Effects of dual-task demands on the complexity and task performance of submaximal isometric handgrip force control

Por: Guzman-Gonzalez, B (Guzman-Gonzalez, Benjamin)[1]; Bustos-Briones, C (Bustos-Briones, Claudio)[1]; Calatayud, J (Calatayud, Joaquin)[2,3]; Tapia, C (Tapia, Claudio)[1,4]; Torres-Elgueta, J (Torres-Elgueta, Julio)[1,5]; Garcia-Masso, X (Garcia-Masso, Xavier)[6,7]; Cruz-Montecinos, C (Cruz-Montecinos, Carlos)[1]

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Abstract

Purpose To determine the effect of cognitive-motor dual-task load on temporal structure irregularity (complexity) of motor output and task performance of submaximal isometric contractions. Methods Twelve young, sedentary subjects performed handgrip isometric contractions until failure at 50% of maximal voluntary contraction under mathematical self-regulated dual-task (own pace; SDT), regulated dual-task (imposed pace; RDT), and control. Force signal complexity was calculated by sample entropy at the initial, middle, and final thirds. Task performance was assessed by muscle fatigue (time to failure and rate of median frequency of the radial flexor of the carpus), force and math task error, and self-perceived difficulty. Results Only RDT decreased complexity with respect to control (17.4% +/- 12.6%, $p = 0.005$), all conditions decreased complexity by the final third (Control: 52.8% +/- 18.7%, $p < 0.001$; SDT: 41.1% +/- 32.1%, $p = 0.003$; RDT: 19.1% +/- 21.9%, $p = 0.035$). Conditions did not affect time to failure, and only RDT decreased the rate of median frequency (0.1%/s +/- 0.1%/s, $p = 0.020$). Inferior force error rate was increased by conditions (SDT: 1.5% +/- 0.8%, $p < 0.001$; RDT: 2% +/- 1.5%, $p = 0.002$). Math error was only augmented by RDT (from 9.9 +/- 6.7 to 51.7 +/- 18.8, $p < 0.001$), categorized as "very hard" in 85.7% of participants ($p = 0.015$). Conclusion Only the RDT condition reduced complexity and neuromuscular fatigue while increasing force error rate of the handgrip's motor output, without affecting time to failure. A highly demanding dual-task may become a strategy to modify the organization of the hand force motor output, which may contribute to its motor adaptations.

Palabras clave

Palabras clave de autor: Entropy; Motor control; Strength; Muscle activity; Cognitive demand
KeyWords Plus: KNEE EXTENSOR TORQUE; MUSCLE; FEEDBACK; INTERFERENCE; AUTOMATICITY; CONTRACTIONS; VARIABILITY; MODULATION; FATIGUE

Información del autor

Dirección para petición de copias: Cruz-Montecinos, C (autor para petición de copias)

Univ Chile, Fac Med, Dept Phys Therapy, Lab Clin Biomech, Santiago, Chile.

Direcciones:

[1] Univ Chile, Fac Med, Dept Phys Therapy, Lab Clin Biomech, Santiago, Chile

[2] Univ Valencia, Dept Physiotherapy, Exercise Intervent Hlth Res Grp, Valencia, Spain

[3] Natl Res Ctr Working Environm, Copenhagen, Denmark

[4] Univ Tecnol Chile INACAP, Escuela Salud, Santiago, Chile

[5] Clin Davila, Serv Phys Med & Rehabil, Santiago, Chile

[6] Univ Valencia, Dept Teaching Mus Visual & Corporal Express, Valencia, Spain

[7] Univ Valencia, Human Movement Anal Grp, Valencia, Spain

Direcciones de correo electrónico:carloscruz@uchile.cl

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