

TheraPilates® for OSTEOPOROSIS



with Sherri Betz, PT, GCS, CEEAA, PMA®-CPT

Objectives



- Integrate knowledge of osteoporosis definitions, etiology and pathology into programs for adults with osteoporosis.
- Select appropriate Fletcher Pilates exercises for frail and fit older adults with osteopenia or osteoporosis
- Integrate the best Fletcher exercises to build and stimulate bone.
- Avoid contraindicated movements for clients with osteoporosis/osteopenia.

Objectives



- Design private sessions and group exercise programs with considerations for older adults and aging.
- Utilize Fletcher Fundamentals, Towelwork™, Barrework, Mat and Small Apparatus for osteoporotic adults with supporting evidence.
- Learn additional exercises to complement the Fletcher Repertoire and enhance a bone building program.

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Joseph & Clara Pilates



This work is inspired by the teachings of **Joseph and Clara Pilates** originally called Contrology developed from 1926-1971.



Joseph and Clara Pilates in their NYC 8th Ave. Studio

www.pilatesmethodalliance.org

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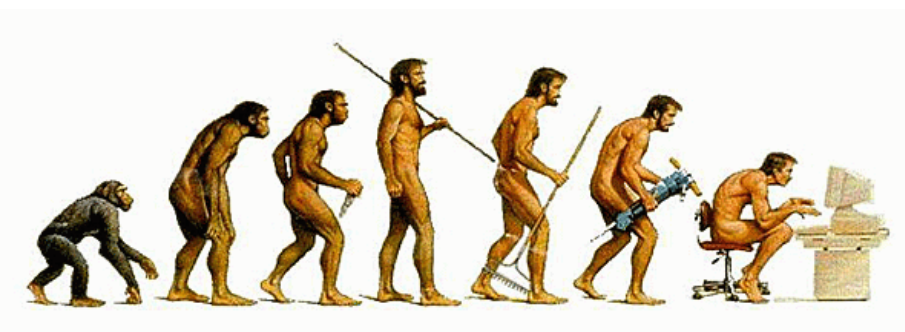
Ron Fletcher

This work is
OF COURSE
also inspired
by the
teachings of
Ron Fletcher
and the
**Program of
Study Team!**



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Evolution??



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What patients hear...



- *“You have the bones of a 90 year old.”*
- *“Don’t lift more than 20 lbs.”*
- *“You just need to walk.”*
- *“You need to get on meds to keep your bones from crumbling.”*

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Does Pilates Build Bone?

Did you know?



1 in 2 women....

1 in 4 men....

over age 50 has low bone density and is at risk for fracture

TheraPilates® Physical Therapy

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Newest research shows
that bone responds
differently
to exercise

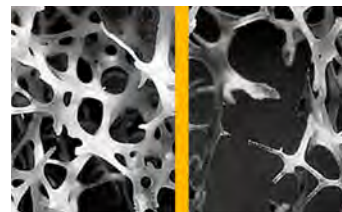
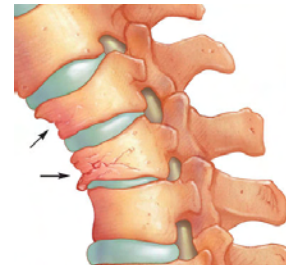


at every age...

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Osteoporosis

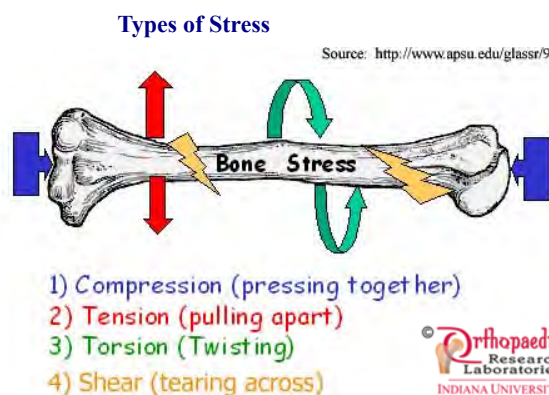
- World Health Organization (WHO) defined Osteoporosis as a disease in 1994.
- Definition:
“a skeletal disorder characterized by compromised bone strength, predisposing one to an increased risk of fracture.”



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Bone Mechanical Loading/ Response

- Mechanosensitive: adapts mass, size and strength in response to loading
- Level of strain determines response
- Strain threshold varies from bone to bone



Dr. Stuart J. Warden, PT, PhD
2009 CSM Las Vegas Presentation

Torrance et al. *Calcif Tissue Int* 1994;54:241-7

Strength Training: Muscle = Bone



- 1 Repetition Max
- *Ideal Intensity of training: 70-85%*
- *8-12 Reps to temporary muscle failure or fatigue*
- *15-20 Reps is low intensity or more endurance training and not as effective for building strength or bone*



Chahal, J., et al. (2014), Mosti, M. P., et al. (2014).
Multanen, J., et al. (2014).

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Strength Training: Muscle = Bone




As clients progress, weights ~~and/or~~ resistance may need to be added to stimulate muscle strength and bone building.



Chahal, J., et al. (2014), Mosti, M. P., et al. (2014). Multanen, J., et al. (2014).

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Clinical Practice Guideline

OPEN



Physical Therapist Management of Patients With Suspected or Confirmed Osteoporosis: A Clinical Practice Guideline From the Academy of Geriatric Physical Therapy

Gregory W. Hartley, PT, DPT, FAPTA¹; Kathryn E. Roach, PT, PhD¹;
Robert W. Nithman, PT, DPT, PhD²; Sherri R. Betz, PT, DPT³;
Carleen Lindsey, PT, MScAH⁴; Robyn K. Fuchs, PhD, FACSM⁵;
Keith G. Avin, PT, DPT, PhD⁵




Downloaded from https://www.jgpt.org/

Hartley GW, Roach KE, Nithman RW, Betz SR, Lindsey C, Fuchs RK, Avin KG. Physical therapist management of patients with suspected or confirmed osteoporosis: a Clinical Practice Guideline from the Academy of Geriatric Physical Therapy. *J Geriatr Phys Ther*. 2022;44(2):E106-E119.

CPG

Post-Menopausal Exercise Effects on BMD



	Post-Menopausal	Pre-Menopausal
Static Weight Bearing Exercise (SWB)	Slows ↓ Hip	0
Dynamic Weight Bearing Exercise (Low Force) (DWBLF)	Slows ↓ LS	0
Dynamic Weight Bearing Exercise (High Force) (DWBHF)	0	Slows ↓ FN
Non-Weight Bearing Exercise (Low Force) (NWBLF)	0	0
Non-Weight Bearing Exercise (High Force) (NWBHF)	Slows ↓ FN, LS	↑ LS
Combination with more than one of the above exercise types (COMB)	Slows ↓ FN, LS	↑ FN, LS

Hartley GW, Roach KE, Nithman RW, Betz SR, Lindsey C, Fuchs RK, Avin KG. Physical therapist management of patients with suspected or confirmed osteoporosis: a Clinical Practice Guideline from the Academy of Geriatric Physical Therapy. *J Geriatr Phys Ther*. 2022;44(2):E106-E119.

General Recommendations for Post-Menopausal Women



- Static Weight Bearing: **Single Leg Balance** to slow BMD decline at femoral neck
- Dynamic Weight Bearing Low Force: **Dynamic Balance Exercises** and **Activities of Daily Living/Transfers** as exercise, **Tai Chi, Yoga Standing Poses, Slow Stair Climbing** as exercise to slow BMD decline Lumbar Spine.
- Non-Weight Bearing High Force: **Gym Machines, Free Weights, Resistance Bands** to slow BMD decline at Femoral Neck/Lumbar
- **Combined exercise (SWB, DWBLF, NWBHF) + PRE strength training** to slow decline at lumbar spine and femoral neck

CPG

CPG

Pre-Menopausal Exercise Effects on BMD



	Post-Menopausal	Pre-Menopausal
Static Weight Bearing Exercise (SWB)	Slows ↓ Hip	0
Dynamic Weight Bearing Exercise (Low Force) (DWBLF)	Slows ↓ LS	0
Dynamic Weight Bearing Exercise (High Force) (DWBHF)	0	Slows ↓ FN
Non-Weight Bearing Exercise (Low Force) (NWBLF)	0	0
Non-Weight Bearing Exercise (High Force) (NWBHF)	Slows ↓ FN, LS	↑ LS
Combination of Exercise Types (COMB) of any 2 exercise types	Slows ↓ FN, LS	↑ FN, ↑ LS

Hartley GW, Roach KE, Nithman RW, Betz SR, Lindsey C, Fuchs RK, Avin KG. Physical therapist management of patients with suspected or confirmed osteoporosis: a Clinical Practice Guideline from the Academy of Geriatric Physical Therapy. *J Geriatr Phys Ther*. 2022;44(2):E106-E119.

