Guidelines for the Audiologic Management of Adult Hearing Impairment

Task Force Members

Michael Valente, Chair
Harvey Abrams
Darcy Benson
Theresa Chisolm
Dave Citron
Dennis Hampton
Angela Loavenbruck
Todd Ricketts
Helena Solodar
Robert Sweetow

1. INTRODUCTION

This document was prepared by the American Academy of Audiology Task Force for Guidelines for the Audiologic Management of Adult Hearing Impairment. The specific goal of this document is to provide a set of statements, recommendations, and strategies for best practice in the provision of a comprehensive treatment plan for the audiologic management of adults with hearing loss. Specific statements and recommendations were made by initially reviewing the existing scientific evidence published in peer-reviewed and non-peer-reviewed journals. When direct evidence (i.e., evidence directly relating clinical procedures to the principal health outcomes) was not available, both indirect evidence, which involves examining two or more bodies of evidence to relate the clinical procedures to the principal health outcomes,[1] and consensus practice were considered in making recommendations. This guideline addresses the technical aspects of hearing aid selection, fitting, verification, and validation, but within the context of a comprehensive treatment plan. This guideline does not address treatment with cochlear implants.

In the process of making specific statements, recommendations, and strategies, careful consideration was given to the elements of care that optimize patient outcomes. The primary effects of hearing loss are addressed by the World Health Organization's International Classification of Functioning, Disability, and Health's (WHO-ICF) classification b230 which relates to hearing function, specifically, the function of sensing the presence of sounds and discriminating the location, pitch, loudness, and quality of sounds.[2] Thus, primary outcome measures for hearing aid use assess the effects of the treatment in terms of improving hearing functions, a process often referred to by audiologists as "verification." The presence of a hearing impairment can result in activity limitations and participation restrictions as described in the ICF classification scheme.[2] For example, a person with a hearing loss may have difficulties in receiving spoken messages (ICF classification d310), engaging effectively in conversations (ICF classification d350), learning through listening (ICF classification d115), remunerative employment (ICF classification d850), engaging in some forms of recreation and leisure (ICF classification d920), attending religious services (ICF classification d320), and so forth. Both environmental (i.e., external) factors, which comprise the physical, social, and attitudinal environment in which people live, and personal (i.e., internal) factors or those features of the patient that are not part of a particular health condition or state will influence the effect of the impairment, activity limitations, and participation restrictions on the health-related quality of life (QOL) of a person who has a hearing loss.[3] If hearing aids and other hearing assistive technology are successful in reducing a hearing impairment, activity limitations and participation restrictions related to communication should also be alleviated. Improvements in quality of life occur when activity limitations and participation restrictions are reduced. When the audiologic management of hearing impairment is placed within a comprehensive rehabilitative approach, outcomes of hearing aid use are also measured in terms of activity, participation, and QOL. Audiologists often refer to outcomes measured in these domains as “validation” of treatment.

1.1 Need for a Guideline for Audiologic Management of Hearing Impairment

Approximately 28 million Americans have a hearing loss, making it one of the most prevalent chronic health conditions in the United States. Hearing loss affects people of all ages, in all segments of the population, and across all socioeconomic levels. While approximately 17 in 1,000 children under age 18 have hearing loss, the incidence increases with age so that approximately 314 in 1,000 people over age 65 have hearing loss. There are many causes of hearing loss, including heredity, disease, trauma, long-term exposure to damaging levels of noise, or ototoxic medications. Hearing loss occurs as a result of damage to the outer and middle ears (the conductive component of hearing) and/or damage to the inner ear (the sensory and/or neural component of hearing). It can range from mild to total loss of hearing. Hearing aids are particularly useful in improving the hearing and speech understanding of patients with hearing loss.[4]

The most current national guideline in the United States designed to address issues related to management of hearing loss in the adult population was published in 2000.[5] Since the development of that guideline, many advances have occurred in the field of audiology and in hearing aid technology, as well as in the methods used to verify and validate the outcomes of the selection and fitting process. The National Guideline Clearinghouse[5] of the U.S. Agency for Healthcare Research and Quality[7] considers for review only those guidelines developed, reviewed, or revised within five years. Additionally, the management of hearing impairment, within a comprehensive treatment plan, involves more than a simple technical matter of hearing aid fitting. It involves the provision of a systematic approach, supported by evidence, which addresses not only the hearing impairment, but also the co-occurring activity limitations, participation restrictions, and consequent reductions in QOL. Statements, recommendations, and strategies made within this guideline thus address the entire treatment process. This guideline is not considered static; every five years, the American Academy of Audiology will review its recommendations and determine if they require modification as evidence, technologies, and clinical practices evolve.

This guideline is not intended to serve as a standard to dictate precisely how hearing aids should be selected, verified, or validated. Rather, this guideline is intended to provide several “paths” which audiologists may follow in order to decrease variability of outcomes and increase the probability for user satisfaction and benefit. The audiologist, however, has the freedom to implement segments of the guideline that are appropriate to his/her clinical environment and individual patients. In addition, this guideline can help inform physicians, reimbursement agencies, government agencies, the hearing health-care industry, and patients about what the research evidence reveals are current best practices related to hearing aids and other, non-medical treatment services for adults with hearing loss. Finally, although this guideline addresses the technical aspects involved in the fitting of hearing aids, the audiologist is reminded that the process of fitting hearing aids is an ongoing process requiring joint participation of the audiologist, patient, and family/caregivers.

1.2 Guideline Development Process

The process of developing this guideline was evidence-based when possible. Evidence-based practice integrates clinical expertise with the best available clinical evidence derived from systematic research. Where evidence is ambiguous or conflicting, or where scientific data are lacking, the clinical experience of the task force was used to guide the development of consensus-based recommendations. The review of the literature, evaluation of evidence, and development of the guideline proceeded in sequential steps.

The task force identified the following two guidelines as appropriate starting points for the identification of the processes involved in the audiologic management of adult hearing impairment.

- The Guidelines for Hearing Aid Fittings for Adults[8]
- The Audiology Clinical Practice Algorithms and Statements[5]

Review of these guidelines resulted in the identification of four general process areas: (1) Assessment and Goal Settings; (2) Technical Aspects of Treatment; (3) Orientation, Counseling, and Follow-up; and (4) Assessing Outcomes. At least two task force members were assigned to each of these general areas to search the literature to identify the best available evidence to provide support for the development of key recommendations. In searching the literature, task force members first sought to identify studies at the top of the hierarchy of study types. Once definitive clinical studies that provided valid relevant information were identified, the search stopped. The search was extended to studies/reports of lower quality (observational studies) only if there were no higher quality studies. Due to the breadth of topics reviewed for this guideline, a detailed description of inclusion of specific search terms, search engines, and "hits" would be prohibitive.

The task force members assigned to each area reviewed and graded the evidence using the rating scheme described below. The Quality of Evidence Ratings (Table 1.1) and Grades for Recommendation (Table 1.2) were adopted for use after members of the task force were oriented to the evidence-grading process.[9] In addition, it was decided if the evidence was “Effective” (EV) or “Efficacious” (EF). “EV” is evidence measured in the "real world" while “EF” is evidence measured under *laboratory or ideal* conditions. All task force members reviewed the recommendations and evidence grading in each of the four general process areas and agreed on the levels of quality assigned.

