TITLE

Response to the Letter to the Editor from Costa do Couto et al. regarding our article 'Isokinetic eccentric exercise substantially improves mobility, muscle strength and size, but not postural sway metrics in older adults with limited regression observed following a detraining period'.

AUTHORS

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RESPONSE

We would like to thank Costa do Couto et al. for their Letter to the Editor, which provides an accurate dissection of the findings and implications of our article, with a constructive critique of some of the limitations. The first issue raised was that we did not specify the directionality of the expected reduction in features of posturographic data. Given the multi-joint exercises in the exercise programme that stressed muscles across hip, knee and ankle joints, we felt it was important to examine potential changes in centre of pressure (COP) sway in both anteroposterior and mediolateral directions. In our study we observed no change in sway in either direction following eccentric-only resistance training involving hip and knee extensor contractions, nor the same training with additional eccentric-only plantarflexor contractions. Nonetheless, we acknowledge that as the ankle muscles play a central role in minimising postural sway in the anteroposterior direction during quiet standing, we could have clarified the primary directionality that we could expect to see a reduction in sway.

The second issue raised was that, considering the physiologic mechanisms involved in the static balance in the orthostatic position, our hypothesis, that strengthening the plantarflexor muscle group would reduce postural sway, lacked evidence. Whilst we included earlier research reporting associations between plantarflexor strength and postural sway (Winter, 1995) as a rationale for our strength training reducing postural sway, we did not include the only study we are aware of that has examined the effects of an eccentric-dominant exercise programme on static balance (Katsura et al., 2019). The inclusion of this article (Katsura et al., 2019), which confirmed a reduction in centre of pressure (COP) path length but did not measure changes in the directionality of sway, would have strengthened the evidence to support our hypothesis.

We agree Costa do Couto et al.'s assertion that falls commonly occur while older adults are exposed to some form of perturbation whilst performing mobility tasks, such as walking or transfers. Whilst we also agree that rapid force generation is crucial to recover balance following a trip or slip, we did not assess balance perturbations in our study as we were limited by the equipment available to us in our laboratory. Following a trip, a recovery step is initiated in an attempt to prevent a fall with flexion at the hip, knee and ankle occurring with the lower-limb extensor muscles about these joints likely contracting eccentrically to arrest whole-body angular momentum (Nagano et al., 2015). Thus, we felt it reasonable that eccentric muscle force may be important for the successful performance of the initial recovery step, a concept that has been reported previously in the literature (Grabiner et al., 2014). Furthermore, in the community setting, fall risk is often determined by functional mobility assessments

(i.e. gait speed or timed-up-and-go [TUG]; Schoene et al., 2013) rather than perturbation assessment. Accordingly, we used the TUG test to determine the clinical relevance of changes in mobility performance following training. Nonetheless, given that many high fall-risk tasks, such as walking downhill or descending stairs, rely almost exclusively on eccentric contractions, we agree with Costa do Couto et al. that eccentric training may affect factors not examined in our study including rate of force development, electromechanical delay, reaction time and muscular coactivation, although the impact of eccentric training on these factors remains to be established.

Costa do Couto et al. noted the limitations we identified in our article regarding the lack of observation of physical activity during the detraining period, use of seated isokinetic dynamometry to deliver eccentric exercise, and the limitations of dynamometry used in our study for wider use in the public. We accept their recommendation that more practical forms of eccentric training such as downhill walking have been examined. Although it should be noted that, for this population where ambulation can be limited, seated exercise does provide a safe exercise environment and a greater magnitude of loading is available from dynamometry. Finally, as highlighted in our article, we concur with Costa do Couto et al.'s recommendation that examining low-cost, easily accessible forms of eccentric exercise should be a priority for researchers to enable health professionals improve clinical practice for falls prevention in older adults, given the advantages of the use of eccentric exercise in older adults (e.g. lower metabolic demand and perceived exertion, and greater tolerance and adherence).

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