General Recommendations for Premenopausal Women



- High Impact Exercise: Jogging, Stairclimbing, Dance/Aerobics *to increase lumbar spine BMD and slow BMD decline at femoral neck*
- High Force Progressive Resistance Exercise *to slow decline at lumbar spine and femoral neck*
- Combined high impact and High Force PRE strength training *to possibly increase BMD at lumbar spine and femoral neck*

CPG

NEW Canadian CPG



Guideline **CPD**

Clinical practice guideline for management of osteoporosis and fracture prevention in Canada: 2023 update

Suzanne N. Morin MD MSc, Sidney Feldman MD, Larry Funnell, Lora Giangregorio PhD, Sandra Kim MD, Heather McDonald-Blumer MD, Nancy Santesso PhD, Rowena Ridout MD, Wendy Ward PhD, Maureen C. Ashe PhD, Zahra Bardai MD, Joan Bartley, Neil Binkley MD, Steven Burrell MD, Debra Butt MD, Suzanne M. Cadarette PhD, Angela M. Cheung MD PhD, Phil Chilibeck PhD, Sheila Dunn MD, Jamie Falk PharmD, Heather Frame MD, William Gittings PhD, Kaleen Hayes PhD, Carol Holmes MD, George Ioannidis PhD, Susan B. Jaglal PhD, Robert Josse MD, Aliya A. Khan MD, Virginia McIntyre, Lynn Nash MD, Ahmed Negm MD PhD, Alexandra Papaioannou MD MSc, Matteo Ponzano PhD, Isabel B. Rodrigues PhD, Lehana Thabane PhD, Christine A. Thomas MBA, Lianne Tile MD, John D. Wark MBBS PhD; for the Osteoporosis Canada 2023 Guideline Update Group

■ Cite as: *CMAJ* 2023 October 10;195:E1333-48. doi: 10.1503/cmaj.221647

NEW Canadian CPG



Table 2: Recommendations on exercise and nutrition for fall and fracture prevention in postmenopausal females and males aged 50 years and older*

Recommendations	Strength of recommendation and certainty of evidence†
1. Exercise‡	
<p>1.1. We recommend balance and functional training ≥ twice weekly to reduce the risk of falls. Remark: Increase difficulty, pace, frequency, volume (sets, reps) or resistance over time. Balance exercises challenge aspects of balance, such as:</p> <ul style="list-style-type: none"> • Shifting body weight to the limits of stability, • Reacting to things that upset one's balance (e.g., catching and throwing a ball), • Maintaining balance while moving (e.g., Tai chi, heel raises, agility training), and • Reducing base of support (e.g., standing on one foot). <p>Functional exercises improve ability to perform everyday tasks, or do activities for fun or fitness (e.g., chair stands for sit-to-stand ability, stair-climbing to train for hiking).</p>	Strong recommendation; moderate-certainty evidence
<p>1.2. We suggest progressive resistance training ≥ twice weekly, including exercises targeting abdominal and back extensor muscles. Remark: Resistance training involves exercises in which major muscle groups (e.g., upper and lower extremities, chest, shoulders, back) work against resistance (e.g., squats, lunges and push-ups). Increase volume (e.g., sets, reps, weight), frequency or difficulty to achieve progressive overload. Many resistance-training exercises would be considered functional exercises.</p>	Conditional recommendation; low-certainty evidence
<p>1.3. We suggest that people who want to participate in other activities (e.g., walking, impact exercise, yoga, Pilates) for enjoyment or other benefits be encouraged to do them, if they can be done safely or modified for safety. Other activities should be encouraged in addition to, but not instead of, balance, functional and resistance training. Remark: Encourage a variety of types and intensities of physical activity in accordance with the Canadian 24-Hour Movement Guidelines (https://cvgguidelines.ca), such as getting ≥ 150 min of moderate to vigorous physical activity per week, but prioritize balance, functional and resistance training. If participating in impact exercise, progress to moderate-impact (e.g., running, racquet sports, skipping) or high-impact (e.g., drop or high vertical jumps) exercise only if appropriate for fracture risk or physical fitness level; safety or efficacy of impact exercise is uncertain in people at high fracture risk (e.g., history of spine fracture or 10-yr fracture risk for major osteoporotic fracture of ≥ 20% calculated by FRAX or CAROC fracture risk assessment tools).</p>	Conditional recommendation; very low-certainty evidence
<p>1.4. Activities that involve rapid, repetitive, sustained, weighted or end range-of-motion twisting or flexion of the spine may need to be modified, especially in people at high risk of fracture.</p>	Good practice statement
<p>1.5. When available, seek advice from exercise professionals who have training on osteoporosis for exercise selection, intensity and progression, and activity modification, especially after recent fracture or if there is high risk of fracture. When not available, refer to Osteoporosis Canada resources.§</p>	Good practice statement

Chart expanded on next slide...

Exercise Recommendations Canadian CPG pg. E1338



- Balance and functional training** ≥ twice weekly to reduce the risk of falls.
- Progressive resistance training** ≥ twice weekly, including exercises targeting abdominal and back extensor muscles.
- For participation in **other activities** (e.g., walking, **impact exercise, yoga, Pilates**) for enjoyment or other benefits be encouraged to do them, if they can be done **safely or modified** for safety. Other activities should be encouraged **in addition to**, but not instead of, balance, functional and resistance training.
- Activities that involve rapid, repetitive, sustained, weighted or end range-of-motion **twisting or flexion** of the spine may need to be modified, especially in people at high risk of fracture.
- When available, seek advice from **exercise professionals** who have **training on osteoporosis** for exercise selection, intensity and progression, and activity modification, especially after recent fracture or if there is high risk of fracture. When not available, refer to Osteoporosis Canada resources.§

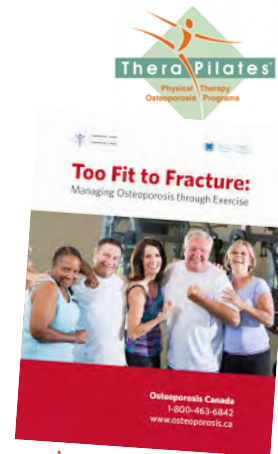
Too Fit to Fracture

International consensus led by osteoporosis.ca to identify **research priorities in osteoporosis and exercise**: in-depth study of exercise for high-risk fracture, evaluation of multimodal interventions, research to examine fracture outcomes.

Giangregorio, L. M., et al. (2014). "Too Fit To Fracture: a consensus on future research priorities in osteoporosis and exercise." *Osteoporos Int* 25(5): 1465-1472.

A consensus process was conducted to develop **exercise recommendations for individuals with osteoporosis or vertebral fractures**. A multicomponent exercise program that includes balance and resistance training is recommended.

GIANGREGORIO LM, et al. (2015). "Too Fit To Fracture: outcomes of a Delphi consensus process on physical activity and exercise recommendations for adults with osteoporosis with or without vertebral fractures." *Osteoporos Int* **26(3): 891-910**



LIFTMOR TRIAL

■ High Intensity Strength Training Trial



WATSON SL, et al. (2015) "Heavy resistance training is safe and improves bone, function, and stature in postmenopausal women with low to very low bone mass: novel early findings from the LIFTMOR trial." *Osteoporos Int* Aug 5.

LIFTMOR TRIAL



High Intensity Strength Training Trial - 8 Month, 2xw, 30 min

- Postmenopausal women received 2 Months of training of the 4 exercises with no resistance.

Intervention Group: N=49, BMD (0 to -3.9), 23 osteoporotic

- Warm-up: 2 sets of deadlifts at 50% to 70% of 1 RM
- Performed 3 Lifting exercises (Deadlift, Back Squat, and Overhead press) at 80–85% of (1RM) for 5 sets of 5 repetitions.
- 4th exercise: impact loading 5x5 sets of jumping chin-ups with drop landings, progressing to a firm, flat-footed landing.

