

# FES Cycle Ergometry for Cerebral Palsy – Evidence Library

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## **Cycling with functional electrical stimulation in an adult with spastic diplegic cerebral palsy.**

**Johnston T.E.; Wainwright S.F. (2011).**

*Physical Therapy*, 91(6): 970-982.

### **Abstract**

Background and Purpose: Adults with cerebral palsy (CP) are at risk for decreased mobility and health complications, and exercise may combat some of these negative changes. Because people with CP have difficulty generating sufficient muscle force, exercise augmented with functional electrical stimulation (FES) is an option for increasing exercise intensity. This mixed-method (quantitative-qualitative) case report describes the effects—across the International Classification of Functioning, Disability and Health (ICF) model—of cycling with FES (FES cycling) in an adult with CP.

Case Description: An ambulatory 49-year-old man with spastic diplegic CP cycled with FES at home for 30 minutes, 3 times per week, for 12 weeks. Volitional efforts were augmented by FES of the bilateral quadriceps, gastrocnemius, and gluteal muscles. Testing was performed before and after the intervention and 4 weeks after intervention withdrawal.

Outcomes: After training, quadriceps muscle strength (force-generating capacity) improved by 22.2%, hamstring muscle strength improved by 18.5%, and the Timed “Up & Go” Test time decreased from 11.9 to 9.0 seconds. The patient reported increased performance and satisfaction for self-identified goals at the ICF level of participation, and his score on the Medical Outcomes Study 36-Item Health Survey questionnaire increased from 62.1 to 77.6. However, he reported increased back pain, which he attributed to positioning while cycling. Qualitative interviews provided context (the patient's perspective) for some of the quantitative results.

Discussion: The patient made gains in body structure and function, activity, and participation (ICF levels) after FES cycling. The mixed-method approach provided insight into his experiences and perceptions about the

measures assessed quantitatively. Further investigation on FES cycling in this population as well as positioning during cycling is warranted.

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## **Review: Clinical Benefits of Functional Electrical Stimulation Cycling Exercise for Subjects with Central Neurological Impairments.**

**Peng, C.-W.; Chen, S.-C.; Lai, C.-H.; Chen, C.-J., Chen, C.-C., Mizrahi, J. & Handa, Y. (2011).**

*Journal of Medical and Biological Engineering*, 31(1): 1-11.

### **Abstract**

Functional electrical stimulation (FES) cycling ergometer has been utilized in recent decades for rehabilitation by sequentially stimulating the large leg-actuating muscles of paralyzed leg muscles to produce cyclical leg motion. A number of studies reported physiological adaptations after regular FES-cycling exercise (FESCE) training in subjects with spinal cord injury, stroke, cerebral palsy and other conditions. This article provides a comprehensive overview of general aspects of FES cycling systems and clinical applications of FESCE. The studies cited in this article provide supportive findings for the potential clinical efficacy of FESCE for reducing the risk of secondary medical complications in subjects with paralysis. The potential therapeutic benefits of FESCE include conditioning the cardiopulmonary, muscular, and skeletal systems, and improving other physiological and psychological performances. Our recent pilot study also indicated that the decrease of leg spasticity in subjects with cerebral palsy is one of the acute effects of FESCE. In conclusion, we recommend that FESCE is of benefit in a variety of aspects to improve the general condition and to prevent deterioration in subjects with central neurological impairments.

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**Cycling induced by FES in children affected by Cerebral Palsy case report. Trevisi. (2011).**

*European Journal of Physical and Rehabilitation Medicine, 48(1): 135-145.*

**Abstract**

**BACKGROUND:** Recently, the efficacy of functional electrical stimulation (FES) cycling have been demonstrated on the improvement of strength and motor control in adults with stroke. FES-cycling, providing a repetitive goal-oriented task, could facilitate cortical reorganization and utilization of residual cortico-spinal pathways. These benefits could be more enhanced in children because of the greater plasticity and flexibility of their central nervous system. **AIM:** The aim of the present case report study was to explore the feasibility of FES-cycling in children with cerebral palsy (CP) and to provide a set of instrumental measures able to evaluate the effects of this novel treatment on cycling and walking ability.

**DESIGN:** Interventional study.

**SETTING AND POPULATION:** Two ambulant outpatient children with diplegic CP were recruited by the "E. Medea" Scientific Institute.

**METHODS:** Patients followed a FES-cycling treatment for 30 minutes a day, 3 days a week for 7 weeks. Pre and post treatment tests were performed, namely clinical measures and electromyographic, kinematic and oxygen expenditure analysis during gait and cycling.

**RESULTS:** The treatment was safe, feasible and well accepted by the 2 children. After treatment both patients achieved a more symmetrical muscular strategy during voluntary cycling and gait and a significant reduction of muscle co-contractions during cycling. These improvements were corroborated by a decrease in oxygen expenditure during the post test for one of the two children, the less impaired, implying a better exploiting of bi-articular muscles.

**CONCLUSION AND CLINICAL REHABILITATION IMPACT:** FES-cycling is feasible and safe and it may be an alternative rehabilitation method for diplegic CP patients. The set of instrumental measurements proposed seems to be a valuable tool for functional

assessment to identify subclinical anomalies and improvements on cycling and gait in CP patients.

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