COMPUTER AIDED HANDGRIP DYNAMOMETER: A NEW DEVICE FOR MEASURING SARCOPENIA

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INTRODUCTION

Between 20 and 30 years, humans lose about 50 to 70% of their muscle mass and strength. This wasting of skeletal muscles (sarcopenia) is one of the major causes of dysfunction and disability in the elderly and is a major underlying cause for hospitalisation in senescence. Sarcopenia can usually be analysed by measuring hand-strength. The equipment (figure 1) was therefore developed to acquire and assess the strength of hand and forearm on a computer based measurement. Examinations of manual agility and power (contraction) after hand surgery or studies in neuromuscular disease (nonischemic forearm exercise test) are first examples. The measuring system can be easily adapted to the patient's anatomical conditions by means of a mechanical force transmission. The data acquisition, monitoring and storing is performed by the graphical development system LabVIEW. The software based concept makes it possible to generate a computer aided handgrip dynamometer, serving special measuring programs for unique user requirements.

Figure 1: Handgrip dynamometer

MEASURING TECHNOLOGY

The equipment consists of an ultra-miniature load cell (sensor), a full bridge amplifier (signal conditioning), a data acquisition card (DAQCard-6024E) and a notebook serving LabVIEW. The data acquisition software LabVIEW has to manage the following tasks: Continuous acquisition, displaying and saving the data, controlling the user interface and the examination programs. For example, the patient's muscle contraction force (MCF) will be acquired with optical and audible feedback in relationship to his maximal force of contraction. Figures 2 and 3 show the different MCF-time-diagrams to determine the feature 'maximum grip time' in static and dynamic mode. The offline data processing module extracts the several features (i.e. grip-times, surface integrals) and sends them to prepared Excel sheets.

DISCUSSION

This new device is now in use in the department of neurology since 3 years. Several performed studies have shown the benefits in clinically and pathophysiologically questioning [1]. Further studies have to be done to test this devise with old and weak patients. Longterm-outcome studies should show if the maximal force or the static force development measurements are better predictive parameters. Based upon the easily reconfiguration of the equipment we expect only a small effort to analyse the wasting of skeletal muscles. Innovative measuring algorithms have to be created to detect new features for the further research of sarcopenia. A possible and useful extension could be a multi-channel acquisition of additional bio-signals.

Lactate production upon short-term non–ischemic forearm exercise in mitochondrial disorders and other myopathies
Journal of Neurology Vol.253 Nr.6 p.735-740

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