WATSON SL, Weeks BK, Weis LJ, Harding AT, Horan SA, Beck BR. (2017) 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. *J Bone Miner Res.*

LIFTMOR TRIAL



RESULTS:

Table 3. Baseline and 8-Month Measures (\pm SD) With Adjusted Percent Change in DXA and QUS-Derived Measures of Bone After an 8-Month Exercise Intervention in Postmenopausal Women With Low Bone Mass (Per Protocol Data, $n = 86$)

Parameter	CON ($n = 43$)			HIRIT ($n = 43$)			p Value
	Baseline	Follow-up	% Change	Baseline	Follow-up	% Change	
LS BMD (g/cm^2)	0.816 ± 0.097	0.807 ± 0.098^a	-1.2 ± 3.1	0.823 ± 0.108	0.846 ± 0.116^a	2.9 ± 3.1	$<0.001^b$
FN BMD (g/cm^2)	0.682 ± 0.059	0.670 ± 0.059^a	-2.0 ± 3.0	0.699 ± 0.086	0.700 ± 0.084	0.3 ± 3.0	0.025^b

CONTROLS:

LS BMD: -1.2%

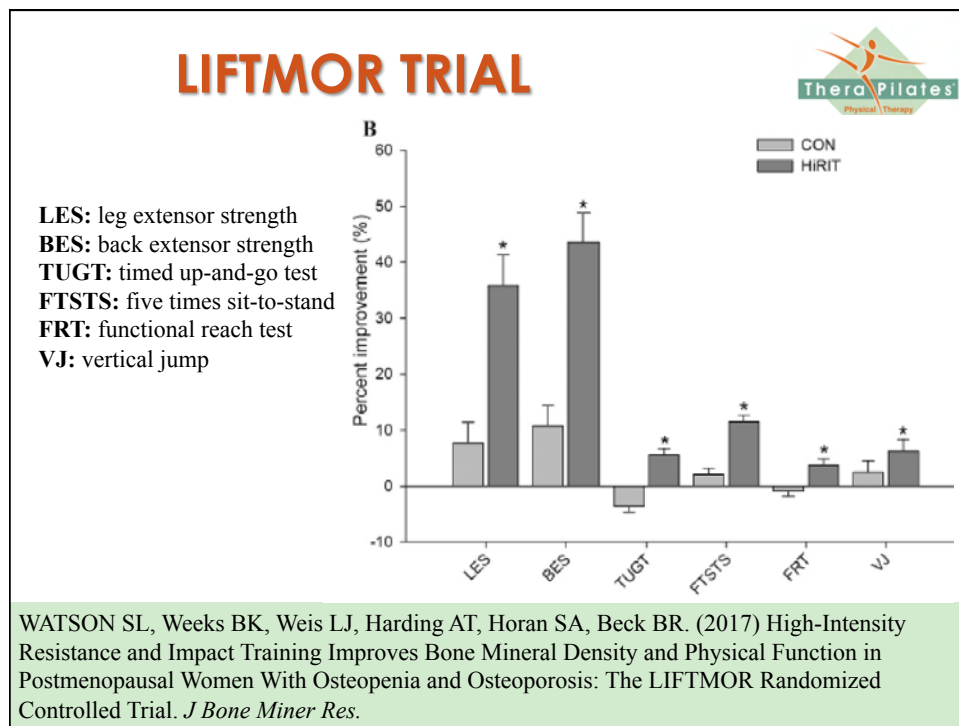
FN BMD: -2.0%

HiRIT:

LS BMD: +2.9%

FN BMD: +0.3%

WATSON SL, Weeks BK, Weis LJ, Harding AT, Horan SA, Beck BR. (2017) 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. *J Bone Miner Res.*



High Impact Training RCT

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Montgomery 2020:

N=28 Postmenopausal (Non-Osteoporotic) women 12 month
3xW High-Impact training with jumping sequences

1. CTS Jumps at 15/minute “Jump as high as possible.”
2. INT Jumps 30 total at 4 per minute
3. Control Group-No jumps (significant loss of more than 3x reduction in FN -2.7% & LS -3.0% as compared to jumping groups)

*Both jumping groups showed no significant difference in effect and no bone loss

MONTGOMERY GJ, et al. (2020) A 12-month continuous and intermittent high-impact exercise intervention and its effects on bone mineral density in early postmenopausal women: a feasibility randomized controlled trial. *J Sports Med Phys Fitness* 60:770-8.

KOSHY 2022

High Impact Training RCT



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Alison 2013 (DXA)

N=35 Men 12 month 7xW Up to 5x10 multi-directional unilateral hops

- Peak GRF ↑ from 2.7x to 3.0x BW
- Mean Femoral neck BMD ↑ (by 0.7%) in the EL and decreased (by 0.9%) in the CL representing a 1.6% net gain in BMD.
- Lower neck BMD ↑ in EL by 1.4% and decreased in the CL by 0.8%.
- L4 ↑ by 1.8% but L1-3 did not change significantly

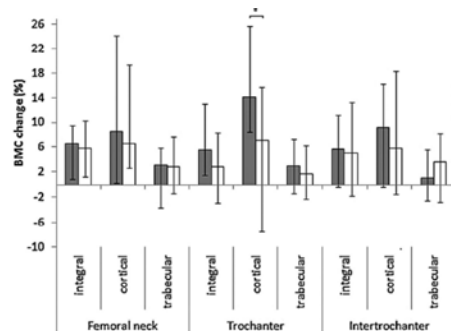
ALLISON SL, et al: High impact exercise increased femoral neck bone mineral density in older men: a randomised unilateral intervention. *Bone*. 2013; 53:321–8.

High Impact Training RCT



24

Alison 2015 (CT) N=34 Men 12 month 7xW Up to 5x10 multi-directional unilateral hops 10 minutes total, 15 sec rest btw sets

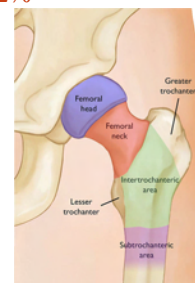


TROCHANTER:

- Cortical bone ↑ 12%

FEMORAL NECK

- Trabecular ↑ 1.2%
- Integral ↑ .5%



ALLISON SJ, et al. (2015) The Influence of High-Impact Exercise on Cortical and Trabecular Bone Mineral Content and 3D Distribution Across the Proximal Femur in Older Men: A Randomized Controlled Unilateral Intervention. *J Bone Miner Res*. 30: 1709-1716.

High Impact Training RCT



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Tucker 2015 N=60 premenopausal women 2xDay,
6 days per week for 16 weeks

8 weeks:

JUMP 10 Group: 10 jumps with 30 sec rest between jumps +.29%

JUMP 20 Group: 20 jumps with 30 sec rest between jumps +.91%

Control Group: Stretching Legs only - Lost .51%

16 weeks:

JUMP 10 Group: +.52%

JUMP 20 Group: +.55% (high attrition)

Control Group: Lost 1.3%

- Both groups had GRF of approximately 3.8 and 4.0
- No other studies reveal BMD changes at 8 wks.
- Authors state that hip changes may start to occur at 8 wks.
- *Authors recommend JUMP 10 program due to similar results, shorter time to perform and improved compliance.*

TUCKER LA, et al. (2015) Effect of two jumping programs on hip bone mineral density in premenopausal women: a randomized controlled trial. *Am J Health Promot.* 29:158–16.

High Impact Training Systematic Review




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Manaye 2023

- Kistler-Fischbacker 2021
- Multanen 2014
- Watson 2018
- Hettchen 2021
- Aboarrage 2018
- Pinho 2020
- Moreira 2013
- Basat 2013
- Sanudo 2017
- Kistler-Fischbacher 2021


Concluded that high intensity + high impact training either improved or maintained BMD in post-menopausal women safely with careful supervision.

MANAYE S, Cheran K, Murthy C, et al. (2023) The Role of High-intensity and High-impact Exercises in Improving Bone Health in Postmenopausal Women: A Systematic Review. *Cureus.*

<div> <h2>High Impact Training Systematic Review</h2> <p>Manaye 2023</p> <div>  24 </div> </div>				
Author/year	Study type	Exercise intervention	Sample size (dropouts)	Results and conclusion
Kistler-Fischbacher et al. 2021 [18]	RCT	Supervised HIRIT for 40 minutes on non-consecutive days, twice-weekly for eight months. Low-intensity exercises for 40 minutes on non-consecutive days, twice-weekly for eight months (CG)	HIRIT- 42 (1) CG - 44 (5)	There was a positive correlation between maximum weight lifted and changes in LS-BMD in the HIRIT group. High-intensity training led to significant improvement in the indices of fracture risk
Multanen et al. 2014 [19]	RCT	High-impact, multidirectional, aerobic, and step aerobic jumping exercise programs alternating every two weeks. Supervised group exercise classes lasting 55 minutes three times a week for 12 months	40 (4)	BMC at the femur neck was significantly greater in the exercise group. There were no significant differences in the trochanter or lumbar spine
Watson et al. 2018 [20]	RCT	Supervised HIRIT for 30 minutes, twice weekly for eight months (EG). Home-based low-intensity exercise program for 30 minutes, twice weekly for eight months (CG)	EG - 49 (6) CG - 52 (9)	Effects were superior in the HIRIT group for LS- BMD, FN- BMD, FN cortical thickness, height, and all functional performance measures
<p>MANAYE S, Cheran K, Murthy C, et al. (2023) The Role of High-intensity and High-impact Exercises in Improving Bone Health in Postmenopausal Women: A Systematic Review. <i>Cureus</i>.</p>				

