introducing unstable surfaces the proprioceptive feedback is unreliable due to the fact that the control mechanism responsible for maintaining balance is being permanently stimulated, its task thus becoming more difficult.

These exercises, carried out in special conditions (on balance fits, using TRXs, gym balls), stimulate proprioception and may lead to an increase in athletic performance both in case of a high stress game and of technical performance demands in particular situations: imbalance, shooting, passing etc.

References

1. Acsinte, A., Alexandru, E., Guiterrez a Quilar, O., (2012), *Neuro-muscular coordination and balance skills development in young female handball players*, 2nd EHF Scientific conference women and handball scientific and practical Approaches, 28-32;
2. Bressel, E., Yonker, J.C., Kras, J., Heath, E.M., (2007), *Comparison of static and dynamic balance in female collegiate soccer, basketball, and gymnastics athletes*, Journal of Athletic Training, 42-46;
3. Freiwald, J., Papadopoulus, C., Slomka, M., Bizzini, M., Baumgart, C., (2006), *Prävention im fußballsport. Sportorthopädie Sporttraumatologie*, 22, 140–150;
4. Gauchard, G.C., Gangloff, P., Jeandel, C., Perrin, P.P., (2003), *Physical activity improves gaze and posture control in the elderly, Neurosci Res* 45, 409-417;
5. Gribble, P.A., Tucke,r W.S., Whit, P.A., (2007), *Time-of-day influences on static and dynamic postural control.* J Athl Train 42, 35–41;
6. Gstöttner, M., Neher, A., Scholtz, A., Millonig, M., Lembert, S., Raschner,C., (2009), *Balance ability and muscle response of the preferred and nonpreferred leg in soccer players, motor control*, Human Kinetics,13, 218-231;
7. Ilić, D., Drašković, V., Marković, S. (2009). *Selection of students for handball gifted teaching physical education*. In Book of Abstracts 5-th FIEP Euoropean congress, 2- nd Serbian congress of P.E. Teachers (52). Niš: Ministry of youth and sport, Minisrty of science and technological development ministry of education;
8. Lee, A., Lin, W., Huang, C., (2006) *Impaired proprioception and poor static postural control in subjects with functional instability of the ankle*. J Exerc Sci Fit 4, 117–125;
9. Lidor, R., Falk, B., Arnon, M., Cohen ,Y., Segal, G., Lander, Y., (2005), *Measurement of talent in team handball: The questionable use of motor and physical tests*. J Strength Cond Res.; 19, 318–325;
10. Milanović, D. (2007), *Training theory*, Zagreb: Faculty of Kinesiology;
11. Starosta,W., (2006), *The concept of modern training in sport, Physical Culture And Tourism*, 13(2), 9-23;
12. Subasi, S.S., Gelecek, N., Aksakoglu, G., (2008), *Effects of different warm-up periods on knee proprioception and balance in healthy young individuals*. J Sport Rehab 17, 186–205;
13. Zech, A., Markus Hubscher, M., Vogt, L., Winfried Banzer, W., Hansel, F., Pfeifer, K., (2010), *Balance training for neuromuscular control and performance enhancement: a systematic review*, Journal of athletic training, 45(4), 392–403.

THIGH MUSCLES ELECTROMYOGRAPHY RESEARCH

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Abstract:
The aim of this study is to examine the effect of body mass increase (32.46% and 64.92%) over two main muscles of the human musculoskeletal system. Therefore, were analyzed the thigh muscles. More precisely was captured the electrical activity of rectus femoris muscle and biceps femoris muscle. For this experiment was used a BIOPAC MP 150 data acquisition system. The experiment consisted in five trials, 15 seconds each, departing from siting and followed by three normal steps and a relaxation phase. The resulted data revealed that although the lower limbs muscle structure is extremely complex the two muscle in question retrieve a large amount of overload, given that in some cases the electrical activity doubles in amplitude.

Key words: electromyography, biceps, rectus, muscle activity

1. Introduction

The human locomotor system is an extremely complex system that provides form support, stability, and movement to the body. A key component of the human locomotor system is the muscular system. Muscular system fundamental element is the muscle cell. Due to the excitability property, the muscle cell generates electric and magnetic fields and as a consequence forces that sustain in balance and propels the body. A method for analyzing the electric fields is electromyography (EMG). The electromyography represents the study of muscle activity by monitoring the electric signal produce at rest or moving by the muscle cell. In addition, this method is a noninvasive method for analyzing skeletal muscle. The EMG signal is a succession of action potentials (Motor Unit Action Potential – MUAP). Thus, the EMG signal results from summing of all fiber action potentials of motor units composition. EMG can also be used in diagnosing deterioration of muscles and nerves [1].