TABLE 1.1: Quality of Evidence (QE)

Level	
1	Systematic reviews and meta-analysis of randomized controlled trials (RCT) or other high-quality studies
2	Well-designed RCT
3	Non-randomized treatment studies
4	Cohort studies, case-control studies, cross-sectional surveys, and uncontrolled experiments
5	Case report
6	Expert opinion

TABLE 1.2: Grade of Recommendation

A	Level 1 or 2 with consistent conclusions
B	Level 3 or 4 studies or extrapolated evidence (generalized to a situation where it is not fully relevant) from Level 1 or 2 studies
C	Level 5 studies or extrapolated evidence from Level 3 or 4 studies
D	Level 6 evidence or inconsistent or inconclusive studies of any level or any studies that have a high risk of bias

1.3 The Process of Audiologic Management of Hearing Impairment

The task force members recognize that a comprehensive treatment approach is necessary for achieving the best outcomes for adults with hearing loss. To achieve the greatest probability of successful treatment, the members agreed that the following components are required in the context of a comprehensive plan:

- Services must be provided by a licensed audiologist.
- The combined efforts of the audiologist, patient, significant others, and/or caregivers are essential.
- In keeping the WHO-ICF, assessment is viewed as a multifaceted process, including assessment of auditory function to diagnose the extent of the impairment; assessment of activity limitations and participation restrictions through self-report of communication need and performance; assessment of environmental and personal contextual factors; and consideration of how all the levels of assessment impact QOL.
- As a result of a multi-faceted assessment, clear and realistic individualized goals for treatment must be set.
- The foundation of a successful treatment plan involves the technical aspects of hearing aid selection, quality control, fitting, and verification.
- The use of technology other than hearing aids, referred to as “hearing assistive technology” (HAT), should be part of the process.
- The success of treatment depends on provision of effective instruction and orientation to device use, counseling, and, for some patients, more intensive, on-going group and/or individual audiologic services.
- The success of treatment is determined through outcome assessment.

This guideline consists of descriptions of clinical processes and, where appropriate, the assessment of evidence for specific recommendations in four general areas: (1) Assessment and Goal Setting; (2) Technical Aspects of Treatment; (3) Orientation, Counseling, and Follow-up; and (4) Assessing Outcomes.

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2. ASSESSMENT AND GOAL SETTING

Assessment for the purposes of a comprehensive treatment plan consists of evaluation in three areas: (1) Auditory Assessment and Diagnosis; (2) Self-Perception of Communication Needs and Selection of Goals for Treatment; and (3) Non-Auditory Needs Assessment.

2.1 Auditory Assessment and Diagnosis

Objective

The objective of auditory assessment is to diagnose the type and magnitude of hearing loss and the need for treatment including candidacy for amplification. As a result of the audiologic assessment, the patient may be referred for additional services (e.g., electrophysiologic tests, medical or surgical intervention, etc.). The prerequisites leading to the hearing aid fitting process should include a comprehensive case history, otoscopic inspection, cerumen management, hearing assessment, and needs assessment.

The audiologic assessment process should result in the following outcomes:

- Diagnosis of type and extent of hearing loss,
- Determination of need for medical referral to a licensed physician,
- Provision of audiometric results and treatment options through appropriate patient and family/caregiver counseling,
- Determination of candidacy for amplification and counseling and patient's attitude toward treatment plan,
- Determination of lifestyle through needs assessment techniques,
- Determination of need for medical clearance as determined by the guidelines established by the Federal Drug Administration (FDA).

All test results, correspondence, and other interactions with the patient should be documented in the patient's chart. This documentation should be organized and reported in a manner that allows for later retrieval and easily communicates information to the patient, other audiologists, and professionals. The documentation must adhere to all applicable state and federal guidelines for record keeping.

2.2 Self-Perception of Communication Needs, Performance, and Selection of Goals for Treatment

Objective

The objective of this portion of the selection process is to establish patient-specific communication needs and realistic expectations from treatment. An additional objective of this component in the hearing aid selection process is to create patient-specific fitting goals. These are developed following the assessment of the patient's communication status. Goals are critical to quantify the benefits of amplification. This is the initial stage in the "validation" process, where treatment outcomes are established and measured. Specific measurement of treatment outcomes is a necessity to provide a basis for evidence-based clinical practice guidelines.

Background

A variety of tools exists to assess communication needs and function, as well as assisting in evaluating patient expectations of hearing aid use. These include, but are not limited to, the Client Oriented Scale of Improvement (COSI),[1] Abbreviated Profile of Hearing Aid Benefit (APHAB),[2] Hearing Handicap Inventory for the Elderly (HHIE),[3] and Expected Consequences of Hearing Aid Ownership (ECHO).[4] Lifestyle questionnaires are also available from specific hearing aid manufacturers and network providers. Most of these tools can be administered quickly so that goals can be outlined in a pragmatic and timely fashion. Use of these assessment tools can assist in the selection of particular amplification features such as directional microphones, direct audio input, environmental noise management, frequency modulated (FM) systems, and so on. Following the fitting, these same measurement tools can be used to help quantify the patient's functional benefits/satisfaction with amplification.

Following the administration of the above-mentioned tools, a list of realistic patient goals can be developed. It is important to include both "cognitive" and "affective" goals. For example, a "cognitive goal" may be "improved conversation with a spouse in a quiet environment" or "improved communication with unfamiliar speakers on the telephone without removal of the hearing aid." An "affective goal" could be "feeling less embarrassment or distress during communication." These goals can be evaluated as to the amount of change with the use of amplification. The statements or questions in the HHIE, COSI, and ECHO contain both cognitive and affective characteristics.

The importance of specifying patient goals continues to be a challenge with the introduction of new hearing aid features. Patient demands and expectations increase due to the commercial promotion of certain hearing aid features such as adaptive directional microphones, environmental noise reduction, and automatic telecoils. The determination of comprehensive,

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patient-specific goals will assist the audiologist in the selection of specific features as they apply to the needs of the patient.

Recommendations

1. Each patient should receive formal self-assessment instrument(s)/inventory(s) prior to fitting to establish communication needs, function, and goals.
2. Goals should be patient specific and composed of both cognitive and affective characteristics.
3. Post-fitting administration of these instrument(s) is necessary to validate benefits/satisfaction from amplification.

Summary of Evidence for Needs Assessment

Recommendations	Evidence	Source	Level	Grade	EF/EV
1	A formal self-assessment inventory/instrument test battery determines patient-specific communication needs/function and detailed hearing aid features (e.g., directional microphones).	[1-4]	3	B	EV
1	Test battery addresses user expectations of hearing aid use.	[1, 4]	3	B	EV
1,2	Both cognitive and affective patient needs/goals can be assessed with the test battery.	[1-4]	3	B	EV
3	Test battery is proven useful in validating the patient's goals and expectations following the use of amplification.	[1-4]	3	B	EV

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2.3 Non-Auditory Needs Assessment

Objective

The objective of this segment of the fitting process is to determine which contextual or non-auditory aspects warrant further assessment prior to fitting hearing aids. More specifically, the objective is to consider factors beyond those ascertained during auditory and communication needs assessment that may affect prognosis and require further attention and counseling.

Background

For a variety of reasons, many adults delay action or reject recommendations for treatment of hearing loss. A number of studies have documented the negative social and emotional consequences of untreated hearing impairment. These studies have shown a reduction in effective social functioning,[1] diminished psychological well-being,[2] lower self-esteem,[3] and a reduction in general QOL.[4-6]

Just as hearing impairment impacts non-auditory aspects of life, non-auditory factors can impact a patient’s communication deficits. Therefore, in addition to recognizing how lack of treatment may impact a given individual considering amplification, it is also relevant to determine if and how other non-auditory factors might affect prognosis with amplification, and whether these factors should be formally assessed by the audiologist.

Non-auditory, contextual factors can be “internally” or “externally” based. “Internal” (i.e., personal contextual) factors impacting communication include cognitive decline, personality characteristics (expectations, motivation, willingness to take a risk, assertiveness), additional sensory impairments (manual dexterity, visual acuity), prior experience with amplification, general health, and other otologic conditions (tinnitus). “External” (i.e., environmental contextual) factors include environmental characteristics (such as occupational demands and recreational habits) and patient support systems. Questions asked during the case history should be tailored to address these issues.

