Integration of Neuromuscular Electrical Stimulation Approaches into Clinical Practice

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Abstract

As part of our mission at Shriners Hospitals for Children, Philadelphia (SHC-PHL), we strive to introduce innovative, evidence-based treatments to children with orthopaedic impairments. While there is strong research to support the use of various applications of electrical stimulation (ES), widespread clinical transfer has been elusive. This paper describes our attempts, with varying success, to integrate ES modalities into our clinical practice.

1 Introduction

Electrical stimulation (ES) has previously been reported to be efficacious for use in pain control, wound healing, muscle strengthening and functionally related applications. A challenge to the successful deployment of ES programs is defining which approaches are most efficacious and aligning key programs with the organizational resources.

2 Methods

2.1 Determining clinical ES applications

At SHC-PHL, therapists and researchers collaborate to formulate ideas and plans with regard to clinical ES applications. For a given idea, together they determine if the ES applications are efficacious based on Shriners internal research experience, best practice patterns, and the current body of literature. They formulate a clinical protocol, determine how to pursue third party reimbursement where applicable, and evaluate the required clinical resources. Often many devices available to adults or adolescents are not appropriate for children. Consideration of age-appropriateness, safety, and size differences are unique challenges encountered within the pediatric setting. Equally important to the decision-making process are determining which ES devices would afford most carryover and success if transitioned into the home setting.

2.2 Family and Staff Education

Critical to successful implementation of an ES clinical service is education of the family and training of the hospital staff. SHC-PHL provides educational pamphlets describing the scope of services at the hospital including ES.

When families are scheduled for evaluation, therapists may utilize handouts and/or DVD’s, local vendor support, and equipment on-site for actual evaluation/demonstration/training. A funding guide is currently in development to assist families with obtaining a particular device. We also connect children (and families) who are current or past ES users to those who are considering it so that first hand knowledge about the pros and cons of the ES application can be shared.

Therapists are trained in the application of the ES systems (and certified where available) including the non-ES alternatives that may be available. Several content experts are available within the hospital for clinical support. Some companies (e.g. Bioness, Parastep) provide ongoing local vendor support, therapist support and/or engineers. Last, hospital policies and procedures have been drafted defining the current scope or programming and philosophy. This information is available to therapists, researchers and other hospital staff. Equally important are efforts to educate and involve the referring physicians and other key hospital staff (e.g. nursing, social services, etc…) critical to the program.

2.3 Implementation

Patients consulted for therapy services undergo a thorough evaluation to determine the appropriate ES application. If appropriate, the child is given the opportunity to trial the system in-house, and in some cases, a loaner system may be available for home use.
3 Results

3.1 ES Cycling

Research at our centre is ongoing for ES cycling for children with spinal cord injury (SCI) and cerebral palsy (CP). [1,2] Based on our initial positive results with ES cycling in research, we developed a 4-week clinical program to expose children with orthopaedic disabilities to various exercise modalities including ES and motorized cycling and ground and aquatic treadmill training. [3] Twenty children have participated in the program over the past 2 years. Several families have pursued insurance-related reimbursement for these cycles without success. Several families have expressed a continued interest in the purchase of a cycle but none have purchased a system after participation in the 4-week program.

3.2 ES Hand Grasp

Initially, our research program successfully implemented an implanted FES system for hand grasp (Freehand system) for children with SCI. [4] We then integrated this application into our clinical services and began a program to implant children soon after injury. [5] We were able to successfully gain third party reimbursement for many patients. The Freehand system is no longer manufactured, however, our hospital now provides exposure to FES hand systems that use transcutaneous stimulation for children with SCI and hemiparetic CP (Bioness). We recently submitted our first letter of medical necessity for the Bioness system. We are currently exploring another device for clinical deployment in spastic hemiparetic CP (Ultraflex).

3.3 ES Upright Mobility and Muscle Strengthening

Similar to the hand grasp application, we experienced success with the implementation of implanted FES devices for upright mobility, gait and muscle strengthening. [6-9] While the implanted devices we used are no longer available, as a result of the positive outcomes we were motivated to become a certified center to implement the Parastep system, a 6-channel system for standing and stepping that employs transcutaneous electrodes. In addition, we are incorporating ES strength training into our rehabilitation protocols.

3.4 Bladder/Bowel Management

Five children have received the Vocare system to provide bladder/bowel management. For the one child who had medical insurance coverage we were able to facilitate reimbursement. No new cases have been performed since the company had discontinued the distribution of devices in the United States.

3.5 Diaphragmatic Pacing

Our hospital has only recently accepted patients requiring full-time respiratory support. To date, 12 patients have participated in stimulated assessment of bilateral phrenic nerves during fluoroscopic visualization of the diaphragm. We anticipate the first implant of a pacing system in the first quarter of 2008.

4 Discussion and Conclusions

As with any clinical service, challenges faced with the deployment of ES programs include the cost of securing ES devices, insurance reimbursement, staffing, and caregiver/patient compliance.

In addition to the direct positive effect the ES technology has provided to the recipients of these devices, there has also been an indirect benefit within our hospital through the expansion of services brought about by the introduction of the ES technology. Upper extremity tendon transfer surgery for children with spinal cord injury emerged from our work with the Freehand system. [10] It has become an important option for children who are not eligible for upper extremity ES systems. In order to accept children who were candidates for a respiratory ES system our hospital needed to establish a respiratory program to accept such patients. We now have a weaning program for children who are not ES candidates. Our hospital expanded our bladder management program for children with SCI as a direct impact of providing ES bladder management. Finally, we have an activity-based rehabilitation program in part as a result of our ES cycling work.

One critical factor to considering an ES program is the stability and commitment of the company or companies supplying the ES devices. Consideration must be given to whether the company will support devices as they are replaced by newer models and what the plan is should the company go out of business or discontinue the product line. This is especially critical for implanted ES devices.
Future enhancements to our ES services will address continued staff development and mentorship opportunities, expansion of our loaner ES items for home use, and the completion of an educational binder for families on funding options and self-advocacy.

References


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