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Aural rehabilitation of older adults with or at risk for cognitive decline: Development of recommendations and supplemental resources based on evidence from the literature.

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AURAL REHABILITATION OF OLDER ADULTS WITH OR AT RISK FOR COGNITIVE DECLINE: DEVELOPMENT OF RECOMMENDATIONS AND SUPPLEMENTAL RESOURCES BASED ON EVIDENCE FROM THE LITERATURE

A Scholarly Project Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Audiology

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Audiology

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has been approved as meeting the requirement for the Degree of Doctor of Audiology in the College of Natural and Health Sciences, Department of Audiology & Speech-Language Sciences, Program of Audiology.

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ABSTRACT

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The purpose of this research project was to determine if there might be a need to supplement hearing healthcare service delivery for older adults with or at risk of cognitive decline. Through database searches, evidence was collected from the literature to determine recommended resources within the professional field of audiology and surrounding healthcare professions. Based on the literature, appropriate resources for retention of medical information in this population were recommended. Resources were then created based on the literature recommendations for hearing aid fittings and follow-ups when working with older adult patients with or at risk of cognitive decline. The resources included written supplemental materials with visual pictures in the form of hand-outs and video supplemental materials available to patients on YouTube. The resources were created to provide older adult patients with hearing loss and with or at risk of cognitive decline with additional support in the hearing aid rehabilitation process.

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CHAPTER I

INTRODUCTION

As the population becomes increasingly older, the prevalence of age-related ailments, such as hearing loss and cognitive decline, is on the rise. It is important for healthcare providers working with older individuals to consider the effects aging has on cognition and sensory functioning. According to Lin et al. (2011), the prevalence and risk factors for hearing loss among adults over the age of 70 is increasing. Hearing loss in older adults was 63.1% in one or more ear and factors were strongly associated with age, sex, and race (Lin et al., 2011). Many older adults acquire age-related hearing loss and hearing aids are often recommended. Although hearing aids are a treatment option for older adults with hearing loss, Bainbridge and Ramachandran (2014) found a low prevalence of hearing aid use in this population. Cross-section data examined and obtained during 2005-2006 and 2009-2010 from adults age 70 years and older revealed only one-third of potential hearing aid candidates reported current use of hearing aids (Bainbridge & Ramachandran, 2014).

Older individuals with cognitive decline face additional obstacles including impaired memory for new information (Wingfield et al., 2005). Learning new medical information, such as how to use a hearing aid, can be a daunting and difficult task for individuals with cognitive decline. Due to impaired memory as a result of cognitive decline, some older individuals might struggle to retain important instructions during audiology appointments. According to Juncos-Rabadán et al. (2013), the prevalence of cognitive impairment in adults aged 50 and older was

31.40% with a positive correlation for age, occupation, memory complaints, reading habits, and level of vocabulary.

It is essential to note that information presented in hearing aid fittings can be difficult to retain for all patients but those with cognitive decline are at greater risk for not understanding or remembering the information presented (Deiber et al., 2015). Not remembering the materials presented during a hearing aid fitting appointment could lead to lack or misuse of a hearing device. According to Latorre-Postigo et al. (2017), older adults with decreased memory function have a difficult time remembering medical appointments when presented with an abundance of information. It was recommended to provide more consultations and less information in each session. Professionals could be cognizant of the effects aging has by adapting materials used for medical counseling based on individual need. To better medical recall for patients during healthcare appointments, Watson and Mckinstry (2009) performed a systematic review of literature to determine the most effective supplemental materials for patients. The results indicated written and audio-recorded methods of medical instructions were most effective.

To assist audiologists in determining appropriate treatment plans for adults of varying ages, American Academy of Audiology Task Force members developed guidelines for audiologic management of adult hearing impairment (Valente et al., 2006). Within these guidelines were ample resources on how to provide the best practice for adults with hearing impairments. Some of the resources provided included diagnostic measures for adults with hearing impairment, non-auditory needs assessments (e.g., cognitive screeners), selection of hearing aids, general fitting and verification of hearing aids, hearing assistive technology, counseling and follow-up (Valente et al., 2006). The resources and recommendations provided

suggested a protocol for the general adult population; however, there were no specific guidelines and/or modifications for adults with cognitive decline.

Statement of Purpose

The purpose of this doctoral scholarly project was to determine the need of resources and supplemental materials for audiologists working with older adults with or at risk of cognitive decline. Thus, the following research question was developed to guide this scholarly project:

Q1 What does the literature suggest in terms of recommendations and needs for treating older adults with hearing loss who may also have difficulties related to cognitive decline?

Summary

Audiologists often provide hearing healthcare services to the aging population. Older adults are at risk of age-related conditions such as hearing loss and cognitive decline. One way to address hearing loss is by wearing hearing aids. The use of hearing aids includes learning new technology, maintenance, and care of the devices. Learning information on medical devices can be difficult for the general population with typical cognition. Older adults with varying degrees of cognitive impairment are at greater risk of misunderstanding or forgetting essential medical information, including hearing aids (Deiber et al., 2015). To increase retention of medical information, written and audio-recorded supplement to medical instruction were considered the most effective supplemental materials (Watson & Mckinstry, 2009). Resources such as the AAA Task Force created by Valente et al. (2006) provide clinical audiologists with guidelines on working with the general adult population and hearing aids. Audiologists need to be well-equipped with materials to assist in information recall in older adults with cognitive decline during hearing aid fitting appointments.

CHAPTER II

CURRENT KNOWLEDGE BASE/EVIDENCE BASE: LITERATURE REVIEW

Prevalence of Hearing Loss and Hearing Aid Use in Older Adults

The purpose of this research project was to determine the need of resources and supplemental materials for audiologists working with hearing impaired older adults with or at risk of cognitive decline. Hearing loss might occur as part of the aging process. Hearing loss associated with increased age is commonly known as presbycusis. Historically, hearing loss in older adults was related to noise exposure throughout the lifetime. To evaluate the risk factor of noise exposure leading to hearing loss in older adults, Yang et al. (2015) reviewed age-related hearing loss and compared its characteristics to ototoxic hair cell death and noise-induced hearing loss. In adults between the ages of 70 and 79 years, 63% of males and 48% of females were affected by hearing loss. Although the influence of genetics and lifestyle played additional factors, it was not certain to what extent their impacts might have contributed to hearing loss. Cochlear pathologies were shown to be the most prevalent form of hearing loss in the aging population. According to Yang et al. (2015), the stria vascularis, spiral ganglion cell, and inner and outer hair cells were common origins for cochlear hearing losses in older adults—more specifically in relation to noise-induced hearing loss. Hearing loss, including noise-induced hearing loss and presbycusis, continues to be one of the leading ailments in the elderly today (Yang et al., 2015). Noise exposure is a critical risk factor to prevent but it is also important to note the strong relationship between age and hearing loss. Lin et al. (2011) analyzed data from a

2005-2006 cycle of the National Health and Nutritional Examination Survey to examine hearing loss prevalence and risk factors among adults over the age of 70. The findings revealed the prevalence of hearing loss in older adults was 63.1% in one or more ear and the factors were strongly associated with age, sex, and race. Noise exposure or medical conditions were not associated with hearing loss in this population (Lin et al., 2011). Therefore, hearing loss found in older adults was not simply due to noise exposure over time. A common treatment for hearing loss in the aging population is hearing aids.

Although hearing aids are a treatment option for older adults with hearing loss, research has shown a low prevalence of hearing aid use in this population. Bainbridge and Ramachandran (2014) examined National Health and Nutrition Examination Survey data to determine factors associated with low proportions of hearing aid use among older adults. The cross-sectional data were obtained during 2005-2006 and 2009-2010 from 1,636 adults aged 70 years and older. Self-reported hearing aid use, perceived hearing ability, data on pure-tone thresholds, date of last hearing test, and socio-demographic considerations were obtained during this survey review. The results indicated only one-third of potential hearing aid candidates reported current use of hearing aids. The authors noted the most prevalent hearing aid use was among the older adults in an upper income level when compared to older adults in a lower income level. In addition, older adults who had their hearing tested within one to four years were more than two times as likely to be a hearing aid user. The authors concluded the use of hearing aids was low among older adults who might benefit or were candidates. Hearing healthcare professionals should consider and identify barriers for hearing aid use in the older population to provide the best professional patient care.

Prevalence of Cognitive Decline and Dementia in Older Adults

While hearing loss is one of the top ailments among older adults in the United States today, another ailment seen in older adults is cognitive decline, ranging from mild cognitive impairment to severe impairments such as dementia. Juncos-Rabadán et al. (2013) examined the prevalence of mild cognitive impairment in adults over the age of 50 who were in care centers with complaints of cognitive decline. The Mini-Mental State Examination, the Cambridge Cognitive Examination-Revised, and the California Verbal Learning Test were administered to a sample of 689 individuals over the age of 50 to evaluate mild cognitive impairment. In addition, the authors were interested to see if any other related factors correlated with cognitive impairment. The authors' findings suggested the prevalence of mild cognitive impairment was 31.40% and positive correlations were found for age, occupation, memory complaints, reading habits, and level of vocabulary in relation to the cognitive decline. Adults aged 70 years and older were likely to have cognitive complaints and lower levels of vocabulary. In conclusion, the authors noted nearly one-third of the adults attending the care centers with cognitive complaints were affected by mild cognitive impairments. Juncos-Rabadán et al. suggested early evaluation of cognitive functioning to establish proper intervention and prevention strategies.

The Relationship Between Hearing Loss and Cognitive Decline in Older Adults

The relationship between cognitive decline and hearing loss has been questioned by researchers for many years. Some researchers believed that decline in the sensory system, more specifically hearing loss, played a large factor in the severity and/or progression of cognitive decline. To further understand this topic, Amieva et al. (2015) investigated the association among hearing loss, hearing aid use, and cognitive decline over a 25-year period. This was a

prospective population-based design that included 3,670 individuals aged 65 and older chosen from the PAQUID, a French epidemiological study. Patients were followed for 25 years and evaluated every two to three years in the time window. At baseline, hearing loss was determined using a questionnaire developed by the research team that assessed self-perceived hearing loss. Of the participants in the study sample, 2,394 reported to have no hearing trouble, 1,139 reported moderate hearing loss, and 137 reported major hearing loss. Cognitive decline was measured using the Mini-Mental State Examination (MMSE) and administered at follow-up visits over 25 years. The association between hearing loss and hearing aid use and decline in MMSE score over the 25 years was assessed using a linear mixed-effect model to analyze longitudinal data. The findings suggested self-reported hearing loss was significantly associated with lower baseline MMSE scores and a greater decline in cognitive ability during the 25-year follow-up period. Of the 1,276 participants with reported hearing loss, 150 wore hearing aids. Individuals reporting hearing loss and not using hearing aids declined more rapidly on the MMSE scores with a mean difference of 0.06 points per year. The authors concluded hearing loss was associated with accelerated cognitive decline and hearing aid use might prevent this decline.

Similarly, Lin et al. (2013) investigated the possible association between hearing loss and accelerated cognitive decline in older adults. A total of 1,984 participants aged 70 to 79 were followed over the course of six years. Cognitive and audiometric testing was done throughout the years to compare results over time. Pure-tone averages were used to assess hearing while the Modified Mini-Mental State Examination (3MS) was performed to assess cognitive impairment in the subjects. Hearing at baseline was determined using a pure-tone average of thresholds at 500Hz to 4000Hz in the better-hearing ear. Cognitive testing was performed at years 5, 8, 10, and 11 and consisted of the 3MS and a digital substitution test. According to results of the 3MS,

individuals with hearing loss at baseline had a 24% increased risk for incident cognitive impairment. A relationship between hearing loss and cognitive decline in older adults was found but the data did not support the thought that hearing loss accelerated cognitive decline. The researchers noted a significant association between hearing loss (pure tone average greater than 25 dB) and poorer cognitive function on verbal and nonverbal cognitive tests. The authors concluded that further research was needed to investigate the association between hearing rehabilitative interventions and cognitive decline.

Older Adults with Comorbidities

In addition to hearing loss and cognitive decline, audiologists need to be aware of possible comorbidities within the aging population. Dupuis et al. (2019) examined the prevalence of identified selected comorbidities in geriatric audiology clinic, comorbidity influence on audiology practice, and the effect of comorbidities on rehabilitation outcomes. One-hundred and thirty-one clients with a mean age of 86 years were examined. Information about comorbidities and rehabilitation recommendations came from audiology charts and hospital electronic health records. Comorbidities included vision decline, manual dexterity, cognitive issues, depression, falls, hypertension, and diabetes. Dupuis et al. indicated that frequency in vision decline was 68%, 50% for cognitive decline, and 42% for manual dexterity issues. Of all 135 clients, 84% had more than one health issue including hypertension (43%), falls (33%), diabetes (13%), and depression (16%). The implications of this study highlighted the importance of modifying audiology practice for clients depending on their individual comorbidities. The authors suggested increased interprofessional communication among clinicians to improve care planning and outcomes for older adults with hearing loss.

