

Abstract

Cerebral palsy (CP) is a commonly reported chronic pediatric neurodevelopmental condition which gives rise to several motor disabilities. Worldwide prevalence is approximately around 2-4 per 1000 live births. Mobility being one among the basic activities of daily living, hence, correction of gait abnormalities common in CP is important. Electrical stimulation (ES) therapy is one of the most promising assistive technology used in recent times. This thesis enquires whether ES therapy could bring therapeutic changes to help in correction of gait abnormalities, and, whether these changes could be retained even after discontinuation of ES for a certain time period, so that it could be used in a structured intermittent therapy program for gait rehabilitation.

In this thesis, three studies involving common gait abnormalities affecting unilateral and bilateral CP (Type I: Foot drop, Type II: Toe-Walking, and Type III: Crouch gait) were studied. The study had a 12 weeks' treatment phase, followed by 12 weeks' follow-up phase. All studies were divided into two groups of intervention and control, both of which received conventional physiotherapy of 30 minutes throughout the study timeline. Additionally, during the treatment phase, intervention received 30 minutes of ES and control received 30 minutes more of physiotherapy. Study type I involving ES on Tibialis Anterior lasted only till treatment phase, due to discontinuation of most participants after that, but other studies, i.e. type II involving ES on Tricep Surae and type III on Quadriceps Femoris, completed the entire 24 weeks' study. A pre, post treatment and post follow-up evaluation of some primary functional measures and physiological signals were assessed which included gross motor functional measure, gait parameters, balance, spasticity, energy expenditure, joint range of motion, physiological changes in the affected muscles through sEMG parameters analysis, and also the neurological changes seen in the motor cortex through EEG band parameters analysis.

After comparing the results, it can be concluded that ES therapy was pivotal in bringing significant functional and physiological improvements, which in turn may assist in correction of foot drop, toe-walking or crouched gait in children with spastic CP. The beneficial effects acquired due to ES therapy were also carried-over to a large extent during the follow-up phase suggesting that ES can be used intermittently in combination with physiotherapy in a rehabilitation program to correct gait abnormalities.

Keywords: *Electrical Stimulation, Cerebral Palsy, Gait Analysis, Spasticity, Range of Motion, Energy Expenditure, Balance, sEMG Analysis, EEG Analysis*