**Electrophysiological characteristics of H-reflexes elicited by percutaneous stimulation of the cauda equina.**

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### Introduction

Electrical stimulation of the tibial nerve in the popliteal fossa evokes a short-latency and or a delayed activation of the motor units of the triceps surae muscle. The latter, reflex-elicted response is due to activation of group Ia fibers from spindles, and became called H-reflex.

The soleus H-reflex has commonly been used to assess stimulus-induced or task-related changes in the excitability of reflex pathways in humans, e.g. during locomotion (Capaday and Stein, 1986). Recent studies have documented that the soleus H-reflex can also be elicited by percutaneous electrical stimulation of nerve roots at the cauda equina (Zhu et al. 1998). On the basis of our experience gained from lumbosacral posterior roots stimulation by epidural electrodes (Minassian et al. 2004), we tried to simultaneously elicit H-reflexes in lower limb muscle groups bilaterally by non-invasive percutaneous electrical stimulation. In the present poster we describe the electrophysiological properties of these H-reflexes.

### Methods

**Eccodive set-up.** The stimulating electrodes were two small self-adhesive disc electrodes (6 × 3 cm) placed bilaterally on the subject's back between two spinous processes at vertebral levels between T11/T12 to L4/L5. Two large indifferent electrodes (8 × 13 cm) were placed on the abdomen.

**Stimulator.** Two different stimulators were used. Stimulator 1 was delivering trains of stimulat at 0.5 Hz with amplitudes of 0 - 70 mA and monophasic pulses of 300 μs length. Stimulator 2 generated biphasic pulses of various widths with strength of 0 - 60 V. Single stimulat and pairs of stimulat could be applied with different interstimulus intervals.

**Recording set-up.** Stimulus-evoked electromyographic (EMG) responses were recorded with surface electrodes placed over quadriceps, hamstrings, tibialis anterior and triceps surae in five adults, able-bodied subjects in supine position.

### Results

#### 1. H-reflexes elicited simultaneously in several lower limb muscle groups

<table>
<thead>
<tr>
<th>Muscle Group</th>
<th>EMG Amplitude</th>
<th>Latency (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadriceps</td>
<td>1 mV</td>
<td>10 ms</td>
</tr>
<tr>
<td>Hamstrings</td>
<td>0.5 mV</td>
<td>15 ms</td>
</tr>
<tr>
<td>Tibialis Anterior</td>
<td>1.5 mV</td>
<td>12 ms</td>
</tr>
<tr>
<td>Triceps surae</td>
<td>2 mV</td>
<td>14 ms</td>
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**Conclusions**

1) H-reflexes can be elicited bilaterally in several lower limb muscle groups by percutaneous cauda equina stimulation due to the geometrical characteristics of the lumbosacral spinal roots anatomy.

2) Relevance for physiological studies: to examine reflex mechanisms under supraspinal control in able-bodied during different motor tasks and gait, and also in people with impaired supraspinal control during externally controlled locomotion.


4) Non-invasive method to provide sustained tonic input to the lumbosacral cord via large posterior root fibers to enhance the central state of excitability of spinal neuronal circuits.

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**References**


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**Figures**

1. H-reflexes elicited simultaneously in several lower limb muscle groups

2. Responses to pairs of stimuli

3. Effect of vibration on H-reflexes

4. Vibration suppresses responses to cauda equina stimulation

5. Mean EMG-amplitudes and latencies of H-reflexes to stimulation at T11/T12

6. Effect of passive movement on H-reflexes

7. Effect of active movement on H-reflexes

8. H-reflexes to stimulation at different vertebral levels

9. Responses to stimulation with different strengths