Functional Electrical Stimulation (FES) and Multiple Sclerosis – A Review of the Literature

The literature on the use of FES with persons who have MS emphasizes the outcomes of gait speed, Physiological Cost Index (PCI), endurance and functional ability. There are 7 Peroneal Nerve FES studies with a significant “N” of persons with Multiple sclerosis: 1 randomized trial, 1 controlled trial (healthy controls), 1 FES vs AFO vs No Device comparison and 4 single intervention (FES) longitudinal studies.

Outcomes

**Gait Speed:** The outcome of gait speed was investigated in 6 of the 7 studies. Every one of the six studies reported a significant increase in gait speed with FES; the increases ranged from 7 to 13.7%. The largest longitudinal study (32 subjects) found that the greatest increase occurred within 3 months but noted that the improvement was significant in as little as 1 month.

**Physiological Cost Index:** Four of the 7 studies used PCI as an outcome measure. Three of the studies reported decreases in PCI ranging from 3% to 16%. The greatest increase was 16% measured after 4.5 months of daily WA wear. One study failed to find a significant difference in PCI with FES or with an AFO; that study was limited by an “N” that was too small to note significant changes. This same study did however address changes in endurance; the results showed a significant increase in distance walked during a timed 3 minute walk with FES.

One novel study looked at effort with gait using the measure of oxygen consumption per distance walked. This study of MS patients who were established FES users (FES worn more than 6 months) showed a significant decrease in oxygen consumed per unit distance with FES.

**Functional Ability:** One study with 11 MS patients (previous AFO users) noted changes in functional ability. This study used the functional activity section of the Modified Emory Functional Ambulation Profile (mEFAP) that includes ambulation on tile, carpet, a Timed up and Go test, ambulation through obstacles and up stairs. That study reported a significant improvement in the stair component of the mEFAP with FES. There was also a trend toward improved navigation of the obstacle course but this was not significant. An earlier study by the same author looked at the effectiveness of AFOs alone in improving gait for persons with MS. That study showed no significant improvements in these same measures illustrating that FES may be an improvement over the current standard of care.

**KEY POINTS**

MS is a condition that responds favorably to FES and the literature supports that MS patients are excellent candidates for FES. Though MS is progressive, FES has demonstrated therapeutic improvements; some of which are cumulative over 3-4 months. Stein et al did show that these cumulative effects were greatest at 3 months and tended to plateau thereafter. But never did values return to baseline showing that some long term improvement was made even taking into account progression of the disease. In fact, Everaert showed neuroplastic changes with MS patients over the course of 4.5 months. He used Transcranial Magnetic Stimulation to measure cortical activity and resulting muscle function (Motor Evoked Potential or MEP). His study noted significant improvements in both MEP and Maximum Voluntary Contraction (MVC) measures that were highly correlated and unrelated to muscle hypertrophy or learning.

FES has proven to be an effective means of eliminating dropfoot and improving motor ability, gait speed and functional mobility for patients who have MS. These are important findings and speak directly to the ability of patients with MS to stay mobile, independent and active well after the functional decline imposed by their disease. This has direct implications for healthcare costs, workplace productivity, and quality of life for patients living with Multiple Sclerosis.
Bibliography