According to Reaz M.B.I, Hussain M.S, Yasin – Mohd F., (2006) the EMG signal can expressed mathematically as following:

$$x(n) = \sum_{r=0}^{N-1} h(r) \cdot e(n-r) + w(n) \qquad (1)$$

where, *x(n)*, modeled EMG signal, *e(n)*, point processed, represents the firing impulse, *h(r)*, represents the MUAP, *w(n)*, zero mean addictive white Gaussian noise and *N* is the number of motor unit firings.

Comparative studies used surface electromyography to analyze signals of the gluteus maximus, gluteus medius, adductor longus, hamstrings, tibialis anterior, triceps surae, rectus femoris and erector spine muscles were recorded on various subject walked over ground at normal walking speeds [3]. Were chosen for these study six healthy volunteers and two cerebral palsy volunteers between the ages of 18-24 years of age. It has been observed that tibialis anterior and triceps surae muscles are showing most significant activities in comparison to other muscle groups [3].

Other authors used electromyography techniques and surface marker to investigate the kinetics and kinematics of knee and ankle in the course of peak performance of a soccer player during kicking action [4].

2. Method

2.1. Instrumentation technique for determining the muscle activity

For monitoring the muscle activity was used both hardware and software. As hardware instrumentation (fig. 1, fig. 2) was used a notebook Fujitsu (processor Intel Core I3 2,53 GHz, 4 GB RAM DDR3, OS Windows 7 64-bits) and a BIOPAC MP 150 data acquisition system (fig. 2).

The instrumentation technique used in this experiment for determining the muscle activity was composed from a muscle potential collecting system, an amplifier, a filter, a processor and a speaker. In other words a STM100C module which is a single channel stimulation amplifier, a UIM100C module (Universal Interface Module) that interfaces the MP150/100 and external devices, and two electromyogram amplifier modules (EMG100C). This module is a single-channel, high-gain, differential input, bio potential amplifier designed specifically for monitoring muscle and nerve response activity [5]. As links between modules and the EL503 sensors, was used LEAD108, LEAD110S-R and extensions MEC11C (fig. 3).

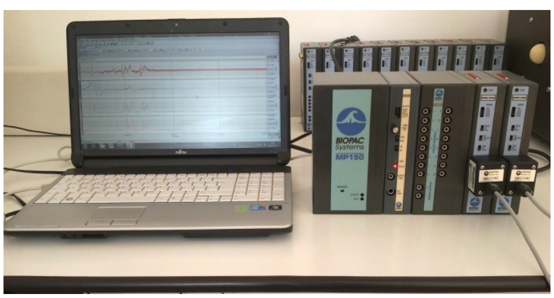


Fig.1. The instrumentation technique

Fig. 2. BIOPAC MP 150 System

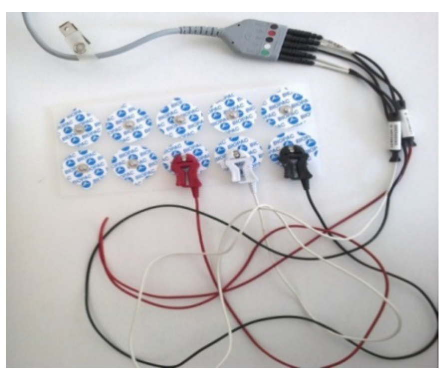


Fig. 3. Link elements and EL503 sensors

2.2. Experimental protocol

In order to obtain valid and accurate data was established the following requirements:

- The ambient temperature had to be relatively constant and ranging between 20^0 C and 25^0 C. Temperature below 20^0 C can lead to muscle contractions due to shivering whereas when more than 25^0 C can lead to muscle cell heating [6];
- For an increased conductivity between skin and the EL503 electrode, any pilosity was removed;
- The electrodes must not come into contact with other parts of the body or foreign objects;
- The participant of the experiment must be familiarized with the protocol in order to be in a state of physical and mental relaxation [7];
- The participant must execute only the movements included within the experimental protocol.

In this experiment was measured and monitoring the electrical activity generated by the rectus femoris muscle and the biceps femoris muscle (fig.4). The rectus femoris is one of four quadriceps muscle. Its main function are the flexion of thigh and at the hip joint and extension of the leg at the knee joint. The biceps femoris is a muscle of the thigh located to the posterior, or back. As its name implies, it has two parts, one of which (the long head) forms part of the hamstrings muscle group and the short head. Both heads of the biceps femoris perform knee flexion.