<div> <h2>High Impact Training Systematic Review</h2> <p>MANAYE S, Cheran K, Murthy C, et al. (2023) The Role of High-intensity and High-impact Exercises in Improving Bone Health in Postmenopausal Women: A Systematic Review. <i>Cureus</i>.</p> <div>  24 </div> </div>				
Author/year	Study type	Exercise intervention	Sample size (dropouts)	Results and conclusion
Hettchen et al. 2021 [21]	RCT	High-impact weight-bearing/high-intensity/velocity resistance training, three times a week for 13 months (EG). Low-intensity exercise, once a week for 13 months (CG)	EG - 27 (6) CG - 27 (7)	LS-BMD was maintained in the EG and decreased in the CG, with a significant difference between the two groups
Aboarrage et al. 2018 [22]	RCT	High-intensity jump based aquatic exercise program, 30-minute sessions, three times a week over 24 weeks	15 (0)	A significant increase in LS, total femur and whole body BMD and functional fitness parameters were observed in the training group
Pinho et al. 2020 [23]	RCT	High-impact exercises and power training, thrice-weekly sessions of 60 minutes on non-consecutive days for 20 weeks	21 (0)	The training group showed significant improvements in LS trabecular bone score, distal tibia trabecular thickness, and trabecular BMD
Moreira et al. 2013 [24]	RCT	High-intensity aquatic exercise sessions lasting for 50 to 60 minutes, three times a week for 24 weeks, in a covered swimming pool	64 (5)	There was an increase in bone formation markers with less considerable rise in bone resorption markers in the exercise group. The femoral trochanter BMD presented a reduction in the CG, whereas no change was observed in the EG

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High Impact Training Systematic Review

Manaye 2023

Basat et al. 2013 [25]	RCT	High-impact exercises for 60 minutes, three sessions a week for six months. Strengthening exercises for 60 minutes, three sessions a week for six months	High impact - 14 (2) Strengthening - 14 (3)	There was a significant increase in the BMD at the LS and FN in the high-impact group compared to the strengthening group
Safudo et al. 2017 [13]	SR	Ten studies were included, and the exercise interventions were categorized as dynamic weight-bearing exercises with progressive resistance strength training; vibration training providing asymmetric impacts, together with high-impact training sessions; and studies that combined more than one of the above exercise interventions	989	Significant changes in LS-BMD, and FN-BMD were found mainly with high-impact exercise and whole-body vibration interventions. Impact exercises combined with other forms of training (vibration or strength training) are effective in preserving BMD
Kistler-Fischbacher et al. 2021 [26]	MA	Exercise intensity was classified as low for 19, moderate for 40, and high for four interventions	EG - 1948 CG - 1582	High-intensity exercise is a more effective stimulus for LS-BMD than low or moderate intensity, but not FN-BMD. A positive relationship between load magnitude and bone response was demonstrated

MANAYE S, Cheran K, Murthy C, et al. (2023) The Role of High-intensity and High-impact Exercises in Improving Bone Health in Postmenopausal Women: A Systematic Review. *Cureus*.



What about Vibration?

- **de Oliveira LC, et al. (2019)** Effects of Whole-Body Vibration Versus Pilates Exercise on Bone Mineral Density in Postmenopausal Women: A Randomized and Controlled Clinical Trial *J Geriatr Phys Ther*; 42(2):E23-E31.
 - In postmenopausal women, 3 weekly sessions of **WBV or Pilates** administered for 6 months provided **an equal effect on BMD**.
- **Ma C, et al. (2016)** Effect of whole-body vibration on reduction of bone loss and fall prevention in postmenopausal women: a meta-analysis and systematic review *Journal of Orthopaedic Surgery and Research*; 11:24.
 - *Low-magnitude whole-body vibration therapy can provide a significant improvement in reducing bone loss in the lumbar spine in postmenopausal women. Moreover, whole-body vibration can be used as an intervention for fall prevention.*
- **Beck B, Rubin C et al. (2022)** The effect of low-intensity whole-body vibration with or without high-intensity resistance and impact training on risk factors for proximal femur fragility fracture in postmenopausal women with low bone mass: study **protocol** for the **VIBMOR** randomized controlled trial. *Trials*, 1/6/2022, Vol. 22 Issue 1, p1-19, 19p, 1 Diagram, 2 Charts. Publisher: BioMed Central., Database: Complementary Index. (*Protocol for upcoming trial*)

Vibration: Conflicting evidence



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Sen 2020 6 mo. Study used similar frequency of 35Hz with two sets totaling 5 minutes and an amplitude of 2mm, finally working up to 4mm on **pro5 PowerPlate**

58 PM Women 3 Groups: 20-60 min training program 3xw

WBV Group: warm-up (cycling, stepping), stretching and strengthening exercises, WBV exercises at high frequency, 30-40Hz, w/ thin sole shoes in 5 static positions: (squat, deep squat, wide-step squat, lunge, hands-front lunge)

High Impact Exercise Group: Jump Rope 10x-60x, cooldown

Control Group: Usual activity

- High-frequency but low-amplitude vibration showed a significant \uparrow in **LS (+1.3%)** and **FN (+5.0%)** after six months in the WBV training group compared to the control group.

SEN EI, Esmailzadeh S, Eskiurt N: Effects of whole-body vibration and high impact exercises on the bone metabolism and functional mobility in postmenopausal women. *J Bone Miner Metab.* 2020, 38:392-404.

Vibration: Conflicting evidence



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Von Stengel, 2011 began with amplitude of 1.7mm and freq of 25Hz, progressively increasing to 35Hz for 6 min/session.

1. **TG:** Conventional training group exercise program:
 - o 20 min dancing aerobics
 - o 5 min balance training
 - o 20 min isometric strengthening and stretching
 - o 15 min dynamic leg-strength training on vibration plates (w/o vibration)
 2. **TGV;** identical exercise regimen +vibration (25–35 Hz) during leg-strength part
 3. **Wellness Control Group:** low-intensity wellness and relaxation program
- LS BMD increased in both training groups, it was concluded that WBV did not lead to any further increases in BMD.
 - WBV was shown to decrease the number of falls significantly.

von Stengel S, Kemmler W, Engelke K, Kalender WA: Effects of whole body vibration on bone mineral density and falls: results of the randomized controlled ELVIS study with postmenopausal women. *Osteoporos Int.* 2011, 22:317-25. (Erlangen Longitudinal Vibration Study)

KOSHY 2022

What about Aquatic Exercise?



Systematic Reviews of Water vs. Land Exercise:

• **Simas V, Hing W, Pope R, Climstein M. (2017)** Effects of water-based exercise on bone health of middle-aged and older adults: a systematic review and meta-analysis. *Open Access J Sports Med.* 8:39-60. Mar 27.

- Water Exercise may reduce age-related bone deterioration as compared to sedentary controls
- LBE is more effective than WBE in promoting positive changes in bone tissue
- interventions lasting >6 months, with 60 minute sessions of high intensity are likely to have positive effects on LS BMD

• **Gomez-Bruton A, et al. (2013)** Is bone tissue really affected by swimming? A systematic review. *PloS one.* 2013;8(8):e70119.

- Swimming (not including Aquatic Exercise) may have a positive impact on bone health in later adulthood. Bones may be stronger but less dense.
- In general, participants in water-based exercise had lower BMD than participants in land-based sports but had better turnover markers

What about Aquatic Exercise?



Older Adult Aquatic Exercise:

• Bravo G, et al. (1997) A weight-bearing, water-based exercise program for osteopenic women: Its impact on bone, functional fitness, and well-being. *Archives of Physical Medicine and Rehabilitation.* Vol 78:12, Pgs. 1375-1380.

- Significant **decrease in spine BMD** and no change in femoral neck after 12 months 3xw water aerobics exercise program in 77 women aged 50-70yrs.

Water Polo:

• Magkos F, et al. (2007) The Bone Response to Non-Weight-Bearing Exercise is Sport, Site and Sex-Specific *Clin J Sport Med.* Vol 17; (2)123-128.

- Compared to controls, swimmers had lower leg and total aBMD ($P < 0.05$), whereas water polo players had lower leg but higher arm and trunk aBMD
- Water polo playing may be preferable over swimming for maintaining bone health; both types of aquatic exercise at the elite level of participation, however, have **unfavorable effects on the lower limb bones.**

• Kavouras SA, et al. (2006) Water Polo is Associated with an Apparent Redistribution of Bone Mass and Density from the Lower to the Upper Limbs. *Eur J Appl Physiol* 97:316-321.

- **Players lost BMD in their legs and gained in their arms during the season**

Aquatic Training: Conflicting evidence

Aboarrage 2018, Wochna 2019



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- Recent studies show that water pressure at varying depths may stimulate bone through muscle loading.
- An aquatic program also has the benefit of lower traumatic fracture risk vs. land-based exercises.
- Both studies were 6 months, 2xw
- Aboarrage's jump-based program increased BMD significantly at the hip.
- Wochna's pool noodles, dumbbells, gloves, balls, and resistance bands program showed no BMD changes.

