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ANALYSIS OF MANIPULATION FUNCTION OF PATIENTS WITH UPPER LIMB DISORDERS

Agata Guzik-Kopyto[1(*)], Robert Michnik[1], Jacek Jurkojć[1], Piotr Wodarski[1], Wiesław Rycerski[2], Marcin Streiss[2]

[1]Biomechatronics Department, Silesian University of Technology, Gliwice, Poland
[2]Upper Silesian Rehabilitation Centre "Repty", Tarnowskie Góry, Poland
[(*)]*Email:* agata.guzik-kopyto@polsl.pl

ABSTRACT

This study shows the developed method of investigation enabling the calculation of the kinematics of human upper limb during daily tasks and manipulations. The research are the first stage of the project titled "Engineering support in diagnosis and rehabilitation process in patient with upper limb disorders."

Keywords: biomechanics, upper limb movement, ranges of upper limb motion.

INTRODUCTION

The upper limb allows to perform prehensile and cognitive actions like, among the others, moving objects and touching. The susceptibility of the upper limb to injuries and it's great importance in daily activities are the reasons of the great interest of physicians, physiotherapists and biomedical engineers in biomechanics and ways of treatment of upper limb injuries and diseases (Guzik 2006, Westerhoff 2009, Henmi 2006).

The aim of the research presented in this paper, was to elaborate a computer system enabling diagnosis and monitoring of a rehabilitation progress of patients with upper limb motor disabilities caused by neurological diseases. The research is realised by scientists from Biomechatronics Department of Silesian University of Technology in cooperation with physicians of Upper Silesian Rehabilitation Centre "Repty" in Tarnowskie Gory. Authors have elaborated methodology of investigation, consisting of biomechanical and medical evaluations.

Experimental investigations within the project have been carried out on healthy people (representative group) and patients. Kinematics of motion during daily activities has been measured and calculated. This paper presents results obtained for 3 patients and they are treated as a preliminary group.

All measurements have been done with the use of Xsens MVN Biomech. Within the frame of the investigation registration of the following daily activities have been done: lifting a cup and drinking (cup-drink), moving a cup (cup-mov), lifting a bottle of water of the specified height (bottle on the shelf, bottle from the shelf) and also screwing and unscrewing a bulb.

RESULTS AND CONCLUSIONS

As a result of experimental investigation, courses of individual joint angles in shoulder and elbow joints and ranges of motion during measured daily activities have been determined.

Maximal and minimal values of range of motion have been obtained for each joint for the following movements: flexion/extension in the shoulder joint and flexion/extension in the elbow joint.

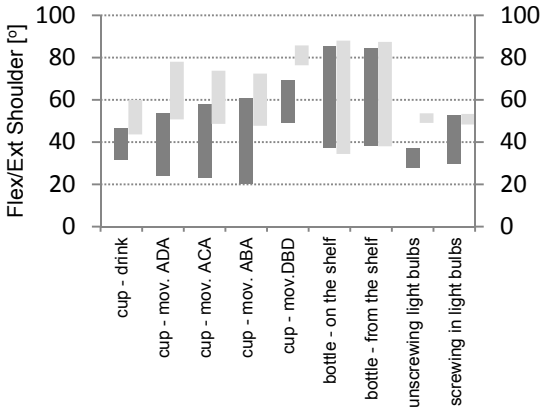

Fig. 1 - Mean values of range of motion during daily activities in the shoulder joint

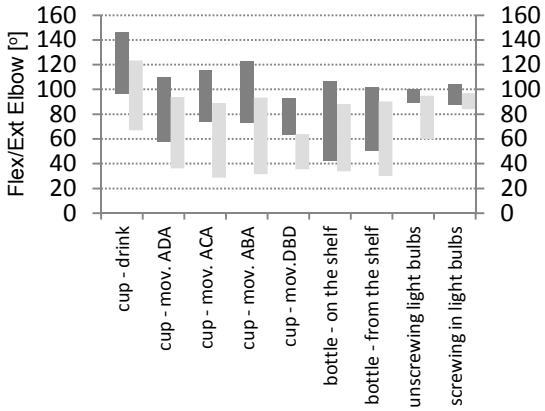

Fig. 2 - Mean values of range of motion during daily activities in the elbow joint

Research, carried out for a group of patients with hemiparesis, showed great disproportion in the way of movement performance between paretic and healthy limb. Mean values of ranges of motion for patient with right hemiparesis are presented in fig. 1 and fig. 2. One can notice that reduced range of motion in the elbow joint causes greater range in the shoulder joint when compared with the left limb.

In the next stage of research measurements will be carried out in the beginning and in the end of rehabilitation process. Obtained results will enable evaluation of rehabilitation progress and, compared with standard values, determination of degree of disability.

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