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Electrical Stimulation In Orthopaedic Disability

Electrical stimulation has a variety of short-term therapeutic applications after injury or surgery as well as some long-term uses for bone healing and bone remodeling in growing children. Each potential candidate deserves individual assessment prior to the application of ES.

Pain Management After Injury Or Surgery

As discussed in the section on Pain Modulation, ES may be a useful adjunct to the management of pain in orthopaedic disability. ES may be employed as a temporary measure during the initial healing and the rehabilitation periods after injury or surgery. It may be useful while the definitive diagnosis of the cause of pain is formulated. Whenever possible, removal of the source of pain is the optimal approach.

Prevention Of Deep Venous Thrombosis

During periods of immobilization, it is important to continue to contract the limb muscles to move the venous blood back to the heart and to prevent pooling of the blood. This is especially true after pelvic fractures as well as after total hip replacement. If there is pooling of blood in the legs, blood clot or thrombus formation [deep venous thrombosis or DVT] may result with breaking off of small portions of the clot [emboli]. The emboli can lodge in the lungs resulting in pulmonary embolism [PE] and possible death. If the patient is sedentary and not up and using their leg muscles in a normal fashion, there is a risk of DVT and PE as late as 3 to 4 weeks after injury or surgery. ES has been used TO PREVENT the blood from pooling by frequent contraction of the calf muscles. In addition to the creation of a muscle pump while the patient cannot do the exercise on their own, ES has been reported to increase the plasma fibrinolytic activity and reduce the potential for clotting.

It is important that the stimulation characteristics are adjusted to provide maximal comfort and minimal muscle fatigue during the calf pumping exercise. It is essential that all care givers, medical and family, understand that ES is to be used frequently throughout the day and night during the period of immobilization. For example, the stimulator may be programmed to turn on and provide 10 to 15 minutes of ES exercise each hour. This can be carried out in a hospital or home setting at minimal cost.

As indicated above, ES is used to PREVENT DVT. IF DVT is present, massage, exercise and ES of the calf muscles would be contraindicated because of the risk of dislodging the clot.

Augmentation Of Wound And Bone Healing

Both electrical and magnetic stimulation are used to encourage bone deposition during fracture healing. Research evidence supports both methods. A magnetic stimulator may be incorporated into a cast or a brace [orthosis] if fracture healing is delayed. Electrical stimulation devices may be implanted near the fracture site to provide the electrical potentials needed for bone deposition. This approach may be used when surgical intervention is required to obtain healing after non-union of a fracture.

ES has been shown to improve the rate of wound healing in a variety of patient groups. If wound healing is delayed in the orthopaedic patient, a simple home protocol with an inexpensive stimulator can result in accelerated wound healing. Although there are many different stimulation protocols that have proven effective, there is consensus that effective intervention must include a total of 2 hours/day or more of electrical stimulation.

Management Of Stiffness And Joint Contractures After Immobilization

ES has multiple benefits in the rehabilitation of stiff joints. ES can be used to augment exerciseso that the patient can contract their muscles and hold the contraction at the end of the available joint range. ES will modulate discomfort or pain during the early mobilization period. And, ES can enhance the force production, work capability and endurance of the stimulated muscles. All of these benefits can be realized by the use of an inexpensive stimulator and a home exercise program.

Management Of Muscle Performance

Gentle ES of muscle may be employed to maintain muscle contractility during periods of immobilization when the effect of muscle contraction would not interfere with healing. Although ES during immobilization will not prevent shrinkage or atrophy of muscle, it will minimize the loss and maintain the metabolic capability of muscle to speed recovery when it is safe to resume movement and exercise.

When the resumption of exercise is permitted after injury or surgery, ES may be used to provide sensory input and to improve muscle recruitment. Objective measurement of the force, work, power and fatigue resistance of muscle(s) with and without ES will provide a groundwork for establishing an optimal exercise protocol. ES may be incorporated into walking and stair climbing by the use of a footswitch trigger that can be placed in the shoe.

Peripheral nerves are sensitive to movement or stretch as well as to compression during traumatic injury or surgery. When there is a perturbation of a nerve, the nerve may stop conduction impulses. This is called a nerve block, or neuropraxia. In this case ES may be used to maintain the paralyzed muscle until the nerve block resolves. Depending upon the location of the weak or paralyzed muscles, ES may be used to substitute for a brace or orthosis. For example, if there is a “foot drop” ES may be used to stimulate the leg muscles to pick up the foot and avoid the need for an orthosis.

If the stress on the nerve was more severe, it is possible that some or all of the nerve fibers in the peripheral nerve will die [axonotmesis]. In this case electrodiagnostic assessment at 3-4 weeks after injury can reveal the extent of nerve loss and determine the indications or contraindications for ES. [See: Muscle Weakness or Paralysis with Compromise of the Peripheral Nerve.]

Peripheral nerve compromise is possible in a wide variety of disorders that are considered "orthopaedic." These include neck or back pain syndromes; shoulder pain and "frozen shoulder;" lateral epicondylitis which is sometimes called "tennis elbow;" carpal tunnel syndrome; compartment syndromes such as in "shin splints;" spinal stenosis; osteoporosis with collapse of the vertebral bodies; and osteoarthritis with joint replacement.

Es In The Management Of Idiopathic Spine Deformity

For the growing child with idiopathic spine deformity, or scoliosis, who is a candidate, ES may halt the progression of the spinal curvature or improve the curve. ES may be used in conjunction with bracing. There is controversy in the literature about the efficacy of ES versus bracing for idiopathic scoliosis, but not all investigators have followed the original ES protocol that proved so successful. There is agreement that exercise alone has no benefit for the child with spine deformity. If the spine deformity is not addressed when the curve is minimal [less than 35 degrees of lateral curve] and when there are 2 or more years of growth remaining, deformity can progress rapidly during growth spurts. When it is possible to use ES at night, this approach is far less devastating than wearing a brace to the pre-teen and teenage youngster. [See: Idiopathic Scoliosis or Spinal Deformity]

Contributor:

J.M. Campbell, Ph.D., P.T., 2002

See:

- General Considerations in the Clinical Application of Electrical Stimulation
- Muscle Weakness or Paralysis with Compromise of the Peripheral Nerve
- Idiopathic Scoliosis or Spine Deformity
- Pain Modulation

References:

- Comfort in Electrical Stimulation
- ES for the Prevention of Deep Venous Thrombosis
- ES in Pain Modulation
- ES for Improving Joint Range of Motion
- ES and Muscle Performance
- ES in Muscle Denervation
- ES in Muscle Reinnervation
- ES in Wound Healing
- ES in Bone Healing
- ES in Idiopathic Spine Deformity