

Guideline

Medicine General & Health Policy



A Position Statement on the Treatment of Hearing Impairment, Focused on Hearing Aids, From the Korean Otological Society Hearing Aid Study Group

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OPEN ACCESS

Received: Apr 25, 2025

Accepted: May 22, 2025

Published online: Jun 10, 2025

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ABSTRACT

Hearing impairment not only diminishes sound perception but also leads to various secondary disabilities; therefore, proper management is crucial for individual well-being and socioeconomic savings. This study establishes an expert consensus on the treatment of hearing impairment, primarily concentrating on hearing aids (HAs), to assist physicians. A modified nominal group technique was used to collect expert opinions about the management of hearing impairment with HAs. The expert panel consisted of 13 otologists from the Korean Otological Society Hearing Aid Study Group. The panel formulated and examined 12 subtopics, with each statement evaluated for consensus using a 9-point Likert scale. Statements with strong consensus were preserved, and those with weak consensus were either discarded or deliberated until agreement was achieved. The position statement discusses essential elements of HA utilization: candidacy, prescription, fitting, maintenance, and verification. It further offers direction on audiological and medical assessments, along with the qualifications and responsibilities of HA practitioners. The statement underscores the need for verification techniques, including coupler and real ear measurements, and stresses the importance of auditory rehabilitation for HA users. Furthermore, it examines the function of HAs in addressing tinnitus and hyperacusis and provides guidance for the management of hearing impairment resulting from external or middle ear complications.

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Disclosure

The authors have no potential conflicts of interest to disclose.

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Conceptualization: Lee JM, Lee DH. Data curation: Lee JM. Formal analysis: Lee JM. Methodology: Lee JM, Lee DH. Supervision: Lee JM, Shin SH, Suh MW, Choi SJ, Shin YR, An YH, Ahn J, Noh H, Moon IJ, Park MK, Park SN, Kim H. Writing - original draft: Lee JM, Shin SH, Suh MW, Choi SJ, Shin YR, An YH, Ahn J, Noh H, Moon IJ, Park MK, Park SN, Kim H, Lee DH. Writing - review & editing: Lee JM, Lee DH.

This position statement presents a thorough and organized methodology for addressing hearing impairment with HAs. It functions as a crucial resource for physicians, offering information vital to the diagnosis, treatment, and rehabilitation of hearing impairment and the management of related diseases. This declaration advocates for a comprehensive approach that combines professional skill, patient awareness, and societal support to effectively manage hearing impairment.

Keywords: Hearing Impairment; Hearing Aids; Consensus Development; Nominal Group Technique

INTRODUCTION

Hearing impairment affects more than 1.5 billion people globally, representing around 20% of the world's population. The International Classification of Functioning, Disability, and Health model transcends simple disease or impairment diagnosis, highlighting how individuals perceive and navigate their health conditions in everyday life and their degree of social participation.¹ Hearing impairment is not solely the inability to perceive sounds; it is increasingly acknowledged to have extensive effects on daily activities and social interactions.

Untreated hearing impairment is linked to several disabilities that affect both psychological and physical health.² For example, recent studies have emphasized the correlation between hearing impairment and dementia,³⁻⁷ highlighting the need for appropriate intervention. The use of hearing aids (HAs) in adults with hearing impairment is linked to a diminished risk of long-term cognitive deterioration and enhanced performance on cognitive assessments.^{5,8-11} Efficient management of hearing impairment could produce significant advantages for both individual well-being and economic savings.

Another significant issue associated with hearing impairment is academic achievement, which can be detrimentally affected if the hearing impairment is not well handled. In the absence of prompt assistance, individuals with hearing impairment face an elevated risk of diminished academic performance, postponed educational advancement, a greater likelihood of school dropout, and a reduced chance of pursuing higher education relative to their hearing counterparts. The correlation between hearing impairment and academic achievement is intricate, affecting cognitive and linguistic development (language acquisition, reading and writing proficiency, learning delays), school engagement (peer interactions, classroom participation, extracurricular activities), and overall educational experiences. Moreover, hearing impairment can significantly affect the behavioral and emotional well-being of teenage students, influencing their self-esteem and leading to behavioral difficulties.¹²⁻²²

Therefore, hearing impairment is a significant worldwide health issue that has attracted attention from international entities, notably the World Health Organization (WHO). Due to its extensive influence, successful treatment of ear and hearing impairments requires a multidisciplinary approach bolstered by coordinated national programs. The WHO has partnered with experts and stakeholders to create the World Report on Hearing, which establishes a framework for tackling hearing impairment globally.² Similarly in Korea, auditory health has emerged as a critical concern, especially in light of the aging population. According to the Korean National Health and Nutrition Examination Survey, approximately

