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THE EFFECT OF DIFFERENT CROUCH STARTS ON EMG ACTIVITY DURING FIRST STEP OF SPRINT

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SUMMARY
The main types of crouched start positions are the bunch, medium, and elongated starts. When the distance between blocks had been changed, the force generated must be changed. The purpose of this study was to understand which sprint start had shorter time to exert strength during first step and measured through the time from sprint start to the peak EMG activity in 4 muscles during first step. Seven elite short-distance track players were recruited as participants in this study. The high-speed camera and the wireless electromyography (EMG) system were used to collect sprint images and lower-extremity EMG data in three types of crouch start. The One-way ANOVA with repeated measures (α = .05) and LSD comparison were used to analysis the time of muscle activity from start to the peak during first step. The results indicated that no significant difference between three different crouch starts in the time to the peak of EMG activity, and the range was 0.28s to 0.41s in 4 muscles. This study concludes that the time to peak EMG activity had the same characteristic in three types of crouch starts during first step.

INTRODUCTION
A push-off is the beginning of the sprint start. Generally, the main types of crouched start positions are the bunch start, medium start, and elongated start. When the distance between blocks had been changed, the force generated must be changed [1]. The related studies of EMG activity have been widely analyzed on the sequence of muscle activity [2] and reaction time [3] during sprint push-off. The purpose of this study was to understand which sprint start had the shorter time to exert strength during first step in muscle activity.

METHODS
Participants: Seven elite short-distance track players were recruited as participants in this study (Aged: 18-22 years, height: 177.1 ± 2.1 cm, and weight: 71.3 ± 4.2 kg; Best record in 100m sprint: 10.94 ± 0.20 sec). All subjects were free of musculoskeletal pain or injuries within the period of experiment.
Equipment: The FASTEC high-speed camera (sampling rate at 250Hz) was used to collect motion images on sagittal-plane. The NORAXON TeleMyo™ 2400T wireless EMG system with 4 sensors (sampling rate at 1500 Hz) were used to collect lower-extremity EMG. The EMG sensors were attached on the vastus lateralis (VL), rectus femoris (RF), biceps femoris (BF), and gastrocnemius lateral (GL) in rear leg. The skin surface electrodes technique and procedure were based on The ABC of EMG [4].
Procedures: The participants ran maximal velocity sprints from the three different crouch starts over 100m in the outdoor PU running track. Each of subjects was tested three times which includes the bunch start, medium start, and elongated start with random arrangement. The bunch start was set with one feet length distance between the blocks. The medium start was one and half length. The elongate start was two feet length. The recovery time of actual performance was 15 to 20 minutes between tests.
Data process: The EMG data was collected from sprint start to first step, and measured the time from start (defend as head move by high speed camera) to the peak of EMG activity before first step touchdown. The raw EMG signal was processed by 10-500 Hz Band-pass and full wave rectify. The One-way ANOVA with repeated measures (α = .05) and LSD comparison were applied to examine significant difference in this study.

RESULTS AND DISCUSSION
Figure1 is the time from sprint start to the peak of EMG activity during first step, and no significant difference between three different crouch starts. The time to peak of EMG activity was 0.28s to 0.41s in 4 muscles. RF was 0.32 ± 0.14, 0.29 ± 0.10, and 0.28 ± 0.12 in bunch, medium, and elongated, respectively. VL was 0.34 ± 0.13, 0.32 ± 0.03, and 0.37 ± 0.03 in bunch, medium, and elongated, respectively. BF was 0.34 ± 0.03, 0.35 ± 0.02, and 0.38 ± 0.04 in bunch, medium, and elongated, respectively. GL was 0.34 ± 0.09, 0.38 ± 0.02, 0.41 ± 0.02 in bunch, medium, and elongated, respectively.

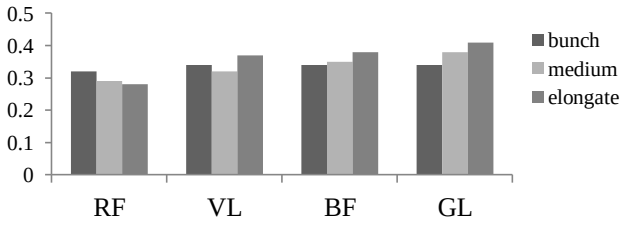

Figure 1: the time from start to the peak of muscle activity

Schot and Knutzen [5] reported that the elongate start had a significant higher horizontal velocity in the take-off, and greater stride length than bunch start. The push-off is beginning with the head and the thigh moving forward and lifts up for first step, and the RF, VL, BF and GL are the main muscles for move the thigh. Although studies indicated the different performance in different sprint starts, the different crouch starts did not affect the time from start to the peak in EMG activity in this study.

CONCLUSIONS

This study measured the EMG activity to understand the difference in bunch start, medium start, and elongated starts, and concluded that the time to peak EMG activity had the same characteristic in three types of crouch starts in RF, VL, BF and GL muscles.

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