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COGNITION

Cognitive assessment in human patients equipped with a vestibulo-cochlear implant

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Introduction

- Prior vestibular research supports a prominent role for vestibular information in cognition and navigation. Cognitive tests are abnormal in vestibular patients, and subjective cognitive impairments in vestibular patients can degrade quality-of-life more than motor deficits [1-2].
- **The Geneva-Maastricht** team has developed a novel sensory neuroprosthesis, the **Vestibulo-Cochlear Implant (VCI)** (Fig.1), designed to electrically stimulate the cochlea and three semicircular canals to restore both hearing and balance function [3]. The VCI was activated for stimulation periods during the day, and then the patients were sent home with the device turned off.

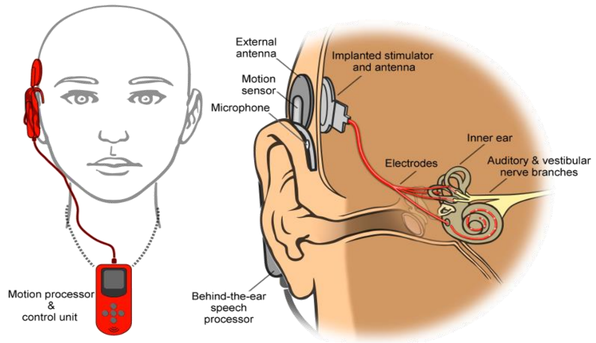

Figure 1. The Vestibulo-Cochlear Implant (VCI)

Objective

Herein, we studied the effects of VCI short-term stimulation on navigation and neuropsychologic function in patients with bilateral vestibulopathy

Methods et Materials

- Two patients implanted with VCIs completed a virtual reality based spatial navigation task and neuropsychological testing included the Corsi Block Test (CBT), Digit Span Test (DST), and an Egocentric Mental Transformation Task (EMT).
- Testing was performed in 3 stimulation conditions: (1) One month prior to VCI stimulation (VCI OFF); (2) During stimulation (VCI ON), and (3) One month after stimulation (VCI POST).

Results

Navigation task

- Both subjects demonstrated improved **accuracy** and **precision** in the dynamic and stationary conditions during VCI stimulation (**Fig.2**)
- Performance worsened when the stimulation was turned off.

Neuropsychological testing

- Both subjects demonstrated improved performance on the DST and EMT during VCI stimulation.
- Subject 1 showed improvement on the CBT during stimulation.

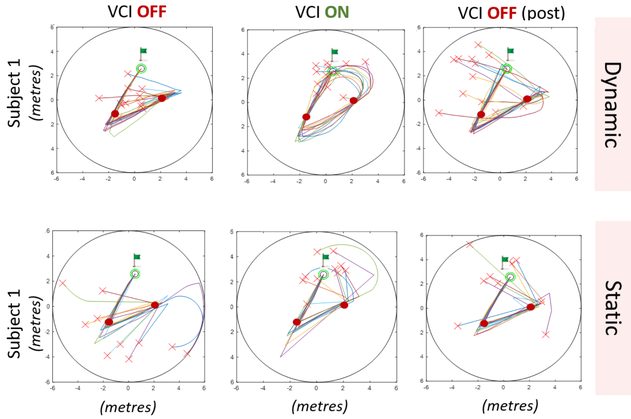

Figure 2. *Sample trials from Subject 1 for dynamic and static task condition. Testing was performed at least 1 month prior to VCI stimulation (VCI OFF), during stimulation (VCI ON), and at least 1-month post-stimulation (VCI OFF (post)).*

Conclusion

Our preliminary findings suggest that the VCI has the potential to improve higher-level cognitive function in patients with bilateral vestibulopathy during acute stimulation.

Further research is needed to investigate the effects of VCI on cognitive function.

References

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