Strength Training in the Physically Challenged Population

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It is estimated that 2 to 3 million athletes with physical and mental disabilities participate in organized athletic activities in the U.S. (3, 4). As evidence of the increasing popularity of sports for the physically challenged, the recent Barcelona Paralympic Games provided opportunities for more than 3,000 athletes from 90 countries to test their athletic ability (1). There are many modes of exercise and sport for those with physical disabilities, and improved technology and adaptive equipment now permit participation in virtually any sport.

The recent passage of the Americans With Disabilities Act, which mandates equal access and opportunity for recreation and sport, has a potentially vast impact on sport and exercise services in communities, universities, and public and private facilities. Strength training is an integral component of total fitness for both health maintenance and sport performance in the physically challenged population, just as it is in the able-bodied population. Thus it is important for the strength training specialist to understand basic concepts with respect to resistance training in the physically challenged population.

- Strength Training Considerations

Strength training in the physically challenged population is an area of increasing interest and practical application. Once thought to be contraindicated and detrimental, resistance training has been shown to be beneficial and even necessary for maintaining functional performance.

Even nonagenarians can benefit from a carefully designed resistance training program, and these benefits result not only in improved measurable strength on objective testing but also in improved functional ability and mobility (6). Nonetheless, there are special precautions and considerations to observe, depending on the unique qualities of the training population.

The spinal cord injured population in large part needs few adaptations for successful weight training. If resistance machines are used, one of the main issues to consider is their accessibility. Many machines on the market today permit use by those in a wheelchair. For paraplegics with lower level injuries, few adaptations may be necessary. These individuals may need help with transferring and positioning on certain pieces of equipment, and a spotter is recommended when using free weights.

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When performing a lift, such individuals should not employ a Valsalva or breath-holding maneuver. In addition to increasing blood pressure, breath-holding maneuvers could be especially troublesome for persons undergoing intermittent catheterization or those who use augmentative techniques (such as strain) for voiding, because unplanned incontinence can ensue.

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Positioning on the equipment is also important because skin breakdown and the risk of shearing forces can increase with equipment not designed for insensitive skin. Wheelchair cushions can be removed and transferred to the lifting site. Velcro straps can be used for the positioning problems created by spasticity or tone.

In higher level lesions (above T-6), participants must be monitored for signs of autonomic hyperreflexia (dysreflexia). This condition can be life threatening, and is characterized by a sudden onset of headache and hypertension in a spinal cord injured individual with a lesion above the sixth thoracic level. It is usually caused by a noxious stimulus, such as a blocked urinary catheter, fecal impaction, or skin pressure sore. The spinal cord injured patient who complains of headache or sweating should have blood pressure and pulse recorded. If the individual is hypertensive, necessary measures should be taken to eliminate the noxious stimuli. In addition, individuals with higher level spinal cord injuries have a greater problem with temperature regulation; thus it is important to keep their environment cool while exercising, such as via fans or air conditioning.

Balanced strengthening of all muscle groups should be the ultimate goal. Most individuals in the wheelchair population tend to have strong anterior shoulder musculature as a result of pushing their chairs. However, most of them do not work on strengthening for the upper back musculature (trapezius, serratus anterior, levator scapulae, rhomboids, latissimus dorsi) and posterior shoulder groups. Thus an imbalance may occur if not addressed in the weight training program.

For the physically challenged population, closed kinetic chain and function based exercises should be the mainstay of treatment. In both the upper and lower extremity, this type of exercise entails a multijoint (usually tri-articular) movement with co-contraction of agonist and antagonist muscle groups to provide stability to the joint and minimize shear force. For example, a wheelchair user would do well to perform rickshaw exercises, which work the shoulder depressors, triceps, and wrist extensor groups in a functional manner, rather than perform isolated triceps exercises.

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Likewise, an above-knee amputee would do well with a program of squats and leg presses to work the hip, knee, and ankle in a functional manner and to minimize the shear force on the knee that an isolated quadriceps extension exercise would provide. Care should be taken to ensure that a base program of muscle endurance, emphasizing low weight and more repetitions, is firmly established with a sound technique before progression to higher weight strength training.

Neuromuscular disease has received much attention with respect to resistance training and has long been the subject of controversy. Individuals with cerebral palsy (10), spastic hemiplegia (7), poststroke hemiplegia (8), spinal muscular atrophy (9), and muscular dystrophy (12, 13) can achieve objective improvements in strength and functional performance with no apparent deleterious effects on muscle.

