Author
Alexander, Michael (zvia IL) | CO (Certified Orthotist) Ped (Pedorthist)
Stride Orthopedics Ltd. - Orthotics

Title
Effects of Functional Electrical Stimulation on Gait in Children with Hemiplegia – A preliminary research report

Coauthors
Segal I, Katzenellenbogen# S, Sagi L, Fattal-Valvsky A,

Summary
A new study undergoing in Tel Aviv - Dana-Dwek Childrens Hospital Neurology Unit, will try to provide evidence based data for physicians and patients, who consider using an FES device, with regards to a better selection of patient who could profit from this device and the expected benefits.

Introduction
Cerebral palsy (CP) is the most common neuromuscular disorder among children, resulting from a non-progressive injury during early brain development which leads to impairment of movement and posture. Functional Electrical Stimulation – FES for the treatment of drop foot externally induces dosiflextion by electrical stimulation to the peroneal nerve. It helps during the swing phase with patients who suffer from central nervous system injury such as CP , CVA, incomplete spinal cord injury, MS, etc. FES was first introduced in the beginning of the 60s. Computerized FES has been used since 2007 (Innovative Neurotronics WalkAide, Bioness L300, Otto Bock MyGait). Application of FES with the pediatric CP population is limited, yet studies have shown good acceptability, improved ankle kinematic parameter, (dorsiflextion), use dependent muscle plasticity. There is still no solid evidence whether the improvements seen in laboratory setting are reflected in functional ambulation in daily life.

Methods
Study population: 20 patients with CP will participate. Inclusion criteria: children above age of 6 years, with CP hemiplegia (GMFCS I/II), with drop foot and dynamic contracture of the ankle on examination, who are being treated at the CP clinic in the Tel Aviv Dana-Dwek Childrens Hospital. Exclusion criteria: Children with fixed contracture of ankle joint (passive range of

motion< 0 degree); children who had orthopedic surgery to the lower extremity or had botulinum toxin injection to the plantar or dorsiflexor muscles within 6 months prior to the study; children who cannot tolerate the electrical stimulation delivered by the device.

Results

STUDY DESIGN: open label study. FES device used (WalkAide; Innovative Neurotronics, USA) delivers electrical stimulation to the common peroneal nerve, triggered by an accelerometer and a tilt sensor, to improve dorsiflexion and foot clearance during swing phase. The duration of the study - 5 months: First month is an adaptation period and 4 months of daily using of the device - intervention period. The aim is a "minimal threshold" use of at least 5 days per week, 4 hours per day and 1500 steps per day. Each child will go through: Medical interview and neurological and physical therapist examination (Definition of passive range of ankle dorsiflexion, modified Ashworth scale test), Motor function tests: "6 min walk test", Gross motor function measure (GMFM),"Timed up and down stairs test", walking on a ramp, with and without the FES device. Gait analysis test with and without FES device (ankle kinematics and analysis of foot clearance parameters). Parents will complete questionnaires on the quality of life, and frequency of falling + the compliance to the FES. Gait analysis will be performed by: Hasomed RehaGait at adaptation period and A 3D gait analysis Vicon MX Giganet motion analysis system at intervention period. Kinetic data will be collected using four force plates. For each child, the results of the gait analysis and the functional tests will be compared between the baseline (beginning of intervention period) and final parameters using the paired t-test analysis.

Conclusion

Study is still undergoing. At the OT-World congress we will describe the experience accumulated at that point in time, including preliminary results.

References

1.Pakula AT, Van Naarden Braun K, Yeargin-AllsoppM. Cerebral palsy: classification and epidemiology. Phys Med Rehabil Clin N Am. 2009

2.Liberson WT, Holmquest ME, Scot D, Dow M. Functional electrotherapy: stimulation of the peroneal nerve synchronized with the swing phase of the gait of hemiplegic patients. Arch Phys Med Rehabil.1961 Feb;42:101-5.

3.Postans NJ, Granat MH. Effect of functional electrical stimulation, applied during walking, on gait in spastic cerebral palsy. Dev Med Child Neurol. 2005 Jan;47(1):46-52.

4.Prosser LA, Curatalo LA, Alter KE, Damiano DL. Acceptability and potential effectiveness of a foot drop stimulator in children and adolescents with cerebral palsy. Dev Med Child Neurol. 2012 Nov; 54(11):1044-9.

5.Damiano DL, Prosser LA, Curatalo LA, Alter KE. Muscle plasticity and ankle control after repetitive use of a functional electrical stimulation device for foot drop in cerebral palsy. Neurorehabil Neural Repair. 2013 Mar-Apr;27(3):200-7.

6. Galen S, Wiggins L, McWilliam R, Granat M. A combination of Botulinum Toxin A therapy and Functional Electrical Stimulation in children with cerebral palsy--a pilot study.Technol Health Care. 2012;20(1):1-9.

7.Maher C, Williams MT, OLDs TS. The six minute walk test for children with cerebral palsy. Int J Rehabil Res. 2008 Jun;31