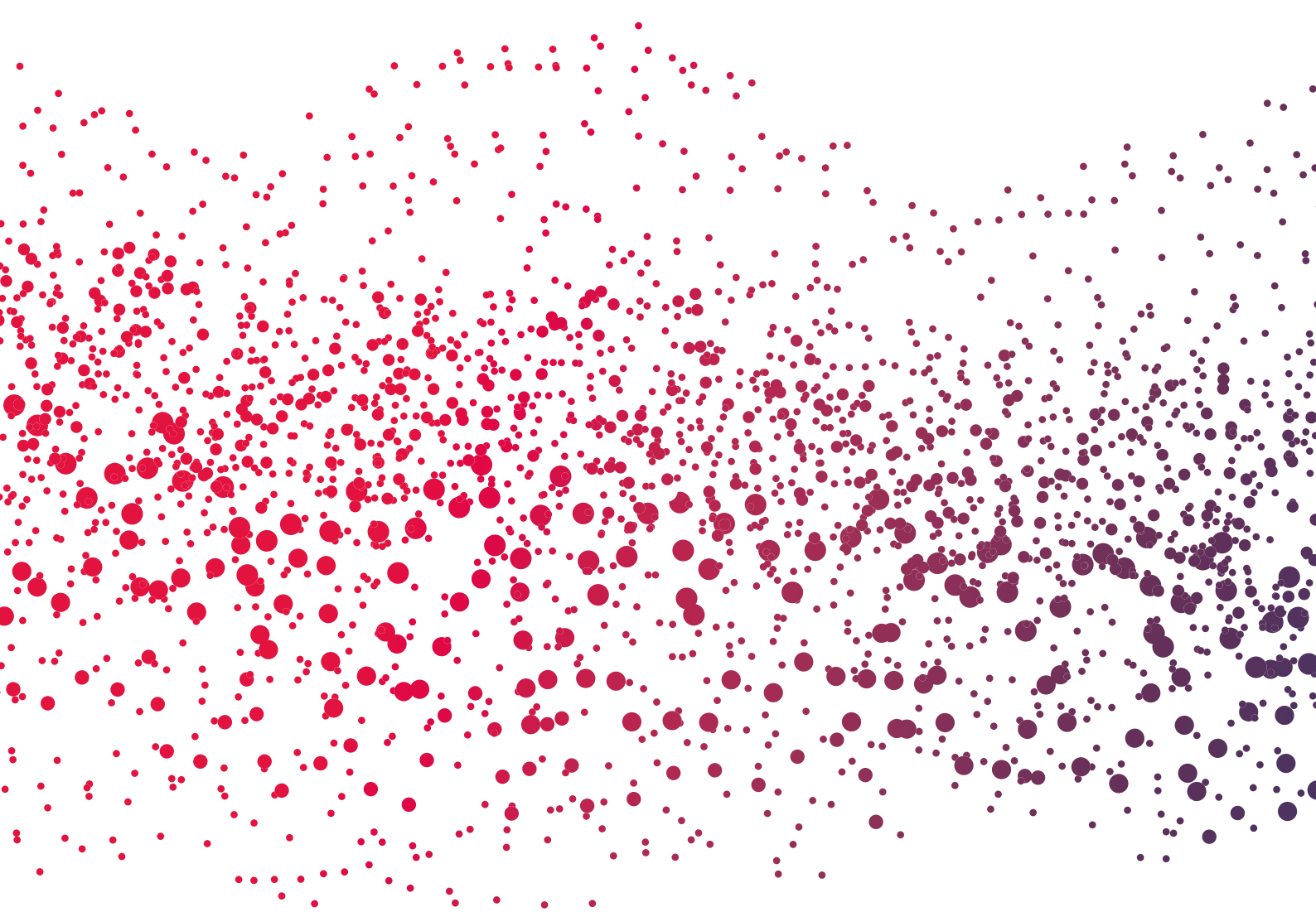




**AMPLIFON CENTRE FOR
RESEARCH AND STUDIES**

CRS SCIENTIFIC JOURNAL

Otology & Audiology Article Review



JULY 2018

July 2018

- Page 04: Tali Bar-Moshe – Israel:
 - Benefits from, Satisfaction with, and Self-Efficacy for Advanced Digital Hearing Aids in Users with Mild Sensorineural Hearing Loss.
 - *C. E. Johnson, A. M. Jilla, J. L. Danhauer, J. C. Sullivan, K. R. Sanchez. Seminars in Hearing, Vol 39 (2) 2018 p 158-171.*
 - *Persons with Mild Sensorineural Hearing Loss, as well as with other degrees of HL, benefit from and satisfy with Advanced Digital Hearing Aids.*
- Page 05: Tom De Neve – Belgium:
 - “There are more important things to worry about”: attitudes and behaviours towards leisure noise and use of hearing protection in young adults.
 - *Abby Hunter.*
 - *International Journal of Audiology, 57:6, 449-456.*
 - *Because of a lack of knowledge and concern over the consequences of noise damage and hearing problems, many young people felt there were more important things to worry about. Hearing problems were not viewed as a priority when there are other behaviours such as smoking, alcohol and drug use that are given much more attention and focus in society.*
- Page 07: Katrien Hoornaert – Belgium:
 - Mild-Gain Hearing Aids as a Treatment for Adults with Self-Reported Hearing Difficulties.
 - *Christina M. Roup, Emily Post, Jessica Lewis.*
 - *Journal of the American Academy of Audiology, (2018) Vol29:477-494.*
 - *The authors conclude that individuals who present clinically with Hearing Difficulties should be assessed beyond the standard audiometric test battery. Furthermore that mild-gain, open-fit hearing aids with adaptive multiband directional microphones and noise reduction may provide a viable treatment option for some individuals with Hearing Difficulties consistent with Auditory Processing Disorders.*
- Page 09: Reddy Sivaprasad – India:
 - Olivocochlear efferents: Their action, effects, measurement and uses, and the impact of the new conception of cochlear mechanical responses.
 - *Guinan Jr JJ.*
 - *Hearing Research (2018): 362, 38-47.*
 - *This review current understanding of efferent auditory system – anatomy, physiology and functional role in hearing is clearly summarised. The understanding of this less known auditory system is increasing.*
- Page 10: Reddy Sivaprasad – India:
 - Hearing results after type III tympanoplasty: incus transposition versus PORP. A systematic review.
 - *Bartel R et al.*
 - *ACTA OTO-LARYNGOLOGICA (2018): VOL. 138, NO. 7, 617-620.*
 - *This systematic review of 2 most common tympanoplasty surgical techniques was much sought after. The authors selected 14 studies published up to 2016 and compared outcomes of the surgeries on various intervals post surgery. PORP seems to be more promising than the simple IT technique.*
- Page 12: Reddy Sivaprasad – India:

