AMPLIFON CENTRE FOR RESEARCH AND STUDIES

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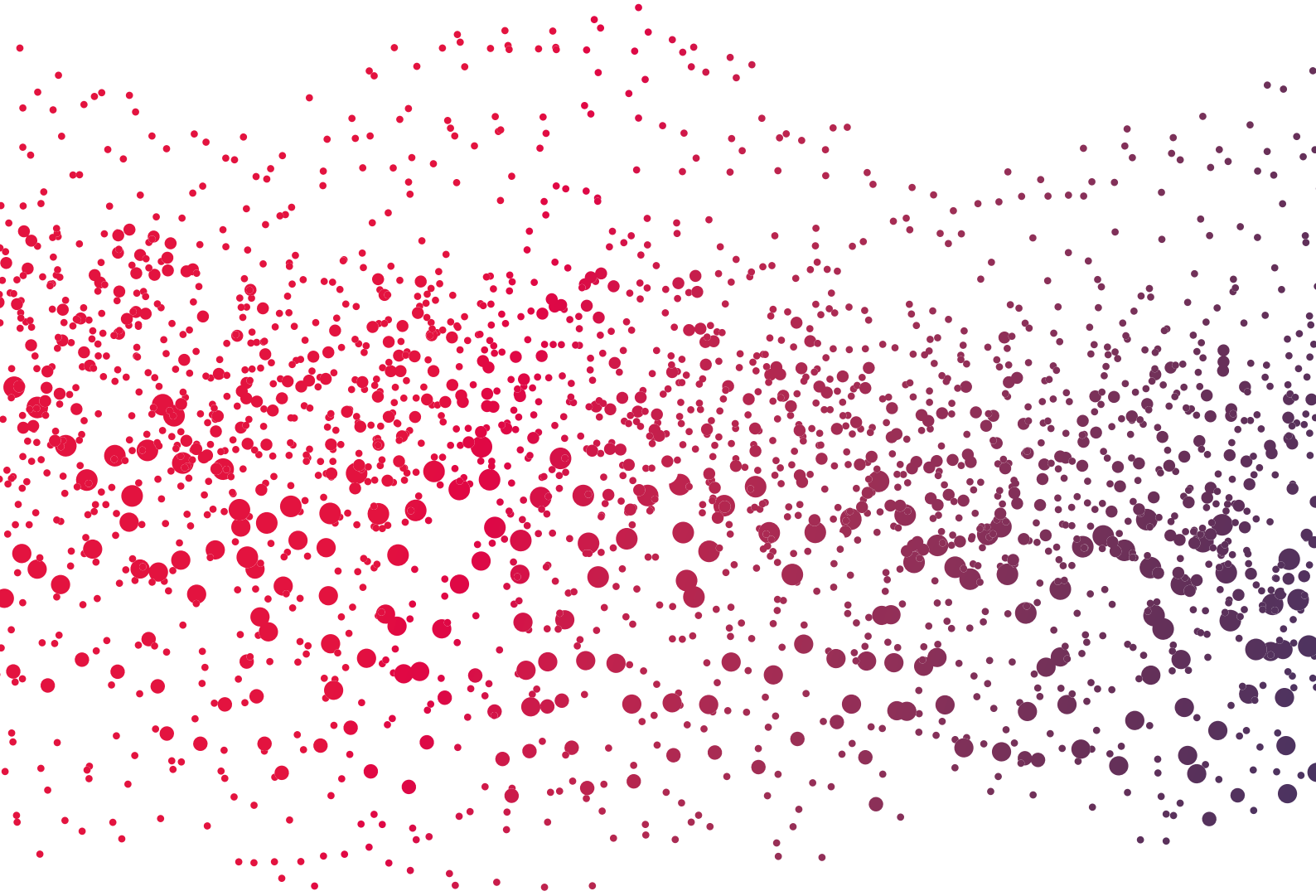
Otology & Audiology Article Review



APRIL 2018

April 2018

- Page 14: Melissa Babbage – New Zealand:
  - The psychological and social consequences of single-sided deafness if adulthood.
    - *Laura Lucas, Roulla Katiri & Pádraig Thomas Kitterick.*
    - *International Journal of Audiology 2018; 57: 32-30*
    - *This qualitative analysis presented in this paper provides detailed information on the significant functional, social, and psychological consequences of SSD from the perspective of patients. The impact of this pattern of hearing loss on patient well-being is significant and therefore important for audiologists to understand and acknowledge when interacting with these patients.*
- Page 16: Katrien Hoornaert – Belgium:
  - Older adults' experiences and issues with hearing aids in the first six months after hearing aid fitting.
    - *Jorunn Solheim, Caryl Gay and Louise Hickson.*
    - *International Journal of Audiology, 2017; 57: 31-39*
    - *The findings show that follow-up support is needed to improve user experience among HA recipients. The rehabilitation process should not be considered complete once the HA is fitted, but rather that the fitting is simply the beginning of an ongoing rehabilitation process.*
- Page 18: Tine De Boodt – Belgium:
  - Patients' and Clinicans' views of the Psychological components of tinnitus treatment that could inform audiologists' usual care: A Delphi survey.
    - *Thompson D et al.*
    - *Ear & Hearing, VoL. 39, N°. 2 (Feb 2018), 367–377.*
    - *During this Delphi survey, the panel agreed that an audiologist can use the following more common psychological skills during tinnitus therapy: Socrative questioning and active listening.*
- Page 20: Reddy Sivaprasad – India:
  - Effect of sound generator on tinnitus and hyperacusis.
    - *Park JM et al.*
    - *Acta Oto-Laryngologica, 2018; VOL. 138(2), 135–139.*
    - *This study examines the effectiveness of a sound generator on normal hearing subjects with tinnitus and hyperacusis. Three important outcomes measures were used. Sound generators are effective in the treatment of Jastreboff's categories 1 and 3.*
- Page 22: Reddy Sivaprasad – India:
  - Patterns of Extended High-frequency Hearing Loss Following Stapes Surgery.
    - *Babbage MJ et al.*
    - *Otology & Neurotology, Vol.38, 1405–1410.*
    - *This study clearly measured long-term changes in HTLs at conventional and EH frequencies post-stapedectomy. While there were improvements in hearing in conventional frequency range, losses continued after a temporary recovery at EHFs.*
- Page 24: Reddy Sivaprasad – India:
  - The Etiological Relationship Between Migraine and Sudden Hearing Loss.
    - *Arslan Y et al.*
    - *Otology & Neurotology, Vol.38, 1411–1414.*
    - *The study found increased prevalence of migraine among those with sudden SNHL. However, there was no difference in several haematological and migraine parameters between those with and without migraine.*
- Page 26: Reddy Sivaprasad – India:
  - Long-term Complications and Surgical Failures After Ossiculoplasty.
    - *Cox MD et al.*
    - *Otology & Neurotology, Vol.38, 1450–1455.*
    - *Outcomes of an Ossiculoplasty surgery are examined with reference to sustaining success.Tobacco smoking, Eustachian tube dysfunction, and an unexpectedly poor hearing result on the first postop are found to be important*

risk factors. Successful hearing results have been defined in terms of ABG for different surgical observations.

- Page 28: Reddy Sivaprasad – India:
  - Resveratrol Promotes Recovery of Hearing following Intense Noise Exposure by Enhancing Cochlear SIRT1 Activity.
    - *Hiong H et al.*
    - *Audiology & Neurotology, 2017, Vol.22,303–310.*
    - *This study examines the effects of high doses of resveratrol on NIHL in mouse models. Study clearly showed the effects on OHC strengthening and recovery even after intense noise exposures.*
- Page 30: Reddy Sivaprasad – India:
  - Acoustic reflexes are common but not pervasive: evidence using a diagnostic middle ear analyser.
    - *McGregor KD et al.*
    - *International Journal of Audiology, 2018; Vol. 57, S42-S50.*
    - *In this normative research study, authors used a refined and better equipment to study the prevalence of ARs in normal hearing population across age groups and genders. This study shows as explained in the tile that ARs are very common but not pervasive.*
- Page 32: Leanne Ma – New Zealand:
  - Cross-cultural adaptation and psychometric properties of the Chinese tinnitus functional index.
    - *Anna Chi Shan Kam et al.*
    - *International Journal of Audiology 2018; 57: 91-97*
    - *The development of the TFI-CH as an outcome of this study, and the validation of this, provides a tool to be used in the assessment of tinnitus in Chinese tinnitus patients.*
- Page 34: Leanne Ma – New Zealand:
  - Tone production and perception and intelligibility of produced speech in Mandarin-speaking cochlear implanted children.
    - *Yi-Lu Li et al.*
    - *International Journal of Audiology 2018; 57:2; 135-142*
    - *This study indicates the need for further development in cochlear implant technology and rehabilitation programmes that can minimise the current perceptual limitations in lexical tone languages as tone perception is positively correlated with tone production which in turn can influence the ability of Mandarin-speaking implanted children to produce intelligible speech.*
- Page 36: Leanne Ma – New Zealand:
  - Perception of Cantonese Lexical Tones by Pediatric Cochlear Implant Users.
    - *Colleen M. Holt et al.*
    - *Journal of Speech, Language, and Hearing Research; Vol 61; 174-185. January 2018*
    - *This study highlights the difference in language acquisition for paediatric cochlear implant users in non-tonal and tonal languages and indicates that the outcomes of studies conducted with CI users of nontonal languages may not be applicable to speakers of tonal languages.*

Persistent Hair Cell Malfunction Contributes to Hidden Hearing Loss.

