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**Tinnitus-Matcher—new feature**

The American Tinnitus Association defines tinnitus as "the perception of sound when no actual external noise is present". Tinnitus is usually subjective, that is, only the individual hears it but in rare cases can be objective where others can hear it as well. While it is commonly referred to as "ringing in the ears", tinnitus can be of perceived of many different sounds, including buzzing, hissing, whistling, swooshing, and clicking. Very infrequently, tinnitus patients report hearing music. The sound can be of high or low pitch and can be described as soft or loud. Tinnitus can be constant or intermittent. Although relatively rare, in some cases, tinnitus correlates with spontaneous otoacoustic emissions (SOAE).

Tinnitus is often caused by hearing loss or other underlying health conditions. Therefore, for those experiencing tinnitus, tinnitus matching is completed in addition to standard audiometry, which often includes pure tone and speech testing, loudness discomfort levels, acoustic immittance, and otoacoustic emission evaluations. Tinnitus matching is often conducted along with tinnitus questionnaires to determine the impact that tinnitus has on the patient since tinnitus can negatively affect a person's quality of life.

Tinnitus matching involves using different tones or noises to try to identify the patient's specific perception of the tinnitus that they are experiencing. It involves adjusting the pitch and loudness (frequency and intensity) of a signal to allow the patient to determine as close as possible, a match to the subjective perceptions of the sound that they are hearing. Tinnitus matching is done to provide information useful for tinnitus management.

Loudness and pitch matching are conducted after the audiologic evaluation. Much like standard audiometry, pitch matching is often started at 1000 Hz and the patient is asked

to identify if their tinnitus is higher or lower than the signal presented. The goal is to bracket the pitch to within a half octave and finally to match the pitch of the tinnitus. At the pitch-matched frequency, hearing threshold, and tinnitus loudness match are obtained in 1 dB steps. Initial loudness match is presenting the signal at 10-20 dB SL when normal hearing threshold levels are present and at 5-10 dB SL where hearing loss is present. Pure tones or narrow bands of noise can be used for the loudness and pitch matching.

The main differences between the Tinnitus Matcher to the pure-tone audiometry (PTA) module are that the frequencies can be set with a high resolution of down to 0.1Hz with levels that can be set with a step size as small as 1 dB HL. In addition, both ears can be independently stimulated. Stimuli also include, in addition to pure tones, pulsed and warbled tones, and narrowband noise. Tinnitus Matcher supports the same range of air conduction transducers as PTA. Another test that is often completed is the Octave Confusion Test. The goal is to confirm the octave of the patient's tinnitus. Patients with tinnitus can confuse the pitch of their tinnitus with a tone that is an octave above or below their tinnitus. The test is performed by presenting tones one octave above and one below the frequency that the patient selected during frequency matching.

In addition to loudness and pitch matching, the minimum masking level (MML) is found to make the tinnitus inaudible. A correlation between the MML and treatment efficacy has been identified. When there is an improvement with the patient's tinnitus there is a decrease in the MML (Jostreboff, Hazell & Graham, 1994). It has also been reported that when tinnitus masking is used as treatment, when the MML is less than the loudness match, benefit is considered likely and conversely, if the MML is greater than the loudness match, the success is less likely (Vernon, Griest & Press, 1990; Vernon and Meikle, 2000).

The minimum masking level (MML) is measured by presenting a stimulus that is adjusted so that the tinnitus is not perceived anymore. The stimulus type must be selected to be able to mask the tinnitus, i.e., it must contain sufficient spectral components of the tinnitus (Vernon and Meikle,2003). Either pure-tones or noise can be used depending on the spectral complexity of the tinnitus (AWMF guideline, 2021).

## References


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