Recommendations

There is no strong evidence to suggest that any one or a combination of these non-auditory issues can be used to reliably predict success or failure with hearing aids.[7] Gatehouse found that factors such as personality and intelligence did not predict performance with hearing aids but did predict reported self-perceived disability.[8] Nevertheless, identifying these factors should be addressed in counseling and in establishing realistic expectations with the patient. The following recommendations are made:

1. Audiologists should be aware of the non-auditory factors that may impact successful prognosis.
2. At a minimum, all patients should be queried or screened for issues related to general health, manual dexterity (finger sensitivity), near vision, support systems, motivation, and prior experience with amplification.
3. Self-assessment scales, visual analog scales, or semantic differential scales can be used to assess hearing aid readiness.
4. Cognitive abilities or personality assessments should be assessed by a professional specially trained in these areas.
5. Training is available for audiologists who wish to perform relatively simple screening measures; for example, the Beck Depression Screening Inventory, Snellen charts for near field visual acuity, or simple tests of manual dexterity.
6. Audiologists should have a list of professionals trained to deal with the above-mentioned issues to whom patients might be referred.

The Appendix below provides lists of several tools that can be used to assess non-auditory needs

Summary of Evidence for Non-Auditory Needs Assessment

Recommendations	Evidence	Source	Level	Grade	EF/EV
1	Severity of hearing loss is associated with reduced quality of life in older adults.	[6]	4	B	EV
1	Listeners with greater cognitive ability derive greater benefit from temporal structure in background noise when listening via fast time constants.	[9]	2	A	EF
1,2	Non-auditory aspects of aging can affect a person's ability to manage daily communication with an acquired hearing loss and to manipulate and maintain hearing aids that may be selected.	[10]	6	D	EV
1,2	Test battery approach is useful in assessing relative contribution of different input signals and effects of age, hearing impairment, and visual contribution on functions important for speech processing.	[11]	4	B	EF
1,2,3	Certain baseline factors (perceived functional handicap, education, number of medications, age) are statistically significant related to individual measures of successful hearing aid use. However, no factors are sufficient to consistently differentiate successful from unsuccessful candidates.	[7]	2	A	EV/EF
1,2,3	Non-auditory factors may not reliably predict performance with hearing aids but can predict reported self-perceived disability.	[8]	4	B	EV/EF
1,2,3	The majority of patients suspecting a loss of hearing do not feel they could personally benefit from amplification.	[12]	4	B	EV
1,2,3	Personality variables (i.e., introvert/extrovert; locus of control;	[13]	4	B	EV

	and anxiety) can affect self-reports of disability and handicap.				
2	Audiologists should assess patient’s vision and conversational performance along with hearing thresholds before prescribing hearing aids and specific rehabilitative procedures.	[14]	4	B	EV
2	Custom hearing aids may provide easier insertion than behind-the-ear (BTEs) and may thus be more suitable for individuals with manual dexterity problems.	[15] [16]	4 5	B C	EF EV
2	The completely-in-the-canal (CIC) may be more difficult to manipulate for patients with vision and/or dexterity problems.	[17]	4	B	EV/EF
2,3	Threshold discrepancy may be interpreted as an index of the subject’s confidence in his or her own hearing ability with a relatively poor threshold from the clinical procedure indicating lower confidence. Given this interpretation, more “confident” individuals receive greater benefit from amplification.	[18]	4	B	EF
2,3	New hearing aid users are found to have stable, though unrealistically high, prefitting expectations about hearing aids. Only one of the four subscales of ECHO is predictive of corresponding satisfaction data.	[19]	4	B	EV/EF
2,3	Attitude and motivation can be measured using self-assessment scales and may be correlated with prognosis.	[20]	4	B	EV
2,3,4	Attitude towards amplification is related to both satisfaction with it and its use.	[21]	4	B	EV
2,3,4	Controllability together with dispositional style and aspects of expressed emotion play an important role in explaining the overall success rates of hearing-impaired individuals.	[22]	4	B	EV
2,4	There are varying degrees of correlation between cognitive function and dichotic test	[23]	4	B	EF

	parameters. There is a correlation between age-related cognitive decline in the elderly and problems in perceiving stimuli presented to the left ear.				
3	Overall health and presence of significant others in the household can impact prognosis.	24	6	D	EV
4	Formal testing of personality can shed some light on counseling patients who use hearing aids.	25	6	D	EV/EF
5	Minimal additional training is available for audiologists wishing to perform relatively simple screening measures. These tools are listed in the appendix.	26	4	B	EV
6	Audiologists should have a list of professionals, representing multiple disciplines and trained to deal with the above-mentioned issues, to whom patients might be referred.	Consensus opinion	6	D	EV

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Appendix: Tools for Non-Auditory Assessment

General Health Tests

Sickness Impact Profile (SIP)
Short Form (SF) – 36 Health Survey

Tests for Cognition

Cambridge Cognitive Examination (CAMCOG and CAMTAB - http://www.camcog.com)
Cognistat
Wechsler Adult Intelligence Scale (WAIS)
Kahn-Goldfarb MSQ
Short Portable MSQ
MicroCog
Mini Mental Status Exam (MMSE)
Speech and Visual Information Processing System (SVIPS; Hallgren et al, 2001)

Tests for Attention
Brief Test of Attention
Continuous Performance Test
Paced Auditory Serial Attention Test
STROOP, Auditory STROOP
Trail-Making Test
Timed Sustained Attention Test

Tests for Executive Function
Delis-Kaplan Executive Function System
STROOP, Auditory STROOP
Tower of London
Trail-Making Test

Tests for Memory
Digit Span, Word Span, Sentence Span
Rey Auditory Verbal Learning Test
Wechsler Memory Scale-III
California Verbal Learning Test

Personality Tests
Myers-Briggs Personality Type Test
NEO-Five Factor Inventory
True Colors
Assertion Inventory
Patient Motivation for Therapy Scale (CMOTS)

Vision Tests
Visual Acuity (Near and Far)
Peripheral Vision
Pupil Reflex Test
Visual Search and Attention Test

3. TECHNICAL ASPECTS OF TREATMENT

Comprehensive management of the technical aspects of treatment consists of at least four areas: (1) hearing aid selection, (2) quality control, (3) fitting and verification of hearing aids, and (4) hearing assistive technology (HAT).

3.1 Hearing Aid (Selection)

Objective

The objective of this segment of the fitting process is to select, based on the patient's auditory and non-auditory needs assessments, appropriate amplification systems and HATs. This includes matching the appropriate hearing aid style and features with the patient's needs.

Background

Treatment begins with the selection of appropriate amplification and HATs. Although certain signal processing schemes require digital processing, the discussion of digital versus analog signal processing is not relevant here. The issue is not whether audiologists should select digital or analog hearing aids but what signal processing or specialized features are appropriate to meet the patient's needs. The choice of appropriate hearing aid and HAT features for each patient will also be paramount.

