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Effect of galvanic vestibular stimulation on motor activity rhythm in human

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Background

Human and animal studies demonstrated anatomical and functional links between the central biological clock and the vestibular system.

- Hypergravity negatively impacts temperature and locomotion rhythms of rats.
- In human, swinging protocols have demonstrated a positive effect in the wake-sleep transition.

Galvanic Vestibular Stimulation (GVS) is a non invasive, safe and useful tool to stimulate vestibular afferents

Impact of GVS on the rest/activity rhythm has never been tested.

→ The present study targets the impact of GVS on the motor activity rhythm in human

Discussion

The present study confirms the high tolerability of the GVS protocol. The statistical tendency on the MESOR suggest the potential impact of the vestibular stimulation on the biological rhythmicity and specifically the rest/activity rhythm. This protocol is a preliminary study dealing with the impact of GVS on the rest/activity rhythm in human. It is necessary to optimize the protocol applied. Effects of GVS have to be tested at different times of the day, in constant routines. The long term effects of repeated GVS need to be tested.

Our results open many perspectives in the use of GVS in biological rehabilitation.

Objectives

- 1) Assess the tolerability of the GVS protocol in relation to the level of motion sickness symptoms.
- 2) Evaluate the impact of the GVS on the rest/activity rhythm.

Results

Motion sickness symptoms

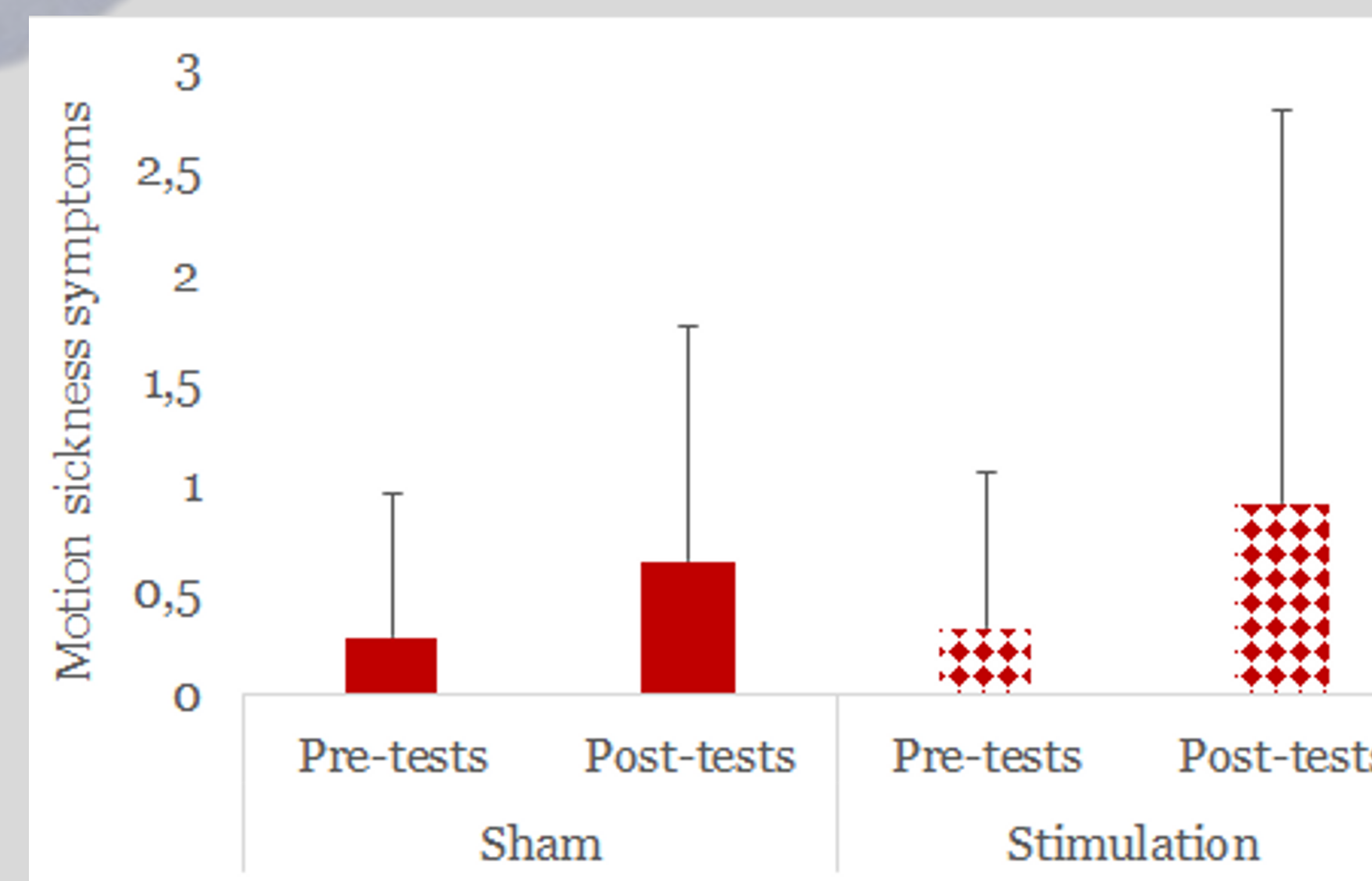


Figure 2: Evolution of the motion sickness level for time (pre-tests, post-tests) and session (Sham, Stimulation) factors.

→ No effect of the GVS on motion sickness symptoms

Method

25 participants were recruited (35.05 ± 9.7 y.o.). They underwent Sham and Stimulation sessions in counterbalanced order. Sessions were scheduled the same day at the same hour (between 12 a.m. and 2 p.m.) to avoid any variations. One session was scheduled by week. Actimetry recording started one week before the first session (Baseline) and was stopped one week after the second session. Parameters of the vestibular stimulation (figure 1) and dependent variables were summarized in the figure 2. During the Sham stimulation no current was diffused.

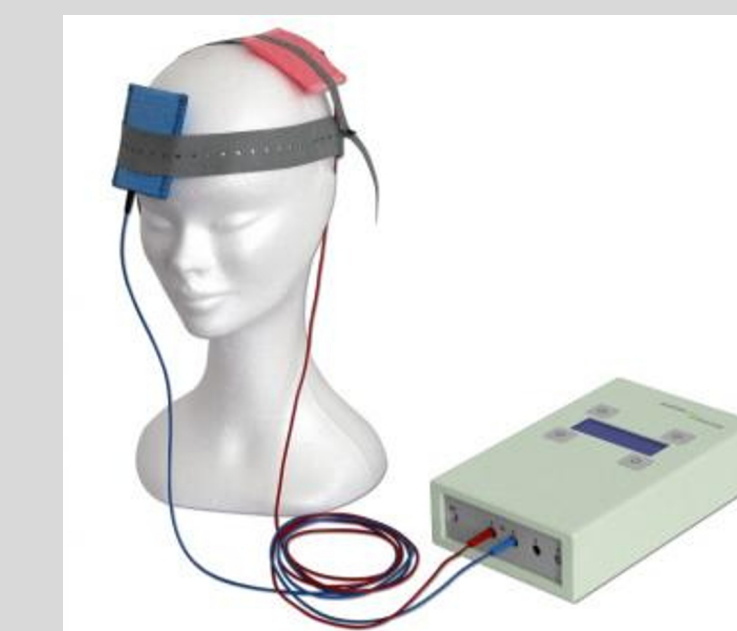


Figure 1: GVS device (neuroConn Technology).

| Pre-tests | Condition | Post-tests |
|----------------|-----------------------------------|--------------------------------------|
| | Sham | |
| | Galvanic vestibular stimulation | |
| Graybiel scale | : 1 mA, 20 min, 1 polarity change | Graybiel scale Sleep latency test |

Figure 2: List of the dependent variables measured during Sham and Stimulation sessions and parameters of the GVS.

Statistical Analysis : We performed multifactorial non-parametric analyses of variance for repeated measures for the Graybiel scores. Concerning the rest/activity rhythm a cosinor analysis was executed.

