DIFFERENCES IN SOUND HAND AND PROSTHETIC PREHENSION FROM A COORDINATION DYNAMICS PERSPECTIVE

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BACKGROUND

Testing upper limb function after amputation and prosthesis fitting is an important step to evaluate the rehabilitation process and to gauge the functionality of prostheses. Characteristics of movement such as naturalness and coordination quality are relevant for the patient, but they are difficult to measure objectively. Principles and tools from the framework of coordination dynamics, however, might provide means to describe those aspects of motor behavior with a prosthesis. AIM This study builds on findings in pilot experiments. The aim is to investigate whether coordination dynamic parameters of the upper limb can characterize differences between healthy participants and prosthesis users during rhythmic prehension movements.

METHOD

During the pilot experiment three able-bodied participants picked up a wooden cylinder and returned to the starting position. They performed 50 repetitions with their sound hand and 50 repetitions with a prosthetic simulator (Otto Bock Variplus Hand). 3D Kinematics were measured with an optoelectric system and (relative) joint angles of elbow and shoulder were calculated. Discrete relative phase was calculated between prominent peaks in the time series of elbow and shoulder angles. Variability of discrete relative phase was assessed by its standard deviation. A larger follow-up experiment with more participants is planned, including patients wearing myoelectric prostheses.

RESULTS

Visual inspection of relative angle plots of elbow flexion and the plane of shoulder elevation revealed a more variable pattern in the prosthetic simulator condition (Figure1). The standard deviation (SD) of discrete relative phase was moreover found to be higher in the prosthetic simulator condition (SD: 6.09) compared to reaching with the sound hand (SD: 3.44). In this poster, results of the follow-up study will be reported, including the comparison between able-bodied individuals and prosthesis users. Figure 1. Relative Angle Plot of Participant 1

DISCUSSION & CONCLUSION

Sound hand and prosthesis simulator conditions could indeed be distinguished by coordination dynamics parameters. Upper limb joint coordination patterns during a rhythmic prehension task appeared to be less stable when reaching with a prosthesis simulator, compared to reaching with the

sound hand. Establishing ranges of natural performance and criterion values of these coordination dynamics parameters will be used in the future to develop a new tool to assess prosthesis user skill or to evaluate functionality of prostheses.