



# Cycling with Functional Electrical Stimulation in Pediatric Spinal Cord Injury: A Case Report

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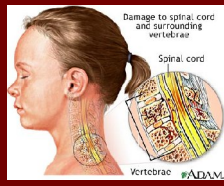
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## Pediatric SCI

- Affects 1.99 per 100,000 children
- Improvements in life expectancy
- Long term health issues
  - Earlier onset of disease with SCI
  - Neuromuscular effects



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## Cycling with FES

- Activates muscles needed for cycling
  - Typically quadriceps, hamstrings and gluteals
- In adults with SCI, improvements seen in
  - Muscle size
  - Lean body mass
  - Muscle strength (volitional & stimulated)
  - Utilization of oxygen
  - Heart rate, stroke volume and cardiac output
- No prior published work with children with SCI who may respond differently to exercise

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## Purpose

- Report effects of FES cycling for a child with SCI
  - Muscular
  - Respiratory
  - Cardiovascular

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## Methods

- 12 year old female
  - 2 yrs post T11 complete SCI due to MVA
  - Walked short distances with walker & braces
  - Primary mobility with wheelchair

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## FES Cycling

- RT300-P FES cycle (Restorative-Therapies, Baltimore, MD)
  - Target cadence of 50 rpm
  - Increasing resistance as able
- Surface stimulation to quadriceps, hamstrings, gluteals
- Subject seated in wheelchair
- 1 hour, 3X/wk week for 6 mos.
- Data collection pre & post



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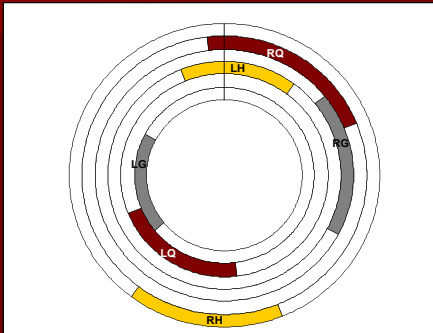
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## FES Pattern



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## Data Collection: Strength

- Electrically stimulated isometric strength of the quadriceps and hamstrings



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## Data Collection: Cardiovascular & Respiratory

- Progressive upper extremity ergometer test until fatigue
  - Increases of 10 Watts every minute
  - Peak HR
  - Peak  $VO_2$
- Fasting lipid profile

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## Results

- 81 FES cycling sessions completed
- Resistance tolerated increased from 1.0 to 2.4 Nm
- Weight loss
  - BMI decreased from 22.4 to 18.0

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## Results: Stimulated Strength

	Baseline	6 months
Quadriceps	67.1 N	94.2 N
Hamstrings	78.3 N	89.2 N

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## Results: Cholesterol

	Baseline	6 months
Total Cholesterol (mg/dL)	164	165
HDL Cholesterol (mg/dL)	37	53
LDL Cholesterol (mg/dL)	105	103

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## Results: Cardiorespiratory

	Baseline	6 months
Peak VO <sub>2</sub>	0.98 L	1.31 L
Peak Heart Rate	172 bpm	181 bpm

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## Discussion/Clinical Implications

- Strength
  - Increased strength likely due to muscle hypertrophy (MRI results pending)
  - Decreased muscle atrophy may decrease risk of metabolic syndrome & diabetes
- Cholesterol
  - HDL level of 37 at baseline is too low (American Heart Association)
    - At risk for metabolic syndrome & heart disease
  - Increase to 53 is significant
    - Increase of 16 points > 4.8 seen with children post exercise (Kelley GA, *Atherosclerosis*, 2007)

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## Discussion/Clinical Implications

- Peak VO<sub>2</sub>
  - Gain of 0.33 L or 36.3%
    - In children, typical gains post exercise are 6.5% (Rowland TW, *Pediatrics*, 1995)
  - Represents improved functional capacity

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Thank you!

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