Journal of Applied Physiology 2015 vol.118 N11, pages 1364-1374

Spinal segment-specific transcutaneous stimulation differentially shapes activation pattern among motor pools in humans

Sayenko D., Atkinson D., Dy C., Gurley K., Smith V., Angeli C., Harkema S., Edgerton V., Gerasimenko Y.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Copyright © 2015 the American Physiological Society. Transcutaneous and epidural electrical spinal cord stimulation techniques are becoming more valuable as electrophysiological and clinical tools. Recently, we observed selective activation of proximal and distal motor pools during epidural spinal stimulation. In the present study, we hypothesized that the characteristics of recruitment curves obtained from leg muscles will reflect a relative preferential activation of proximal and distal motor pools based on their arrangement along the lumbosacral enlargement. The purpose was to describe the electrophysiological responses to transcutaneous stimulation in leg muscles innervated by motoneurons from different segmental levels. Stimulation delivered along the rostrocaudal axis of the lumbosacral enlargement in the supine position resulted in a selective topographical recruitment of proximal and distal leg muscles, as described by threshold intensity, slope of the recruitment curves, and plateau point intensity and magnitude. Relatively selective recruitment of proximal and distal motor pools can be titrated by optimizing the site and intensity level of stimulation to excite a given combination of motor pools. The slope of the recruitment of particular muscles allows characterization of the properties of afferents projecting to specific motoneuron pools, as well as to the type and size of the motoneurons. The location and intensity of transcutaneous spinal electrical stimulation are critical to target particular neural structures across different motor pools in investigation of specific neuromodulatory effects. Finally, the asymmetry in bilateral evoked potentials is inevitable and can be attributed to both anatomical and functional peculiarities of individual muscles or muscle groups.

http://dx.doi.org/10.1152/japplphysiol.01128.2014

Keywords

Electrophysiological assessment, Evoked potentials, Human, Neurorehabilitation, Transcutaneous spinal cord stimulation