Recommendations

1. *Style:* The choice of hearing aid style should be made based on factors such as gain and output requirements, ear canal size and geometry, ease of insertion and manipulation, skin sensitivity, need for specific features (e.g., directional microphone, direct auditory input [DAI], telecoil), comfort, occlusion considerations, and cosmetic concerns.[1-3]

2. *Occlusion:* While smaller (e.g., completely-in-the-canal hearing aids) hearing aids are often desirable for cosmetic reasons, it is well recognized that with conventional signal processing, increased gain will require increased separation of the microphone and receiver to avoid acoustic feedback because of venting (including slit leak).[4] In order to maintain appropriate gain, while minimizing the occlusion effect (OE), it may be necessary to (1) separate the microphone and receiver physically by using a larger hearing aid style if the fitted hearing aids do not have an effective feedback algorithm; (2) reduce occlusion complaints by extending the shell of the hearing aid to the bony portion of the canal. It should be noted that this may be uncomfortable to many patients and may prove impossible in patients with significant changes in ear canal geometry with jaw movement;[5] and (3) implement digital feedback reduction.[6]

3. *Volume control (wheel, toggle, button, etc.):* Volume controls (VC) are recommended for many patients regardless of the type of gain processing (linear or compression).[7-10]

4. *Monaural versus binaural:* Binaural amplification is recommended for most patients.[11-14] However, monaural fittings may be warranted based on specific patient needs and in particular cases of asymmetry, binaural interference, and financial and/or cosmetic concerns.[15-16]

5. *DAI and telecoil circuitry:* These should be considered, when appropriate. DAI is needed for wireless sound systems in which the receiver is coupled directly to the hearing aid and/or sound input systems and HAT systems that allow direct coupling to the hearing aid. Telecoil usage may also be appropriate for many patients since it is beneficial for HAT application as well as for telephone usage.[17-19]

6. *Gain processing:* Initial selection of target gain for average speech input levels should be based on a validated prescriptive procedure. This recommendation is based on evidence that validated prescriptive methods appear to be a reasonable starting point and are time efficient.[20-24] Hearing aids with a low compression threshold (CT) are recommended for patients with reduced dynamic range (DR) of hearing to improve audibility for low-intensity sounds while avoiding discomfort for high-intensity sounds[21, 25] though linear signal processing with compression limiting (CL) may be preferred to low CT.[26] The evidence relative to the number of compression channels is mixed.[27-31] Given the lack of agreement in the literature and the potential for reduced performance, greater than three to five channels of compression is not considered necessary unless data can support that the specific implementation can result in at least equivalent performance and sound quality when

compared to lower numbers of channels. Additional points to this recommendation are as follows:

a. Use of compression for patients with severe to profound hearing loss should be limited to compression that minimizes the alteration of speech cues, particularly in the temporal domain (i.e., CL or low CT with few compression channels, low compression ratios (CR), and long time constants).[27, 34-38]

b. Fast-acting compression may not be suitable for patients with limited cognitive abilities (more prevalent in the elderly population). Fast compression time constants may be slightly beneficial for patients with normal and high levels of cognitive functioning.[25]

7. *Frequency shaping:* At least four to eight frequency handles (bands) for gain shaping are recommended to optimize audibility. Greater numbers of handles (bands) may be desirable to increase the precision with which the frequency response of the hearing aid follows the slope of the audiogram, but evidence does not support improved audibility.[39]

8. *Output and $OSPL_{90}$:* Measurement of Threshold of Discomfort (TD) on individual patients and the setting of $OSPL_{90}$ so that it does not exceed TD is recommended.[10, 40] Minimally, the output sound pressure level with a 90 dB input ($OSPL_{90}$) of a hearing aid should not exceed the patient's TD in order to ensure comfort and to reduce exposure to potentially damaging input levels. CL is recommended over peak clipping (PC) for output limitation.[41] PC may be preferred by some patients with profound hearing loss having prior experience with PC hearing aids.

9. *Multiple memories:* Multiple memories are useful when specific signal processing is beneficial in some environments, but not others.[41-44] The most obvious case is that of directional versus omnidirectional microphone modes.

10. *Digital noise reduction (DNR):* DNR processing may be helpful for enhancement of sound quality and patient comfort. Not all implementations of DNR are equivalent, and data specific to individual implementations should be evaluated prior to selection.[45-50]

11. *Digital feedback suppression/cancellation (DFS):* DFS processing may be helpful for reduction of feedback and allow for a wider vent that may be beneficial to reduce the occlusion effect. Not all implementations of DFS are equivalent, and data specific to individual implementations should be evaluated prior to selection.[51-53]

12. *Switchable directional/omnidirectional microphone:* This feature is recommended for patients with complaints of speech understanding in noise. Common listening situations exist in which directional technology is not desirable (e.g., wind noise), therefore fixed (non-switchable) directional technology is not recommended in the majority of cases. Those patients with extremely poor speech understanding in noise may not receive enough signal-to-noise ratio (SNR) advantage from this technology when listening at poor SNRs to reveal benefit, and other technologies such as FM systems may be warranted. Adaptive directional microphone technology is recommended for patients who experience difficult listening situations with relatively discrete noise source location.

13. *Special technologies/applications:*

a. *Proportional frequency compression hearing aids:* It is recommended that proportional frequency compression hearing aids be experimentally considered for patients with severe-to-profound hearing loss,[59-60] especially when other treatments (such as conventional amplification and/or cochlear implants) have failed or may not be an option.

b. *Bone-Anchored Hearing Aids (BAHA):* These devices are recommended for patients with conductive/mixed hearing loss and unilateral deafness.[61-64] It is noted that bone-anchored devices require collaboration between audiologist and otolaryngologist/otologist.

c. *CROS/BICROS/Transcranial CROS:* Contralateral Routing of the Signal (CROS) and Bilateral Contralateral Routing Of the Signal (BICROS) fittings are specially designed for patients having either unilateral hearing loss (appropriate for CROS) or bilateral asymmetrical hearing loss (appropriate for BICROS) where one ear is unaidable. Currently, these hearing aids are available in wired and wireless configurations and having either analog or digital signal processing. As mentioned above, a BAHA has recently been reported to be effective for unilateral deafness.

Summary of Evidence for Hearing Aid Selection

Recommendation	**Evidence**	**Source**	**Level**	**Grade**	**EF/EV**
1	Custom hearing aids may provide easier insertion than BTEs.	[1-2]	3	B	EF
1	CICs may be more difficult to manipulate for patients with vision and/or dexterity problems.	[3]	5	C	EF
2	Maximum gain depends on hearing aid style and is based, in part, on the inverse relationship between OE and feedback in patients with high gain requirements. Ear canal shape and volume changes with jaw movement can be extreme. The amount of volume change is highly patient specific.	[4-5]	2	B	EV
2	Feedback can be reduced through DSP algorithms.	[6]	4	C	EV
3	Occasions arise when patients report a desire to change the overall volume even when using compression. The majority of patients with previous experience with hearing aids having VCs prefer VCs. No significant desire for VCs has been expressed by patients without prior VC experience.	[7-10]	3	B	EF
4	Bilateral hearing aid fittings	[11-14]	1	B	EV

	generally result in improved speech recognition, localization, and sound quality re: monaural fittings.				
4	In some cases, monaural may be preferred over bilateral.	[15-16]	4	C	EV/EF
5	Telecoils are useful with HATs and can improve telephone use with hearing aids.	[17-19]	4	C	EV/EF
6	Validated prescriptive procedures provide a reasonable starting point for target gain in linear and, to a lesser extent, non-linear hearing aids because they are time efficient. Studies reveal similar preferred gain across many patient populations using adaptive methods that are more time-consuming.	[20-24]	1	B	EV
6	Hearing aids with low CTs yield better outcomes when compared to linear PC. Patients prefer CL to at least one typical low CT instrument.	[21, 25-26]	2	A	EF
6	A wide range of CTs and time constants may be appropriate.	[27]	1	A	EV
6	Speech recognition differences can be associated with increased number of compression channels.	[27-33]	1	D	EV
6a	Listeners with severe to profound hearing loss have poorer speech recognition performance with high CRs or greater number of compression channels. Improved speech recognition is obtained for listeners with severe to profound hearing loss with CL and PC rather than with two- or three-channel low CT, even though audibility was improved. When using compression with listeners with severe to profound hearing loss, the amplitude variations that contain usable information should be maintained when possible.	[27, 34-38]	2	B	EV
6b	Listeners with greater cognitive ability derive greater benefit from temporal structure in background noise when listening with faster	[25]	2	A	EF