30% of Korean adults aged 65 years and older have some degree of hearing loss (≥ 25 decibel hearing loss [dB HL] in the better ear).⁸ However, despite this high prevalence, the HA adoption rate remains below 20% among Korean older adults.²³ Furthermore, untreated hearing loss has been associated with increased risk of dementia and depression in this population.^{8,24} The government is exploring ways to support not only registered individuals with hearing loss but also the broader senior population. The rapid growth of the HA market reflects the growing demand for effective treatments. In addition, new technologies have expanded available options beyond traditional HAs to include personal sound amplification products (PSAPs) and implantable hearing devices. However, despite these advances, access to clear and fair treatment guidelines remains limited.

Therefore, a balanced perspective on auditory care and rehabilitation, as well as a more methodical and professional approach to HAs, is needed. The main aim of this position statement was to achieve consensus among professionals about the diagnosis and treatment of hearing impairment, while providing a comprehensive understanding of the diagnosis, treatment, and rehabilitation of hearing impairment. It could provide practical, evidence-informed guidance for the selection, fitting, verification, and rehabilitation of HAs in adults with hearing loss. The goal is to support clinicians in Korea with standardized recommendations that reflect both international best practices and national healthcare context.

METHODS

A modified nominal group technique (mNGT) was used to achieve expert consensus on “The Treatment of Hearing Impairment with Emphasis on Hearing Aids.” The nominal group technique (NGT) is a methodical consensus-building approach to systematically gather expert viewpoints and achieve consensus on a topic.²⁵

The expert panel for this research consisted of 13 otologists from the Korean Otological Society Hearing Aid Study Group. The lead facilitator presented the study objectives and derived 12 subtopics from participant feedback. Each participant was allocated a subtopic and individually developed statements pertinent to the study's aims. Those statements were then gathered, anonymized, and dispersed among the panel members for assessment.

Participants evaluated the need for each statement on a nine-point Likert scale. The assessment criteria were as follows: statements were preserved if a minimum of seven individuals evaluated them within the 7–9 range, signifying strong positive consensus. Statements were omitted if a minimum of seven participants ranked them within the 1–3 range, signifying strong negative consensus. Statements ranked between 4 and 6 or without a definitive majority for any score were subjected to additional discourse and reassessment until final agreement was achieved. This methodology guaranteed a thorough and equitable decision-making process.

RESULTS

Statement 1. Hearing rehabilitation methods for hearing-impaired individuals

Statement 1.1. Comparative analysis of PSAPs and HAs

1.11. PSAPs are over-the-counter gadgets intended to enhance environmental noises for particular activities, such as birdwatching or attending lectures. Conversely, HAs are controlled

medical devices designed specifically to augment auditory perception by amplifying sound and enhancing speech intelligibility.

1.12. PSAPs offer restricted amplification, perhaps benefiting patients with mild hearing loss in particular contexts. HAs provide a customized and frequency-specific amplification spectrum, rendering them appropriate for diverse degrees and configurations of hearing impairment. While certain high-quality PSAPs may provide limited benefit in controlled settings for individuals with mild hearing loss, HAs remain the gold standard due to their superior performance in speech recognition, listening effort, and sound quality, as well as their regulation and individualized fitting protocols.²⁶ Moreover, HAs can integrate sophisticated functionalities to manage problems such as tinnitus.

1.13. PSAPs are a fiscally prudent choice for temporary or infrequent use. Conversely, HAs are a long-term investment that offer personalized auditory rehabilitation and continual professional oversight.

1.14. A thorough auditory assessment and examination of auditory health is crucial—especially for selecting and precisely fitting HAs to align with an individual's auditory profile.

1.2. Indications for implantable HAs

1.21. Implantable HAs (middle ear implants, implantable bone conduction devices, and cochlear implants) can be alternative options for specific groups of individuals who cannot benefit sufficiently from conventional HAs.

1.22. When deciding on an implantable HA, the type and duration of hearing loss, degree of hearing loss, chief complaint of the individuals, specifications of each implantable device, and social factors should all be considered.

1.23. Bone conduction device implants are most beneficial for individuals with conductive or mixed hearing loss who cannot wear conventional HAs. Intractable otitis media and externa, congenital aural atresia, and single-sided deafness are typical disorders that might indicate the need for a bone conduction device implant.²⁷⁻²⁹

1.24. Audiologic criteria for bone conduction implants can vary depending on the specific devices. In general, a bone conduction threshold of 45 dB HL or less at 0.5, 1, 2, and 4 kHz is required.³⁰ To ensure a large and useful dynamic range (DR), a bone conduction threshold of 33 dB HL or less might be a safer criterion.³¹ Also, speech discrimination score (SDS) should be good.