Fig.4. Appling the EL 503 sensors

The experiment consisted in five trials, 15 seconds each, departing from siting and followed by three normal steps and a relaxation phase.

The experiments were conducted under the following conditions:

- The first experiment consisted in execution of three simple steps, without overload. In this case the locomotor system muscles had to support a body mass of 77 Kg;
- The second experiment consisted in execution of three simple steps, with an overload of 32.46 % of body mass. The 25 Kg dumbbell was positioned at the chest and support by both upper limbs;
- The third experiment consisted in execution of three simple steps, with an overload of 64.9 % of body mass. Therefore was added two 25 Kg dumbbells supported by each lower limb;
- The fourth experiment consisted in execution of three simple steps, with an overload of 32.46 % of body mass. The 25 Kg dumbbell was support by the left upper limb;
- The fifth experiment consisted in execution of three simple steps, with an overload of 32.46 % of body mass. The 25 Kg dumbbell was support by the right upper limb.

Figure 5 represents a connection scheme used in the experiment. In total were used six electrodes EL503, four LEAD110S-R cables for VIN + and VIN –, and tow LEAD108 cables for ground (GND).

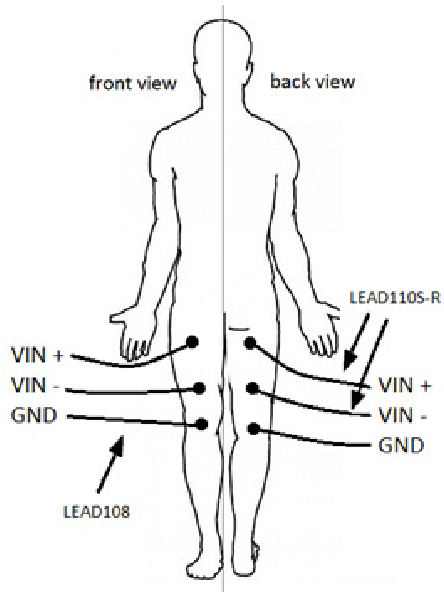


Fig.5. Electrode EL503 connections

3. Results

For a more accurate estimate of the EMG signals generated by the states of rectus femoris muscle and biceps femoris muscle we adopted a filtering procedure. Therefore, by using MATLAB the signal was transposed into positive domain, rectified and outlined (fig 6,7,8,9,10).

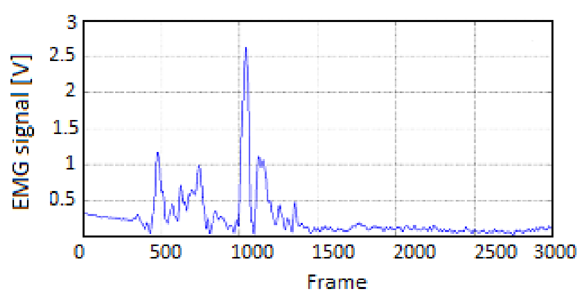
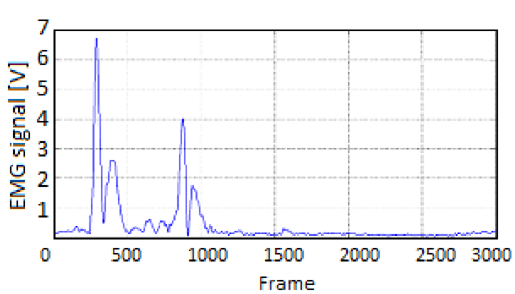


Fig.6. Rectus femoris muscle activity (1st experiment)

Rectus femoris muscle acts as a flexor of the thigh at the hip joint and as an extensor at the knee joint. The resulted data revels the overload had a significant impact to the muscle activity. In some cases (fig 7,8,9,10) the potential difference between points had increased with more 200% due to the fact was needed more energy to extend the knee. The energy surplus was generated when the participant to the experiment had risen from a sitting position.



