

Release of the next generation of hearing aids

The Sankei newspaper has reported a warning by WHO that states, 'One billion young people are at risk of hearing loss from listening to loud music with portable devices, WHO – 2015'. According to WHO, in order to avoid ear function damage, the limit of listening to sounds of over 85dB is 8 hours, and only 15 minutes for sounds over 100dB. As a result of damaging the sensory receptor hair cells of the cochlea, noise-induced hearing loss occurs. Once these sensory hairs are lost, they do not recover. Consequently, noise-induced hearing loss results in permanent hearing loss.

Hearing aids destroy auditory organs

Hearing aids damage the ears in the same way that listening to loud music results in hearing loss.

A hearing aid is a device which picks up sound through a mic and amplifies it. Listening is facilitated by increasing the sound through speakers. In other words, an air conducted hearing aid compensates for loss of hearing by sending the amount of sound lost into the ear. The problem is, when that sound is over 85dB, through long term use of a hearing aid, hair cells are lost beginning with loss of high frequency sounds that affect consonants and then midrange sounds. This results in the failure to be able to clarify words, which is sensorineural hearing loss. Accordingly, when hearing aids are used for severe hearing loss, because users are listening continuously at volumes above 100dB, hearing ability will be damaged just as WHO has warned. In this way, the mechanism of hearing aids has caused this problem to occur, but there has been no valid alternative.

The use of air conducted hearing aids provides a temporary fix by increasing volume, but subsequently deprives the user of their remaining hearing and quality of life. A safe and effective alternative to this hearing aid system is required. Although bone conducted hearing aids which use vibration instead of sound are able to safely transmit audio information into the ear have been promising, as the performance of existing bone conducted hearing aids is inadequate, they are often used for patients with external auditory canal atresia etc, who are not able to use air conducted hearing aids.

Japan's state-of-the-art technology has resulted in the highest performing

bone conducted hearing aid ever produced

While the world has been waiting for the development of the next generation of hearing aids that are high performing and safe, Kimitaka Kaga, M.D., Professor Emeritus of the University of Tokyo (National Hospital Organization Tokyo Medical Center, Director of Honors Center, former Director of Japan Otology Society) reported in the medical journal, *Acta Oto-Laryngologica* (2006) about the results of performance experiments on the next generation of hearing aids using mice at the University of Tokyo, School of Medicine.

In the paper, the details are reported of a comparative experiment which applied the same magnetostrictive principle as the state-of-the-art GMT magnetostrictive sonar, (affecting the performance of hearing aids) to show the difference in information reproduction capability (Response speed) between two types of hearing aids. The results showed an overwhelming difference of over 100,000 times between the response time of conventional hearing aids (1 mil sec) and GMT bone conducted hearing aids (10 nano sec).

Clinical data of the effects of PRESTIN® hearing aid

Following the publishing of the above paper, development of a bone conducted hearing aid using a giant magnetostrictive transducer continued. Then in 2012, under the leadership of Professor Kimitaka Kaga, M.D., a grant was received from the Japanese Ministry of Health, Labour and Welfare ‘*Grant for support towards developing equipment for those with disabilities to gain independence away from caregiver*’ to collect clinical data of the effects of the completed PRESTIN® hearing aid device for severe hearing loss. Forty cases of patients with moderate to severe hearing loss were collected and analyzed at National Hospital Organization Tokyo Medical Center.

The analysis report of the clinical data which far exceeded existing performance limitations of existing hearing aids was submitted to the Ministry of Health, Labour and Welfare in April, 2014. The report can be downloaded from the website of the Ministry of Health, Labour and Welfare under the area, *Support towards developing equipment for those with disabilities to gain independence from caregiver*, entitled: ‘Development of unprecedented high-powered and high-quality bone conducted hearing aid’ (Development facility: DCC K.K.) In conductive hearing loss, sound from the outer ear goes to the eardrum but fails to be transmitted by the ossicles of the ear. Although it is possible to improve hearing by increasing volume, the result is that the hair cells will be damaged, dying due to apoptosis. But when this results in sensorineural hearing loss due to the loud volume, even raising the volume will not have any reaction to sound, air conducted hearing aids have no effect.

The results of 40 cases of clinical data from patients showed, PRESTIN® bone conducted hearing aid was able to hear all the sounds heard with air conducted hearing aids, including for sensorineural hearing loss. In addition, the sound quality of PRESTIN® bone conducted hearing aid naturally produces a high sound quality, and its quietness (no external sound) makes everyone want to listen to music again with PRESTIN®. The Ministry of Health, Labour and Welfare, 2014 ‘*Support towards developing equipment for those with disabilities to gain independence from caregiver*’ report on performance of PRESTIN® Performance from evaluation of measurement of 40 patient cases, conducted by Dr. Kimitaka Kaga, Tokyo Medical Center (National Hospital) Clinical Research Center (Sensory).

Types of hearing difficulty and suitability

1. Light-Middle range (25dB-70dB) hearing loss

(a) Conductive hearing loss Very good

(b) Sensorineural hearing loss Very good

2. Severe hearing loss (70dB-90dB)

(a) Conductive hearing loss Very good

(b) Sensorineural hearing loss Can expect good effect, depending on symptoms

3. Auditory Neuropathy Very good

4. Profound hearing loss (over 90dB)

(a) Conductive hearing loss Some instances of good effect, depending on symptoms

(b) Sensorineural hearing loss Some instances of good effect, depending on symptoms

5. Damage to cerebral cortex X No effect