

COMPARISON OF HAMSTRING MUSCLE ACTIVATION DURING HIGH-SPEED RUNNING AND VARIOUS HAMSTRING STRENGTHENING EXERCISES

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ABSTRACT

Purpose/Background: Several studies have examined the effect of hamstring strength exercises upon hamstring strains in team sports that involve many sprints. However, there has been no cross comparison among muscle activation of these hamstring training exercises with actual sprinting. Therefore, the aim of this study was to examine different hamstring exercises and compare the muscle activity in the hamstring muscle group during various exercises with the muscular activity produced during maximal sprints.

Methods: Twelve male sports students (age 25 ± 6.2 years, 1.80 ± 7.1 m, body mass 81.1 ± 15.6 kg) participated in this study. Surface EMG electrodes were placed on semimembranosus, semitendinosus and biceps femoris to measure muscle activity during seven hamstrings exercises and sprinting together with 3D motion capture to establish at what hip and knee angles maximal muscle activation (EMG) occurs. Maximal EMG activity during sprints for each muscle was used in order to express each exercise as a percentage of max activation during sprinting.

Results: The main findings were that maximal EMG activity of the different hamstring exercises were on average between 40-65% (Semitendinosus), 18-40% (biceps femoris) and 40-75% (Semimembranosus) compared with the max EMG activity in sprints, which were considered as 100%. The laying kick together with the Nordic hamstring exercises and its variations had the highest muscle activations, while the cranes showed the lowest muscle activation (in all muscles) together with the standing kick for the semimembranosus. In addition, angles at which the peak EMG activity of the hamstring muscle occurs were similar for the Nordic hamstring exercises and different for the two crane exercises (hip angle), standing kick (hip angle) and the laying kick (knee angle) compared with the sprint.

Conclusions: Nordic hamstring exercises with its variation together with the laying kick activates the hamstrings at high levels and at angles similar to the joint angles at which peak hamstring activation occurs during sprinting, while cranes did not reach high levels of hamstring activation compared with sprinting.

Level of Evidence: 1b

Key words: Electromyography, muscle activity, hamstring, sprint

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