- Health Burden and Socioeconomic Disparities From Hearing Loss: A Global Perspective.
 - Ramsey T et al.
 - *Otology & Neurotology*, 2018: 39, 12–16.
 - *This study provides a nice framework for policy creation to deal with hearing loss as a public health challenge. The burden distribution across world economies is clearly shown.*
- Page 13: Reddy Sivaprasad – India:
 - The Progressive Nature of Meniere’s Disease: Stress Projections and Lesion Analysis.
 - Pender DJ.
 - *Otology & Neurotology*, 2018: 39, 221–226.
 - *Author of the study has applied chamber-stress engineering model to study Meniere’s disease and its progress pattern in the membranous labyrinth. The model is somewhat accurate to reflect the lesion findings of group data.*
- Page 14: Reddy Sivaprasad – India:
 - Survey of the American Neurotology Society on Cochlear Implantation: Part 1, Candidacy Assessment and Expanding Indications.
 - Carlson ML et al.
 - *Otology & Neurotology*, 2018; Vol. 39 (1) p e12–e19
 - *This survey from the 81 respondents on CI candidacy tests and criteria showed huge variations and deviations from the minimum speech test battery. Authors recommend the need for updating the candidacy tests.*
- Page 16: Min Roh – New Zealand:
 - Effects of cochlear synaptopathy on middle ear muscle reflexes in unanaesthetized mice.
 - Valero MD, Hancock KE, Maison SF, & Liberman MC.
 - *Hearing Research*, 363(2018), 109-118.
 - *This original research article on a noise-induced synaptopathic animal model in mice, suggests that the middle ear muscle reflex may be a novel and more sensitive measure of synaptopathic regions than the ABR in cochlear synaptopathy.*
- Page 19: Min Roh – New Zealand:
 - Impaired speech perception in noise with a normal audiogram: No evidence for cochlear synaptopathy and no relation to lifetime noise exposure.
 - Guest H, Munro KJ, Prendergast G, Millman RE, & Plack CJ.
 - *Hearing Research*, 364(2018), 142-151.
 - *This clinical research article investigates humans with a normal audiogram but who have impaired speech perception in noise. They find no electrophysiological evidence of cochlear synaptopathy in these patients, and no relation between speech perception in noise and lifetime noise exposure.*
- Page 21: Min Roh – New Zealand:
 - Development of a Test Battery for Evaluating Speech Perception in Complex Listening Environments: Effects of Sensorineural Hearing Loss.
 - Phatak SA, Sheffield BM, Brungard DS, & Grant KW.
 - *Ear & Hearing*, Vol. 39, N°3 (2018), 449-456.
 - *This study explores the use of a modified Quick SIN test to assess whether alterations of these tests could provide a more sensitive and*

comprehensive measure of perceived listening difficulties in individuals who present with normal scores in conventional speech in noise tasks.

- Page 23: Amrutha Kishore – New Zealand:
 - Factors Affecting Hearing Aid Adoption and Use: A Qualitative Study.
 - Nicola Gallagher & Jayne Woodside.
 - *Journal of the American Academy of Audiology*, (2018) Vol 29:300–312.
 - *Although there is a huge difference in terms of use of hearing aids between regular and irregular users, the reasons associated with not wearing them are very similar. Regular follow-ups after an individual has been fitted with hearing aids was one major common factor. Proper counselling on effects of untreated hearing loss and more distribution of information creating awareness of hearing aids and services provided could play a big role in individuals who are more hesitant to get hearing aids.*
- Page 24: Amrutha Kishore – New Zealand:
 - Hearing Handicap and Speech Recognition Correlate with Self-Reported Listening Effort.
 - Sara Alhanbali, Piers Dawes, Simon Lloyd and Kevin J Munro.
 - *Ear & Hearing* Vol39(3) May/June 2018:470-474..
 - *It is important to measure listening effort and fatigue in individuals with hearing loss and that emphasising on the positive side of listening could facilitate hearing aid use. Implementing communication strategies and working with health psychologists could result in an overall improvement for the individual with hearing loss.*
- Page 25: Amrutha Kishore – New Zealand:
 - Criteria to Classify Children as Having Auditory Processing Disorders.
 - Asha Yathiraj and Chitnahalli Shankaranarayan Vanaja.
 - *American Journal of Audiology*, June 2018, Vol. 27, 173-183.
 - *Using a strict criterion in the test battery could help identify children with APD using these 4 tests for children 7 years or older, if more than one test was failed. A less strict criterion can be adopted for children who have failed only one test out of four. This could provide direction for management of the disorder as they provide areas of deficits that will most likely need to be targeted during rehabilitation.*
- Page 27: Lorenzo Notarianni – Italy:
 - Readability of Patient-Reported Outcome Measures in Adult Audiologic Rehabilitation.
 - Alana Douglas and Rebecca Kelly-Campbell.
 - *American Journal of Audiology*, June 2018, Vol. 27, 208-218.
 - *This study examined the grade of readability of published patient reported outcome measures (PROMs) used in adult audiologic rehabilitation. Readability levels recommended for health information by health literacy experts were used to compare the readability of results. The authors suggest that readability formulas used in this research do not provide an infallible estimate of readability.*

Benefits from, Satisfaction with, and Self-Efficacy for Advanced Digital Hearing Aids in Users with Mild Sensorineural Hearing Loss.



Carole Johnson et al.

Seminars in Hearing, 39 (2018), 158-171.

In light of the development of Over-the-Counter (OTC) HAs for persons with mild to moderate hearing loss (HL), this study investigated the benefits, satisfaction and self efficacy of advanced digital technology (ADT) hearing aids (HAs) use among 56 participants (mean age=72 years) with mild sensorineural hearing loss (MSNHL). The HAs fitting process was done by audiologists in two private clinics in CA and included HAs selection, fitting, assessment, verification and instructions. During the 45 days of trial period, the participants came to weekly visits in the clinic. 22.6 % used advanced HAs and 32% used premium HAs. At the end of the trial period they payed for the HAs out of their pocket which indicate that although they had (MSNHL) they were convinced of the benefits they are receiving from the HAs used.

The materials used in the study were the following: 1. A patient information form (PIF); 2. The Visual Analog Scale for Daily Use of Hearing Aids (VASuse); 3. The International Outcome Inventory for Hearing Aids (IOI-HA); 4. The Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids (MARS-HA); 5. The Satisfaction with Amplification in Daily Life (SADL).

The study findings showed that most of the participants used their HAs during most of their waking hours. They were highly satisfied with the acoustic benefits provided by ADT HAs, with the psychological aspects of the HAs and with the service and cost of their ADT HAs. They were moderately satisfied with noise and feedback reduction and seemed to benefit from the audiologist's care provided in the follow-up visits during the trial period.

The study findings indicated that the HA wearers' relationships with their audiologists are very important. Patients with MSNHL are not "easy cases". They would benefit from additional counselling and audiological care during the fitting process in order to better adjust the HAs systems to their needs, understand how to use their HAs in different listening situations, increase their self-efficacy and confidence with their HAs and ensure their knowledge regarding care and maintenance of their devices. It is important to ensure that the future OTC delivery model for persons with MSNHL will include adequate audiological counselling and follow-ups.

This article's findings are in line with my team's professional view and experience: Persons with MSNHL, as well as with other degrees of HL, benefit from and are satisfied with ADT HAs. Moreover, ADT provide audiologists with a much more technological tool that help adjust the HAs to better satisfy our patients' needs. Our professional obligation is to offer and fit our patients with the most advanced HAs available because no one deserves to be fitted with basic level HAs!.

“There are more important things to worry about”: attitudes and behaviours towards leisure noise and use of hearing protection in young adults.



Abby Hunter.

International Journal of Audiology, 2018;
Vol 57 (7), 449-456.

Intro:

Within the context of UK laws, in the workplace there are hearing protection regulations to protect employees from noise damage. However, unlike as is the case for workers, there is no specific legislation setting noise limits for the audience exposed to noise, but only recommendations.

In recent years, there has been an increase amongst the younger generation of exposure to loud noise and an increase in noise induced hearing problems. However, amongst young adults, the risk of hearing loss is not perceived to be of high personal relevance

Aim:

This study lies within the context of the culture and laws of the UK. The aim was to explore attitudes and behaviours towards leisure noise and use of hearing protection, specifically earplugs, among young adults with no known hearing loss or tinnitus. Using qualitative research methods, the study aimed to address the following questions: (1) What attitudes do young adults have towards leisure noise and hearing damage, (2) and what are the motivating and inhibiting factors for engaging in protective hearing behaviours.

Population:

Young adults aged between 18 and 35 years with no known hearing impairment or tinnitus were recruited via advertisements asking for participation in a focus group concerned with involvement in noisy leisure activities. N= 28 young adults, (6 male; 22 female; mean age 23 years). Two were members of staff at the University. The others were undergraduate and postgraduate students. None of the participants had permanent hearing loss or tinnitus.

