Critical Review: In Patients with Alzheimer Disease (or Other Forms of Dementia), Will the Provision of Hearing Aids Result in a Reduction of Negative or Unwanted Behaviours?

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This critical review examines the benefits of assessing and treating hearing loss in patients with Alzheimer disease (AD) or other forms of dementia. The effect has been studied using one primary method; observation of problem or negative behaviours by caregivers and research associates. Overall, although limited, research in this area suggests that appropriate fitting of amplification in early stage Alzheimer disease may provide benefit to the patient and caregiver by reducing the problem behaviours associated with Alzheimer's Disease.

Introduction

Hearing impairment is a common condition affecting ageing individuals whereas Alzheimer disease is a progressive, degenerative disorder affecting thousands of Canadians and their families. Both of these disorders directly affect an individual's ability to communicate and interact with his or her environment. Several studies assessing the combined impact of the two disorders have found that hearing loss in patients suffering from Alzheimer disease or other forms of dementia can in fact exacerbate the cognitive decline while further decreasing the individual's daily functioning (Herbst & Humphrey, 1980; Peters *et al.*, 1988; Uhlmann et al., 1989 for example). Considering the high incidence of hearing impairment in the general population and the high incidence of Alzheimer disease, it is inevitable that the two could potentially overlap in one individual. Accordingly, many researchers have noted the high incidence of hearing impairment within the dementia population.

Many similarities have been noted when comparing hearing loss and dementia, namely the effect of hearing loss on daily functioning, even for the cognitively sound patient. For example, Chartrand (2002) developed a chart comparing the most common behaviours for both disorders. Many of the behaviours noted in Alzheimer disease such as reduced communication ability and memory loss are noted in a similar form in those with hearing impairment. It is therefore easy to see how those with dementia will experience increased communication difficulties as a result of a combination of hearing loss and cognitive decline. This is often described as increases in negative or unwanted behaviours that are disruptive and challenging for caregivers and/or family and friends.

It has been suggested that elderly individuals who are age and hearing level matched but do not experience any abnormal cognitive dysfunction are routinely assessed and treated for hearing loss while those suffering from dementia are not (Durrant, Palmer & Lunner, 2005). In addition, research has also shown the vast improvements in communication and functioning for hearing impaired individuals following hearing aid fitting. A common misconception by health professionals of patients suffering from cognitive decline is the assumption that they would not be good candidates for hearing aids given the inherent learning curve associated with these devices. However, much research has shown that this is not the case. In many instances, patients in the early stages of cognitive decline are fully capable of complying with regular behavioural testing procedures and with the use of amplification.

Given the success of improved hearing ability on communication function and interaction level in cognitively normal individuals, perhaps those with dementia might achieve the same improvement. Specifically, perhaps improved hearing sensitivity will help patients with cognitive decline to reconnect with their environment resulting in a reduction in negative or problem behaviours exhibited. It is therefore important to know whether or not the provision of hearing aids in patients with Alzheimer disease or other forms of dementia will lead to a reduction in negative or unwanted behaviours. If so, perhaps assessing hearing ability is something that should be incorporated into the assessment and management of cognitive decline.

Objectives

The primary objective of this review is to analyze and critically review the existing literature in the area of hearing aid use in patients suffering from AD or dementia. The secondary objective is to make a statement as to the benefit of hearing healthcare in patients with Alzheimer disease or other dementias and how this may be applicable to the average clinic.

Methods

<u>Search Strategy</u>

Computerized search databases including PSYCHINFO, SCOPUS and CINAHL were searched using the following key words:

((Alzheimer disease) OR (dementia) AND (hearing loss) OR (hearing impairment) OR (hearing aids) OR (amplification))

No limitations were applied to these searches.

Selection Criteria

Studies selected for this review were required to examine and assess the impact of amplification on patients suffering from Alzheimer disease or dementia. All studies were required to include participants with full time caregivers who were able to reliably record patient's daily behaviours. No limitations were made on the tools used however participants were required to have a medical diagnosis of Alzheimer disease or dementia.

Data Collection

Results of the literature search yielded the following types of design consistent with the previously stated criteria: Experimental single-subject design (3) and Non- randomized clinical trial (1).

Results

Experimental Single Subject Design

Three of the studies analyzed employed a single subject design analysis.

