BREATHING AS A MEDIATOR BETWEEN POSTURAL STABILITY AND STRESS IN STUDENTS

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Introduction

There is an increasing incidence of musculoskeletal conditions (58% increase from 1990 to 2017), especially among adolescents (up to 75% of the population) [1]. Psychological factors such as mismanaged stress, anxiety, and other emotions may be contributing factors [2]. Breathing affects motor control, postural stability, and plays several roles in physiological and psychological regulation [3]. Hence, breathing may be a mediator between posture and emotions. Yet, results from preliminary studies suggest that many cannot intentionally perform diaphragm breathing, impacting their posture, and affecting their emotional regulation abilities [4]. This study aims to identify a possible triangular link among posture, breathing, and stress.

Material and Methods

Twenty-nine healthy volunteers (20 male, 9 female) between 18 and 23 years of age, participated in the study. Breathing analysis was performed using optoelectronic plethysmography (OEP). Eight infrared cameras were used, and eighty-nine markers placed on the trunks of subjects [5]. Subjects were asked to stand on a force plate while their breathing (abdominal, pulmonary, and abdominal rib cage compartments) and displacement of the center of pressure (COP – 27 different variables among time, frequency hybrid domain measures) were recorded. Four recordings of three minutes each were made with subjects asked to keep their eyes closed or open and to breathe abdominally or naturally (i.e., without specific instructions). Subjects were classified as capable or not of abdominal breathing if the abdominal compartment was used more than the pulmonary one. Breathing and stability results were normalized based on the height of the subjects. Twenty volunteers also filled out dispositional measures of psychological health: State-Trait Anxiety Inventory (STAI-T) and Rosenberg Self-Esteem Scale (RSE). To evaluate possible relations among breathing, COP, and anxiety (STAI-T), all parameters were analyzed using a multifactorial ANOVA. Factors taken into consideration were gender, the requested modality of breathing, the position of eyes, and the actual capability to perform abdominal breathing. Multiple linear regression with stepwise variable selection was employed to identify possible relations among breathing, stability, and dispositional measures. Finally, binary logistic regression with forward feature selection was used to discriminate between subjects who could breathe abdominally or not.

Results

ANOVA analysis showed no significant difference between the requested modality of breathing nor positions of eyes, whereas significantly different behaviors were shown for gender and capability of abdominal breathing. Thus, the following analyses of the effect of breathing have been split by gender. One hundred thirteen acquisitions resulted valid for the breathing-stability analysis. Logistic regression was able to perfectly classify (100% accuracy) females (35 acquisitions) and males (78 acquisitions). Equations showed different behaviors for males and females. In males, abdominal breathers are more stable subjects while the opposite is suggested for females. Multiple regression identified linear dependency between abdominal ribcage volume and dispositional measures. In female subjects, RSE adjR^2=0.85, positive relation and STAI adjR^2=0.63, negative relation; in males STAI adjR^2=0.46, positive relation. Finally, dispositional measures were found to be related to the stability of the subjects in both males and females (male RSE vs COP adjR^2=0.91, female STAI vs COP adjR^2=0.83, RSE vs COP adjR^2=0.72).

Conclusions

The stability of volunteers was found to be linearly related to dispositional measures of psychological health. However, only 26% of female recordings presented abdominal breathing against 53% of male subjects. The imbalance of recordings and limited number of women present a clear limitation in the evaluation of female subjects. Nevertheless, strategies appear to be inverted between males and females. Breathing presents as a possible mediator showing relations to both stability and psychological health. However, in both cases, the relationship is inverted by gender. Such differences do not seem explicable by mere biology, and social canons should be taken into consideration.

References

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