Mulders Wilhelmina, Chin IL, & Robertson D.

Hearing Research, 361(2018), 45-51.

This original research article on an acoustic trauma animal model suggests that "hidden hearing loss", which has commonly been attributed to dysfunction of the primary afferent auditory nerves only, may also involve damage to the hair cell transduction mechanisms.

Introduction

Noise induced hearing loss (NIHL) is the permanent damage to the auditory pathway as a result of acoustic trauma. Most often, it is noise of a greater volume and longer duration that could cause this kind of permanent damage in the clinical population today.

Traditionally, it was understood that a milder acoustic trauma could induce temporary changes to the auditory system. Noise would damage the outer hair cells (OHC) of the cochlea, causing a temporary threshold shift (TTS). This threshold shift would eventually restore itself, and based on this assumption one would presume that the overall cochlear function was fully restored as well. However more recent studies have shown that in these cases, despite restoration of threshold levels, responses to supra-threshold stimuli were depressed. This phenomenon may explain why patients with normal audiometric thresholds may still report difficulties hearing, especially in background noise.

This so-called "hidden hearing loss" has been commonly associated with damage to the synapse of the inner hair cell (IHC) and the primary afferent neurons. However, most studies of this phenomenon have been based on auditory brainstem responses (ABR), which assesses the overall cochlear neural output, rather than measuring independent hair cell function.

Alternative methods to isolate and measure independent hair cell function would be to measure their electrophysiological properties. The summating potential (SP) is thought to be dominated by the receptor current generated by the IHC. This, in combination of neural threshold measures via the compound action potential (CAP), will give an indication of the deficiencies in both the IHC as well as the overall neural pathway. Thus the purpose of this study was to make electrophysiological measurements of both OHC and IHC function, and to investigate their contributions (if any) to this "hidden hearing loss".

Methods

Eighteen pigmented guinea pigs of either sex were anaesthetized and trauma exposed to their left ear using a closed sound delivery system. The right ear was covered with plasticine. The guinea pigs were randomly allocated to one of three groups:

- 0.5hr exposure of a pure-tone acoustic trauma (10kHz, 124dB SPL)
- 1.0hr exposure of a pure-tone acoustic trauma (10kHz, 124dB SPL)
- Control who received identical treatment minus the acoustic trauma

A silver wire electrode was placed in the round window of the cochlear to measure CAP and SP for tone bursts ranging from 4 to 24kHz before and after the acoustic trauma. This was then repeated at 2 weeks post-trauma.

Results

CAP thresholds

Both acoustic trauma groups showed an immediate CAP threshold loss from 8-20kHz, with the 0.5hr group showing less threshold loss than the 1.0hr group. After the 2 week recovery period, the 0.5hr

groups showed full recovery of thresholds, while the 1.0hr group showed only a partial recovery of thresholds.

CAP & SP input/output functions

Compared to the control group, there was a significant reduction in CAP amplitudes at high-frequency supra-threshold stimuli intensities for both acoustic trauma groups.

The restoration of high-frequency CAP thresholds but reduced high-frequency supra-threshold CAP amplitudes in the 0.5hr group provides evidence of "hidden hearing loss" in this cohort. Furthermore, the restoration of CAP thresholds but reduced supra-threshold SP amplitudes in the 0.5hr group suggests evidence of IHC damage present in this cohort. However the results of the reduced SP amplitudes alone cannot explain the reduced CAP output, and therefore it is likely that there is a synaptic neuropathy contributing to this deficit as well.

The results for the 1.0hr group are more difficult to interpret as there was a permanent threshold shift, which could have affected the supra-threshold CAP/SP amplitudes.

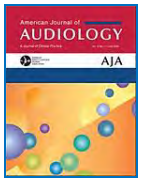
The authors speculate that the mechanism of IHC damage causing the results shown in this study is that there is a reduced supra-threshold output of individual IHCs even when their transmitter release at threshold sound levels is normal. This could arise from a proportional loss of transduction channels or associated structures such as stereocilia tip links. However this will need further investigation.

Conclusively the results of this study suggest that hidden hearing loss may involve defects in the supra-threshold behaviour of IHCs, and not just the primary afferent nerve as previously thought.

As this is the only animal model that has shown potential IHC damage in "hidden hearing loss", more studies in a variety of acoustic trauma animal models will have to be conducted in order to determine whether these findings are exclusive to this animal model only.

Should the findings be consistent in a variety of animal models, further experimentation should be conducted in order to determine the relative contributions of IHC damage and neural synaptopathy to the "hidden hearing loss", as well as determining the exact mechanisms of the IHC malfunction.

Relation Between Listening Effort and Speech Intelligibility in Noise.



Melanie Krueger et al.

American Journal of Audiology, Vol. 26 (October 2017), 378–392.

Purpose:
Previous research showed that including subjective ratings of listening effort might be able to estimate hearing difficulties and benefit of hearing aids even at signal-to-noise ratios (SNRs) at which speech intelligibility scores are near 100% (near or at ceiling).

Hence, ratings of listening effort were compared with speech intelligibility scores at different SNRs, and the benefit of hearing aids was evaluated.

Methodology:
Speech materials

- Listening effort was assessed using an adaptive version of the ACALES. The ACALES quantifies subjective listening effort for sentences in a background masker with different SNRs on a 14-point categorical scale.
- For the speech intelligibility measurements, an adaptive speech-in-noise test was used with the OLSA sentences and a constant masker of 65 dBSPL.

Masker materials:
The listening effort ratings as well as the speech intelligibility tests were performed in four different maskers:

- the fluctuating maskers were the International Female Fluctuating Masker and the Icra5-250
- the stationary maskers were the 'Olnoise' and the 'Cafeteria' noise.

Test subjects

- The first group: 15 listeners with normal hearing (mean age = 25)
- The second group, 15 listeners with hearing impairment (mean age = 68), with mean PTA4 of 42 dB HL.

These subjects were experienced HA users and wore their own HAs (receiver-in-the-canal HAs) with their customary settings. All HAs had an automatic program, which was used in this study. No special speech-in-noise program was used.

Results:
Listening Effort for Listeners With NH and HI:

- Listeners with hearing impairment showed higher rated listening effort compared with listeners with normal hearing.

Differences due to Masker in Speech Intelligibility and Listening Effort:

- The discrimination functions of the fluctuating and stationary maskers differed by approximately 11 dB SNR at SRT for listeners with Normal hearing.
- This distance was nearly four times smaller for unaided listeners with HI (approximately 3 dB SNR).
- Similar results were found for listening effort ratings. At lower SNR values, the listening effort was rated less effortful in a fluctuating masker in comparison with a stationary masker.
- This difference vanished with increasing SNR and was absent for the rating category no effort.
- In the fluctuating maskers, the benefit of the gaps might have been transformed into a disadvantage of the masker's peaks.

- At –0.6 dB SNR, speech intelligibility scores reached 95% for listeners with NH and became saturated for further increasing SNR. The SNR required for speech intelligibility scores of 95% shifted to positive SNR values (3 dB SNR) for unaided listeners with HI.
- A similar pattern was seen for the listening effort results: It was noticeable that, at a speech intelligibility of 95%, perception of listening effort differed between maskers.
- The SNR values at which a speech intelligibility score of 95% was reached differed between listeners with NH and unaided listeners with HI. Nevertheless, despite the high speech intelligibility scores, the listeners experienced great listening effort. With increasing SNR, listening effort ratings decreased, whereas speech recognition remained at 100%.
- For listeners with NH, the rating category no effort was used at an SNR value between 4 dB SNR and 7 dB SNR and for unaided listeners with HI between 8 dB SNR and 10 dB SNR, depending on the masker. This SNR range could be used to evaluate the perception of speech in ecologically valid situations similar to typical daily life (Smeds et al., 2015).

Relationship Between Speech Intelligibility and Listening Effort

- At lower SNRs, subjective listening effort ratings depended more on objectively measured intelligibility than at higher SNRs.
- At higher SNRs, listening effort might be related to other, yet unknown, factors.

Relation to Hearing Loss:

- Higher hearing loss was related to higher SRT values. Higher PTA4 led to more effort. This effect was stronger in speech related maskers.
- In general, the correlation between the PTA4 and the SRT was higher than the correlation between the PTA4 and the listening effort categories no effort and extreme effort. This supports the assumption that other mental functions might have an impact on the perception of listening effort. It is noteworthy that the subjects with NH were younger than the subjects with HI. Thus, possible cognitive decline might have influenced the results.

Benefit of HAs Assessed by ACALES

In the averaged results, the benefit of HAs on listening effort was not significant for the stationary and fluctuating maskers.

- To some extent, the benefit was even negative at positive SNR values, especially when speech was used as a masker (IFFM).
- For low SNRs, where intelligibility is clearly below 100%, an average benefit is evident for all maskers.

Conclusion:

The adaptive procedure for rating subjective listening effort yields information beyond using speech intelligibility to estimate hearing difficulties and to evaluate hearing aids.

Critical note from the authors:

As the cognitive status of the subjects was not addressed in this design in future research, individual factors, such as cognition, should be addressed to minimize possible confounding factors.

Personal note

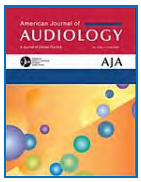
Interesting study with important potential applications in daily hearing fitting practice. Given that adding subjective ratings of listening effort can help us to gain more insight into how people actually function with their hearing aids (especially in communication situations close to everyday life). The study would probably have been even more interesting, if a normal hearing test population was used with a mean age closer to that of the hearing impaired group.