Palmer, Adams, Durrant, Bourgeois & Rossi's (1998) experimental design assessed the functioning of a single patient following the provision of hearing aids. This gentleman lived at home with his caregiving wife. In this study, there was no random assignment to groups and there was only one participant. The study did not specify how this patient was selected, only that he had a diagnosis of probable Alzheimer disease and multi-infarct dementia, thus satisfying the criteria for medical diagnosis of dementia. The patient underwent a full audiometric assessment (including air conduction, bone conduction and tympanometry) and was found to have a moderately-severe sensorineural hearing loss bilaterally. After four weeks of behaviour tracking by the participant's wife with reliability confirmed by a research assistant, the patient was fitted with a monaural Oticon Multifocus In the Ear (ITE) style hearing aid. Behaviour measures were recorded via the Behave-AD questionnaire asking the wife to indicate any behaviours exhibited by the patient that may be deemed problematic or negative. The participant's wife was asked to rate how upsetting each behaviour was in an attempt to quantify any behaviours related to both dementia and communication. Four such behaviours were identified. It was found that over the course of one month, there seemed to be a significant reduction in all of the four behaviours mentioned by the wife. In addition, the report stated that the patient was wearing his hearing aid up to 15 hrs per day at this time.

An interesting aspect of this study is that during the course of hearing aid use assessment, the patient was without his hearing aid for one full week due to its malfunctioning from ear wax. During this time behaviours of searching, pacing and repeating were found to increase slightly, and decrease once hearing aid function was restored.

It is important to note some limitations to this study. Only one participant was assessed (resulting in low power) and the assessment measures relied very much on subjective observation. Therefore, it is important to be cautious with generalizability. There is no way to control any bias in reporting as the wife and research assistant were not blind to treatment conditions. Furthermore, there was no discussion of probability in terms of significant change following hearing aid fitting. However, the findings do provide convincing evidence of the positive effect of improving hearing ability on functioning in an AD patient.

Palmer, Adams, Bourgeois, Durrant & Rossi (1999) formed a similar study to their 1998 version except that the participant group in the second study was slightly larger than the first. In the 1999 study, the researchers recruited eight patient-caregiver dyads for a more complete assessment of the effect of amplification on negative behaviours in AD. This study employed a multiple baseline design and participants were assessed for a baseline measure of behaviours. This baseline then served as a comparison throughout the study to determine the degree of change in negative or unwanted behaviours. As with the previous study, this one did not employ a control group. It was thought that the aforementioned comparison between behaviours exhibited prior to and following hearing aid fitting would act as the control. Again, this study used a reduction in nominated behaviours as indication that improvement of hearing levels is a good management tool in dealing with dementia. All participants were fitted monaurally with ITE style hearing aids and presented with mild sloping to moderately-severe sensorineural hearing loss.

In order to be eligible to participate in this study, all patients were required to have Mini Mental State Examination (MMSE) scores between 12 and 24. However, the authors did allow one individual with a score of only 5 in the study to assess the impact of hearing aids on those in later stages of AD.

Assessment and measurement lasted between 4 and 5 months and each participant was analyzed on one to four behaviours. Positive results were identified by a reduction in any given behaviour. Overall, Palmer

et al. found either significant reductions in at least one of four problem behaviours or no change. There were no instances of an increase in negative behaviours following hearing aid fitting. In this study, the authors did use specific probability ratings to determine significance and all reductions noticed fell well within p=.05. It is interesting to note that only 2 participants did not seem to exhibit any change in behaviour. These 2 participants actually had the greatest decrease in MMSE score throughout the duration of the study and it was suggested that perhaps the cognitive decline was far too great to be positively affected by increased hearing ability.

The primary limitation to the interpretation of the findings of this study is the lack of a control group. The use of a control group is to assess the extent to which the behaviour of an individual with hearing aids differs from that of a patient who did not receive hearing treatment. However, given the high degree of variability with AD, it is likely that a control group would not provide strong evidence for or against the provision of amplification. Also, all participants were fitted with the same model and make of hearing aid. Although this would simplify the fitting procedure, perhaps this model was not the best for all participants. It is possible that those who did not wear their hearing aids as regularly would have benefitted from a different make. However, it is also likely that using the same make and model of hearing aid for all participants provided more consistency in measures.

This study perhaps provides more concrete evidence for the benefit of amplification as the participant group was larger than the previous study.

