

# Using Electromyography for Improving of Training of Sport Shooting

Lucie Svecova, David Vala

VSB-TU Ostrava, 17. listopadu 15, Ostrava, 708 33, Czech Republic  
(e-mail: [lucie.svecova@vsb.cz](mailto:lucie.svecova@vsb.cz)).

**Abstract:** This article describes possibilities of using electromyography (EMG) as an objective method for identification of wrong muscles work during aimed shooting focused on disciplines of sport shooting. On the beginning, there is a preview to another works, where EMG was used in sport shooting. Own measurement was focused on upper limbs, especially of tension of biceps brachii during aiming and its effect on rifle movements. For this task were used SCATT Shooter Training system and SOMNOScreen device with two channels EMG. Measurement was done on several shooters with different shooting skill in standing position with air rifle. There is presumption dependence between increased tension in muscles and rifle trajectory. Also shooters errors which were hard to find were detect with EMG.

© 2016, IFAC (International Federation of Automatic Control) Hosting by Elsevier Ltd. All rights reserved.

*Keywords:* EMG, shooting, electromyography, measurements, biomechanic

## 1. INTRODUCTION

Using electromyography in training of sport shooting may help to make training more effective and detect some mistakes, that shooter makes. At present time, electronic training systems are used as a supplement for training and improving shooting skill. These devices work on optoelectronic principle and display movement of the rifle, moment of a shot and important interval after shot. Generally, these training systems show stability of rifle, afterwards stability of shooter. It is possible to detect, that something is wrong. Combine with EMG measurement may specify the mistakes. Adequate muscle tonus hold body in proper position, in the same time tonus is not too strong to cause unwanted movements of rifle. Today, information about muscle tonus is given only as a feedback from shooters feelings. And it is unreliable, especially in case of young shooters. Not everybody is able to perceive own body properly. It requires long-term training. If the shooter gets bad habits are very difficult to remove them.

The beginning of the research is focused on air rifle shooting in standing position, because it is technically easiest position (Sawicki et al. (2015); Idzkowski and Walendziuk (2009)). Group of postural muscles, which ensure the upright attitude, have some level of tonus as fundamentals of their function. In case of upper limbs muscles, there is different load between left and right arms. Left upper limb carries the weight of the rifle, so especially biceps brachii, muscles of the forearm and trapezoid are in the mild tension. If the tension gets over some level, it caused instability of rifle. On the other side, right upper limb muscles are almost relaxed. The stronger tension in right arm also causes instability. Furthermore, right hand (in case of right handed shooter) is responsible for triggering. Only digital flexor may be integrated in this action, otherwise the rifle will move away. The intensity of muscle tension is quite individual matter, which depends on fitness condition, shooting skill and his somatotype,



Fig. 1. Preparing for measurement: Attached electrodes on forearm and biceps brachii

but is possible to create a certain map of muscle tension, applicable for most of shooters.

## 2. EMG IN SPORT SHOOTING

Several times EMG was used in an effort to improve training of sport shooting and prove certain dependences. In the study: Effects of muscle fatigue on the pistol shooting performance was used just EMG and electronic training system SCATT. 17 elite male pistol shooter included also Korea national team were participate in this study. They were divided into two groups randomly. In the beginning, both groups performed ten shots for 150s toward the SCATT training system. As the next step, shooters did

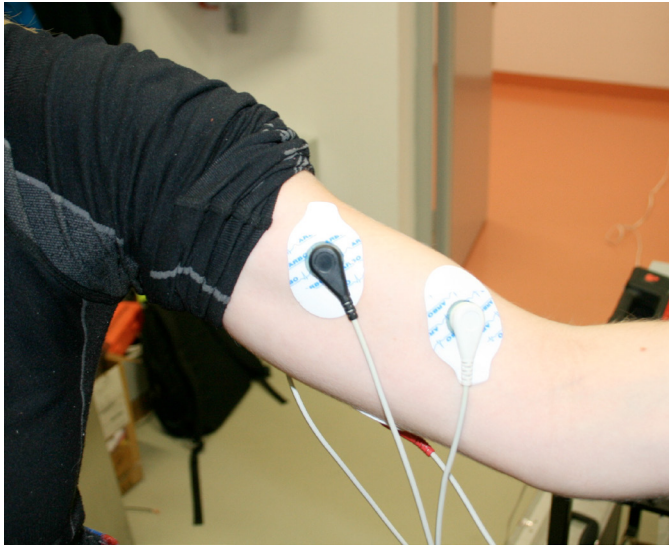


Fig. 2. Preparing for measurement: shooter in full equipment with attached electrodes on selected muscles