As this is the only animal model that has shown potential IHC damage in “hidden hearing loss”, more studies in a variety of acoustic trauma animal models will have to be conducted in order to determine whether these findings are exclusive to this animal model only.

Should the findings be consistent in a variety of animal models, further experimentation should be conducted in order to determine the relative contributions of IHC damage and neural

synaptopathy to the “hidden hearing loss”, as well as determining the exact mechanisms of the IHC malfunction.

Subjective Fatigue in Children with Hearing Loss Assessed Using Self- and Parent-Proxy Report.



Benjamin Hornsby, Samantha Gustafson, Hope Lancaster, Sun-Joo Cho, Stephen Camarata and Fred Bess.

American Journal of Audiology, October 2017, Vol. 26:393-407.

Mild, transient fatigue is often experienced in everyday life and this type of fatigue generally resolves with rest. For some individuals, especially those with disabilities and chronic health conditions, fatigue can be more frequent and severe. Despite the adverse consequences of fatigue in persons with chronic conditions, empirical research examining hearing loss and fatigue is still sparse. To date, most research examining hearing loss and fatigue has focused mostly on the adult population, and results suggest that adults with hearing loss may be at increased risk for fatigue-related issues (Alhanbali, Dawes, Lloyd, & Munro, 2017; Hornsby & Kipp, 2016; Kramer et al., 2006). Investigations on fatigue in children with hearing loss are even more limited; there is however growing empirical evidence suggesting that children with hearing loss may also be at higher risk for experiencing fatigue. Parents and teachers of these children, audiologists, and speech-language pathologists have long speculated that the additional attention and concentration needed for listening and processing speech could result in increased effort, stress, resulting in fatigue. Such an outcome might compromise their ability to learn in a noisy classroom environment, potentially increasing the risk of experiencing learning problems in school and this undoubtedly highlights the potential importance of this present research.

Participants included 60 children with hearing loss, 43 normal hearing children, and one parent or guardian of each child. All child participants were between 6.0 and 12.9 years of age and had no diagnosis of learning disability or cognitive impairment as reported by the parent or guardian. Cognitive ability was also assessed in all children using the Test of Nonverbal Intelligence– Fourth Edition (TONI-4; Brown, Sherbenou, & Johnson, 2010). Participants were recruited by using various methods. Normal hearing children were mostly recruited through an advertisement in a local parenting magazine, through word of mouth, and through the Vanderbilt Kennedy Center's Study Finder website. Children with hearing loss were recruited from the Vanderbilt Audiology Clinics and from school districts throughout Middle Tennessee. Children were excluded from this study on the basis of factors known to affect fatigue. This criterion resulted in the exclusion of (a) children who were bilingual or whose primary language in the home was not listening and spoken language, (b) children with autism spectrum disorder, (c) children with a linear metabolic or endocrine disorder (e.g., diabetes or hypothyroidism), (d) children with a chronic medical condition, and (e) children who utilized stimulant medications. Ten CNH and five CHL who participated in our preliminary study (Hornsby et al., 2014) met the inclusion criteria for the current study, and their data were included in the current study. Of the 60 children with hearing loss that participated, all but one was fitted with hearing aids. Upon entry into the study, all children received an audiological assessment. Children with normal hearing received a standard hearing screening at 15 dB HL for octave frequencies ranging from 0.25 to 8.0 kHz, bilaterally.

The PedsQL-MFS questionnaire was completed by children and their parent/guardian to assess self-reported perceptions of fatigue for both children with hearing loss and those with normal hearing. The PedsQL-MFS is a comprehensive fatigue scale that has been validated for use with children from 5 to 18 years of age (Varni et al., 2002, 2004; Varni & Limbers, 2008). The 18-item PedsQL-MFS is a standardized fatigue measure comprised of three subscales, each containing six items: (1) general fatigue—items in this subscale ask about general feelings of tiredness or weakness, regardless of the cause; (2) sleep/rest fatigue— items in this subscale ask specifically about sleep/rest-related tiredness; and (3) cognitive fatigue—items in this subscale ask specifically about fatigue-related

cognitive difficulties. An overall (composite) fatigue score is also calculated by combining scores from the subscales.

Participants completed audiologic and language testing during the initial study visit. During this visit, children with hearing loss and those with normal hearing, and their parent/guardian also completed subjective ratings of fatigue using the PedsQL-MFS. At the start of the visit, a trained research assistant administered the age appropriate PedsQL-MFS: Young Child (ages 6–7) or Child (ages 8–12). For the Young Child form, the research assistant read each item aloud and asked the child to point to the corresponding happy, neutral, or sad face for their response. For the Child form, the research assistant read each item aloud and asked the child to circle their response. The PedsQL-MFS was self-administered for the parent/ guardian.

Pediatric Quality of Life Inventory Multidimensional Fatigue Scale (PedsQL-MFS) subscale and overall scores for
children with hearing loss (CHL) and children with normal hearing (CNH) from the current study (means for both groups are based on child data only) and a preliminary study (Hornsby et al., 2014). Data from the current study are shown by the white (CHL) and gray (CNH) unfilled vertical bars. Data from the preliminary study are shown by the white (CHL) and gray (CNH) striped bars. Error bars = 1 SE.

The School-age children with hearing loss experience more subjective fatigue than peers without hearing loss. Furthermore the risk for fatigue appears to be increased for children with poor language abilities. While parent-proxy reports can be useful, given the discrepancy with child reports of fatigue, the results in this paper suggest that the parent-proxy version of the PedsQL-MFS should not be used exclusively when assessing fatigue in schoolage children with hearing loss. The poor association between parent proxy and child reports suggests that the parent-proxy version of the PedsQL-MFS should not be used in isolation when assessing fatigue in school-age children. Future research should examine how language abilities may modulate fatigue and its potential academic consequences in children with hearing loss. Future studies are needed to explore the impact of fatigue on academic performance and to examine in more detail the relationship between specific language abilities and fatigue.

A very interesting paper, with multidisciplinary implications to be explored and that clearly calls for future research studies including the development of a hearing-related and age-specific fatigue instrument, the use of longitudinal designs to explore self-report fatigue in large diverse samples of children with hearing loss, and further exploration of parent–child differences including factors that influence agreement (i.e., impact of proxy gender in relation to child gender).

The Non-specific Effect of Endolymphatic Sac Surgery in Treatment of Meniere's disease: A prospective, randomized controlled study comparing "classic" endolymphatic sac surgery with the insertion of a ventilating tube in tympanic membrane.

Sten Hellström Thomsen J et al..

Acta Oto-Laryngol 1998: 118: 769–773,
Acta Oto-Laryngologica, 138:3, 304-309.

The Non-specific Effect of Endolymphatic Sac Surgery in Treatment of Meniere's Disease.
This article, is from a special Issue of Acta Oto-laryngologica celebrating 100 years of publications of the journal. Therefore, this article is from 1998 and it could be argued that since then more recent research with more validity has been undertaken. However, as a tribute to the 100 years, a summary of its findings will be presented.

Introduction
Meniere's patients are a group of subjects suffering from varying degrees of symptoms associated with the disease. In patients who have been affected severely by the disease surgery is suggested to provide good outcomes, whereas others have claimed that a less invasive treatment should be used. This article compares the outcomes comparing two different treatment options; shunt insertion into the endolymphatic sac and T-tube insertion in the tympanic membrane (TM).
At the time, there were 3 main types of surgical procedures on the endolymphatic sac: decompression, drainage and ablation. Clear demonstration that any surgical procedure alleviated vertigo, tinnitus and pressure whilst improving hearing is hampered by the erratic course of the disease. The researchers cite from previous research, that an improvement in hearing is the direct result of survival intervention and not merely the result of the natural course of the disease over time.

Methodology
29 patients were included. 15 of the clients had a shunt inserted into the endolymphatic sac and 14 had a T-tube inserted into the TM. All patients presented with Meniere's symptoms: vertigo, hearing loss and tinnitus. Prior to any treatment, a functional level scale was applied to all patients, the majority were at level 4 or 5 (major adjustments needed and limited essential activities).

Treatment
The aim of the study was to investigate whether one of the treatment options is more effective than the other.

Results
The participants collected daily feedback on how they felt 6 months before and 12 months after intervention with monthly audiogram results monitored. There was no difference reported between the two treatment groups before or postoperatively. Tinnitus was unaffected ($P > 0.05$) although some non-significant improvement in the ventilation group. The patients were asked about their subjective impression of the treatment, the ventilation group is more favourable (86%) compared with saccus group (60%), but again the difference is not significant. Post-surgery functional level had moved to level 5/6.

This research only sampled a small number of subjects (29) and with a relatively short follow up time of one year, yet the findings show that due to the non-statistical difference between the two procedures that the T-tube option should be the first choice of treatment. The actual pathophysiological explanation for the effect of T-tubes in the TM is unclear, and the effect on Meniere's patients is described as non-specific as the effect may originate from different underlying mechanisms.

Listening Effort: How the Cognitive Consequences of Acoustic Challenge Are Reflected in Brain and Behavior.

Jonathan E. Peelle.

Ear & Hearing, Vol. 39, N°. 2, 204–214.

The author provides a very interesting overview of the state of art of the research, done, to investigate the processing accomplished by the brain to cope with the degraded signal received due to cochlear damage. Manufactures focus now more and more on alleviating the listening effort a hearing-impaired person needs to understand in complex situations. The idea behind this is, if we clean the signal as much as possible from non-wanted noise, he the subject will experience less effort to separate the desired from the undesired signal which results in an increased capacity to memorize the message. The outcome being better comprehension of speech.

