Biceps femoris long head architecture alterations in different knee and hip positions: preliminary results

Heinrich Leon Souza Viera[1], Tiago Dutra Leite Nunes[1], Martina Weis Regert[1], Victória dos Santos Turchetto[1], Fábio Juner Lanferdini[1]

[1]Biomechanics Laboratory, Federal University of Santa Maria, Santa Maria, Brazil

Email: heinrichviera@hotmail.com

Summary

In-vivo measurements of muscle architecture changes across normal day range of motion are scarce. We assessed the architecture and quality of the biceps femoris long head (BFlh). Fascicle length (FL) changed about 41% of muscle length (ML) from the shortest to the longest position. However, no differences were found in any other variables across the four joint configurations (p>0.05). A larger sample size (we only evaluated five subjects) will provide impactful insights of in-vivo muscle changes.

Introduction

The biceps femoris long head (BFlh) muscle is one of the most commonly affected by strain injury [1] in athletes. As a muscle that crosses both knee and hip joints, its excursion and architectural properties may be affected differently, as the moment arm length varies at each joint [2]. Given that muscle architecture and quality are closely related to muscle function, we aimed to compare how the architecture and quality variables of the BFlh changes across four different knee and hip joint configurations.

Methods

The project was approved by the local ethics committee. Five physically active male subjects (~21.2 years, ~82.4 kg, ~181 cm) had their BFlh assessed in prone position in an isokinetic dynamometer (Biodex System 4®) bench. Three images of the BFlh were recorded in each of the following positions: knee at 30º (0º = full extension) and hip at 0º (K30H0); knee at 30º and hip at 45º (K30H45); knee at 90º and hip at 0º (K90H0); and knee at 90º and hip at 45º (K90H45). An ultrasound system (Siemens® Acuson S2000) in extended field of view (EFOV) was used for all data collection. The images were analyzed using a semi-automated Python® script to determine pennation angle (PA), fascicle length (FL) and muscle thickness (MT). ImageJ® was used to determine echo intensity (EI) and muscle length (ML). A repeated measure ANOVA test with a Bonferroni post hoc was used to compare the four joint configurations (significance α=0.05).

Results and Discussion

No significant differences were found between the four joint configurations (K30H0 versus K30H45 versus K90H45 versus K90H45) in the architecture and quality of BFlh (p>0.05). Additionally, the variation between knee positions for each variable is illustrated in Figure 1.

Ranging from the shortest (i.e., K90H0) to the longest (i.e., K30H45) position, for a ML change of 13.8 mm, FL changed approximately 5.7 mm or about 41% of ML.

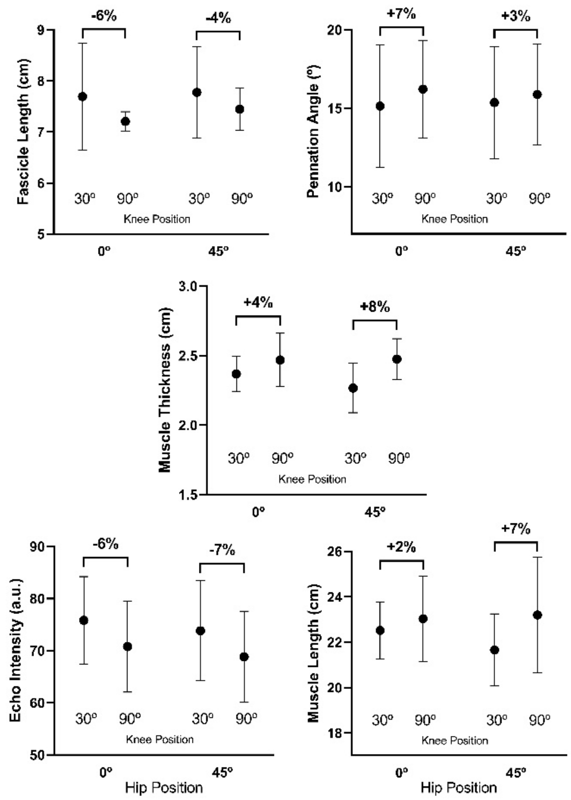

Figure 1: Biceps femoris long head architecture variables in each knee and hip position. Percentage values indicate variation between knee positions.

The modulation of BFlh architecture in relation to joint positions has been poorly investigated in in-vivo settings. We expect that with a larger sample size, these data will provide clarity on how the muscle structure is modified during knee and hip movements.

Conclusions

These preliminary results suggest that there are no difference in BFlh architecture variables across the tested knee and hip joint configurations. While the sample size limits the statistical power, FL and EI appear to decrease with knee flexion, whereas PA, MT, and ML increase with knee flexion.

Acknowledgments

H.L.S.V acknowledge Coordenação de Aperfeiçoamento de Pessoa de Nível Superior (CAPES-Brasil) for scholarship.

References

[1] Opar DA et al. (2012). *Sports. Med*, **42**: 209-26.

[2] Kellis E and Blazevich AJ (2022). *BMC Sports. Sci. Med. Rehabil*, **14**: 166.