

Physical activity and bone health

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The optimal use of exercise for bone health is dependent upon the practice of a sustained, adequate dose of the correct modality of exercise/physical activity in the target populations while minimising the risk of side effects. This article provides a brief summary of current recommendations for effective and safe implementation of physical activity in various cohorts.

Childhood and adolescence

The goal of physical activity in relation to bone health in youth is to maximise peak bone mass in order to delay the onset and potentially reduce the incidence of osteoporotic fracture in adults. The types of activities that appear to be most effect, ie. on the young skeleton are:

- high impact, rapid, forceful loading (jumping, running, gymnastics, volleyball)
- changing, diverse, or novel loading angles and magnitudes of forces over time (ball sports, gymnastics)
- weight bearing, high forces (dancing, weight lifting rather than swimming, water polo, cycling), and
- activities that directly impact on the bone of interest (eg. dominant arm of tennis players).

Therefore, beginning in childhood (before puberty), individuals who are able should be encouraged to engage in regular weight bearing exercise via a combination of lifestyle choices (eg. walking to school), structured sports and school based physical education, and unstructured games (outdoor play).

Premenopausal women

Although weight bearing aerobic exercise, high impact training and resistance training have been shown to maintain or augment lumbar spine bone density in this cohort, resistance training has the added benefit of increasing femoral bone mineral density, muscle mass and strength, as well as

balance. The most economical prescription with the broadest benefits for body composition and bone health as well as neuromuscular function would be resistance training. Intensity and dose recommendations are:

- moderate to high intensity progressive resistance training and/or high impact training is more effective than low intensity or nonprogressive programs
- 2–3 days per week of weight lifting, aerobic exercise or high impact programs have been shown to augment bone density
- exercise every other day (approximately 3 days per week) satisfies both muscle and bone requirements.

Postmenopausal women and older men

Significant changes in the femur, lumbar spine and radius have been seen following aerobic training, resistance training, and combined programs of aerobic and resistive exercise. In general, the older the individual, the more favourable resistance training appears, due to its broader benefits on muscle, bone, balance, and fall risk, relative to aerobic training. Benefits for bone and muscle are generally greater with higher intensity exercise if tolerable.

Conclusion/future directions

At all ages, an exercise prescription is important for the prevention and treatment of osteoporosis. A combination of lifestyle choices, organised sports, unstructured play, and household and occupational tasks can

contribute to a desirable exposure to physical activity that will be lifelong and robust enough to counteract age and disease related loss of bone. An initial emphasis on weight bearing aerobic and high impact activities in youth, shifting toward resistive loading and balance enhancing exercises in old age, appears to optimally address the needs and capacities of the musculoskeletal system throughout the lifespan.

Additional data is needed in men, as is refinement of the exercise prescription for bone health in terms of the optimal modality, dose, frequency and intensity of activity recommended. Even if exercise alone is an insufficient stimulus to maintain bone density at youthful levels, the combination of exercise effects on bone strength, muscle mass, muscle strength, and balance should lower the risk of injurious falls substantially in physically active individuals. However, large, long term, randomised controlled trials of any exercise modality with osteoporotic fracture itself as a primary outcome remain to be conducted, and are a priority for advances in this field.

Acknowledgment

This article is a summary of current recommended guidelines by Osteoporosis Australia. The guidelines were written by Maria A Fiatarone Singh and members of the Osteoporosis Australia Medical and Scientific Advisory Board: Terry Diamond, Philip Sambrook, Margaret Williamson, Leon Flicker, Caryl Nowson, Stephen Lord, Linda Ferris, Sheila O'Neil, Alistair MacLennan, Peter R Ebeling, David M Findlay and Nicholas Pocock.

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