J. Peelle describes the cognitive processing and how it is possible to measure.
He introduces a new approach where apart from the Verbal Working Memory the attention based performance should be monitored. Not only listening effort but listening demand (he prefers more cognitive demand), will play a role. He emphasizes the importance of knowing these processes to decide if and which additional rehabilitation program or training is appropriate. Other factors that influence comprehension are motivation, fatigue and psychosocial considerations.
The author discusses 3 types of evidence for the cognitive challenge during listening: behavioural, Psychosocial and neuroimagining.

A very interesting publication, that is surely worth the complete reading!.

Speech Perception in Noise and Listening Effort of Older Adults With Nonlinear Frequency Compression Hearing Aids.

James Shehorn, Nicole Marrone and Thomas Muller.

Ear & Hearing, Vol. 39, N°. 2, 215–225.

Nonlinear frequency compression is a feature that is frequently available in most premium hearing instruments. The benefits are often discussed. Some studies find improvement in speech recognition, while others could not make that assumption. The authors of this study used a dual task to verify possible advantages in noise. They combined a speech-in-noise test with a memory task. Sets of 6 sentences (half of them with high predictable last words, half with low predictable last words). 17 adults (57 – 85y) with a sloping hearing loss where included and the where wearing a Phonak Naida IX UP of the Spice generation, fitted to their loss with the NAL NL2 rule. NFC was activated in a second program and all the other features where switched off.

The aim was to see if a good working memory positively influences on the score, in the assumption that this would enable these patients to use the working memory to quickly solve mismatches in phonemes due to the frequency lowering. They did not find a correlation.
On the other hand, they discovered a significant correlation with the slope of the hearing loss (the steeper the better the performance with NFC) and age, where older patients performed less well than the younger ones.

The authors concluded that the use of Nonlinear Frequency Compression should depend on individual needs of the patient rather than using it by default.

Remarks: In the meanwhile, manufactures have developed further updates for this algorithm and is no longer used as a standard "on" feature. The possible benefits should be further investigated.

The psychological and social consequences of single-sided deafness if adulthood.

Laura Lucas, Roulla Katiri & Pádraig Thomas Kitterick.

International Journal of Audiology 2018; 57: 32-30.

Single-sided deafness (SSD), defined as a severe-to-profound' hearing loss in one ear and normal or near-normal hearing in the other ear, can lead to significant audiological disability. Previous studies have primarily used self-report questionnaires with closed set questions to characterise the impact of SSD on the individuals, which may have limited the depth and breadth of information gathered. The purpose of this study was to apply qualitative methods to collect more in-depth information regarding the psychological and social consequences of SSD on everyday life. A critical incident technique (CIT) was employed to generate discussions around the situations that participants saw as problematic as a result of their hearing loss.

The study included eight adults with a diagnosis of SSD of any aetiology for a period of at least 12 months. SSD was defined as a pure-tone average of 60 dB HL in one ear and an average threshold of 30 dB HL in their other ear. Three group interviews were conducted using the CIT technique to create a semi-structured discussion whereby participants themselves generated all topics for discussion. Audio recordings were analysed by the researchers using a thematic analysis.

Functional consequences of SSD: Analysis of the interview transcripts showed that all participants reported difficulties with recognising and understanding speech, particularly in noisy situations. In both quiet and noisy situations, participants noted that it was important for the sound of interest to be on the side of their better ear to maximise understanding. Participants also reported significant difficulty with sound localisation and reduced ability to selectively attend to one sound.

Psychological consequences: Participants who had experienced a sudden loss reported feelings of shock and fear, and some participants linked it to depression and anxiety. All participants were concerned about age-related hearing loss in their good ear. Participants felt that there was a social stigma about their hearing loss from others and they reported often feeling frustrated and embarrassed due to their communication difficulties.

Social consequences: Problems with social interactions, particularly with unfamiliar people, were reported consistently. Participants reported feeling marginalised at social events and recognised that their hearing loss often led them to withdraw from situations or withdraw within situations.

Coping strategies: Discussion also addressed coping strategies used by participants to manage difficulties associated with SSD. Positioning in a social setting was regarded as very important for participants to maximise the signal-to-noise ratio at their better ear and to access visual cues. Participants also highlighted the importance of support from family and friends in communicating in challenging listening situations and to help in potentially dangerous situations.

Based on the qualitative analysis, the authors conclude that SSD imposes a substantial degree of burden and can lead to negative effects on psychological well-being and restrictions on social participation. A hearing loss in to one ear only cannot therefore be assumed to have only minimal effects on well-being.

The study also found that participants felt that there was a lack of support and information provided by clinicians. The participants suggested that they would have benefitted from receiving information about the long-term implications of their condition, the potential benefits and limitations of available interventions (e.g. CROS), and advice on techniques and strategies for self-management. The authors

propose that the provision of such information could provide an opportunity to reduce any negative emotions and coping strategies associated with in social interactions, assist with the adoption of effective coping strategies, and develop motivation towards adopting hearing devices.

This qualitative analysis presented in this paper provides detailed information on the significant functional, social, and psychological consequences of SSD from the perspective of patients. The impact of this pattern of hearing loss on patient well-being is significant and therefore important for audiologists to understand and acknowledge when interacting with these patients. The lack of perceived clinical support from audiologists that the participants in this study reported provides a clear target for improvement for clinicians. The provision of counselling and information regarding the potential effects of SSD and strategies for management; either through the use of listening strategies or hearing devices, is likely to be very beneficial to this group of patients. As the authors acknowledge, this study was limited by the inclusion of only a small number of adult participants with acquired SSD. Further studies employing qualitative methods to investigate the impact of SSD will benefit from larger participant numbers, and potentially comparisons of people with congenital versus acquired SSD and those with and without hearing devices.

Older adults' experiences and issues with hearing aids in the first six months after hearing aid fitting.

Jorunn Solheim, Caryl Gay and Louise Hickson.

International Journal of Audiology 2018; 57: 31-39.

Many Hearing Aids (HAs) fitted end up not being used, and reasons for non-use are not always clear. Earlier research indicates that the most common reasons for limited or non-use of HAs after the initial fitting are due to handling issues, sound quality concerns and lack of benefit. Research mostly focuses on reasons for non-use, and relatively few explore issues experienced by occasional or minimal HA users.

The participants of this study are first time and experienced users, aged ≥60 years and have unilateral or bilateral digital Has. The entire HA fitting process took about 2-3 months on average, including one month trial of HAs at home. In a six-month follow-up appointment, there were 30 minutes reserved for a research interview and 30 minutes with another audiologist for adjustments to the hearing aids or other issues associated with their use.

During the interview, participants were asked about potential issues experienced with HA use since they received them. They were asked about nine specific issues: the handling, sound quality, perceived need, benefit, earmolds/domes, economic factors, functional factors, cosmetic factors, health-related factors and other issues.

All participants were fitted with unilateral or bilateral digital HAs that continuously record time of use in the memory of the HA (datalog). Non-users were defined as those using their devices on average <30 min/day. If the datalog differed between the left and right HA, the device with the higher average duration of use was chosen.

Results

At the six-month follow-up, most participants (72,9%) reported at least one issue with using their Has. The most frequently reported issues are earmold, sound quality and handling.
Participants who reported at least one issue with the Has used them an average of 3,3 h/day less than participants who reported no issues. This difference remained significant even when HA non-users were excluded from the analysis.

Moreover, as the number of reported issues increased, the duration of HA use decreased. However, despite this association, the proportion of HA non-users did not differ significantly between participants who reported at least one issue and those who reported no issues with their devices. While the number of reported issues was associated with the frequency of HA use, it was not significantly associated with whether the HA was used.

Two specific categories of issues were more likely to be reported among non-users: handling or no perceived need. Among HA users, certain reported issues were associated with less frequent HA use: no or little perceived need and health-related issues.

Participants who perceived no or little need for a HA tended to be younger than participants who did not report this issue. In addition, participants who perceived no or little need for a device had less hearing loss than participants who did report more need for Has.

HA users and non-users reported a similar number of issues with their devices, although the types of issues varied somewhat between the to groups. Not surprisingly, the issue most strongly associated with HA non-use was no perceived need. Therefore, participants reporting no need for a HA might be

challenged to review their decision and, together with a professional, consider whether to get assistance for potential problems or to postpone the process of obtaining a HA until they perceive greater need.

Consistent with prior studies, cosmetic concerns were not a significant reason for non-use of Has.

The findings show that follow-up support is needed to improve user experience among HA recipients. The rehabilitation process should not be considered complete once the device is fitted, but rather that the fitting is simply the beginning of an ongoing rehabilitation process.

Patients' and Clinicans' views of the Psychological components of tinnitus treatment that could provide more information as an integration towards audiologists' usual standard care: A Delphi survey.

Thompson D., Taylor J, Hall D., Walker D-M, McMurran M., Casey A., Stockdale D., Featherstone, Hoare D.

Ear & Hearing, Vol. 39, N°. 2, 367–377.

Tinnitus is still one of the most difficult health problems due to its heterogeneity, thus intervention requires flexibility to meet each different patients' needs. Research indicates that 5 % of the people are annoyed by tinnitus, while 1 % reports that tinnitus has a severe impact on their life. Worldwide, various therapies are used to help people who suffer from tinnitus (sound enrichment, noise generators, use of apps, hearing aids, habituation therapies,…).