The third experimental single subject design study reviewed was conducted by Allen, Burns, Hickson, *et al.,* (2003). Again, this study did not employ the use of a control group; participants acted as their own controls through pre and post hearing aid fitting assessment. Similar information was collected for these participants as was collected in the previous studies mentioned, that is, full audiometric assessment, hearing handicap and cognitive function prior to being fit with a hearing aid. This study consisted of 31 subject-caregiver dyads, with an average MMSE score of 18. All participants were fitted monaurally on the right (unless audiometric results indicated otherwise) and caregivers and participants were counselled on proper insertion, care and maintenance of the hearing instrument. Over the course of the study, participants were visited in their homes every 2 weeks for the first 12 weeks of the study and then every 4 weeks for the remaining 12. Hearing handicap was assessed for both the participant and caregiver at each visit, while all other measures were assessed at 1, 3 and 6 months following hearing aid fitting. The authors used changes in MMSE score as their primary outcome measurement variable and found that more than 40% of the participants showed global improvement (significant at p=0.008) following hearing aid treatment, while 58% remained unchanged. In comparing this with results from a study looking simply at rate of change in untreated patients, the authors found that 87% would have otherwise remained unchanged. This finding points to a large reduction in problems following hearing aid fitting. Reductions in hearing handicap as measured by the NHHHIP/C were found to be significant at p=0.007 and p=0.001, respectively. The authors of this study did note a decline in hearing aid use over the 24 week period. However, those who did maintain regular use showed greater decline in hearing handicap than those who did not (this was also significant at p=0.034). Overall, these researchers found that hearing aid fitting will provide benefit for patients suffering from both dementia and hearing loss and although it did not improve caregiver burden, it did not add to it. Also, it is possible to assess improvement in dementia through hearing treatment by using measures designed to assess hearing function in cognitively normal individuals.

This study had some limitations, primarily in the lack of a control group to which one can make specific comparisons. Also, many of the changes noted were not significantly different making it important to interpret these findings with caution.

This study did provide a much stronger chance for generalizability than the previous two as it had a much larger participant group. Additionally, this study did not find that those participants who were less cognitively impaired used their hearing aids with more regularity, indicating the importance of including patients with more advanced dementia from hearing healthcare.

Non-Randomized Clinical Trials

The study by Durrant, Gilmartin, Holland *et al.,* (1991) is the only study assessing the topic of amplification and AD that differed in its design. In addition, the study did not look specifically at hearing aid fitting. Instead, the authors attempted to assess experimentally the impact of a lack of hearing healthcare on those suffering from AD or dementia. Durrant, *et al.* employed a control group of hearing impaired individuals who were age matched and hearing level matched but did not suffer from dementia of any type. Each AD participant was matched with one cognitively normal subject who had a similar audiogram (within 10dB from 500 to 4000Hz). However, randomization between the two groups was impossible as those with AD or dementia comprised one group while those without formed the other. A total of ten AD patients and ten matched controls

participated in the study. The primary goal was to determine if those with AD suffered more functional difficulties as a result of their hearing impairment. The participants were tested with basic pure tone audiometry, speech recognition and speech discrimination. The speech discrimination was done in sound field with a signal to noise ratio (SNR) of +6dB as well as without any background noise.

In terms of actual audiometric assessment, the authors did not find that the AD patients experienced any increase in difficulty on measures of speech discrimination, recognition or ability to perform pure tone audiometry. From this, the authors have postulated that patients with AD and hearing loss should derive the same or similar benefit from amplification as do their age and hearing level matched peers. However, upon examination of hearing aid use, it was found that the AD patients were far less likely to be using hearing aids ($p<0.05$) even though hearing levels and hearing handicap as measured by the HHIE were similar to controls. In addition, the authors found that patients with AD were just as likely to comment truthfully on their difficulties related to hearing impairment. It is suggested that perhaps the AD and dementia patients require much more advocacy from their caregivers or family members to encourage hearing testing and subsequent hearing aid fitting. Perhaps informing caregivers about the difficulties surrounding hearing impairment and the benefits of hearing healthcare would be ideal to promote change in this area.

Although this research study did not look specifically at the use of hearing aids in patients with AD and how they can reduce problem behaviours, its findings are still very important to the field. Durrant, *et al.* have shown that patients suffering from dementia are very capable of complying with behavioural tests and providing reliable results with which one can fit a hearing aid. It is for this reason that the study was included despite not meeting the selection criteria stated above. The use of a control group both for testing procedures and for comparing hearing aid use provides compelling evidence for that fact that dementia patients should be provided the same opportunities as their peers since hearing loss can in fact exacerbate the symptoms or behaviours of dementia.

