Muscle activity during gait – - Electromyographic and Thermographic point of view

B. ZAGRODNY[1], M. LUDWICKI[2], W. WOJNICZ[3], J. MROZOWSKI[5], J. AWREJCEWICZ[6]

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1. Introduction

The aim of this paper is to presents a results of electromyographic and thermographic analysis of muscles activity during gait. A surface electromyographic signals (sEMG) are compared before and after treadmill exercise; similarly, whole body thermogramms are examined. Results of both methods ~~results~~ are presented and discussed.

2. Material and Methods

Nine male volunteers participated in this study. Four of them, basic anthropometric data are presented in the Table 1. They all gave a written consent agreement to the experimental procedure and whole experiment was organized as required by the Helsinki Declaration.

Table 1. Data of the volunteers

volunteer	age [years]	weight [kg]	height [cm]	fat ammount [%]
1	22	84,3	179,5	16,5
2	21	90,6	182	21
3	20	69	169,5	17
4	21	77,6	188	17
EX	21,00	80,38	179,75	17,88
SD	0,82	9,26	7,71	2,10

Research was done in laboratory of Biomechanics, Department of Automation, Biomechanics and Mechatronics, Łódź University of Technology. A Noraxon TeleMyo 2400T sEMG and Nec Avio R500EX infrared camera were used for examination. Following muscle signals were recorded: biceps femoris - lateral head, rectus femoris, gastrocnemius medialis and tibialis anterior, both – left and right lower limbs, according to the SENIAM standards [1]. Thermogramms and sEMG signals were

[1]Bartłomiej Zagrodny, Department of Automation, Biomechanics and Mechatronics, Łódź University of Technology, Stefanowskiego str. 1/15 Łódź, *contact author: bartlomiej.zagrodny@p.lodz.pl

[2]Michał Ludwicki, Department of Automation, Biomechanics and Mechatronics, Łódź University of Technology, Stefanowskiego str. 1/15 Łódź, michal.ludwicki@p.lodz.pl

[3]Wiktoria Wojnicz, Department of Mechanics and Mechatronics, Gdańsk University of Technology, Narutowicza str.11/12, Gdańsk, wiktoria.wojnicz@pg.gda.pl

[4]Jerzy Mrozowski, Department of Automation, Biomechanics and Mechatronics, Łódź University of Technology, Stefanowskiego str. 1/15 Łódź, jerzy.morozowski@p.lodz.pl

[5]Jan Awrejcewicz, Department of Automation, Biomechanics and Mechatronics, Łódź University of Technology, Stefanowskiego str. 1/15 Łódź, jan.awrejcewicz@p.lodz.pl

compared before and after 10 minutes of gait, performed with velocity of 4.5 km/h on the self-propelled treadmill. For thermogramm analysis a method similar to the one described in paper [2] was used.

3. Results

Differences in temperature distribution on the volunteer body is analysed; for exemplary results see fig. 1, a difference for *biceps femoris* mean-maximal for all volunteers reaches a value 0.51 K. Also, change in sEMG signals (frequencies, amplitudes) are examined and described; for exemplary results see fig. 2, for *gastrocnemius medialis* median frequency decreased by 0,9 Hz. Obtained data are compared and discussed with other published results (ex. [3, 4])

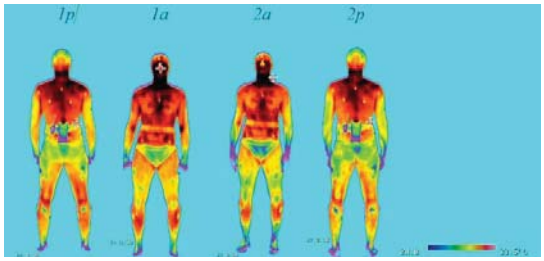

Fig. 1. Examples of thermogramms of the anterior (a) and posterior (p) part of the body before (1) and after 10 minutes of treadmill gait (2)

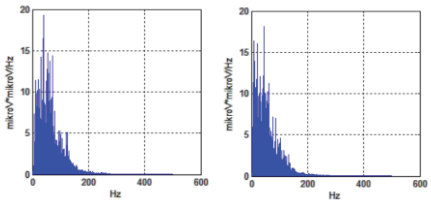

Fig. 2. Examples of EMG signals frequency analysis for a right *rectus femoris* muscle before (left) and after (right) 10 minutes of treadmill gait

4. Discussion

Small, but noticeable differences in body skin temperature and frequencies of EMG signals were observed during experiments, what allows to correlate results obtained from infrared camera and electromyography measurements.

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