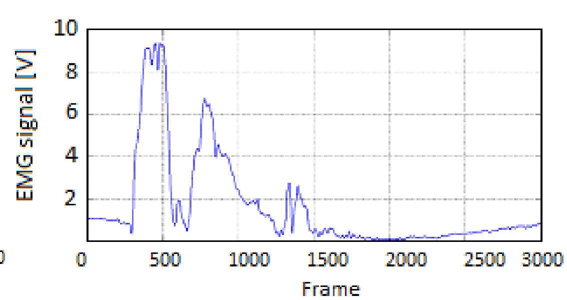


Fig.7. Rectus femoris muscle activity (2nd experiment) Fig.8. Rectus femoris muscle activity (3rd experiment)

The fourth experiment consisted in execution of three simple steps, with an overload of 32.46 % of body mass (fig 9). The 25 Kg dumbbell was support by the left upper limb. Although the weight was not fully supported by this right rectus femoris muscle, it had to generate more electric power to support the body in a balanced position.

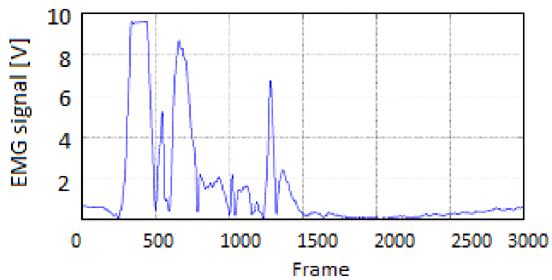


Fig.9. Rectus femoris muscle activity (4th experiment)

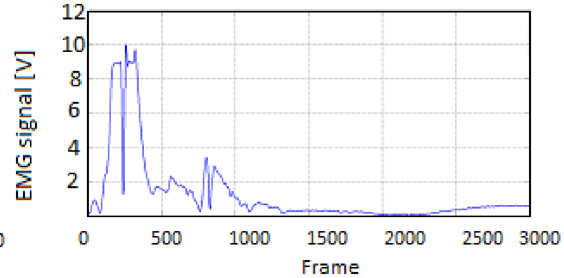


Fig.10. Rectus femoris muscle activity (5th experiment)

Biceps femoris muscle acts as a flexor of the knee. The electrical activity generated by this muscle is shown in figure 11 to 15.

It can be notice that like as the other study muscle, rectus femoris also intensified the electrical activity to maintain support, stability, and movement to the body.

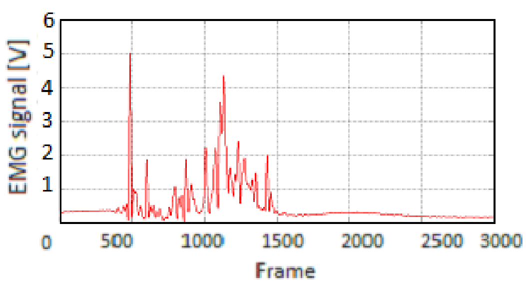


Fig.11. Biceps femoris muscle activity (1st experiment)

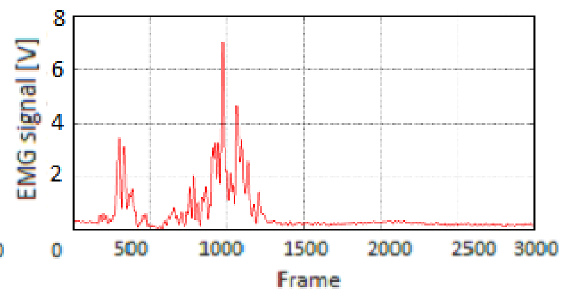


Fig.12. Biceps femoris muscle activity (2nd experiment)

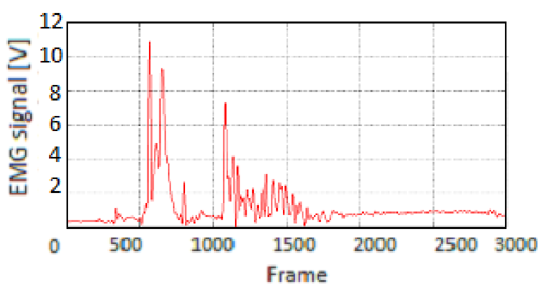


Fig.13. Biceps femoris muscle activity (3rd experiment)

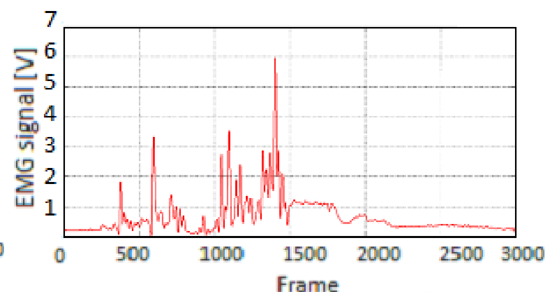


Fig.14. Biceps femoris muscle activity (4th experiment)