Hearing Aid Use in Older Adults

Current knowledge and evidence base shows many older adults have varying degrees of hearing loss that require amplification. Unfortunately, it was noted by Hartley et al. (2010) that only 11% of older adults with amplifiable hearing loss owned hearing aids. The reason for the low number of this population wearing hearing aids had to do with a variety of factors including poor visual acuity and dexterity problems. Erber (2003) found older adults with poor vision and manual dexterity difficulty were less likely to own or succeed with hearing aids. Although non-auditory factors contribute to a large number of older adults not succeeding with hearing aids, other factors to take note of include cognitive and memory impairment. Baltes and Lindenberger (1997) examined the relationship between sensory and cognitive function between younger and older adults. A total of 171 younger individuals (25 to 69 years old) and 516 older adults (70 to 103 years old) were included in this study. The researchers measured visual acuity, auditory acuity, and cognitive ability through a cognitive test battery; 14 tests measured five different cognitive abilities including perceptual speed, reasoning, memory, knowledge, and fluency. From these testing measures, Baltes and Lindenberger concluded that older adults (age 70 to 103) displayed a strong relationship between cognitive and sensory function—meaning older adults with cognitive decline also appeared to have high rates of hearing loss.

According to the literature, it was apparent that hearing aid use was minimal for older adults, especially those with cognitive and sensory loss. Hartley et al. (2010) conducted a study to determine the prevalence and factors associated with the use of hearing aids and assistive listening devices (ALDs) in older adults. In their study conducted between 1997 and 2003, 2,956 participants between the ages of 49 and 99 were included. Full audiologic assessments were administered and a comprehensive hearing survey that included hearing aid and ALD questions

was completed. Of the population sample, 33% had a measured hearing loss, 11% owned hearing aids, and 24% reported never using their hearing aids. The more severe the hearing loss, the more prevalent the use of ALDs. The authors found hearing aid and ALD usage was low in the older population. Approximately 4.4% had used ALDs in the past 12 months and only 11% of the older population owned hearing aids. Since a significant portion of older adults reported hearing loss, hearing aids would be beneficial to increase quality of life. The authors concluded the need for professionals to contribute a greater effort to encourage and promote the benefits of hearing aid technology in hopes of increasing the use of hearing aids and ALDs in older adults with hearing loss.

With the low proportion of hearing aid use in this age group in mind, Erber (2003) looked at the influence of non-auditory factors (vision and manual dexterity) on the successful use of hearing aids in older adults. Due to the nature of age-related hearing loss, older adults might struggle to understand conversational speech. To compensate for the loss of audition, these adults attempted to counteract with an increased use of visual cues to comprehend speech. According to Erber, older adults used visual cues to assist in speech understanding and some might maintain the ability to converse without the use of hearing aids. Therefore, avoidance and denial of the need for hearing aids could be seen in this population.

Benefit of Hearing Aid Use in Older Adults with Hearing Loss

Hearing aid use in older adults with hearing loss has been proven to increase quality of life. Lotfi et al. (2009) investigated the quality of life in older individuals with hearing impairment after being fitted with hearing aids. Older adults who were referred to the Tehran Welfare Organization rehabilitation centers completed the Hearing Handicap Inventory for the Elderly (HHIE) questionnaire before the hearing aids were fit and three months after using

hearing aids. The subjects' quality of life scores were compared with each other and between males and females. The researchers found significant improvements of quality of life were seen in these individuals after three months of using a hearing aid. Participants with severe hearing loss scored an average of 141.93 in the social component of the HHIE before the use of hearing aids. After the use of hearing aids, their averaged social handicap scores dropped to 105.33. Subsequently, scores for the emotional component dropped as well. The results led the researchers to conclude that hearing aids were beneficial for presbycusis. The data obtained were used as a tool for audiologists to counsel older adults on the benefits of hearing aids. Comparing scores from before and after the use of hearing aids allowed patients to see the apparent benefit of wearing hearing aids.

Cognitive Decline and Memory in Older Adults

A common impairment that might influence the use of hearing aids in older adults is cognitive decline and/or memory impairment. Deiber et al. (2015) conducted a study to determine if subtle cognitive decline in healthy older adults could be predicted by electrophysiological recording (EEG) signals under cognitive activation. Continuous EEGs were recorded in 97 elderly control subjects and 45 age-matched mild cognitive impairment cases to demonstrate how cognitive deterioration could affect attention and working memory. The participants in the control group were evaluated with an extensive neuropsychological assessment and the participants in the mild cognitive impairment condition were assessed with a shortened battery that included the MMSE, Hospital Anxiety and Depression Scale, and the Lawton Instrumental Activities of Daily Living. An 18-month follow-up was conducted to compare the results from the initial patient visit. Two cognitive tasks were tested—a detection task and a working memory task were both measured with continuous EEG recordings using 30

surface electrodes mounted on a cap. Reaction time was measured as the time between target onset and the participant's response with a button press. Among the healthy subjects, 43% developed subtle cognitive decline after the 18-month period based on event-related potential data obtained from the EEG recordings done at both visits. Deiber et al. indicated that the results showed perception, discrimination, and working memory processes were associated with cognitive deterioration but attention was most strongly associated. Additionally, EEG recordings showed cognitive decline altered neural firing synchronization at high frequencies, indicating a possible relationship between hearing loss and cognitive function.

Multidisciplinary Perspectives of Working with Older Adults with Cognitive Decline

When working with older adults who have cognitive decline, it is important to consider multidisciplinary perspectives. Irace et al. (2021) investigated the association between age-related hearing loss and cognitive decline. The professional departments involved in the study included the Baltimore Department of Otolaryngology, Psychiatry, Behavioral Neuroscience, and the Institute on Aging and Gerontology. The researchers included participants from the Baltimore Longitudinal Study aged 50 and older with an audiometric evaluation completed between January 1991 and 1994 and at least one neuropsychological assessment after the hearing evaluation. Only participants with normal pure-tone averages were included in the study. Learning and memory were assessed with the Benton Visual Retention Test, executive function was assessed with the Trail-Making Test, mental status was assessed using the MMSE, and language was assessed using the Letter Fluency test. The authors found that of the 263 participants, no significant relationships were observed between hearing and dementia diagnosis. A relationship between cognitive decline and hearing loss was noted for the Letter Fluency test.

Alexandria et al. noted further research was necessary to determine where in the spectrum of hearing loss the relationship between hearing loss and cognitive decline could be observed.

Cooley et al. (1998) discussed what practitioners should know about working with older adults. The authors discussed how the elderly population itself is living longer, common myths about older people, age-associated physical changes, cognitive changes associated with aging, and how older adults coped with these changes. The authors overviewed how psychologists should consider individual needs when conducting testing such as making sure the testing instructions are clear and concise, preparing the individual ahead of the testing, being aware of language difficulties associated with cognition, creating a well-lit and quiet environment, and using test material specifically constructed for older adults. Finally, Cooley et al. discussed appropriate psychological interventions with older adults. It was noted how individual needs are essential to take into consideration when developing intervention procedures. This study shed light on how other professions, such as psychologists, could modify or adapt their intervention style when working with older adults who have cognitive decline.

Furthermore, it is crucial for professionals to learn ways to optimize understanding health-related information. Heinrich and Karner (2011) evaluated and examined patient education in the nursing profession. Focus groups were held with elderly patients living independently in the community in an urban area. A total of 14 older adults aged 60 years and older were included in the focus groups. The focus groups were centered around how healthcare providers delivered instructions, how they felt about the way the instructions were explained, what helped patients understand and remember information, and what patients thought interfered or stopped them from knowing the medical information. Based on the results, the authors found the patients usually had a difficult time understanding what was being presented by the

physician. The participants also noted additional written instruction was a useful supplement. Participants also noted that physicians often seemed too busy to answer useful questions and the information provided was often inconsistent. The findings of this study led readers to understand the importance of educating elderly patients on essential medical information.

Healthcare professionals have an important role in destigmatizing hearing loss in older adults. Wallhagen (2009) explored the depths of stigma older adults with hearing loss experienced daily. The longitudinal qualitative study was conducted over one year where older adults (over the age of 60) with hearing loss and their communication partners or families were interviewed regarding their thoughts on hearing aid stigma. The researcher found patients reported a perceived stigma in terms of accepting a hearing loss, hearing aid selection, and where or if recommended hearing aids were worn. The stigma was related to alterations in self-perception, ageism, and vanity influenced by interpersonal relationships and societal norms. Wallhagen's final discussion included ways professionals across all disciplines could help break the stigma by promoting assessment and treatment of hearing loss and emphasizing the importance of remaining engaged to support physical and cognitive functioning.

Retention of Medical Information in Older Adults

Older adults with cognitive decline struggle to remember essential medical information. Latorre-Postigo et al. (2017) analyzed and tailored different ways of presenting medical information to older adults with decreased memory function. In this experimental study, adults over the age of 60, with and without cognitive decline, were recruited to analyze the type and amount of information presented, mode of presentation, and time delay of recalling medical information during medical appointments. Based on the results, the authors indicated the greater amount of information provided to the patient resulted in a poorer recall of the information. It

was noted that visual presentation in supplement to verbal presentation did not increase recall. Medical information was less likely to be recalled than lifestyle information. After only 10 minutes, the percentage of memory recall decreased significantly and the first and last recommendations were remembered the best. It was recommended that instead of overloading the patient with information, it was best to provide more consultations and less information in each session (Latorre-Postigo et al., 2017).

Similarly, Mcguire (1996) examined older adults' memory for medical information compared to that of younger adults. The participants were split into two groups: one younger group with ages ranging from 18 to 44 years and another older group with participants ranging from 60 to 82 years of age. All participants were screened for cognitive impairment; across the two groups, there was no significant difference in cognitive status. The participants were presented with a videotape on osteoarthritis that was designed to stimulate a counseling session in a physician's office. The information was presented in either an organized or unorganized presentation condition. In the organized condition, the information was presented in the usual order: test results, diagnosis, treatment, and miscellaneous. The unorganized was presented as treatment, results, diagnosis treatment, diagnosis, test results, treatment. The unorganized scenario is what is commonly seen in medical follow-ups. The retention of information was assessed immediately and after one-week and one-month delays. The results indicated the organization did not impact the amount of information remembered. Mcguire's findings suggested younger and older adults remembered equivalent amounts of medical information. All subjects recalled more information immediately when compared to after the one-week and one-month delays. Younger adults initially recalled more information than older adults. However, regardless of the adults' cognitive status, each had a difficult time recalling medical information.

The outcomes of this study validated the difficulty adults of all ages have in retaining medical information. Audiologists need to take the difficulty of medical retention into consideration, especially when working with older adults who have cognitive decline.

The Impact of Cognitive Decline on Benefits of Aural Rehabilitation in Older Adults

To assess the impact of audiological rehabilitation on older adults with cognitive decline, Pichora-Fuller and Singh (2006) conducted a review of the effects of age on auditory and cognitive processing and the implications for hearing aid fitting and audiologic rehabilitation. The authors explored hearing aid and audiologic rehabilitation recommendations for this population and focused on assessment and outcome measurement tools. First, Pichora-Fuller and Singh considered cognitive neuroscience as a framework for rehabilitative audiology including the site-of-lesion-view and processing view. Within this topic, it was mentioned how listening effort, memory, comprehension, and attention were slowed with cognitive decline. The authors examined new methods for rehabilitative audiology in this population and auditory factors contributing to age-related differences in communication. Finally, Pichora-Fuller and Singh focused on cognitive decline in older adults and how audiological rehabilitation could be adapted for individual need. Adaptations included use of simple terminology, more frequent follow-ups, and attention to patient's non-auditory and auditory ability when selecting proper amplification.

Comparably, Tremblay and Backer (2016) conducted a review on how cognitive contributions influenced the rehabilitation of older adults with and without audiometrically defined hearing loss. The authors summarized that aging affected the way sensory input is processed in the brain and cognition was heavily involved in effective auditory communication. Due to these age-related changes in processing within the central auditory pathway, the aging brain's reduced capacity requires increasing effort for tasks such as listening and interactions

involving the ear-brain system. Measuring cognition is not the same as measuring effort as two individuals might have equal performance on a cognitive task but one exerts more effort than the other. The decline associated with aging places an extra burden on processing resources when trying to listen to sound in noisy environments, often resulting in listener fatigue. Tremblay and Backer noted how listening and learning in older adults could be accomplished through aural rehabilitation. Hearing aids and listening training were discussed in terms of how patients could reduce the amount of cognitive effort required in various everyday tasks for older individuals.

Finally, Mamo et al. (2018) conducted a systematic review to assess the studies of treating hearing loss in older adults with cognitive impairment. The literature search included PubMed, the Cochrane Library, Embase, CINAHL, and PsychINFO. Of 50 eligible full-text reviews, 13 were included in the final review. Overall, the studies suggested hearing loss treatment was beneficial in improving dementia-related symptoms and communication. Older adults with cognitive impairment showed positive outcomes related to hearing aid use that included reduced dementia-related behavioral symptoms, reduced hearing handicap, and improved speech-in-noise abilities. The authors noted clinical applications in which adaptions were made to help patients adapt to their hearing aids. Some adaptions made in the studies included delivering hearing aid fitting services at home, using non-custom personal sound amplifiers, using speech therapy and communication training to improve communication in conjunction with hearing aids, and using pocket talkers to transition to hearing aids. In conclusion Mamo et al. noted that with the additional of clinical adaptions, older adults with cognitive impairment saw improvements with the use of aural rehabilitations.

