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Hamstring muscle electromyographic activity in various sprint drills

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INTRODUCTION:
During sprinting, and specifically the swing phase of the leg, hamstring muscles are exposed to high levels of muscle activity as the muscle-tendon unit (MTU) is lengthening and the musculotendinous force is peaking a. These considerable mechanical loads could explain the high prevalence of hamstring muscle injury (HMI) specifically in sprint-related sports. Before maximum sprinting, part of the warm-up is devoted to carrying out sprint drills aiming at loading hamstring muscles' specifically to sprint b. Sprint drills are divided into 4 main categories (A, B, C and D drills), targeting key phases of the gait cycle (Swing phase: (A) early pre-activation and (B) pre-activation, (C) stance phase, (D) swing phase: recovery) c and are assumed to provide a specific mechanical stimulus, notably high hamstring muscles activity. As part of a more global project studying mechanical loads on hamstring muscles, this study aimed to characterise hamstring muscles' electromyographic (EMG) activity during sprint drills compared to sprint maximal activity.
METHODS:
Sixteen athletes, competing in track and field performed A, B, C and D sprint drills and two 40-meter sprints. Hamstring muscles (biceps femoris and semi-tendinosis) electromyographic activity was recorded with EMG (Delsys©, 1000Hz) electrodes. Raw EMG signals were filtered, rectified, and expressed as a percentage of a maximal voluntary isometric contraction (%MVIC). Comparison in maximal EMG activity between sprint and athletic drills was tested with repeated ANOVA.
RESULTS:
During maximal sprinting, hamstring muscles were maximally activated at 247.5% ±139%MVIC for biceps femoris and 206% ±100% MVIC for semi-tendinosis. Biceps femoris overall activity level for sprint drills ranged from an average of 132.4%-146.9%, relative to MVIC. Semi-tendinosis overall activity level for sprint drills ranged from an average of 144.8%- 177.5%, relative to MVIC. Biceps femoris activity was significantly greater during sprints than during A-Skip ($p < .05$; Cohen's $d = 1.29$); B-Skip ($p < .05$; $d=1.29$); C-Bound ($p < .01$; $d =1.47$), and ABCD-Run ($p < .01$; $d= 1.42$). However, no significant differences were reported between sprints and drills for semi-tendinosis EMG activity.
CONCLUSION:
This preliminary analysis revealed that the exercises performed by track and field athletes during warm-up elicit lower levels of biceps femoris electromyographic activity than those reported during maximal sprinting. Further analysis of hamstring muscle-tendon unit lengthening and lengthening velocity is currently underway to draw more definitive conclusions about hamstring mechanical loading reported during sprint drills and to know whether hamstring muscles are prepared enough for sprinting.

REFERENCES:
a Chumanov et al., 2012, BJSM
b Hickey et al., 2022, JAT; Mendiguchia et al., 2017, MSSE
c Howard et al., 2018, Sports Biomechanics

Topic: Biomechanics

Presentation Oral