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# Test-Retest Reliability of the 40 Hz EEG Auditory Steady-State Response

## Confiabilidade das respostas auditivas de estado estável no teste-reteste modulado a 40 Hz

## Confiabilidad de la respuesta auditiva en estado estable el test-retest a 40 Hz

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The auditory system does not follow a linear projection of neurons ascending from the cochlea to the cerebral cortex, but rather a formation in a net that interacts intensely with other neuronal systems, such as language and the limbic system. This interaction occurs through sensors, nerve nuclei present at different heights, as well as afferent and efferent connections that follow more than one pathway and sometimes come into contact with each other, forming retroalignment circuits.

A number of substances (gamma-aminobutyric (GABA) and dopamine) are involved in transmitting stimuli through the efferent auditory system, and knowing its action is essential to understanding the processes that occur in the auditory pathway.

Studies suggest that GABA plays an important role in generating auditory steady-state responses (ASSR) and this relationship may serve as a marker for schizophrenia. Although the neural mechanisms responsible for generating ASSR and their disturbance in schizophrenia are little known, these responses are being used as an auxiliary procedure in the diagnosis of psychiatric diseases.

This study assessed the test-retest reliability of auditory steady-state responses (ASSR). Furthermore, it investigated the reliability of ASSR being influenced by the parameters (stimuli) and analysis method used.

Nineteen normal hearing adults were evaluated, 10 men and 9 women, aged between 20.3 and 54.9 years. The inclusion criteria were: individuals with no history of psychiatric or neurological disorders.

Participants underwent two recording sessions one week apart, performing the same tasks at the two sessions. Both were passive listening tasks, and 200 white noise or click stimuli were promediated, presented binaurally through insert earphones at 75 dB NPSpe. All participants executed the task with white noise stimulus and the task with click stimulus.

In addition to descriptive statistics, two analysis methods were used. In the first method, Fisher Transform was applied for both tasks (white noise and clicks) and for each session (test and retest), in order to assess the tasks and session reliability. The Student's t-test was also executed to compare ASSR between the tasks and the Coefficient of Squared Magnitude to observe the noise signal relationship between the tasks. The second method involved

projecting the means of both tasks and sessions, which were analyzed together.

Although the click stimulus evoked a greater ASSR compared to white noise, the results showed that the differences between the two tasks were not statistically significant. Good test-retest response reliability was also observed, seemingly more evident in phase coherence. Phase coherence was statistically significant when correlated between sessions for both stimuli studied and both methods used.

This study presented important information regarding the consistency of ASSR and its reliability when different methods and stimuli are applied. These aspects must be considered given that the ASSR has been used in a number of centers as an auxiliary procedure in the diagnosis of psychiatric diseases, primarily schizophrenia, whose main characteristic is disturbed auditory perception.

Although noninvasive measures do not detect signals at the cellular level of neurons, the electroencephalogram (EEG) and other potentials can detect the synchronous activity of a set of neurons. Therefore, studies such as these must be better characterized in order to be used as a biomarker of the factors, mechanisms and effects of interventions in patients with schizophrenia.

Concern over the use of these data in clinical speech therapy will be a challenge for future studies, given the lack of information on the reliability of these responses and their measures in psychiatric patients.