

# **Effects of Interphase Gap Duration in Alternating Symmetrical Electrical Stimulation on Strength and Endurance in SCI**

Patrick L. Jacobs, Gabriel Somarriba, Brad Johnson, Andrew Carter

## **Introduction**

Various factors of electrical stimulation, such as stimulation frequency, pulse amplitude and width, have been associated with specific neuromuscular responses in paralyzed muscle. Less is known regarding the effect of varying the duration of the interphase interval, between the positive and negative pulses, of an alternating monophasic waveform pattern. It was the purpose of this preliminary study to examine the strength and endurance of electrically stimulated paralyzed muscle using two different interphase intervals (25ms & 40,000ms).

## **Methods**

Four men with complete paraplegia (T<sub>3</sub>-T<sub>11</sub>) participated in isokinetic muscle testing and endurance testing of the knee extensors using the programmable Exostim FES system (Neopraxis, AU). Testing was performed with low interphase interval of 25 ms (LPI), and high interphase interval of 40,000 ms (HII) with both conditions applying stimulation frequency 25pps, amplitude of 140ma, and pulse width 200  $\mu$ s.

The two conditions were both assessed on each of two different days in randomized order, with the mean of the two days serving as the outcome value for each condition. Isokinetic strength testing was performed using a Biodex II system with movement velocity of 60 degrees per second. Endurance was operationally defined as the duration of knee extension (>165degrees) with 3-sec recovery periods at 15-sec intervals.

## **Results**

The results of this assessment series indicated that the LII produced 8 – 22% more peak torque in the four subjects while the HII provided considerably more endurance (67 – 144% greater time to fatigue). These findings suggest that an extended interphase interval may provide a significantly greater resistance to muscle fatigue and thereby increase functional capacity during FES activities in persons with spinal cord injury.