

下肢筋群の脊髄興奮性を評価する経皮的脊髄刺激法 — 縦断的評価法としての確立を目指して —

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Spinal Reflex Excitability of Lower-Limb Muscles Using Transcutaneous Spinal Cord Stimulation - The Study of Development for Longitudinal Test -

by

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ABSTRACT

The purpose of this study was to examine reproducibility of recruitment properties of the spinal reflexes evoked by a transcutaneous spinal cord stimulation (tSCS) between days. Twenty males (25.8 ± 3.4 years) participated in this study. Experiments were conducted while the subjects were in the supine position. Recruitment curves were obtained from the spinal reflexes evoked by tSCS in two consecutive days. A paired-pulse stimulation with 50 ms inter-pulse interval was delivered to confirm that responses were caused by activation of the sensory fibers. Surface electromyography (EMG) of eight muscles in the lower-limbs (i.e., foot, shank, and thigh muscles) was recorded. Peak-to-peak EMG amplitudes of the first response was calculated for each

muscle when no response was observed in the second response. Threshold intensity of the responses was defined as the minimum stimulation intensity that produced the responses, and maximal slope of the responses was determined by fitting six-order polynomial function to the recruitment curve. Inter-day reproducibility of the recruitment parameters was quantified using intraclass correlation coefficients (ICC) . ICCs of threshold intensity for each muscle ranged between 0.487 and 0.874, and ICCs of maximal slope ranged between 0.474 and 0.964. These results suggest moderate to high reproducibility of the parameters of the recruitment curve of spinal reflexes in lower-limbs. Therefore, spinal reflexes evoked by tSCS could be useful in longitudinal neurophysiological studies.

要 旨

本研究の目的は、経皮的脊髄刺激法 (transcutaneous spinal cord stimulation: tSCS) を用いて下肢筋群から誘発された脊髄反射の動員特性の再現性を明らかにすることであった。被験者は男性 20 名 (25.8 ± 3.4 歳) であった。仰臥位で安静を維持している被験者の脊髄に電気刺激 (1ms 矩形波, 50ms 間隔の 2 連発刺激) を与え、下肢 8 筋 (足趾, 下腿, 大腿部筋群) から脊髄反射を誘発した。計測では刺激強度を漸増させて各筋から脊髄反射動員曲線を取得した。実験は 24 時間の間隔を空けて 2 回実施された。各筋における脊髄反射の動員曲線の閾値強度および最大傾斜を算出し、級内相関係数 (intraclass correlation coefficient: ICC) を用いて再現性の程度を評価した。脊髄反射の閾値強度の ICC は 0.487 から 0.874 であり、最大傾斜の ICC は 0.471 から 0.964 の範囲であった。tSCS により誘発された脊髄反射動員曲線は、中程度以上の再現性があることが示された。