Abstract

Title: The effect of airway control on stance dynamic stability

Objectives: The aim of this thesis is to find out whether and how will the influence of vocal cords modulation be manifested on the dynamic stabilization of the standing body during translational shifts of the supporting surface of different intensities and A-P directions. Thus, building on the findings of Massery et al (2013).

Methods: The thesis has the character of qualitative research. The experiment was attended by 23 healthy probands, of which 7 men and 16 women aged 20-40 years. Spirometry was used to test the objectivity of airway airflow during breathing / phoning maneuvers with different vocal cords positioning and dynamic computer posturography using the Neurocom Smart Equi Test System and its Motor Control Test, which evaluated the effectiveness of automatic postural responses. We connected the posturograph with the spirometer using the Kistler accelerometer (type 8766A100BB). The course of the experiment was simultaneously recorded by a camera (GoPro Hero 7). The Smart EquiTest System generated three postural perturbations of different intensity (S - sub treshold, M - threshold, L - saturating) in two directions (anterior translation / posterior translation). The measured data were then processed in the program Neurocom Balance Manager Software, data from the spirometer in the program Dewesoft X3. The main parameter examined was latency, evaluating the efficiency of the reaction to the force plate shift. Data from the Smart EquiTest System were processed in the statistical program R and analyzed using the following methods: t-test, Pearson correlation test, Chi-square test. The significance level was set to $p = 0.05$.

Results: The results of the work show that the parameters of translational perturbation and breath control have some influence on the dynamic postural standing stability (latency values). The direction and intensity of the perturbation significantly influenced the rate of the body corrective response to the translation of the supporting surface, the vocal cord modulation showed a tendency on the margin of significance. There was a significant difference in latency between the forward pulse and the reverse pulse

(t-test, p <1e-16). In the forward translation, the differences were significant (t-test, p = 4e-05, difference between the smallest and the largest pulse). Influence of vocal cords modulation on latency was manifested in the voicing variant “Ah” (partially open vocal cords). The "Ah" maneuver induced the lowest latency value compared to other breath variants. This difference is on the margin of significance (one-sided t-test, p = 0.049). However, the second voicing variant with partially open vocal cords (“counting”) showed no significant effect on the improvement of latency values (one-sided t-test, p = 0.35). Mid-range glottal control, but only the "Ah" variant, proved to be the most effective breath control in translational postural perturbations.

Keywords: breath control, dynamic computerised posturography, glottis, IAP, ITP, MCT, Neurocom Smart EquiTest System, postural control, postural stability, spirometry, vocal cords, voicing