ABOARRAGE Junior AM, Teixeira CV, Dos Santos RN, et al: A high-intensity jump-based aquatic exercise program improves bone mineral density and functional fitness in postmenopausal women. *Rejuvenation Res.* 2018, 21:535-40.

WOCHNA K, et al: BMD and bone turnover markers in postmenopausal women subjected to an aqua fitness training program. *Int J Environ Res Public Health.* 2019, 16:2505.

KOSHY FS, et al. Exercise Prescription and the Minimum Dose for Bone Remodeling Needed to Prevent Osteoporosis in Postmenopausal Women: A Systematic Review. *Cureus.* 2022;14(6):e25993.

Posch 2019 – Mini Trampoline



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Exercise Group (56-83yrs): 2xw for 12 weeks, 45–60 mins

- Balancing in different foot positions
- Strength: Squats, Hip Ab/Add, and UE movements
- Jumping exercises

Control Group: Usual activities

- (↓ -6% Spine and -2% Femoral Neck)

Props: tennis balls, therabands® and balloons

RESULTS:

- No significant difference at LS (.81% ↑)
- 2% ↑ at Femoral Neck Spine in Exercisers



POSCH M, et al. Effectiveness of a Mini-Trampoline Training Program on Balance and Functional Mobility, Gait Performance, Strength, Fear of Falling and Bone Mineral Density in Older Women with Osteopenia. *Clin Interv Aging.* 2019;14:2281-2293.

Comparing Types of Exercise



22

Kistler-Fischbacher, 2021: **PILATES VS HiRIT**

- HiRIT improved LS BMD $1.9 \pm 0.3\%$ versus BB $0.1 \pm 0.4\%$
- HiRIT improved stature (0.2 ± 0.1 cm versus -0.0 ± 0.1 cm) more than BB.
- HiRIT effects were almost 2x greater for leg and back muscle strength.
- Both programs improved functional performance.
- Positive relationship between maximum weight lifted and changes in LS BMD and muscle strength in the HiRIT groups. (Also confirmed by the **BEST trial N=167** (Houtkooper, et al 2007))

Nicholson, 2015: **Body Pump™ vs. Control Group**

- No significant changes in LS BMD resulted in BodyPump™ group.
- Substantial **decrease** in LS BMD was seen in CG.
- No other changes at any other sites were observed.
- Total body BMD was decreased in the BodyPump™ group.

Harding, 2020: bioDensity™ (**OsteoStrong™**) vs LIFTMOR

- **LIFTMOR**: improved or maintained indices of bone strength at the tibia and proximal femur in middle-aged and older men.
- **IAC Isometric Axial Compression**: did not result in any significant improvement in bone strength at any skeletal site examined, but may mitigate age-related loss of indices of bone strength at the distal tibia and radius.

Research Review Best Exercise for Building Bone



- **Walking**, as an isolated intervention, is **not** able to modify the loss of BMD. Recommend walking at least 30 minutes/day.
- **PRE's** (Progressive Resistive Exercise) for the **lower limbs** is most effective for BMD increase at **femoral neck**.
- Challenging **high impact** exercise programs (i.e. jumping) are more effective when they are **associated** with other **low impact** exercises.
- Strength training showed increases at femoral neck & lumbar spine.
- The use of **vibration** platforms can improve muscle strength in the lower limbs of elderly patients, but it **does not** seem to induce significant changes in bone mineral density in women. WBV (Whole Body Vibration) findings are

BENEDETTI MG, Furlini G, Zati A, Letizia Mauro G. (2018) The Effectiveness of Physical Exercise on Bone Density in Osteoporotic Patients. *Biomed Res Int*. Published Dec 23.

Research Review

Effects of Resistance Exercise on Bone Health



- To stimulate osteogenesis, bone tissues must be exposed to mechanical load exceeding those experienced during ADL.
- Mechanical load enhances osteoblast activity
- Weight-bearing impact exercise such as hopping and jumping, and/or progressive resistance exercise (RE), alone or in combination can improve bone health in adults
- Evidence suggests that prolonged aerobic training (e.g., swimming, cycling, walking) does not provide adequate stimulus to bones
- Power training showed better effects than strength training and in postmenopausal women without increasing risk of injury or pain
- Strength= ability to overcome resistance and power refers to ability to overcome resistance in the shortest period of time

Hong AR, Kim SW. (2018) Effects of Resistance Exercise on Bone Health. *Endocrinol Metab (Seoul)*;33(4):435-444.

Recent Research Review

Effects of Resistance Exercise on Bone Health



- RE interventions included weighted lunges, hip abduction/adduction, knee extension/flexion, plantar/dorsi-flexion, back extension, reverse chest fly, and abdominal exercises or compound movements of squats and deadlifts, target the major muscle groups attached to the hip and spine.
- Recommend 2x 8-12 reps at 70-80% 1RM
- For sedentary or unfamiliar with RE, start at lower intensity
- WHO global recommendation 65+ age group suggests that muscle-strengthening activities be performed 2 or more days/week.
- Greatest skeletal benefits from progressive RE resistance, at high mechanical loads (i.e. 80-85% of one RM)

HONG AR, Kim SW. (2018) Effects of Resistance Exercise on Bone Health. *Endocrinol Metab (Seoul)*;33(4):435-444.

Implementation: Fit or Frail?



- Older Adults need **low-cost, long-term** group exercise programs targeted to their level of **Fitness** and **Function**
- Triage of Older Adults into the **Fit** or **Frail** categories can be simplified by asking, “Can you get down to and up from the floor without assistance?”
- The frail older adult will need chairs, props and balance poles for their exercises

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MOVEMENT PRIORITIES



1. Protect from Fracture!
2. Treat pain and biomechanical dysfunction
3. Teach Spine Sparing Strategies, i.e. Neutral Spine – Hip hinge (touch floor)
4. Avoid all flexion, deep sidebending and deep rotation
5. When all of the above are mastered begin bone building program

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Assessment: Easy Red Flags



- Height loss of more than 1" (6cm or 2.4 inches strongly predictive of vertebral compression fracture)
- Previous Fracture
- Family History (70% contributing factor)
- Presence of Kyphosis (greater than 7 cm occiput to wall distance OWD is strongly predictive of fracture)

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Assessment Top 10 (or 11) Tests

- Standing Height
- OWD
- Rib to Pelvis
- Flexible Ruler Kypholordosis
- Functional Reach
- Prone Hip Extension
- Supine to Sit
- Floor to Stand
- Single Leg Standing Balance
- TUG: Timed Up & Go
- Sit to Stand
 - Hip Hinge/Spine Alignment?
 - Use of UE Assist?
 - Leg Alignment?
 - Balance?

Do not test spine mobility!



Carleen Lindsey

Fracture Prevention: Contraindicated Movements



- ADL with rounded spine
- Crunches
- Sit Ups
- Toe Touches with round back
- Forward Bends with round back
- Abdominal Oblique Work with Rotation
- Deep Spinal Sidebending (Avoid endrange)
- Deep Twists/Spinal Rotation (Avoid endrange)
- Forced Rotation of the Femur as in Pigeon Pose
- *Do not test spine mobility*



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Yoga & Vertebral Fractures



3 CASES REPORTED:

- Healthy Female, 87yo, Spine T-score -1.4 sustained L2 VCF
- Healthy Female, 61yo, Spine T-score -1.8 sustained T4 VCF
- Female with DJD of C-spine, 70yo, Spine T-score -1.3, sustained VCFs at T8 and T9.



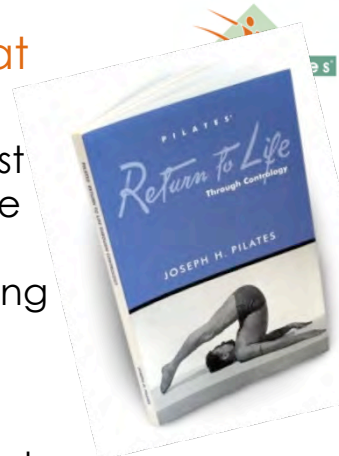
Sinaki M. (2012) "Yoga Spinal Flexion Positions and Vertebral Compression Fracture in Osteopenia or Osteoporosis of Spine: Case Series." *Pain Practice*.

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Contraindicated Pilates Mat

- Roll Up
- Rollover
- Rolling Like A Ball
- Spine Stretch
- Open Leg Rocker
- Cork-screw
- Saw
- Neck Pull
- Scissors
- Bicycle
- Spine Twist
- Jack-Knife
- Teaser
- Boomerang
- Seal
- Crab
- Rocking
- Control Balance
- 100 or Abdominal Work with head lifted

Pilates, JH. (1945) *Return to Life Through Contrology*,
Pilates Method Alliance: Miami, FL.



