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The Survey of Object-Related Negativity Evoked Potential in Concurrent Sound Segregation

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Letter to Editor

Abstract

Perception of concurrent sounds such as speech in the presence of noise is one of the auditory challenges in many disorders such as auditory processing disorders, hearing loss, learning disabilities, autism, etc. in children, adults, and the elderly. Objective examination of concurrent sound perception is possible using object-related negativity (ORN) electrophysiological assessments. This wave can be recorded in the range of N1 and P2 late latency responses (LLR). The stimuli used to obtain this wave are dichotic pitch, spatial differences, simulated echoes, asynchronous at the onset, and mistuned harmonics. This wave can be detected in the frontocentral part of the brain, and since it has not yet been completely studied in various disorders, we recommend it in objective studies in future research as well as clinical and rehabilitation monitoring.

Keywords: Object-related negativity; Concurrent sound separation; Streaming

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Introduction

From birth, we encounter different sounds that are presented simultaneously. In a complex auditory environment, the acoustic characteristics of many of these sounds overlap, and although a single sound pressure consisting of several sound waves reaches the human ear, the auditory events are properly separated and distinct. Therefore, it can be concluded that in order to identify different sound patterns such as a person's voice among other sounds, first the audio information entered into the hearing system is properly separated and then the features related to the similar audio sources are grouped together. The process of separating and grouping synchronous audio sources is called synchronous streaming, first introduced by Bergman in 1990 (2). This ability is a key component of auditory scene analysis skills and is essential for speech and language development, social skills, and musical ability (2). Object-related negativity (ORN) is electrophysiological index for the study of concurrent sounds (3) of, which, unlike other electrophysiological responses such as "Auditory Brain Stem Responses: ABR", "Middle Latency Response: MLR", "Late Latency Response: LLR", "Mismatch negativity: MMN" and P300, is less addressed (4).

The ORN is part of the auditory event-related responses introduced by Alain et al (3). About 22 years ago as an indicator for simultaneous sound perception that reflects simultaneous processing or the result and outcome of (perceiving two or more sounds in combination). Of different sounds). The ORN is distinct from the MMN as a tool for sequential processing, and is independent of the possibility of an auditory stimulus events (5). The origin of the ORN is the medial planum temporale neural network (3). ORN is evoked by acoustic cues that are involved in concurrent sounds segregation such as dichotic pitch (6), location difference (7, 8), stimulated echo (9), onset asynchrony (8, 10) and mistuned harmonics (4, 11). The ORN wave is obtained between 160-200 milliseconds and has a maximum amplitude in the fronto-central part and reverse polarity in the mastoid. This wave is a

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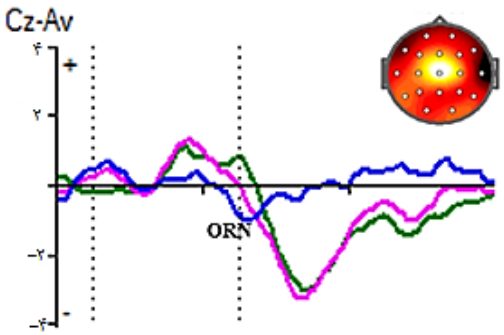

Figure 1. Late Latency Response (LLR) wave using tuning stimulus (purple), LLR wave using mistuning stimulus (green) and differential ORN wave (blue) in children with normal hearing

differential wave, for example from the difference of late latency auditory evoked potentials (LLAEPs) obtained from complex tone with tuned harmonic from complex tone with mistuned harmonic. ORN response overlaps with N1 and P2 components and in active listening conditions and passive listening can be registered (3). Since this stimulus can also be recorded in passive listening conditions, it is of a pre-attentive nature (12). The amplitude of the ORN wave increases with attention (13). The results obtained from the changes of this wave in hearing-impaired children (4), people with autism (14), schizophrenia (15) and the elderly (16) indicate a defect in concurrent sound segregation. Due to the importance of this wave in the study of sounds streaming, it is recommended to be studied in future research on different disorders. Figure 1 is the average ORN reported by the authors from 12 children, aged 6-12 years, with normal hearing.

Authors' Contribution

Study design and ideation: Nasrin Gohari, Zahra Hosseini Dastgerdi

Manuscript preparation: Zahra Hosseini Dastgerdi, Nasrin Gohari

Specialized scientific evaluation of the manuscript: Nasrin Gohari, Zahra Hosseini Dastgerdi

Confirm the final manuscript to be submitted to the journal website: Nasrin Gohari, Zahra Hosseini Dastgerdi

Maintaining the integrity of the study process from the beginning to the publication, and responding to the referees' comments: Nasrin Gohari, Zahra Hosseini Dastgerdi.

Conflict of Interest

There was no conflict of interest in this study.

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