The purpose of this study was to determine the effect of a fatigue resistant protocol on maximal force and rapid force production in persons with PD and non-impaired older adults.

Methods

Twenty individuals (PD=11, OA=9) volunteered for this study. Following a warm-up and familiarization, participants performed two maximal isometric quadriceps contractions (MVIC) of the knee extensors. Following a recovery period, participants completed a fatiguing protocol that consisted of 5-se maximal isometric voluntary contractions of the quadriceps femoris with 3-se rest for a total of 30 contractions. During this fatigue protocol, participants were instructed to push their legs against the cuff (activating their quadriceps muscles) as hard and as fast as they could.

The highest torque (Nm) achieved during the first, middle, and last contraction was calculated and defined as peak torque (PT). Additionally, peak rate of force development (pRFD; Nm/s) was assessed as the highest positive peak using the first derivative of the force signal and determined as the highest rate of change in the force time curve (Figure 3). PT and pRFD were normalized (PTn and pRFDn, respectively) to the maximal PT and pRFD collected from the highest MVIC contraction. Fatigue in PT, PTn, pRFD, and pRFDn was calculated as a percent decline using the following equation: % decline=100−100(last Repetition/Initial Repetition). Independent samples t-tests were conducted to investigate the differences in % decline in the PD and OA groups. Separate 2 (Group) × 3 (Contraction) repeated measures ANOVA were run to investigate the differences in PT, PTn, pRFD, and pRFDn between the PD and OA group during the fatigue knee extension protocol.

Results

Statistical analysis revealed a significant difference in % decline in pRFD (PD: 3.1±5.5%; OA: -50.3±14.8%, p = 0.017) but not in PT (PD: 3.1±18.3 vs. OA: 33.7±17.0, p = 0.611). PTn (PD: 13.9±28.2 vs. OA: 13.3±45.4, p = .195), pRFDn (PD: 26.6±41.4 vs. OA: -27.7±96.6 p = 0.950) (Figure 4).

Conclusions

These data demonstrate a significant difference in pRFD fatigue between the PD and OA groups. However, the difference in pRFD is normalized to account for PT (pRFDn). The elimination of the differences in pRFD could be due to the PD having an impaired capacity for rapid torque production compared to OA. These data suggest that the potential fiber type shift in the PD group may contribute to fatigue resistance. The % decline in PT is similar in PD compared to the OA. However, pRFD % decline is greater in the PD compared to the OA suggesting that PD may influence RFD to a greater extent than PT production.

Practical Applications

Coaches, clinicians, and practitioners may use the reduction in the rate of torque production in older adults and persons with Parkinson’s Disease following a fatigue protocol to improve exercise programming.

References


