

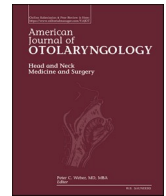


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American Journal of Otolaryngology–Head and Neck Medicine and Surgery

journal homepage: www.elsevier.com/locate/amjoto

Another response to the article “Comparison of pure tone audiometry thresholds and transient evoked otoacoustic emissions (TEAOE) in patients with and without Covid-19 pneumonia”

ARTICLE INFO

Keywords

Screening TEOAE
Covid-19
OAE amplitude

The article “Comparison of pure tone audiometry thresholds and transient evoked otoacoustic emissions (TEAOE) of patients with and without Covid-19 pneumonia”, published in your journal [1] caused methodological discussions rather than results [2,3]. The focus of discussion is the method of conducting the TEAOE test.

In his article, the author states that Maico-Easyscreen was used in the TEAOE measurements and the measurements were made in the range of 250–8000 Hz: “TEAOE measurements were performed using a Maico-Easyscreen® device (Berlin, Germany). The frequency range of 250–8000 Hz was used in the tests. The mean frequency amplitudes were recorded.” [1].

Kalcioglu criticized that Maico-Easyscreen is not a suitable device to collect TEAOE data as mentioned in the article [2]. The author's response to this criticism was as follows: “Although the Maico-Easyscreen® tool (Berlin, Germany) is mostly used for ABR screen in our country, it can also perform TEOAE test successfully when the software module is added. For this reason, TEOAE can be performed in some of the models of Maico-Easyscreen® in Turkey. Information on this subject can be obtained from the distributor company” ... “In our TEOAE test, we used measurement amplitude averages. TEOAE results were measured at 1000Hz, 1400Hz, 2000Hz, 2800Hz and 4000Hz for both the right and left ears and averaged” [3].

The technical problems that arise according to this article and subsequent discussions can be listed as follows:

1. Technically, TEOAE tests can give reliable results between 1000 and 4000 Hz [4]. Maico-Easyscreen performs the scanning TEAOE test in the range of 1400–4000 Hz [5]. For this reason, it is not technically possible to measure between 250 and 8000 Hz with TEAOE as Yıldız claims. Further, in his reply to Kalcioglu, Yıldız claimed that he carried out the test in the range of 1000–4000 Hz, which is not also possible because, as stated above, Maico-Easyscreen's lowest range is 1400 Hz.
2. Maico-Easyscreen gives the TEAOE test results as “pass” or “refer” in the test frequencies (1.4, 2, 2.8, 4 kHz). It does not give amplitude values. “Bar graph displays progress toward Pass at each frequency band” [5]. Therefore it is unexpected to have the emission amplitudes at every frequency band or their averages as Yıldız did. The

author needs to explain how he calculated TEAOE amplitudes in the 250–8000 Hz range (or 1000–4000 Hz range).

3. The main feature of OAE tests is frequency-specific analysis. For example, if no emission is observed at 4000 Hz, but OAE is recorded in the 1000–3000 Hz range, the outer hair cells are considered damaged in the 4000 Hz frequency region. However, the clinical value of this finding is lost if the OAE analysis is performed by averaging the frequency amplitudes. In addition, since 4000 Hz TEAOE amplitudes in adults are quite low compared to other frequencies [6], the value that this frequency band will add to the average will already be quite low. For these reasons, it is not very convenient for the OAE logic to work by averaging the amplitude of the frequencies. However, if the results are to be summarized by averaging, the explanation of the emission amplitudes in each frequency band will make the evaluation more realistic.
4. In the discussion section of the study, the author states that a slight decrease in emission amplitudes was observed at high frequencies: “These results showed that minimal impairment and minimal reductions in the amplitude occurred in high frequencies in patients, who recovered from COVID-19. However, such changes were found to be restored in the third month.” It is necessary to explain which frequency range is meant by high frequencies and how this decrease is detected with the test device which does not give the amplitude value.
5. While investigating the effect of the Covid-19, it is necessary to pay attention to individual differences as well as the overall results. If there is a low percentage of people with hearing loss due to Covid-19, statistical analysis between test and control groups may not reveal a significant difference due to a methodological error. Therefore, in addition to group comparisons, individual comparisons should also be made in the study. At least the standard deviations of the obtained values should have been given.
6. Shahnaz found TEAOE amplitudes of young adult Caucasians between 8.2 and 1.9 dB in the 1000, 1500, 2000, 3000 and 4000 Hz bands [7]. The 1–4 kHz average was 5.1 dB. These values are close to half of the average values given by Yıldız. While the average age in Shahnaz's subject group was around 26, in Yıldız's study, the average

<https://doi.org/10.1016/j.amjoto.2022.103664>

Received 15 May 2022

Available online 15 October 2022

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age was over 50. Emission amplitudes would be expected to decrease with aging [6]. However, Yildiz's findings gave the opposite results.

7. Yildiz excluded people with sudden hearing loss in his study. He made the definition of sudden hearing loss as follows: “In this study, patients with the criteria of ‘sudden sensorineural hearing loss’ were excluded. (A commonly used criterion to qualify for this diagnosis is a sensorineural hearing loss of greater than 30 dB over 3 contiguous pure-tone frequencies occurring within 3 days' period). Patients who did not meet this criterion were used.” In this case, it is expected that Covid-19 patients will be excluded from the study since they will show a hearing loss of more than 30 dB in 3 frequency bands within 3 days, which will be defined as “sudden hearing loss.” However, whether the “sudden hearing loss” is a result of Covid-19 will remain unclear. For this reason, it would be important for the author to indicate how many patients were excluded from the study with the criterion of “sudden hearing loss”.

References

- [1] Yildiz E. Comparison of pure tone audiometry thresholds and transient evoked otoacoustic emissions (TEOAE) of patients with and without COVID-19 pneumonia. *Am J Otolaryngol* 2022. <https://doi.org/10.1016/j.amjoto.2022.103464>.
- [2] . M. Tayyar Kalcioğlu, *American Journal of Otolaryngology–Head and Neck Medicine and Surgery*, doi:10.1016/j.amjoto.2022.103448.
- [3] Yildiz E. Response to “Letter to the Editor” by Kalcioğlu et al. “Comparison of pure tone audiometry thresholds and transient evoked otoacoustic emissions (TEOAE) of patients with and without Covid-19 pneumonia”. *Am J Otolaryngol* 2022;43(3). <https://doi.org/10.1016/j.amjoto.2022.103464>.
- [4] Kemp David T. Otoacoustic emissions, their origin in cochlear function, and use. *Br Med Bull* 2002;63(1):223–41.
- [5] EasyScreen New Born Hearing Screening |MAICO Diagnostics. <https://www.maico-diagnostics.com/products/oe/easyscreen>. Accessed 21nd April 2022.
- [6] Liu J, Wang N. Effect of age on click-evoked otoacoustic emission: a systematic review. *Neural Regen Res* 2012;7(11):853–61.
- [7] Shahnaz Navid. Transient evoked otoacoustic emissions (TEOAEs) in Caucasian and Chinese young adults. *Int J Audiol* 2008;47(2):76–83.

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