Fascicle behaviour of the biceps femoris during Nordic hamstring exercise with a sloped platform

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Introduction

The Nordic hamstring exercise (NHE) is one of the high-intensity hamstring exercises. Recently, several findings have been reported that fascicle length of biceps femoris long head (BFlh FL) does not change during NHE [1]. This would imply that passive elastic tissues (such as aponeurosis, tendon, and myofascia) are elongated during NHE. However, there is no reported investigation of the dynamics of passive elastic tissue and BFlh FL during NHE using a sloped platform. Because tendon adaptation increases with tendon elongation [2], it may be clinically significant to investigate the dynamics of passive elastic tissue and BFlh FL during NHE at different angles of the platform. Therefore, this study investigated the dynamics of passive elastic tissue and BFlh FL during NHE at different angles of the platform.

Methods

Nine male volunteers (age 20.8 ± 2.6 years; height 179.8 ± 7.5 cm; and body mass 75.7 ± 15.1 kg) performed isometric NHE with three different slope angles (0°: NH0, 20°: NH20, and 40°: NH40) by extending the knee as far as possible and maintaining isometric contraction for 5 seconds. B-mode ultrasound was used to measure resting values of BFlh FL while participants were in the prone position and during the NHE tasks. An inertial measurement unit (IMU) monitored the knee flexion angle. The muscle-tendon unit length (MTUL) of BFlh was calculated based on knee flexion angle during exercise [3]. To quantify the elongation of passive elastic tissues, MTUL / BFlh FL index was calculated. Then, the relative values of MTUL / BFlh FL index were calculated using the following formula: MTUL / BFlh FL index of NHE tasks / MTUL / FL index of resting value. A one-way ANOVA was used for comparisons among NHE tasks in BFlh. In addition, Friedman test was used to compare among NHE tasks in MTUL / FL index.

Results

Figure 1 shows BFlh FL.The main effect of NHE tasks-factors was significant (Partial $\eta^2 = 0.686$; $p = 0.000$). The BFlh FL of NH40 was higher than that of NH0 ($d = 1.98$; $p = 0.005$) and NH20 ($d = 1.91$; $p = 0.002$).

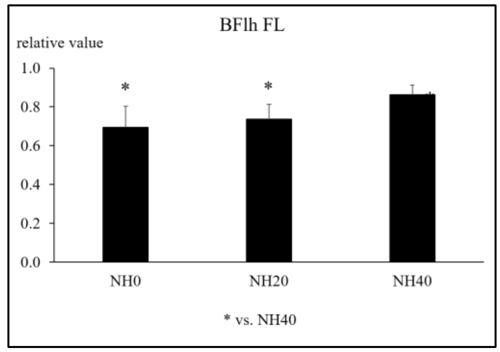

Figure 1: BFlh FL during isometric NHE tasks (NH0, NH20, and NH40) The symbol * indicates a statistically significant difference between NH40. 1 indicates the resting value.

Figure 2 shows MTUL index.The MTUL index of NH40 was lower than that of NH0 ($d = 0.93$; $p = 0.028$) and NH20 ($d = 1.28$; $p = 0.015$).

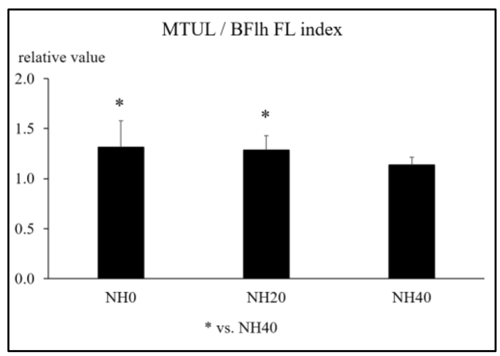

Figure2: MTUL / BFlh FL index during isometric NHE tasks (NH0, NH20, and NH40) The symbol * indicates a statistically significant difference between NH40. 1 indicates the resting value.

Conclusions

We postulate that the decoupling between fascicle length and MTU length is related to stretch of passive elastic tissues. Since tendon adaptation increases with tendon elongation [2], adapting passive elastic tissues may be facilitated with high-intensity stimuli in NH0 and NH20.

References

[1] Van Hooren et al. Scand J Med Sci Sports. 2022.

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