Results:

- The participants generally had positive attitudes towards noise, in that they enjoyed loud music and considered themselves music lovers.
- Participants were concerned that earplugs would have an effect on music quality by reducing the clarity of the music. As participants considered themselves music lovers, they placed more importance on their lifestyle, enjoyment and love of loud music, than on their hearing. However, a love of music was also a motivating factor for earplug use for some participants who had experienced injury from noise.
- Many young people have little experience with earplugs because there is still a stigma attached to wearing them. Peer norms and behaviours were a significant factor in the decision to not wear earplugs
- There was a clear lack of knowledge concerning the potential damage that noise can do and their own susceptibility to hearing loss and tinnitus.

- *They felt their personal risk of hearing damage was low due to the infrequency of exposure. There was the view that going out once or twice a week would not cause any damage and hearing loss was considered an old person's illness and not something to worry about at a young age.*

Conclusion:

Because of a lack of knowledge and concern over the consequences of noise damage and hearing problems, many young people felt there were more important things to worry about. Hearing problems were not viewed as a priority when there are other behaviours such as smoking, alcohol and drug use that are given much more attention and focus in society.

Limitations:

- *The study sample was drawn from one University and these participants are therefore not representative of young adults in general.*
- *It is also possible that there is a bias in terms of those who volunteered to take part*
- *The culture and social norms of young adults' behaviour with regards to nightclubs and hearing protection may be different in the UK.*

Critical note:

It is important to regard this study within its limitations, as described by the author herself. It is striking to see how little knowledge there is about the dangers of noise, even in a population of higher educated people.

It would be interesting to collect more representative data (lower educated, etc.). There is also a need for further research to provide us a clearer picture of noise exposure and how we deal with this at a much younger age (6-18 year olds). It possibly makes sense to give children a sound education from primary school.

Therefore, there is still a long way to go ...

Mild-Gain Hearing Aids as a Treatment for Adults with Self-Reported Hearing Difficulties



Christina M. Roup, Emily Post, Jessica Lewis.

Journal of the American Academy of Audiology, Vol 29:477-494 (2018).

Intro: Individuals with suprathreshold auditory deficits and self-reported hearing complaints in the presence of normal pure-tone sensitivity represent a unique yet not uncommon adult clinical population. When untreated, it can lead to a reduction in quality of life, and generate depressive symptoms etc. The treatment option to provide a personal-level device such a mild-gain hearing aids, has not yet been investigated.

This study used a control group of 20 young adults with no reported hearing difficulties, and an experimental group of 17 participants with self-reported hearing difficulties. Both groups have normal pure-tone sensitivity. An additional inclusion criterium was a score ≥ 20 on the HHIA for the HD group and an HHIA score ≤ 18 for the control group. (HHIA: Hearing Handicap Inventory for Adults)

Auditory tests were administered in a single test session for the control group. The HD group participated in three sessions: 1) for completing most of the auditory tests 2) for unaided R-SPIN testing and the hearing aid verification 3) four weeks after Session 2: aided questionnaires and aided R-SPIN testing.

Participants of the HD group were fitted bilaterally with receiver-in-the-canal, wide dynamic range compression hearing aids (Widex Dream 440 Fusion) with open domes. The hearing aids also had adaptive multiband directionality and noise reduction. The hearing aids were programmed to provide 5-10 dB of insertion gain between 1000 and 4000 Hz for soft and conversational inputs and no gain for loud inputs. Hearing aid insertion gain was verified using real-ear probe-microphone measures for two inputs: 65 and 90 dB SPL. MPO did not exceed 100 dB SPL for any participant. Each participant was asked to wear the hearing aids for a minimum of 4h per day in a variety of listening environments.

RESULTS

Control group vs HD group: significant differences between both groups, in the auditory processing test battery, the questionnaires, and the Speech-in-Noise test.

Unaided vs Aided HD group: significant differences in the questionnaires and the Speech-in-Noise test.

Hearing Aid Use: as the unaided HHIA-score increased, so did the average number of hours of hearing aid use.

Self-Reported Hearing Aid Benefit in Quiet and Noise: the majority felt that the hearing aids either helped a lot or helped a little both for listening in quiet and listening in noise.

DISCUSSION

Diagnosis of an APD was not required, rather the auditory processing test battery was used to characterize the HD group. 94% of the HD group performed abnormally on at least one of the auditory processing tests administered. 100% of the HG group performed below normal range for the R-SPIN.

The higher scores on the questionnaires for the HD group demonstrate the value of questionnaires as part of a diagnostic auditory processing test battery.

The HD group performed significantly poorer for the Speech-in-Noise test, as a function of both context and SNR. Auditory deficits of individuals who present with HD may go unnoticed if auditory tasks are too simple. The task needs to challenge the auditory system. The questionnaires after the hearing aid trial showed significantly less self-perceived hearing handicap and auditory processing difficulties when wearing the hearing aids. However, 2 HD participants experienced increased hearing handicap and 1 of the 2 also experienced increased self-perceived auditory processing difficulties. Although they both had improved R-SPIN recognition performance, it was not perceived to be beneficial.

Hearing aids "helped a lot" or "helped a little" the majority of the time in both quiet and noise environments. Greatest benefit is more frequently for noise environments.

3/17 purchased the hearing aids after the trial. For 2 of these 3, there was a clear pattern of objective and subjective results.

REMARKS

There are several limiting factors: non-age-matched control participants; minimal investigation into participants comorbid factors; the use of only one intervention method and the lack of a sham condition. Future research should explore age and additional comorbid factors. The role of a placebo effect cannot be ruled out. For most participants with HD, self-perceived benefit was noted primarily when listening in noise environments when the adaptive directionality and noise reduction would have engaged.

The authors conclude that individuals who present clinically with HD should be assessed beyond the standard audiometric test battery. Furthermore, that mild-gain, open-fit hearing aids with adaptive multiband directional microphones and noise reduction may provide a viable treatment option for some individuals with HD consistent with APD.

Olivocochlear efferents: Their action, effects, measurement and uses, and the impact of the new conception of cochlear mechanical responses.



Guinan Jr JJ.

Hearing Research (2018): 362, 38-47.

Olivocochlear (OC) neurons receive sound-driven inputs from the cochlear nucleus and form brainstem-level acoustic reflexes. They are the most known part of the efferent auditory system. In mammals there are two groups of olivocochlear efferents: medial OC (MOC) and lateral OC (LOC) efferents. MOC neurons are located in the superior olivary complex - medial, ventral and extending slightly anterior to the medial superior olivary nucleus. They have myelinated axons that synapse on outer hair cells (OHCs). MOC neurons receive sound driven inputs from both cochlear nuclei with the strongest input from the contralateral side. LOC cell bodies are located in and near the lateral superior olivary (LSO) nucleus. LOC neurons have unmyelinated axons that synapse on the dendrites of AN fibres under inner hair cells (IHCs). LOC axons go predominantly to the cochlea on the same side as the axon's cell body. Since LOC axons are thin and unmyelinated, they are difficult to record from or electrically stimulate. Consequently, little is known about when they are activated or what they do to AN firing.

Most MOC neurons respond to sound in one ear and are facilitated by sound in the other ear. MOC neurons have regular, repetitive firing. They have V-shaped, tone-response tuning curves that are slightly wider than those of AN fibres. The addition of noise in the opposite ear can greatly increase MOC tone response areas, but there are few data on MOC-neuron responses to noise, despite noise being the most potent and preferred MOC stimulus in humans. LOC neuron responses to sound have never been measured, but it is assumed that they respond to sound, in part because their cell bodies are embedded in an auditory nucleus, the LSO. LSO neurons aid in sound localization by increasing their rate in response to the ipsi/contra sound-level difference.

