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Comparison of the Effect of Heart Rate Variability Biofeedback and Slow Breathing Training on Promoting Autonomic Nervous Function Related Performance

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Abstract : Background: Heart rate variability (HRV) biofeedback can promote autonomic nervous function, sleep quality and reduce psychological stress. In HRV biofeedback training, it is hoped that through the guidance of machine video or audio, the patient can breathe slowly according to his own heart rate changes so that the heart and lungs can achieve resonance, thereby promoting the related effects of autonomic nerve function; while, it is also pointed out that if slow breathing of 6 times per minute can also guide the case to achieve the effect of cardiopulmonary resonance. However, there is no relevant research to explore the comparison of the effectiveness of cardiopulmonary resonance by using video or audio HRV biofeedback training and metronome-guided slow breathing. Purpose: To compare the promotion of autonomic nervous function performance between using HRV biofeedback and slow breathing guided by a metronome. Method: This research is a kind of experimental design with convenient sampling; the cases are randomly divided into the heart rate variability biofeedback training group and the slow breathing training group. The HRV biofeedback training group will conduct HRV biofeedback training in a four-week laboratory and use the home training device for autonomous training; while the slow breathing training group will conduct slow breathing training in the four-week laboratory using the mobile phone APP breathing metronome to guide the slow breathing training, and use the mobile phone APP for autonomous training at home. After two groups were enrolled and four weeks after the intervention, the autonomic nervous function-related performance was repeatedly measured. Using the chi-square test, student's t-test and other statistical methods to analyze the results, and use $p < 0.05$ as the basis for statistical significance. Results: A total of 27 subjects were included in the analysis. After four weeks of training, the HRV biofeedback training group showed significant improvement in the HRV indexes (SDNN, RMSSD, HF, TP) and sleep quality. Although the stress index also decreased, it did not reach statistical significance; the slow breathing training group was not statistically significant after four weeks of training, only sleep quality improved significantly, while the HRV indexes (SDNN, RMSSD, TP) all increased. Although HF and stress indexes decreased, they were not statistically significant. Comparing the difference between the two groups after training, it was found that the HF index improved significantly and reached statistical significance in the HRV biofeedback training group. Although the sleep quality of the two groups improved, it did not reach that level in a statistically significant difference. Conclusion: HRV biofeedback training is more effective in promoting autonomic nervous function than slow breathing training, but the effects of reducing stress and promoting sleep quality need to be explored after increasing the number of samples. The results of this study can provide a reference for clinical or community health promotion. In the future, it can also be further designed to integrate heart rate variability biological feedback training into the development of AI artificial intelligence wearable devices, which can make it more convenient for people to train independently and get effective feedback in time.

Keywords : autonomic nervous function, HRV biofeedback, heart rate variability, slow breathing
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