

## FES driven cycling: increased crank resistance in the case of lower level of injury – comparison of case studies

Mariann Mravcsik<sup>1,2</sup>, Andras Kaluber<sup>3</sup>, Jozsef Laczko<sup>1,2</sup>,

*1 University of Pécs, Pécs, Hungary*

*2 Wigner Research Centre for Physics, Hungarian Academy of Sciences, Budapest, Hungary*

*3 National Institute for Medical Rehabilitation, Budapest, Hungary*

### Introduction

We compared the performances of two paraplegics with complete spinal cord injury, who participated in FES driven cycling trainings weekly twice. Fourteen trainings of each participant were included in this study. The level of injury of one participant (P1) was Th8 and of the other's (P2) was C5-6.

### Method

Four muscles were stimulated per legs: vastus lateralis, vastus medialis, rectus femoris, hamstrings. A MOTOMED Viva2 ergometer (Germany), a stimulator (Pazmany Peter Catholic University, Hungary) and bipolar surface electrodes (PG473WTENS ELEC 45x80mm) were applied. Stimulation frequency was constant 30 Hz with pulse width 300 $\mu$ s. Average current amplitude was 28 $\pm$ 5.7mA and 31.8 $\pm$ 4.6mA for P1 and P2 respectively. They were cycling with a cadence of 47-48 rpm as long as they wished (max. 30min.). The ergometer allowed cycling against various crank resistances (1.4Nm and 2.1Nm). The power- and energy outputs of the participants were compared by student's t-test ( $p < 0.01$ ).

### Results

Average cycling time (and SD) was 21.8 (2.6) and 22.8 (2.6) minutes for P1 and P2 respectively. Average power output was 9.4W $\pm$ 1.7W and 6.9W $\pm$ 0.4W, average total energy output was 12.4J $\pm$ 2.6J. and 9.46J $\pm$ 1.1J for P1 and P2 respectively. The cycling time and cadence didn't differ for the 2 participants. The significantly higher power- and energy output by P1 was achieved by cycling against higher resistance as he was able and pleased to do so. P2 was not able to cycle against 2.1Nm, he slowed down and his active cycling paused when resistance was increased from 1.4 to 2.1Nm.

### Discussion and conclusions

For SCI participants with lower level of injury, an increased crank resistance is advised when the aim is to reach higher energy output. In this case not cycling time or cadence but crank resistance should be increased which is more motivating than long cycling trainings for participants with low level of injuries.

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