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EFFECTS OF COMPRESSION GARMENTS ON MUSCLE ACTIVITY DURING RUNNING

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SUMMARY
The average muscle activation for the major muscles such as rectus femoris (RF) and Gastrocnemius (GN) during running reveals that they need to exert higher muscle force without wearing compression garment. Previous evidences have shown that lower muscle activity at particular phases of gait cycle prolongs activity, reduces fatigue and reduces injury susceptibility. Therefore, it would seem that reduced muscle activation whilst wearing sports compression apparel may have advantages during physical exercise.

INTRODUCTION
Sports compression apparel is commonly selected sportswear to improve athletic performance and reduce sports injury, which consist of elastic textile that exerts compression and pressure onto muscles [1]. Since muscle activation is very sensitive to external conditions, the alternations of muscle activations can be detected during sports activities between wearing or without wearing the compression garment. But there is limited scientific work to explore on this topic [2].

To identify the underlying regulation of muscle pattern may lead to a better understanding of compression garment. EMG analysis is a substantial component often used for the assessment of muscle activity [3-6]. In this paper, we investigated muscle activation with and without wearing sport compression garments during running. In order to standardize the running process, the mean normalized running velocity was around 7-8 m/s. While collecting EMG single with synchronized video recording, subjects were running on a floor-mat while recording footprint. The portable floor-mat walkway embedded with pressure-activated sensors that provide measurement of temporal and spatial gait characteristics. The EMG signal was processed by proposed method to represent the muscle activation force. The effect of wearing compression garment via muscle activity evaluation is presented.

METHODS
Wireless EMG system was used for EMG signal acquisition. Surface electrodes were pasted on the major muscles of the subjectôs skin. The location of electrode placement was thigh and shank, as shown in Fig. 1.

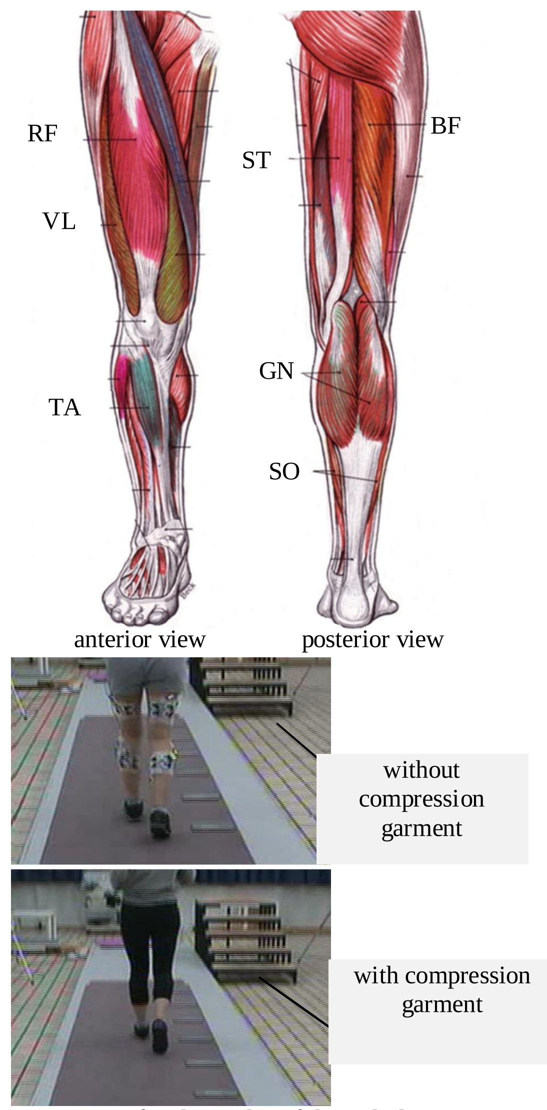

Figure 1: Superficial muscles of the right leg in anterior view and posterior view: soleus (SO), tibialis anterior (TA), gastrocnemius medialis (GN), vastus lateralis (VL), rectus femoris (RF), semitendinosus / semimembranous (ST) and subject running with and without compression garments.

