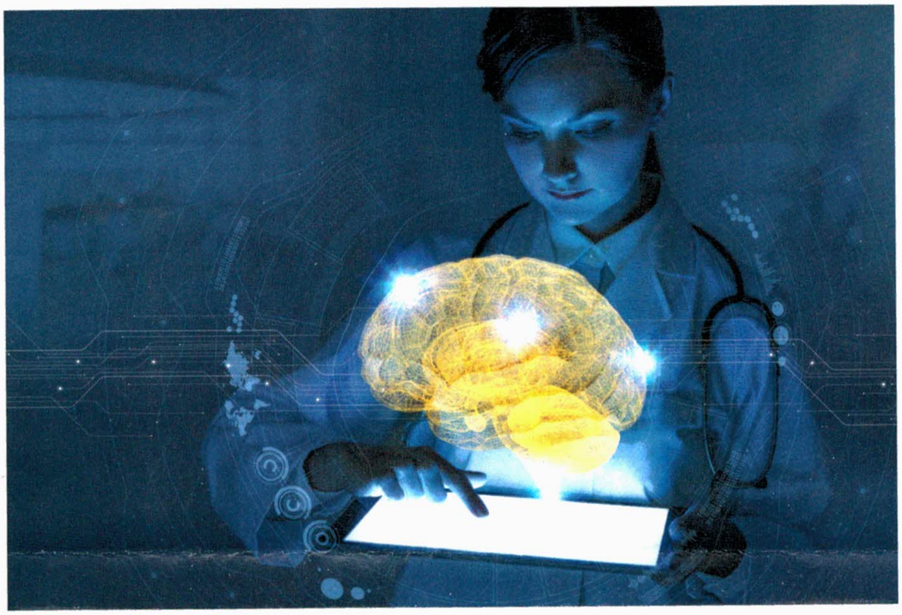
Neural and Cognitive Benefits of Hearing Aid Use

By Samira Anderson, PhD



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If you talk to one of your older patients about their greatest fears, you are likely to find that loss of memory or cognitive awareness ranks close to the top of the list. Although we know that hearing loss leads to isolation and depression,[1] the typical senior focuses on deficits that may lead to a loss of independence, such as mobility or cognitive deficits.[2] In recent years, there has been increasing interest in the possible link between cognitive decline and hearing loss in older adults among scientists and clinicians. Some of this interest resulted from studies that used data obtained from the Baltimore Longitudinal Study on Aging (BLSA), which has been active since 1958 and provided a wealth of data on various conditions known to be affected by aging, including hearing and cognition. Investigations of this dataset have revealed that individuals with hearing loss experience a steeper decline in cognitive abilities as they age than individuals with normal hearing.[3] The implications of this study are fairly obvious, and this and follow-up studies have triggered speculation that perhaps hearing aid use may improve or offset cognitive decline. In fact, some hearing aid companies have capitalized on the hearing-cognitive connection in their advertisements. Given seniors' fears of losing cognitive ability, this line of marketing makes sense. An older adult may be reluctant to try hearing aids, but the potential for improved or maintained cognitive ability might be a significant motivating factor.

EXAMINING THE EVIDENCE

Is there any evidence that hearing aid use improves cognitive ability? Recent studies have shown promising results. A 25-year longitudinal study showed that individuals with self-reported hearing loss experienced significantly more cognitive decline (measured using the Mini-Mental State Examination) than individuals with normal hearing.[4] However, the hearing-impaired participants who wore hearing aids demonstrated cognitive ability similar to that of normal-hearing participants. Another study investigated several factors to determine if hearing aid use is associated with better cognitive performance.[5] This study used the Digit Triple Test, a telephone speech-in-noise screening test that is highly correlated with audiometric thresholds,[6] and measures of fluid intelligence, reaction time, and pairs matching (memory) to evaluate cognitive ability in a large cross-sectional sample of 164,700 participants. They found that hearing aid use was associated with better cognition, and that these effects were independent of isolation and depression factors. However, the mechanisms responsible for this association have not yet been elucidated. Furthermore, while these studies show potential positive benefits of hearing aid use, it may be the case that individuals who have greater cognitive ability are more likely to pursue hearing aid use.

