   - muscular endurance in spinal extensors
   - stretch muscles restricting mobility or optimal alignment
3) prevention of further bone loss:
   - exercise may not have a certain effect on bone mineral density.

CSEP Exercise Guidelines

For health benefits, adults aged 65 years or older should be physically active each day, minimize sedentary behaviour, and achieve sufficient sleep.

A healthy 24 hours includes:

- PHYSICAL ACTIVITY
  - Performing a variety of types and intensities of physical activity, which includes:
    - Moderate to vigorous aerobic physical activities such that there is an accumulation of at least 150 minutes per week
    - Muscle strengthening activities using major muscle groups at least twice a week
    - Physical activities that challenge balance
    - Several hours of light physical activities, including standing

- SLEEP
  - Getting 7 to 8 hours of good quality sleep on a regular basis, with consistent bed and wake-up times

- SEDENTARY BEHAVIOUR
  - Limiting sedentary time to 6 hours or less, which includes:
    - No more than 3 hours of recreational screen time
    - Breaking up long periods of sitting as often as possible

Replacing sedentary behaviour with additional physical activity and trading light physical activity for more moderate to vigorous physical activity, while preserving sufficient sleep, can provide greater health benefits.

Progressing towards any of these targets will result in some health benefits.
CSEP Exercise Guidelines

2010 Clinical Practice Guidelines

Early release, published at www.cmaj.ca on October 12, 2010. Subject to revision.

2010 clinical practice guidelines for the diagnosis and management of osteoporosis in Canada: summary

Alexandra Papaloannou MD MSc, Suzanne Morin MD MSc, Angela M. Chi, Stephanie Atkinson PhD, Jacques P. Brown MD, Sidney Feldman MD, David Anthony Hodman MD, Sophie A. Jamal MD PhD, Stephanie M. Kaiser MD, Kerry Siminovitch MD, William D. Leslie MD MSc; for the Scientific Advisory Osteoporosis Canada

Key points

- The management of osteoporosis should be guided by an assessment of the patient's absolute risk of osteoporosis-related fractures.
- Fragility fracture increases the risk of further fractures and should be considered in the assessment.
- Lifestyle modification and pharmacologic therapy should be individualized to enhance adherence to the treatment plan.
Risk Assessment

FRAX

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: Canada
Name/ID:

Questionnaire:
1. Age (between 40 and 90 years): Y N
2. Sex: Male Female
3. Weight (kg):
4. Height (cm):
5. Previous fracture:
6. Femoral fracture:
7. Current smoking:
8. Glucocorticoids:
9. Rheumatoid arthritis:

10. Secondary osteoporosis:
11. Alcohol 3 or more
   times/week:
12. Personal risk BMD (T-score):

Low Risk (10%)
Moderate Risk (20%)
High Risk (30%)

CAROC

Osteoporosis.ca

Osteoporosis Exercise Guidelines

Too Fit to Fall or Fracture

Strength Training Every 2 days:
- Exercises for legs, arms, chest, shoulders, back
- Use body weight against gravity, bands, or weights
- 8 - 12 repetitions per exercise

Balance Exercises Every day:
- Tai Chi, dancing, walking on your toes or heels
- Have a sturdy chair; counter, or wall nearby, and try (from easier to harder): shift weight from heels to toes while standing; stand heel to toe; stand on one foot: walk on a pretend line

Posture Awareness Every day:
- Gently tuck your chin in and draw your chest up slightly
- Imagine your collarbones are wings - spread your wings slightly without pulling your shoulders back

Aerobic Physical Activity At least 150 mins/week:
- Quick of 10 mins or more, moderate to vigorous intensity
- You should feel like your heart is beating faster and you are breathing harder
- You might be able to talk while doing it, but not sing

*If you have a spine fracture, consult a physical therapist/kinesiologist before using weights, and choose moderate, not vigorous aerobic physical activity.

