

Electrical Stimulation In Multiple Sclerosis

Because multiple sclerosis is a chronic disorder in which there may be intermittent periods of recovery or remission, the indications for and the application of electrical stimulation [ES] will vary with the symptoms and functional limitations. ES may be helpful in the management of spasticity, pain, respiratory dysfunction and urinary incontinence with resulting improvements in muscle strength, coordination, balance, walking ability and performance in daily activities. Applications that involve the use of skin electrodes may be accomplished with a variety of commercially available electrical stimulation devices that are small, battery powered and inexpensive. Implantable electrical stimulation technology would be selected by the surgeon.

Management Of Spasticity:

ES has been demonstrated to reduce or eliminate interfering spasticity, or involuntary muscle activity, in multiple sclerosis. The involuntary muscle activity may take the form of spontaneous muscle contractions or it may occur when voluntary movement is initiated. A variety of ES protocols have been employed. Some investigators and clinicians have used inexpensive portable stimulators and skin electrodes [placed on the spastic muscles, or over the muscles that work against the spastic muscles or on areas of skin that receive the same nerve supply as the spastic muscles]. The intensity of ES may be minimal, with only a tingling sensation felt by the user. In other protocols, the intensity of ES is increased to assist with joint movement. The intensity of ES should never cause discomfort. Other clinicians have surgically placed microelectrodes over the dorsal columns of the spinal cord. Stimulation protocols varied from one to two hours each day to intermittent use all day long, as needed.

As a result of ES, spasticity has been reduced, pain was less, bowel and bladder function improved and walking was more normal [with longer step lengths and greater walking velocity].

Maintaining Or Improving Joint Range Of Motion:

ES of muscle[s] can be used to move the joint to the end of the available range or it can be combined with the patient's exercise to be sure the patient is going to the end of the range and stretching just a bit. Electrical stimulation for this purpose has advantages over vigorous manual range of motion including the use of the individual's muscles to gain the range in a gentle manner without traumatizing the tissues and it can be done several times during the day as part of a home program.

When spasticity has contributed to the limitation of joint motion, the movement may improve remarkably as ES helps to reduce the spasticity.

Among the advantages of improved joint range of motion are greater ease of positioning and reduced risk for development of pressure sores. For the individual who has the ability to walk, improved range will reduce the energy expenditure of standing and walking which should translate into less fatigue for the person with multiple sclerosis.

Improving Muscle "Strength" Or Performance:

When interfering spasticity is reduced or eliminated, muscles may appear to be stronger in the absence of actual change in the muscle properties. In addition, ES may improve the timing or recruitment of muscles so that muscles exert force in a more useful and coordinated manner.

Exercise home programs, with ES added to voluntary effort, can be designed to improve muscle force production and fatigue resistance.

Improving Bladder And Bowel Control:

Electrical stimulation has been reported to improve urge incontinence, urethral and anal sphincter control and constipation. Investigators and clinicians have used exercise of the abdominal and pelvic floor muscles in combination with ES of these muscles with skin electrodes. Some protocols have employed special electrodes made to fit in the anus or vagina. Surgical approaches have included placement of electrodes on the spinal cord in the thoracic, or upper back; on the sacral spinal nerves [in the low back]; as well as in the pelvic floor near the pudental nerve. The majority of patients [78 to 85%] reported improvements in their bowel and bladder function, but there is agreement that multiple sclerosis patients do need daily home ES treatments.

Reducing The Risk Of Respiratory Infection:

While most people with multiple sclerosis who can walk are not likely to have serious impairment of their respiratory muscle function, those in a wheelchair with decreased arm and trunk activity are at risk for respiratory compromise and infection. One of the most serious problems is the reduction in coughing ability and ES may be useful in contracting the abdominal muscles to assist in coughing and keeping the airway clean. Reduction of spasticity by ES may improve breathing and coughing by allowing more coordination of the muscles of inspiration and expiration.

Minimizing The Risk Of Pressure Sores And Treating Skin Lesions:

Among the many factors that contribute to pressure sores are spasticity, joint contractures, muscle paralysis and poorly fitting wheelchairs. ES may reduce the risk by reducing the involuntary movements in spasticity, by improving joint range of motion, and by increasing the bulk of muscles that cushion the bony prominences and so distribute pressures more evenly over the skin.

Once a pressure sore has occurred, ES may be helpful in speeding the healing process. While most of the research in this area has been done in spinal cord injury or diabetes, the findings are applicable to multiple sclerosis. Possible mechanisms include improving the oxygen supply to the skin and the muscle in the area of the sore, improving the rate of deposition of connective tissue, or scar, and minimizing the infection in the wound. The chance of healing is, of course, better if the pressure sore is a partial thickness lesion, meaning that only the more superficial layers of the skin are missing. In this case, the skin can grow from the base or bed of the dermis, similar to the way grass grows after mowing. If the sore is deep enough to go through the skin, it must heal in from the sides and surgery is often needed. If there is infection underlying the skin and in the exposed bone, surgical intervention is required to clean the area and to graft skin and sometimes muscle over the bony prominences. After wound closure, the mechanical integrity of the skin will not return to normal and it will be necessary to continue routine skin checks and to use custom seating devices for pressure relief as needed.

Successful ES protocols have included daily stimulation for a total time of two or more hours. Some investigators have employed a very low intensity, direct current. Others have used a pulsatile current and created a muscle contraction in the area of the pressure sore. Electrodes may be placed adjacent to the wound or one of the electrodes may be placed in the wound. In the latter case, an electroconductive dressing is used as the electrode.

Improving The Mechanics And Energetics Of Walking:

ES has been discussed for the reduction of spasticity as well as improvement in joint range of motion and muscle performance. Maintenance of ankle dorsiflexion range of motion [to 10 degrees of ankle dorsiflexion] and modulation of ankle plantar flexor spasticity are critical to walking. It is necessary for the body weight to progress over the stance limb in order to take a step with the other leg. If the ankle does not have dorsiflexion range or if the calf muscles contract at the wrong time because they are stretched as the body moves forward, the stance leg will be pulled backward and the patient will have to use crutches and drag their entire lower extremity. These two problems prevent walking for many people with multiple sclerosis. ES can be employed to rectify these problems and result in much more normal walking.

There is evidence to show that people with multiple sclerosis who walk better with ES will continue to use the ES device at home for many years. For the MS patient who has a relapsing and remitting course, ES is only needed when ankle spasticity and/or range is a problem. For those individuals who have more persistent symptoms, ES may continue to be needed on an everyday basis to maintain walking ability for as long as possible, and then indefinitely to control spasticity, joint range of motion and bladder function.

Careful selection of shoes will contribute further to the benefits of ES. Many people with multiple sclerosis have improved their walking ability by using rocker shoes, or clogs. Based upon the research assessment of the rocker shoes that have been most beneficial, there are specific shoe dimensions [in terms of heel bevel, forefoot rocker and heel height] that result in improvement for those patients who are candidates. It is necessary to have sufficient muscle control at the hip and knee in order to be able to walk at the increased velocity of joint motion afforded by the rocker shoes.

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See:

General Considerations in the Clinical Application of Electrical Stimulation

References:

ES in Multiple Sclerosis

Comfort in Electrical Stimulation

ES in Pain Modulation

ES in the Modulation of Spasticity

ES in Walking

ES and Muscle Performance

ES for Improving Joint Range of Motion

ES in the Management of Bowel and Bladder Incontinence