Patient-Centered Care for Older Adults

Counseling is an important component in audiologic rehabilitation efforts to provide medical information as well as to increase the likelihood of success and satisfaction with hearing aids. Brooks (1979) examined the effects of counseling on hearing aid use. The author was trying to determine if patients who received counselling before and after hearing aid fittings made better use of their hearing aids than individuals who did not receive counseling. Eight men and 22 women between the ages of 65 and 88 participated in this study. The control group was given hearing aids with just one visit to the clinic and instructions to come back only if questions arose. The second group was given maximum counseling on the benefits of hearing aids, the problems that might occur, and how to overcome difficulties with the device. After the sessions, both the control and experimental groups were interviewed and the overall experience using hearing aids was taken into consideration. Participants who did not receive additional counseling used their hearing aids less and had lower competence when it came to use of the hearing aids. The participants who received additional counseling made significantly better use of their hearing aids, were better at handling their aids, and had more positive social experiences when compared to the control group. The results of this study could be generalized to those with cognitive decline because it might be even more important for additional support and counseling in this population.

Family Member Involvement and Client-Clinician Interaction

The ability for family members to be present and supportive during and after hearing aid fittings has shown to be directly related to the success of the individual with his/her hearing aids. Ekberg et al. (2014) investigated family involvement in audiology rehabilitation appointments. The study included 13 audiologists, 17 adults with hearing loss (average age of 72 years), and 17

family members. Audiology appointments were videotaped to capture everyone in the appointment and recorded to assess the importance of family involvement. Based on the video recordings, the researchers found family members participated in the client-clinician conversations 12% of the time. The family members did not have to be invited to participate in order to contribute to the conversation. It was found that family members often had minimal involvement in the appointments. The addition of family member opinions and answers could potentially sway the client's opinion and change the experience. According to an analysis done by Ekberg et al., the 12% talk time done by family members included responding to questions from the audiologist that were directed at the client, self-initiating expansions on a turn by the client, and asking questions. Positive involvement from family members included assisting in identifying the patient's hearing difficulties and potential ways it could be managed. The authors noted a client's need to make their own decisions; however, implications for family-centered care were key. Ekberg et al. found family members showed interest in being involved and sharing their experiences of the client's hearing impairment. Finally, the authors suggested audiology practices implemented family-centered care principles.

Along with family involvement, client-clinician interaction is essential in making the client feel comfortable and motivated to succeed with hearing aids. Poost-Foroosh et al. (2011) examined the factors in client-clinician interactions that influence hearing aid adoption. A total of 13 adults between the ages of 45 and 85 (mean age of 71), who had received hearing aid recommendations within the past three months, and 10 audiologists participated in this study. Concept mapping was used to develop factors in client-clinician interactions that were essential according to client perceptions. Important concepts for client success included ensuring client comfort, understanding and meeting client needs, client-centered actions, acknowledging client

as an individual, eliminating pressure and discomfort, conveying device information by clinician, supporting choices and shared decision making, and factors in client readiness. The two overarching themes among clients were client-centered interaction and client empowerment. Poost-Foroosh et al. suggested clinicians be aware of their interactions with patients to make them more client-centered rather than clinician-centered. Switching to a more client-centered approach empowers the client and in turn improves hearing aid outcomes and satisfaction. Creating a client-centered environment not only benefits the general population but older adults with cognitive decline because it allows clinicians to provide services appropriate for that specific population.

Supplemental Material for Information Recall

Information is typically not recalled from healthcare-related appointments within the general population. To assist older adults with cognitive decline with information recall, supplemental materials and modifications could be made. Murphy et al. (2000) studied the effectiveness of video and written material for improving knowledge among patients with limited literacy skills. The researchers compared the outcomes of written materials and video materials to determine which would be the most effective with this population. A total of 192 patients with a reading level between grade seven and eight participated by watching either an instructional video about sleep apnea or read a newly designed brochure. The participants then had to respond to a structured questionnaire that included 11 knowledge-based questions and one open-ended question (suggestions for improvement of the brochure or videotape). Using video significantly improved two areas of knowledge on sleep apnea for low-level readers. The participants suggested there be more information on treatment and outcomes and fewer polysyllabic words.

Murphy et al. recommended that professionals emphasize diagnosis and treatment using simple words and to provide information by video and written formats to benefit all patients.

Similarly, Ou and Squires (2020) studied the effectiveness of patient education (PEM) materials for age-related hearing loss. The authors sampled PEMs from three selected databases: Micromedex, Ebsco, and MedlinePlus. To assess the effectiveness of PEMS, the authors looked at readability and suitability. Readability measures were to estimate how easy or difficult text was to read and the target readability was chosen to be between fifth and eighth grade levels. The suitability was measured by a systemic tool, Suitability Assessment of Materials, to assess the suitability of written health materials. Ou and Squires found 66.7% of PEMs were written above the target readability of eighth grade level. In terms of communication sciences disorders organizations, readability revealed that 76.5% was written above the eighth grade. Overall, the average PEM was rated as "adequate" with a mean suitability score of 44%. The authors noted some common areas of weakness among PEMS were failure to include a summary of key information, reading level, vocabulary, and limited subdivision of complex topics. Ou and Squires recommended professionals make information about hearing health care more accessible and useable by improving the readability, suitability, and comprehensibility of PEMS on age-related hearing loss.

Watson and Mckinstry (2009) also examined the effectiveness of supplemental materials for improving recall of medical advice during healthcare consultations. The researchers performed a systematic review of the literature by searching the following databases: Medline, Embase, Cinahl, PsychINFO, and Cochrane Library Collection. Nine recall interventions were reported in the literature and included audio recordings, written materials, adjunct questions, prompt sheets, visual aids, cognitive strategies, rehearsal, communication styles, and

personalized teaching. Based on the results, the authors concluded that written and audio-recorded methods of medical instructions were the most popular among researchers. Watson and Mckinstry indicated that written and tape-recorded instructions improved recall in most situations.

Wilson et al. (2010) examined the effectiveness of video and print material for patient education on asthma. The authors examined immediate and delayed recall of information and assessed the effect of giving patients take-home materials after the initial presentations. A total of 450 patients aged 40 years and older were given video-based, print-based, or no education about asthma symptoms and triggers. Following the information, the patients were asked to answer knowledge-based questions. Participants were split into print and video. The print participants only received print materials and of the video group, half received take-home materials in addition to the video. A week later, participants completed the knowledge assessment again. Based on the results, the authors determined that information recall for the participants who received video-based materials did not significantly differ from the information recall for those who received print-based materials. Receiving take-home print materials in addition to video materials predicted better performance on the assessment performed a week later.

Supporting Older Adults with the Use of Technology

Weil et al. (2021) discussed digital inclusion for older adults in the age of COVID-19 through a case study from Older Adults Technology Services (OATS). The researchers noted those over the age of 65 were seen as a marginally represented group within the digital domain. Older adults struggled to adopt newer technology models before the COVID-19 pandemic. During the pandemic, the world shifted to a virtual model and a critical need to increase digital

inclusion for older adults was observed. Weil et al. discussed the isolation older adults felt over the course of COVID-19 in terms of feeling less agency, not being able to see family and friends as often, and more likely to work virtually or lose face-to-face work. The authors discussed how the OATS program offered in-person technology classes to older adults prior to COVID-19 but a shift to virtual programming was seen at the beginning of the pandemic. The OATS program reported that of their members, 16% had no internet access in their homes, 37% desired help setting up the online program, and 34% were interested in pairing with other older adults. Weil et al. concluded by discussing guidelines needed to be presented to address appropriate, age-based education training, technology designed for older adults, and programs that offered increased connectivity for older adults.

It is a common misconception that older adults do not use technology in the same way younger adults do. Olson et al. (2011) investigated this misconception by examining the frequency of technology use for younger and older adults. A total of 430 younger adults aged 18 to 28 and 251 older adults aged 65 to 90 participated in this study. The participants completed a survey that included four sections: technology domains, technology importance, computer experience, and internet experience. Participants chose one of six frequency options—presented in a Likert scale—when answering the usage for each of the technologies. There were age-related differences for nearly all aspects of computer use and older adults reported a range of experience. Older adults reported regular internet use; however, fewer than 50% of older adults had been using the internet for more than five years. Older adults also reported using home-based systems (alarm systems and thermostats) and healthcare devices (lifeline and blood pressure monitors). Based on the results, Olson et al. concluded younger adults used a wider range of technologies than older adults. However, age-related difference in usage and the frequency of

use depended on the technology domain. The information collected about technology in this study could assist clinicians in determining appropriate technology levels for resources adapted for this population; however, it is important to note this study is over a decade old and technology has changed.

An internet support system-based platform by Brännström et al. (2016) used for psychologists and their clients was adapted for audiologic purposes. The system included an agenda to record the content of the appointments, messaging (to facilitate communication between audiologist and client), tasks or results of audiologic assessment, memos, a shared library to store text files/videos between clinician and client, and a personal library for the audiologist to upload specific materials for certain clients. Twenty-three hearing aid users and four audiologists participated and evaluated the support system. Five of the clients and all audiologists were interviewed and their responses were analyzed. Hearing aid users and audiologists reported satisfaction and positive experiences with the internet-based support system. Audiologists reported that the internet-based system did not address the needs of all types of hearing aid users. Hearing aid users who had more positive experiences and those more satisfied with the support system had a greater reduction in self-reported consequences of hearing loss and reported better hearing aid outcomes. Both audiologists and hearing aid users recognized the potential value of having internet-based support in audiology services.

Summary

This project examined the need to supplement hearing healthcare service delivery for older adults with or at risk of cognitive decline. Although there are clinical guidelines for audiologic management of adult hearing impairment, there are no specific guidelines in relation to adults with cognitive decline. While patient education resources are available to the public, Ou

and Squires (2020) found 66.7% of patient education materials were written above an eighth-grade reading level. For healthcare professionals to improve patient information recall, Watson and Mckinstry (2009) found written and audio-recorded methods of medical instructions were most effective. Erber (2003) mentioned how the audiology profession needed to coordinate methods for assessing hearing/need for hearing aids and rehabilitation outcomes with non-auditory factors in mind. Due to non-auditory impairments, older adults could struggle with basic routine use of hearing aids. Older individuals might not fully understand or remember spoken and/or printed instructions for hearing aid use and maintenance. Erber's suggestions included changing the design of the hearing aids to alleviate problems with handling and dexterity and educating audiologists on the needs of this population. Finally, Dupuis et al. (2019) emphasized the importance of counseling, adapting, and modifying instructions, more frequent follow-ups, and auditory-cognitive rehabilitation training as essential modifications for working with this population. Formal clinical guidelines and supplemental written and video materials are warranted to assist this population in having a successful and beneficial experience with hearing aids.

CHAPTER III

STATEMENT OF ISSUE OR CLINICAL PROBLEM

Rationale

The intention of this research project was to determine the need for audiologists to supplement hearing healthcare service delivery for older adults with or at risk of cognitive decline. Many physiologic changes occur as individuals age. Two common health conditions that occur in older adults are hearing loss and cognitive impairments of varying degrees. As a result, audiologists who work with the older adult population might find themselves fitting amplification on individuals with some form of cognitive impairment. Audiologists working with this population might be challenged to alter their services due to differences in cognitive status of patients being fit with amplification. Currently, no best practices guidelines are available for clinicians working with this population. To better serve the older adult population, audiologists should be well equipped with materials to assist older adults with cognitive decline and/or their caregivers in the use and maintenance of dispensed hearing aids.

Hearing Aid Fittings

Hearing aid fittings can be overwhelming for the general population with an abundance of information provided to the patient in a short amount of time. A typical hearing aid fitting appointment consists of prior hearing aid selection, hearing aid verification, hearing aid validation, and counseling the patient on the device itself as well as any other assistive technology (Valente et al., 2006). The hearing aid verification process is done with little input from the patient; however, the validation and counseling component of the appointment heavily

revolves around patient participation and involvement. Validation and hearing aid orientation components include making sure the patient is comfortable and satisfied with their new device(s) as well as showing the patient how to properly use, care for, and maintain their devices in order to prolong the lifespan and obtain the full benefit (Valente et al., 2006).

At the UNC Audiology Clinic, the appointment is typically, at most, one hour in length proceeded by follow-up appointments as necessary. After the hearing aid fitting appointment, the patient is expected to remember how to use this device along with any other assistive technology without much additional assistance. Valente and et al. (2006) recommended comprehensive counseling with the addition of written instructions to increase patient success with their new hearing device(s). For individuals with varying degrees of cognitive decline, the large amount of information shared within a short time frame might lead to increased difficulty in remembering how to use the device and/or important details related to obtaining the full benefit of the hearing aid technology. To help make this process easier for older adults with cognitive decline and/or their caregivers, having a variety of materials available might help reduce the challenges associated with cognitive decline. Supplemental materials such as detailed written instructions, picture examples, and video instructions could assist in the retention of information as well as serve as a guide for the patient, family, or caregiver for use and maintenance of the hearing aids. Not only would these supplemental materials benefit the patient or caregiver but also the audiologist and the clinic by allowing the patient to be more self-reliant in learning how to use their new hearing device(s).