Osteoporosis Exercise Guidelines

- Prioritize Strength Training
- Train Posture
- Practice Spine Sparing Strategies
  - Hinge from your hip
  - Step to turn rather than twisting

Alignment Matters!
The Hip Hinge

BoneFit

- BoneFit: A training program for health and exercise professionals to train people with osteoporosis
Low intensity Exercise

The Effects of Home Exercise in Older Women With Vertebral Fractures: A Pilot Randomized Controlled Trial

Jenna C Gibbs, Caitlin McArthur, John D Wark, Lehana Thabane, Samuel C Scherer, Sadhana Prasad, Alexandra Papaloannou, Nicole Mittmann, Judi Laprade, Sandra Kim


Published: 03 January 2020  Article history

“There was a small effect of exercise on 5 times sit-to-stand test versus control (MD = −1.58 [95% CI = −3.09 to −0.07], intention-to-treat; MD = −1.49 [95% CI = −3.12 to 0.16], per-protocol). There were no other major or statistically significant MDs for any other measured outcomes after follow-up. Adherence declined over time”

“Declining adherence to home exercise suggests that strategies to enhance long-term adherence might be important in future confirmatory trials”

High Intensity Exercise

High-Intensity Resistance and Impact Training Improves Bone Mineral Density and Physical Function in Postmenopausal Women With Osteopenia and Osteoporosis: The LIFTMOR Randomized Controlled Trial

Steven Watson, Benjamin Weeks, Lisa Wells, Amy Hardling, Sean Horan, Belinda Beck


Published online: February 25, 2019

“The HIIT group exhibited an increase in height (0.2±0.5 cm versus −0.2±0.5 cm, p = 0.004; 95% confidence interval [CI] 0.0% to 0.3% versus 0.0% to −0.3%) compared with the CON group (ITT). There were no significant between-group differences in change for weight, cBPAQ, or daily calcium intake”
"Data on a total of 287 surveys were collected. The sample was 90% female with a mean age of 67 (SD: 10.7) years. Most participants preferred to exercise in the morning (n=208, 75%), on their own time (n=180, 65%), with exercise that were easy to perform (n=151, 55%), slow paced (n=133, 48%), and easy to remember (n=117, 43%). Home (n=171, 62%) was the most preferred location to exercise. The most important goal for the participants was to improve strength (n=241, 84%) and the least important goal was to reduce falls (n=129, 45%). Time was the most common barrier reported in 30% of participants and followed by pain in 23% of the participants."
Make it Practical

Reduce Fall Risk to Reduce Fracture Risk
Fall Risk Factors

- Previous Fall
- Medication use
- Polypharmacy
- Vision and Hearing Impairments
- Diabetes
- Arthritis
- Incontinence
- Pain

Fall Prevention Strategies

- Balance exercises
- Home Hazard Assessment
"Only 90 of 133 (67.7%) residents completed the 6-month intervention period, and 84 (63.2%) completed the 7- to 12-month falls-monitoring follow-up period. Both prevalence of postural hypotension (p = 0.0005) and poor visual acuity (p = 0.04) were reduced in the intervention group. There was no difference between the groups in the number of falls sustained, the risk of falling [odds ratio 0.45 (95% CI 0.19–1.14)], or in the risk of recurrent falling [odds ratio 1.07 (95% CI 0.40–2.97)].

Falls Prevention Strategies - Balance

- Need to continue to challenge balance
- Static
- Dynamic
- Progression
  - Static >> dynamic
  - Static + reduced support
  - Static + reduced senses
  - Static + mental challenge
The effects of Tai Chi on fall prevention, fear of falling and balance in older people: A meta-analysis

Inge H.J. Logge, Arianna P. Verhagen, Arno C.H.J. Radermaker, Siets M.A. Brema-Zeestraten, Erik van Roostum, Marjan J. Faber, Bart W. Koes

Identification of home fall hazards is another strategy to reduce falls
- This shows promise since many adults spend a lot of time in their homes
- Gold standard: therapist assessment of home hazards
- Other strategies may need to be considered

