The relation of asymmetry in power and balance in the lower extremities

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THE RELATION OF ASYMMETRY IN POWER AND BALANCE IN THE LOWER EXTREMITIES

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Introduction Asymmetry in the lower extremities can affect performance (Portegijs et al., 2005) and increase injury risk (Smith et al., 2015). Common ways to identification asymmetry are single legged measures of power or balance. However, there is little understanding about the relation between asymmetries in these capacities (Overmoyer et al., 2013). This study aims to explore the relation between asymmetry in power and balance in the lower extremity in a young athletic population. Methods A total of 196 subjects participated in this study. All participants were first year physical education students with a mean age of 19.5 (±2.4) years for men (N=132) and 18.3 (±2.6) years for woman (N=60). Balance was determined by anterior reach of the Starr Excursion Balance Test (Hertel et al., 2006). Jump height of single legged counter movement jumps were used to calculate power for each leg with the Sayers formula and normalized for body weight. Results Anterior reach was on average 66.5% (±5.6) of leg length for men and 68.9% (±4.0) of leg length for woman. Anterior reach asymmetry was on average 2.4% (median: 1.7; range: 0.0-20.2) for men and 2.5% (median: 1.8; range: 0.0-17.0) for woman. Average power was 29.9 W/Kg (±2.8) for men and 24.4 W/Kg (±2.4) for woman. Power asymmetry was 1.6 W/Kg (median: 1.4; range 0.1-6.1) for men and 1.6 W/Kg (median: 1.1; range 0.1-7.1) for women. Values for power and anterior reach did not correlate (p=0.078-0.636). Asymmetry in power and anterior reach significantly correlated for women (r=0.393, p=0.004). This relation was not significant for men (r=0.162, p=0.083). Discussion Small asymmetries in balance and power are common in a healthy and active population. In few cases asymmetry was found to be large. Values for power and balance did not correlate. Asymmetries in power and balance have a weak relation for woman. This implies that asymmetry in balance or power are to a large extent independent of each other. Asymmetry in power and balance should therefore be identified complementary. References Portegijs,E., Spïld, S., Alen, M., Kaprio, J., Koskenvuo, M., Tiainen, k., Rantanen, T. (2005). Extension Power Asymmetry and Mobility Limitation in Healthy Older Women. Arch Phys Med Rehabil. 86:1838-42. Smith C.A., Chimera N.J., Warren M. (2015). Association of y balance test reach asymmetry and injury in division I athletes. Medicine and Science in Sports and Exercise. 47(1):136-141. Overmoyer, G.V., Reiser, R.F. (2013): Relations between asymmetries in functional movements and the star excursion balance test. Journal of Strength and Conditioning Research. 27(7):2013–2024. Hertel, J., Brah, ham, R.A., Hale, S.A., Olmsted-Kramer, L.C. (2006). Simplifying the Star Excursion Balance Test: Analyses of Subjects With and Without Chronic Ankle Instability. J Orthop Sports Phys Ther. 36(3):131-137.

DIFFERENT DIFFICULTY LEVELS OF BALANCE TASK INDUCED SPINAL EXCITABILITY ALTERATION

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Introduction In balance training, there are no scientific guidelines concerning the optimal duration and intensity of these exercises (Taube, Gruber and Gollhofer, 2008). Therefore, the aim of this study was to determine mechanical differences between different difficulty levels of balance task and their acute influence on H-reflex amplitude. Methods The research included 13 participants. Each of them performed balance task of three difficulties in random order (20 s, 7 repetition, 150 s rest). The rest time between each intensity was one week. Balance task was performed on balance board with motion in sagittal plane. We measured soleus H-reflex in standing position, active time of establishing balance control, number of hand supports because of losing balance, distance and speed of balance board. Normal distributed variables were analyzed with Shapiro-Wilk test. Differences between independent variables were analyzed with repeated measures ANOVA. In case of statistical significance, we used Tukey-Post-hoc test. For abnormal distributed variables, we used Friedman test (in case of sig., Wilcoxon rank sum test). Spearman correlation coefficients were calculated to analyze dependency of chosen variables. Results Active time of establishing balance, number of hand supports because of losing balance and speed of balance board are statistically different between difficulties (all: p<0.001). Mean values of wave H amplitude measured standing after whole balance task were significantly lower than before (p<0.01). Although we did not find significant differences between difficulties, H-reflex amplitude was significantly reduced already after the second repetition (p<0.05) in the most difficult and after the fifth repetition (p<0.05) after the easiest balance task. Discussion We assume that the most difficult balance task induces greater alteration in excitability of alpha motoneurones and/or presynaptic inhibition of Ia afferents due to the need for more precise control of movement. The advantage of reduced spinal reflexes in balancing tasks was assumed to rely on the prevention of reflex-mediated joint oscillations and on a shift in movement control to higher centres (Llewellyn et al., 1990; Koceja and Mynark, 2000; Solopova et al., 2003; Taube et al., 2008). It would be useful to research chronic adaptations induced by different difficulties of balance task on spinal and higher centres. References Koceja DM, Mynark RG. (2000). Int J Neurosci, 103(1-4), 1-17. Llewellyn M, Yang JP, Prochazka A. (1990). Exp Brain Res, 83(1), 22-28. Solopova IA, Kazennikov OV, Deniskina NB, Levik VS, Ivanenko YP. (2003). Neurosci Lett, 337(1), 25-28. Taube W, Gruber M, Gollhofer A. (2008). Acta Physiol, 193(2), 101-116. Contact darjan.smajla@fsp.uni-lj.si

MAXIMUM MUSCLE STRENGTH AND BALANCE PERFORMANCE AFTER THE HIGH INTENSITY STRENGTH AND AGILITY EXERCISE OF THE FOOT AND LEG MUSCLES

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[Introduction] Physical exercises cause to muscle fatigue, which is a decrease in the ability of muscles to produce force (Bigland and Woods, 1984) and a decrease in the ability of nerves to transmit signals (Hagg, 1992). Muscle strength of the foot and leg is important essentials for physical performance in standing. We showed that the foot strength was significantly correlated with dynamic lower-limb physical performances such as sprinting and jumping in children (Morita et al. 2015) and adolescent (Ohtsuka et al. 2015). Also, we showed that limitation of ankle joint movement decreased vertical jump performance (Koyama et al. 2014) and the foot strength (Yamauchi and Kayama, 2015). The foot muscles are a unit that produces force for postural control during the locomotion. However, there are no studies how physical exercises affect to the force generating capacity of the foot and leg muscles as well as the postural balance ability.

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