Gaps in Literature

Research is available related to retention of information in healthcare; however, little was specifically related to audiologic appointments. Furthermore, there were gaps in the literature

when it came to working with older adults who had cognitive decline in the field of audiology. According to Pichora-Fuller and Singh (2006), approaches to fitting and aural rehabilitation of conventional hearing aids was based on knowledge about how young adults heard and adapted to hearing aids; however, there was a lack of how these devices worked with older adults. Authors such as Latorre-Postigo et al. (2017) and Mcguire (1996) studied medical retention of information in older adults with decreased memory and the implications of supplemental materials and strategies to assist this population in remembering information from medical appointments. Research within the medical field, if generalized to audiology, suggested information retention could be a challenge at audiology appointments. This challenge might be greatest when fitting amplification due to the large amount of information shared during these appointments. The development of written and video aural rehabilitation materials for hearing aid fittings would provide audiology clinicians with the tools to implement appropriate, patient-centered care to older adults with cognitive decline.

CHAPTER IV

APPROACHES TO THE ISSUE OR CLINICAL PROBLEM

The purpose of this project was to determine if the research supported a need for audiologists to supplement hearing healthcare service delivery for older adults with or at risk of cognitive decline. To increase memory recall of information during a hearing aid fitting appointment, a variety of modes of presentation are essential. According to Latorre-Postigo et al. (2017), patients have poorer memory recall when overloaded with information at an initial appointment; instead, it is recommended to have more follow-ups and resources available for patients to refer to. In the general aging population, older adults remember essential medical information immediately after an appointment; however, after a one-week or one-month delay, the memory recall has significantly diminished (Mcguire, 1996). Since the majority of research on retention of medical information was done on the general population, aging or not, there was little information on appropriate strategies when working with older adults who had cognitive decline. By modeling suggestions made by researchers on how to promote medical retention in the general population, audiologists should be equipped with supplemental materials to provide their patients.

In Appendices A and B, supplemental written and video materials are provided to assist patients with cognitive decline in the aural rehabilitation process of wearing hearing aids. The focus on these materials was to provide detailed, yet simplified, instructions on how to maintain and operate common hearing instruments sold at the University of Northern Colorado Audiology Clinic.

CHAPTER V

SUMMARY AND FUTURE DIRECTIONS

As individuals age, declining sensory and cognitive function both present challenges to everyday living. As evidence has provided, older adults with hearing loss benefit immensely from hearing aids. Hearing aids can improve communication skills, social involvement, and overall quality of life. However, individuals with cognitive decline might not receive full benefit from hearing aids due to additional barriers such as memory and attention loss. The prevalence of cognitive decline and hearing loss in the elderly population has led many researchers to question if cognitive decline is impacted by hearing loss and if the provision of hearing aids might increase cognitive functioning (or slow down cognitive decline). However, providing hearing aid services to this population could be challenging. To overcome the many challenges cognitive decline might have on the consistent and proper use of (and subsequent benefit of) hearing aids, clinicians need to be equipped with ways to modify clinical practices related to the hearing aid fitting process. Adaptations in clinical settings should be tailored to an individual's needs.

To assist in adults remembering more medical information, Latorre-Postigo et al. (2017) suggested that professionals condense the information given to patients and provide fewer recommendations. Supplemental materials to increase memory recall such as modified written instructions and/or video instructions are encouraged. Research has provided evidence to support the inclusion of family member involvement, client-clinician relationship, and clinical adaptions when considering cognitive decline. Cooley et al. (1998) discussed how no single intervention

was appropriate but rather adaptions/modifications should be made to interventions when deemed appropriate.

The purpose of this doctoral scholarly project was to determine the need to supplement hearing healthcare services for audiologists providing services to older adults with or at risk of cognitive decline. Although there are clinical guidelines for audiologic management of adult hearing impairment, there are no specific guidelines in relation to adults with cognitive decline. Erber (2003) mentioned how the audiology profession needs to coordinate methods for assessing hearing/need for hearing aids and rehabilitation outcomes with non-auditory factors in mind. Due to non-auditory impairments, older adults could struggle with basic routine use of hearing aids. Older individuals might not fully understand or remember spoken and/or printed instructions for hearing aid use and maintenance. Erber's suggestions included changing the design of the hearing aids to alleviate problems with handling and dexterity and educating audiologists on the needs of this population. Finally, Dupuis et al. (2019) emphasized the importance of counseling, adapting and modifying instructions, more frequent follow-ups, and auditory-cognitive rehabilitation training as essential modifications for working with this population. Formal clinical guidelines and supplemental written and video materials are warranted to assist this population in having a successful and beneficial experience with hearing aids.

REFERENCES

Amieva, H., Ouvrard, C., Giulioli, C., Meillon, C., Rullier, L., & Dartigues, J.-F. (2015). Self-reported hearing loss, hearing aids, and cognitive decline in elderly adults: A 25-year study. *Journal of the American Geriatrics Society*, *63*(10), 2099–2104. https://doi.org/10.1111/jgs.13649

Bainbridge, K. E., & Ramachandran, V. (2014). Hearing aid use among older U.S. adults. *Ear and Hearing*, *35*(3), 289–294. https://doi.org/10.1097/01.aud.0000441036.40169.29

Baltes, P. B., & Lindenberger, U. (1997). Emergence of a powerful connection between sensory and cognitive functions across the adult life span: A new window to the study of cognitive aging? *Psychology and Aging*, *12*(1), 12–21. https://doi.org/10.1037/0882-7974.12.1.12

Brännström, K. J., Öberg, M., Ingo, E., Månsson, K. N., Andersson, G., Lunner, T., & Laplante-Lévesque, A. (2016). The initial evaluation of an internet-based support system for audiologists and first-time hearing aid clients. *Internet Interventions*, *4*, 82-91. https://doi.org/10.1016/j.invent.2016.01.002

Brooks, D. N. (1979). Counselling and its effect on hearing aid use. *Scandinavian Audiology*, *8*(2), 101–107. https://doi.org/10.3109/01050397909076308

Cooley, S., Deitch, I. M., Harper, M. S., Hinrichsen, G., Lopez, M. A., & Molinari, V. A. (1998). What practitioners should know about working with older adults. *Professional Psychology: Research and Practice*,*29*(5), 413-427. https://silo.tips/download/what-practitioners-should-know-about

Deiber, M.-P., Meziane, H. B., Hasler, R., Rodriguez, C., Toma, S., Ackermann, M., Herrmann, F., & Giannakopoulos, P. (2015). Attention and working memory-related EEG markers of subtle cognitive deterioration in healthy elderly individuals. *Journal of Alzheimer's Disease*, *47*(2), 335–349. https://doi.org/10.3233/jad-150111

Dupuis, K., Reed, M., Bachmann, F., Lemke, U., & Pichora-Fuller, M. K. (2019). The circle of care for older adults with hearing loss and comorbidities: A case study of a geriatric audiology clinic. *Journal of Speech, Language, and Hearing Research, 62*(4S), 1203-1220. https://doi.org/10.1044/2018_jslhr-h-ascc7-18-0140

Ekberg, K., Meyer, C., Scarinci, N., Grenness, C., & Hickson, L. (2014). Family member involvement in audiology appointments with older people with hearing impairment. *International Journal of Audiology, 54*(2), 70-76.

Erber, N. P. (2003). Use of hearing aids by older people: Influence of non-auditory factors (vision, manual dexterity). *International Journal of Audiology, 42*(2), 21-25. https://doi.org/10.3109/14992020309074640

Hartley, D., Rochtchina, E., Newall, P., Golding, M., & Mitchell, P. (2010). Use of hearing aids and assistive listening devices in an older Australian population. *Journal of the American Academy of Audiology, 21*(10), 642-653. https://doi.org/10.3766/jaaa.21.10.4

Heinrich, C., & Karner, K. (2011). Ways to optimize understanding health related information: The patients' perspective. *Geriatric Nursing, 32*(1), 29-38. https://doi.org/10.1016/j.gerinurse.2010.09.001

Irace, A. L., Armstrong, N. M., Deal, J. A., Chern, A., Ferrucci, L., Lin, F. R., Resnick, S. M., & Golub, J. S. (2021). Longitudinal associations of subclinical hearing loss with cognitive decline. *The Journals of Gerontology: Series A, 77*(3), 623-631. https://doi.org/10.1093/gerona/glab263

Juncos-Rabadán, O., Pereiro, A. X., Facal, D., Lojo, C., Caamaño, J. A., Sueiro, J., Bóveda, J., & Eiroa, P. (2013). Prevalence and correlates of mild cognitive impairment in adults aged over 50 years with subjective cognitive complaints in primary care centers. *Geriatrics & Gerontology International*, *14*(3), 667–673. https://doi.org/10.1111/ggi.12157

Latorre-Postigo, J. M., Ros-Segura, L., Navarro-Bravo, B., Ricarte-Trives, J. J., Serrano-Selva, J. P., & López-Torres-Hidalgo, J. (2017). Older adults' memory for medical information, effect of number and mode of presentation: An experimental study. *Patient Education and Counseling*, *100*(1), 160-166. https://doi.org/10.1016/j.pec.2016.08.001

Lin, F. R., Thorpe, R., Gordon-Salant, S., & Ferrucci, L. (2011). Hearing loss prevalence and risk factors among older adults in the United States. *Journal of Gerontology,66A*(5), 582-590. https://doi.org/10.1093/gerona/glr002

Lin, F. R., Yaffe, K., Xue, Q., Harris, T. B., Purchase-Helzner, E., Satterfield, S., Ayonayon, H. N., Ferrucci, L., & Simonsick, E. M. (2013). Hearing loss and cognitive decline in older adults. *JAMA Intern Med, 173*(4), 293-299. doi:10.1001/jamainternmed.2013.1868

Lotfi, Y., Mehrkian, S., Moossavi, A., & Faghih-Zadeh, S. (2009). Quality of life improvement in hearing-impaired elderly people after wearing a hearing aid. *Arch Iranian Med*, *12*(4), 365-370. https://pubmed.ncbi.nlm.nih.gov/19566353/

Mamo, S. K., Oh, E. S., Price, C., Reed, N. S., Occhipinti, D., & Lin, F. R. (2018). Hearing loss treatment in older adults with mild cognitive impairment or dementia: A systematic review. *Journal of Speech, Language, and Hearing Research, 61*, 2589-2603. https://doi.org/10.1044/2018_JSLHR-H-18-0077

Mcguire, L. (1996). Remembering what the doctor said: Organization and adults' memory for medical information, *Experimental Aging Research*, *22*(4), 403-428. https://doi.org/10.1080/03610739608254020

Murphy, P. W., Chesson, A. L., Walker, L., Arnold, C. L., & Chesson, L. M. (2000). Comparing the effectiveness of video and written material for improving knowledge among sleep disorders clinic patients with limited literacy skills. *Southern Medical Journal, 93*(3), 297-304. https://doi.org/10.1097/00007611-200003000-00010

Olson, K. E., O'Brien, M. A., Rogers, W. A., & Charness, N. (2011). Diffusion of technology: frequency of use for younger and older adults. *Ageing International, 36*(1), 123-145. https://doi.org/10.1007/s12126-010-9077-9

Ou, H., & Squires, E. S. (2020). Patient education materials for age-related hearing loss. *The Hearing Journal*, *73*(4), 26. https://doi.org/10.1097/01.hj.0000661608.26036.66

Pichora-Fuller, M. K., & Singh, G. (2006). Effects of age on auditory and cognitive processing: Implications for hearing aid fitting and audiologic rehabilitation. *Trends in Amplification, 10*(1), 29-59. https://doi.org/10.1177/108471380601000103

Poost-Foroosh, L., Jennings, M. B., Shaw, L., Meston, C. N., & Cheesman, M. F. (2011). Factors in client–clinician interaction that influence hearing aid adoption. *Trends in Amplification, 15*(3), 127-139. https://doi.org/10.1177/1084713811430217

Tremblay, K. L., & Backer, K. C. (2016). Listening and learning: Cognitive contributions to the rehabilitation of older adults with and without audiometrically defined hearing loss. *Ear Hear, 37,* 155-162. https://doi.org/10.1097/aud.0000000000000307

Valente, M., Abrams, H., Benson, D., Chisolm, T., Citron, D., Hampton, D., Loavenbruck, A., & Ricketts, T. (2006). *Guidelines for the audiologic management of adult hearing impairment task force members*. https://audiology- web.s3.amazonaws.com/migrated/haguidelines.pdf_53994876e92e42.70908344.p df

Wallhagen, M. I. (2009). The stigma of hearing loss. *The Gerontologist*, *50*(1), 66-75. https://doi.org/10.1093/geront/gnp107

Watson, P. W., & Mckinstry, B. (2009). A systematic review of interventions to improve recall of medical advice in healthcare consultations. *Journal of the Royal Society of Medicine,* 102(6), 235-243. https://journals.sagepub.com/doi/10.1258/jrsm.2009.090013

Weil, J., Kamber, T., Glazebrook, A., Giorgi, M., & Ziegler, K. (2021). Digital inclusion of older adults during COVID-19: Lessons from a case study of older adults' technology services (OATS). *Journal of Gerontological Social Work*, *64*(6), 643-655. https://doi.org/10.1080/01634372.2021.1919274

Wilson, E. A., Park, D. C., Curtis, L. M., Cameron, K. A., Clayman, M. L., Makoul, G., vom Eigen, K., & Wolf, M. S. (2010). Media and memory: The efficacy of video and print materials for promoting patient education about asthma. *Patient Education and Counseling*, *80*(3), 393-398. https://doi.org/10.1016/j.pec.2010.07.011

Wingfield, A., Tun, P. A., & Mccoy, S. L. (2005). Hearing loss in older adulthood. *Current Directions in Psychological Science, 14*(3), 144-148. https://doi.org/10.1111/j.0963-7214.2005.00356.x

Yang, C., Schrepfer, T., & Schacht, J. (2015). Age-related hearing impairment and the triad of acquired hearing loss. *Frontiers in Cellular Neuroscience, 9*, 1-12. https://doi.org/10.3389/fncel.2015.00276

APPENDIX A

WRITTEN HEARING AID INSTRUCTIONS

Written Hearing Aid Instructions with Picture Supplement

Tavia Hoenecke

RECHARGEABLE HEARING AIDS (RICs)

IMPORTANT HEARING AID FEATURES

- Parts of the hearing aid (Figure A1 and A2).

