

Testing for Otoacoustic Emissions

Discovered in the late 1970's by Dr. David Kemp was the capability of the cochlea to produce sound. The resulting sound is generated by the outer hair cells of the cochlea (inner ear). These sounds produced by the cochlea were in fact discovered to be a direct response from external auditory stimuli. Otoacoustic Emissions, OAEs are present in all normal-hearing ears. The absence of OAE's is a direct indication of hearing loss or middle ear pathology.

Two classifications of Otoacoustic Emissions exist as either Distortion Product (DPOAEs) or Transient (TEOAE's). Distortion Product Otoacoustic Emissions are generated by simultaneous stimulation of the outer hair cells by presenting two pure tones of different frequencies through an OAE probe. Reliable frequencies for such OAEs exist at or above 4kHz. Transient Otoacoustic Emissions are produced when the ear reacts to stimuli such as clicks or tonebursts. Reliable frequencies for this type of OAE exist at or below 1.5kHz.

The current type of method of testing for proper auditory response is pure-tone audiometry and tympanometry. These methods of testing solicit responses from the patients themselves. Such type responses include raising a hand, dropping a block depressing a button, etc. in response to an external audible tone. In other words, instruction and conditioning is required for the patient. Unfortunately, not all patients can be conditioned properly as to provide reliable feedback. Special needs children; newborns and ESL (English as a second language) students provide for just a few of the demographics unable to successfully participate in traditional pure-tone audiometry.

Recent developments in audiometric technology are now allowing for innovative methods of testing for proper hearing response. The ability or inability to measure the Otoacoustic Emissions from a patient's cochlea provides reliable information pertaining to hearing and middle and outer ear disorders. The way in which an OAE is detected involves an OAE probe with eartip to be inserted into the ear canal and sealed. The signal travels through the ear canal, the middle ear, and finally reaches the cochlea where the outer hair cells are excited. The excitable nature of these hair cells generates the

emission. The emission then travels back through the middle and outer ears and is detected by a highly sensitive microphone in the OAE probe. The emissions are very soft sounds that must be separated from environmental and biological sounds. Computer averaging and noise reduction techniques (sound booths) are used to differentiate the emissions from the noise. A PASS indicates normal OAEs and this correlates with normal hearing and proper cochlear function. A REFER means the OAEs were not present and suggests a possible hearing loss greater than 30 db (high or low) or an outer or middle ear disorder. Mentioned above is that both the stimuli and emission must travel from the outer ear through the middle ear before reaching the cochlea and back. For this reason, OAE tests are able to detect middle ear pathology as well as cochlear hearing loss.

Several advantages arise with the use of Otoacoustic Emission testing. The time required for traditional screening is nearly halved. In addition to time, the simplistic nature of the equipment allows for testing to be performed by nurses or trained volunteers in a scholastic setting. External noise associated with traditional methods of testing is significantly reduced. Most importantly, this type of screening is effective with difficult to test patients.

With Otoacoustic Emission come specific uses for certain OAEs. For example, high frequency Distortion Product emissions prove useful for ototoxic drug monitoring in young patients, as well as the effect of aging on DPOAEs. They also provide for prospective studies of noise-induced hearing loss.

Information obtained from:

- 1) <http://www.maico-diagnostics.com>
- 2) <http://www.earaces.com/oaes.htm>
- 3) <http://www.nicoletbiomedical.com/home.shtml>
- 4) http://www.viasyshealthcare.com/prod_serv/prodDetail.aspx?config=ps_prodDtl&prodID=69