The only exception to this concerns severely dystrophic individuals (12, 13). It is generally accepted that strength training should not proceed in individuals with active inflammatory myopathies. Daily specific training of the respiratory muscles can also improve strength and endurance by increasing vital capacity and respiratory muscle endurance in persons with neuromuscular disease (5).

In any resistance program, the early emphasis should be on enhancing voluntary movement control rather than muscular strength. Individuals with mild coordination or strength deficits probably can use free weights, but more severely involved individuals may need machines that control the exercise throughout the range of motion.

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Positioning is crucial in all physically challenged athletes. A balanced, stable, and secure position is needed for arm and leg exercises. An elastic binder or chest strap or belt may provide trunk stability and yet allow the freedom of movement to perform exercises. Alignment can influence muscle tone, and malpositioning can set off primitive reflexes.
In certain individuals with cerebral palsy, head injury, or stroke, care must be taken to ensure that primitive reflexes do not interfere with exercise performance. For example, a neutral head position must be maintained in an individual with cerebral palsy. During a bench press, neck flexion may set off a reflex pattern that produces elbow flexion and thus places the lifter at risk for injury.

Creative use of straps can permit stable posture in isolated use of the extremities while limiting increased tone and maladaptive response patterns. Proper positioning and strapping can stabilize the trunk and diminish the stimulus for an extensor spasm response. During exercise in a wheelchair, a strap placed above the normal footrests will increase hip and knee flexion and decrease the chances of an extensor response in susceptible individuals.

Finally, strapping below the knees can help control hip adductor spasticity, and anterior and posterior straps can stabilize the legs and help prevent knee extension thrusts during exercise (2). As always, with the use of straps, skin must be closely monitored for breakdown.

Depending on the physical deficit, amputees or those with poor distal extremity (especially hand) function may need to use wrap-around weights that can be secured with Velcro. Upper extremity amputees may find that exercise while wearing their prosthesis helps condition the skin to stresses and shears that occur when the prosthesis is under a load (14). The skin should be closely examined before and after exercise, with progression only if skin tolerance permits. Amputees may find that more resistance is needed on the residual limb because of a shorter lever arm.

The role of manual resistance strengthening should not be underestimated. It can greatly enhance motor control in individuals with moderate to severe difficulties. To enhance mechanical advantage in the face of limb or joint absence or functional weakness, springs can be set up or resistance rubber tubing used to provide progressive resistance in multiple planes, including diagonal-spiral and sport-specific patterns.

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Special attention should be given to the role of spasticity when designing a strength training program. Individuals with severe spasticity should refrain from resistance training, and any exercise that triggers abnormal muscle tone in a nonfunctional manner should be stopped immediately.

The goal of all resistance training is improved motor function and control. Weights should be raised and lowered in a slow, controlled fashion because fast, ballistic movements can trigger or set off spasms. With maximum effort, an athlete’s extremity may move in an involuntary pattern and spasticity may increase on the more involved extremities with increasing muscular effort on the noninvolved side; this should subside after the exercise stops. In mild to moderate spasticity, it is important to strengthen antagonist muscles, which oppose the spastic muscle groups.

As in the able-bodied population, special care must be taken when resistance training is used in the young athlete (before growth plate closure). Epiphyseal areas are relatively weak compared to surrounding ligamentous and fibrous supports, and if this “weak link” is injured, bony deformity and unequal growth can result (15). Proper technique prevents these problems by not overloading any bone or muscle and joint complex. In addition, lower weight and more repetitions should be emphasized.

The same function-enhancing benefits of resistance exercise can occur in the physically challenged child athlete, however, and progressive resistance exercise has been shown to produce strength benefits for children with neuromuscular disorders (16). During periods of rapid growth, strength training should be decreased and flexibility exercises should be emphasized (11).

**Conclusion**

Instructing the physically challenged individual in appropriate strength training techniques can be very rewarding. Many of these athletes get their training information and assistance from friends or fellow participants in sports rather than from specific recommendations based on sound research. The Certified Strength and Conditioning Specialist should be aware of this population and the special considerations and precautions that have an impact on training. It is hoped that increased involvement will lead to improved training techniques, injury prevention, and appropriate injury specific rehabilitation.
References