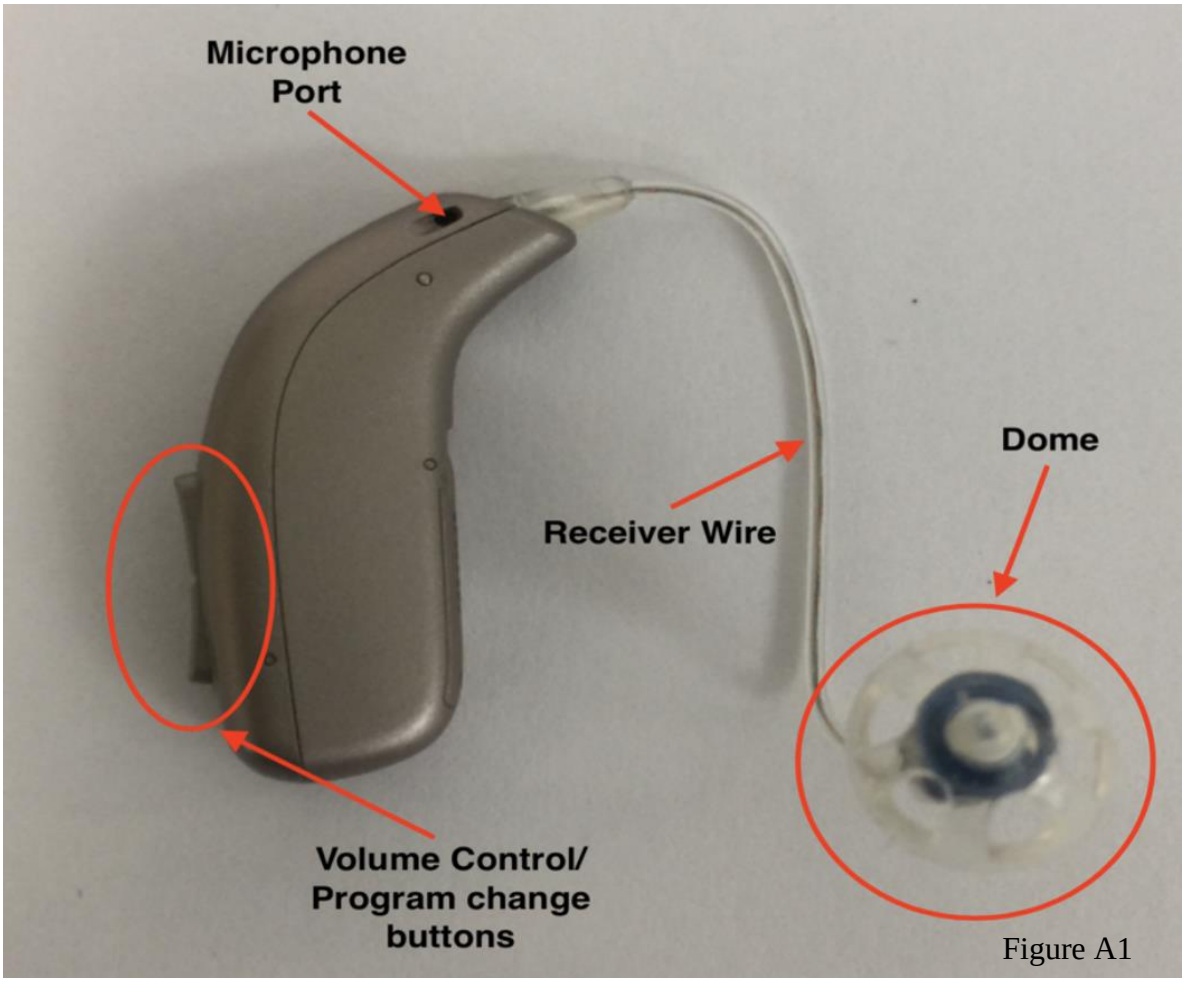
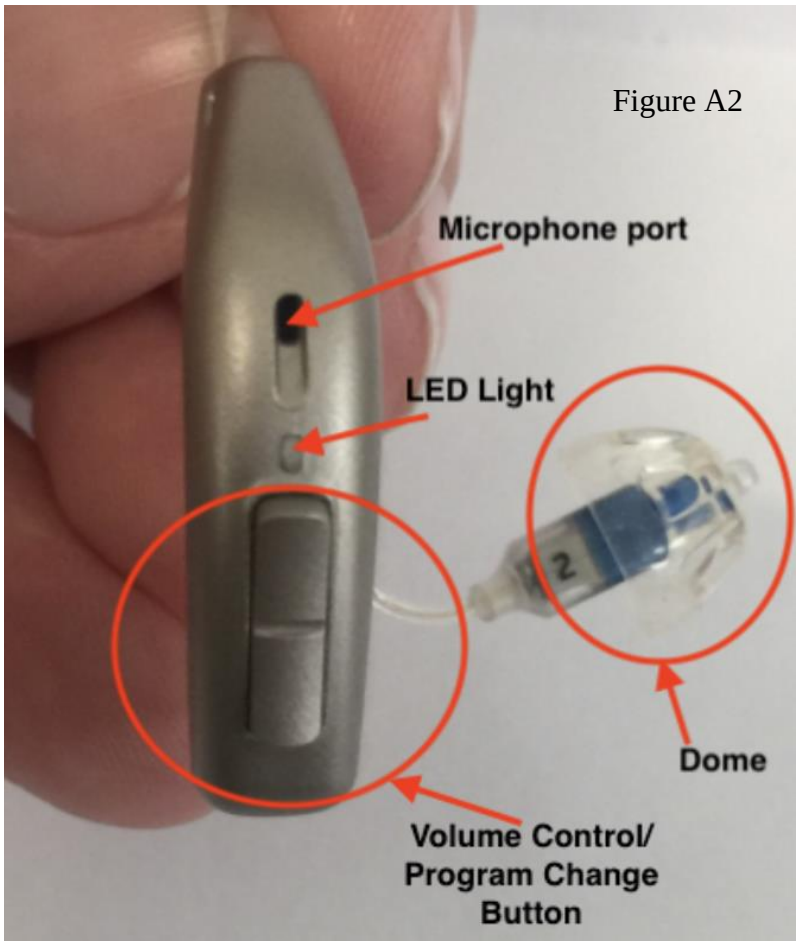
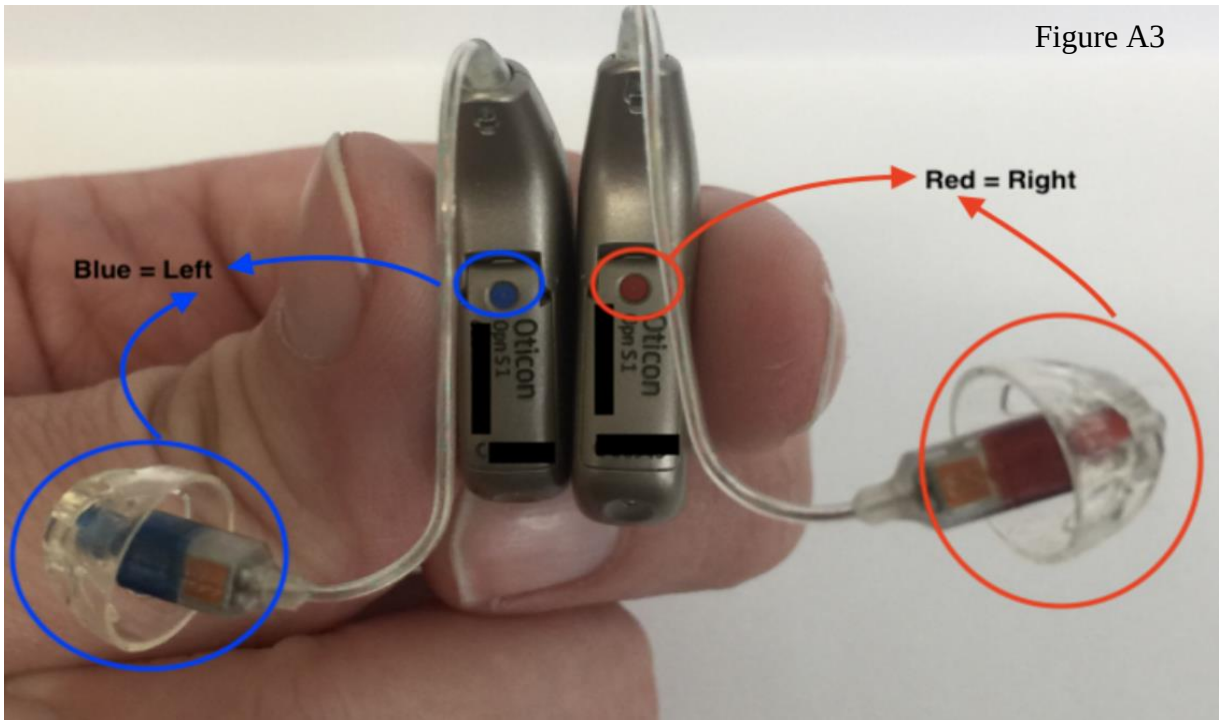


Figure A1



The red and blue markers will help you identify which hearing aid belongs to the right and left ears. (Figure A3)

Red = right ear
Blue = left ear



Charging the hearing aids

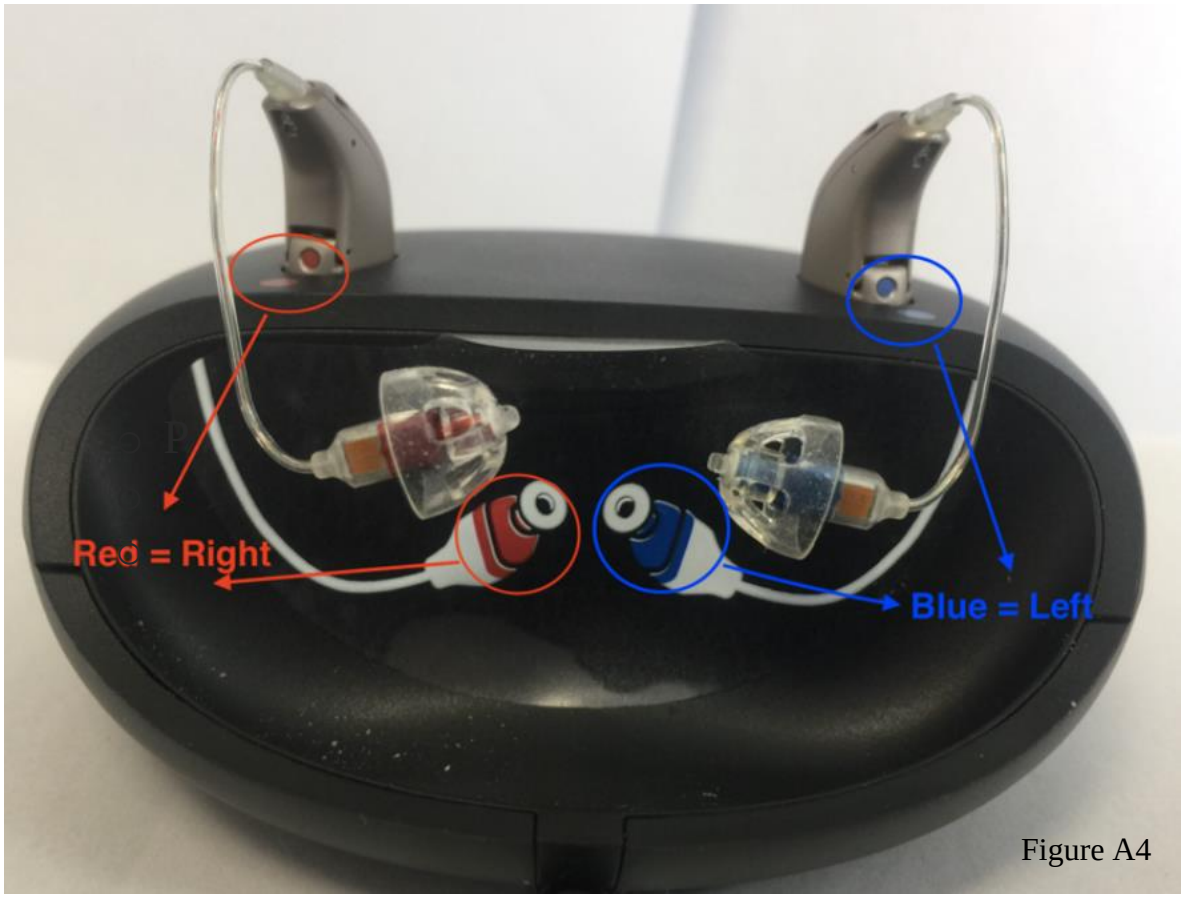


Figure A4

- Place each hearing aid in their spot. Their spot is marked with red for right, blue for left. (Figure A4)
- Let the receiver wires hang down
- The hearing aids will automatically turn off when placed in the charger and display an orange light. (Figure A5)
- When your hearing aids are fully charged, they will display a green light. (Figure A6)

