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Osteoporosis and Osteopenia: A Guide to Proactive Bone Health

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INTRODUCTION

Many exercise professionals mistakenly categorize bone health as an aging issue. Bone health is an issue that should be addressed with clients of all ages, and both sexes. The manner in which exercise professionals address bone health, with exercise prescription, will be somewhat age dependent. A thorough understanding of the etiology and terminology involved with bone health as well as an awareness of the definitions of disease criteria are essential tools an exercise professional (e.g., RCEP, CES, HFS, CPT) should possess.

Throughout ones life, bone undergoes a dynamic process of breakdown (resorption) and formation known as remodeling. Bone remodeling is a natural process that involves cells that act on degrading older bone (osteoclasts) and cells that stimulate the building of new bone (osteoblasts). During childhood, adolescence, and early adulthood the balance between these processes favors bone formation with peak bone mass being attained sometime during the second or third decade of life. After the third decade, there are a combination of lifestyle choices and natural physiologic processes that eventually shift the balance of bone remodeling in favor of resorption [5]. If specific steps are not taken to optimize bone formation (build up bone mineral reserves) early in ones life and minimize the resorptive process that follows as one ages, bone loss may progress to the level of osteopenia or osteoporosis (See Table 1).

Osteoporosis and osteopenia are skeletal disorders characterized by a compromise inbone strength. Bone strength is reflective of bone mineral content (grams of mineral per area of bone), most commonly referred to as bone mineral density (BMD). A person can be classified as having normal bone strength with a BMD that is either above the mean or does not exceed one standard deviation below the mean of peak values for young normal adults. Osteoporosis is defined as a BMD of $\geq$ 2.5 standard deviations below mean peak values for young normal adults and represents an increased usceptibility to fracture. Osteopenia (low bone mass) is defined as a BMD that is between 1.0 and 2.5 standard deviations below mean peak values for young normal adults. It has been estimated that 44 million Americans have osteoporosis or osteopenia and that one half of all women and one quarter of all men over the age of 50 will suffer a fracture related to these disorders during their lifetime [5].

There are a host of nutritional, pharmacological, and exercise interventions which can be employed in the prevention and treatment of osteoporosis and osteopenia. The remainder of this paper will focus primarily on exercise interventions for individuals of various ages and stages of bone health. As with other chronic health issues, bone health is most effectively addressed with preventative measures that begin early in life.

EXERCISE PRESCRIPTION FOR THE YOUNG CLIENT: OPTIMIZING PEAK BMD

With prevention in mind, clients less than 30 years of age should concentrate on an exercise program that optimizes peak BMD. The level of BMD that is achieved during early adulthood is an important predictor of subsequent bone mineral status later in life. While all types of physical activity should be encouraged in children and adolescents, there are specific activities that will enhance the osteogenic (bone formation) impact. Children and adolescents should be encouraged to participate in sports (e.g., soccer, basketball, gymnastics, track and field, etc.) or other activities that generate relatively high ground reactive forces such as running, skipping, and jumping. Active children who participate in activities that generate high impact forces have higher bone mass than children who engage in low impact activities (e.g., walking) or non-weight bearing activities (e.g., swimming) [3].

Young adults can add other physical activities that generate relatively high intensity loading forces such as plyometrics and high intensity resistance training. It is important to remember the exercise principle of **specificity** in that only the bones that are stressed by a specific activity receive an osteogenic stimulus. Therefore, including resistance exercises that focus contraction on the hip (e.g., leg press, squat) and spine musculature (e.g., back extensions) will help optimize peak BMD values in regions that are prone to resorptive bone loss in later years. Exercises intended to stimulate an osteogenic effect should be included in the exercise programs of children, adolescents, and young adults at a minimum frequency of three-days per week and duration of 10-20 minutes [3].

EXERCISE PRESCRIPTION FOR THE MIDDLE AGE CLIENT: MAINTAINING PEAK BMD

With clients between the ages of 30 and 50, exercise programming should focus on activities that will maintain BMD's at or near peak levels. Exercise professionals should pay particular attention to the principle of **reversibility** in middle-age clients. Too few middle-aged adults have kept up with the level of physical activity that they performed at younger ages. Therefore, bone loss may exceed 0.5% per year after the age of 40, independent of sex or ethnicity [5].

With the focus on maintaining BMD, the high intensity activities needed to build a healthy bone base during youth can be scaled back to moderate to high intensity bone loading forces during middle age. While the continued involvement in sports such as tennis, basketball, volleyball, and soccer should be encouraged, the inclusion of weight bearing (e.g., stair climbing, elliptical exerciser, moderate to high impact group exercises, jogging) and resistance training exercises help fill the exercise gap. Weight bearing endurance activities should be performed three to five days per week and resistance training exercises encompassing all major muscle groups, in the 8-10 rep maximum range, should be performed two to three days per week [3].

EXERCISE PRESCRIPTION FOR THE OLDER CLIENT: DEPENDENT ON CURRENT BONE STATUS

Exercise programming for clients over the age of 50 will be heavily dependent upon the level of attention placed on proactive bone health (earlier in life) and current bone status if preventative exercises were either ignored or underutilized in optimizing or maintaining peak BMD. For older clientele who have a BMD within the normal range, the exercise prescription should concentrate on maintaining BMD and/or minimizing bone loss as the body adjusts to a changing hormonal milieu that favors bone resorption. In this population, the exercise prescription would not vary greatly from that recommended for the healthy middle-aged persons mentioned above. The primary difference would be that as age increases, attention paid to safety issues such as balance and exercise intensity must increase as well.

In older adults who have been diagnosed with osteopenia, exercise prescription should focus on preventing further bone loss. The exercise prescription should include moderate resistance training loads of 12-15 rep maximums (attention should be placed on preventing compressive forces on the vertebral column), two to three days per week, and weight bearing endurance activities.

Additionally, attention to nutrition (calcium, vitamin D) and pharmacologic intervention (bisphosphonates, calcitonin, estrogens) may be needed to realize improvement in BMD. Those who were taking either bisphosphonates or calcitonin realized significant improvements in BMD when resistance training was added to the pharmacologic intervention, while subjects on pharmacology alone were unable to realize improvements [1, 2].

The exercise prescription for older adults diagnosed with osteoporosis presents additional challenges for the exercise professional. Many of the activities with high bone loading forces (recommended to increase BMD in non-osteoporotic patients) are contraindicated for patients with osteoporosis. Contraindicated exercises include running, jumping, jogging, rowing, plyometrics, high intensity resistance training, and any type of spinal flexion, especially when combined with a resistive or twisting movement [3, 5]. Prior to prescribing exercise for an individual with osteoporosis the exercise professional should consult with the clients'physician.

Exercise programs most suited for osteoporotic patients focus on fall prevention. These include conservative muscle strengthening, aerobic/endurance, balance, and agility exercises. Recommendations include walking or stationary cycling, conservative resistance training with 8-10 exercises of 15 repetitions, performed one to two days per week, and range of motion exercises that avoid spinal flexion]4]. Unfortunately, more specific resistance training guidelines, with regard to intensity, are not available at this time. Treatment may also rely heavily on pharmacologic and nutritional interventions.

SUMMARY

Bone health is an issue that should be addressed with clients of all ages. The exercise prescription varies throughout the lifespan beginning with building a strong foundation of bone prior to the age of 30, preserving as much bone as possible through the aging process, and understanding the exercise limitations of patients diagnosed with

low BMD. As with all exercise prescription in special populations, it would be prudent to obtain medical clearance (prior to exercise testing and training) of individuals diagnosed with either osteoporosis or osteopenia.

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