

Assessment of Conductive Dysfunction: Wideband Acoustic Immittance

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Editorial

The conductive mechanism plays an important role in our hearing: the first stage of signal processing in the auditory system. While it consists of the ear canal, the crucial portion is the middle ear system, which transforms airborne sound into mechanical vibration and helps improve sound transmission into the fluid-filled inner ear. Hearing loss due to dysfunction of the middle ear system may be threatening to the quality of life for humans. For example, conductive hearing loss may significantly impact normal speech and language development of children. Assessment of middle ear dysfunction is essential for audiological diagnosis of hearing loss and differential diagnosis of ear diseases. For instance, middle ear dysfunction may cloud outcomes of newborn hearing screening. Acoustic immittance is the current clinical technique for assessment of middle ear dysfunction. The major procedures include tympanometry and acoustic reflex test. In these procedures, a single-frequency probe tone (e.g., 226 Hz and 1000 Hz) is used to estimate the acoustic impedance/admittance of the middle ear. Although they have been a clinical routine in audiology since 1970s, value of these procedures in assessment of conductive dysfunction has been limited.

Wideband Acoustic Immittance (WAI) is the most recently developed technique for evaluating middle ear transfer function. Compared with the conventional acoustic immittance technique, WAI uses a different calibration technique with the sound pressure in the ear canal measured in the presence of a probe single [1]. On the basis, several measures could be derived such as acoustic impedance/admittance and pressure reflectance. Energy reflectance (defined as the squared pressure reflectance, sometimes called power reflectance) has been investigated the most [2,3]. It represents the proportion of energy that is reflected back from the middle ear, which varies from 0 to 1. Its complement is referred to as energy absorbance. One advantage of WAI is that the outcome is minimally influenced by the position of probe in the ear canal if the reflectance measure is used. In other words, the reflectance measured at the canal is a good approximation of the reflectance at the eardrum. Another advantage of this technique is utilization of wideband probe signals, e.g. clicks and tone chirps. Thus, the middle ear transfer function is evaluated in a wide frequency range (e.g. from 226 to 8000 Hz).

Research on WAI has extensively initiated, for example, normative study in adults and infants [2]. Energy reflectance measure has been shown to provide superior performance in prediction of conductive hearing loss [4] and help improve newborn hearing screening outcomes [5]. The measure could be useful in the diagnosis of middle ear pathologies, e.g., otitis media with effusion [6], otosclerosis [7], and negative middle ear pressure [8]. The energy reflectance or absorbance measurement can also be performed with air pressure varied in the ear canal, known as wideband tympanometry [9,10].

WAI is an emerging technique for clinical audiology. There is a great need for additional research to increase the database [11]. This includes intensive research in various aspects of WAI, from effects of procedural/subject variables to clinical performance in identifying conductive dysfunction. It is undoubted that research in this arena would quickly grow in the era of online open-access journals. As an interdisciplinary academic journal, the Journal of Communication Disorders, Deaf Studies, and Hearing Aids would help accelerate dissemination of research findings among laboratory and clinical researchers worldwide.

Declaration of Interest

The author reports no conflict of interest.

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