Figure A5

Figure A6

- When you are ready to wear the hearing aids for the day
    - Take them out of the charger
    - The light will blink green and play a start-up jingle (Figure A7)
- Charge your hearing aids every night

Figure A7

INSERTING AND REMOVING HEARING AIDS

Figure A8

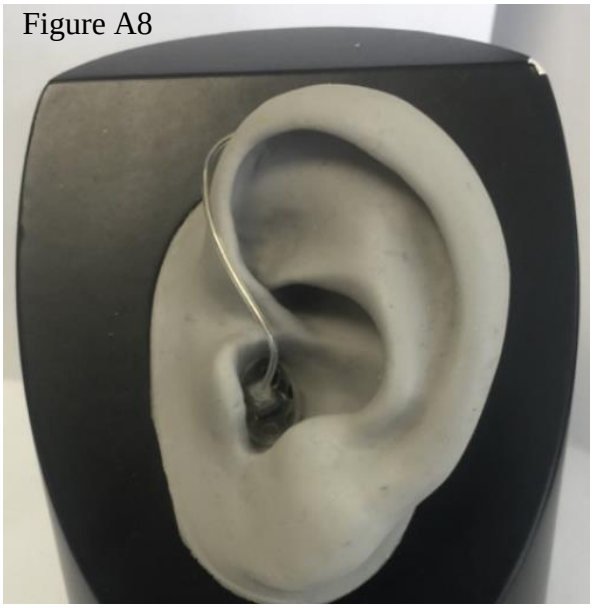
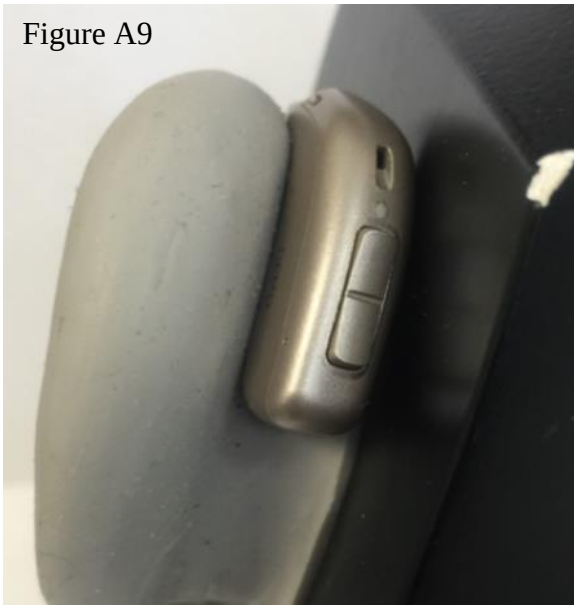


Figure A9



- The hearing aids should sit on the ear like shown above (Figures A8 and A9)

Putting the hearing aids on:

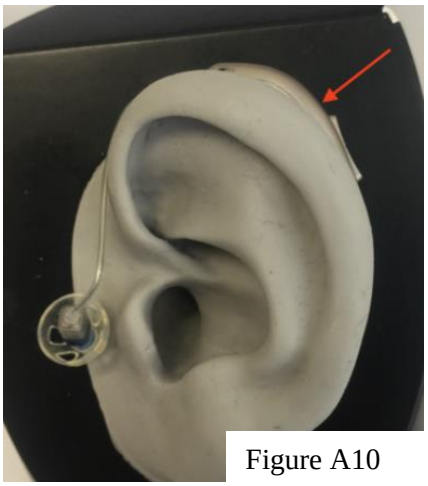


Figure A10

Put the hearing aid behind the ear

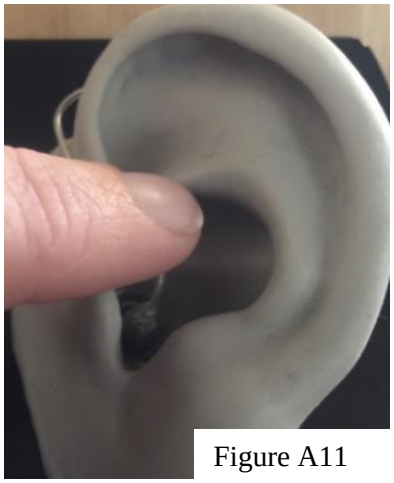


Figure A11

Insert the dome

Figure A11

Push the dome in all the way

- **Repeat on opposite ear**

HEARING AID MAINTENANCE

Cleaning

- Clean hearing aids every day
- Examine hearing aids for any debris or dirt
- Remove debris with a soft brush or a dry cloth (provided to you at fitting)
    - Lightly wipe down hearing aids with cloth (Figure A13)
    - Lightly brush microphone ports and earpiece (Figure A14)

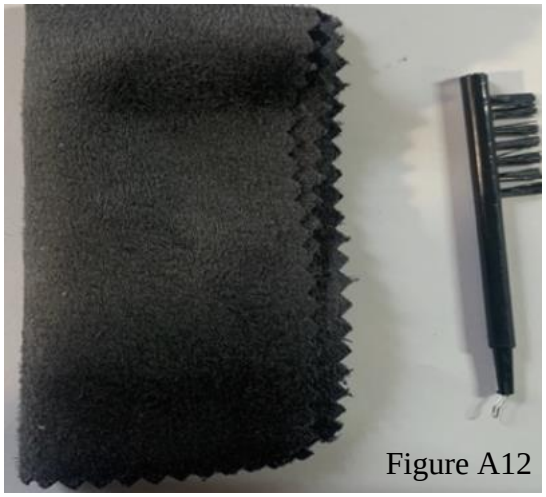


Figure A12

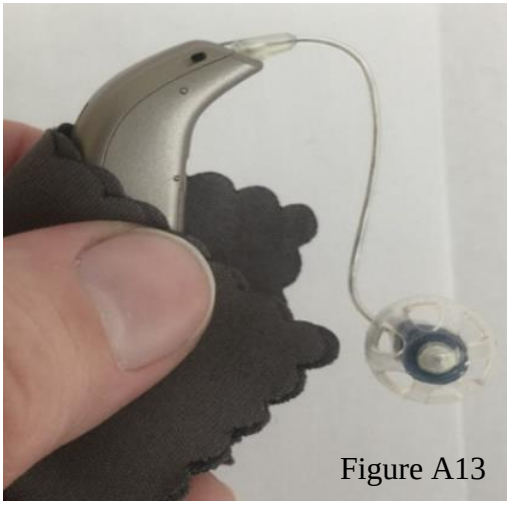


Figure A13

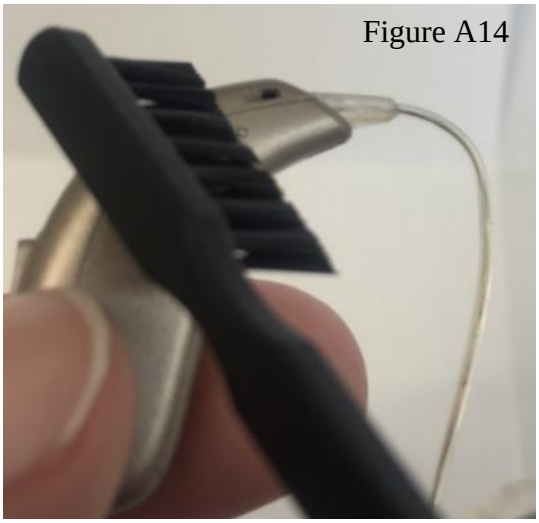


Figure A14

TROUBLESHOOTING

Hearing aids won't turn on

- Make sure charger is plugged into outlet
- Make sure hearing aid body is placed into charging ports fully, indicated by charger lights

Hearing aids sound weak

- Check hearing aids to make sure they are clean
- Clean hearing aids as needed
- Make sure hearing aids are charged

Charger doesn't display lights

- Make sure charger is plugged into outlet
- If charger is plugged in and you still don't see lights, try another outlet
- If charger is displaying a flashing red light—return to your hearing health care provider

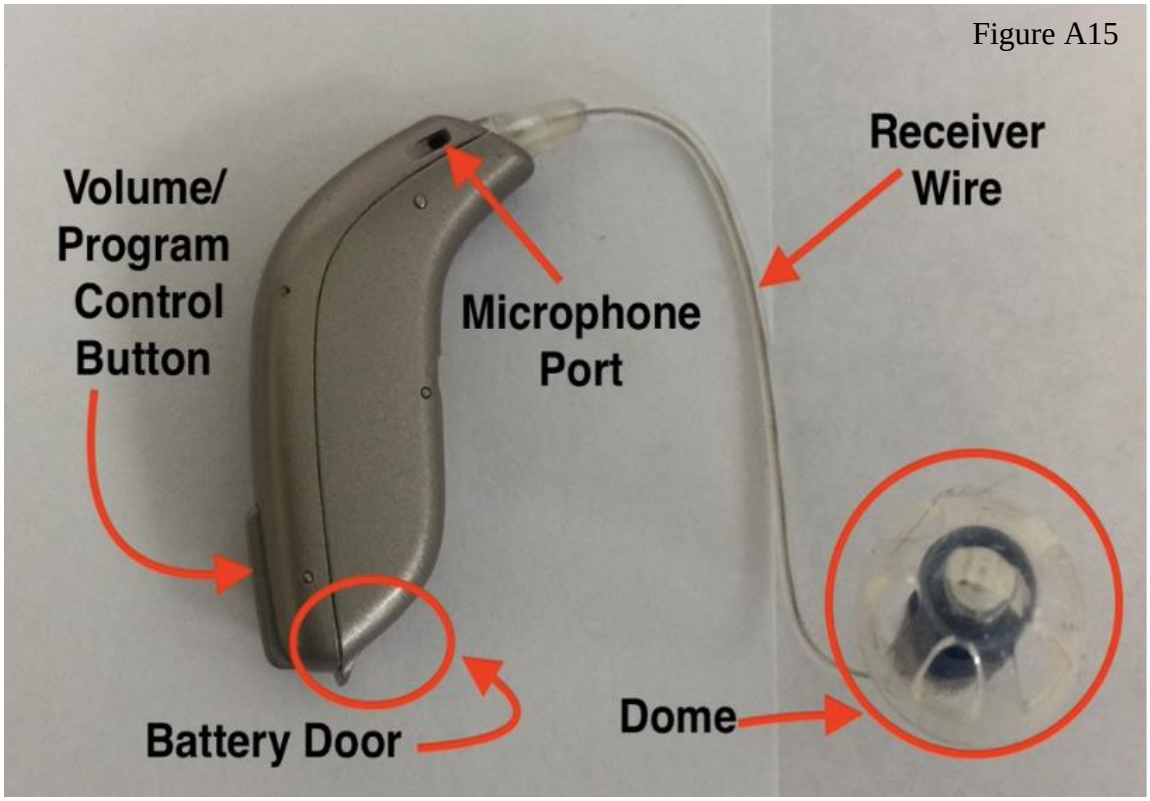
RETURN TO YOUR HEARING HEALTH CARE PROVIDER IF YOU CANNOT FIND A SOLUTION

RIC WITH DISPOSABLE BATTERIES

IMPORTANT HEARING AID FEATURES

- Parts of the hearing aid: (Figure A15 and A16)