Efferent effects on hearing are commonly assessed by the difference between some physiologic variable (such as OAE, ABR, speech-in-noise score) measured with and without efferent stimulation. DPOAE, TEOAE and SFOAE have been used to study MOC effects. However, the OAE SNR should be very high, else it leads to erroneous conclusions. Use of ABR (or CAP) is difficult in humans as it requires a lot of averaging. The efferent effects on speech perception in noise are not conclusive. The MOC reduction in cochlear amplifier gain has been estimated using psychophysical methods. Ipsilateral MOC-elicitors produced 20 dB gain reductions and contralateral MOC-elicitors produced 4.4 dB gain reductions. A large body of data thus indicates that a major role of both LOC and MOC efferents is to reduce the damage from traumatic sounds. MOC is also known to modulate haircells and auditory nerve fibres, aiding probably in better hearing.

The review summarises the anatomy, physiology and functional role of the efferent system in overall hearing process. However, findings in humans are presented along with those of other mammals. First time readers can possibly be led into confusion. So far, the understanding has been only from normal hearing subjects, hence the implication to disorders is not clear.

**Hearing results after type III tympanoplasty: incus transposition versus PORP.
A systematic review.**



Bartel R et al.

*Acta Oto-Laryngologica, 2018, Vol138,
NO. 7, 617–620.*

It is well known that longstanding conductive hearing loss leads to ossicular chain discontinuation and is one of the most frequently seen ossicular chain problems of the middle ear. It is a major challenge for otological surgeons to reconstruct the same. Various materials as well as techniques have been documented as surgical options – to reconstruct incudostapedial joint continuity, including incus transposition (IT) of a biological autograft or homograft, and use of partial ossicular replacement prostheses (PORP) and bone cements.

The aim of the present study was to assess the existing evidence in favour of or against IT type III tympanoplasty in comparison with PORP type III tympanoplasty, with regard to postoperative hearing results. Web-based search engines were used to retrieve all the studies published on this subject. The following key words were used: "tympanoplasty", "type III tympanoplasty", "PORP", "partial ossicular replacement prostheses", "incus tympanoplasty", "incus transposition", and "ossicular reconstruction". Furthermore, references of the retrieved articles were searched.

Among the 14 analyzed studies, a total of 1055 patient were gathered, nine studies had the needed information in relation to IT type III tympanoplasties, counting a total of 614 patients with hearing results between 3 and 12 months postoperative time. Ten studies had the needed information regarding PORP type III tympanoplasties, counting a total of 441 patients with hearing results between 3 and 12 months postoperative time. Among these studies, five studies had direct data comparing hearing results between IT and PORP type III tympanoplasties.

Incus transposition group: A total of 614 patients were analyzed. A mean preoperative ABG of 31.74 dB with a standard deviation (SD) of 10.51 dB was obtained. A mean postoperative ABG of 18.97 dB with a SD of 10.6 dB was obtained. A mean dB gain of 12.76 dB with a SD of 14.97 dB was obtained. An ABG closure rate of 64.48% was obtained.

PORP group: A total of 441 patients were analyzed. A mean preoperative ABG of 28.02 dB with a standard deviation (SD) of 10.47 dB was obtained. A mean postoperative ABG of 16.27 dB with a SD of 10.45 dB was obtained. A mean dB gain of 11.75 dB with a SD of 15.02 dB was obtained. An ABG closure rate of 71.32% was obtained.

Regarding hearing results, of the review evidenced demonstrated that it is better to perform a type III tympanoplasty independently be it IT technique or PORP than not performing it. Postoperative hearing results were considerably better after surgery than before. The decibels gained after surgery were comparable between IT and PORP with no real difference between them. Although a better chance to close the air bone gap to less than 20 decibels is better achieved with PORP than with a incus sculpted transposition technique.

This is a very important systematic review which compared between 2 common middle ear reconstruction surgeries. While the authors controlled most factors in selecting studies, there are some crucial variables not covered as later admitted by them.

Health Burden and Socioeconomic Disparities From Hearing Loss: A Global Perspective.



Ramsey T et al.

Otology & Neurotology, 2018: 39, p12–16

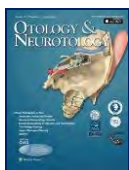
Despite several improvements in awareness, screening and management, several global trends have exacerbated the incidence of hearing loss (HL) in recent years. According to the World Health Organization (WHO), greater than 5% of the global population has some form of HL, and 1.1 billion teenagers and young adults are at risk secondary to the use of personal electronic devices without adequate hearing protection. HL not only decreases quality of life of the individual but also generates costs to society such as greater welfare payments, health care expenditures, and lost tax revenue. If this burden of HL persists, it could potentially slow economic growth, with developing countries experiencing the greatest impact. Objectives of the study were to characterize whether disparities in HL-related disability exist, using worldwide data to estimate the health burden of this common entity.

Disability-adjusted life years (DALY) were used in this study to measure the burden of hearing loss. This measurement is a well established and validated way of measuring disease burden, calculated by the sum of years of life lost due to early deaths and full healthy years lost due to living in a less-than optimal health state. The disability weight represents the proportional reduction in perfect health due to a disease, with 0 being the perfect health state and 1 being death. For hearing loss, this value ranges from 0 to 0.333 based on severity of the condition. Kruskal–Wallis and Mann–Whitney U tests were used to calculate the statistically significant difference of age-standardized DALY rates between the socioeconomic groups. Linear regression analyses were used to assess the correlation between countries' socioeconomic status and hearing loss burden, and trends of Gini coefficients and concentration indices.

Countries with the greatest burden of disease were located in South Asia, Eastern Sub-Saharan Africa, and Central Sub Africa. Global hearing loss burden has slightly increased over the past 25 years from 577.2 DALYs in 1990 to 595.9 DALYs per 100,000 population in 2015. The analysis illustrates a 3.2% increase in age-standardized DALY rate of hearing loss between 1990 and 2015. This is in contrast to another special sensory impairment, sequelae from cataracts; worldwide cataract burden has demonstrated an at least 7.0% reduction in age-standardized DALY rate from 1990 to 2013. The global burden of hearing loss remains high and has not shown a substantial decline since 1990. The gap in hearing loss burden between developing and developed countries improved initially but has demonstrated signs of regression in recent years. Global health advocates and policymakers should be aware of the economic burden and cost-effectiveness of hearing loss prevention and treatments to minimize global burden of hearing loss.

This study provides a framework for policy making on hearing loss prevention at country level/ region level. Comparing the trends among other countries and over the years is further useful in understanding the success of healthcare/ disease prevention programs.

The Progressive Nature of Meniere's Disease: Stress Projections and Lesion Analysis.



Pender DJ.

Otology & Neurotology, 2018: 39, p 221–226

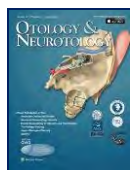
Meniere's disease can affect virtually every part of the membranous labyrinth. Type of lesions vary from simple chamber dilation to gross deformity, herniation, bone contact, and overt rupture. The expansion of the endolymphatic space noted in the original report suggests that increased endolymphatic pressure causes the membrane walls to distend, deform, and disrupt. However, the mechanics of disease evolution have remained unclear. It is hypothesized that an engineering stress model of the membranous labyrinth can provide a mechanism of disease that accounts for the lesion development pattern observed in this malady.