	time constants.				
7	Quantification of a theoretical multi-channel compression hearing aid, using intelligibility-index and target-gain matching measures, indicate a seven-channel system would suffice for most audiograms in order to meet the strictest root-mean-square (RMS) error criterion evaluated.	[39]	2	B	EF
8	Data support measurement of individual TD and setting of $OSPL_{90}$ so it does not exceed TD in order to minimize chances of auditory discomfort in the real world. When asked what feature listeners wished their hearing aids had, the second most requested feature was keeping loud sounds from being too loud.	[10, 40]	3	B	EF
8	CL leads to improved outcomes when compared to PC. Anecdotal evidence suggests PC may be preferred for some profound hearing loss listeners with past PC experience.	[40]	2	B	EF
9	Multiple memories affecting frequency response are preferred by a subset of listeners. Directional hearing aids are preferred in some environments, but not others.	[41-44]	2	A	EV/EF
10	One implementation of DNR has shown improved speech recognition in steady-state noise in the laboratory while another configuration has shown decreased performance under the same laboratory conditions. Sound quality and comfort may be enhanced by DNR. No efficacy data to date support improved speech recognition.	[45-50] [45-46, 50]	2 2	D D	EV EF
11	DFS systems can allow for increased gain under the same coupling constraints. Increasing vent size can improve sound quality for the listener's own voice.	[52-54]	2	B	EV
12	Listeners experience situations in which they perceive greater	[44-45, 48, 55-59]	2	B	EF/EV

	hearing aid benefit from a directional mode, and other situations in which they perceive greater hearing aid benefit from omnidirectional mode. Switchable directional/omnidirectional hearing aids provide improved perceived benefit when compared to their omnidirectional and/or fixed directional counterparts. Adaptive directional microphone technology can improve speech recognition compared to a fixed directional microphone system in laboratory conditions in which the noise source location is discrete. Similar performance is expected for fixed and adaptive directional microphone systems when more than a few noise source locations are present, even if a discrete source location is dominate.				
13a	Proportional frequency compression can improve speech recognition over conventional amplification for some listeners with severe to profound hearing loss.	[59-60]	2	B	EV-EF
13b	A BAHA can provide significantly decreased handicap and significantly enhance perceived general well-being and disease-specific QOL when compared to pre-treatment across a range of conductive etiologies. BAHA fittings can improve speech recognition in some listeners with unilateral deafness and reveal some advantages in terms of improved hearing aid benefit when compared to CROS.	[61-64]	3	B	EV-EF

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3.2 Quality Control

Objective

The objective of this segment of the fitting process is to ensure that hearing aids meet reasonable and expected quality standards prior to scheduling patients for hearing aid fitting and verification.

Background

A small percentage of new hearing aids and earmolds may be defective on receipt. In addition, hearing aids and earmolds may arrive in good working order but with the incorrect configuration/features. Quality control measures are therefore necessary to limit patient and audiologist frustration and inconvenience.

Recommendations

1. Electroacoustic verification of all hearing aids (new and repaired) is recommended.[1-2] This verification should be completed prior to fitting to ensure the hearing aid is in working order and to provide a benchmark for future quality control measures. For convenience, the hearing aid's electroacoustic information can be attached directly to individual patient charts.
2. Verification of features and physical parameters is also recommended prior to the hearing aid fitting.[3] Such verification may include confirmation of earmold/shell style, ordered vent size, color, type, as well as a number of hearing aid processing (memories, automatic switches, etc.) and mechanical (directional microphones, t-coil, integrated FM, etc.) features. Those features which cannot be verified through physical examination or standard electroacoustic verification methods should be verified through a listening check. These may include operation of the VC, directional microphones, FM, t-coil, and so on.

Summary of Evidence for Quality Control

Recommendation	Evidence	Source	Level	Grade	EF/EV
1	Electroacoustic verification of hearing aids provides a benchmark against which future quality control measures can be compared and ensures the hearing aid is in working order prior to fitting.	[1-2]	6	D	EF
2	Clinical experience and expert opinion reveal that errors are made in the manufacture and shipping of hearing aids and earmolds relative to inclusion of requested features.	Consensus opinion	6	D	EF

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3.3 Fitting and Verification of Hearing Aids
Objective

The objective of this segment of the fitting process is to assure that the fitting and verification procedure is viewed as a process rather than an event, which culminates in the optimal fitting for the patient. Verification procedures also serve as a benchmark against which future hearing aid changes can be compared.

Background

Specific goals and rationales underlie all hearing aid fittings. Verification procedures should be based on validated hearing aid fitting rationales as supported in the hearing aid selection section of this document. Hearing aid fitting and verification procedures are expected to yield a comfortable fit of hearing aids including all desired features.

In the various procedures described under verification, a signal must be presented to the hearing aid whether it is being tested with a microphone in the test chamber or with a probe microphone in the real ear. The audiologist must select test signals that will ensure accurate verification. Recent investigations have illustrated that various types of signal processing features (compression, noise reduction, feedback reduction, etc.) interact with the test signal, and the most accurate representation of the hearing aid's response will be through the use of a speech-like signal. Additionally, the audiologist can turn off signal processing features which will attempt to reduce output that it considers noise during testing.[1-2] While no direct evidence exists, it is clear that disabling specific signal processing features may obscure potential interactions between signal processing schemes in the same hearing aid. Consequently, when attempting verification of prescriptive methods for which the targets are based on speech inputs, a speech-like signal should be used. That is, for a specific hearing aid, the preferred hearing aid verification method will include a test signal which produces an output similar to the output for a speech signal of the same level. This may require that the test signal adequately represents the frequency, intensity, and temporal aspects of speech.[1-2]

Recommendations

1. *Choice of assessment signal:* Actual speech or a speech-like signal should be used when attempting verification of prescriptive methods for which the targets are based on speech inputs. That is, the preferred hearing aid verification method should include a test signal that produces an output similar to the output for a speech signal of the same input level. This would require that the test signal adequately represent the frequency, intensity, and temporal aspects of speech.[1-2]

2. *Physical fit:* Physical fit should be assessed in order to: (1) ensure ease of insertion/removal; (2) ensure subjective comfort (for both static and dynamic movement of the earmold/custom case); (3) ensure the appearance and microphone angle (directional microphones and microphone arrays) are appropriate; and (4) ensure audible feedback is not present.[3-5] Failure to complete these assessments is likely to lead to reduced patient satisfaction and comfort.

3. *Occlusion effect (OE):* The magnitude of the OE should be assessed informally to ensure that the quality of the hearing aid wearer's own voice is not problematic due to occlusion.[5] In cases in which occlusion problems are suspected, verification of the magnitude of occlusion should be verified using probe microphone techniques[7] or with a device designed to measure real-ear occlusion effect. While data is not available supporting the effectiveness of routine measure of OE, it is generally recommended given that it requires only a very brief period of time beyond that required for probe microphone verification of gain and output.

4. *Gain verification:* Prescribed gain from a validated prescriptive method should be verified using a probe microphone approach that is referenced to ear canal SPL.[9-18] Although deviation from target gain in some instances is tolerable, or even desirable, some evidence suggests that reliability of the gain verification method is important due to a decrease in perceived hearing aid benefit with increasing deviation from target gain values. One common desirable deviation from target relates to bilateral fitting. The majority of prescriptive formulas for gain and output targets are based on monaural amplification. For those methods that do not account for binaural summation, gain verification targets should be reduced by approximately 5-6 dB, while the maximum output may or may not be reduced. Also, some prescriptive formulas for open fittings may be inappropriate as there is no need to correct for the insertion loss created by including an earmold or hearing aid shell in the fitting process.

The use of the most reliable method for gain verification, probe microphone, or "real-ear" measures is desirable for the reasons described above and in order to identify a known starting point for comparison if changes in the hearing aid settings are made at future visits. Probe microphone verification requires the placement of a probe microphone and hearing aid in the ear while sound is presented through a loudspeaker at several intensity levels (e.g., soft, moderate, loud), or a "simulated" real-ear-to-coupler difference (RECD) real ear technique can be employed.[19] Depending on the verification technique specified by the prescriptive method, the following probe microphone measures may be completed: real-ear unaided response/gain (REUR/G) and real-ear aided response/gain (REAR/G). The real-ear insertion gain (REIG)[14] is the difference between REUG and REAG.