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Fracture Prevention Brochure



Fracture Prevention
Brochure developed as
a partnership with
American Bone Health
and the
APTA Geriatric
Section's Bone Health
Special Interest Group

Download at www.therapilates.com or call
American Bone Health for printed brochures

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DO IT RIGHT! AND PREVENT FRACTURES!
The Bone-Healthy Way of Life and Exercise

Everyday Activities Keep Your Back Straight. Avoid rounding your spine & shoulders.

- General Lifting:** Feet on a line, back straight, lift with legs.
- Unpacking Groceries:** Keep spine straight and strong, avoid back and neck strain.
- Lifting a Pet:** Feet on a line, back straight, lift with legs.
- Brushing Teeth:** Feet on a line, back straight, lift with legs.
- The Oven:** Feet on a line, back straight, lift with legs.
- Washing the Dishes:** Feet on a line, back straight, lift with legs.
- Making the Bed:** Feet on a line, back straight, lift with legs.
- Gardening:** Feet on a line, back straight, lift with legs.
- Driving:** Feet on a line, back straight, lift with legs.

Exercising Considerations for Exercise. Avoid rounding and TWISTING your SPINE.

- Core Strengthening:** Avoid all forms of abdominal exercises that involve rounding the spine.
- Spinal Twisting:** Avoid seated or supine exercises that involve twisting the spine.
- Spinal Stretching:** Avoid seated or supine exercises that involve stretching the spine.
- Postural Strengthening:** Avoid all forms of abdominal exercises that involve rounding the spine.
- Spine Strengthening:** Avoid all forms of abdominal exercises that involve rounding the spine.
- Abdominal Strengthening:** Avoid all forms of abdominal exercises that involve rounding the spine.

Fracture Prevention Poster developed as a partnership with American Bone Health and the APTA Geriatric Section's Bone Health Special Interest Group

Download 24x36" Poster Free at www.therapilates.com

So you want to do Pilates? and you have Osteoporosis...

TheraPilates Physical Therapy Osteoporosis Programs

ALIGNMENT
AWARENESS
LEG STRENGTH
POSTURE
SPINAL EXTENSION
CORE CONTROL

WITH LOW BONE DENSITY AVOID:

- ROUNDED SPINE ABDOMINAL WORK:** Hundred, Rollup, Rolling, Crisscross, Teaser, Single/Double Leg Stretch, Neck Pull, Open Leg Rocker
- LOADED SPINE FLEXION:** Rollover, Corkscrew Spine Stretch, Jack-Knife, Scissors, Bicycle, Boomerang, Seal, Crab, Control Balance
- DEEP TWISTS:** Spine Twist, Corkscrew Saw, Criss Cross
- PRESSURES ON THE RIBCAGE:** Rocking, Swan 2/3

For more information contact:
TheraPilates® Physical Therapy
920-A 41st Avenue
831-476-3100

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TheraPilates Physical Therapy Osteoporosis Programs

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TheraPilates
Physical Therapy
Osteoporosis Programs

So you want to do **PILATES** for your **BONES**?

RECOMMENDED MATWORK:

CORE CONTROL DYNAMIC ALIGNMENT

LEG STRENGTH

SPINAL EXTENSION

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www.TheraPilates.com 831-476-3100

CTheraPilates® Physical Therapy 2016

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So you want to do **Yoga** and you have Osteoporosis...

ALIGNMENT
AWARENESS
BALANCE
WEIGHTBEARING
SPINE EXTENSION
MENTAL CALM

WITH LOW BONE DENSITY AVOID:

- ROUNDING POSES: Uttanasana, Paschimottanasana, Sarvangasana
- DEEP TWISTS: Matsyendrasana, Parivrtta Trikonasana
- DEEP HIP STRETCHES: Pigeon Pose (Eka Pada Rajakapotasana)
- WARRIOR 1: Virabhadrasana I
- OVERPRESSURE FROM TEACHERS

For more information contact:
TheraPilates® Physical Therapy
920-A 41st Avenue
831-476-3100

TheraPilates.com

So you want to do YOGA for your BONES?



RECOMMENDED POSES:



BALANCE DYNAMIC ALIGNMENT

LEG STRENGTH

SPINAL EXTENSION


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Reduce Spinal Compression During ADL's


Neutral Spine Alignment
Hip Hinge




Good Standing Posture



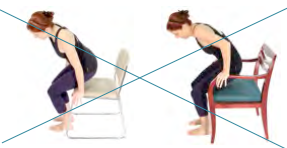
Semi-Squat Hold




Poor Sit-To-Stand Posture/Technique



Using Hands to Push Up Increases Thoracic flexion





Spine Awareness Skills



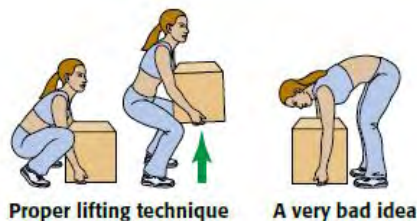
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Reduce Spinal Compression During ADL: Lifting

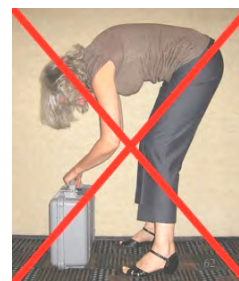


Neutral Spine/Hip Hinge during lifts

- Good posture, body mechanics and positioning
- Spinal extensor strengthening exercises to reduce fracture risk



Shipp 2014, Katzman 2013



Reduce Spinal Compression During Reformer Long Box Transfers



Spine Position Awareness

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Reduce Spinal Compression During Reformer Long Box Transfers



Shoulder Girdle Position Awareness

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Starting Progressive Resistive Strength Training



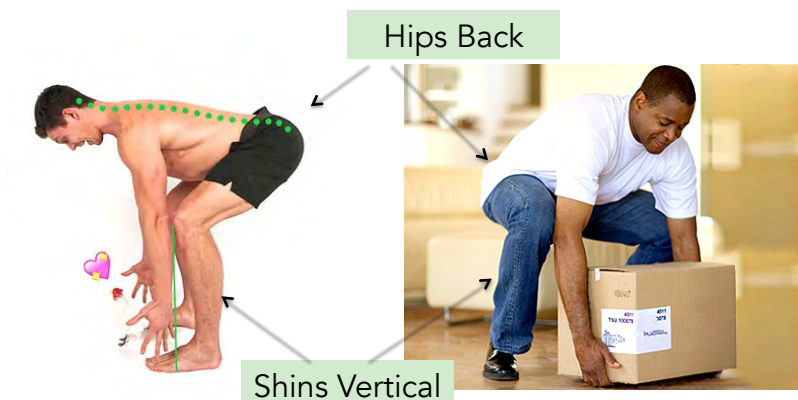
Beginning Lifting

General Lifting

Stand with your feet a little wider than your hips, keep knees in line with your middle toes as you squat to lift an object. Hinge at the hips, keep the chest lifted, shoulder blades back and down and bring the object as close as possible to you.

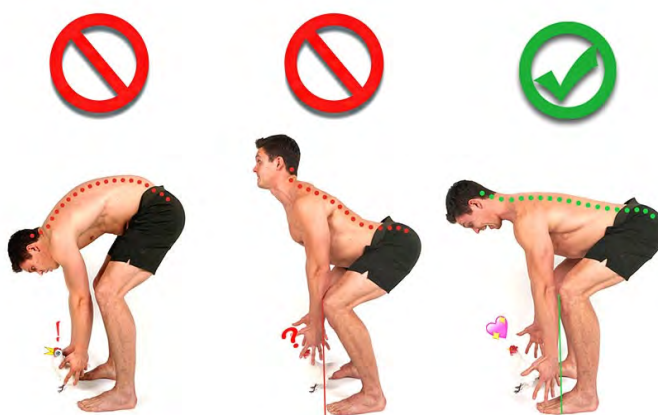


Preparation for Lifting- *Alignment Options*



Be able to touch the floor in neutral spine before ever lifting any weight!

Preparation for lifting



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Is this really correct?

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Osteoporosis Programs

1 The first thing to do before lifting a box or a similar load is to estimate the weight. Stand close to and right in front of what you plan to lift, with your legs wide apart.

