

**CHARLES UNIVERSITY IN PRAG**

**Faculty of Physical Educational and Sport**

Department of Physiotherapy

THE INFLUENCE OF THE TRAINING PROGRAM ON MUSCLE ACTIVITY OF  
LOWER LIMB MUSCLES IN RELATION TO THE RISK FACTORS OF  
HAMSTRING INJURY AT SOCCER PLAYERS

Dissertation thesis

Supervisor:

Doc. PaedDr. Dagmar Pavlů, CSc.

Author:

Mgr. Iva Hnátová

Consultant:

PhDr. Aleš Kaplan, PhD.

November 2012

## **SUMMARY**

**Titel:** The influence of the training program on muscle activity of lower limb muscles in relation to the risk factors of hamstring injury at soccer players.

### **Objective:**

Hamstring strain is a serious injury and requires long-term treatment. Hamstring strain has a high risk of recurrence. As a result of this injury is long-term lost of competition and training. Prevention is necessary because of this.

The mechanism and etiology of this type of injury is still uncertain and still under discussion. Multifactorial etiology is commonly discussed.

In our opinion, the best solution is the training program, which is made on the basis of cooperation the physiotherapists and coaches. The goal of this training program should be primary prevention of injury or reintegration of injured athlete in the training program or the prevention of recurrence of injury. As the result of this cooperation should be training program with all aspects of training, therapy and treatment. The basic of such training program should be muscle strengthening, core training and stretching. This training should be specific to the elimination of risk factors of injury. Recommendation by some authors, for example Best a Garret (1996), Carruthers, Sancturay (2006), Kolt, Snyder-Mackler (2003), Tornese et al. (2000) is squat and its modifications, step-up, step-up lateraly, step-down, cross-lift, leg-press, leg curls, benchpress, neckpress, dead lift, hip abduktor strengthening, general strengthening exercises, pawback exercise, prone reverse hypers and glute-ham-gastroc raises. Brukner, Khan (2007) usually recommend the Nordic eccentric exercise. We have chosen for our training program stretching, squat and its two modification.

In our study we evaluate the influence of such program on muscle timing after seven weeks of regular application.

**Aim:** The main aim of this study is make a hamstring injury prevention training program and evaluate the short-time effect of this program on timing of m. gluteus

maximus, m. biceps femoris caput longum, m. semitendinosus, m. adductor magnus, m. tensor fasciae latae, m. rectus femoris in running. Also to evaluate the effect of our program on muscle coactivation. Next aim is to make a questionnaire about the incidence of hamstring injury in Czech football players.

**Methods:** Literary review is the basic of our training program focusing on hamstring injury prevention. This program is according to the review effective. For the evaluation of this program we use the surface EMG. We have observed the timing of muscles: m. gluteus maximus, m. biceps femoris caput longum, m. semitendinosus, m. adductor magnus, m. tensor fasciae latae, m. rectus femoris, mainly according to functional muscle groups at the soccer players in running starting position. Functional muscle groups are muscles stabilizing the pelvis, hip extensors and flexors. The experimental group is made by Czech soccer players at the level Czech soccer league and Division. The participants are separated into two groups. In group I (n=6) we evaluate the timing of muscles, coactivation rate and cocontraction index. In group II (n=3) we evaluate the timing of muscles and coactivation rate. In preintervention measurement took part thirteen players, but during seven weeks of intervention, two of them have injured and two have got ill. Because of this is the total number of participants nine.

**Results:** On the literary review it seems that an effective prevention of hamstring injury is program composed of warm-up, stretching and special exercise. Because of this we have chosen low intensity running, static stretching and three modifies of squat. According to EMG we can see individual variability of muscle timing during semihalf starting position in running. Effect of our program is also very individual, but we can see some similarities like in probands 1 and 8, probands 2 and 5, probands 3 and 4, probands 6 and 7. Proband 9 has no significant similarities with the others. For statistical assessment are used nonparametric t-tests. The changes in coactivation are evaluated on the significance level level  $p < 0.05$ . Statistically significant increasing of coactivation rate is in case of m. gluteus maximus and m. biceps femoris (GM/BF). Statistically significant decreasing we can see in m. adductor magnus and m. biceps femoris (ADD/BF), m. semitendinosus and m. biceps femoris (ST/BF), also m. adductor magnus and m. gluteus maximus (ADD/GM), m. tensor fasciae latae and m. gluteus maximus (TFL/GM), m. semitendinosus and m. gluteus maximus (ST/GM), m. rectus femoris and m. gluteus maximus (RF/GM), hamstring group and m. gluteus maximus

(HAM/GM). Decreasing of coactivation rate of m. biceps femoris and m. gluteus maximus (BF/GM) is not significant on the significance level level  $p < 0.05$ . We have established Hamstring index. Hamstring index is rate of m. biceps femoris and m. semitendinosus (BF/ST). Hamstring index is after seven weeks of intervention significantly higher. Significantly higher coactivation index we can see also in case of hamstring group and m. gluteus maximus (GM/HAM). The results are significant due to the group of soccer players who were participated in the study. The results of our questionnaire conducted in years 2010-2012 show the 33,33% incidence of hamstring injury at soccer players of the total amount (n=75) players across three performance levels.

**Key words:** Hamstrings, injury, muscle injury, injury prevention, soccer