1.25. The middle ear implant was first developed to treat sensorineural hearing loss, but it can also be used for individuals with conductive or mixed hearing loss. Individuals with intractable otitis externa or uncontrolled HA feedback can benefit from the middle ear implant.

1.26. The audiologic indications for the middle ear implant in cases of sensorineural hearing loss greatly overlap with those for conventional HAs. Typical indications include air and bone conduction thresholds of 45 dB HL (500 Hz), 50 dB HL (1,000 Hz), and 65 dB HL (2,000 Hz and 4,000 Hz) or less.³² SDS should be 50% or higher. Low-frequency amplification can be insufficient in some cases, and that should be taken into consideration.

1.27. Audiologic indications for a middle ear implant in cases of conductive or mixed hearing loss are bone conduction thresholds of 45 dB HL (500 Hz), 50 dB HL (1,000 Hz), and 65 dB HL (4,000 Hz) or better.³² SDS should be 50% or higher. A very high air conduction threshold is not a strict contraindication, but the middle ear should be clean and free of infection.

1.28. A cochlear implant is considered for individuals with severe to profound hearing loss. If the three-tone (0.5, 1, and 2 kHz) average of air and bone conduction thresholds is 70 dB HL or higher, or if SDS is worse than 40%, a cochlear implant is indicated.³³ In recent years, there has been a move to broaden the indications for cochlear implants because their outcomes are favorable and the chance of complications is very low. For instance, some argue that cochlear implants are beneficial if the air and bone conduction thresholds are 60 dB HL or greater and SDS is 60% or lower.³⁴ Additionally, more individuals are now receiving implants to treat single-sided deafness or asymmetric hearing loss.

Statement 2. Indications for HA use

2.1. HA candidacy is based on the interaction of audiological and non-audiological factors. Audiological factors include the degree and configuration of hearing loss and speech-recognition ability. Non-audiological factors include the extent of the communication difficulties, motivation, medical problems, and cost.

2.2. HAs can be considered for individuals with any degree of hearing loss, but severe or profound loss can limit the usefulness of HAs. Most HA users have a moderate degree of hearing loss (41–60 dB HL).³⁵

2.3. The configuration of hearing loss influences HA usage. Some configurations make it challenging to provide appropriate amplification with HAs and thus require other hearing rehabilitation methods. For example, high-frequency precipitous loss, in which hearing sensitivity is normal through 500 Hz and drops off dramatically (25 dB HL or more per octave) at higher frequencies, can be difficult to treat with traditional amplification strategies. In cases of rising audiograms, fitting could be troublesome due to the amplification of background noise.

2.4. Another audiological factor of HA use is speech-recognition ability. The effectiveness of HA is generally correlated with the SDS, and in cases of central auditory processing disorder, auditory neuropathy spectral disorder, or retrocochlear hearing loss, the benefit of HAs can be reduced. However, those conditions are not fully contraindicated, as there have been reports that HAs can be beneficial for individuals with low SDS.³⁶

2.5. Perceived difficulties in communication and motivation are important factors in HA candidacy. A person who has difficulty with communication is a candidate for an HA.

2.6. Some medical problems can be a barrier to HA use, such as microtia, externa otitis or ear drainage that cannot be controlled medically, contact dermatitis, dementia/cognitive impairment, and motor coordination issues such as Parkinson's disease. All such conditions should be evaluated before HAs are prescribed.

Statement 3. Examinations and evaluations before HA use

3.1. Children with any degree of hearing loss must be evaluated by otologists before they receive a prescription, and they must get regular follow-up. For adults, a medical evaluation

is not mandatory before purchasing HAs. However, we recommend that all ear conditions be evaluated by otologists for the following reasons: 1) to check for medically or surgically correctable factors, 2) to ensure an accurate diagnosis of the severity and configuration of hearing loss, 3) to check for medical conditions appropriate for HA use, 4) to ensure the appropriate selection of hearing rehabilitation methods (surgical interventions, HAs, or implantable hearing devices), 5) to ensure safe and optimal amplification. To read more about correctable factors, please refer to statement 12.

3.2. Pure-tone audiometry (PTA) evaluates hearing sensitivity across frequencies from 250 Hz to 8,000 Hz. It determines the degree and configuration of hearing loss.