Also a number of psychological therapies that use psychological theory models have been used to help patients to cope with their tinnitus-related distress. Cognitive behavioural therapy (CBT) is the approach for tinnitus which is most supported by high level evidence for its effectiveness on tinnitus. Different examples of CBT-techniques for tinnitus are shortly overviewed in this article.
Currently there is not enough evidence-based research available about psychological intervention for tinnitus patients that can fit the diversity of the tinnitus patient population.
Current research focuses on psychological therapies for tinnitus patients delivered by psychologists. However, due to current waiting lists for this approach by psychologists, the UK Department of Health recommends that:
"Where psychologists are not available, the audiologist's role should extend to offering psychological treatment through CBT or other appropriate counselling techniques."

During this research, a panel of 39 patients, audiologists, hearing therapists and psychologists therefore gave their opinion during a Delphi survey*. They tried to get agreement on the following question: 'which components of psychological therapies are the most important and appropriate to inform audiologists' usual care for people with tinnitus?'

(The Delphi method is a structured communication technique or method which relies on a panel of experts. The experts answer questionnaires in two or more rounds. After each round, a facilitator or change agent[5] provides an anonymised summary of the experts' forecasts from the previous round as well as the reasons they provided for their judgments. Thus, experts are encouraged to revise their earlier answers in light of the replies of other members of their panel. It is believed that during this process the range of the answers will decrease and the group will converge towards the "correct" answer. Finally, the process is stopped after a predefined stop criterion and the mean or median scores of the final rounds determine the results. (source wikipedia))*

During this Delphi survey, the panel agreed on more than 80 % of the questions. Most importantly, they agreed that an audiologist can use the following more common psychological skills during tinnitus therapy: Socrative questioning and active listening. Other more technical skills weren't agreed: mindfulness, graded exposure therapy or cognitive restructuring,…. All the panels also agreed that audiologists can use educational counselling about etiology, maintenance and progression of tinnitus. Education should primarily focus on dispelling misconceptions about tinnitus. There was also agreement to include largely concerned psychological models of tinnitus rather than giving detailed neuropsychological information.

After these agreements, following research should focus more on the effectiveness of audiologist-delivered psychological interventions for tinnitus.

In the UK, tinnitus therapy has already reached a high level of awareness among the UK population. How can this data be used for our own country? In Belgium for instance, CBT or psychological techniques are nowadays limited to the psychologist himself. A list of psychologists is not available to refer to when necessary so the problem is very recognizable. It would be interesting to find out what patients and psychologists in our own country might think of the approach of using more psychological skills during tinnitus therapy and to use a form of CBT. The tinnitus research initiative (http://www.tinnitusresearch.org/) could write international guidelines for this approach so more awareness of this option for audiologist-led CBT therapy for tinnitus could become available.

Effect of sound generator on tinnitus and hyperacusis.

Jung Mee Park, Woo Jin Kim, Jin Bu Ha, Jung Ju Han, So Young Park & Shi Nae Park.

Acta Oto-Laryngologica, Vol 138 (2) (Feb 2018), 135–139.

Tinnitus management took a huge turn with Jastreboff's neurophysiological model and introduction of tinnitus retraining therapy (TRT) is based on such a model. Jastreboff has also emphasized the importance of enriching background sound using hearing aids or sound generators (SGs) during TRT sessions, grouping tinnitus patients into five categories depending on the presence or absence of hyperacusis, kindling, hearing loss, and the degree of impact on the patient. SGs may be useful for category 1 patients, who are greatly impacted by tinnitus but are without hearing loss and patients in category 3 and 4, who complain comorbid hyperacusis. To these patients, SGs may decrease contrast between tinnitus and background neural activity, reduce detection of tinnitus, and suppress abnormal gain of auditory system.

Previous studies on the effects of SG on tinnitus were performed in small groups, 50 and 30 patients, and did not differentiate patients with comorbid hyperacusis. This study aimed to verify the therapeutic effect of SGs on tinnitus patients with or without hyperacusis during their course of TRT in a larger group of subjects in a busy hospital setup.

120 patients (all normal hearing subjects) were retrospectively included in this study from the records of over 8 years. Seventy eight patients were category 1 patients who did not have hyperacusis and 42 patients were category 3 patients who had comorbid hyperacusis with tinnitus. The characteristics summarised in the following data. Both groups showed the hearing level around 20 dB, indicating normal hearings. Time of SG prescription after initial visit was much earlier for category 3 patients compared to category 1 patients, 12.0 months and 6.1 months, respectively. Duration of SG usage and follow-up period did not differ significantly.

The following clinical parameters of enrolled subjects were compared between the two groups, using Student's t-test for continuous variables and chi-square test for categorical variables: sex, age, site of tinnitus, hearing level, time to prescription of SGs, duration of SG usage, and follow-up period. Treatment outcomes were evaluated by comparing scores of LDLs, tinnitus Visual analogue scale (VAS), and tinnitus handicap inventory (THI) before and after six months use of SGs, using a paired t-test.

Initial tinnitus severity scores comparing category 1 and category 3 patients showed statistically significant difference in the 'effect on life' of tinnitus VAS scores as well as THI scores. After six months use of SGs, tinnitus severity scores for both category 1 and category 3 patients improved in all categories, with all values statistically significant. The degree of improvements (as shown by THI and VAS scores) was greater for category 3 patients when compared to category 1 patients, but the changes of scores did not show statistically significant difference between the two groups.

The average initial LDLs for category 3 patients was 97.9 dB, about 4 dB less than category 1 patients with average LDLs of 102.8 dB. After six months use of SGs, however, LDLs for category 3

patients increased about 6 to 104.4 dB, which was a statistically significant change from the initial result.

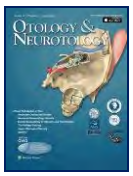
The authors cited from previous EEG based studies which indicated that tinnitus patients with comorbid hyperacusis show an increased activity and connectivity in the auditory, anterior cingulate, and orbitofrontal cortex areas of the brain. A pathologic state of these areas may cause anxiety disorders and may activate a 'hypervigilance' or 'hyper responsive' network. This was used to explain why hyperacusis patients with normal audiograms rated their hearing levels as worse and their tinnitus as louder than expected. In this respect, earlier intervention and treatment is necessary for these patients.

With regard to tinnitus in normal hearing subjects, the authors cited one hypothetic perspective of viewing 'tinnitus as a result of an amplification of neural noise' induced by a sensory deprivation. This hypothesis may explain why 70% or more of normal-hearing subject can 'hear' tinnitus in sensory deprived environment such as a soundproof chamber. According to this theory, sensitivity of central auditory center is enhanced in an environment of low acoustic level and this increase in central sensitivity may amplify the neural noise, which then leads to an auditory perception or 'tinnitus'.

The study concluded with an observation that SGs can help category 1 and 3 patients and almost alleviate hyperacusis where other therapies failed to provide any relief.

This large scale study on normal hearing subjects with tinnitus and/or hyperacousis is unique and should strengthen the belief on the effectiveness of SG. Another interesting aspect of this study was the used of LDL to analyse the effectiveness of a SG.

Patterns of Extended High-frequency Hearing Loss Following Stapes Surgery.



Melissa Babbage, Greg O'Beirne, Michael Bergin and Philip Bird.

Otology & Neurotology, Vol.38, 1405–1410.

A limited opening/hole within the central footplate of the stapes (accomplished via laser or manually with a drill) is referred to as "stapedotomy." Total or subtotal removal of the stapes footplate (usually accomplished manually) is referred to as "stapedectomy." These procedures are associated with high rates of improvement in hearing and low rates of sensorineural hearing loss when measured in the conventional frequency range. However thresholds in the extended high-frequency (EHF) range (> 8 kHz) thresholds often worsen following surgery as shown by several studies. These studies documented reduced hearing in the EHF range after stapedectomy, but did not employ a longitudinal approach that could be used to look for changes in hearing over the postoperative period.

The aims of this study were to document the prevalence of hearing loss from 0.25 to 16 kHz following stapedectomy, to determine the relative rates of transient and permanent hearing loss, and to document any postoperative recovery of the deterioration in hearing and describe its time course.

Thirty-nine participants who underwent 44 surgeries were enrolled in this study. Participants included 11 males and 28 females, with a mean age of 49.2 years. Twenty-six procedures were performed on the right ear and 18 on the left ear.

Most procedures used a stapedotomy technique using either an argon or CO2 laser to create a rosette. The stapedotomy was then completed using a hand drill to approximately 0.7 mm in diameter. A SMart (Olympus Medical, Tokyo, Japan) prosthesis 0.6mm in diameter in lengths varying from 4.25 to 4.75mm was then placed into the vestibule and connected to the long process of the incus using the laser. Audiometric assessments were performed at 4 instances - no more than 1 month before surgery and at approximately 1 to 2 weeks, 1 month, 3 months, 6 months, and 1 year postoperatively.
Assessments included otoscopy, air- and bone-conduction audiometry at the conventional pure-tone frequencies, and bilateral air-conduction audiometry in the EHF range. AC thresholds were measured at 0.25-8 kHz, and at 3 kHz. Above 8 kHz, thresholds were measured at frequencies at 1/6th octave steps from 9-16 kHz. Masked bone-conduction thresholds were measured at 0.5, 1, 2, 3, and 4 kHz.

Outcome measures included i) the mean, standard deviation, and range of each of these measures at each assessment; ii) the percentage of patients with an ABG of < 10 and < 20 dB at each assessment; and iii) the percentage of patients with a 4 kHz BC threshold shift of > 10 and > 20 dB, and the mean threshold recorded at this frequency at each assessment. For EHF thresholds, for each of the assessments, the percentage of patients with a change in the highest frequency HTLs was measured.