Falls Prevention Strategies- Fall Hazards

TC participants showed significant improvements in fall rates (2 trials included, IRR: 0.51, 95% CI 0.38–0.68) and static balance (2 trials included, SMD: 0.47, 95% CI 0.23–0.72). Compared with non-exercise controls, no improvement was found for TC participants in fall rates (5 trials, IRR: 0.79, 95% CI 0.60–1.03) or static balance (2 trials, SMD: 0.30, 95% CI = 0.03–0.70), but a significant improvement was found for fear of falling (SMD: 0.37, 95% CI = 0.03–0.70).
Home Hazard Identification

Preventing Falls in Older People: Outcome Evaluation of a Randomized Controlled Trial
Margaret Stevens, PhD,* C. D’Arcy J. Holman, PhD,* Nicole Bennett, MPH,†
and Nick de Klerk, PhD‡

“At the 6-month follow-up, PPA falls risk scores were significantly lower in the EIG than in the CG. EIG subjects assigned to the extensive exercise intervention group showed significant improvements in tests of knee flexion strength and sit-to-stand times but no improvements in balance. EIG subjects assigned to the extensive visual intervention group showed significant improvements in tests of visual acuity and contrast sensitivity. The rate of falls and injurious falls within the trial period were similar in the three groups.”

“A total of 8 studies (n=8) and 5,177 participants were included. There was a high risk of bias across the studies mostly due to improper blinding of personnel of the outcome assessor. Pooled estimate effects from 5 studies assessing the incidence rate of falls from 3,019 individuals indicated no difference between fall hazards identification programs and control (Incidence rate ratio IRR = 0.98, 95% CI: 0.87 to 1.10).”
An innovative way to monitor home falls

Journal: Journal of Hand Therapy
Title: GoPro Video-based Therapist-rating of comprehensive-home-fall-hazard-checklist shows excellent inter-rater reliability for postmenopausal women with distal radius fracture - a technical report
Corresponding Author: Ms Neha Dewan
Co-Authors: Christina Ziebart, PT, Ph.D.; Armanaghan Dabbagh, PT, MSc; Joy C MacDermid, PT, Ph.D.
Manuscript Number: HANDTHE-D-23-00069

Nutrition Recommendations

- Best to consult a doctor
- But important to be able to answer some questions
- Calcium
  - Food sources
- Vitamin D
  - Likely requires supplementation
- Protein?
Nutrition Recommendations

“RECOMMENDATIONS: Current recommended intakes of calcium are too low. Revised intake guidelines designed to reduce bone loss and protect against osteoporotic fractures are suggested. Canadians should attempt to meet their calcium requirements principally through food sources. Pharmaceutical calcium supplements and a dietician's advice should be considered where dietary preferences or lactase deficiency restrict consumption of dairy foods... Adequate amounts of vitamin D are necessary for optimal calcium absorption and bone health. Elderly people and those who use heavy sun screens should have a dietary intake of 400 to 800 IU of vitamin D per day”

Summary statements
Calcium and vitamin D

52. Adequate calcium and vitamin D through diet or supplements are essential for the prevention of osteoporosis and, taken together, are essential adjuncts to preventative therapy. [Level 1]

53. Calcium and vitamin D should not be used as the sole treatment of osteoporosis; however, calcium and vitamin D through diet or supplements are essential adjuncts to osteoporosis treatments. [Level 1]

54. The recommended calcium intake from all sources (where “all sources” means total diet and supplement) is as follows:
   a. prepubertal children (ages 4-9 years) — 600 mg/day [Level 1]
   b. adolescents (ages 9-18 years) — 1300 mg/day [Level 1]
   c. perimenopausal women — 1000 mg/day [Level 1]
   d. men after adolescence and until the age of 50 years — 1300 mg/day [Level 1]
   e. menopausal women — 1500 mg/day [Level 1]
   f. men over the age of 50 years — 1600 mg/day [Level 1]
Protein

Dietary protein is beneficial to bone health under conditions of adequate calcium intake: an update on clinical research
Katelyn M. Magana,*** Shyari Sahni,*** and Jana E. Korotkov

Purpose of review
To underscore recent clinical studies, which evaluate the association between dietary protein and bone health.