To further explore these issues, we performed a short-term longitudinal study in new hearing aid users to determine if hearing aid use improves cognitive function. Because hearing loss and aging may affect cortical representation of auditory signals,[8,9] we wanted to determine if hearing aid use results in changes in cortical auditory evoked potentials (CAEPs) and whether neural changes are associated with cognitive improvements. The study

After practicing clinical audiology for 26 years, **Dr. Anderson** decided to pursue research to better understand the hearing difficulties experienced by her patients. She obtained her PhD in 2012 and joined the department of hearing and speech sciences at the University of Maryland. Her research focuses on the effects of aging and hearing loss on central auditory processing and neuroplasticity and uses this information to evaluate efficacy of hearing aids, cochlear implants, and auditory training.

Table 1. Sample Policies to Mitigate Professional Liability in Audiological Practice[5]

Patient Written Consent: Patients have a right to know what procedures will be performed and what is expected of them during assessment. Patients should be required to provide a written consent for the assessment and any subsequent treatment after receiving a full explanation of the test process and management plan and an opportunity to ask questions. Parents or legal guardians must consent for the hearing assessment of minors (below 18 years old in most U.S. states).
Patient Safety is Priority #1: Consistent with the well-appreciated Hippocratic oath, audiologists should strive to improve communication and quality of life of their patients, while also causing their patients no physical or other forms of harm. General steps to maintain patient safety include observing universal precautions to control and prevent infection, preventing falls, and maintaining a safe environment of care.
Patient Privacy, Security, and Confidentiality: Patient privacy and security are extremely important goals in modern health care delivery. Patient privacy includes the right to control personal information and the freedom from intrusion or observation. Security includes administrative, physical, and technical safeguards that limit and control access to protected health information and prevent accidental or intentional disclosure of information to unauthorized persons or entities. Audiologists must comply with Federal laws, such as the Health Insurance Portability and Accountability Act (HIPAA), and state laws pertaining to patient privacy and security.

experiences a medical emergency like a heart attack or epileptic seizure. Even the most junior staff member or student-in-training should feel empowered to bring to his or her supervisor's attention any perceived potential or actual problems involving patient rights, privacy, security, and safety.

STEP 3: FOLLOW STANDARD OF CARE

Standard of care in our context is defined as the degree of prudence and caution that a reasonable audiologist should exercise in caring for patients in a given clinical situation. In the modern health care setting, standard of care is almost always consistent with national clinical practice as defined in written statements of guidelines and recommendations, as reviewed next. These documents include those generated by audiology professional organizations and also multi-disciplinary groups of professionals. Standard of care in audiology must also be consistent with statements of scope of practice, code of ethics, state licensure laws and regulations, and federal health care regulatory entities like the Centers for Medicare & Medicaid Services (CMS).

STEP 4: KNOW AND COMPLY WITH GUIDELINES

Evidence-based, peer-reviewed clinical practice guidelines exist for almost everything audiologists do in the process of identifying, diagnosing, and managing hearing loss and related disorders (e.g., auditory processing disorders, vestibular disorders, tinnitus, and disorders of decreased sound tolerance). Sample guidelines in Table 2 online (bit.ly/Table2Hall). Compliance with clinical practice guidelines is the simplest and most straightforward step that audiologists can take to lower the risk of professional liability. These documents are readily available on the websites of professional organizations like the American Academy of Audiology and the British Society of Audiology. An audiologist who is drawn into a professional liability lawsuit has a strong legal defense if she or he can prove full compliance with relevant clinical practice guidelines. Practicing audiology as recommended in widely accepted evidence-based guidelines demonstrates adherence to standard of care.

STEP 5: COMMUNICATION AND DOCUMENTATION

Another important two-part step in minimizing professional liability is not at all complicated. First, audiologists should consistently communicate effectively with patients and their family members, beginning with compassionate and caring interactions upon the initial meeting. Before performing any procedure, the audiologist should explain the process first and answer the patient's questions. It's a good policy to reassure patients that they can ask you to discontinue a procedure at any time if they have concerns or experience physical discomfort. Provide patients with reports of services provided and respond promptly to any telephone calls or emails from patients or family members. Second, audiologists must carefully and completely document in writing everything that was done with and to the patient. Supplement written notes with printouts of all test findings and/or photographic documentation (e.g., images from video-otoscopy). Of course, all documentation must be safeguarded for patient privacy. Common legal advice about documentation is straightforward: If you did not document what you did, then you did not do it.