This paper modelled the membranous labyrinth as a series of 6 geometrical chambers: The semi-circular canals are modelled as toroids, the ampullae as spheroids, the utricle as a prolate spheroid, and the saccule as an oblate spheroid. The engineering model shows that Reissner's membrane is flat like a trampoline in its undistended position. Model risk of lesion formation predicated on normalized stress susceptibilities indicates that, in the face of pathologic endolymphatic pressure, Reissner's membrane in the cochlea apex will be affected in 100% of cases, the saccule in 90.7%, the utricle in 58.3%, the ampullas at 4.4%, and the canal system in only 2.5% of cases. This model reflects a progressive, strictly decreasing model risk that follows the serial order of the interconnected chambers', starting with Reissner's membrane in the cochlea, progressing through the saccule, utricle, and ampullae to the canal system.

Lesion data was collected from 4 published studies, which all in had 93 temporal bone specimens. Comparison of lesion data with the model findings reveal that the model risk of lesion formation based on stress vulnerability cleaves closely to the actual risk of chamber lesion formation in a combined series of 93 temporal bones. This concordance suggests that the model is reasonably accurate in projecting risk of lesion formation. Author notes that individual lesions is not yet predictable using the stress model and it needs upgradation.

This is a unique study where in engineering principles are applied to model the disease process in the ear. Success of this model opens up doors for modelling individual data.

Survey of the American Neurotology Society on Cochlear Implantation: Part 1, Candidacy Assessment and Expanding Indications.



Carlson ML et al.

Otology & Neurotology, 2018; Vol. 39(1) p e12–e19

Since the first approval to a Cochlear Implant (CI) by the American FDA, more degrees of HL were included in the candidature for CI. With every CI device, the adult and child candidature have been defined by FDA. It is also notable that despite the development of a minimum speech test battery, there remains significant variance in candidacy assessment practices across the United States. Such data can inspire momentum for FDA labelling modifications and revision of Medicare and third-party payer criteria and can also offer a preliminary framework for the development of consensus guidelines. It helps in standardization that would reduce the access inequities that currently exist. Many patients are currently denied access to cochlear implants due to the lack of clarity in guidelines, misinterpretation of criteria, and use of outdated testing routines. The current study was taken up to examine the differences in CI candidatures used across member clinics of American NeuroOtolological Society.

26-item web-based questionnaire was circulated through the survey monkey program. 81 of the 257 respondents completed the survey. In total, 63 (78%) respondents reported performing cochlear implantation for at least one of the following indications: profound hearing loss in children less than 12 months of age (35, 43%), children with asymmetrical hearing loss where at least one ear scored better than performance cut-off for age (25, 31%), adults with asymmetrical hearing where at least one ear was better than the performance cut-off for adult criteria (49, 60%), single-sided deafness (37, 46%), and ipsilateral vestibular schwannoma (28, 35%). Surgeons in academic practices more commonly performed implantation in children less than 12 months of age, compared with those in private practice implant programs.

75 (100%) respondents who answered this question reported routine use of AzBio sentences, 42 (56%) consonant-nucleus consonant (CNC) word scores, and 26 (35%) HINT testing; 7 (9%) reported using Bamford-Kowal-Bench Speech-in-Noise testing and 6 (8%) reported using City University of New York. Fifty-one (68%) reported routine use of speech-in-noise testing to determine adult cochlear implant candidacy, 21 (28%) reported selective use only when patient scores were borderline in quiet, and 3 (4%) reported that their center does not currently use testing in noise for candidacy determination. Similarly, there was variation in terms of the use of SNR levels between +5 and +10 dB SNR.

Such a variation can be due to various factors – rapid growth of CI technology, lack of high quality research to support candidacy etc. This study found a significant variation in cochlear implant candidacy assessment and off-label implantation exists across the United States resulting in healthcare inequity. The high percentage of surgeons performing implantations for off label or non-traditional indications reflects the overly restrictive and dated status of current implant guidelines.

With greater adoption of more difficult speech perception testing in noise, careful clinical judgment is needed to maintain a favourable risk-benefit balance for prospective implant candidates.

This small study (a few participants and a few questions) found huge variations in almost all clinical parameters deciding CI candidacy. The study also showed the need for revising CI candidacy tests.

**Effects of cochlear synaptopathy on middle ear muscle reflexes in
unanesthetized mice**



*Valero MD, Hancock KE, Maison SF, &
Liberman MC.*

Hearing Research (2018): 363, 109-118.

This original research article on a noise-induced synaptopathic animal model in mice, suggests that the middle ear muscle reflex may be a novel and more sensitive measure of synaptopathic regions than the ABR in cochlear synaptopathy.

Introduction

Cochlear synaptopathy is defined as the loss of auditory nerve connections with cochlear hair cells. It is also known as 'hidden hearing loss', given that audiometric thresholds do not change until 50% of the synaptic innervations have died. The causes of cochlear synaptopathy include age, noise, damage, and other acquired sensorineural hearing losses.

Current literature has suggested that the subset of auditory nerve fibres with high thresholds and low spontaneous rates (low SR) are more susceptible to this damage. This is line with the fact that the low SR fibres are not responsible for threshold innervation as they have a high threshold of activation, thus explaining the lack of threshold change with damaging synapses. The main role of the low SR fibres is believed to be in encoding supra-threshold signals in background noise, aiding in speech in noise performance.

Traditionally in animal models, the study and diagnosis of cochlear synaptopathy has been done using the Wave I amplitude of the auditory brainstem response (ABRs), which shows a progressive attenuation with increasing synaptic loss. However given the small onset response of the low SR fibres, the ABR may not be the best way to assess signs of low SR fibre loss.

The middle ear muscle reflex (MEMR) is a sound-evoked, negative-feedback reflex that stimulates a contraction of the stapedial muscle on the stapes. This generates tension on the middle ear, therefore reducing the sound transmission through the middle ear. Given that the MEMR often has a high threshold of activation, it is plausible that the MEMR response may be dominated by the low SR auditory nerve fibres. Previous studies by the same group have shown that the MEMR is permanently attenuated by noise-induced loss of IHC synapses, despite recovery of ABR thresholds and little to no loss of hair cells in anesthetized mice.

The MEMR strength is known to be attenuated by anaesthesia, as well as confounding factors from another sound-evoked, negative feedback reflex, the efferent medial olivocochlear reflex (MOC). To account for both factors, the authors have developed a knock-out mice strain with the MOC efferent neurons inactivated, as well as an unaesthetised mouse preparation to record the MEMR response.

Methods

CBA/CaJ mice were used in this study, with a knock-out mice strain (KO) for the alpha-9 nicotinic acetylcholine receptor, responsible for the MOC reflex. Six KO and ten wild type (WT) mice were placed in a reverberant chamber and were exposed to octave-band noise (8-16 kHz) for 2h at 93.5dB SPL. Mice with a permanent threshold shift following acoustic overexposure were not used in the results.

Cochlear function tests were performed on all mice under anaesthesia using distortion-product otoacoustic emissions (DPOAEs) and auditory brainstem responses (ABRs). MEMR measurements were elicited by various wideband octaves and volume presented in the contralateral ear for 3 seconds, with the probe ear recording changes to the sound pressure level of a chirp stimulus. Mice were then euthanized for cochlear immunostaining and analysis of innervation and hair cell counts using confocal microscopy.

Results

Overall cochlear histology and function were similar in WT and KO mice before noise exposure. The magnitude of the MEMR response was insignificantly different between the WT and KO mice, suggesting that the wideband reflex assay used in this study minimizes the effects of the MOC reflex and predominately reflects the MEMR reflex.

Compared to the previous study by the same authors (Valero et al., 2016), the effects of **anaesthesia** proved to attenuate the magnitude of the MEMR thresholds. This is in line with other studies showing the sensitivity of the MEMR to anaesthesia.

Following noise exposure, both the WT and KO group showed signs of cochlear synaptopathy with minimal permanent threshold shift. This was shown by near complete outer hair cell survival, with synaptic damage and a decrease in the Wave I amplitude of the ABR peaking at 32 kHz. Wideband MEMRs measured at peak synaptopathic damage (22.6-45.2 kHz) displayed the greatest deviation in MEMR thresholds, increasing by approximately 15-17dB compared to non-noise exposed controls.