3.3. Speech audiometry evaluates an individual's ability to listen and understand everyday speech sounds (mono-syllabic and bi-syllabic words). The SDS reflects the percentage of words correctly identified. The benefits of HAs increase with higher scores, but individuals with scores < 50% have also shown significant benefits from HAs.³⁶

3.4. The most comfortable level (MCL) and uncomfortable level (UCL) are used in suprathreshold speech testing. MCL is the sound intensity at which a person feels most comfortable listening to speech, usually 35–40 dB HL above the speech reception threshold (SRT). It helps to determine the HA gain settings. UCL is the point at which sound becomes uncomfortable or painful, typically 75–90 dB HL above the SRT. The DR is the difference between the SRT and MCL. When fitting HAs, the output should be set within the DR. A DR greater than 45 dB HL is ideal for HA use, 30–45 dB is average, and below 30 dB might require a compression amplifier.

3.5. The auditory brainstem response and the auditory steady-state response are objective test methods that assess hearing by recording electrical activity from the cochlea to the brainstem in response to sound stimuli. They are used to determine the degree and configuration of hearing loss when subjective tests (PTA, speech audiometry, MCL, UCL, etc.) are unavailable.

3.6. Assessing hearing in children is challenging, with reliable evaluations using methods such as PTA and speech audiometry typically possible around age five. Other subjective tests, such as behavioral and visual reinforcement audiometry, are adapted to the child's developmental stage. However, limited cooperation from young children can reduce the reliability of these tests. A comprehensive approach that combines skilled subjective assessments with objective measures can greatly improve the accuracy of pediatric hearing evaluations.

3.7. Questionnaires can be used to assess and determine hearing status or the need for HAs. Representative questionnaires are unaided scores from the Abbreviated Profile of Hearing Aid Benefit and the Hearing Handicap Inventory for the Elderly. They show good correlation with the reduction in activity limitation following hearing rehabilitation, and validated Korean versions are available.^{37,38}

Statement 4. Selection of aided ear(s) for HA(s)

4.1. Binaural listening is beneficial in localizing sound, frequency selectivity,³⁹ discrimination ability in both quiet settings and especially noisy and reverberant settings, and quality of sound. It is also recommended when using HAs.

4.2. In cases of bilateral symmetric hearing loss, bilateral HAs are the best option. However, half of individuals with bilateral symmetric hearing loss prefer to use unilateral HAs for

various reasons, such as cost or binaural interference.⁴⁰ Neither right nor left provides better or worse audiologic benefit, so the side can be chosen based on factors such as the individual's physical status (right side for right handed people, easier to fit auditory canal, etc.) or listening environment (right side for taxi drivers, etc.).

4.3. In cases of unilateral mild to moderate hearing loss with normal hearing on the other side, an HA is recommended to allow the person to benefit from binaural hearing.⁴¹

4.4. In cases of asymmetric hearing loss, two HAs are the best option. If individuals choose to use an HA on only one side, the 60 dB HL rule (fitting the ear with a four-frequency pure-tone average threshold closer to 60 dB HL) can be applied.⁴²

Statement 5. HA prescription and buying process

5.1. Licensed HA practitioners, otologists, and HA dispensers can sell HAs in South Korea.

5.2. An HA prescription is tailored to an individual's specific needs and includes the following information: the individual's name, issue date, expiration date, prescribing provider's name and license number, assessment results (audiometry, including air and bone conduction thresholds and SDS), type and style of the device, and medical need for the recommended features.

5.3. HA practitioners should provide the following information before selling: type and style of HAs that will most meet the individual's needs, the special features (e.g., connectivity to wireless systems) the user's HAs might need to fit their lifestyle, the cost of the HAs, any non-refundable cost when individuals return the HAs after a trial or adjustment period (return policy), whether there is a warranty and if it can be extended, what is covered by the warranty, and whether the warranty covers maintenance and repairs.

5.4. HA practitioners must give users: a copy of the contract, information about the warranty on the prescription HAs that user purchases, a user guide for prescription HAs, a notice that the user may cancel the purchase, and the cancellation fee. The HAs must show the manufacturer or distributor name, model name or number, serial number, and year of manufacture.

5.5. For maintenance, HA practitioners should show clients how to care for their HAs and explain the repair process (e.g., the name, address, and phone number of the service provider; length of the warranty; cost of the warranty; how much the user must pay before the warranty applies; all other warranty terms and conditions). Regular follow-up is needed for fitting, and clients should be told whether the HA can be adjusted if their hearing loss worsens.

