

HOW DO AGE AND VISUAL FEEDBACK AFFECT ACCURACY AND VARIABILITY OF FOOT FLEXION AND EXTENSION OUTPUT?

Cesnaitiene, V.J., Skurvydas, A., Mamkus, G., Kavaliauskiene, E.
Lithuanian Academy of Physical Education

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LAPE (Kaunas, Lithuania)

Introduction

Visual information is essential in human motor control, and especially in the continuous modulation of isometric force. The gain of visual feedback, that is, the amount of space used to represent change in force, has been shown to affect both the magnitude and time-dependent properties of variability in the force output (Lee Hong & Newell, 2008). The aim of this research was to establish the influence of visual feedback and age on the accuracy and variability of foot flexion and extension output.

Methods

The studied subjects were healthy women free of neurological diseases: Group 1 — 11 women (mean age – 70.0 ± 5 years) and Group 2 – 11 women (mean age – 25.0 ± 5 years). The subjects were tested applying the equipment for testing and rehabilitation of human bones and muscles (Biodex MS3). For the establishment of accuracy of isometric contractions (IC) we calculated the absolute errors (AE) (Magill, 2007). The variability of IC was established calculating the coefficient of variation (CV).

Results

Maximum voluntary force of foot flexion was statistically significantly higher ($p < 0.001$) than foot extension in both groups. The foot flexion force in Group 1 (79.5 ± 20 Nm) was statistically significantly less ($p < 0.05$) than in Group 2 (106.8 ± 42 Nm). The foot extension force was the same in both groups. The Group 1 coefficient of variability of foot flexion output with visual feedback was statistically significantly ($p < 0.05$) less (2.51 ± 1.55 %) than without VF (4.1 ± 1.84 %). The Group 2 coefficient of variability of foot flexion output with VF was 1.72 ± 1.07 %, without VF was 1.67 ± 0.87 %. The Group 1 coefficient of variability of foot extension output with VF was less (9.5 ± 4.2 %) than without VF (14.9 ± 5.8 %) ($p < 0.05$). The Group 2 coefficient of variability of foot extension output with VF was 5.6 ± 1.72 %, without VF it was 12.66 ± 2.1 % ($p < 0.05$). Group 1 made absolute errors (AE %) of foot extension output less with VF (5.3 ± 3.34 %) than without VF (8.57 ± 6.32 %) ($p < 0.05$). AE of foot extension output with VF of Group 2 was 2.3 ± 0.87 %, without VF it was 4.85 ± 2.83 % ($p < 0.05$). Group 1 made AE of foot extension output less with VF (8.3 ± 3.34 %) than without VF (20.51 ± 8.19 %) ($p < 0.05$). AE of foot extension output with VF of Group 2 was 4.6 ± 1.17 %, without V F it was 15.7 ± 4.4 % ($p < 0.05$).

Discussion

Visual feedback improved the accuracy and variability of foot flexion and extension statistically significantly in both groups of subjects. Older women demonstrated higher variability, and made more errors in foot flexion and extension output than younger women.

References

- Lee Hong S, Newell K, M. Visual information gain and the regulation of constant force levels. *Exp Brain Res*. 2008; May 10.
Magill, R.A. *Motor learning and control: Concepts and applications*. 2007; McGraw-Hill International Editon.

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