5. *Output verification:* Given the importance of avoiding excessive hearing aid output (as described in the hearing aid selection section), maximum hearing aid output ($OSPL_{90}$) verification is recommended to ensure that it does not exceed the patient's threshold of discomfort (TD). Simulated real-ear techniques are recommended for accomplishing this goal as accurately as possible, while limiting exposure level.[20] Alternatively, aided loudness measures may be obtained; however, data supporting the efficacy of these procedures is still lacking.[21-22] Aided loudness measures may be preferred for time-saving purposes, especially if TD is estimated, rather than directly measured.

6. *Aided soundfield threshold:* These measurements may be useful for the evaluation of audibility of soft sounds: however, it should be noted that audibility of speech has not been shown to be correlated with hearing aid benefit (though it may lead to increased use),[23] and excessive audibility of soft sounds may lead to complaints of noisiness and intolerance.[24] In addition, aided soundfield thresholds are problematic for several reasons as noted in Recommendation 4 in this section.[12-17]

7. *Verification of special features:* Verification of special features as applied to individual patients is recommended. Repeating these measures at later appointments will allow the audiologist to verify reduced hearing aid functioning and allow for differentiation from reduced listener function. Examples of such factors include: (1) the plane through the directional microphone ports is affected for a BTE fitting after tubing is cut to a length to provide optimal patient comfort; (2) the desired orientation of the hearing aid telecoil is impacted by specific use (e.g., room loop versus telephone); (3) directional microphone directivity may be impacted by accumulation of dirt, moisture, venting, and other factors.

a. It is recommended that the telecoil output should be verified given the presentation angle of the desired signal. In-situ measurement simulating the desired condition may be necessary to obtain the most accurate results.[25-26]

b. In-situ measures of directional efficacy are recommended. Given the difficulty in estimating directional benefit in the real world from clinical measures with a single noise speaker[27] and the time involved in making these measures, measurement of directional benefit using speech recognition techniques may not be useful beyond general counseling. The probe microphone technique of front-to-back ratio (FBR) is recommended as a time-efficient and reliable method for quantifying that the directional microphone is functioning. This method is impacted by compression parameters and is not useful for prediction of benefit, but is advocated for within-patient quality control and examination of the impact of fitting effects such as venting.[28]

Summary of Evidence for Fitting and Verification of Hearing Aids

Recommendation	Evidence	Source	Level	Grade	EF/EV
1	Some signal processing can interact with the test signal. In some cases, a test signal that is similar to speech in both spectral and temporal content or the disabling of these features will be necessary in order to obtain an accurate representation of the hearing aid's response for speech.	[1-2]	2	B	EF
2	Physical fit of the hearing aid shell is important to ensure comfort and reduce feedback. Misaligned microphones can result in reduced directivity.	[3-5]	3	C	EF
3	User's own voice quality through hearing aids continues to be problematic.	[6]	2	B	EV
3	Probe microphone techniques provide a quick and reliable method for assessing the magnitude of occlusion. However,	[7]	3	B	EF

	the relationship between physical occlusion and perceived occlusion can vary substantially across patients.				
4	Test-retest reliability exceeding that demonstrated by other verification techniques has been demonstrated for probe microphone measurements. Deviations from target gain in a non-linear hearing aid may lead to reduced hearing aid benefit.	[8-14]	1	A	EF
4	Gain and output verification methods which are apparent alternatives to probe microphone techniques (namely functional gain and predicted gain) are limited in that (1) advanced signal processing features cannot easily be assessed; (2) ambient room noise, circuit noise, and low-level noise in the test environments may act as maskers; (3) artifacts with sloping hearing loss may lead to inaccurate results; (4) predicted gain measures are inaccurate.	[15-18]	2	B-C	EF
4	RECD and REDD (real-ear dial difference) may be used as level-independent HL to SPL transforms as a substitute for in-situ audiometric procedures.	[19]	2	B	EF
5	The coupler-to-dial-difference (CDD) and RECD can be used to derive a valid estimate of RESPL when not possible to measure directly.	[20]	2	B	EF
5	Aided loudness procedures can provide reliable loudness data, but efficacy is unknown.	[21-22]	3	C	EF
6	Increased audibility of speech is correlated with hearing aid benefit and associated with increased use.	[23]	2	A	EV
6	It is speculated, based on clinical experience, that excessive audibility of soft sounds may be undesirable.	[24]	6	D	EF
7a	In-situ measurement of telecoil output simulating the desired condition may be necessary to	[25-26]	4	C	EF

	obtain the most accurate result.				
7b	Directional benefit in the real world is not related to clinical measures with a single noise loudspeaker.	[27]	2	B	EF
7b	Front-to-back ratio (FBR) measures are time efficient and reliable (reliability claim is based on probe microphone reliability) for quantifying directional microphone function.	[28]	4	C	EF

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3.4 Hearing Assistive Technology (HAT)

Objective

The objective of this segment of the fitting process is to use hearing assistive technology (HAT), when appropriate, as part of the treatment plan in the management of hearing impairment to ensure that all of the patient's communication needs are met.

Background

Hearing-impaired patients vary in their specific communication needs. The use of personal hearing aids may not address all of the communication and safety needs of the patient. The use of HAT, such as assistive listening, alerting, and/or signaling devices, plays an important role in meeting individual needs and in the treatment of the hearing-impaired. Various assistive technologies are available that can present auditory, visual, and/or tactile information to augment communication and/or to facilitate the patient's awareness of sounds in the environment. Some assistive systems can be used alone, while others are used in combination with personal hearing aids to supplement performance in difficult listening conditions. The use of HAT addresses four basic communication needs, as follows:[1]

1. Live, face-to-face communication (e.g., home, restaurant, meeting, place of worship, concert, lecture, automobile, courtroom, classroom).
2. Broadcast and other electronic media (e.g., radio, television, movie theater).
3. Telephone conversation (e.g., telephone, intercom).
4. Sensitivity to alerting signals and environmental stimuli (e.g., doorbell, smoke detector, telephone ring, appliance timer, baby's cry, child's voice, alarm clock, door knock).

HAT is selected for a particular patient based on his/her communication demands. Assistive technologies are especially useful when the speech signal is presented at a considerable distance from the patient or when the acoustic environment is less than ideal. Situations in which the use of these technologies might be appropriate are:[1]

1. In the home (e.g., one-on-one or group conversations, TV or radio, and sounds in the home environment);
2. In the community (e.g., health-care treatment, employment situations, travel, recreation, restaurant, public spaces); and/or,
3. School environments (e.g., communication with teacher and/or classmates, speech/language therapy).

HAT, such as FM systems, can improve audibility and speech understanding in specific listening situations.[1] This is particularly helpful in situations where there is ambient environmental noise (noise present in a room when it is unoccupied), reverberation, background noise, or a great distance from the patient to the sound source.[1] The FM system picks up the sound from the source and transmits it directly to a sound-generating transducer at the ear. The sound is presented to the ear at an audible level, with a favorable signal-to-noise ratio (SNR) and with minimal ambient noise, reverberation, or background noise. The expected benefits of the remote FM microphone in reducing the negative effects of distance and noise have been demonstrated in laboratory and field conditions.[2] However, careful individualized adjustment of relative gains via FM and hearing aid microphones may be needed for optimal use.[2]

HAT is available as personal systems or large-area listening systems. The most common types of assistive technology are:[1]

a. Personal FM systems

b. Infrared systems
c. Induction loop systems
d. Hardwired systems
e. Telephone amplifier, telecoil, TDD (telecommunication device for the deaf)
f. Situation specific devices (e.g., television)
g. Alerting devices

