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Relationship between support moment and vertical component of ground reaction force during gait

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Support moment is the net summation of ankle plantar flexion, knee extension and hip extension moment. It revealed a total limb pattern to push away from the ground. It has not been considered by a mathematical meaning but this synergy has shown consistently positive during single support [Winter, 1990]. We have found this concept matched not only walking but also squat motion, and contribution of each joint extensor depended on subject's movement pattern. Patients with Osgood-Shulatter disease showed greater knee extension and lessor hip extension moment than those of healthy subjects. Although these spatial features had well-matched to the movement pattern by qualitatively, we have not ever seen the support moment by quantitative aspects. The aim of this study was to examine the relationship between support moment and vertical component of ground reaction forces (: VGRF) during gait quantitatively.

【Methods】

Twenty-five healthy subjects volunteered in this study with informed consent. Average age was 21 ± 0.7 years old, height was 158.8 ± 3.1 cm, weight was 58.4 ± 5.0 kg. They were asked to walk on the force platform by their right foot by self-selected speed. Thirty-five markers were captured by three-dimensional motion analysis system [VICON : Vicon Motion Systems] with eight MX cameras and sampling rate was 200Hz. Three dimensional coordinates of each marker were analyzed with *plug-in gait model* which could analyze moments of lower extremity. Correlation coefficients between support moment and VGRF during gait were analyzed.

【Results】

Correlation coefficients were ranging from 0.70 to 0.96 ($p < 0.001$).

【Discussion】

Support moment had significant relationship to VGRF quantitatively. Wave of VGRF had bimodal feature. First peak of GRF corresponded to the maximum knee extension moment and second peak corresponded to the hip extension moment. These timings may help the evaluation of extensor muscle weakness.