COMPARISON BETWEEN THE STANDARD AVERAGE MUSCLE ACTIVATION WITH THE USE OF SNORKEL AND WITHOUT SNORKEL IN BREAKSTROKE TECHNIQUE

Conceição, A[1,2].; Gamboa, H. [3]; Palma, S. [3]; Araújo, T. [3]; Nunes, N. [3]; Marinho, D. [4,2]; Costa, A. [4,2]; Silva, A. [5,2]; Louro, H. [1,2]

[1] Sports Sciences School of Rio Maior, Polytechnic Institute of Santarém, Portugal

[2] Research Center for Sport, Health and Human Development (CIDESD), UTAD, Vila Real, Portugal

[3] PLUX- Biosignal Acquisition and Processing, Lisboa, Portugal

[4] Departament of C. of Sport, University of Beira Interior, Covilhã, Portugal

[5] Department of C. of Sport, Exercise and Health of University of Trás-os-Montes and Alto Douro; Vila Real, Portugal.

Introduction

In swimming, the snorkel (K4b^2, Italy, Rome), which consists of a valve train Aquatrainer (Cosmed, Rome, Italy), is often used for analysis of various physiological and biomechanical aspects [1,2]. Researchers analyzed its feability and reliability, and the mechanical constraints caused by this system [3]. Electromyography (EMG) is used to evaluate the neuromuscular activity, by plotting the electrical activity of the muscles, using the pattern of muscle activation as benchmark [4,5]. The purpose of this study is to compare the average pattern of muscle activation in two situations: using a snorkel and without the use of snorkeling in the breakstroke swimming technique.

Methods

5 male subjects (Mean ± SD: age 19 ± 3,67 years; weight 76.1 ± 6.58 kg; height 178 ± 0.05 cm; fat mass percentage 14,68 ± 1.96; IMC 24 ± 1,66), were subjected to a test consisting of a protocol of 2 x 25m breakstroke swimming. In the first part of the test the swimmers used a snorkel; in the second part they swam without snorkel, making each part to 95% of transit time for 200m crawl. Using a wireless signal acquisition system (bioPLUX research, Portugal) and EMG sensors (emgPLUX, Portugal), the muscle activity of Biceps Brachii (BB) and Triceps Brachii (TB) of the right arm was recorded throughout the test and synchronized with the video images. The raw EMG was processed offline using Python (version 2.4) routines to compare morphology of the pattern of EMG signal recorded form BB and TB during both test conditions. The signals were sub-sampled to a frequency of 200Hz, low-pass filtered with a smoothing window of 50 samples and rectified. We selected the(middle-700_middle+2300) samples of the raw signal on all identical pathways(15m). For each subject, muscle and test condition, the mean, standart deviation, maximum and minimum values fo EMG were determined. In order to compare the pattern EMG wave of the swimming movement with and without snorkel, the mean EMG wave was computed for each subject, muscle and test condition.

Results

The results demonstrated that the mean (EMG) of the BB and TB are higher with the use of snorkel, thus showing greater activation during the action cycles in this implementation. Looking at the maximum value of EMG activation, it was possible to see that BB muscle has higher values than TB and both muscles presents higher maximum values with the use of a snorkel. The minimum values are also higher in the BB in both situations.

Discussion

We can observe that both muscles, BB and TB, present higher values with the use of snorkel. The BB muscle is the one which shows higher values both with and without snorkel, meaning higher activation in both situations. The time of muscle activation is also bigger with the use of snorkel.
The curve of the EMG signal pattern of the cycles for each muscle group is different from subject to subject, and was different between each situation.

References

1.Fernandes, R., Cardoso, C.,Silva, J.,Vilar, S., Colaço, P.,Barbosa, T.,Keskinen,K., Vilas-Boas, JP.(2006).*Assessment of the time limita t lowest speed corresponding to maximal oxygen consumption in the four competitive swimming strokes*.In: Biomechanics and Medicine in Swimming X.Portuguese Journal of Sport Sciences, Porto.
2.Rodriguez, F. A., K. L. Keskinen, Et Al. (2008).*"Validity of a swimming snorkel for metabolic testing.*" Int J Sports Med 29(2): 120-8.
3.Costa, M., Reis, A., Reis, Vm., Silva, Aj.,Garrido, N.,Louro,H.,Marinho,Da.,Baldari, C., Barbosa, Tm.(2009). *Constraint caused by mechanical valve Aquatrainer associated with system oxymetry direct (K4B^2) in breakstroke kinematic.*3º Nacional Congress of Biomechanic, M.A.Vaz *et al* (Eds), Bragança.
4.Clarys, J. (1983). *A review of EMG in swimming: explanation of facts and/or feedback information*. In: A. Hollander, P. Huijing, G. Groot (eds), Biomechanics and medicine in swimming, pp. 123-135. Champaign, Illinois, USA.
5.Rouard, A., Billat, R., Deschodt, V.; Clarys, J.(1993). *Muscular activation in sweep movements of the upper limb in freestyle swimming.* In: H., Riehle, M., Vieten (Eds), *XIX I.S.B. Congress*, pp 781-782.