Abstract
The association of dietary protein with fracture risk was further examined by calcium intake (high or low). Greater dietary protein reduced fracture risk by 85% among individuals with calcium intake greater than 800 mg/day [4], whereas the effect may be reversed with low calcium intake. These results suggest that protein may be beneficial to bone only under conditions of adequate calcium intake.

Pulling it all together

Managing bone health requires a multi-modal approach
Knowledge on exercise, falls prevention and nutrition guidelines is ideal
When do we start osteoporosis prevention strategies?
Hands-Up Trial

- Online exercise and education program
- Adults aged 50-65 after a DRF
- Whole body exercise routine
  - Upper body strength
  - Lower body strength
  - Balance and falls prevention
- Education about bone health

Hands-Up Trial

- 6-week intervention
- Following pre-recorded videos online
- Tracking their adherence and retention to the program
- Assessing their whole-body strength, bone mineral density, physical activity and wrist recovery
COVID friendly!
Pulling together everything I’ve learned about osteoporosis and bone health management
Ideally making lifestyle changes to prevent the more debilitating osteoporotic fractures
Osteoporosis Prevention Starts Early

As people age, their bones may become very weak and fragile — a condition called osteoporosis. It often develops unnoticed over many years, with no symptoms or discomfort until a bone breaks.

Fortunately, there are many things that people at all stages of life can do to build strong, healthy bones. Childhood and adolescence are especially important times for building bones and developing habits that support good bone health for life.

Healthy Bones Begin in Childhood
**Kids and Their Bones: A Guide for Parents**

Typically, when parents think about their children’s health, they don’t think about their bones. But building healthy bones by adopting healthy nutritional and lifestyle habits in childhood is important to help prevent osteoporosis and fractures later in life.

Osteoporosis, the disease that causes bones to become less dense and more prone to fractures, has been called “a childhood disease with old age consequences,” because the bone mass attained in childhood and adolescence is an important determinant of lifelong skeletal health. The health habits your kids are forming now can make, or literally break, their bones as they age.

**Why is childhood such an important time for bone development?**

Bones are the framework for your child’s growing body. Bone is living tissue that changes constantly, with bits of old bone being removed and replaced by new bone. You can think of bone as a bank account, where (with your help) your kids make “deposits” and “withdrawals” of bone tissue. During childhood and adolescence, much more bone is deposited than withdrawn as the skeleton grows in both size and density.

For most people, the amount of bone tissue in the skeleton (known as bone mass) peaks by their late twenties. At that point, bones have reached their maximum strength and density. Up to 90 percent of peak bone mass is acquired by age 18 in girls and age 20 in boys, which makes youth the best time for your kids to “Invest” in their bone health.

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Building your children’s “bone bank” account is a lot like saving for their education: The more they can put away when they’re young, the longer it should last as they get older.

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**Bone mass and fracture risk over the lifetime**

[Diagram showing the relationship between bone mass and fracture risk over the lifetime, with phases labeled as Skeletal Maturation, Peak Bone Mass, Bone Loss, and Established Osteoporosis.]
You can’t start too early, and it’s never too late!

Talk to your patients/ clients

- Inform them of the risks of osteoporosis
  - Get a DXA scan
  - Know what the risk assessment means
- Discuss the importance of exercise
  - Talk to a BoneFit trained exercise professional
  - Disseminate the exercise recommendations
- Discuss the importance of calcium and vitamin D
  - Have them ask their GP to provide calcium and vitamin D recommendations
- Discuss the importance of falls prevention strategies
  - Balance exercises
  - Home hazard assessment
Thank You!