HAT can enable a hearing-impaired person to participate more fully in and benefit from many social and cultural activities.[3] Large-area assistive listening systems supplement the use of hearing aids by providing the extra help that hearing-impaired people need to supplement the use of hearing aids.[3] For patients with severe-to-profound sensorineural hearing loss, an FM hearing-aid system and an assistive device may provide a reasonable solution for hearing in a variety of demanding listening situations.[4] HAT can be used to assist patients with special auditory needs (e.g., patients with auditory-based deficits in dichotic listening).[9]

HAT has been shown to be useful for older adults living independently, for those who participate in different types of residential and day facilities, and for patients in more institutionalized settings.[5] With older adults, assistive technologies are an important part of the treatment process and contribute to the ability of the older adult to live comfortably and independently within his/her home.[5, 8] Assistive devices can also reduce the impact of hearing loss and ensure safety for older patients.[5, 8] HAT may be helpful and acceptable when hearing aid use alone does not prove satisfactory.[7, 10] HAT together with environmental modification can improve communication ability and the quality of life for patients in nursing homes.[11]

The use of amplification, both personal hearing aids and FM systems, has been shown to have a significant impact on the quality of life of elderly persons.[6] However, if the FM equipment is large and cumbersome, the older adult is usually not willing to endure the difficulties associated with its use.[6] To ensure optimal use of FM technology for adults of any age, counseling, instruction, and coaching are needed.[2] Patient success with FM systems can be achieved when individualized communication goals are established and when patients are provided with systematic instruction and counseling regarding FM use over several sessions.[12]

Recommendations

1. The use of HAT should be considered in the management of each patient as personal hearing aids may not address all of the patient's communication and safety needs.

2. Counseling, instruction, and coaching should be included to ensure optimal use of FM systems.

3. Careful individualized adjustment of relative gains via FM and hearing aid microphones is needed for successful use of the FM system.

4. The establishment of goals and the provision of systematic instruction and counseling regarding FM use over several weeks are critical to success with FM systems.

Summary of Evidence for Hearing Assistive Technology (HAT)

Recommendation	Evidence	Source	Level	Grade	EF/EV
1	When the listening conditions are less than ideal, hearing aids may not be adequate to maximize an individual's listening potential.	[1]	6	D	EV
1, 2, 3	Careful, individualized adjustment of relative gain via FM and hearing aid microphones is needed to ensure optimal use of FM technology.	[2]	4	B-C	EF
1, 2, 3	Considerable counseling, instruction, and coaching is needed with HATs to ensure optimal use of FM technology.	[2]	4	B-C	EV
1	An assistive listening system (ALS) is of great potential significance for people with hearing loss because it provides the extra help needed to supplement the use of hearing aids.	[3]	4	B-C	EF
1	Successful audiologic management is accomplished for a patient with severe-to-profound hearing loss with the use of a BTE FM system for some purposes and an HAT for others.	[4]	5	C	EV
1	Assistive devices constitute an important part of the rehabilitation of hearing-impaired older adults.	[5]	5	C	EV
1	Elderly users usually are not willing to endure the difficulties associated with the use of remote-microphone HATs systems.	[6]	4	B-C	EV
1	Consider the importance of trial use of HAT in elderly patients who reject conventional aids.	[7]	5	C	EV
1	Listeners with an auditory-based	[9]	4	B-C	EF

	deficit in dichotic listening may function better with an HAT, such as an FM system.				
1	For some older persons who do not benefit adequately from conventional hearing aids, HATs may be helpful.	[10]	6	D	EF
1	HATs would improve communication ability and quality of life of the nursing home resident.	[11]	4	B-C	EV
1, 2, 4	When specific goals are established and individuals are provided with systematic instruction and counseling regarding FM use over several sessions, success with the FM system can be achieved.	[12]	4	B-C	EV

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4. ORIENTATION, COUNSELING, AND FOLLOW-UP

4.1 Hearing Aid Orientation

Objectives

The objective of this segment of the fitting process is to ensure that the patient obtains the desired benefits from treatment as easily and efficiently as possible. An effective orientation program can reduce hearing aid returns by half.[1-2] There also appears to be a strong correlation between the amount of follow-up care (orientation and counseling) and overall patient satisfaction.[3]

Background

The hearing aid orientation process begins with the initial hearing aid fitting visit and may continue over several visits. Because a great deal of information is provided, as much of the information as possible should be provided in writing as well as orally. It is usually more effective if at least one family member or caregiver is also involved in the orientation sessions.[4-7] Hearing aid orientation is complete only when all appropriate information has been provided and the patient (or family member/caregiver) is either competent to handle the hearing aids or declines further post-fitting care.

Orientation information can be categorized as “device-related” or “patient-related.” “Device-related” information is related specifically to the care and use of hearing aids. “Patient-related” information includes helping the patient understand the nature of hearing loss, adjustment to amplification, realistic expectations of the benefits and limitations of amplification, and taking advantage of other sources of help (such as better communication strategies, HATs, and speechreading). This information may be provided during hearing aid orientation visits, as well as during long-term follow-up care .[8-10]

Recommendations

1. The following device-related information should be provided to each patient, and ideally to at least one family member or caregiver, as part of the hearing aid fitting process:

- Hearing aid features (multiple programs, telephone coil, directional microphone settings, direct audio input, and other special features)
- Insertion/removal
- Battery use (size, how to change, disposal, purchase options)

- Care and cleaning
- Comfort
- Feedback
- Telephone use
- Warranty protection

2. The following information should be reviewed with each patient, and ideally at least one family member or caregiver, as part of the hearing aid fitting process:

- Wearing schedule
- Goals and expectations
- Adjusting to amplification: family, social, school, and work settings
- Environment issues: restaurants, groups, movies, television
- Improved hearing and listening strategies
- Speechreading
- Monaural/binaural hearing aid use
- Post-fitting care

Summary of Evidence for Hearing Aid Orientation

Recommendation	**Evidence**	**Source**	**Level**	**Grade**	
1,2	Individuals receiving post-fitting orientation/education have significantly fewer hearing aid returns.	[1] [2]	3	B	EF
1,2	Individuals receiving more than two hours of education and counseling report higher levels of satisfaction.	[3]	3	B	EF
1,2	Orientation and education should be provided to individuals and significant others as part of the hearing aid fitting process.	[4-10]	4	C	EF

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4.2 Counseling and Follow-Up

Objective

The objective of this segment of the process is to provide comprehensive understanding to patients and their primary communication partners concerning the effects of hearing loss and the effective implementation of strategies to reduce those effects.

Background

The fitting of hearing aids is the beginning of the treatment process. Successful management of the hearing-impaired adult requires comprehensive counseling to help the patient adjust to his/her hearing aids and to instruct the patient and his/her primary communication partners to develop appropriate strategies to maximize and augment the assistance he/she receives from those hearing aids. Most adults live with their hearing loss for many years prior to seeking help and have developed adaptive and maladaptive behaviors to compensate for their loss of audibility and comprehension. The fitting of hearing aids does not necessarily guarantee immediate communication success. Counseling is often required to help the patient "unlearn" their maladaptive compensatory behaviors and learn new strategies to help ensure success. In addition, emotional factors concerning hearing loss must be addressed in a comprehensive program.[1] Counseling can be provided on an individual basis but is also delivered in small group settings.

Recommendations

Subjective reports suggest that group adult counseling is perceived as beneficial in terms of reduced return rate of hearing aids, increased use of HATs, fewer trouble-shooting visits, increased referrals provided by satisfied hearing aid users, and good community relations. Research has demonstrated that patients participating in post-fitting follow-up programs have improved outcomes as measured by decreased self-perceived handicap,[2] improved self-perceived QOL,[3] improvement in select communication functions,[4] and reduced return-for-credit rates as compared to patients who receive hearing aids alone.

Limited evidence suggests that short-term benefit in personal adjustment and self-perceived handicap is achieved with minimal counseling and instruction; however, it is not clear if this short-term benefit is maintained in the long-term as a result of intensive counseling and follow-up. There is some indication that long-term benefit is equal between groups of patients who receive extensive counseling and those who do not.