Discussion

The results of the study suggest that animals with cochlear neuropathy have a reduced MEMR function. If this is true in humans, and given that the primary role of the MEMR is to reduce incoming noise, it may be possible that daily exposures of noise levels initially cause a temporary threshold shift, leading to a cochlear neuropathy of sorts, which in turn reduces the protective effects of the MEMR, thus leading onto a permanent threshold shift.

In addition, given that the MEMR in humans have been elicited at levels substantially below what we would consider as damaging noise levels, another role of the MEMR has been posited to reduce the upward spread of masking by attenuating low-frequency noise, which has been shown by physiological recordings in cats in the past. Previous studies have suggested that patients with damaged MEMR (e.g. damaged facial nerve in Bell's palsy or stapedectomy) have difficulty in high-level speech and speech-in-noise tasks. Future studies should lead onto the potential effects of MEMR dysfunction in these tasks.

Clinical Implications

Clinically, the MEMR in humans is recorded with a 226Hz probe tone to ipsilateral and contralateral pure-tone stimuli. Its primary purposes are to act as a cross-check for conductive hearing losses, facial nerve dysfunction, auditory neuropathy, and auditory nerve tumours. However, given that the pure-tone threshold for the MEMR is very high, a ceiling effect may be present, limiting the ability to measure a valid MEMR threshold in most cases.

The implications of this study suggest that the wideband-MEMR may be used as part of a diagnostic test battery to identify cochlear synaptopathy in humans, as well as identifying narrowband regions of damage. Wideband-MEMR is still new to audiological practice, and once normative parameters and values are set for this, the functional use of the MEMR in diagnostic audiology is sure to increase.

Impaired speech perception in noise with a normal audiogram: No evidence for cochlear synaptopathy and no relation to lifetime noise exposure



Guest H, Munro KJ, Prendergast G, Millman RE, & Plack CJ.

Hearing Research (2018): 364, 142-151.

This clinical research article investigates humans with a normal audiogram but who have impaired speech perception in noise. They find no electrophysiological evidence of cochlear synaptopathy in these patients, and no relation between speech perception in noise and lifetime noise exposure.

Introduction

From the proportion of patients that attend audiology services for hearing difficulties, approximately 5-8.4% of this cohort report deficits of speech perception in noise (SPiN), whilst presenting with a normal audiogram. Given the relatively high clinical presentation of 'SPiN impairment with a normal audiogram', extensive research has been put into potential causes of this, revealing a more heterogeneous spectrum of causes.

More recent literature has suggested that the recent emergence of a pathophysiology termed 'cochlear synaptopathy' may be linked with the SPiN impairment with a normal audiogram. Cochlear synaptopathy has been demonstrated in animal models from noise exposure, and it is where there is a loss of synapses between the inner hair cells and the auditory nerve fibres, without causing a significant change in auditory threshold. Studies of animal models with have shown that this preferentially affects low spontaneous rate (low SR) auditory nerve fibres which have high response thresholds, and is associated with a significant reduction in the Wave I amplitude of the auditory brainstem response (ABR), known to be a good electrophysiological measure for cochlear synaptopathy.

It is hypothesized that because the low SR fibres have higher activation thresholds, they will code for suprathreshold sounds such as background noise, presumably enhancing the ability in speech perception in noise situations.

Of the numerous animal and human studies done on the subject, there is currently mixed evidence in suggesting an association between lifetime noise exposure, SPiN performance, and electrophysiological results that are sensitive to cochlear synaptopathy. However much of the current literature have not investigated synaptopathy in individuals with a verified SPiN impairment, and audiometric thresholds have not been accounted for, which can greatly affect electrophysiological and perceptual measures.

Therefore the present study investigates associations between verified SPiN impairment in humans with a normal audiogram and:

1. ABR measures of cochlear synaptopathy
2. Envelope Following Response (EFR) measures of synaptopathy
3. Lifetime noise exposure

Methods

A total of 16 participants aged 18-40 years with a normal audiogram (< 20dB HL at 0.25 – 8 kHz) and reported & verified SPiN deficit were in the experimental group. The control group was matched with the experimental group based on age, sex, and audiometric thresholds. Extended high frequency audiometry up to 14 kHz was performed on both groups.

SPiN testing was performed to obtain the SNR at which the participant would score 50% correct in a one-interval, 16-alternative, forced-choice procedure with a CRM phrase.

A structured interview was used to identify lifetime noise exposure by noise type, duration, level, and whether hearing protection was used or not. These are then combined to estimate and yield units of lifetime noise exposure.

Electrophysiological measures of the ABR were measured using a broadband click stimulus (1.2-4.7 kHz) at 102 dB peSPL. EFR was performed using transposed tones of either full modulation or shallow modulation to obtain an EFR slope that result from the difference between these two tones. This slope reflects the degradation of encoding shallow modulations, which would be seen in cochlear synaptopathy.

Results

Between the participants with verified SPiN impairment and the control group:

- Mean audiometric thresholds did not vary significantly between the two groups
- Results of the SPiN test showed considerable inter-subject variability
- Lifetime noise exposure did not differ significantly between the two groups
- For the ABR, both the Wave I amplitude and Wave I: V amplitude ratio yielded no significant differences between the two groups
- For the EFR, there was no significant effect of the verified SPiN group on the EFR amplitude

Discussion

This study is the first to investigate synaptopathy in individuals with significant listening difficulties, of which no bb and noise exposure are insufficiently sensitive.

Nevertheless, the results of this study do not support the notion that noise-induced cochlear synaptopathy is a significant aetiology of SPiN impairment with a normal audiogram. Future directions of research into this area should incorporate more clinical studies in humans to verify finding in animal models, as well as obtaining more sensitive measures of noise exposure (e.g. dosimeters), speech in noise measures, as well as electrophysiological measures of cochlear synaptopathy as they develop (e.g. wideband middle ear reflex responses).

Development of a Test Battery for Evaluating Speech Perception in Complex Listening Environments: Effects of Sensorineural Hearing Loss.

Phatak SA, Sheffield BM, Brungard DS, & Grant KW.

Ear and Hearing 2018, 39(3), 449-456.



This study explores the use of a modified Quick SIN test to assess whether alterations of these tests could provide a more sensitive and comprehensive measure of perceived listening difficulties in individuals who present with normal scores in conventional speech in noise tasks.

Introduction

In individuals with reported hearing difficulties, they are often situation-based in difficult listening environments, such as noisy reverberant spaces, multi-talker conversations, and rapid speaking rates. Often, these situations are not the typical scenarios that are assessed in a standardized hearing test used in audiology. Thus, at times, the clinical assessments of hearing loss do not correlate with the everyday communicating difficulties reported by patients.

One main lack in current clinical speech tests is the lack of tests for binaural function, which is crucial for speech perception in complex environments. Most of the widely used speech in noise tests in the clinical setting is the Quick speech-in-noise (Quick SIN) test, which rely exclusively on multi-talker babble maskers presented dichotically with the target speech.

Previous studies have sought to overcome this problem by modifying the Quick SIN test to reflect various auditory scenarios, and hence provide a more comprehensive assessment of an individual's speech in noise performance and hence their communication ability.

One previous study (Brungart et al., 2014) created a Quick SIN-based test battery and tested normal hearing individuals to obtain a normative data set. This study sought to use the same tests to measure speech in noise performance in individuals with varying degrees of hearing loss. This would help to identify which specific auditory scenes would be more sensitive to speech in noise deficits, as well as tease out the effects of hearing loss in these tasks.