2 Keep your back straight, bend your knees and flex your hips.

3 Take hold of what is to be lifted, stretch your legs, flex your hips and carry the load close to your body.

4 Turn as you lift, remembering not to turn your body while you are lifting.

5 Employ a similar technique when you set down the object. Bend your knees and flex your hips, keep your back straight.

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SAFELY Start Weight Training

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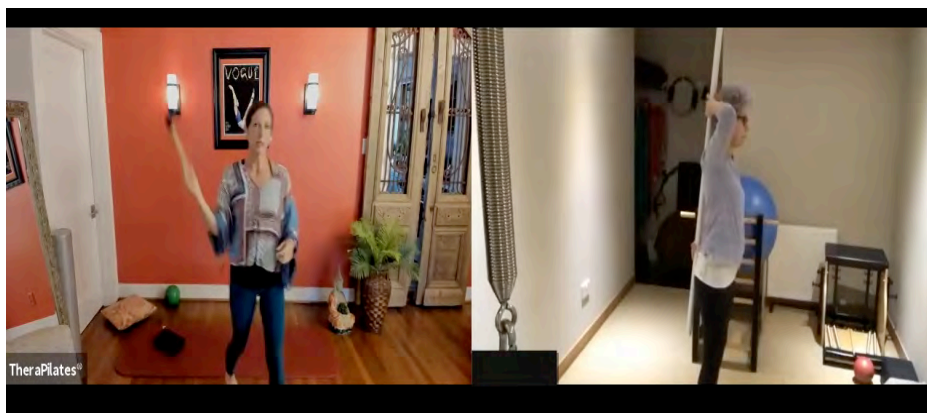
Photo Credit: Alamy Stock Photo

1. Be able to touch the floor in neutral spine using dowel before ever lifting any weight!
2. Lift your EMPTY milk crate or sturdy box from the floor in correct alignment.
3. Put on shoes to protect your feet from dropping weights!
4. Place 2# in your box – Perform 10 lifts
5. Rate the difficulty of your performance
6. Increase repetitions to 15. When you can do 15, add 1-2#
7. Increase weight in only 1-2# increments with GOOD SPINE ALIGNMENT!

Combination High Force Exercise using Weights



- Hip Hinge/Deadlifts/Squats



Working with a Patient...



Fletcher Pilates Group Class for Osteoporosis



(Bold Italics are important exercises to include in the client's program)

Exercise Focus

- Fracture Prevention-most *important!*
- Leg & Trunk Strength
- Balance
- Thoracic Extension
- Hip Extension



Fracture Prevention



Leg Strength



Balance



Thoracic Extension

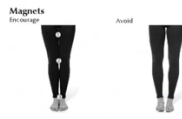


Hip Extension

Standing & Centering



Ron Fletcher's 7 Standing and Centering Cues



1. Tripod Foot Centers, find subtalar neutral, pronate and supinate, avoid collapsing of arch, 40/60% weightbearing.

2. "Magnets" image between heels, shins and thighs (great for ankle control)

Stand more often with feet together to activate postural muscles. When performing heel raises draw heels together.

3. Pelvic Bolts: Pubis to mid-sacrum Greater Trochanters

Avoid tucking pelvis and tailbone under
Avoid arching pelvis and lifting tailbone up

Avoid squeezing buttocks.
Keep pubis and tailbone level with back muscles relaxed.

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Ron Fletcher's 7 Standing and Centering Cues



4. Girdle of Strength: Lift ribcage off pelvis especially from the sides.

Keep ribcage centered over pelvis

Keep lumbar muscles relaxed

5. "Placement" of the shoulder blades and collarbones resting on the ribcage.

6. Draw the throat back and lift the ears up towards the ceiling. Lengthen the back of the neck.

7. Percussive Breathing: Lateral Costal: supports core control Diaphragmatic: relaxing Accessory: (upper lung): stressful

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Ron Fletcher's 7 Standing and Centering Cues



1. Tripod Foot Centers, find subtalar neutral, pronate and supinate, avoid collapsing of arch, 40/60% weightbearing.

40% of weight inside foot.
60% of weight outside foot.

2. "Magnets" image between heels, shins and thighs (great for ankle control)

Stand more often with feet together to activate postural muscles. When performing heel raises draw heels together.

3. Pelvic Bolts: Pubis to mid-sacrum Greater Trochanters

Avoid tucking pelvis and tailbone under
Avoid arching pelvis and lifting tailbone up

Avoid squeezing buttocks.
Keep pubis and tailbone level with back muscles relaxed.



Balance Progression

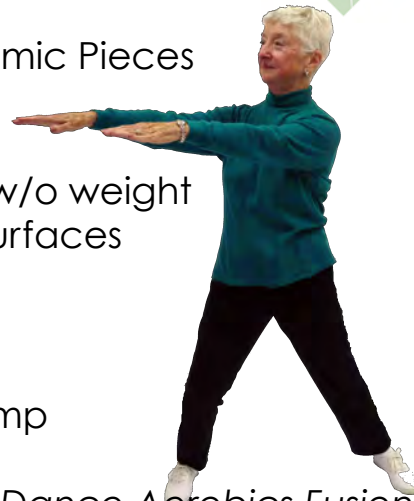
- Stand with Feet Together
- Heel Raise with Feet Together
- Single Leg Stand
- Single Leg Heel Raise
- Single Leg Stand with Head Turns
- Standing on Unstable Surface
- Weight Shifts
- Dynamic Stepping



Dynamic Balance



- Fletcher Towelwork - Dynamic Pieces
- Lunges- All Directions
- Single Leg Knee Bend
- Diagonal Stepping w/ or w/o weight
- Balance Discs/Unstable Surfaces
- Romberg Test Positions
- Braiding/Grapevine!
 - *Bring back the 80's!*
- Step Aerobics or Body Pump
- Zumba:
 - *Salsa, Hip Hop, African Dance Aerobics Fusion*



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Suggested Fletcher Towelwork™



- T1 Taut Towel Pulls at Hips, Collarbones, Overhead**
- T2 Anterior ROM (Add with single leg)
- T3 Pull to "W"**
- T4 Posterior ROM** (Add with single leg)
- T6 Lateral Hip Stretch (Avoid endrange sidebending)
- T7 Footwork
- T8 Thoracic Rotation (Avoid rapid twists & endrange rot)
- T9 Lateral Lunge Series**
- T10 Lateral Flexion in 2nd (Avoid endrange sidebend)
- T11 Lunge into Sidebend** (Avoid endrange sidebend)
- T14 Vail Pattern
- T17 Dallas Pattern

Suggested Fletcher Towelwork™



T18 “Ron” de Jambe Pattern

(Avoid thoracic flexion at start)

Perfect Pattern with balance, leg strength, hip extension, & thoracic extension!

T19 Vancouver Pattern

T23 Thoracic Spiral Pattern *(Avoid contractions and rolls)*

T24 Graham Turn with Towel *(Avoid thoracic flexion w/ turn)*

Leg Strength



- Bridging
- Single Leg Standing Balance
- Fletcher “Barrework”
- 3-Way Hip with Tubing
- Heel Raises
- Squats: + Deadlifts/Back Squats
- Plies (Vertical Squat)
- Marriage Proposal Lunge Progression

Suggested Fletcher Barrework™



- B1 Releve and Plie
- B2 Running
- B3 Passes in Turnout
- B4 Ron's Barre Stretches
*(Avoid thoracic flexion in contraction
& Cat Stretch)*
- B5 Lateral Footwork
- B6 Lateral Battement

Suggested Fletcher Barrework™



- B7 Posterior Battement**
- B8 Hip Stretch
- B9 The Egyptian
- B10 Figure Eights
(Avoid forward contraction)
- B11 High Release**
- B12 Attitude Pattern**

Sherri's "Fletcherized" Marriage Proposal Lunge



Marriage Proposal Lunge: 3 foot stride, parallel legs and feet (railroad track image), pelvic headlights, lift pubic bone.



Short Step vs. Long Step Lunges:
Escamila, 2008



Marriage Proposal Lunge



Level 1: Keep knees straight, inhale as heel lifts. Exhale to bring heel to floor. Stretch calf and hip flexor.



Level 2: Inhale: Bend back knee, then bend front knee and go 1/4 way down, then 1/2, then 3/4, then Full (like Thigh Stretch), no translation of the body forward. Exhale to return to vertical. Keep torso vertical.



Level 3: All the way to floor: end in 90 degree angle at both knees.

Modification: Spine against a door frame

Marriage Proposal Lunge



Modification:

Spine against a Ped-O-Pul or Door Frame



Transfers to Floor



Hip Hinge to Quadruped:

- Practice weight shifts and core control to achieve the high kneeling position.
- Hinge at hips sitting back toward heels keeping neutral spine to bring hands to floor



Hard Roller-"Teaser" Mount



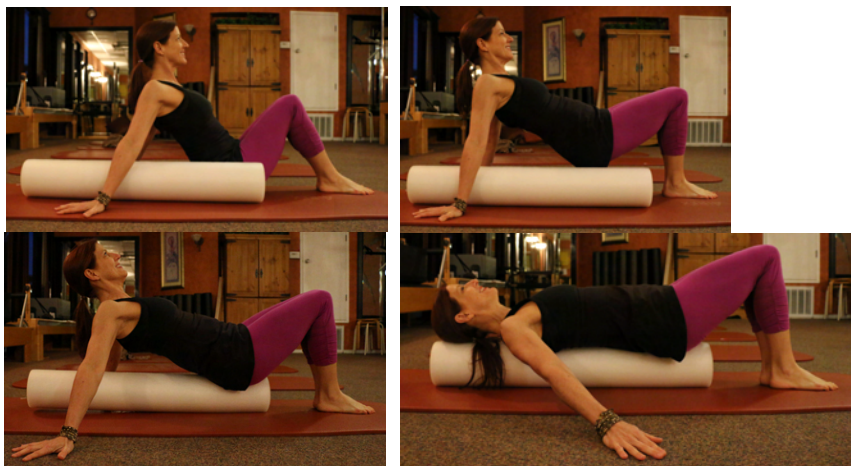
TheraPilates® Special "Teaser" Hard Roller Mount:

- Sit beside Foam Roller with buttocks in line with the very end of the roller.
- Lean back on your hands and place one hand with fingers pointing backwards on the opposite side of the roller.
- Perform a few Teaser Bent or Straight Leg Lifts.
- Keep chest lifted and spine in neutral and lift hips up and place the sacrum on the roller.
- Carefully slide hands directly apart and lie down on the foam roller.