Recent evidence suggests also that the participation of spouses and significant others is an important component for success.[5] While the specific elements of a post-fitting program have not been individually examined, several reports have proposed specific elements to include in a comprehensive program.

1. Post-fitting counseling and follow-up should be (a) provided to new hearing aid users and (b) offered to experienced users who have not received these services or who may want a “refresher” course.
2. The patient’s primary communication partner(s) should be included.
3. Counseling and follow-up can be provided in a group or individual format.
4. A counseling-based program may include discussion of the following topic areas:
    a. Basic anatomy and physiology of the hearing process
    b. Understanding the audiogram
    c. Problems associated with understanding speech in noise
    d. Appropriate and inappropriate hearing and listening behaviors
    e. Listening and repair strategies
    f. Controlling the environment
    g. Assertiveness
    h. Realistic expectations
    i. Stress management
    j. Basic speechreading
    k. Hearing assistive technology
    l. “Helpful hints” for communicating with spouse
    m. “Helpful hints” for spouse communicating with patient
    n. Hearing aid use and care
    o. Community resources
5. Patients should be informed that the full benefits from amplification may not be immediately apparent and that there may be a period of adjustment and/or acclimatization.

Summary of Evidence for Counseling and Follow-Up

Recommendation	Evidence	Source	Level	Grade	EF/EV

1	Post-fitting audiologic rehabilitation should be provided to all new hearing aid users.	[3]	3	B	EF
1,3	Return-for-credit rates decrease from 9% to 3% for individuals attending a formal audiologic rehabilitation group.	[6]	4	B	EF
2,3,4	Curricula for group programs are in existence.	[7] [8]	6 6	D D	EF EF
1,3,4	Perceived hearing handicap can be reduced using a combination of amplification plus a three-week counseling-based AR program.	[2]	3	B	EF
1,3,4	A four-week AR course post-HA-fitting provides patients with significantly greater reduction in self-perceived handicap in treatment group compared to control group receiving hearing aids alone.	[9]	2	A	EF
1,3,6	A combination of individual and group rehabilitation produces greater improvement than group rehabilitation alone.	[10]	4	B	EV
1,3,6	Synthetic training alone produces as much overall improvement in speech recognition as synthetic plus analytic training. Improvements are sustained for at least four weeks post-training.	[11]	4	B	EV
1,4	Hearing aids and AR improve personal adjustment to hearing loss, with AR groups particularly helpful during the initial stages when important decisions about returning hearing aids are made.	[4]	2	A	EF
1,4	Teaching of active listening (coping strategies, listening drills, confidence) produces sustainable small, but statistically significant, improvements in speech recognition. Synthetic approach (not analytic) improves several	[12]	2	A	EV

	aspects of psychosocial function.				
1,6	Ability of patients to extract information from speech signal improves as a result of audiologic rehabilitation. Auditory and visual training was equally effective.	[13]	2	A	EV
2	The patient's primary communication partner(s) should be included as part of this service.	[5]	2	B	EF
3,6	Individual communication training program shows reduction in self-perception of hearing handicap and slight improvement in speech recognition measures. Considerable variation in individuals.	[14]	2	B	EF
4	A post-fitting AR program should include specific elements.	Consensus opinion	6	D	EF
5	Benefit decreases at 6- and 12-month follow-up relative to one month post-fitting.	[15]	4	B	EV
5	Benefits of amplification as measured by speech in noise may continue to increase for 6-12 weeks.	[16] [17]	4 3	B B	EF EF
5	Acclimatization is not uniform across patients.	[18] [19]	4 4	B B	EV EV
5	Perceived benefits of amplification can increase over at least a three-month time frame.	[20]	4	B	EF
5	Primary challenges for future research involve identifying the components accounting for individual variability and devising techniques to maximize the rate and extent of acclimatization after the fitting of hearing aids.	[21]	6	D	EF
5	Patients should receive training that is characteristic of the desired listening environments.	[22]	4	B	EF
6	Audiologists should closely monitor progress in the ongoing development and availability of computerized interactive audiologic rehabilitation programs designed for home use.	[23] [24]	4 2	B A	EV EF
6	Description of a laser video disc program for speechreading.	[25]	6	D	EF

6	Overview of computer-managed instruction.	[26]	6	D	EF
6	Description of MacAid computerized hearing aid orientation communication strategy program.	[27]	6	D	EF

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5. ASSESSING OUTCOMES

The part of the patient management process that assesses how well treatment has reduced activity limitations, decreased participation restrictions, and improved quality of life is often referred to as the “validation” stage. Validating the choices made as part of the evaluation, selection, and fitting processes, to the extent that the patient’s treatment goals have been met, is accomplished through the administration of outcome measures. It is not the intent of this guideline to prescribe the specific measures to be used but, rather, to stress the importance of incorporating one or more standardized and psychometrically sound measures into routine clinical practice and to advocate the appropriate and effective use of outcome measures by matching the measures to the treatment goals.[1-2]

Outcomes can be measured objectively or subjectively. Objective outcomes often refer to measures of improved speech understanding in various everyday listening situations. In real-world conditions, however, the activity of speech understanding and the participation in events that require speech understanding are heavily influenced by contextual factors related to both the environment and the patient. As a result, many subjective outcome measures, in the form of disease-specific questionnaires, have been developed to assess the impact of a hearing impairment on the patient in the areas of communication functioning, activity limitation, and participation restrictions. Examples include the Hearing Handicap for the Elderly (HHIE),[3] the Abbreviated Profile of Hearing Aid Benefit (APHAB),[4] and the Client Oriented Scale of Improvement (COSI).[5]

It is equally as important to measure treatment outcomes in terms of their impact on our patient's perceived health-related quality of life (QOL) which are typically measured through the use of generic functional health questionnaires such as the Medical Outcome Survey Short Form 36 (MOS SF-36)[6] or the Sickness Impact Profile (SIP).[7] These questionnaires are designed to elicit responses to questions pertaining to general health, independence, pain, and depression. Unfortunately, such general measures of functional health status are often insensitive to the impact of hearing loss.[8] However, a recent study which utilized the World Health Organization's Disability Assessment Schedule (WHO-DAS II)[9] as a generic quality of life outcome measure demonstrated that the WHO-DAS II is, in fact, sensitive to hearing aid use.[10]

Occasionally, audiologists may want to look beyond the specific functional benefits of amplification to the more global domain of satisfaction which includes dimensions such as cost, expectations, perceived value, comfort, and service. The Satisfaction with Amplification in Daily Life (SADL)[11] is an example of such a measure.

There are several outcome measures that address multiple hearing aid outcome domains (functional benefit, satisfaction, QOL) within a single questionnaire. Examples of such "omnibus" measures include the Glasgow Hearing Aid Benefit Profile (GHABP)[12] and the International Outcome Inventory – Hearing Aids (IOI-HA).[13] The IOI-HA promises to be a particularly effective measure due to its ease of administration (7-item), well-researched psychometrics,[13-14] and translation into several languages.[15]

As critical as it is to measure the benefits of treatment at the level of the patient, the measurement of treatment outcomes is assuming greater importance on the national health-care stage. Through the routine use of clinically applied outcome measures and carefully controlled clinical trials, audiologists can build a foundation for evidence-based clinical practice guidelines. Clinical practice guidelines, in turn, minimize variability in outcome, maximize treatment efficacy, reduce risks, decrease waste, improve patient satisfaction, and should help to elevate the awareness of the profession of audiology among third-party payers, other health-care providers, and, most importantly, current and future patients. As audiologists continue to compete in the health-care marketplace, they must demonstrate that treatments reduce activity limitations, decrease participation restrictions, and improve health-related quality of life. Only by measuring the outcomes can audiologists be assured that treatments make a difference and patients have benefited from their care.

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