Stabilograficzne metody oceny symetrii postawy
(Posturographic methods for body posture symmetry assessment)

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Clinical trials conducted at the Silesian Center for Rheumatology, Rehabilitation and Disability Prevention in Ustroń, Poland, confirmed effectiveness of the lower limb loading symmetry training based on the so-called follow-up posturography in patients rehabilitated after total hip arthroplasty. Observations of the rehabilitation process gave birth to the idea of utilisation of the follow-up posturography as a new method of postural symmetry evaluation.

The main goal of the dissertation was to develop effective postural symmetry measures utilising the so-called follow-up posturography and to verify their usefulness in the process of rehabilitation after total hip arthroplasty.

The follow-up posturography is a type of visual feedback posturography. It enables quantification of one’s ability to change position of his or her COP (Center of Pressure) – the point of application of the ground reaction force – according to a visual stimulus presented on the computer screen. During the examination the subject is standing on a fixed sensory device known as posturographic platform. Trajectories of the applied visual stimuli take form of circles drawn in a clockwise and counter-clockwise directions. They are localized symmetrically with respect to the vertical and horizontal axes of the computer screen. However, as far as the movements of the points of the visual stimuli are concerned, there is a mutual symmetry only with respect to the vertical axis. The COP trajectory representing the subject’s response to the clockwise visual stimulation is called the clockwise follow-up posturographic trajectory. Similarly, the COP trajectory measured in response to the counter-clockwise visual stimulation is referred to as the counter-clockwise follow-up posturographic trajectory. Comparative analysis of the obtained follow-up posturographic trajectories enables assessment of the left and right lower limbs’ mutual dynamic load transfer symmetry.

As part of the research the two postural symmetry measures have been proposed. The first one quantifies the degree of coincidence of the polygons representing the phase approximation of the counter-clockwise follow-up posturographic trajectory and the mirrored against the vertical axis phase approximation of the clockwise follow-up posturographic trajectory.

The second of the proposed measures of postural symmetry quantifies similarity of instantaneous and average COP displacements registered in response to the clockwise and counter-clockwise visual stimuli. Evaluation of the instantaneous likeness of signals is performed using covariance-based coefficients calculated independently for anteroposterior and mediolateral coordinates. The average COP displacements are evaluated using the so-called half-plane averaging of the follow-up posturographic trajectories.

Usability of the developed postural symmetry measures has been tested in the group of 30 patients rehabilitated after total hip arthroplasty. Statistical analysis confirmed significant growth of their values over the period of the rehabilitation program, corroborating positive effects of the applied rehabilitation therapy. The observed lack of significant correlations between the proposed measures of postural symmetry and the symmetry measures used in the static posturography supports the statement that the considered groups of measures quantify different aspects of postural symmetry.