Rest/activity rhythm

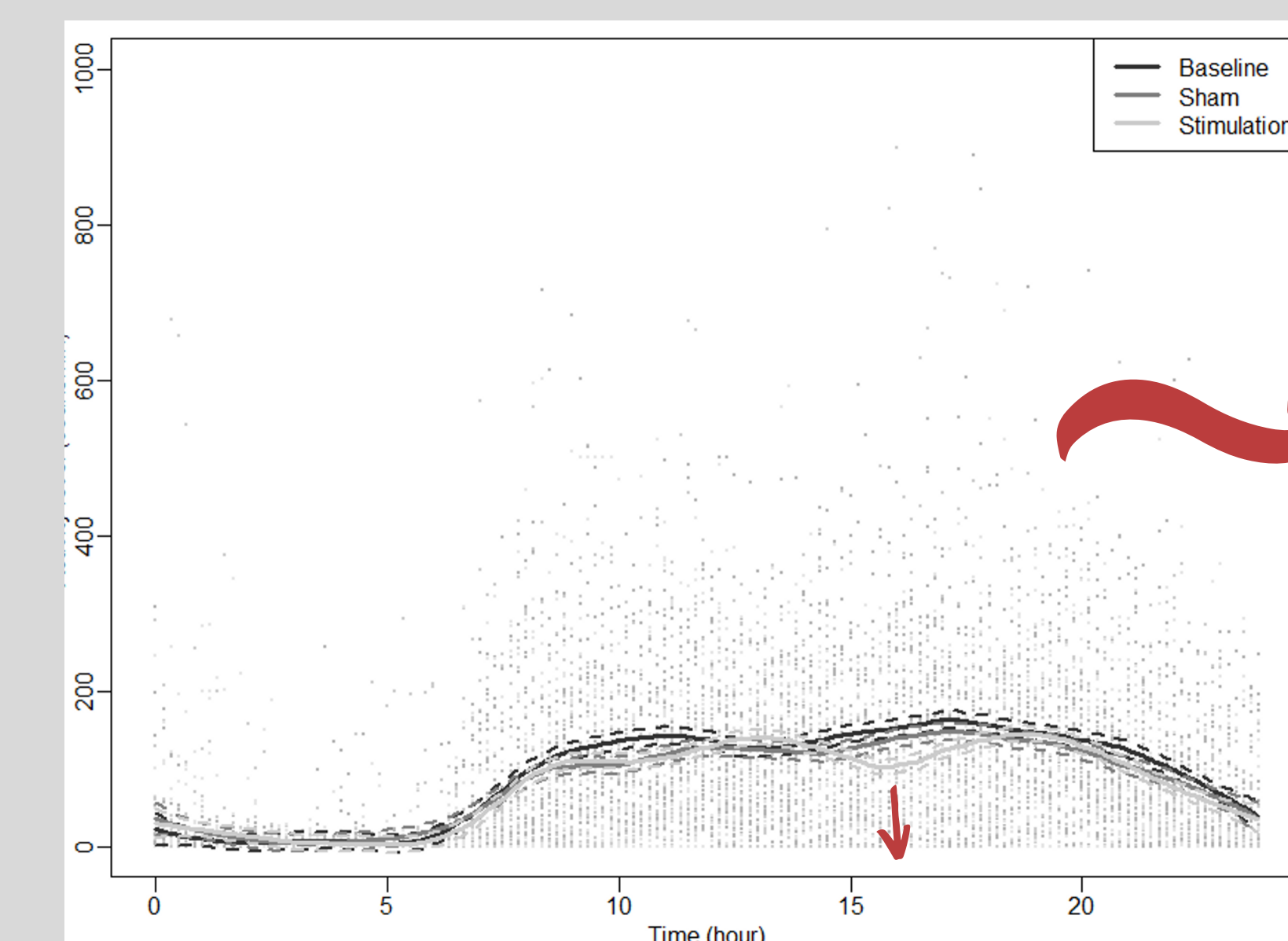


Figure 3: Rest/activity rhythm for each condition (Baseline, Sham, Stimulation) the day following sessions. A statistical tendency (p = 0.084) was found on the MESOR for the Stimulation condition.

→ no significant difference but a statistical tendency concerning the MESOR (i.e. the mean level of motor activity)