Methods

A total of 122 participants were allocated into groups based on their audiometric configuration:

- H1NH: normal hearing
- H1BN: borderline normal
- H2: mild
- H3: moderate to severe

The modified Quick SIN test consisted of participants recognizing the Institute of Electrical and Electronic Engineers (IEEE) sentences spoken by a female speaker in eight auditory scenarios:

- Babble: standard Quick SIN condition with a four-talker masker

- AV: Babble condition with audiovisual IEEE sentences
- NOS π : Babble condition but phase of the target sentences shifted by 180 deg in one ear
- AV + NOS π condition
- Spatial: eight-talker babble with half presented to either side of the talker (left and right)
- Reverb: Spatial condition with reverberation added to stimuli
- Time compression+Reverb (TC+Rev): Reverb condition with target speech rate increased by 50%
- Speech-Spectrum Noise (SSN): standard Quick SIN condition with babble replaced by continuous speech-spectrum noise masker

Participants were required to estimate their psychometric curve (0% to 100% speech intelligibility) for each scenario by adjusting the background masker level to a level that:

- They could hear the speech but no longer understand any word (SRT0)
- They could hear the speech and understand all the words (SRT100)

This was then followed by a standard Quick SIN procedure to measure the actual speech in noise threshold corresponding to 50% speech intelligibility (SRT50)

Finally, an abbreviated version of the Speech, Spatial and Qualities of Hearing Scale Questionnaire (SSQ) was administered in order to obtain their perceived difficulties in everyday speech communication.

Results

From the four-talker scenarios (Babble, AV, NOS π , and AV + NOS π), the addition of both visual input (AV) and binaural phase difference between stimulus and masking (NOS π) significantly improved thresholds across all groups of hearing when compared to the standard Babble condition.

From the eight-talker scenarios (Spatial, Reverb, TC+Rev), the addition of both reverberation (Rev) and the time compression (TC) showed the greatest degradation of thresholds across all groups of hearing when compared to the standard Spatial condition.

Speech-in-noise performance decreased with a moderate to severe hearing loss, but not with mild hearing loss. Compared with the standard Quick SIN condition, the greatest separation between cumulative distributions of the hearing groups was observed in the TC+Rev and NOS π conditions (in that order).

Perceived difficulties in everyday speech communication as measured by the modified SSQ were used to identify which auditory scenarios would correlate to specific questions in the modified questionnaire. The Question pertaining to attention and effort required correlated mostly with the TC+Rev condition. The Question pertaining to localization of a sound source was correlated mostly with the NOS π condition.

Thus the results suggest that a modified speech in noise test battery which incorporates both conditions (TC+Rev and NOS π) will help in identifying individuals with hearing loss with speech in noise deficits but who score normally on traditional speech in noise tasks. Future directions the researchers are taking is to modify these tests to administer in sound field, which would allow evaluation of hearing aids and their performance in speech in noise tasks; as well as standardizing and distributing these modified versions for a more widespread clinical use of these.

Factors Affecting Hearing Aid Adoption and Use: A Qualitative Study



Nicola Gallgher & Jayne Woodside.

Journal of the American Academy of Audiology, Vol 29:300–312 (2018).

Hearing loss has been found to occur largely in the older population. It has a high prevalence and has vast effects on affected individuals and those around them. Despite this, rehabilitation using hearing aids has not been very successful. Many individuals with a hearing loss choose not to wear hearing aids and many individuals with hearing aids do not wear them regularly.

This study aimed to identify the reasons for low adoption and use of hearing aids in three different groups of people (mostly issued by National Hearing Services) with self-reported hearing loss, through qualitative thematic analysis. The first group consisted of individuals who wore hearing aids regularly (more than 8 hours a day), the second group were individuals who did not wear their hearing aids regular and the third group who had a hearing loss but did not own hearing aids.

*Each group of participants were asked to fill in a short questionnaire and then asked open ended questions. Baseline quantitative analysis showed that most non-hearing aid users were younger than those with hearing aids and that regular users had a more severe hearing loss than *that of* irregular wearers. Qualitative data analysis revolved around 3 major themes in the regular versus irregular users; inadequacy of audiology services, complexity of low hearing aid use and attitude towards hearing loss/hearing aids.*

In these two groups, common problems identified with inadequacy of audiological services revolved more around follow-ups not being scheduled and lack of information rather than quality of services provided. Most wearers reported that discomfort, dexterity issues or hearing aids not benefiting them in back ground noise or the telephone along with vanity and medical conditions were reasons contributing to low hearing aid use. Most individuals expressed some positive (accepted and satisfied) and negative emotions (despair, isolation and frustration) towards them. The last group of individuals who did not own hearing aids were found to be having a hearing loss that was a lot less severe and not experiencing major difficulties in different situations. They mostly agreed to get a hearing aid if their hearing loss worsened. They also thought that the reasons to not have a hearing aid outweighed the reasons to get them.

Thus, the study concludes that although there is a huge difference in terms of use of hearing aids between regular and irregular users, the reasons associated with not wearing them are very similar. Regular follow-ups after an individual has been fitted with hearing aids was one major common factor. Proper counselling on effects of untreated hearing loss and more distribution of information creating awareness of hearing aids and services provided could play a big role in individuals who are more hesitant to get hearing aids.

Hearing Handicap and Speech Recognition Correlate With Self-Reported Listening Effort and Fatigue.



*Sara Alhanbali, Piers Dawes, Simon Lloyd
and Kevin J Munro.*

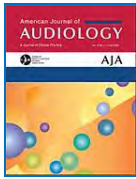
*Ear & Hearing Vol 39(3) May/June 2018,
p470-474.*

Individuals with hearing loss often report higher listening effort and fatigue in challenging situations. Studies have shown a positive correlation between self-reported fatigue and hearing difficulty (Hornsby and Kipp, 2016). Hockey, 2013 proposed a model (Motivation Control Model) that relates a higher difficulty for unrewarding tasks in terms of effort and fatigue.

This study aimed at providing correlations between hearing handicap and listening effort, and speech recognition and listening effort. They used 3 questionnaires (Fatigue Assessment Scale, Effort Assessment Scale and Hearing Handicap Inventory for the Elderly) on 84 individuals with hearing loss. The Speech Recognition in noise was also measured in these individuals to determine the SNR required for 71% correct scores.

The results were consistent with previous studies and showed a strong correlation between hearing handicap and fatigue and effort. It also associated individuals who required a greater SNR to hear in noise, with higher scores of effort and fatigue.

The study concludes that it is important to measure listening effort and fatigue in individuals with hearing loss and that emphasising on the positive side of listening could facilitate hearing aid use. Implementing communication strategies and working with health psychologists could result in an overall improvement for the individual with hearing loss.

Criteria to Classify Children as Having Auditory Processing Disorders.

Asha Yathiraj and Chitnahalli
Shankaranarayan Vanaja.

American Journal of Audiology, June
2018, Vol. 27, 173-183.

The criteria used to classify an individual with an Auditory Processing Disorder (APD) has long been studied. Many authors have discussed different criteria weighing their advantages and disadvantages. The aim of this study was on providing a cut-off criterion to successfully classify children with APD.

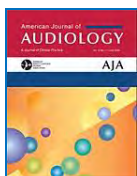
The authors begin by discussing about how the prevalence of APD changes with location. They argue that this change could be due to different techniques utilized to diagnose the disorder. Different professional Associations like ASHA, AAA and BSA use different criteria backed by evidence relevant to their locations and previous studies. One example of a study in 2012 by Dillon, Cameron, Glyde, Wilson and Tomlin examined three different methods of diagnosing APD along with possible disadvantages of using that specific method. The first one involved using a strict pass-fail criterion. They argued that this may not be reliable because it needed a very poor performance for the child to fail the test. The second method suggested the necessity that the child fail in more than one test to be diagnosed with APD. This would mean that test battery should contain many tests, which requires more time and fatigue to the child. The last method suggested was to diagnose a child with APD only if he/she failed the same test twice. However, this would require additional time. Thus, the authors concluded that although there are many tests studying different criterion to diagnose APD, there is no unanimity across them.