muscle fatigue isometric exercises. Group A did 1 set of exercise, group B did 3 sets. All subjects immediately shoot another series. The result in the group A was significantly increasing of the shooting time but decreasing of aiming period. Shooting score neither aiming time was not affected. In case of group B, all variables were significantly decreased. EMG shown significantly increased tonus of deltoids and triceps in both groups, in group B was increased also the triceps brachii.

Another study aiming to sport shooting investigated biomechanical analysis and provided basic data for technical training for air rifle shooters. They measured ground reaction force and pressure distribution to analyse the type of change in biomechanical factors based on movement pattern of body's core during rifle shooting in left/right and back/forth direction. There were measured small differences between tested shooters. All of them had very stable position. Still, every shooter needs to develop his own ideal shooting position instead of taking over excellent shooters position. And therefore, measurements as EMG are necessary for future researches.

As it was referred in the study above, imitating another's shooting position is not sporadic. Although every shooting position has its basic standards, it is important to respect shooter's condition and somatotype and this is the right place for using EMG, see Minvielle and Audiffren (2000).

Another solution how to improve shooting performance with EMG measurement was present in the article Preparatory heart rate patterns in competitive rifle shooting (Konttinen et al. (1998)). In this study, the relationship between heart rate patterns and competitive shooting performance. EMG was used as supporting method for displaying upper body movements, which also affect heart rate.

Also the rifle parameter as weight of rifle and its centre of gravity has influence on shooter's muscle tonus. In article Effects of rifle weight and handling length on shooting performance (Yuan and Lee (1997)) is described how rifle weight and design affects the muscle activity during



Fig. 3. Preparing for measurement: SCATT optical sensor is mounted on the end of the barrel

aiming just with EMG measurement. It was shown that different rifle designs led to an alteration of rifle holding postures and muscle activation levels in order to maintain the shooter-rifle system in balance and affecting aiming stability. Also the shooting accuracy was affected.

EMG was used also in another sports than sport shooting. Several studies were made for archery, where the proper muscle activity pattern has the same consequence as in sport shooting. All phases of shooting, from drawing to releasing, were examined with the camera and surface EMG. The examined subjects were from elementary school archers to high school archers between both, female and male. For example see Tinazzi (2011).

Sport shooting and archery have one important character, static burden of muscles, where EMG seems to be very helpful with improvement in training. But also in more dynamic sports is EMG useful. For example, electromyography patterns gained during the golf swing may detect the way to predict the shot effectiveness and has potential to enhance exercises especially of a long carry distance drives. More details you can find in Verikas et al. (2016).

EMG in sport field has also another character than improving skills and it is a prevention of injuries. Like in the study: Effects of evidence-based prevention training on neuromuscular and biomechanical risk factors for ACL injury in adolescent female athletes, where different training methods were examined. More details you can find in Zebis et al. (2016).

Finnish team did large study of isolated components of shooting skill without emg measurement. On the group of two level shooters, national and international level (40 experienced shooters participated), six components in the air rifle shooting techniques were investigated (aiming time, stability of hold, measurement time, cleanness of triggering, aiming accuracy, timing of triggering) by using optoelectronic device Noptel ST 2000 training system and a triangular-shaped force platform Good Balance. They named four more important components, which affect shooting performance for 81%: stability of hold, cleanness of triggering, aiming accuracy and timing of triggering. On the other side is postural balance, which affects shooting performance for less than 1%. More details you can find in Ihalainen et al. (2016).

Download English Version:

<https://daneshyari.com/en/article/5002902>

Download Persian Version:

<https://daneshyari.com/article/5002902>

[Daneshyari.com](https://daneshyari.com)