

The effect of two weeks of training with vibrotactile biofeedback of trunk sway on balance control of multiple sclerosis patients a multiple case study

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Introduction

There are an estimated 2 million people worldwide which are living with the diagnosis of multiple sclerosis (MS) [1]. Due to the axonal loss of the myelinated long-nerve pathways the information can not travel along to the CNS [2]. This causes problems with proprioception which leads to slower motor response and thus to balance problems [3].

A gyroscope system, SwayStar™, measuring lower trunk sway, was used to measure the Balance Control Index (BCI). The head-mounted vibrotactile biofeedback (VTBF) which contains eight tactores (Fig.1), provided information for afferent nerve pathways. VTBF was directionally active when a sway threshold was exceeded.

In a previous study [4] was demonstrated, that one session of training with VTBF could improve balance control in MS patients, compared to one training session without VTBF.

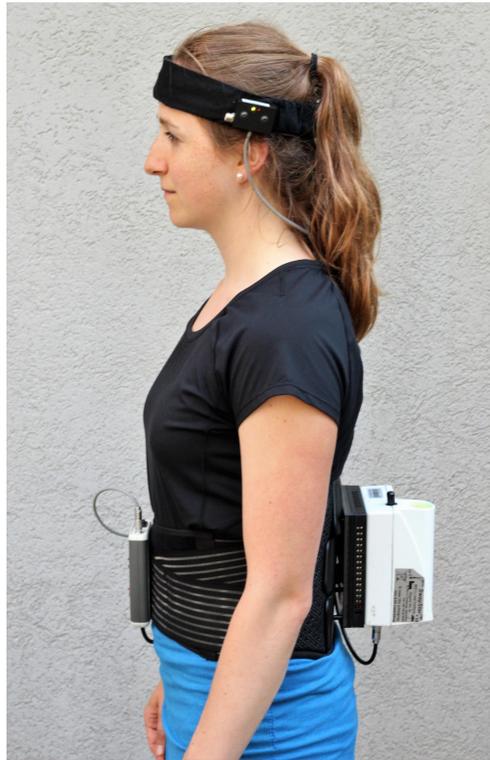


Figure 1: Sway Star™ and head-mounted vibrotactile biofeedback

Aim

- To examine the effect of two weeks of VTBF training on BCI and therefore on balance control in MS patients
- To determine a possible carry-over effect after one week without training and one week of training without VTBF

Methods

15 MS patients with balance deficits participated in the study. Participants were trained on seven different stance and gait tasks: two times for two weeks (four sessions) with VTBF and then after a week's pause, once for one week (two sessions) without VTBF (Fig. 2). An assessment sequence of 11 stance and gait tasks was performed once before training started and several times during the training to set VTBF thresholds individually.

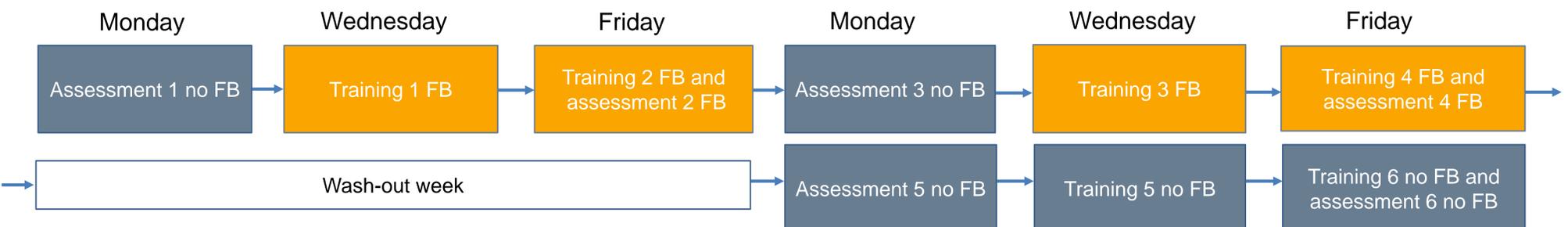


Figure 2: Study protocol of 4 weeks; FB = feedback

Results

- From assessment 1 to 2 a significant decrease in the BCI is shown after one week of VTBF training.
- From assessments 2 to 7 the BCI remains constant.
- From assessment 1 to 6 the BCI shows a significant decrease after a wash-out week and one week of training without VTBF (Fig. 3).

Discussion

- The decrease of the BCI of assessment 1 to 2 can be explained by a learning effect or by the VTBF training. A training effect could have been excluded due to the low intensity shown in other studies [5].
- A constant level of the BCI from assessments 2 to 7 could be due to the VTBF training and can show a carry-over effect.
- The BCI decreased from assessment 1 to 6 probably due to a carry-over effect

To have a clear statement of effectiveness of VTBF training and to eliminate the learning effect, an other study design is recommended.

Conclusion

According to this study VTBF training seems to be a promising method to improve balance control and also shows a certain carry-over effect. However, future studies should consider another study design to eliminate the learning effect.

Keywords: Multiple sclerosis, balance control, trunk sway, vibrotactile biofeedback, Balance Control Index

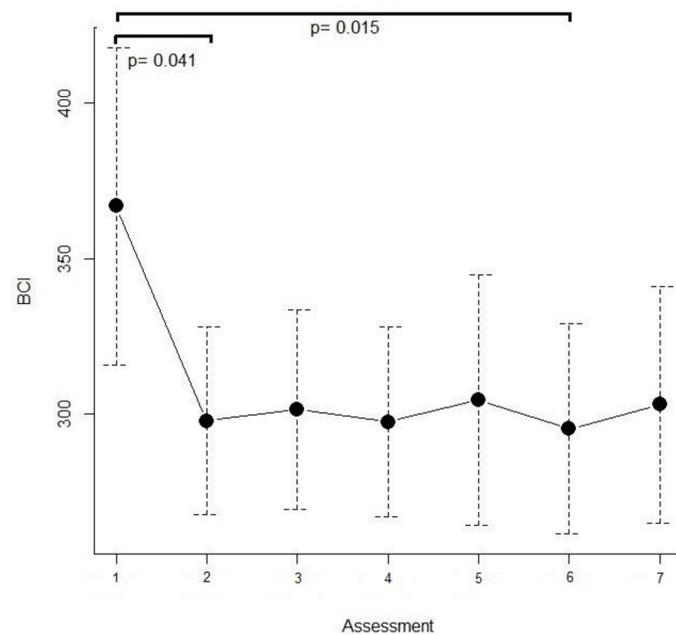


Figure 3: 95% confidence interval of Balance Control Index of the mean of assessment 1 to 7

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