

FES Cycle Ergometry for Paediatrics – Evidence Library

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The use of functional electrical stimulation in children and adolescents with spinal cord dysfunction: A pilot study.

Castello F.; Louis B.; Cheng J.; Armento M.; Santos A.M. (2012).

Journal of Pediatric Rehabilitation Medicine, 5(4):261-273.

Abstract

BACKGROUND AND METHODS: Children who experience spinal cord injuries (SCI) may develop many complications, including loss of bone mass, osteoporosis, and pathological fractures. Additionally, patients with SCI often rate their quality of life as poor compared to non-injured peers. We examined the effect of functional electrical stimulation (FES) cycle exercise on bone mineral density (BMD) and quality of life (QOL) in six patients ranging in age from 9 to 20 years. BMD was determined using Dual X-ray Absorptiometry scans, and QOL was measured using the Pediatric Quality of Life Inventory (PedsQL™ 4.0).

RESULTS: While patients experienced difficulty in attending sessions consistently, we found a tendency toward improved BMD and QOL associated with the number of months using the FES cycles. In addition, a positive relation was seen between improved BMD and the total number of cycling sessions, as well as between the final rating of QOL and time from injury.

CONCLUSION: FES cycle exercise has the potential to increase BMD, possibly leading to a decrease in pathologic fractures, as well as to improve QOL, in children and adolescents with SCI. Further investigation is warranted on a larger population of children with SCI in order to establish the full benefits of FES cycle exercise.

Outcomes of a home cycling program using functional electrical stimulation or passive motion for children with spinal cord injury: a case series.

Johnston T.E.; Smith B.T.; Oladeji O.; Betz R.R.; Lauer R.T. (2008).

The Journal of Spinal Cord Medicine, 31(2): 215-221.

Abstract

Background/Objective: Children with spinal cord injury (SCI) are at risk for musculoskeletal and cardiovascular complications. Stationary cycling using functional electrical stimulation (FES) or passive motion has been suggested to address these complications. The purpose of this case series is to report the outcomes of a 6-month at-home cycling program for 4 children with SCI.

Methods: Two children cycled with FES and 2 cycled passively at home for 1 hour, 3 times per week.

Outcome Measures: Data collected included bone mineral density of the left femoral neck, distal femur, and proximal tibia; quadriceps and hamstring muscle volume; stimulated quadriceps and hamstring muscle strength; a fasting lipid profile; and heart rate and oxygen consumption during incremental upper extremity ergometry testing.

Results: The 2 children cycling with FES and 1 child cycling passively exhibited improved bone mineral density, muscle volume, stimulated quadriceps strength, and lower resting heart rate. For the second child cycling passively, few changes were realized. Overall, the lipid results were inconsistent, with some positive and some negative changes seen.

Conclusions: This case series suggests that cycling with or without FES may have positive health benefits and was a practical home exercise option for these children with SCI.

Effects of cycling and/or electrical stimulation on bone mineral density in children with spinal cord injury

Lauer, R.T., Smith, B.T., Mulcahey, M.J., Betz, R.R. & Johnston, T.E. (2011).

Spinal Cord, 49: 917–923

Abstract

STUDY DESIGN: Randomized clinical trial.

OBJECTIVES: To determine the effect of cycling and/or electrical stimulation on hip and knee bone mineral density (BMD) in children with spinal cord injury (SCI).

SETTING: Children's hospital specializing in pediatric SCI.

METHODS: A total of 30 children, aged 5-13 years, with chronic SCI were randomized to one of three interventions: functional electrical stimulation cycling (FESC), passive cycling (PC), and non-cycling, electrically stimulated exercise (ES). Each group exercised for 1 h, three times per week for 6 months at home. The hip, distal femur and proximal tibia BMD were examined via dual-energy X-ray absorptiometry (DXA) pre- and post-intervention.

RESULTS: In all, 28 children completed data collection. The FESC group exhibited increases in hip, distal femur and proximal tibia BMD of 32.4, 6.62 and 10.3%, respectively. The PC group exhibited increases at the hip (29.2%), but no change at the distal femur (1.5%) or proximal tibia (-1.0%). The ES group had no change at the hip (-0.24%) and distal femur (3.3%), but a loss at the proximal tibia (-7.06%). There were no differences between groups or within groups over time. Significant negative correlations were found between baseline BMD and the amount of BMD change.

CONCLUSION: Although not achieving statistical significance, hip BMD changes observed were greater than the reported 0.9-10% gains after exercise for children with and without disability. Thus, cycling with and without electrical stimulation may be beneficial for skeletal health in pediatric SCI, but further research is needed with a larger sample size.

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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