These steps offer a practical and effective approach to minimizing risk of professional liability, including civil and criminal malpractice claims. Unstated was the requirement to maintain current clinical credentials like state licensure and specialty certificates. Audiologists working in hospitals, large multi disciplinary practices, and academic health care systems are no doubt familiar with and regularly receive updates on these and other systemic approaches to minimizing medical errors in providing hearing care. Audiologists who own or are employed in individual practices are advised to develop and implement similar approaches to mitigate professional liability while also improving patient care.

References for this article can be found online at http://www.thehearingjournal.com.

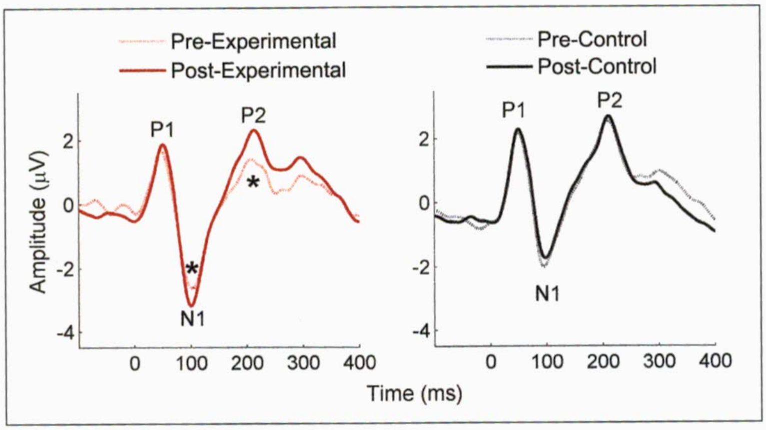

Figure 1. Group average cortical waveforms are displayed for day one of the hearing aid trial (Pre, dashed line) and at six months (Post, solid line) in hearing aid users (experimental, red) and non-hearing aid users (control, black). The N1 and P2 peaks increased significantly in the hearing aid users, but not in the non-users. $^*p < 0.05$. (Adapted with permission from Karawani, et al., 2018).

involved 36 participants with mild-to-moderate sensorineural hearing loss who were randomly assigned to either the experimental (hearing aid use) or control (no hearing aid use) group. Eighteen participants in the experimental group and 14 participants in the control group completed the study. Each participant was fit with hearing aids (Widex Dream 440 receiver-in-the-canal hearing aids). CAEPs to the speech syllable /ga/ were recorded in aided and unaided conditions at the first visit and six months later. Cognitive testing (working memory, speed of processing, and attention/inhibition) was performed in the aided condition at both the first and last visits. The experimental group was instructed to wear the hearing aids for a minimum of eight hours per day. They were seen at regular intervals (two, six, 12, and 18 weeks) to ensure compliance with hearing aid use and to record aided CAEPs. During these visits, the participants' data logging records were examined, and when necessary, they were counseled to troubleshoot reasons for non-use. The hearing aid settings were not adjusted until completion of the study.

STUDY RESULTS

We found that the amplitudes of the N1 and P2 cortical peaks increased after six months in the experimental group, but no changes occurred in the control group (Fig. 1). The two groups were matched in working memory at the first visit. After six months, the working memory standard score increased by an average of six points in the experimental group, but the working memory score did not change in the control group (Fig. 2). No changes in processing speed or attention/inhibition were seen in either group. Interestingly, increases in cortical P2 amplitudes related to improvement in working memory scores. Previous studies have shown that sensory exposure may increase P2 amplitudes and thus improve the auditory system's sound identification.[10] Therefore, the association between cortical and working memory changes suggests that improved auditory perception frees up resources that can then be allocated to cognitive tasks, such as working memory.

We are currently evaluating the data to determine the time course of neuroplasticity. Knowledge of the time course of changes in neural and cognitive functions would provide an important counseling tool, especially for new hearing aid users. While the results of this study are quite encouraging, it is important to note the limitations of the study. The control group did not receive any treatment and was not seen in the intervening months between the first and last visits. Therefore, their expectations for improvement would be reduced compared with the experimental group, possibly influencing performance during the final visit. Also, this was a relatively small study, and it would be important to replicate these findings in a larger dataset. Finally, it would be beneficial to evaluate neuroplasticity in hearing aid users over a longer period using a double-blind protocol.

