Abstract

Introduction. The aim of this study was to measure the duration of biopotentials in selected muscles of the lower limbs, evaluate the time of elevated bioelectrical activity in these muscles, and identify similarities and differences in electrical phenomena that occur in the muscles for various external settings of a cycle ergometer. Material and methods. The study examined 10 healthy people (5 women and 5 men) aged from 20 to 30 years. A cycle ergometer and EMG apparatus were used in the experiment. The bioelectrical activity of six muscles of the lower limbs (rectus femoris, vastus medialis, tibialis anterior, biceps femoris, gastrocnemius caput mediale, and gastrocnemius caput laterale) was recorded for four different settings of the cycle ergometer (variable saddle height and method of foot attachment to pedals). The EMG records were presented with reference to the bicycle crankset rotation cycle. Conclusions. The study found that changing the height of the saddle of the cycle ergometer and the use of toe clips in the pedals caused changes in bioelectrical activity in the muscles. The adjustment of saddle height affected the duration of potentials more noticeably than the use of toe clips. Furthermore, only one period of elevated electrical activity in the muscles of the lower limbs was found in the pedalling cycle. The longest time of the presence of action potentials was recorded for the m. gastrocnemius caput laterale, whereas the shortest time was observed in the m. vastus medialis.

Key words: biomechanics, electromyography, pedalling, muscle, lower limb

Introduction

Cycling, including riding a stationary bicycle (or cycle ergometer), is a popular topic of scientific research, particularly among researchers in the field of biomechanics [1]. The research typically focuses on such aspects as improved pedalling efficiency [2], energy expenditure for this movement, improved energy expenditure for the movement, and improved cycling comfort [3]. Studies have examined optimal positions on a bike [4, 5] and the choice of adequate and optimal pedalling rate [6].

Scientific interests are also focused on issues related to coordination [7] during the driving motion of the cyclist’s body. Some studies have been oriented at the use of new technological solutions in bicycles, ranging from changes in the area of the cogset [8] to the types of foot fixation to the pedals [9].

Numerous biomechanical examinations of locomotor activity on a bicycle have helped gain knowledge useful for physiotherapists. Drozdek et al. [10] evaluated the effect of body position adopted on a bicycle on the recordings of bioelectrical muscle activity (EMG). Similarly, the results of the studies that examined the effect of various pedalling techniques on biomechanical motion indices [11] can have some practical implications.

The interest of physical therapists in the problems discussed results directly from the fact that one of the standard pieces of equipment at surgeries is the stationary bicycle (cycle ergometer). The popularity of this device stems from ease of use, easy control of progress, and uncomplicated load modulation. Furthermore, most patients have their own traditional bikes which can later be used to continue the rehabilitation. Therefore, researchers in biomechanics cooperate with physical therapists to prevent the adverse consequences of cycling [12, 13, 14], examine the effect of saddle height on knee joint load [15], and improve rehabilitation protocols [16].

This study addresses a combination of problems which have been discussed over the years. The innovative character of the study, however, lies in the fact that it approaches these issues in the context of physiotherapy.

The aim of the study

As mentioned before, physical therapies are often focused on the patient’s movements. Therefore, physiotherapists use various devices and accessories which allow for the engagement of selected muscles, i.e. those that are expected to be activated in the rehabilitation process. One of the ways of stimulating the muscles of the lower limbs is having the patient perform exercise on a cycle ergometer.

The aims of this study were as follows:

a) to measure the duration of the biopotentials of selected muscles of the lower limbs,