

Age-related differences in medial gastrocnemius tendon strain during eccentric contractions

Juliette Lancelot¹, Robin Souron¹, Guillaume Chapelet², Eva Demoy¹, Anne-Sophie Boureau², *Christophe Cornu¹, *Marion Crouzier¹

¹Nantes Université, Movement - Interactions - Performance, MIP, UR 4334, F-44000 Nantes, France

²Nantes Université, CHU Nantes, Pôle de Gériatologie Clinique, F-44093 Nantes, France

*These authors contributed equally to this work.

Email: juliette.lancelot@univ-nantes.fr

Summary

This study examined age-related differences in medial gastrocnemius (MG) tendon strain during eccentric contractions. MG tendon strain was measured during maximal and submaximal contractions from 12 young (22±3 yrs) and 11 old (71±4 yrs) adults. Ultrasonography was used to determine tendon strain. MG tendon strain during eccentric contractions was similar across participants, irrespective of their age or the intensity of the contraction (both $p > 0.05$).

Introduction

Advancing age can lead to changes in the interactions between tendon and muscle fascicles during dynamic and functional tasks involving eccentric contractions [1,2]. Ageing is associated with tendon mechanical and morphological alterations [3], but the effect of ageing on the behavior of tendinous tissues during eccentric contractions is unknown. This work determined whether medial gastrocnemius (MG) tendon strain is similar during maximal and submaximal eccentric contractions in old and young adults.

Methods

The study included 23 healthy, physically active adults: 12 young adults (age: 22±3 yrs, 5 females) and 11 old adults (age: 71±4 yrs, 6 females). Their level of physical activity was similar, as assessed with the Godin Leisure Time Exercise Questionnaire (young adults: 43±10, old adults: 37±9, $p = 0.13$). The old adults were pre-frail or not frail (from the step 1 of the ICOPE questionnaire).

Each participant performed maximal and submaximal eccentric plantar flexion contractions on an isokinetic ergometer from 40° of plantar flexion to their maximal dorsiflexion. The submaximal contractions were conducted at 30% of each participant's MG maximal activation. Plantar flexion moment (dynamometry), muscle activation (surface electromyography), ankle angle (goniometer) and tendon strain (B-mode imaging of the MG myotendinous junction) were recorded simultaneously during the contractions.

Results and Discussion

Young and old adults produced a similar peak torque of 194±93 and 149±58 Nm, respectively, during the maximal eccentric contractions ($p=0.23$). During the submaximal contractions, young and old adults activated their MG at 30±7 and 34±9 % respectively, confirming they similarly matched the targeted level of MG activation ($p=0.29$). This

corresponded to a torque of 101±26 and 76±32 Nm in each group, respectively ($p=0.08$). Total range of motion was 63±7° and 62±9° for the young and old adults respectively ($p=0.78$). Tendon strain was not significantly different in young and old adults during either maximal or submaximal eccentric contractions (from SPM analysis: all $p>0.05$; Figure 1).

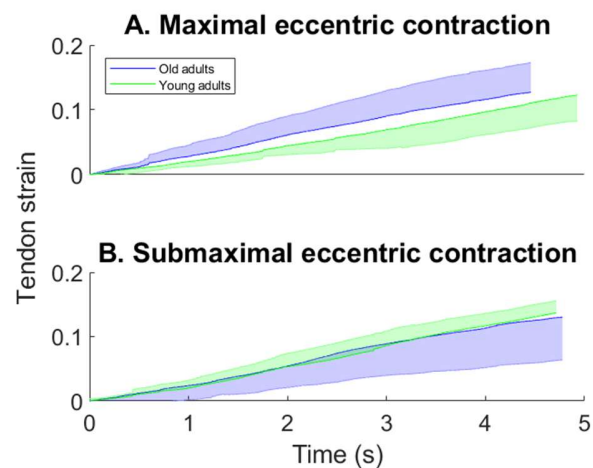


Figure 1: Tendon strain of young (green) and old (blue) adults during eccentric contractions that were maximal (panel A) and submaximal at 30% of MG maximal activation (panel B).

The lack of between-group difference in MG tendon strain suggests similar tendon stiffness in both groups, as they produced similar maximal voluntary torques.

Conclusions

MG tendon strain during maximal and submaximal eccentric contractions, as measured in the current study, is similar between physically active young and old adults.

Acknowledgments

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References

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