Functional electrical stimulation in children and adolescents with cerebral palsy

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This commentary is on the original article by Prosser et al. on pages 1044–1049 of this issue.

Functional electrical stimulation (FES) is defined as the electrical stimulation of muscles that have impaired motor control, in order to produce a contraction to obtain functionally useful movement. It was first proposed in the 1980s as a treatment option in children with cerebral palsy (CP). FES is used to achieve a direct orthotic effect during gait, for example, by triggering the dorsiflexors to lift the foot in swing or to trigger the quadriceps to extend knee in stance. Probably the most common application, at least in the adult stroke population, is FES applied to the dorsiflexors during the swing phase to prevent drop foot which could lead to tripping and falls. A 2009 UK National Institute for Health and Clinical Excellence (NICE) guidance[1] states that current evidence on safety and efficacy of FES for improving drop foot of central neurological origin is adequate to support the use of this procedure. However, the studies reviewed for this guidance were mainly on the adult stroke population.

Currently, ankle foot orthoses (AFOs) are most commonly prescribed for children with CP with insufficient dorsiflexion in the swing phase (drop foot), although as also discussed in the literature, children often dislike wearing them. In addition, AFO use is also often associated with weakness and atrophy of the lower limb muscles and this may lead to a poorly developed foot structure.

A recent review[2] with regard to electrical stimulation for children with CP only found five small-scale studies with 12 participants or less. Only two studies[3,4] used gait analysis to quantify the change in gait kinematics due to the application of FES. As a result, recent reviews called for appropriately powered studies with more rigorous research designs into the effects of FES in children with CP.

The research by Posser et al. is therefore an important addition to the evidence for FES of the tibialis anterior muscle in children and adolescents with CP.[5] Nineteen participants enrolled in this study, and a statistically significant improvement of dorsiflexion during swing was found with FES. In addition, the authors report clinically relevant information such as the average time the device was used and how many participants continued to use the device after 3 months (18/19). Clinical acceptability is an important issue. Previous studies with a different device discussed the presence of wires as being a problem especially for younger children. The device used in the study by Posser et al. is wireless and this may have contributed to the high acceptability compared with earlier studies. Other important strategies to increase acceptability of the device include support such as follow-on phone calls and a period of neuromuscular electrical stimulation (used passively) prior to FES to improve the responsiveness of the muscle and to get the child used to the sensation.[4] Long-term follow-up data are also required to decide whether a treatment effect (therapeutic effect or orthotic carry-over) exists, i.e. does long-term use of FES improve the ankle kinematics without FES? Posser et al. did not find this, but the follow-up of 3 months may have not been sufficient. Future studies should look at this over a possibly longer period, and the future electromyography results referred to in the current study would be very informative in this respect as it may shed light into the possibility of improved motor control as a result of FES. Other topics of investigation for future studies in this important area are the stimulation of the gastrocnemius and the use of FES after botulinum toxin.

The study by Posser et al. provides an important contribution to the existing literature on FES for children and adolescents, providing not only a scientifically sound design but also commenting on compliance – which is essential information for the clinician. However, further work, including randomized controlled trials, as well health economic evaluations may be necessary to inform decision-making by national health care or medical insurance bodies.

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