Statement 6. Requirements for HA practitioners

6.1. HA practitioners, including otologists, audiologists, and HA dispensers, must have specialized knowledge and clinical experience in audiology, speech-language pathology, or the hearing sciences. It is recommended that they complete a formal curriculum of training programs for HA fitting and dispensing, in addition to a foundational course in audiometric testing from recognized educational institutions and organizations. These programs often involve coursework in acoustics, anatomy and physiology, psychology and linguistics, audiology, HA technology, auditory rehabilitation processes, and HA fitting. These programs should cover topics such as auditory anatomy and physiology, psychoacoustics, auditory assessments, hearing devices, and auditory rehabilitation. These educational requirements

can be confirmed by certification and licensing; for example, a doctor of audiology degree, otolaryngologist license, or audiologist certificate.

6.2. HA practitioners must provide practical assistance to hearing-impaired individuals in all processes, including the selection, prescription, and proper management of HAs. HA practitioners could explain the widespread provision of HAs as their first-line clinical management. HA practitioners should assist individuals in selecting the appropriate HA by considering factors such as the degree and type of hearing loss, age, financial status, motivation for purchase, and level of social activity. HA practitioners should advise individuals to seek medical consultation upon identifying any medical conditions that could affect the use or effectiveness of HAs. HA practitioners should provide the proper amplification and solve problems that occur during the process of wearing HAs.

6.3. HA practitioners need the ability to manage a hearing testing room with audiometric equipment and a soundproof booth and a consultation room equipped for fitting and verifying HAs. It is recommended that these facilities and equipment be constructed and operated in compliance with applicable regulations. They should undergo regular inspections and be calibrated periodically to ensure their accuracy and proper functioning.

Statement 7. HA fitting and management

7.1. To provide qualified HA fitting services, educational, facility, equipment, and ethical requirements must be met. The educational requirements for HA practitioners were described in statement 6.

7.2. Facility requirements: the HA fitting management process must be conducted in facilities that are appropriately separated and compartmentalized. Any consultation area shall be sufficiently private so that no other persons within the facility can overhear conversations taking place. Facilities should be clean, safe, and easily accessible to the disabled. Audiometric testing rooms shall comply with the maximum ambient noise levels set by KS I ISO8253-1. If sound field audiometry is needed, the ambient noise levels shall comply with KS I ISO8253-2 for measurable threshold levels down to 20 dB HL. Fitting areas also require a controlled acoustic environment in which the ambient noise with no dominant pure-tone component is less than 40 dBA.

7.3. Equipment requirements: a range of equipment is needed to provide quality services.⁴³

7.3.1. Audiometric equipment: for pure-tone audiogram, use an audiometer to test air conduction and bone conduction thresholds, using masking if necessary. PTA can also be used to measure the MCL and UCL levels. The procedures and requirements for PTA and speech audiometry are presented by an audiometer through a transducer, e.g., an earphone, bone vibrator, or loudspeaker arrangement (for sound field audiometry) and should comply with KS I ISO8253-1 and KS I ISO8253-3. The requirements for sound field audiometry using pure tones and narrow-band test signals are presented by one or more loudspeakers and should comply with KS I ISO8253-2.

7.3.2. Equipment for otoscopy and earmold impressions: An otoscope with specula of various sizes should be available to examine the ear canal and eardrum. Equipment for taking ear impressions, such as an impression syringe containing ear impression material and an ear block, should also be available.

7.3.3. HA programming equipment: A computer system with hardware and software appropriate for programming hearing instruments and storing relevant client and fitting data must be available.

7.3.4. Electroacoustic measurement equipment: Electroacoustic equipment should be available to measure HA characteristics in an acoustic coupler or ear stimulator. The measurement and estimation of the real-ear acoustical performance characteristics of air-conduction HAs and the measurement of certain acoustic properties of the ear related to the application of HAs are recommended to comply with KS C IEC61669. It is recommended that the calibration interval for electroacoustic measurement equipment not exceed 12 months.

7.4. Ethical requirements: HA practitioners should always strive to provide the best solution for their clients. When dealing with customers, HA practitioners must respect and keep confidential all personal information collected. HA practitioners need to collaborate and communicate with other healthcare practitioners to provide the best possible care to their clients. If it is determined that communication or hearing problems might be caused by a medical condition requiring medical attention, a referral to the appropriate healthcare provider should be made.

7.5. Post-fitting follow-up visits are recommended at least once within 4 to 6 weeks after the initial HA fitting, and subsequently every 3 to 6 months based on individual needs. These follow-up sessions should include verification of HAs, assessment of user satisfaction (e.g., through self-report), and counseling on device use, communication strategies, and auditory rehabilitation when needed.