Results showed that, the mean AC PTA at the first postsurgical assessment improved by an average of 17 dB from preoperative levels and continued to improve gradually over the next 6 months, with a slight increase at the 12 month point as a result of the failure of two surgeries by this assessment. The mean ABG decreased significantly by 18 dB by the first assessment and by a further 5 dB by the second assessment, after which it remained reasonably stable. At the final assessment, around 80% of patients had an ABG of 10 dB or less.

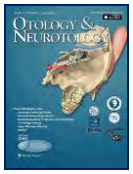
The greatest improvements in hearing were achieved in frequency Band 1 (0.25–1 kHz). Improvements in this band were apparent from the first assessment, with continued improvement until 3 months after surgery. In Band 2 (2–8 kHz) most patients experienced hearing improvement by 3 months. Hearing loss was greatest in Band 3 (9–11.2 kHz), particularly 1 week after surgery, with gradual, partial recovery by 3 months. At the highest frequencies, 12.5 to 16 kHz, the median loss in

hearing was not as great as in Band 3 and the range of changes recorded was smaller. At the final assessment, approximately 12 months after surgery, at frequencies from 8 to 11.2 kHz, there was a relatively even distribution of patients experiencing either no change in thresholds, hearing improvement, or hearing loss.

One week after surgery, 77% of the 39 patients tested experienced a decrease in the highest frequency at which a hearing threshold could be measured compared with their preoperative audiogram. The same decreased to a minimum of 47% by the assessment at approximately 3 months postoperatively and remained reasonably stable. This continuous loss of EHF hearing could be due to trauma to the cochlea is the principal cause, with possible mechanisms being high-intensity noise or vibration, perilymph aspiration or excessive force transmission to the inner ear. Authors concluded with a recommendation to measure EHF hearing after stapedectomy as it could be useful as a model of iatrogenic damage.

Longterm study of extended high frequency range has helped in understanding better the improvements or deterioration as a consequence of stapedectomy. Proposing the EHF HTLs to control iatrogenic loss is the other highlight of this study.

Efficacy of Bone-Anchored Hearing Aids in Single-Sided Deafness: A Systematic Review.



Yıldız Arslan, Ilker Burak Arslan, Huriye Aydın, Özlem Yag˘ ız, Figen Tokucog˘lu and Ibrahim Cukurova.

Otology & Neurotology, Vol.38, 1411–1414.

Sudden SNHL (SSNHL) is generally defined as unexplained sensorineural HL more than 30 decibels (dB) in three consecutive audiometric frequencies occurring over a 72-hour period. This disorder accounts for 1% of all cases of HL, and its incidence is estimated to be 20 per 100,000 person-years.

SSNHL is idiopathic at presentation; nearly always unilateral. The pathophysiology of SSNHL remains poorly understood, but numerous possible pathophysiological mechanisms have been suggested. The most accepted explanations include viral infections, ischemic insults, and autoimmune diseases. Moreover, vascular etiologies have recently gained interest due to the abrupt onset of the clinical presentation and the correlation between SSNHL and certain vascular events.

Recent studies have indicated there could be a relationship between SSNHL and migraine. Some studies have found a higher incidence of migraine in patients with SSNHL and suggested that these disorders have a common vascular etiological basis. Some case reports have indicated that some patients with SSNHL exhibit symptoms that can be attributable to migraine and that sudden HL associated with severe migraine headache is linked to ischemic changes in the inner ear.

The present study investigated the relationship between SSNHL and migraine to determine the incidence of migraine in patients with idiopathic SSNHL and to identify a possible common vascular etiopathogenesis for migraine and SSNHL. Additionally, initial HL and long-term and post-treatment recovery rates were analysed and compared among patients with and without migraine.

A total of 61 patients diagnosed with SSNHL included in this study. 24 of them had in addition migraine and the remaining 37 did not report of the same. All patients underwent physical examinations of the eardrum and cranial nerves, a pure tone audiometry (PTA) procedure, several laboratory tests (hemogram, sedimentation, and analyses of C-reactive protein [CRP], antistreptolysin O [ASO], rheumatoid factor [RF], vasculitis markers, viral antibodies, cholesterol, low-density lipoprotein [LDL], triglyceride, thyroid stimulating hormone [TSH], calcium [Ca2p], and coagulation marker levels), and fistula tests. Cranial magnetic resonance imaging (MRI) scans with gadolinium were obtained from all patients.

Each patient received oral glucocorticoids (1 mg/kg) on the first day of treatment; intra-tympanic glucocorticoids were then administered for 5 days. PTA was performed on the initial day, following the first and second week and the first, second, and third month after treatment, and at the last clinic visit.

The degree of HL was measured using the average HTL of 0.5, 1, 2, and 4 kHz during the PTA procedure. The audiometry results from the sixth month after discharge were accepted as final. Siegel's criteria were used to assess recovery and to classify the patients into four groups: Type I (complete recovery), which included patients whose final hearing level was more than 25 dB regardless of the size of the gain; Type II (partial recovery), which included patients who showed more than 15 dB gain, and whose final hearing level was between 25 and 45dB; Type III (slight recovery), which included patients who showed more than 15 dB of gain, and whose final hearing level was less than 45dB; and Type IV (no improvement), which included patients who showed less than 15dB of gain.

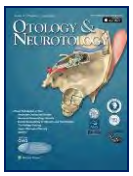
The prevalence of migraine in patients with idiopathic SSNHL and the recovery rates of patients with (Group 1) or without (Group 2) migraine were also evaluated. All vascular and laboratory parameters were compared between patients with and without migraine.

The present study included 61 patients with previous idiopathic SSHNL, of these 24 (39.34%) had migraine. Results of all haematological studies and migraine parameters were not significantly different between the 2 groups.

The recovery rates showed that the initial and final hearing levels of Groups 1 and 2 did not differ significantly, nor was there a difference in terms of no improvement. Except for the prevalence rates, there was no other significant difference between both the groups.

The hypothesis of the present study seems to be valid with current understanding of SSNHL. It shows a large number vascular parameters and migraine parameters are not significantly different between those with and without migraine. This should pave way for use of other cerebral blood flow future studies. The results of MRI were not discussed.

Long-term Complications and Surgical Failures after Ossiculoplasty.



Matthew D. Cox, Joshua Cody Page, Aaron Trinidade and John L. Dornhoffer.

Otology & Neurotology, Vol.38, 1450–1455.

Surgeries of middle ear are of various types and it is often difficult to analyse the outcomes and even challenging to predict the success. Historically, for ossiculoplasty, hearing results (rate of closure of pure-tone average air-bone gap [PTA-ABG]) has been the primary outcome measure. Recent efforts have focused on prognosis, particularly using the identification and analysis of factors that influence outcomes.

In this study, authors aimed to assess surgical outcomes using the traditional approach (hearing test results), with a primary focus on ''significant complications,'' or those complications indicating further surgical intervention.

Authors used a post-facto research design to include 195 patients who underwent different types of ear surgeries from 1998-2010. The following details were examined from the records: all audiometry records, patient age at the time of surgery, sex, smoking status, laterality of procedure, indication for surgery, procedure(s) performed, model number of prosthesis placed, information regarding history of previous surgery on the operative ear, presence of preoperative otorrhea, intraoperative status of the mucosa (thickened, fibrotic, etc.) and ossicles (malleus absent versus present and usable for reconstruction), and postoperative documentation of otoscopic findings, including graft healing status, date of most recent clinical examination, and any documented complications. Also, ossiculoplasty outcome parameter staging (OOPS) index was obtained from these records.

Cartilage tympanic membrane grafts were used in all patients. Types of surgical procedures and techniques are summarised in the article.

The whole post-operative care protocol with which all these patients were driven is described in the article.

The primary outcome measures of this study included any complications requiring further surgical intervention for management (as shown by OOPS index). Hearing results were the secondary outcome: AC and BC 500, 1000, 2000, and 3000 Hz were tabulated (Pure-tone average was average of AC HTLs for 500, 1000, 2000, and 3000 Hz). The preoperative PTA-ABG, short-term postoperative PTA-ABG (between 60 d and 1 yr after surgery) and long-term postoperative PTA-ABG (at least 3 yr after surgery) were then calculated for each patient.

Thus statistical analysis was done comparing 2 groups: one with surgical complications and the one without. Early postoperative ABG (obtained between 2 mo and 1 yr after surgery) and the final (greater than 1 yr after surgery) were assessed for all patients.

Preoperatively, there was no significant difference in average PTA-ABG between these groups. The average postoperative PTA-ABG was observed to be greater for the complications group than the group of patients without complications. Comparison of the final hearing result between the groups did not demonstrate a significant difference.

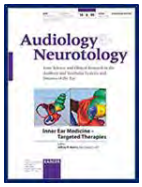
Further analysis showed that the risk factors: Smoking status ($p=0.0003$); First postoperative hearing result ($p=0.002$); and Valsalva status ($p=0.022$) that can accurately predict which patients are at higher risk for failure to sustain satisfactory results.

Finally, to establish an estimate of ''expected hearing result,'' a linear regression fit to the first postoperative hearing results (PTA-ABG) was created, as stratified by OOPS index score.

The authors concluded that tobacco smoking, Eustachian tube dysfunction, and an unexpectedly poor hearing result on the first postoperative audiogram are all important risk factors for the development of significant complications.

This study is a part of the series on this subject. Authors tried to objectively analyse (otherwise what is mostly subjective) the outcomes of ossiculoplasty. The study defined crucial risk factors to success and also clearly defined the successful surgical hearing outcome. This framework should be used to study more patients and various settings.

Resveratrol Promotes Recovery of Hearing following Intense Noise Exposure by Enhancing Cochlear SIRT1 Activity.



