Resistance Training and Bone Growth in the Elderly

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HOW MUCH THOUGHT DO YOU give to your skeletal system when you exercise? For most of us, it is probably the last thing on our minds and is not why we train. However, resistance training is, in theory an excellent way to maintain bone density. I use the term theory because there is not a lot of research in humans that deals with bone growth and resistance training. Research conducted in animal models has shown that mechanical stress, such as external loading (weight-bearing activity), can significantly increase bone mineral density (BMD) but is most effective when the load is dynamic in nature as opposed to static. This would suggest that exercise would have the same effect, but both animal and human studies have shown mixed results. Human-based research has shown that higher intensity aerobic protocols are more effective than low-intensity aerobic training activities (1–3) but that they work best with the addition of resistance training exercises (1–3).

Although the precise mechanism by which exercise modifies bone loss and formation is still undefined, it has been shown that resistance training can maintain and/or elevate bone mass (3). The most effective programs seem to be those utilizing an exercise intensity of 70% of the 1 repetition maximal (1 RM) or above. Younger individuals have no trouble adjusting to a progressive resistance exercise program of this intensity, but the same cannot be said of elderly subjects. In many cases, these individuals have been inactive for long periods of time, lack experience in resistance training, and are intimidated by weight facilities. Therefore, starting a resistance program and developing a long-term adherence to an exercise program involving high-intensity resistance training is often-times difficult to achieve with elderly subjects (research participants) or clients (personal trainers). The key to success is motivation! Older individuals who have not exercised for a long time usually want a quick fix but do not enjoy hurting. Add to this their fear of dying (heart attack), injury (muscle damage, muscle soreness, or bone breaks), and medications they take that may interfere with exercise and you have a difficult group to train. So given the choice, how would you train them? If you pick high-intensity resistance, you will achieve quicker results but run the risk of losing subjects, and this will require more pre-screening prior to training.

So what about low-intensity resistance exercise? Preliminary results from our laboratory suggest that low-intensity exercise can enhance bone growth and muscular function if conducted over an extended period of time. The Ball State University Retirees Fitness (BSURF) program in our laboratory was established in 1986 and represents a moderate to low activity exercise program. Since its conception, the program has been highly successful in terms of adherence and contains participants who have been attending for up to 16 years. The exercise routines employed are low intensity but include both aerobic and anaerobic exercises. The program is designed as a total-body training system but does contain a high degree of social interaction between the participants. This subject population has been the...
focus of several research projects over the past few years. The data from those studies demonstrate that the BMD of the femoral bones (head region) in the hip are 4–9% higher than normative control data for the dual energy x-ray absorptiometry (DEXA) measurements taken. These results are somewhat surprising given the relatively low intensity utilized in our exercise program. However, this type of data does show that our knowledge of how exercise and/or resistance training influences bone growth is extremely limited.

I suspect that most of the readers of this journal are young or represent coaches who deal with young athletes, and therefore motivation is never a problem. Of course, when you are young, bone density and growth are not a problem. Keep in mind that you will not stay young forever and have parents and grandparents who are facing these types of problems.

One specific area that needs attention is menopause. Menopause begins at approximately 50 years of age and involves a dramatic decline in reproductive hormones as the ovaries become nonfunctional. It leads to a 4% decrease in BMD per year in immediately premenopausal women and a 20% bone loss in postmenopausal women. Osteoporosis is one of the most prevalent conditions in postmenopausal women and is characterized by a marked decrease in BMD in the 2–5 years immediately following menopause and continues to decline at a slower rate thereafter. This continual decrease in BMD leads to increased bone frailty and a consequent increase in fracture risk. As a result, it is of great importance to maintain and enhance bone mineral density in older persons, especially older women. Therefore, I challenge the young professionals in the NSCA to examine the interaction between resistance training and skeletal growth in specialized populations.

References