It is possible that the use of sound field testing in this study would not provide results as accurate as those for insert testing. However, the nature of the study was to determine if AD patients experienced any additional difficulties with speech recognition or discrimination than their non demented peers and if this difference would oppose the suggested benefit of amplification.

Discussion & Recommendations

The above evidence has provided a summary of the research that has been conducted to date on hearing loss and Alzheimer disease or dementia. It is clear from the first three studies that improving hearing ability in patients suffering from dementia would be beneficial in reducing negative or unwanted behaviours, perhaps providing a certain degree or level of stress reduction for caregivers. Also, the use of hearing aids in this population may help improve lives by allowing individuals to be more in touch with their auditory environments. It is also important to note from the preceding research that testing this population with regular behavioural procedures can be quite successful. Therefore although other health concerns may take precedence initially, it is important that hearing healthcare not be neglected completely. Perhaps informing caregivers and support networks (such as local Alzheimer Societies) about the importance of one's hearing ability, especially when facing degenerative cognitive decline would increase the probability of testing in this population.

It is also equally important to note that research in this area appears to have reached a stand still. The four studies sighted in this review have summarized nicely the impact of hearing improvement on behaviour, but perhaps it would be beneficial to take this further. Are hearing aids better than assistive listening devices? Should we, as clinicians, persist with binaural fittings or begin with a monaural fitting? It has been suggested by Palmer *et al.* (1999) that further research should assess the use of binaural hearing aids. Perhaps the benefits derived from wearing two will further help to increase functioning. However, all researchers sited in this review chose monaural fittings to make care, cleaning and adaptation easier for the caregiver and patient. It is important to look at this issue further to determine what might be the best choice. This is very important to consider, as patients operating with reduced cognitive function and adaptation to hearing aids is difficult even for individuals who are still cognitively healthy. It is probable that in many cases, this would need to be determined on an individual basis.

Clinical Implications

It is clear from the above research that it is possible for patients suffering from Alzheimer disease or other forms of dementia to be assessed for hearing impairment, to be fitted with amplification and to derive benefit from improved hearing ability. It is also clear that the issue of hearing ability needs to be addressed early in the disease process, perhaps shortly after an official diagnosis of Alzheimer disease or

dementia has been made. The next step would be to take this knowledge and apply to it general practice. The research is there, it is time to use it. Perhaps hearing health care should be made a part of the regular treatment process of those with Alzheimer disease or dementia. This extends beyond the audiology clinic to encompass any professionals potentially working with a patient suffering from dementia. If all are aware of the impact of hearing ability on functioning, perhaps earlier diagnosis and treatment would make it possible to fit patients with amplification sooner, providing benefit to both the patients and their caregiver(s) throughout the disease process.

References

Allen, Burns, Newton, Hickson, Ramsden *et al.* (2003). The effects of improving hearing in dementia. *Age and Ageing, 32,* 189-193.

Chartrand, M.S. (2002) The absence of hearing Healthcare in a so called "Tidal Wave of Alzheimer's cases" 10/5/2004 http://www.audiologyonline.com/articles/pf_arc_disp.asp?id=352

Durrant, Gilmartin, Hollan, Kamerer & Newall (1991). Hearing disorders management in Alzheimer's disease patients. *Hearing Instruments, 42,* 32-35.

Durrant, Palmer, & Lunner (2005). Analysis of counted behaviours in a single-subject design: Model of hearing-aid intervention in hearing-impaired patients with Alzheimer's disease. *International Journal of Audiology, 44,* 31-38

Herbst, K.G. & Humphrey, C. (1980). Hearing impairment and mental state in the elderly living at home, *British Medical Journal, 281,* 903-905

Palmer, Adams, Durrant, Bourgeois & Rossi (1998). Managing hearing loss in a patient with Alzheimer disease. *Journal of the American Academy of Audiology,9,* 275-284.

Palmer, Adams, Bourgeois, Durrant & Rossi (1999). Reduction in caregiver-identified problem behaviours in patients with Alzheimer disease post-hearing-aid fitting. *Journal of Speech, Language, and Hearing Research, 42,* 312-328

Peters, C.A., Potters, J.F., & Scholer, S.G. (1988). Hearing impairment as a predictor of cognitive decline in dementia, *Journal of the American Geriatrics Society, 36,* 981-986

Uhlmann, R.F., Larson, E.B., Rees, T.S., *et al.* (1989). Relationship of hearing impairment to dementia and cognitive dysfunction in older adults, *JAMA, 261,* 1916-1919