Isolated strength exercise for the most affected limb may reduce gait asymmetry in people with Parkinson's disease

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Summary

Improving gait asymmetry could enhance mobility and safety in people with Parkinson's disease (PwPD). We compared the acute effects of strength exercise isolated to the most and least affected limb and for both limbs on spatial-temporal gait asymmetry in eighteen PwPD. Our findings showed that strength exercise isolated to the least affected limb did not change spatial-temporal gait parameters, while strength exercise isolated to the most affected limb or for both limbs improved gait performance in PwPD.

Introduction

Literature evidence supports greater gait asymmetry in PwPD[1], which has been associated with freezing of gait and falls[3]. Therefore, restoring gait asymmetry could enhance safety. Systematic reviews have demonstrated that strength exercise protocols significantly impact gait parameters in PwPD[4]. However, it is still little known about the effect of strength exercise protocols applied only on one side of the body (most or least affected sides) on gait asymmetry. Ricciardi et al.[5] demonstrated that a protocol focusing on the least affected limb yielded greater improvements in motor performance, balance, and gait compared to standard therapy in PwPD. However, the study did not measure specific gait parameters. Therefore, this study aims to compare the acute effects of strength exercise applied to the most and least affected lower limb and for both limbs on spatial-temporal gait asymmetry in PwPD.

Methods

Eighteen (6 females) PwPD (69±6 years old, HY: 1.5–3, UPDRS: 6-95pts) with a diagnosis of idiopathic PD by a neurologist and independent mobility without assistive devices participated in this randomized, controlled, cross-over, single-blind clinical trial (CAAE: 73001023.5.0000. 5398; REBEC: RBR-5s234bn). Each participant attended three laboratory visits (Figure 1). They performed one of the three types of strength exercises each day: isolated for the most affected limb (MAL), isolated for the least affected limb (LAL), or both limbs (BL). Before (pre) and immediately after (post) each intervention, spatial-temporal gait parameters of each step with the most and least affected limb were acquired using three inertial sensors (Opals, APDM Inc., USA). Participants completed five 17-meter walking blocks, each separated by a 20-second interval at a self-selected speed. Anovas two-way (period: pre and post x limb: step with the least and most affected) for spatial-temporal parameters were employed separately for each type of exercise ($p<0.05$).

Figure 1: Protocol design.

Results and Discussion

Anovas revealed no effects of period and limb for LAL ($p>0.05$). For BL and MAL, post-exercise showed reduced step ($p<0.002$ and $p<0.008$), double support ($p<0.006$ and $p<0.01$) and swing time ($p<0.01$), and increased gait speed ($p<0.001$ and $p<0.02$) of both steps (most and least affected). Also, BL increased stride length ($p<0.01$). Period*limb interactions for MAL revealed that the step with the most affected limb reduced double support time post vs. pre-exercise ($p<0.04$), without effects for the least affected limb (Figure 2).

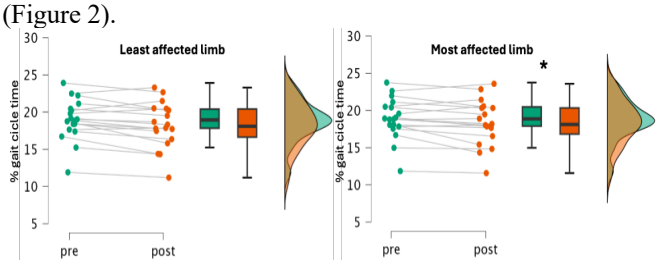

Figure 2: Means and standard deviations of double support time pre and post-MAL. * represents a significant difference.

Conclusions

MAL and BL improved gait performance in PwPD, while LAL did not change spatial-temporal gait parameters. The MAL intervention reduced the double support time of the steps with the most affected limb, which may indicate a positive effect on reduced gait asymmetry in PwPD.

Acknowledgments

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References

[1] Orcioli-Silva D, el. (2020). *Sci Rep*, **10**(1):1-8.
[2] Frazzitta et al. (2013). *J Neurol*, **260**: 71–76
[3] Ni et al. (2018). *NNR*,**32**(10):872-886.
[4] Ricciardi L et al. (2015). *Neurol Sci,* **36**(8):1337-1343.