

Aging, Exercise, and Spinal Cord Injury

Over a period of time, quadriplegics and paraplegics may experience degenerative changes resulting in decreased lean-body mass, low aerobic capacity, increased risk of cardiovascular disease, osteoporosis, renal dysfunction, and possible contractures, joint pain or skin pressure sores. These are similar changes which people with sedentary lifestyles experience. A regular exercise regimen can prevent or alter the rate at which these changes occur. However, the spinal cord injured (SCI) person must understand how SCI effects the body's systems in order to assure safe and beneficial effects of exercise.

Body Mass Decreased lean-body mass is a result of muscle atrophy or wasting from paralysis. Atrophied muscle is gradually replaced with connective tissue and filled with fat and water. The decrease in functioning muscles slows down the body's metabolism which can cause weight gain. Exercise can increase lean-body mass and metabolism and in combination with diet can result in weight loss.

Aerobic Capacity Aerobic capacity is limited due to the disruption of the sympathetic nervous system in people with SCI above T6. The sympathetic nervous system prepares the body for physical challenges and stressful events. The parasympathetic nervous system returns your body's functions to normal levels after these challenges and events occur. Due to the sympathetic nervous system dysfunction in spinal cord injuries above T6, maximum exercise heart rates are limited to approximately 110-130 beats per minute. People with SCI below T6 are able to reach higher maximum heart rates, however they also experience limitations in aerobic capacity due to the inability to use the large muscle groups of the legs. However, the SCI person can still experience an improved extraction of oxygen from the blood through an exercise regimen.

Temperature Regulation The parasympathetic and sympathetic nervous systems also control body temperature. Your body temperature may need to be monitored due to the effects of exercise intensity and environment. Keep damp, cool cloths available to help your body cool down.

Blood Pressure In addition to heart rate and body temperature, the sympathetic nervous system also controls the muscle tone of blood vessels. Because of inactive lower extremities, the blood has a tendency to pool in the legs. This leads to a decreased return of blood to the heart and therefore a decreased stroke volume (the quantity of blood pumped out of the heart). Low blood pressure during exercise (exercise hypotension) results from the pooling of blood in the legs and distribution of blood to the exercising muscles. Feelings of being lightheaded or faint may occur because of the decrease of blood to the brain. To prevent this from happening, you should use a warm-up and cool-down period and slowly increase the intensity and duration of your exercise to allow your blood pressure time to adjust. If exercise hypotension occurs, get assistance to recline in your chair or lie on your back to relieve the symptoms. Elastic stockings and abdominal binders can assist with eliminating these symptoms.

Cardiovascular Disease People with SCI experience a higher risk for hardening of the arteries, hypertension, and lower concentrations of HDL-C (good cholesterol). Studies suggest that physical inactivity in sedentary people with SCI can in part explain lower HDL-C concentrations. This supports the need for exercise in the SCI population to increase HDL-C and decrease the risk of cardiovascular disease.

Osteoporosis Long periods of time without weight bearing through the long axes of bones results in decreased bone mass. Researchers suggest the combination of voluntary muscle contractions and weight bearing through the long axes of the bones may effectively prevent and possibly reverse osteoporosis.

Bowel and Bladder Warning signs of bowel or bladder dysfunction must be closely monitored during exercise and steps must be taken for prevention. If you develop a pounding headache, flushed face, or any other signs of autonomic hyperreflexia, stop exercising immediately, stay upright, and arrange for medical attention. Emptying your leg bag before exercising is a good preventative measure.

Contractures/Decreased Range of Motion (ROM) Contractures are shortening of the muscles and connective tissue which results from immobility and improper positioning. Spasticity and sitting for long periods of time may cause tightness or a decreased range of motion in hip, knee, and ankle flexors. This leads to difficulty with transfers, bed mobility, and other activities. Contractures can be prevented by performing regular, sustained range of motion 1-2 times a day and through proper positioning of the trunk, arms, and legs. Lying on your stomach can stretch the hips and knees. Adjust or replace stretched-out wheelchair upholstery to allow appropriate trunk support.

Decreased range of motion may also be the result of heterotopic ossification (HO) which is excessive bone in soft tissue around joints. Gentle stretching should be performed to maintain ROM.

Joint Pain Frequent and full movement promotes health of fluid-filled joints and keeps them supple. Immobility causes joint structures to become dry, stiff, and painful. At least daily ROMs can prevent joint pain. Adaptive equipment may also be considered to prevent or reduce joint deterioration and pain. Adaptive equipment can significantly improve functional mobility.

Pressure Sores Breakdown of skin and other soft tissues is caused by immobility - primarily sustained positioning, sitting or lying down. People with SCI who perform regular physical activity experience fewer pressure sores and hospitalizations.

Before you begin an exercise program, you should have a survey of your medical history and physical examination to identify exercise restrictions and detect disease. There are several ways to start an exercise program. One choice is to seek the professional opinion of a physical therapist or exercise physiologist to establish a home exercise program with equipment you can purchase. Another choice is to find a health club which possesses or is willing to purchase adapted equipment. The staff should be knowledgeable in exercise for people with physical disabilities.

Some activities for performing cardiovascular exercise include swimming, arm-cranking ergometer, functional electrical stimulation leg cycle ergometry, or wheelchair pushing outdoors or on rollers for indoor use). See your health care professional for specific guidelines.

Strength training should also be a component of a complete exercise program. To build muscle endurance and tone, which will improve your ability to perform repetitive tasks with less muscular fatigue, an individual should perform exercise with lighter weight and higher repetitions (i.e., 15 reps X 3 sets). To gain muscle strength and power, one should exercise with heavier weights and fewer repetitions (i.e., 8 reps X 3 sets). As the exercise becomes less challenging, the weight can be increased followed by an increase in repetitions. A day to rest should be scheduled between workouts and the same muscle group should not be worked two days in a row.

Trial and error may be used to establish appropriate workout weight. Remember, you should be able to complete 3 sets of your desired repetitions through a pain free range of motion.

With SCI, you must maximize the strength and endurance of existing or weak functional musculature without causing overwork injuries. By performing a variety of exercises, you can prevent overuse injuries and promote muscular balance.