Hao Xiong Yongkang, Ou Yaodong Xu, Qiuhong Huang, Jiaqi Pang, Lan Lai and Yiqing Zheng.

Audiology & Neurotology, 2017, Vol.22,303–310.

NIHL is one of the most common types of SN hearing loss and remains a major hearing health care problem. Despite considerable efforts, the mechanisms underlying NIHL are not well understood. Accumulating evidence, at cellular level, indicates that oxidative stress is a key element that may be involved in the pathogenesis of NIHL. Oxidative stress is essentially an imbalance between production of reactive oxygen species (ROS) and antioxidant defenses. Overproduction of ROS is believed to be a major cause of NIHL, and antioxidants have been shown to attenuate noise-induced hair cell death and NIHL. One protein that seems to be involved in this process is the Sirtuin SIRT1.

Reduction in SIRT1 levels seems to be involved in multiple biological processes and is implicated in the prevention of age-related phenotypes such as cancer, Alzheimer disease, type 2 diabetes, presbycusis and cochlear haircell loss.

Resveratrol, a polyphenol that is present in many plant-based foods (grapes and redwine), is widely known to have antioxidant and anti-inflammatory properties and is thought to have therapeutic potential against many neurodegenerative diseases and metabolic disorders. It is believed that resveratrol increases SIRT1 activity and is considered a potent SIRT1 agonist. Previous research has revealed that a low-dose, shortterm resveratrol supplement may exert a protective effect against NIHL induced by moderate noise exposure in rats.

The objective of this study was to test the hypothesis that long-term, high-dose resveratrol treatment attenuates NIHL and cochlear hair cell loss induced by intense noise exposure by enhancing SIRT1 deacetylase activity in a mouse model.

Female C57BL/6 mice at 2 months of age were divided into 3 groups: control group (n = 12), noise-only group (n = 11), and noise + resveratrol treatment group (n = 13). Mice in the noise + resveratrol treatment group were fed a standard chow that contained resveratrol at 4.0 g resveratrol/kg of food for 2 months. After 2 months of treatment, all mice were subjected to noise (120 dB white noise for 1 hour) or sham exposure.

Auditory brainstem response (ABR) measurements were performed at 4 time points: before treatment (baseline), before noise exposure (end of treatment), immediately after, and 15 days after noise exposure. Following all ABR recordings, the deeply anesthetized mice were processed for tissue culture and histological studies.

Results showed that mice treated with resveratrol exhibited significantly higher cochlear SIRT1 activity compared with those fed standard chow. Hearing loss was assessed by ABR measurements. At the beginning of the study, C57BL/6 mice in the different groups exhibited equal hearing thresholds across all tested frequencies, and the highest threshold was detected at 32 kHz. Noise exposure led to significant but equal temporal threshold shifts in both the noise-only and noise + resveratrol groups at 4, 8, 16, and 32 kHz. In mice treated with resveratrol presented much better hearing recovery at 4 kHz and 16 kHz15 days after noise exposure compared with mice fed a standard diet. Threshold shifts at 32 kHz showed no difference between the 2 noise exposure groups (a&b sections of the figure).

Although both noise-exposed groups displayed a base-to-apex gradient of OHC loss, treatment with resveratrol reduced noise-induced OHC loss at 2.5 mm, 3 mm, 3.5 mm, 4 mm and 4.5 mm from the apex compared with controls (c&d sections of the figure). However, there were no significant differences in inner hair cell loss at the base between the 2 groups.

This study demonstrated that administration of the resveratrol increases cochlear SIRT1 activity and promotes recovery of hearing as well as protection of outer hair cells after noise exposure. Therefore, resveratrol appears to protect hearing from noise damage by enhancing cochlear SIRT1 activity and subsequently reducing oxidative stress. Authors concluded the report with a recommendation that resveratrol could have potential therapeutic benefits to treat NIHL.

This study provides clear understanding on the effects of resveratrol on NIHL. Use of Oto Acoustic Emissions could have thrown more light on OHC survival and recovery. The same should be studied in other lab animals also to pave way for human experiments.

Acoustic reflexes are common but not pervasive: evidence using a diagnostic middle ear analyser.

Kara McGregor, Gregory Flamme, Stephen Tasko, Kristy Deiters, William Ahroon, Christa Themann & William Murphy.

International Journal of Audiology 2018; 57:sup1, S42-S50.

The middle ear acoustic reflex (AR) is an involuntary contraction of the stapedius and/or tensor tympani muscles of the middle ear in response to high-level acoustic stimuli. The middle ear muscle contractions (MEMC) are typically assumed to be bilateral and have the effect of increasing middle ear impedance in the low frequencies. AR is also recorded in response to non-acoustic stimuli and in association with behaviours such as eye closure, vocalisation and swallowing. AR may help cochlear though intensity control of external or internally generated sound, enhancing sensitivity to high frequency sounds and functioning as a vestige of muscle activity required for jaw stability in early mammals/amphibians during mastication.

If the ARs are to play a substantial role in exposures above the damage risk criteria (DRC), then they must be known to be pervasive (i.e. present in everyone) in the exposed population. The operational definition of a pervasive response is a minimum of 95% confidence of a minimum of 95% prevalence. This limit is equivalent to the lower boundary of the 90% confidence interval for a prevalence proportion that is 0.95 or more.

One of the authors in a previous study (n> 15000) estimated the prevalence of AR in three participant groups: all participants (74.6% prevalence rate), participants aged 18–30 (85.3% prevalence rate), and participants aged 18–30 with good hearing, defined as H-1 hearing status (86.9% prevalence rate). However, even in individuals with the best hearing and at the youngest age range, the AR was not pervasive (going by the above definition). The goal of the present study was (1) to determine if using a diagnostic middle ear analyser with a friction-fit probe yields a different probability of observing an AR than was observed previously, and (2) to determine whether the results suggest a different findings than their previous study with respect to AR pervasiveness.

A total of 285 participants ranging in age from 18 to 68 years were used for this study. The median age of the participants in the study was 21 years old. A diagnostic impedance analyser was used to record ARs at elicitor tones - 0.5, 1, 2 and 4 kHz both ipsilaterally and contralaterally using a conventional 226 Hz probe tone. Routine puretone audiometry was conducted for all the subjects. Three audiogram configuraions were observed: A11 configuration characterised by bilateral symmetry and mean pure tone thresholds of 10 dB HL or less between the stimulus frequencies of 0.5–8 kHz, with the exception of a mean threshold of 11 dB HL at 6 kHz. Following A11, A19 and A22 were the next most frequent configurations and each accounted for approximately 2% of the sample (i.e. A11, A19 and A22 accounted for approximately 96% of the total sample). These configurations are very similar, but were identified separately for men and women.

ARs were identified using 2 methods: Frequentist and Bayesian/Kalman methods. The first method, referred to as the conventional method (viual identification by an expert), identifies a reflex as present if the maximum change in the reflex trace is greater than 0.02 ml. The second method (auto identification by software), referred to as the correlational method, identifies a reflex as present if the correlation between that trace and one of a set of reflex prototypes exceeds a correlation coefficient ''cut-point''. This procedure required a number of analysis steps.

Proportions of AR observations and 90% confidence intervals and analyses data were calculated using the Stata software package (StataCorp, College Station, TX). The 90% confidence interval was used. A lower bound of the 90% confidence interval that is greater than a proportion of 0.95 would indicate greater than 95% certainty that 95% of the sample would exhibit an AR.
Results showed that the proportion of AR was above 90% in all participant groups for both detection methods. However, the lower bounds of the 90% confidence intervals did not exceed 0.95 for any of the groups using either detection method. Even in the fourth group, which includes individuals who are young (18–30 years) and have very good hearing (hearing levels best described by the A11 configuration), the AR rates did not meet the criterion for pervasiveness. These results are consistent with the results of their previous study, which concluded that the AR was very common, but was not pervasive.

Authors offered an explanation that cases of absent acoustic reflexes in people with very good hearing could be associated with reductions to the numbers of synapses between the inner hair cell and auditory nerve fibres, which can be described as cochlear neuropathy. They further warned that the stimuli are different from those seen in impulse noise causing NIHL and hence ARs should not be used in deciding DRC.

This normative research study addresses one of the basic questions about AR that they are very common but not pervasive. This should help in clinical application of AR in deciding middle ear pathology. The design of the study was very well constructed and the subject inclusion was practical.

Cross-cultural adaptation and psychometric properties of the Chinese tinnitus functional index.

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Subjective tinnitus is associated with variable severity and is often associated with anxiety, insomnia, general agitation, emotional distress and general health deterioration. Tinnitus is also a self-reported phenomenon which is not readily apparent to others except through the complaints of the sufferer. As such, subjective psychometric measures such as questionnaires are essential in assessing the severity and impacts of tinnitus, and determining the effectiveness of intervention. The Tinnitus Functional Index (TFI) is a 25-item self-administered questionnaire which assesses eight domains of negative tinnitus impact, including intrusive, sense of control, cognitive, sleep, auditory, relaxation, quality of life, and emotion. The total TFI score ranges from 0 – 100 with a higher score indicating a greater problem with tinnitus. Currently, the Chinese version of the Tinnitus Handicap Inventory (THI-CH) have been widely used in the hospitals and private hearing clinics. However, the THI-CH can only provide a general score but not specific scores on multiple tinnitus severity domains. Thus there currently lacks a multifactorial tool that is brief but sensitive in detecting treatment effect.

