

EFFECTS OF RELAXATION OVER POSTURAL STABILITY

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Introduction

Effects of tension and relaxation over our daily life are important and not always clear to us. It is easy to get tense or stressed at work, at home or even with friends, but in contrary it is not as easy to relax. The first difficulty lies in the misunderstanding between the concepts of relaxation and rest. Rest is what we do between two tasks e.g. sleeping or sitting on the sofa, while relaxing is what we should do *during* the task. We are usually good at resting, while for relaxation in some cases we require the assistance of experts of specific disciplines [1] or the aid of technology [2]. In the specific case of standing position, a key role is played by the relaxation of the hips. Being able to relax the hips can change the paradigm of standing posture from single to double inverted pendulum. It is assumed that standing is a task humans do automatically at minimum cost of energy (relaxed) [3]. However, since difficulties of healthy subjects in relaxation were already reported [2], such paradigm should be verified. In the present study we want to analyze the effect of tension and relaxation over the standing position.

Methods

The statokinesigram of 26 subjects was acquired (age 33 \pm 5). Foot-ground contact forces were recorded by using a force plate (100Hz sampling). Subjects were asked to stand over the force-plate for one minute, eyes closed. Each subject was analysed in three different days and each time simulating three different conditions: control, tense and relaxed conditions. In control-condition the subject was asked to stand over the force-plate without any additional information. Tense-condition was simulated asking the subject to continuously contract gluteus and shoulders. After tense analysis subjects were guided through few exercises to relax neck, shoulders and hips including deep breathing exercises. Relaxation training took about 5 minutes. Relaxed-condition was then analysed, asking the subject to relax the whole body with particular attention to the gluteus, shoulders, sphincter and perineum area and keeping deep diaphragmatic breathing. Thirty-nine different features were computed for each acquisition, divided in four main domains: Time-distance parameters, time-area parameters, time-hybrid parameters and frequency parameters [4]. Each measurement was averaged over the three session undertaken by each subjects. Wilcoxon paired non-parametric test was used to compare results of different condition and a Binary Logistic Regression was performed to attempt a classification of the results.

Results and Discussions

Tense-condition showed big differences from the control one. All the 39 parameters showed statistically significant difference ($p < 0.05$) and all of them in the direction of an increased energy cost. Only two parameters were enough to perform a classification with an accuracy of 88% (Fig. 1).

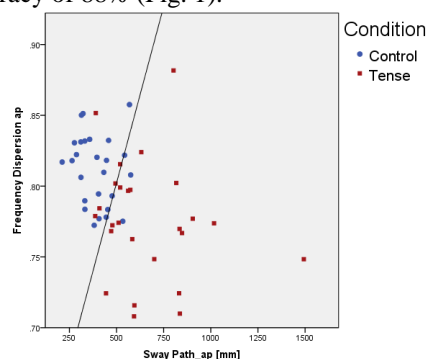


Figure 1 Tense and Control conditions can be easily discriminated using only two parameters.

Relaxed-condition were more difficult to analyze because 7 out of 26 subject showed serious difficulties in relaxation and were completely unable to perform diaphragmatic breath. Removing these subjects from the analysis it was possible to notice statistical difference between relaxed and control conditions in 9 different features and in the direction of decreased energy cost. Classification was also possible with an accuracy of 84% with the use of 4 features: mean frequency, fractal dimension, centroid frequency and frequency dispersion.

The present study shows how states of tensions and relaxation can be discriminated, suggesting that standing position is not an optimize posture, since relaxation can decrease the energy used. Relevant is also the condition of 7 out of 26 subject that were unable of diaphragmatic breath. Such findings suggest to further consider the relaxation ability (or difficulty) of the general population.

References

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