Therapeutic effects of Functional Electrical Stimulation in the upper limb of children with Cerebral Palsy

Wright PA¹, Granat MH¹, Hullin MG²

¹ Bioengineering Unit, University of Strathclyde, Glasgow, Scotland
² Southern General Hospital NHS Trust, Glasgow, Scotland

Introduction

Upper limb disability is a major handicap for many children with Cerebral Palsy (CP). The conventional treatments of surgery, physiotherapy, orthoses and drugs are not always the solution. Recent case studies suggest that Functional Electrical Stimulation (FES) may be a useful therapy for improving upper limb function (Atwater et al. 1991, Carmick J et al. 1993). The aim of this study is to investigate the controlled application of a FES regime applied to the upper limb of a group of children with hemiplegic CP.

Method

Eight children with hemiplegic CP (five male, three female, aged between four and fifteen and with no cognitive impairment) took part in the study. The study began with a baseline period (3 week) which was followed by a treatment period (6 week) and then a follow-up period (6 week). During the treatment phase each of the children received 30 minutes daily of FES to wrist extensors via surface electrodes.

Outcome measures of active wrist extension and hand function were taken weekly throughout the study. Percentage changes in active wrist extension were calculated with respect to the first week measurements. In the hand function test (an adaptation of the Jebsen hand test) the times taken to place six objects in a container, to stack four draughts and to turn over five cards from predefined positions were recorded. The maximum time allowed for each of these tasks was 40 seconds. The time each child took to perform each of these tasks was normalised with respect to the first week measurements.

Results

The mean values and 95% confidence intervals for wrist extension change for the whole group are shown in figure 1. Two children who were unable to actively extend the wrist beyond -45° throughout the study were withdrawn from this analysis. There was a marked improvement in wrist extension during the treatment period which was maintained during the follow-up period.

The mean of the normalised times for each of the three tasks in the hand function test for the group is shown in figure 2. In all three tests the group was quicker in the final week of treatment (week 9) than the final week of baseline measurements (week 3) (paired t-test: p<0.05). In both the draught stacking and card turning the group was quicker during the final follow-up week (week 15) than the final week of baseline measurements (week 3) (paired t-test: p<0.05).
The parents of several children, and some of the children themselves, observed improvements in their upper limb function during the treatment period. These improvements involved tasks requiring the use of both hands: playing with toys, lifting a tray, tying shoelaces, sorting hair clasps, and being able to dress more easily.

**Discussion**

Increased wrist extensor strength and soft tissue changes may be responsible for the increase in wrist extension. These effects, together with sensory-motor learning experienced during the stimulation sessions, may also contribute to the functional improvements in the hand.

FES improved active wrist extension and hand function and these improvements were observed, in some children, six weeks after the treatment had stopped. This suggests that FES may be a valuable adjunct therapy to the conventional treatment options currently available.

**References**


**Acknowledgements**

This project was funded by the Scottish Office Home and Health Department [K/RED/6/31/5/F2].