While collecting EMG single with synchronized video recording, the subject ran on a pressure mat whilst foot pressure data was collected. The portable pressure mat walkway embedded with pressure-activated sensors provided measurement of temporal and spatial gait characteristics. The subjects commenced walking prior and following the run trial to account for the accelerations and decelerations during running. In order to standardize the running process, the normalized mean running velocity is around 7-8 meters/second.

RESULTS AND DISCUSSION

The representative muscle power for the major muscle Gastrocnemius (GN) is shown in Figure 2. Results of three trials are compared. The decrease of muscle activity reveal throughout the entire 20 second recording. In order to investigate the change of muscle activity, root mean square (RMS) are processed and compared for the overall tendency as shown in Figure 3. Significant decreasing muscle activity is presented in the major muscles during running at same speed. More effect is shown on the rectus femoris (RF) than Gastrocnemius (GN). The different between two types of garments are similar.

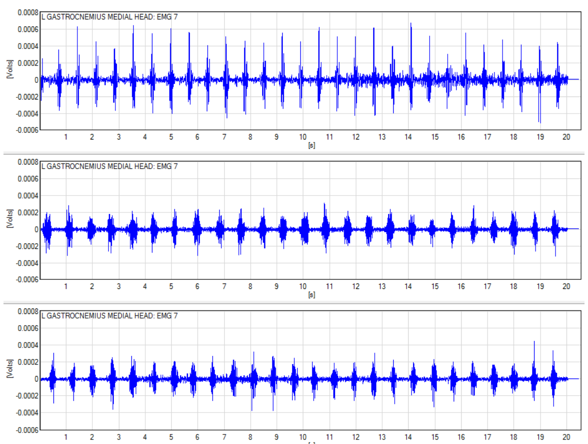

Figure 2: Comparisons of the muscle activity on two muscle group GN on trail 1: running without garment; trail 2: wearing wearing Type 1 compression garment and trail 3: wearing Type 2 compression garment

Furthermore, muscle activation can be of interest to sports compression garment manufactures who seek to enhance sports performance through gradient compression garment design. Researchers have also claimed that muscle force being exerted for a limbôs motion and stability may be wasted on stability on muscle vibrations while compression garment may prevent muscle vibrations during sports activities which may enhance athletic performance. Hence it is necessary to determine if a link exists between muscle activity and the performance of sports compression garments during dynamic activities. Such an evaluation study would scientifically prove the hypothesis and proved information on muscle activation and the efficacy of gradient compression garment development.

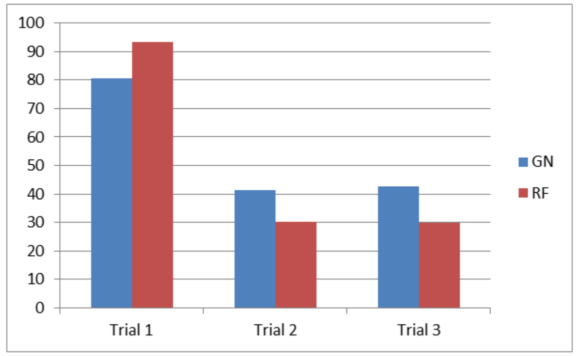

Figure 3: Comparisons of the RMS of muscle activity on two muscle groups GN and RF on trail 1: running without garment; trail 2: wearing wearing Type 1 compression garment and trail 3: wearing Type 2 compression garment

CONCLUSIONS

The major muscles contributing to running need to exert more muscle power without wearing the compression garment. Unnecessary muscle activation can accelerate the onset of fatigue and increase the risk for sport injury. During physical exercise it may be more advantageous to wear the compression garments where less muscle activation is occurring.

ACKNOWLEDGEMENTS

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