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Effects of 3D Multiple Object Tracking Training on Frontal EEG's in Professional Soccer Players

Saito, Y.1, Isogai, H.2, Natsume, K.1

1 Kyushu Institute of Technology ; 2 Kyushu Sangyo University

INTRODUCTION:
In sports, physical training is essential to achieve the optimal performance. However, cognitive ability is also an important factor. In the case of professional athletes who already possess a high degree of physical competence, advantages in perceptual and cognitive abilities can become key superiority .
A method to improve the cognitive abilities of the brain is a 3D multiple-object tracking (3D-MOT) task. NeuroTrackerX (NTX; Neuro Tracker Inc, Canada) has been used for the task. It is performed on a PC the trainee's having 3D glasses. There are some previous studies indicating that 3D-MOT training could improve attention, working memory, and visual information processing speed, accelerate the processing speed, and also producing quantitative changes in the resting-state EEG of the university students [1]. We conducted the study on four professional soccer players currently active in the Japanese League. We measured EEG at the frontal region of the brain with their eyes open after training using NTX . As a result, theta rhythm power at mid-frontal region (Fmθ) showed a significant increase [2]. In this study, we studied whether θ rhythms changed at the other frontal regions after 3D-MOT task of the Japanese League athletes.
METHODS:
Thirteen J-League players with the age of 23.7 ± 1.1 (mean ± SD) years, and the measurements were performed during the J-League season. NTX was used for evaluating the ability of 3D-MOT and training. The training period was about two months. Before and after the training, the cognitive tasks of trail-making test (TMT)-A, and B, and 1-back test were performed. At the same day EEG was measured with the subjects' eyes open for 15 seconds after the NTX task. It was measured at the frontal F3, Fz, and F4. Average power values of θ, α, β, and γ waves were calculated using MATLAB R2020b (Mathworks Inc, USA). In the statistical test, paired student's t-test was performed.
RESULTS:
There was a significant increase in NTX scores by the training ($p < .001$). The increased rate of the score significantly positively correlated with the number of training sessions and (Pearson correlation coefficient $r = 0.57$; $p = .04$). The score of TMT-A, and B significantly increased after the training (A; $p = .004$, B; $p = .03$, respectively). θ powers at F3, Fz, and F4 significantly increased after the training (F3; $p < .001$, Fz; $p < .001$, and F4; $p = .02$).
CONCLUSION:
NTX scores increased with the training accompanying with the significant increase in the scores of TMT-A, B. The results suggest that NTX training will improve the working memory ability in the professional soccer players.
θ rhythms not only at mid-frontal region, but also at the right and left frontal regions significantly increased after the training. Frontal θ rhythm is related to the working memory function. The result suggests that NTX training influences working memory ability throughout the increase in the θ rhythm at the frontal lobe.

1. Parsons et al. (2014). 2. Saito et al. (2021).

Topic: Training and Testing

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