Figure A15



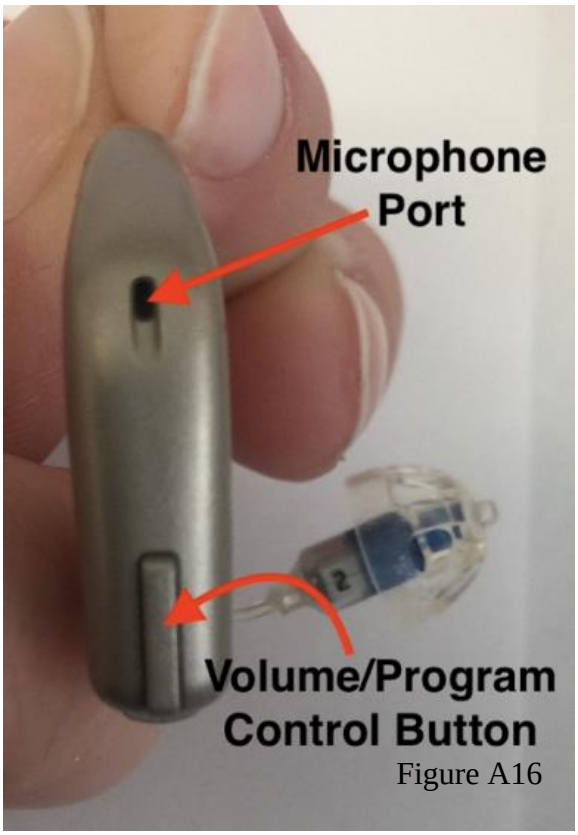


Figure A16

The red and blue markers will help you identify which hearing aid belongs to the right and left ears. (Figure A17)

Red = right ear
Blue = left ear

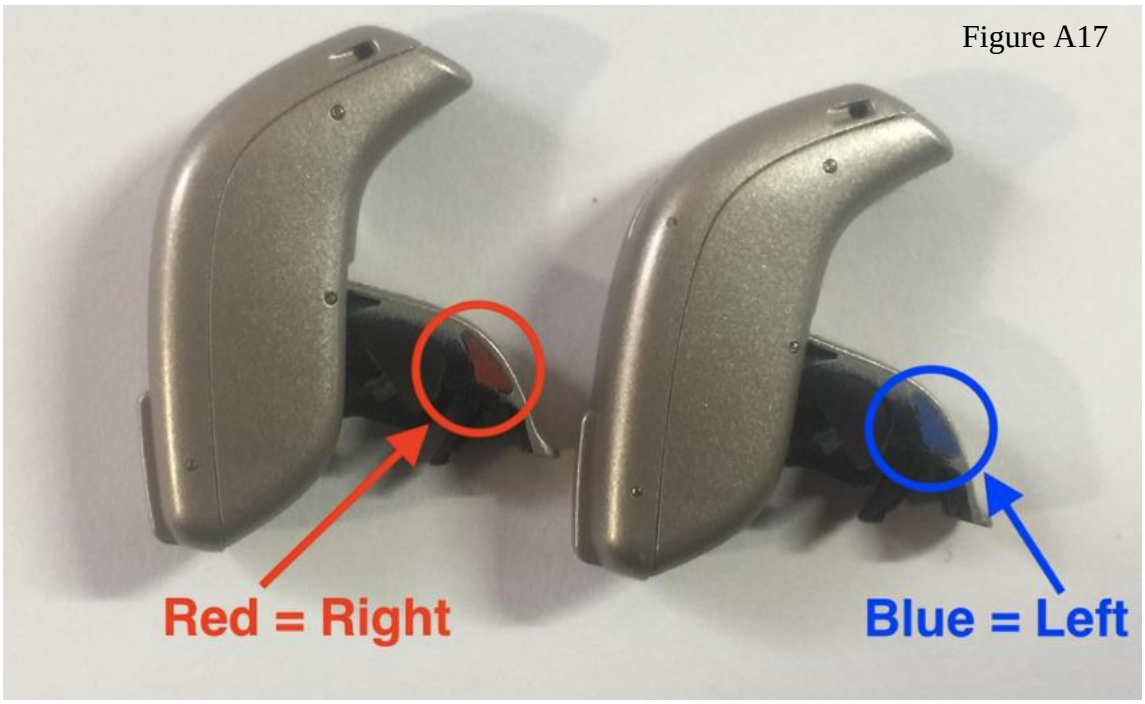


Figure A17

CHANGING HEARING AID BATTERIES

- To place batteries in hearing aids, open the battery door at the bottom of the aid
- Peel of the sticker off the battery (Figure A18)
- Place new battery in the battery drawer. Make sure the '+' symbol is facing up or rounded end down. (Figure A19 and A20)

Figure A18

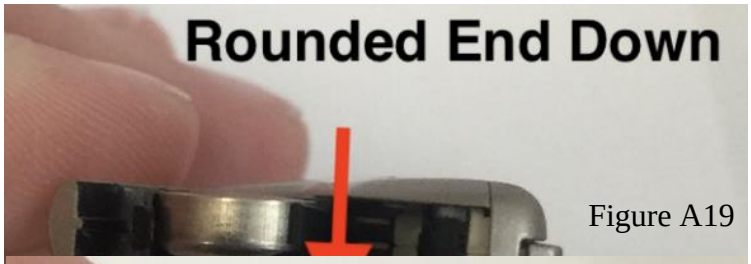


Figure A19

Figure A20

Figure A21

Close the battery door and insert the hearing aid in the ear

HOW LONG DO BATTERIES LAST?

- Batteries typically last 5-7 days
    - To maximize battery life:
        - Turn off hearing aids or open battery door when not in use
        - Always open battery door at night and store in a safe and dry location
        - If you aren't using batteries for an extended period, take the batteries out completely
    - NOTE: Streaming your hearing aids to other devices will decrease battery life

INSERTING AND REMOVING HEARING AIDS

Figure A8

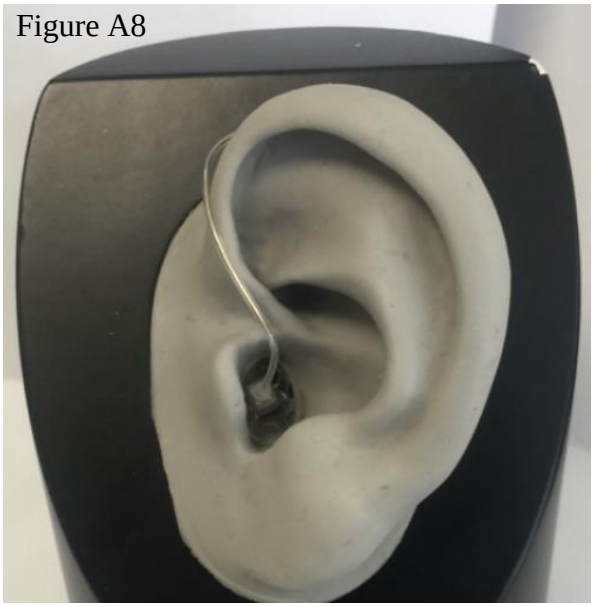
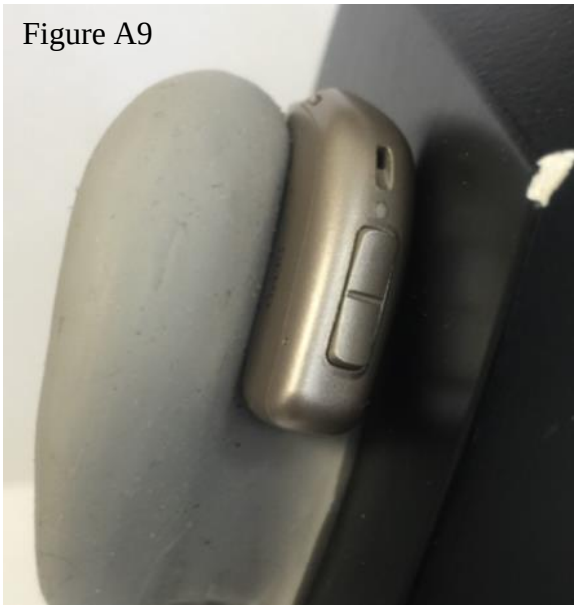


Figure A9



- The hearing aids should sit on the ear like shown above (Figures A8 and A9)

Putting the hearing aids on:

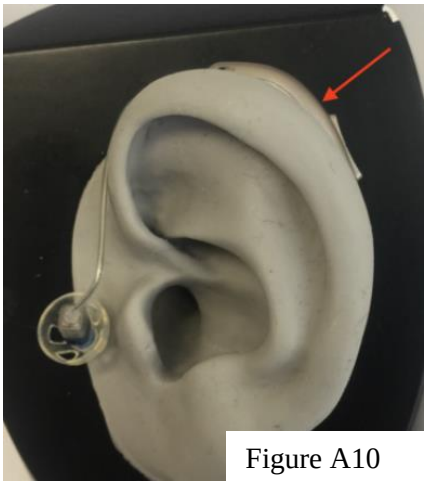


Figure A10

Put the hearing aid behind the ear

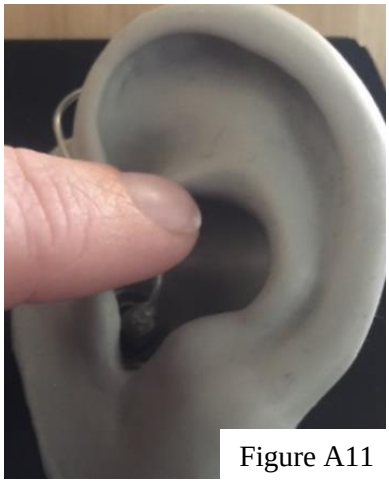


Figure A11

Insert the dome

Figure A11

Push the dome in all the way

- **Repeat on opposite ear**

HEARING AID MAINTENANCE

Cleaning

- Clean hearing aids every day
- Examine hearing aids for any debris or dirt
- Remove debris with a soft brush or a dry cloth (provided to you at fitting)
    - Lightly wipe down hearing aids with cloth (Figure A13)
    - Lightly brush microphone ports and earpiece (Figure A14)

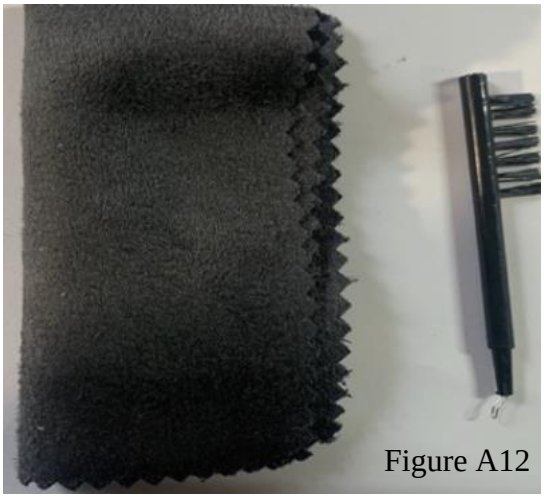


Figure A12

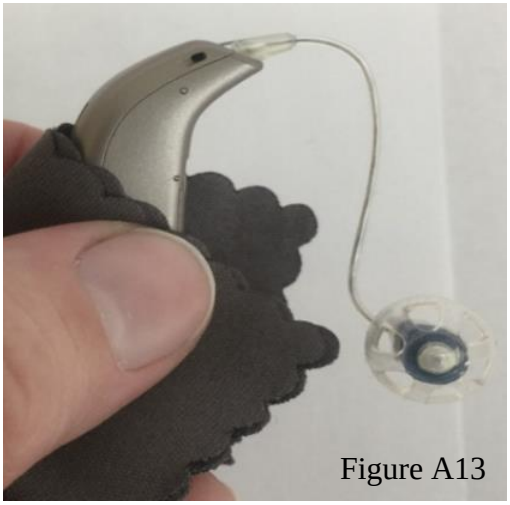
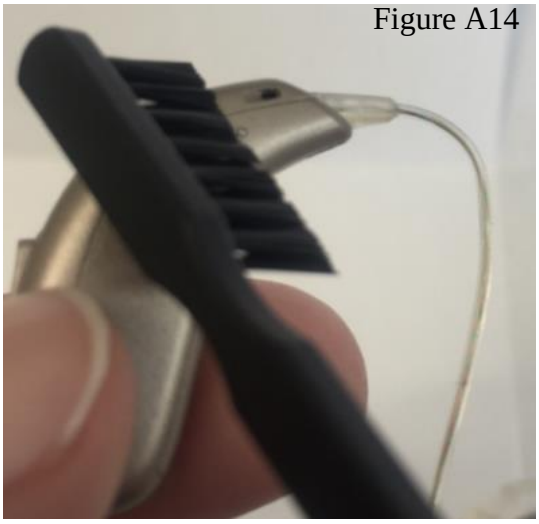


Figure A13

Figure A14



Storing hearing aids

- Always shut off or open battery door when hearing aids are not in use
- Take batteries out of battery drawer when they won't be used for an extended period of time

REMEMBER:

- DO NOT get hearing aids wet! Keep them in a dry location.
- KEEP AWAY FROM PETS

TROUBLESHOOTING

Hearing aids won't turn on

- Make sure batteries have been recently changed
- Make sure batteries are in hearing aid the correct way ("+" facing up or rounded side facing down)

Hearing aids sound weak

- Check hearing aids to make sure they are clean
- Clean hearing aids as needed
- Make sure hearing aids have new batteries