Hard Roller-"Teaser" Mount



TheraPilates® Special "Teaser" Hard Roller Mount:



Hard Roller



Upper Body Opening

- H2 A. Pelvic Curl and Press
- H3 Supine Abdominal Series: Hip Folds, Marching, Single/Double Leg Stretch, Bicycle
- H4 Supine - Balance Series
- HR7 B, C & D. Seated Feet on Top Back Support

Suggested Fletcher Hard Roller



HR8 Supine – Mid-Back on Top:

A. Thoracic Extension-Perform from neutral to extension only without thoracic flexion

- HR9 A, B & C. Prone Hands on Top
- HR11 Seated Series B. Chest Expansion

Suggested Pilates Matwork



- M1 100's (*Head down*)
- M4 Single Leg Circles
- M6 Stomach Series (*Head down*)
- M12 Swan Dive** (*No rocking*)
- M13 Single Leg Kick**
- M14 Double Leg Kick** (*Pad under ribs*)
- M16 Pelvic Press**
- M19 Side Kicks
- M20 Teaser with Hands Behind Back
(*Avoid thoracic flexion*)

Suggested Pilates Matwork



- M21 Hip Circles with Hands Behind Back
(*Avoid thoracic flexion*)
- M22 Swimming** (*Pad under ribs*)
- M23 Leg Pull Prone
- M24 Leg Pull Supine**
- M25 Sidekicks Kneeling (& w/ bottom leg straight)**
- M26 Sidebend (*To neutral only*)
- M32 Push Up** (*Avoid rolldown mount*)

Thoracic Extension



- Thoracic Extension passive mobilization first
- Progress to prone strengthening with UE assist
- Progress to prone strengthening without UE assist
- Add resistance using arms
- Add resistance using weights or back pack



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3-Part Thoracic Extension:



Upper Thoracic



Middle Thoracic



Lower Thoracic



Full Thoracic




Core Control




Strengthening *Use a pillow to protect the anterior ribs!*
Inspired by Sinaki, 2002

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Hip Extension

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- Quadruped or Prone Hip Extension




- Seated Hip Extension Stretch
- Bridging
- Marriage Proposal Lunge Progression



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Non-Weight Bearing High Force Exercise using Pilates Apparatus

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- Use Reformer Springs with “Footwork” to load LE to achieve fatigue within 10 repetitions
- Single Leg “Footwork”
- Double/Single Leg Bridging
- Seated Rows
- Overhead Press & Swimming
- Long Stretches (Plank/Push Up)

Watch for Spine-Safe Posture!

BMD Benefits:

- Slows decline in Lumbar Spine
- Possibly increases Lumbar Spine

Non-Weight Bearing High Force Exercise using Pilates Reformer Springs



Photo credit: Balanced Body

REFORMER: Footwork with
Heavy Springs

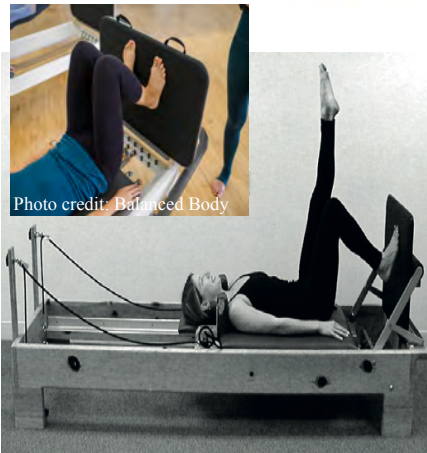


Photo credit: Balanced Body

REFORMER: Footwork-Single Leg Jump
Board

Non-Weight Bearing High Force Exercise using Pilates Reformer Springs



REFORMER: Pelvic Press (Bridging) + Single Leg

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Physical Therapy
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Non-Weight Bearing High Force Exercise using Pilates Reformer Springs




REFORMER: Kneeling or Seated Rows
"Kneeling Arm Series"




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Physical Therapy
Osteoporosis Programs

Non-Weight Bearing High Force Exercise using Pilates Reformer Springs



REFORMER: Breaststroke-Modified
"Overhead Press" (with Straps)



REFORMER: Overhead Press against Footbar

REFORMER: Swimming (adding weights to progress)

Non-Weight Bearing High Force Exercise using Pilates Reformer Springs



REFORMER: Long Stretches
(Plank/Push Up)



REFORMER: Long Back Stretch
(Dips)

Non-Weight Bearing High Force Exercise Pilates Barrel or Massage Ball



Ladder Barrel: Bridging



8" Ball for HEP: Thoracic Extension
to address Hyperkyphosis

Non-Weight Bearing High Force Exercise *Pilates Barrel or Roman Chair*

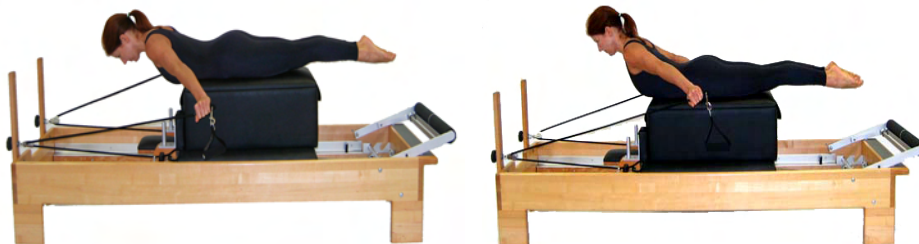


Ladder Barrel: Swan



Roman Chair in Neutral Spine to
Extension

Non-Weight Bearing High Force Exercise *using Pilates Reformer Springs*



REFORMER: Pulling Straps

Dynamic Weight-Bearing Exercise Using Pilates Reformer



Photo credit: Balanced Body

REFORMER:
Side Splits for Hip Adductor and Abductor Resistance

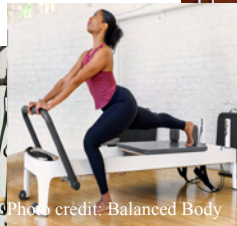


Photo credit: Balanced Body



REFORMER: *Eve's Lunge*

Dynamic WB High Force Exercise using Pilates Apparatus



REFORMER:

- Standing Side Splits
- Eve's Lunge
- Front Splits
- Russian Splits

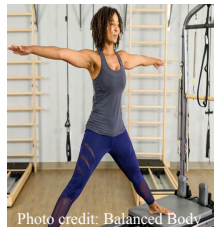


Photo credit: Balanced Body

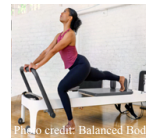


Photo credit: Balanced Body



WUNDA CHAIR:

- Forward Lunge + PRE
- Side Lunge + PRE

Watch for Spine-Safe Posture!

Fracture Risk & BMD Benefits:

- Slows decline in spine & femoral neck
- Odd or High Impact + High Intensity Resistance Training appear effective at increasing BMD at femoral neck

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Top 5 Home Exercises for Patients with Osteoporosis (2-3x10)



99

1. Hip Hinge Squats – add PRE (progressive resistance) 80%1RM
2. Single Leg Standing/Heel Raise-add PRE at 80%1RM
3. Progressive Lunges - add PRE at 80%1RM
4. Thoracic Mobility over round surface
5. Thoracic Extensor Strengthening – add PRE at 80%1RM



Top 5 Gym Exercises for Osteoporosis at 70-75%1RM-3x10 or 80-85% - 5x5



100

1. Hip Hinge Deadlifts & Back Squats
2. Leg Press
3. Overhead Press
4. Roman Chair/GHD
5. Single Leg/Heel Raise (for balance)



1a. Deadlift



2. Leg Press



5. Heel Raise



3. Overhead Press



1b. Back Squat



4. Roman Chair/GHD



Thank you!

**Questions
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RESEARCH UPDATE ON EXERCISE FOR OSTEOPOROSIS
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OCTOBER 20, 2023

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