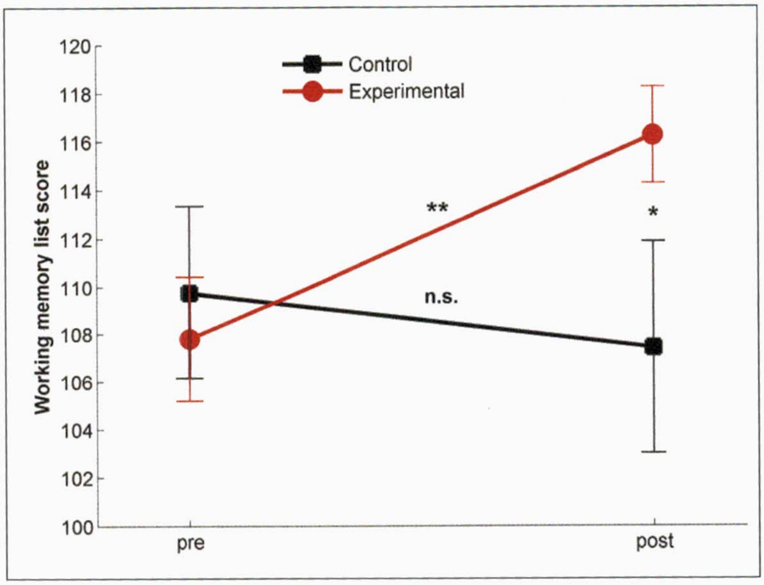

Figure 2. Mean working memory standard scores are displayed for hearing aid users (experimental, red) and non-hearing aid users (control, black). Working memory scores increased significantly in the hearing aid group but not in the control group. $^*p < 0.05$, $^{**}p < 0.01$. (Adapted with permission from Karawani, et al., 2018).

References for this article can be found online at http://www.thehearingjournal.com.

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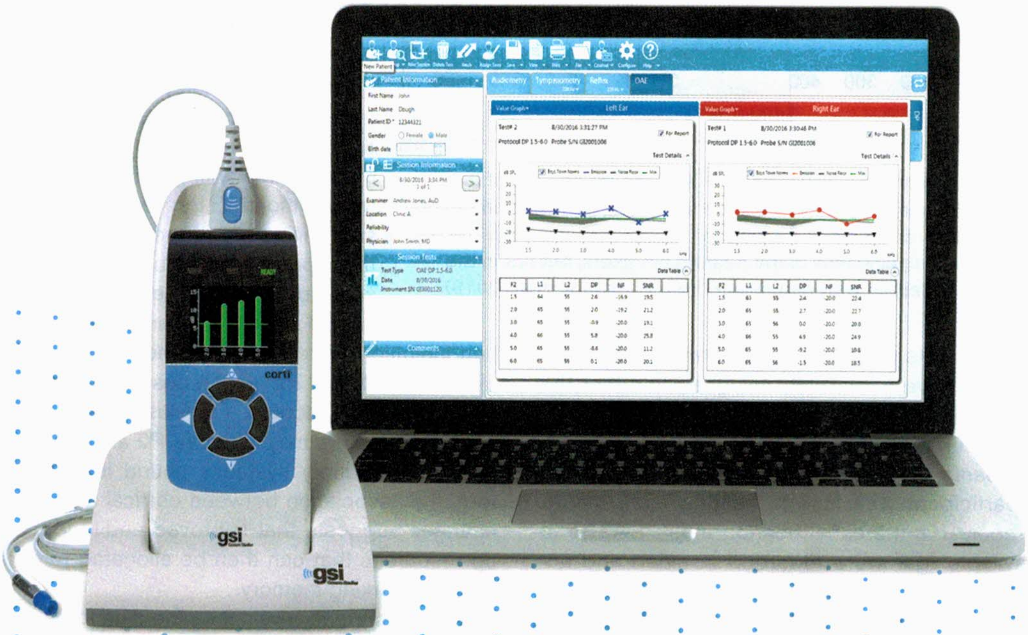
SMART AND SIMPLE



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