This study aimed to translate the TFI into Chinese (TFI-CH) and cross-culturally adapt its use in Chinese patients who were suffering from chronic tinnitus. The psychometric properties including reliability, construct validity and responsiveness of the TFI-CH were determined.

The original TFI was translated into Chinese using the forward translation-back-translation method with the guidance of local professional bilingual translators, audiologists, an ontologist and speech therapist. A pilot test was performed following which 124 Cantonese-speaking subjects participated in the study with a mean age of 53.98. The participants received standard tinnitus treatment, including tinnitus measurement, counselling and sound therapy. Participants completed the TFI-CH, the THI-CH, and the Chinese version of the Short-Form 36 Health Survey (SF-36) , which assesses physical and mental health-related quality of life. The participants were asked to rate tinnitus severity on a 0-100 scale. Follow-up data was collected 3 months after the initial data collection. At the follow-up data collection, participants were additionally asked to fill in a questionnaire regarding tinnitus treatments that they may have received, and the "global perception of change" based on a seven-point scale.

The internal consistency of the TFI-CH was examined, showing a high degree of internal consistency. Good test-retest reliability was also found. The validity regarding internal structure of the tinnitus-severity domains were investigated, assessing whether the TFI-CH subscales represented distinct factors and if eight factors could still be identified as in the original English version. Results show that this eight-factors model was a good fit, indicating that these subscales could be used in the TFI-CH. The construct validity of the TFI-CH was evaluated by examining the respective correlation with the THI-CH, severity VAS and the SF-36. High correlation was found between the overall TFI-CH score and the THI-CH total score, whilst moderately correlations was found between the overall TFI-CH and the severity VAS. Weak to moderate correlations between the TFI-CH and SF-36 scores were also found, indicating that tinnitus-related complaints are considerably different from general psychopathological symptoms and syndromes (Hiller, Goebel, and Rief, 1994).

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This study provides evidence for adequate psychometric properties of the TFI-CH, including reliability, validity and responsiveness, which are consistent with those of the English version. Of note is the measure of responsiveness, which has not been studied previously when looking at other validated tinnitus questionnaires in the Chinese language. This supports the use of the TFI-CH in Chinese tinnitus patients in the clinical setting, as well in in research, and indicates a useful measure for the changes in tinnitus before, during and following treatment. Further studies could look at increasing the sample size and carrying out the assessments in more controlled treatment trials as differences between the various treatments may have affected the range of effect sizes observed, as well as influenced the compliance of follow up in some participants. It would also be interesting to assess these psychometric properties in participants who were not only Cantonese speaking and from Hong Kong, but also Mandarin speaking and from other parts of China as this could broaden the patient population who can benefit from the effects of this measure.

Tone production and perception and intelligibility of produced speech in Mandarin-speaking cochlear implanted children.

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The acquisition of auditory information and linguistic information provided to the profoundly deaf, English-speaking population by cochlear implants has been widely accepted. However, there exists a gap in the literature to explore the perception of lexical tones in the Mandarin-speaking population, particularly in the paediatric setting where tone production, tone perception, and intelligibility of produced speech is being developed. As a lexical tone language, Mandarin consists of supra-segmental parts based on variations in fundamental frequency (F0). The four major tones forming the F0 contour in a syllable can be characterised as T1 (flat), T2 (rising), T3 (falling and rising), and T4 (falling). Differences in the different tones carry different and distinct meaning in such tonal languages even when the phonemic components are identical. Prelingually deaf children with CIs face difficulties perceiving lexical tone languages which is in part due to the limited number of channels in the CI used to transmit the wide range of speech frequencies. Furthermore, the lack of adequate auditory input as well as feedback may result in difficulties for CI users to learn accurate tone production.

This study examines the predictive values of tone perception and tone production as they relate to speech intelligibility. As the age at implantation and the degree of experience with CIs are the two main factors that impact speech intelligibility, this study also tried to evaluate the speech intelligibility and tone production and perception of Mandarin-speaking children who received a CI at a young age who had already experienced many years of CI use.

Thirty-three prelingually deaf children aged over eight years with over five years of experience with a unilateral CI were recruited from the Otolaryngology Department of National Cheng Kung University Hospital in Tainan, Taiwan. The mean age at the time of testing was 13.4 years while the age at the diagnosis of hearing loss ranged from 0.1 to 3.7 years old. Participants underwent tests for tone perception (Mandarin Lexical Tone Recognition Test), tone production where participants were asked to pronounce a sampling of disyllabic utterances, and the Speech Intelligibility Rating (SIR) where participants identified and repeated 20 sample sentences of five different lengths (four, six, eight, ten, and twelve words) with each sentence ending in a different tone.

Results showed a positive correlation between tone perception and tone production, consistent with the hypothesis that good speech perception is a prerequisite for children to product intelligible speech. CI children with better tone perception tend to have higher accuracy in tone production tasks. SIR was also positively correlated to tone perception and production, which is consistent with the prediction of produced speech intelligibility by their tone production performance – the more clearly the four tones are pronounced, the more accurate the meaning is. The results of this study imply that prelingually deaf children who speak Mandarin Chinese with sufficient experiencing using CI performed well in both tone perception and production (scores of 76.88% and 90.08% accuracy respectively).

This study indicates the need for further development in cochlear implant technology and rehabilitation programmes that can minimise the current perceptual limitations in lexical tone languages as tone perception is positively correlated with tone production which in turn can influence the ability of Mandarin-speaking implanted children to produce intelligible speech.

Further research is also indicated for testing in a larger population that may also encompass the entire Taiwanese population or other Mandarin-speaking countries, as well as those children who were implanted when they were older. It is particularly important to consider the difficulties of tone perception in clinical situations, particularly for Mandarin-speaking CI users when the rehabilitation programmes are based in English-speaking countries where tonal differences are not as important for word recognition.

Perception of Cantonese Lexical Tones by Pediatric Cochlear Implant Users.

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The benefits of cochlear implantation on vocabulary and language development have been widely shown in countries where English is the primary language. For speakers of lexical tone languages such as Cantonese, there is less evidence. In lexical tone languages, the relative fundamental frequency (F0) level, contour and direction of F0 change of a single word will contribute to its meaning. Cantonese has six phonologically distinct tones including three tones with a stable F0 but which differ in relative F0 level (F0 height). These are the T1 (high), T3 (mid), and T6 (low) static tones. T2, T4 and T6 are dynamic tones whose F0 trajectory changes over the duration of the word.

Factors such as the wider auditory filter bandwidths, auditory neuron survival rate, and consequently poorer place and temporal cue utilisation experienced by cochlear implant (CI) users do not allow for the same precision of pitch recognition as in individuals with normal hearing. This indicates that children using CIs may not perform as well as peers in perceiving Cantonese tones. Additionally, there is inconclusive evidence for the benefits of earlier implantation on language outcomes in speakers of tonal languages. Whilst some studies show that earlier implantation aids lexical tone acquisition (Lee, van Hasselt, Chiu, and Cheung, 2002; Lee, van Hasselt, and Tong, 2010), other studies have not found a benefit to earlier implantation (Wong and Wong, 2004; Ciocca, Francis, Aisha, and Wong, 2002; Tse and So, 2012).

The present study compared Cantonese word recognition and tone discrimination abilities by Cantonese-speaking children with CIs and those of an age-matched control group of children with normal hearing (NH). 23 CI users and 18 individuals with normal hearing recruited from hospitals, schools and kindergartens in Hong Kong completed the testing. All participants used Cantonese as their primary language and had no diagnosed abnormalities in cognitive development. The CI users were assigned to either an "early" group who had received their implant at or before 2 years of age or a "late" group who were aged over 2 years at the time of implantation. All CI users had bilateral profound hearing loss prelingually. The NH group were chronologically age matched to the CI users and the mean age at the time of testing was 13.3.

Tone perception abilities were assessed using both linguistic (the Cantonese Tone Identification Test) and non-linguistic tasks. The nonsense syllable wi was used to create sets of stimuli, which mimicked the tone contrasts of Cantonese, and manipulated the intervals between the level tones or the offset F0 of the rising/falling tones. The results showed that both CI user groups obtained significantly lower scores than the NH group on the word recognition test and that the NH group consistently achieved higher scores than the CI user groups when discriminating manipulated Cantonese tones. This supports the existing evidence and indicates that Cantonese children using CIs have greater difficulty recognising words in quiet compared to their counterparts with NH. Increasing the acoustic difference between tones improved discrimination performance for CI users for level tone contrasts only. Although those implanted before 2 years of age achieved higher scores in word recognition and discrimination of non-linguistic F0 contours than those implanted after 2 years, the difference between group performance was not significant. The authors have noted that although infants in tonal language environments become sensitive to tonal contrasts by 4 months of age, the earliest age of implantation in this cohort was 1.0 year. This indicates that the delay in receiving cochlear implants may have minimised the significant and beneficial effect of early implantation on tone perception.

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This study highlights the difference in language acquisition for paediatric cochlear implant users in non-tonal and tonal languages and indicates that the outcomes of studies conducted with CI users of nontonal languages may not be applicable to speakers of tonal languages. The results indicate the potential for auditory pitch training programmes using manipulated F0 intervals to provide benefit to tone acquisition for paediatric CI users, helping CI users learn to discriminate between lexical tones. Both the need for training level tone contrasts and more difficult dynamic tones, potentially coupled with visual aids presented through mobile devices, is indicated. The need for further research in cochlear implantation in speakers of lexical tone languages is also highlighted, particularly to assess how the use of CI impacts lexical access, speech comprehension, and higher order language processing. Further research is also needed to fully explore the potential benefit of earlier implantation for speakers of lexical tone languages.