Statement 8. Verification of HAs: coupler and real ear measurements (REMs)

8.1. The electroacoustic performance of HAs can be measured using a coupler, a small cavity that connects the HA sound outlet to a measurement microphone.^{44,45} The HA analyzer, or a test box, generates sounds of a required sound pressure level (SPL) at the HA microphone. For practical reasons, coupler measurements are not performed routinely, only when the HAs fail to produce the proper output or gain after fitting.

8.2. There are two types of couplers, the “2cc coupler,” which approximates the volume of the human ear canal, and the more advanced “ear simulator” coupler, which mimics the acoustic impedance of the human ear more closely to provide a more accurate representation of how the HA will perform in real life.

8.3. The American National Standard Specification of Hearing Aid Characteristics (ANSI S3.22-2003-2014 [R2020]) gives a full description on the measurement parameters of the 2cc coupler. KS C IEC 60118-7 also gives recommendations for measuring the performance characteristics of particular HA models for production, supply, and delivery quality assurance purposes.

8.4. REM is a crucial procedure when fitting and verifying HAs. It involves measuring the sound levels in the ear canal of an HA user to ensure that the HA is delivering the amplification appropriate for their hearing loss, and it provides an objective assessment of how well the HA is compensating for the user's hearing loss. Therefore, HAs should be verified and programmed using REM to a prescriptive target, instead of using no verification with a first-fit.⁴⁶

8.5. The measured SPL is compared with target levels, which are based on prescriptive fitting formulas (e.g., NAL-NL2, DSL). These targets are calculated based on the individual's audiogram (hearing loss profile) and desired amplification. If the measured response does not match the target, the HA's settings should be adjusted using changes to the gain, frequency response, compression settings, or other parameters. The measurement is repeated after the adjustments to verify that the HA is now providing the correct amplification across all relevant frequencies. Using the Speech Map to ensure that the HA delivers appropriate amplification across all speech frequencies can improve speech understanding in comfortable and natural sound, leading to high user satisfaction.

8.6. Accurate REM requires a skilled audiologist who is experienced in performing and interpreting these measurements. A probe tube is inserted into the ear canal alongside the HA. The tip of the tube is placed close to the eardrum, allowing it to measure the sound levels directly at the eardrum. The HA is turned on, and the user is exposed to various sounds, typically speech or noise at different frequencies and volumes. The probe tube measures the SPL in the ear canal.

8.7. In children, even though REM is a crucial process of verification, cooperation issues can make it technically difficult to perform in many cases. Alternatively, the real ear to coupler difference (RECD) is recommended for young children. Changes in RECD occur most rapidly during the first year of a baby's life.⁴⁷ Although the RECD is a valuable alternative to in situ HA verification for children, barriers such as child cooperation can still limit its use.^{48,49}

Statement 9. Auditory rehabilitation after wearing HAs

9.1. Audiological rehabilitation (AR) is the process of providing training and management to improve hearing abilities in individuals with hearing loss. AR can help individuals with hearing loss adapt to HAs.

9.2. The components of AR include education and counseling about adjusting to hearing loss and HAs, making the best use of HAs, listening practice, managing conversations, and psychological therapies with emotional support.

9.3. Structured auditory and cognitive training might help HA users learn to make perceptual distinctions among sounds and subsequently increase their communication skills. Recently, computer/smartphone-based AR programs have been developed and widely used. They provide the huge advantage of allowing individuals to train themselves at home.

9.4. AR can help hearing-impaired individuals enhance their use of communication strategies. However, limited evidence supports the clinical effectiveness of AR in terms of better use of HAs, enhanced use of communication strategies, or improved hearing loss–related quality of life, mainly due to the lack of well-designed studies.

9.5. Well-designed, systematic, randomized-controlled studies are needed because some HA users could benefit from AR beyond the professional fitting of HAs and basic counselling.

Statement 10. Opinions on HA repair and replacements

10.1. HAs are sophisticated electronic devices that are susceptible to damage from physical impact, moisture, and the accumulation of dirt or debris. Repairs are essential when adequate sound amplification is compromised. Even with proper care, HAs typically

require replacement every 5–7 years, as newer models offer advances in sound processing, connectivity, and battery performance.

