Is progressive resistance training an effective intervention in adults with Muscular Dystrophy?

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Introduction

Muscular dystrophies (MD) are inherited disorders with condition specific manifestations, yet they are all characterised by progressive muscle deterioration. This deterioration results in weakness, pain and impaired walking or potentially a loss of ability to walk and with it, independence. Those who remain ambulatory walk slower and experience debilitating and painful gait characteristics [1], one of the most apparent is knee hyperextension. Resistance training (RT) has previously been shown to increase six-minute walk (6MW) distance in adults with Myotonic MD [2]. However, the detailed gait improvements that may accompany the increase in walking speed with RT are yet to be reported.

Research Question

Does RT improve walking capacity and gait kinematics, specifically knee hyperextension, in adults with Limb-girdle and Facioscapulohumeral MD?

Methods

Seven adults with MD (2 with Facioscapulohumeral and 5 with Limb-girdle MD; 44.7 ± 13.1 yrs.) completed testing immediately before (PRE1) and after (PRE2) a 12-week control period, then after completion of a 12-week (two sessions per week) supervised RT programme (POST). Gait analysis was performed at a self-selected pace, using a 3D motion capture system (VICON) with AMTI force plates, from which spatial and temporal parameters and sagittal plane knee joint kinematics were extracted. Additionally, the 6MW test was completed. For comparison, knee angle data are presented from four age-matched controls without MD.

Results

Walking speed and 6MW distance significantly increased from PRE1 and PRE2 to POST, and stride length from PRE1 to POST (Table 1). A significant reduction in minimum knee angle during the stance phase (PRE1: -8.8 ± 11.3°, PRE2: -10.4 ± 12.3°, POST: -5.4 ± 8.8°), swing phase (PRE1: -1.6 ± 3.8°, PRE2: -3.5 ± 4.2°, POST: 1.3 ± 3.7°) and at heel strike (PRE1: -1.4 ± 4.6°, PRE2: -2.5 ± 5.7°, POST: .98 ± 2.9°) was found, POST RE compared to PRE1 and PRE2 (Figure 1).

Discussion

These results offer support for RT as a treatment approach in adults with Limb-girdle and Facioscapulohumeral MD. RT improved walking performance and the severity of knee hyperextension whilst walking. This reduction in excessive motion at the knee may reduce the risk of damage to the knee joint and surrounding ligamentous structures. Future work will consider additional gait deviations to help promote the benefits of RT in MD. The clinical implications of these findings are that RT is an innovative approach to maintaining or improving physical independence in individuals with MD.

Table 1: Mean ± SD spatial and temporal walking parameters for MD participants at PRE1, PRE2 and POST completion of the RT programme. Significant differences from PRE1 and PRE2 are denoted by * and #, respectively.

	PRE1	PRE2	POST	% Change (PRE2-POST)
Walking speed (m/s)	0.81 ± 0.2	0.81 ± 0.2	0.87 ± 0.2*#	+7.4
Stride length (m)	1.17 ± 0.1	1.20 ± 0.1	1.27 ± 0.1*	+5.8
Stride width (m)	0.16 ± 0.04	0.14 ± 0.02	0.14 ± 0.02	0
Cadence (s/m)	83 ± 16.5	81 ± 16.0	83 ± 15.5	+2.5
6MWD (m)	261 ± 88	271 ± 75	292 ± 70*#	+7.7

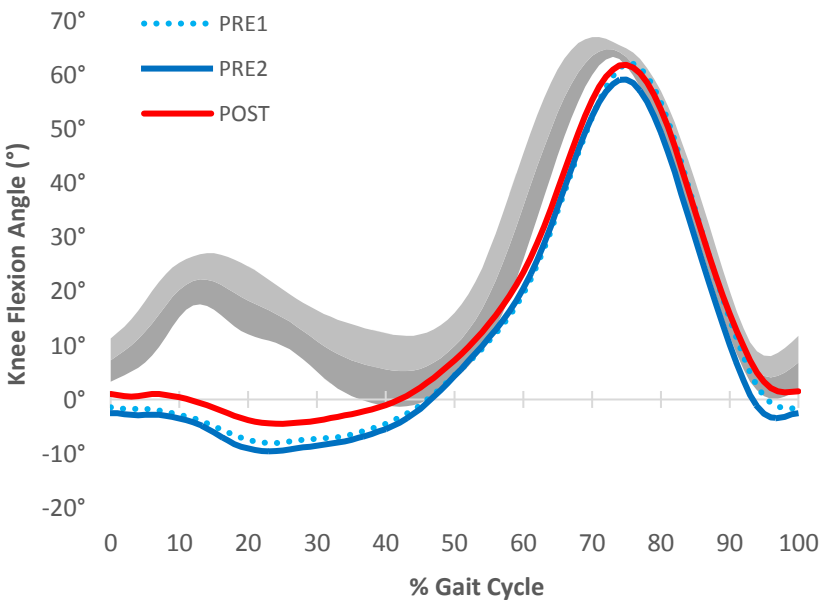

Figure 1: Mean knee flexion (+) and extension (-) angle during the gait cycle in individuals with MD at PRE1 (dotted line), PRE2 (dashed line) and POST (line) completion of RT. The grey band (± 1 standard deviation) represents control group data. On the x-axis, 0% represents heel strike and 100% the following ipsilateral heel strike.

References

D'Angelo, M.G., et al., *Gait pattern in Duchenne muscular dystrophy.* Gait & Posture, 2009. 29(1): p. 36-41.

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