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1. References

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
https://doi.org/10.1002/jbmr.3284

Impact of high-load resistance training on bone mineral density in osteoporosis and osteopenia: a meta-analysis https://pubmed.ncbi.nlm.nih.gov/33851269/ doi: 10.1007/s00774-021-01218-1.

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Osteoporosis in men doi: 10.1016/S2213-8587(22)00012-2.

Resistance Training Load Effects on Muscle Hypertrophy and Strength Gain: Systematic Review and Network Meta-analysis https://pubmed.ncbi.nlm.nih.gov/33433148/ doi: 10.1249/MSS.0000000000002585.

2. Techniques for strengthening

Compound lifts are proven to be effective in improving bone health
Rehab as guided by EBP through the LIFTMOR RCT

Squat

The squat is important for;
Stimulation of overall strength increases
Increased ligament and tendon strength
Increased bone density
Development of strength in the movements involving the trunk, lower back, hip and knee
Improved neuromuscular efficiency that aids performance in biomechanically similar movements.

Technique of Back Squat:

- Position yourself mid bar, resting the bar across the ledge created by the scapulae on the rear of the shoulder
- Hands are approx one thumb length from the edge of the bar knurling
- Position the feet under bar
- Retract shoulder blades and elevate the chest
- Stand straight and step a short distance backwards.
- Keep feet flat on floor, shoulder-width apart, with toes pointed slightly outward.
- Maintain lumbar extension
- Begin by flexing hips and knees simultaneously. A common fault that should be avoided is for athletes to bring their knees inwards during the descent.
- Bring hips and knees to parallel position.
- From the bottom position, drive upwards explosively to the start position, leading the movement with the chest.
- Squeeze gluteals on completion.

Regressions/Progressions
Box Squat, Goblet Squat, Back or Front Squat with barbell

Primary targeted muscle groups: quads, gluteals, abdominals, back extensors

Deadlift

- Step up to the barbell with shins almost touching bar
- Flex at the hips, with minimal knee bend for rack pull deadlift. Knees will bend further on floor deadlift.
- Shoulders should be angled over the bar with the spine in neutral
- Draw scapulae back (You should feel a slight pull in your gluteals and hamstrings as a sensory feedback)
- Push the ground away to stand up holding the bar. Do not raise the bar.
- To lower the bar, maintain it close to your lower limbs, flexing at the hips again aiming to feel a slight pull in your rear chain

Progressions, regressions
Hip hinge, deadlift with KB on step, rack pull deadlift, deadlift from the ground
Primary targeted muscle groups: hamstrings, gluteals, back extensors

Overhead press

- Rest bar on rack slightly below shoulder height
- Step in under bar and rest it on the acromions
- Hold bar slightly wider than shoulder width.
- Press the bar overhead, moving your head out of the way.
- Extend your elbows without over extending your back to achieve it.
- Slowly lower back to resting position.

Progressions, regressions
Single arm shoulder press, barbell press
Primary targeted muscles: deltoids, biceps, triceps, upper back

Other Exercises to build strength, which in turn may increase bone health but also encourage better balance:

Bridge/Hip thruster

- Barbell over lower pelvic region using towel or foam under it as needed
- Bend knees well into 90deg knee bend
- Use elbows to lift yourself onto bench
- Hold barbell in hands
- Pelvic tilt from anterior pelvic tilt to neutral spine or slightly posterior pelvic tilt
- Press hips through and squeeze gluteals
- Keep rib cage and breastbone in neutral and avoid extending through lower thoracic spine, making sure movement is through hips
- Lower back down

Progressions/regressions
Double leg bridge, Single leg bridge, Hip thruster

Step up

- Step up onto step with one leg, bringing the opposite leg through
- Extend your knee and tighten lateral hip
- Maintain for 2-3 seconds then step down
- Repeat required repetitions on same leg then change sides

Progressions/regressions
Step up to, hold on for balance initially, graduate away from holding on, add dumbbell, add barbell

3. Techniques for Jumps

Countermovement jump

- Starts from an upright standing position
- The downward movement is achieved by flexing at the knees and hips
- Then immediately extends the knees and hips again to jump vertically up off the ground

Target
Used in sport to generate power
Good for conditioning jumping with patients, weight bearing for bone health

Drop Land: double leg and single leg

Double leg
- Step off a 15cm step and land with 2 legs in a slightly flexed knee and hip position

Single leg
- Step off single leg and land flexed slightly at the knees and hips

Target
Weight bearing, balance, landing , confidence

4. Balance and Proprioception

https://www.physio-pedia.com/Otago_Exercise_Programme

https://www.bmj.com/content/328/7441/680.full?int_source=trendmd&int_medium=trendmd&int_campaign=trendmd

Handbook on Otago Falls Prevention implementation
https://www.med.unc.edu/aging/cgwep/wp-content/uploads/sites/865/2018/09/ImplementationGuideforPT.pdf