Estimation of locomotion functions of people after stroke

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1. Introduction

Stroke is the third reason of adult people death or disability in Poland [5]. These who survived acute phase of the disease have hemiparesis or tetraparesis and balance disturbances and need long-lasting rehabilitation to restore or compensate lost functions. During this treatment a doctor has to control patient health state in order to estimate the treatment effects. This analysis most frequently is carried out by doctors in subjective estimation or with the use of dedicated tests [1,2]. Application of modern methods enabling rehabilitation progress estimation, based on advanced measurement methods, significantly can increase objectivity of this estimation. It is very valuable both for doctors who can compare their subjective estimation with measurements results and for patients who can realize that there is a real health improvement.

Within the confines of cooperation between scientists from the Department of Applied Mechanics at Silesian University of Technology and doctors from the Rehabilitation Centre “Repty”, the comprehensive system enabling rehabilitation progress monitoring of patients after stroke is working out. This monitoring is based both on medical tests conducted by doctors and on measurements of kinematic quantities and ground reactions carried out during chosen movements.

2. Methods

Examination of patient disability and estimation of rehabilitation progress is carried out at least three times for every patient starting at the beginning of the stay at the hospital. There are two parts of this examinations. In the first one doctors from the Rehabilitation Centre conduct special medical tests which enable estimation of such things like: degree of independence, muscle spasticity, depression or forces generated by muscles. The second part of this examination is carried out by scientists from the Department of Applied Mechanics and consists in measurements and analyses of chosen kinematic and dynamic quantities.

Every patient which is qualified to these examinations has to perform some tasks. He or she has to walk along a measuring path, stand up from a chair and go up the step. If a patient is unable to do one or more of these tasks, it is written down. Execution of exercises is recorded by means of a set of cameras and ground reactions are measured by means of dynamometric platforms. Then measured quantities are processed with the use of APAS system and computer program prepared by scientists from the Department of Applied Mechanics [3,4]. Obtained results, such as courses of joint angles, ground reactions, velocity of gait, cadence, stride length, range of motion in individual joints are analyzed, compared with which other and with medical tests.

3. Results

Next figures present exemplary results obtained for a group of patients during gait. The first three figures show comparison of right and left leg joint kinematic courses obtained for one person after stroke. The next one shows, compared for healthy and paretic leg, range of motion in sagittal plane in hip and knee joints, stride length as well as gait velocity. These results were obtained for a group of patients after stroke and with hemiplegia.

![Fig. 1 a) and b) visualisation of motion of healthy and paretic leg, c) course of the hip abduction adduction angle](image-url)
4. Discussion

Presented results were obtained for patients in the first week of stay in the Upper Silesian Rehabilitation Centre. One can observe that gait velocity is much smaller than this accepted as standard which is about 4 km/h. There are always big differences between right and left leg. Although such results are rather obvious, but doctor can analyze more precisely the state of health and compare these results with the measurements conducted in the next stages of rehabilitation. Proved in this objective way progress in rehabilitation can also encourage patient to do exercises more efficiently and help them to overcome their depression.

References