10.2. The most common factors affecting HA performance are earwax buildup, humidity, and battery-related issues. To minimize the need for repairs, it is crucial to educate users on proper HA usage, including battery replacement, earwax prevention, cleaning, and storage methods to ensure that the devices remain dry and in good working condition. Additionally, users should be informed about the appropriate intervals for device repair and replacement.⁵⁰

10.3. When an individual presents with HA malfunction, the initial step is a visual inspection for exterior damage and cleaning any earwax surrounding the microphone, speaker, or vent. Replacing the battery with a new one can help confirm whether the device is functioning properly. A stethoscope can also be used for a basic diagnostic check to assess for sound distortion, intermittent operation, acoustic feedback, and internal noise. These routine checks should be conducted during regular individual visits as well.

10.4. If the following issues persist despite routine troubleshooting, manufacturer-level repairs might be necessary.⁵¹ 1) Distorted or no sound output: A lack of sound or distorted output can indicate problems with the microphone, receiver, or internal circuitry. 2) Intermittent operation: Sporadic functioning could point to issues with battery contacts, wiring, or internal components. 3) Persistent feedback: Unresolved feedback, despite reprogramming, can be caused by issues with the tubing, earmold fit, or internal components. 4) Physical damage: Visible damage, such as cracks in the casing, broken battery doors, or damaged tubing, usually requires professional repair. 5) Moisture damage: Exposure to moisture from sweat, humidity, or accidental water exposure can cause malfunctions and require repair to restore functionality. 6) Low or weak volume: Consistently low volume could indicate clogged tubing, microphone issues, or other internal problems. 7) Battery problems: Rapid battery depletion or failure to power on, even with a new battery, could signify power management system issues. 8) Connectivity issues (for Bluetooth-enabled devices): If a Bluetooth-enabled HA struggles with connectivity to external devices, a software reset or repair might be needed.

10.5. In general, repairs should be pursued if the problem can be resolved without affecting the device's overall longevity or performance. However, replacement is recommended when the HA is outdated, no longer meets the user's hearing needs, or becomes more expensive to repair than replace.

Statement 11. Feasibility of HA use for hearing problems other than hearing loss: tinnitus and hyperacusis

Statement 11.1. Role of hearing aid in tinnitus management and tinnitus retraining therapy

11.1.1. HAs can be recommended as a sound therapeutic modality for patients with tinnitus and hearing loss. Based on the neurophysiological model of tinnitus, as well as a rather recently proposed tinnitus brain network hypothesis, the generation and persistence of tinnitus is closely related to the reorganization and filling-in phenomenon of the brain, which is known to be a compensatory mechanism that the brain uses to correct hearing deficits caused by hearing loss.⁵²

11.1.2. Counseling about the effect of HAs on tinnitus is essential to optimize adaptation to HAs in tinnitus patients with hearing loss. The role of the HA needs to be fully understood

by the patients, and the full-time use of HA should be emphasized to facilitate habituation to the perception of tinnitus, which might cure it.

11.1.3. For tinnitus patients with mild to severe hearing loss who show feasible speech-recognition ability (SDS greater than 50%), any proper type of HA can first be considered as a sound therapeutic modality to manage the tinnitus. The HAs need to reach a functional gain near to the normal hearing level at all frequencies to induce habituation to the perception of tinnitus and thus overcome the fill-in phenomenon of the brain with a sufficient sound stimulus. A step by step increase in the functional gain up to the normal hearing level should be the final goal to both achieve successful tinnitus management and optimize adaptation to the HAs.

11.1.4. Severe tinnitus with any degree of hearing loss and low speech recognition ability can also be controlled by HAs. However, the patient's expectations for how much the HAs will change their hearing ability need to be adjusted by counseling in advance. HAs in this condition will not be beneficial for speech recognition and will mainly be used to control the tinnitus. For patients who strongly desire both better hearing ability and tinnitus reduction, a bone conduction implant or cochlear implant can be more beneficial than conventional HAs.

11.1.5. Patients suffering from severe tinnitus with normal hearing at speech frequencies and only high frequency hearing loss can be managed with sound generators, but they are also good candidates for HAs.⁵³ Open-type HAs with sound generators are also beneficial to these patients because the noise from the sound generator induces an immediate perception of tinnitus, and a proper functional gain from the HAs at all frequencies accelerates the habituation of that perception. Moreover, full-time daily use of open-type HAs with sound generators is highly effective due to the reduced occlusion effect and better hearing ability, even with the background noise coming from the sound generators.

Statement 11.2. Role of hearing aid in hyperacusis management strategy

11.2.1. Hyperacusis, defined as decreased sound tolerance caused by abnormally strong reactivity of the auditory pathways to sound, needs to be evaluated and managed in patients with hearing loss and tinnitus.