RETURN TO YOUR HEARING HEALTH CARE PROVIDER IF YOU CANNOT FIND A SOLUTION

BEHIND THE EAR (BTE) HEARING AIDS

IMPORTANT HEARING AID FEATURES

- Parts of the hearing aid (Figure A22)

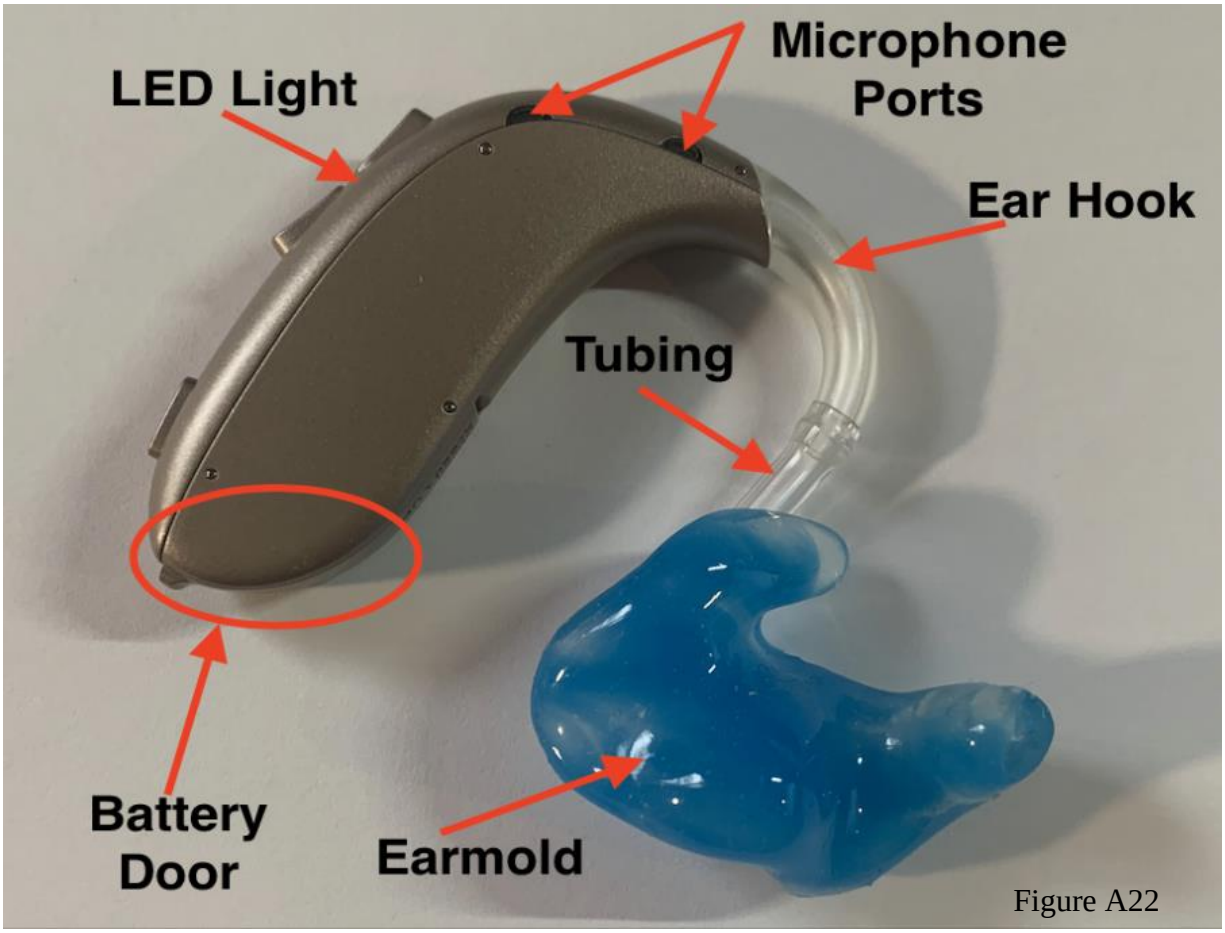


Figure A22

Figure A23

- When you open the battery doors you should see two markers inside (Figure A23)
  - Red = right ear
  - Blue = left ear

- NOTE: Opening the battery door of the hearing aid will shut it off and closing the battery door will turn it on

CHANGING THE BATTERY

- To place batteries in hearing aids, open the battery door at the bottom of the aid
- Peel of the sticker off the battery
- Place new battery in the battery drawer. Make sure the '+' symbol is facing up or the rounded end down. (Figure A19 and A20)

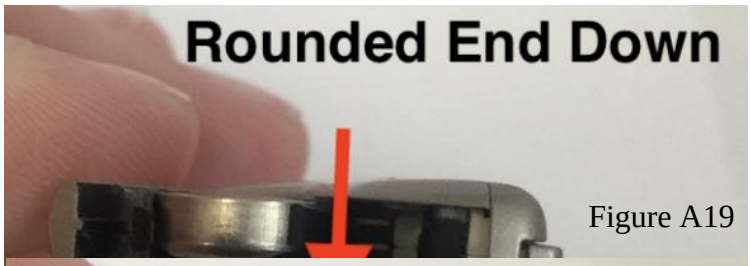


Figure A19

Figure A20

Figure A21

HOW LONG DO BATTERIES LAST?

- Batteries typically last 5-7 days
    - To maximize battery life:
        - Turn off hearing aids or open battery door when not in use
        - Always open battery door at night and store in a safe and dry location
        - If you aren't using batteries for an extended period, take the batteries out completely
    - NOTE: Streaming your hearing aids to other devices will decrease battery life

INSERTING AND REMOVING HEARING AIDS

Figure A24

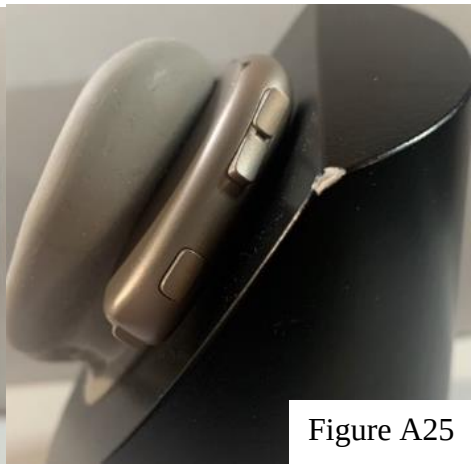


Figure A25

- How the hearing aid sits on the ear (Figures A24 and A25)

Putting the hearing aid on

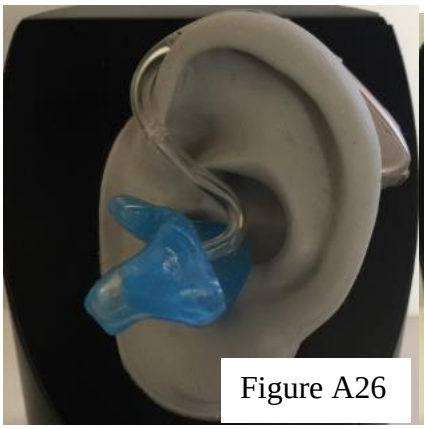


Figure A26

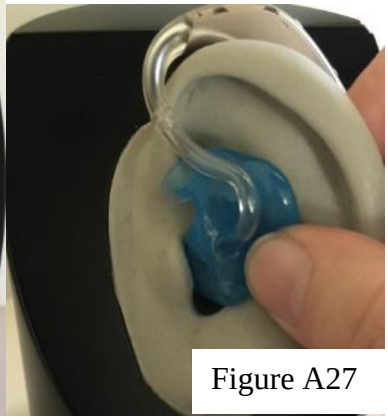


Figure A27

Figure A28

1. Put the hearing aid behind the ear (Figure A26)
2. Insert the earmold (Figure A27)
3. Make sure to push the earmold all the way in as pictured (Figure A28).

HEARING AID MAINTENANCE

Cleaning

- Clean hearing aids at the end of every day
- Wash hands before cleaning hearing aids
- Examine hearing aids for any debris or dirt
- Remove debris with a soft brush, dry cloth, or earmold blower (provided to you at fitting)
    - Lightly wipe down hearing aids with cloth. (Figure A29)
    - Lightly brush microphone ports and earpiece (Figure A30)

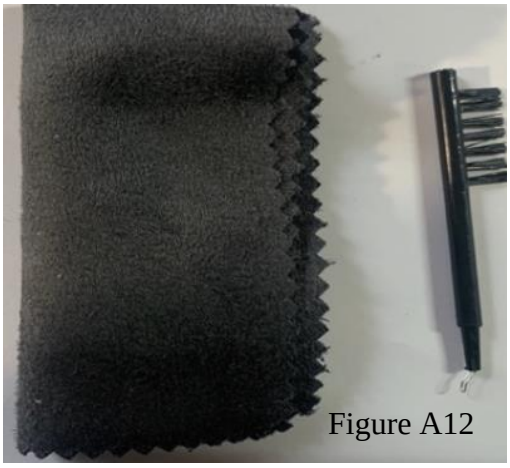


Figure A12

Figure A29

Figure A30

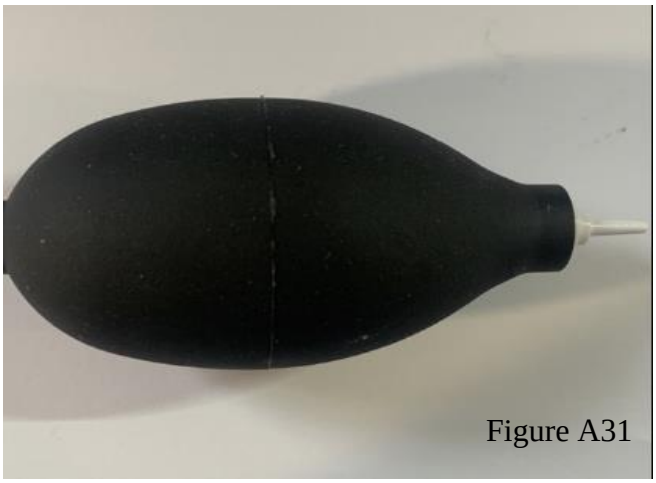


Figure A31

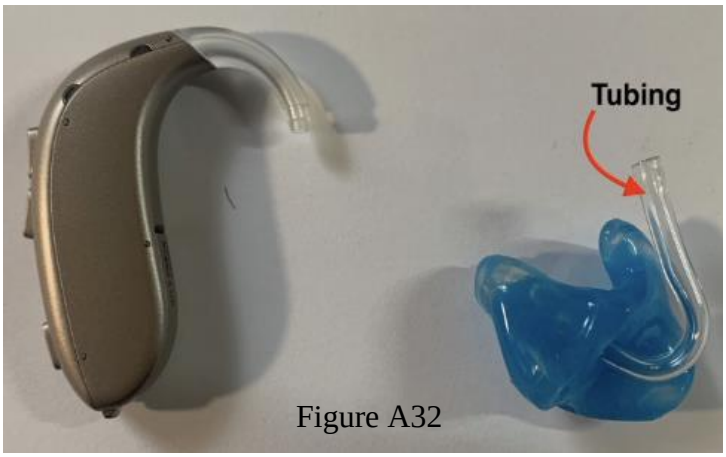


Figure A32

Figure A33

- Remove the earmold from the hearing aid (Figure A32)
  - You can wash the earmold in warm soapy water
  - DO NOT IMMERSE THE HEARING AID IN WATER
- Using the blower, insert it into the tubing and blow out any excess water or moisture that can be trapped in the tubing. (Figure A33)

Storing hearing aids

- Always shut off or open the battery door when hearing aids are not in use
- Take batteries out of battery drawer when they won't be used for an extended period

REMEMBER:

- DO NOT get hearing aids wet! Keep them in a dry location.
- KEEP AWAY FROM PETS

TROUBLESHOOTING

Hearing aids won't turn on

- Make sure batteries have been recently changed
- Make sure batteries are in hearing aid the correct way ("+" facing up/round side facing down)

Hearing aids sound weak

- Check hearing aids to make sure they are clean
- Clean hearing aids as needed
- Make sure hearing aids have new batteries

RETURN TO YOUR HEARING HEALTH CARE PROVIDER IF YOU CANNOT FIND A SOLUTION

Note. All figures were created by the researcher.

APPENDIX B

UNIVERSITY OF NORTHERN COLORADO AUDIOLOGY INSTRUCTIONAL VIDEOS

Inserting and removing a RIC hearing aid
https://www.youtube.com/watch?v=rVIWvK9htHk&ab_channel=TaviaHoenecke

Cleaning hearing aids
https://www.youtube.com/watch?v=6LZnYNGaNaE&ab_channel=TaviaHoenecke

https://www.youtube.com/watch?v=v2AKi09XGUM

How to Charge your Hearing aids
https://www.youtube.com/watch?v=EIk_kAthbME&ab_channel=TaviaHoenecke

Inserting a Hearing aid Battery
https://www.youtube.com/watch?v=J11StHzPpIg&ab_channel=TaviaHoenecke

Inserting and Removing a BTE
https://youtu.be/4hLx7669CSY