3.1
Keynote Lecture

Recently developed measurement techniques and diagnostic apparatuses for the middle ear

H. Wada, Sendai; Japan

Compared with the cochlea, the middle ear is a relatively large organ, has a simple structure and is located close to the surface of the head. This means that the middle ear can be easily accessed. As a result, various kinds of measurement techniques have been developed and the middle ear function has been well analyzed and is understood to a great extent. When we speak, the amplitude of tympanic membrane vibrations is of nanometer order of two digits. This vibration is transmitted to the oval window of the cochlea by means of the three ossicles. The ossicles, which are supported by ligaments in the middle ear cavity, generally rotate around the axis between the anterior malleal ligament and the posterior incudal ligament, and the umbo and stapes have a piston-like movement. The main role of the middle ear is to match the low impedance of the air in the external auditory meatus to the high impedance of the cochlear fluids. In other words, the middle ear is an impedance transformer. Without this function, much of the sound energy would be reflected by the tympanic membrane. In my talk, among various measurement techniques and diagnostic apparatuses, I will focus on the following:

1. The middle ear function assessed by acoustic impedance meters such as conventional tympanometers with frequencies of 226 Hz and 1,000 Hz, a sweep frequency impedance meter, etc.

2. The dynamic behavior of the tympanic membrane and ossicles analyzed by laser Doppler velocimeters and the speckle interferometry technique.

3. Outcomes of ossicular chain mobility measured by diagnostic apparatuses (static and dynamic methods).

4. The function of the eustachian tube evaluated by an analyzer developed in Japan.

5. Effectiveness of finite element method analyses of the middle ear