

干渉波電流刺激による身体動揺低減効果の検討

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Effect of Interferential Current Stimulation on Postural Sway

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ABSTRACT

In earlier studies of postural control system, electrical stimulation had been almost used as a disturbance to vestibular system. In this study, to consider whether an electrical stimulation method can be used as a support system for postural maintenance of human quiet standing, we developed the interferential current (IFC) stimulation device. We examined effects of IFC stimulation on center of pressure (COP) trajectory during one leg quiet standing with opened-eyes in the following conditions: 1) without stimulation, 2, 3, 4) IFC stimulations with 40, 60, 80 % sensation threshold intensities. We calculated four parameters relative to postural sway, which were corresponded to a variance of COP sway in mediolateral (ML) and anteroposterior (AP) directions (ML SD and AP SD) as “sway degree” in each direction, an area of 95% confidence ellipse for COP distribution as “swept area” and a COP trajectory path length in unit time as “average velocity”. As a result, ML SD and swept area were significantly decreased during the applied IFC stimulation at 80% sensation threshold intensity. On the other hand, AP SD and average velocity were not changed by IFC stimulation. These results suggest that IFC stimulation at sensation-subthreshold intensity may enhance a sensitivity of position sensing of knee joint. We confirmed that IFC stimulation at sensation-subthreshold intensity was effective support method for postural maintenance, especially postural sway in ML direction, during

one leg quiet standing in healthy young adults using our prototype IFC stimulation device.

要 旨

これまで姿勢制御に関する研究において電気刺激は主に前庭感覚への外乱として用いられてきた。本研究では、電気刺激が姿勢維持の支援として利用可能かどうかを検討するために、感覚閾値下の刺激強度での干渉波電流（IFC）刺激を膝関節に経皮的に印加し得る電気刺激装置を開発し、IFC刺激による足圧中心点（COP）動揺の低減効果を若年健常者で調べた。30秒間の片脚立位を開眼で行い、その際、IFC刺激なし、40%感覚閾値、60%感覚閾値および80%感覚閾値強度のIFC刺激の4条件におけるCOPの軌跡を計測した。その結果、80%感覚閾値強度でのIFC刺激時のCOP動揺において左右方向の動揺が有意に低減し、さらにはCOP動揺面積も有意に減少した。一方で、前後方向のCOP動揺や単位時間当たりの移動距離に関しては、IFC刺激有り無しにおいて違いは観察されなかった。試作したIFC刺激装置による感覚閾値下のIFC刺激が若年健常者の片脚立位時における横方向のCOP動揺を低減し、動揺面積を小さくさせる効果があることが確認された。