THE IMPORTANCE OF STRENGTH TRAINING FOR SENIORS

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AGING MUSCLE

The common perception of the elderly is that they become weak and fragile due to an age induced muscle wasting. The clinical term for this condition is sarcopenia, and it has been shown to contribute to the reduction in muscle mass and strength associated with aging. However, studies involving injury and disuse have clearly demonstrated that inactivity can also induce muscle wasting, and is a major factor in the loss of muscle mass (3,5,& 6). Several investigators have addressed this issue by either factoring out training effects or using age groups with the same training level. Frontera *et al.* (1) compared whole muscle strength of young (36.5 + 3 males) and older subjects (74.4 + 6 males and 72.1 + 4 females) and found that age was not a factor when strength was expressed as force over cross sectional area (CSA) of the subject's muscle. In another study Kent-Braum *et al.* (5,6) examined inactive young (32 + 1 yrs of age) and older (72 + 1 yrs of age) male subjects, and found no significant difference in force production with a single muscle contraction. However, they did show a loss in the older subject's ability to perform rapid repetitive movements. The older subjects were unable to maintain the same rate of foot tapping as the young, which suggests that their ability to recruit fast muscle fibers was diminished. Hakkinen *et a*l. (4) measured the response of middle-aged and elderly subjects to a resistance training program that included some explosive conditioning. They found that muscle strength increased regardless of age but that the older subjects were more dependent on neural recruitment in the early stages of training than their younger counterparts. Neuronal conduction speed (the time it takes to respond) does decrease with age (8) and these results suggest that it may have a greater effect on the ability to use fast twitch muscle fibers rather than slow ones.

A common characteristic of muscle from sedentary elderly subjects is a phenomenon called fiber type grouping (2,3). Muscles of young and middle-aged subjects contain a mix of fibers types, and therefore have a checkerboard appearance. In untrained elderly subjects clumps of muscle fibers have been observed and consist of predominantly slow twitch or type I fibers. This type of muscle fiber distribution has also been shown in patients with certain neural diseases (7) and it has been suggested that re-innervation is responsible for the effect (2,3,7). The basic theory states that fast twitch motor neurons, which are connected to type IIa muscle fibers, atrophy and die by a process called apoptosis when they are not recruited over long periods of time. Therefore, extended periods of inactivity and a decrease in the recruitment of fast muscle fibers in the elderly may contribute to the apoptosis (programmed cell death) of fast twitch motor neurons. With the loss of their motor neurons type IIa muscles fibers must be re-innervated to survive. Adjacent slow twitch perform this task by forming new synapses with the type IIa fibers. This changes the fibers' stimulation pattern from high intensity, low frequency to low intensity, high frequency. This alteration in stimulation pattern changes the chemical make up of the fiber (2,3,7), and converts these fast twitch fibers to slow twitch. The evidence for this theory is found in both animal (2) and human models (3).

TRAINING EFFECTS

It has been shown that resistance training can enhance muscle mass and function even in 90 year old subjects (1,7), and is the most effective way to maintain the quality of life as we age. Much of the research in this area has examined whole muscle changes, and therefore has not been able to identify the structural alterations that resistance training induces. The technical ability to measure both functional and molecular characteristics of single human muscle fibers has been established and is used to study the effects of disuse on skeletal muscle in the elderly (9-11). The functional data of single muscle fibers in older male subjects performing 12 weeks of progressive resistance training was reported and demonstrates that both type I and type II fibers increased in size, produced a greater contraction velocity, and were more powerful following training. The effects were more predominant in the type I fibers than type II. In short this research has shown that resistance training can alter muscle growth, and may have an effect on the type of muscle fiber present.

PRACTICAL APPLICATIONS

Anyone who has reviewed the literature on aging and exercise realizes that a tremendous amount of research has been conducted in this area and has shown that resistance training can be safely performed by the elderly if done correctly. What the research literature does not give is an exact training program for this population. However, we do know that the basic guidelines for resistance training in younger individuals can be used if certain precautions are taken. The first of these is make sure you pre-test and/or screen your subjects prior to starting their training. Anyone over the age of 40 should go through a health screening before they initiate any exercise program to insure their safety and to identify any possible limitations (risks) they may have to exercise. Depending on the initial fitness level of your subjects I advise a slow approach in dealing with them, especially if you are working with older females who may have little or no lifting experience. Always start with familiarization sessions that stress proper form and technique, the concept of breathing properly, and why they should avoid locking out their joints at the end of specific lifts. In my opinion free weights produce better results than machines but I would start older subjects with machines because it reduces their learning curve and is not as intimidating. Free weights can be introduced once they establish a strength base (6-8 weeks), and can be mixed with the machines.

TRAINING PROGRAM

I do not believe there is a typical training program for older subjects because there is no such thing as a typical older adult. Their level of aerobic training, age, and what they want out of this type of training varies and each influence how they should train. Given those reservations I would suggest the following.

Warm-up and Cool-down

Inflexibility is a major problem with older subjects and I would recommend that they warm-up on a stationary bicycle set at 30-50 watts for 5 minutes prior to lifting, and undergo 10 minutes of stretching.

Workload, sets and Reps

They should use a 3 set, 10 repetition progressive program they can perform 3 days per week. The first set should be at 50%, of a calculated 1 RM (obtained from a 3RM determined at each station), with the second and third sets being 65%, and 80% of the calculated 1 RM.

Lifting Stations, Lifting Circuit, and Rest Periods

Use a full body routine that exercises all the major muscles and alternates between the upper and lower body. The lifting stations and sequence of lifts is given below. Use 2 minutes of rest between stations.

1. Bench Press, 90 seconds between sets
2. Leg Extension, 90 seconds between sets
3. Lat Pulldown (front), 90 seconds between sets

4. Hamstrings, 90 seconds between sets
5. Shoulder press, 90 seconds between sets.
6. Leg press, 90 seconds between sets

Periodization Plan

The above routine is a starter program that is designed to build-up basic strength. After 3 months I would introduce biceps curls and triceps pushdowns or other lifts into the routine, and start modifying the workload and exercise intensity. It will reduce boredom and keep them interested in lifting. The bottom line is that they are training for life and will need to continue this training for as long as they are able. Adding changes will help them maintain their enthusiasm, and keep them active.

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