

496. Evaluation of human postural balance in quiet standing by direct measurement of human body center of mass acceleration

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Abstract. Present article deals with the evaluation of human postural balance in quiet standing by the direct measuring acceleration of center of mass. Displacements of subjects' center of mass were determined and trajectories in anterior-posterior-medial-lateral plane were obtained. Comparison of parameters between healthy and subjects with stroke was performed and measurements revealed higher sway amplitudes of ones with stroke.

Keywords: human postural balance, body sway, center of mass acceleration, accelerometry.

Introduction

Ability to hold upright standing posture is essential for human being. A seemingly simple task performed by human being is more or less automatic and a complex activity both mechanically and neurologically. Researches on balance control and postural stability are very diverse. There are many ways to evaluate human postural balance and one of the most often applied methods is experimental measurements by using force plates, for example computerized posturography [2, 3]. Force plates are used to measure the position and path of the center of pressure (COP) – one of the parameters to estimate a postural stability [10, 11]. The COP refers to the point of application of the supportive force applied to the force plate and it is affected by the center of gravity and by the muscular forces acting on the foot. There are many others so called stabilometric descriptors like mean velocity (MV), area under COP, sway density curve (SDC) and etc., enabling identifying changes in postural control, for example with ageing [6, 12, 14]. Loss of postural stability may be caused by different disorders like stroke, because most of stroke survivors become disabled due to motor and cognitive dysfunction [4, 5, 13, 16]. Comprehensive rehabilitation of such patients can help to gain back lost functions and improves quality of life. Rehabilitation can be implemented by balance feedback training using MTD-balance system [4]. Alternatively to the traditional descriptors obtained from force plate measurements, some researchers have proposed, as a parameter for the evaluation of postural control, an acceleration of center of mass (COM), estimated with force platform recordings [1, 14, 15]. Though, it is not direct measurement of COM acceleration, it could be possible indeed with the application of modern motion video analysis systems. With the successful implementation of affordable electronic sensors nowadays it is possible to perform direct measurement of human motion by accelerometry, using accelerometers [8, 9]. The signals