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Letter to the Editor

Considerations when Analyzing Vestibular Evoked Myogenic Potential (VEMP) Outcomes Elicited by Chirp Stimulus in Healthy Participants

Dear Editor,

We read with great interest the article of Özgür et al. [1] entitled "Comparison of Tone Burst, Click and Chirp Stimulation in Vestibular Evoked Myogenic Potential Testing in Healthy People." This comparative study is indeed relevant in searching for the optimum stimulus for recording the vestibular evoked myogenic potential (VEMP). We agree with the authors that not many studies have utilized chirp stimulus to record VEMP, and more efforts are required to further explore the usefulness of this stimulus.

However, because VEMP was recorded using the commercially available octave-band chirp stimulus, we would like to highlight some issues that may be worthy of consideration. The chirp stimulus is synthesized to achieve an optimum neural response by compensating for the cochlear delay, particularly when recording the auditory brainstem response [2]. Different delay models have been utilized in constructing the chirps [3-5]. Among them, the CE-Chirp stimulus (in honor of Claus Elberling, PhD) has been extensively studied, and both broadband [5] and octave-band [6] types are available for clinical applications. During the construction of the CE-Chirp stimulus, its onset and offset times have been "adjusted" in such a way that it appears earlier than the conventional stimulus such as click [5]. In fact, the offset of the chirp is the onset of the click (0 ms) [5]. Consequently, when the CE-Chirp stimulus is used for recording electrophysiological responses, waveforms with earlier latencies are produced (which is not related to physiological factors). In relation to the studies of Özgür et al. [1] and Wang et al. [7], the shortest latencies of VEMP peaks noted for the chirp are indeed expected and do not necessary indicate that it is superior to other conventional stimuli.

In addition, we are currently conducting a study comparing VEMP outcomes between the 500-Hz tone burst and an "exact" custom-built chirp (with no onset/offset temporal adjustment) in healthy adults. Consistent with the study of Özgür et al. [1], our preliminary data analysis (30 ears) revealed significantly lower amplitudes of VEMP peaks for the chirp. In contrast, no significant differences were found in the latencies of VEMP peaks between the two stimuli (even though descriptively, the chirp produced slightly longer mean latencies than the tone burst). These findings further support that the latencies of VEMP peaks evoked by the chirp stimulus should be interpreted with caution, particularly when comparisons among different stimuli are made. Perhaps in this situation, the amplitude comparison is more appropriate for analyzing VEMP outcomes.

Nevertheless, we agree with Özgür et al. [1] that the 500-Hz tone burst is preferable to the octave-band chirp stimulus in recording VEMP because the tone burst produces much larger VEMP amplitudes.

Mohd Normani Zakaria, Zuraida Zainun, Cheu Lih Aw
Audiology Programme, School of Health Sciences, Universiti Sains Malaysia, Kelantan, Malaysia

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Corresponding Address: Mohd Normani Zakaria, E-mail: mdnorman@usm.my
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Author Reply

Dear Editor,

First of all, we thank Zakaria et al. for their interest and contribution to our manuscript entitled "Comparison of Tone Burst, Click, and Chirp Stimulation in Vestibular Evoked Myogenic Potential Testing in Healthy People." Measurement of vestibular evoked myogenic potentials (VEMP) is a relatively new test that has a wide range of application. An increasing number of studies have been published regarding VEMP in recent years. The overall objectives of these studies are standardizing VEMP and improving its clinical benefits. Our study aimed to evaluate the results of VEMP findings that were obtained using different stimuli. We compared the click, chirp, and 500-Hz tone-burst stimuli. [1] As stated by Zakaria et al., the chirp stimulus is usually preferred for auditory brainstem response. The obtained results with this stimuli were similar to data in the literature [2]. We agree with the authors that earlier latencies in VEMP responses with chirp are related to the construction of stimulus rather than physiological factors. Consistent with our study, Zakaria et al. obtained significantly lower amplitudes of VEMP peaks with their custom-built chirp compared with tone burst. In contrast, no significant differences were found in the latencies of VEMP peaks between the two stimuli in their preliminary data. The authors did not report how they modified the chirp stimulus. We believe that the differences in outcomes were related to the modification of the stimulus. The results reported in recent studies revealed that otolitic afferents, which are the start of the VEMP reflex arc, were more sensitive to stimuli at frequencies near 500 Hz. Walther and Cebulla obtained waves with longer latency and higher amplitude with chirp stimulus frequency at a specific range of 250–1000 Hz compared with tone burst and click stimulus. [3]. These data support the theory that the closer the stimulus is to specific frequencies near 500 Hz, the higher the amplitude and the more stable the waves are that can be obtained.

Consequently, our study aimed to present the data we had obtained using different stimuli in VEMP tests rather than demonstrating a superiority of any stimulus in terms of wave and latency differences. We believe that providing data regarding the standardization of VEMP using different stimuli and test techniques on different patient groups will contribute in improving the reliability and clinical use of this test.

Abdulkadir Özgür
Department of Otorhinolaryngology Recep Tayyip Erdogan University Medical Faculty, Rize, Turkey

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Corresponding Address: Abdulkadir Özgür, E-mail: akozgur53@gmail.com