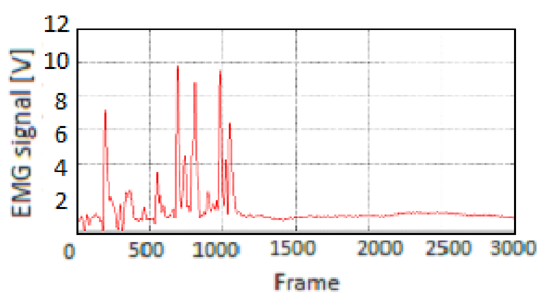


Fig.15. Biceps femoris muscle activity (5th experiment)

4. Conclusions

The human locomotor system is an extremely complex system that provides form support, stability, and movement to the body. A key component of the human locomotor system is the muscular system. Due to the excitability property, the muscles generates electric and magnetic fields and as a consequence forces that sustain in balance and propels the body.

In this paper we've analyze the electrical behavior of biceps femoris muscle and rectus femoris muscle will different situation. For this experiment was used a BIOPAC MP 150 data acquisition system. The experiment consisted in five trials, 15 seconds each, departing from siting and followed by three normal steps and a relaxation phase. The resulted data revealed that although the lower limbs muscle structure is extremely complex the two muscle in question retrieve a large amount of overload, given that in some cases the electrical activity increases in amplitude with more the 200%.

References

1. Dardiotis, E., Papathanasiou, E., Vonta, I., Hadjigeorgiou, G., Zamba-Papanicolaou, E., Kyriakides, T., 2011. A correlative study of quantitative EMG and biopsy findings in 31 patients with myopathies. Acta Myologica 30 (1), 37 41;
2. Reaz M.B.I, Hussain M.S, Yasin – Mohd F., Techniques of EMG signal analysis: detection, processing, classification and applications, Biological Procedures Online December 2006, Volume 8, 2006, Issue 1, pp 11-35, Open Access;
3. Ashish Kumar Mishra, Amit Srivastavaa, R. P. Tewari, Rakesh Mathur, EMG Analysis of Lower Limb Muscles for Developing Robotic Exoskeleton Orthotic Device, Procedia Engineering 41 (2012) 32 – 36 1877-7058, doi: 10.1016/j.proeng.2012.07.139;
4. Chu Yih Binga, S.Parasuraman a*and M.K.A.Ahmed Khan, Electromyography (EMG) and Human Locomotion, Procedia Engineering 41 (2012) 486 – 492 1877-7058 doi: 10.1016/j.proeng.2012.07.202;
5. http://www.biopac.com/wp-content/uploads/mp_hardware_guide.pdf
6. Szilágyi Tibor, Habor Adriana, Orbán-Kis Károly,(2008), Fiziologie umană: îndreptar de lucrări practice, University Press Târgu Mureş.
7. Nemeş D., Gogulescu A., Kinesiologie funcţională, Universitatea de Medicină şi Farmacie „Victor Babeş", Timişoara, 2006;

ASSESSING THE LEARNING OUTCOMES AT INSTITUTIONAL LEVEL

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Abstract:
The paper presents the results of an on-line survey aiming to assess the learning outcomes on institutional level. The questions on the questionnaire were related to recruitment stage, to the durations of studies, to the funding, to the employability, to the first contract. Thus, this study provides a real image on the graduates and a proper feed-back in the supply-demand ratio on the labor market. The survey can be considered a tool for assessing the quality of educational process.

Keywords: quality management, quality assessment, survey

1. Introduction

The quality management system of higher education has been designed on a national basis, on the requirements of European standards, on university peculiarities and requirements of strategic management, on policy and quality objectives.

Academic management provides a systemic approach to quality management; each component has a well-defined status and represents an entity within the quality management system, characterized by functional links with other entities and systems. This approach allows involvement at all levels in the implementation and continuous improvement of quality management system by understanding customers' needs and acting accordingly.

Process approach in quality management involves the following activities:

a) Identification of the processes requirements, in order to achieve the desired result;
b) Establishing the sequence and interaction processes;
c) Identification of functional interactions between processes and academic structures;
d) Identification and evaluation of input and output data processes;
e) Establishing the process indicators;
f) Choosing the methods for tracking, analysis, control and improve performance;
g) Continuous improvement according to the matrix DMADV (Define, Measure, Analyse, Design, Verify).