This study used a standard group comparison design where data from a standard group consisting of 280 typically developing children aged 6-10 (findings adopted from a previous study by Yathiraj and Vanaja, 2015) were compared to another group of 100 children "at risk" (using the Screening Checklist for Auditory Processing) of developing APD. Four tests (Speech in Noise Test in Indian English, Dichotic Consonant-Vowel, Duration Pattern Test and Rapid Auditory Memory and Sequencing Test in Indian English) were administered on each of the children of the "at risk" group and compared to the already existing findings from the typically developed group. These tests are based on processes such as auditory closure, auditory integration, temporal patterning and higher order cognitive abilities associated with auditory processing, that have been found to be affected in children with APD. To factor in age variability, further classification into groups (Ages 6-7, 7-8, 8-9, 9-10 and 10-11) were done to compare results between the standard group and "at risk" group of children.

Results indicated that when a stricter criterion (-1SD below the mean of each test) was used to analyze if a child "at risk" failed, greater number of children (92%) were identified correctly than if a less strict criterion (-2 SD below the mean for each test) was used. They also concluded that 3 out of 4 tests, namely SPIN-IE, DCV and RAMST-IE could be used to identify APD in 6-year old children, which could facilitate early identification and rehabilitation.

In conclusion, using a strict criterion in the test battery could help identify children with APD using these 4 tests for children 7 years or older, if more than one test was failed. A less strict criterion can be adopted for children who have failed only one test out of four. This could provide direction for management of the disorder as they provide areas of deficits that will most likely need to be targeted during rehabilitation.

Readability of Patient-Reported Outcome Measures in Adult Audiologic Rehabilitation.



Alana Douglas and Rebecca Kelly-Campbell.

American Journal of Audiology, June 2018, Vol. 27, 208-218.

This study examined the grade of readability of published patient reported outcome measures (PROMs) used in adult audiologic rehabilitation. Readability levels recommended for health information by health literacy experts were used to compare the readability of results. The authors suggest that readability formulas used in this research do not provide an infallible estimate of readability.

INTRODUCTION

Audiologists have always quantified the benefits of audiologic rehabilitation via objective measures. Among these are speech perception testing, aided loudness judgments and real ear insertion gain. Though essential in the validation process, they still do not provide a holistic evaluation of rehabilitation efforts aligned with Patient Centred Care/Family Centred Care principles. Direct estimates of perceived activity limitations and participation restrictions are only obtainable with patient reported outcome measures (PROMs).

With growing importance given to Patient Centred Care /Family Centred Care, it is appropriate that clinicians include PROMs into their daily health care practice.

PROMs can be very useful in audiology as they enable the assessment of self-perceived limitations and participations restrictions in everyday life listening situations. These tools are inexpensive, convenient, and are in agreement within the founding principles of PCC/FCC.

PROMs are by definition questionnaires that are both standardised and validated, completed by patients (or family members) to measure their own perceptions regarding their functional status and wellbeing. They facilitate shared decision making, monitor treatment efficacy, engage patients, and may simplify potential treatment options for patients, significant others, and for clinicians.

Attempting to quantify in a systematic and accurate manner the client's opinions regarding rehabilitation requires the use of self-report measures such as PROMs. They provide a meaningful estimation of real world benefit as compared with traditional laboratory-based evaluations. In order to be useful as a clinical/ research tool PROMs must be readable. Readability can be influenced variables such as layout, sentence length, typography, legibility, jargon, polysyllabic words, personal factors (such as comprehension or motivation) and the use of illustrations. If the reading level of a document is superior to that which the intended audience are capable of comprehending, there is a founded risk of not only failing to understand the material but also of not completing the questionnaire. If the aim is allowing patients to make active contributions and helping in informed decisions relating to the delivery of their care services, they must be able to fully comprehend the written materials provided.

The level of readability of a text is measurable in different ways including the use of readability formulas. Objective readability programs have become mainstream and are available in many software packages such as Microsoft word. Numerous readability formulas are available, and this can represent a challenge for researchers to decide which is the most appropriate to use. The readability of audiologic PROMs has received a

considerable amount of attention in recent years. When reading levels of a patient reported outcome questionnaire are difficult, patients are at risk of rejecting the tool or not providing adequate information leading to incongruent responses with their real health status. The risk of this is that treatment, planning and outcomes suggested by practitioners based upon the responses obtained from these questionnaires may very well be unsuitable. By jeopardizing a client's ability to read, comprehend, and appropriately answer questionnaires due to the high level of health literacy required to read such a text, active participation, and patient narrative promoted by PCC/ FCC models cannot be achieved. As such, the readability of audiologic PROMs remains an area of utmost importance.

METHODOLOGY

For the assessment of the published patient reported outcomes measures, a literature research was performed and the inclusion criteria used for the analysis was that the literature be in English language; the tool be an adult audiologic self-assessment questionnaire; be published in a peer reviewed journal, and be published in research after the year 2012. On the other hand, the exclusion criterion were the following: be one of the four published patient reported outcomes measures used in the Kelly-Campbell et al study (2012); contain primarily open ended items, and; be solely aimed at children.

From literature, ten published patient reported outcome measures were identified.

As no specific standards for choosing readability formulas exist the readability criterion used for this study were identified based upon the following aspects: the suitability for use with questionnaire data; the comparability to existing literature, and; their ability to report readability in RGL. The Flesch Kincaid formula is most applicable for use with manuals and forms. The assumption being that of 75% comprehension and uses the total number of words, sentences, and syllables present within the text to drive reading grade level (RGL).

The source documents for analysis were then imported into a Microsoft Word document. The word documents were then used with the windows-based Readability Studio.

RESULTS

Of the entire published patient reported outcomes measures only two contained instructions of at least a hundred words. Using the readability formulas, the median RGL for the communication Profile for the Hearing-Impaired instructions was 12.0 and the median for the Speech, Spatial, and Qualities of Hearing Scale instructions was 8.8.

As the GHABP published outcome reported measures contained less than a hundred words it was removed from the analysis.

All the PROMs taken into account in this study exceeded the recommended RGL in the items section. Four PROMs contained a sufficient word count in the response scale to perform the readability analysis. Finally, each entire PROM was analysed for readability and not one met the recommended RGL when using the median of the four readability formulas.

DISCUSSION

The variability in reading grade levels (RGL) means that formulas used do not provide an infallible evaluation of readability and this is partially because they take into consideration simple quantitative features of text, such as word count, number of syllables, monosyllabic words, and hard words, and fail to incorporate the effects of multiple factors upon a particular texts readability. Readability formulas also fail to provide any indication of the appropriateness of a text's content with regard to a particular audience. A possible issue in

readability formulas is that many require a minimum of 100 words to obtain an accurate analysis and this implies that shorter texts are not be taken into consideration.

Nonetheless, the results of this research are in agreement with previous literature. The general finding is that the RGL of the PROMs exceeded the recommended sixth RGL. It is important that developers of PROMs use appropriate formulas to assess the readability of their tools as poor readability may possibly have adverse effects on the validity of the empirical data collected using the PROM. This is all the more stringent when regarding patient – family centred care values are to be adhered.

A very interesting study on patient reported outcome measures, and their readability, used in Patient Centred Care. According to the authors, Patient Centred Care reported outcome measures receives inadequate attention in audiology compared to other health care professions. This is surprising when considering the World Health Organisation definition of health literacy as “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use information in ways which promote and maintain good health” hence the importance that patient reported outcome measures are readable. It also important that researchers provide Patient Reported Outcome Measure instructions within the index of the publication as a deterrent to third parties from creating their own set of respondent instructions which risk being unaligned with the readability recommendations of health literacy experts.