The Relationship between Visual Steadiness and Muscle Force Steadiness in Young and Old Adults
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Introduction
Old adults exhibit a decrease in both muscle force steadiness [1, 2] and visual capability [3] compared to young adults. Many studies investigating force steadiness have used a visual target as the stimulus for modulating muscle force [1, 2]. Since visual capability declines with age, and vision is used in most investigations of muscle force control with age, reduced muscle force control in older adults might be partially related to or explained by altered visual capacity. The purpose of this exploratory study was to compare the relationships between eye movement, as a component of visual steadiness, and quadriceps muscle force steadiness in young and old adults during isometric quadriceps contractions of constant and varying forces.

Methods
19 healthy young adults (20.7±1.82yrs) and 18 healthy old adults (71.6±3.01yrs) participated in this study. Isometric quadriceps torque data were collected using an isokinetic dynamometer and used as a surrogate for muscle force. Horizontal and vertical eye movement data were collected using an eye-tracking system by recording motion of the pupil.

Visual feedback for all trials was a cursor that moved vertically in response to torque magnitude and horizontally with time. Tasks consisted of three vision only tasks, two vision and torque tasks at a relative value of 40% MVC, and two vision and force tasks at an absolute value of 54Nm. The middle 60% of each data set was plotted and a line of best fit was calculated. The horizontal and vertical vision data and force data were detrended before calculating measures of variance and central tendency. We used standard deviation to quantify steadiness for the vision and force trials and Pearson Product Moment correlations to identify the relationships between steadiness in muscle torque and visual capacity.

Results & Conclusions
There were no age-related differences in torque steadiness for the absolute (54Nm) condition (p=0.19). Old adults showed less torque variability than young in the relative (40% MVC) condition (p<0.05). The static vision condition did not show an age-related difference for the horizontal (p=0.08) or vertical (p=0.28) visual components. The vision no-line and vision straight-line conditions did not show a significant difference between young and old adults for the vertical vision component, p=0.34 and p=0.47, respectively. Old adults showed decreased horizontal visual steadiness compared to young (p<0.05). Correlations performed between visual steadiness and muscle force steadiness failed to show a statistically significant relationship for either condition in either age group.

We were not able to identify any physiological relationship between muscle force steadiness and eye movement, as a component of visual steadiness.