学位論文要約
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論文タイトル：Brain and muscle activation patterns during postural control affect static postural control

Background: Previous studies have reported existence of coordinated brain and muscle activity patterns that affect postural control. However, what differences in these activity patterns affect postural control are still unclear. The purpose of this study was to clarify brain and muscle activity pattern affecting postural control.
Research question: Does the difference in brain and muscle activity patterns during postural control affect postural control ability?
Method: Nineteen healthy men (mean age: 24.8 ± 4.1 years, height: 171.8 ± 5.5 cm, and weight: 63.5 ± 12.5 kg) performed a postural control task on a balance board, and their brain and muscle activities and body sway during the task were measured using functional near-infrared spectroscopy, surface electromyography, and three- dimensional accelerometry. Hierarchical cluster analysis was conducted to extract subgroups based on brain and muscle activities and postural control, and correlation analysis was performed to investigate the relationship between brain activity, muscle activity, and postural control.
Results: Two subgroups were found. Subgroup 1 ($n = 9$) showed higher brain activity in the supplementary motor area ($p = 0.04$), primary motor cortex ($p = 0.04$) and stable postural control in the mediolateral ($p < 0.01$) planes, and subgroup 2 ($n = 10$) showed higher muscle activity in the tibialis anterior ($p < 0.01$), a higher shank muscles co-contraction ($p = 0.02$) and unstable postural control. Furthermore, the supplementary motor area activity is negatively correlated with body sway of mediolateral plane ($r = -0.51$, $p = 0.02$), and tibialis anterior activity is positively correlated with body sway on the mediolateral plane ($r = 0.62$, $p = 0.004$).
Significance: Higher brain activity in motor-related areas, lower activity in the lower limb muscles and lower co-contraction of shank muscles were observed in stable postural control. These characteristics of stable postural control shown in this study will facilitate the planning of new rehabilitation methods for improving postural control ability.