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THÈME

Functional near-infrared spectroscopy for cortical evaluation of tinnitus

Mariana Lopes Martins; Edgard Morya; Liliane Kaline Araújo de Lima; Isabelle Costa de Vasconcelos; Sheila Andreoli Balen; Daniel Gomes da Silva Machado; Marine Raquel Diniz da Rosa

Abstract

- **Population:** This study was composed of two groups; a tinnitus group with bilateral chronic tinnitus (n=23), and a control group without chronic tinnitus (n=23).
- The inclusion criteria were auditory thresholds within the normal range (average lower than 25dBHL at frequencies of 500, 1000, 2000 and 4000Hz) and all frequencies from 250 to 8KHz below 40dBHL adopted for both groups.

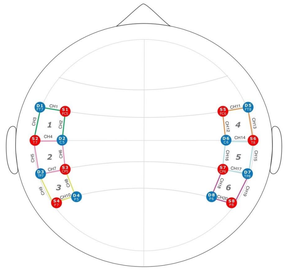

Figure 1. Experimental set-up on the participant. Optode array set up with eight sources/detectors resulting in 20 channels according to the 10-20 system. The optodes were placed over the frontal, temporal, and parietal cortices with a 30-mm Source-detector (SD). Sources are represented in red, detectors in blue, and channels are indicated in the connection between the optodes.

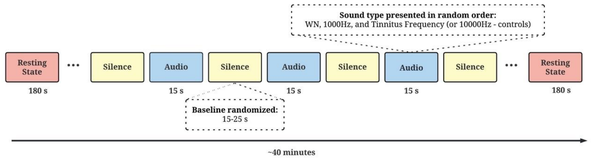

Figure 2. Listening block-paradigm. The experimental run consisted of 20 trials of each sound separated by 60 trials of silence. The stimuli are presented in three conditions: White Noise (WN); 1000Hz; and tinnitus frequency (selected according to the tinnitus frequency of the participant), or 10,000Hz in the controls. The presentation order of the stimuli is randomized. The sound stimuli have a fixed duration of 15s, and the silence period has randomized variation between 15-25s.

Résultats

- There was a significant difference in the condition, region of interest (ROI) and channel when analyzed alone. However, there was no difference in the theta between the groups.
- In combinations, there is a significant difference in the group and condition interaction, and group and channel interaction.
- The Tinnitus Frequency decreased HbO levels, while other sounds (WN and 1KHZ) increased HbO levels. And in the control group all sounds differed from each other, except for 1000Hz with Baseline.

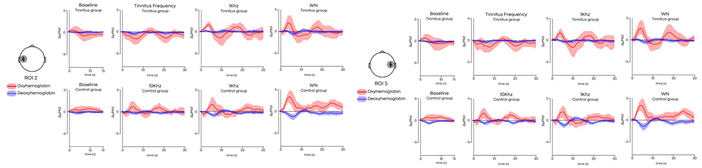

Figure 3. Mean response of HbO levels in the medial ROI (2 and 5) by the group.

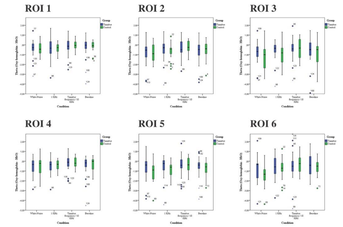

Figure 4. Comparison of oxyhemoglobin levels between the groups considering the conditions. Legend: ROI 1 and 4 cover part of frontal (inferior frontal gyrus), ROI 2 and 5: primary auditory cortex covering temporal (superior temporal gyrus, middle temporal gyrus, supramarginal gyrus, and postcentral gyrus), and ROI 3 and 6 cover part of parietal (angular gyrus and occipitotemporal area).

Objectifs

- Compare the changes in the oxy-hemoglobin concentration of individuals with and without tinnitus using auditory stimulation (White Noise, 1000Hz, tinnitus frequency, and silence) by NIRS.

Conclusion

- **Interpretation:** The type of sound presented, and brain region influenced the variations in HbO levels in both groups. Although, tinnitus group had less variation in HbO levels between the type of sound presented and the brain region assessed. The tinnitus loudness measured by psychoacoustic exam, and tinnitus annoyance, loudness and severity measured by questionnaires showed an association with variations in cerebral blood flow.
- **Conclusion**: There is a difference in cerebral blood flow between people with tinnitus and controls. Thus, cortical changes should be considered in the treatment of tinnitus.

Méthodes et Matériels

- The region-of-interest was focused on the primary auditory cortex bilaterally covering Heschl's gyrus in the temporal cortex (superior temporal gyrus, middle temporal gyrus, supramarginal gyrus, and postcentral gyrus) (ROI 2 and 5).
- Then, a passive listening block-paradigm design was adopted with reoccurring blocks of tasks with 15s interspersed with randomized silence periods between 15-25s.

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