11.2.2. Due to the decreased sound tolerance, hyperacusis should be always managed first, before considering hearing rehabilitation with HAs. Enhanced sound or speech signals coming from HAs usually cause an exaggeration of hyperacusis and a failure of HA use.

11.2.3. Hyperacusis, diagnosed by subjective decreased sound tolerance and a low low-density lipoprotein, can usually be managed by sound generators. A gradual but substantial increase in the volume of sound generators from sub-threshold to a higher level is recommended.

11.2.4. Hyperacusis accompanied by hearing loss can be managed by open-type HAs with sound generators. The initial management needs to focus on the hyperacusis by first using a sound generator mode with no or very low gain. Very slow increases in the functional gain of the HAs are crucial for these patients to prevent a relapse of hyperacusis. The HA alone mode can be used for hearing rehabilitation after the hyperacusis has been successfully treated or cured.

Statement 12. Recommendations for HA use in cases of external or middle ear issues

12.1. In cases of hearing loss caused by external or middle ear problems, it is crucial to first assess whether the issue can be resolved by an otologist before deciding to use HAs. In accordance with statement 3.1, a medical evaluation by otologists is no longer required before adults may purchase an HA; however, HA practitioners are obligated to adhere to the "red flag" system. It is strongly recommended that individuals experiencing difficulty hearing undergo an accurate diagnostic assessment and receive counseling to determine the most suitable AR method.

12.2. Statement 12.1 is particularly relevant when the issue can be resolved with a simple procedure or surgery. For example, tympanostomy tube insertion for middle ear effusion, myringoplasty for a clean tympanic membrane perforation, or ear wax removal for ear canal obstruction caused by cerumen impaction can achieve better and more cost-effective results than HAs. Even in cases in which more complex surgical treatment is required, the primary goal should be the restoration of hearing through curative treatment rather than HAs.

12.3. Nonetheless, it is important to keep in mind that HAs can sometimes be the most effective option, especially when hearing loss is caused by external or middle ear problems and SDS is relatively good. When serious surgical complications (e.g., total hearing loss) are a concern, the individual's overall health condition is not suitable for surgery, postoperative care is not feasible due to geographical limitations, or when HAs are the most cost-effective option, it might be advantageous to use HAs for AR, even if external or middle ear problems are present. Because many factors can influence this decision, a comprehensive assessment is essential.

12.4. Even if HAs are chosen for an individual with an external or middle ear issue, appropriate intervention by an otologist is still necessary. The fitting of HAs without a thorough evaluation of the external and middle ear conditions can sometimes lead to problematic complications.⁵⁴

12.5. The earmold or earpiece of HAs can potentially lead to infections in the external and middle ear. If the occurrence of otorrhea due to chronic otitis media is a concern, the use of HAs with an external ear insert might not be appropriate. Even if the disease is stable at the time of HA fitting, it is important for the individual to understand the potential risks of infections, such as frequent otorrhea. As discussed in statement 1.2, implantable HAs could be a better option for those patients.⁵⁵⁻⁵⁷

CONCLUSION

This study used a mNGT to compile a position statement about the treatment of hearing impairment, focused on HAs. It was crafted by otological experts to offer a balanced understanding of the diagnosis, treatment, and rehabilitation of hearing loss using HAs. It summarizes issues to consider when prescribing HAs and presents the indications for other AR methods in patients with hearing loss. It includes information on selecting and evaluating individuals for HA use and information and appropriate management practices when providing HAs. Furthermore, it describes AR after wearing HAs and other auditory benefits that can be obtained through HAs, such as treating tinnitus and hyperacusis.

In this study, expert opinions were collected using the mNGT technique. While mNGT is a structured method for group decision-making, it also presents certain limitations. One limitation is the potential for dominance bias, where more vocal or authoritative participants may disproportionately influence the consensus outcome. Additionally, mNGT typically involves a limited number of experts, which may restrict the diversity of perspectives and lead to reduced generalizability of the recommendations. To address these limitations, the present study adopted an anonymous response format and incorporated structured item-by-item evaluation to minimize potential bias arising from dominant participants or group dynamics.

Hearing impairment is not a simple problem of not being able to hear sounds, but a cause of many secondary disabilities. Therefore, the appropriate management of hearing impairment is essential for both individuals and society at large. Managing hearing impairment requires a multifaceted approach, including personal understanding of hearing loss, a professional approach, and social support. This positional statement offers clinicians a better understanding of and proper approach to the clinical practice of offering HAs.

ACKNOWLEDGMENTS

This study was supported by a grant from the E.N.T. Fund of the Catholic University of Korea, awarded in the program year of 2025.

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