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Intermittent centrifugation attenuates the disruption of rat walking induced by 2-week hind limb unloading

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【Purpose】
Centrifuge-induced artificial gravity is known as possible countermeasure to weightlessness (e. g., space flight). Nevertheless, studies for centrifugation have been confined to musculoskeletal issues despite weightlessness evokes alteration in motion such as walking, not only musculoskeletal degeneration. The purpose of this study was to examine the counter effect of intermittent centrifugation against alteration in walking evoked by simulated microgravity via hindlimb unloading.
【Methods】
Eight-week old male Wistar rats were distributed into four groups : (1) Free control (Ctrl, n = 18), (2) Unloaded by their tail for 2 weeks followed by 2 weeks of reload (UL, n = 18), (3) Unloaded for 2 weeks with 1G Standing for 1 hour/day followed by 2 weeks of reload (+1G, n = 18), (4) Unloaded for 2 weeks with 2G Centrifugation for 1 hour/day followed by 2 weeks of reload (+2G, n = 18). At each time point of interest (0, 2, and 4 wk after initiation of unloading), 6 rats from each group were investigated for their gait motion and hindlimb extensor muscle weights. One way ANOVA and Tukey-kramer test as post hoc test was used for statistical analysis with $p < 0.05$ as significance.
【Results】
While muscle weights of all groups recovered to Ctrl level at 4 wk after transient decrease at 2 wk ($p < 0.01$), altered gait properties (hyperextension in knee and ankle at stance phase ; overshoot at paw contact) persisted at 4 wk ($p < 0.01$) in UL and +1G. However, these alterations were not observed in +2G.
【Discussion】
Intermittent centrifugation could attenuate motion disruption evoked by weightlessness, which persists after the termination of unloading. Since this motion change could be attributed to other factors than muscle recovery, these findings imply that intermittent centrifugation could affect neural structures responsible for hindlimb motions.