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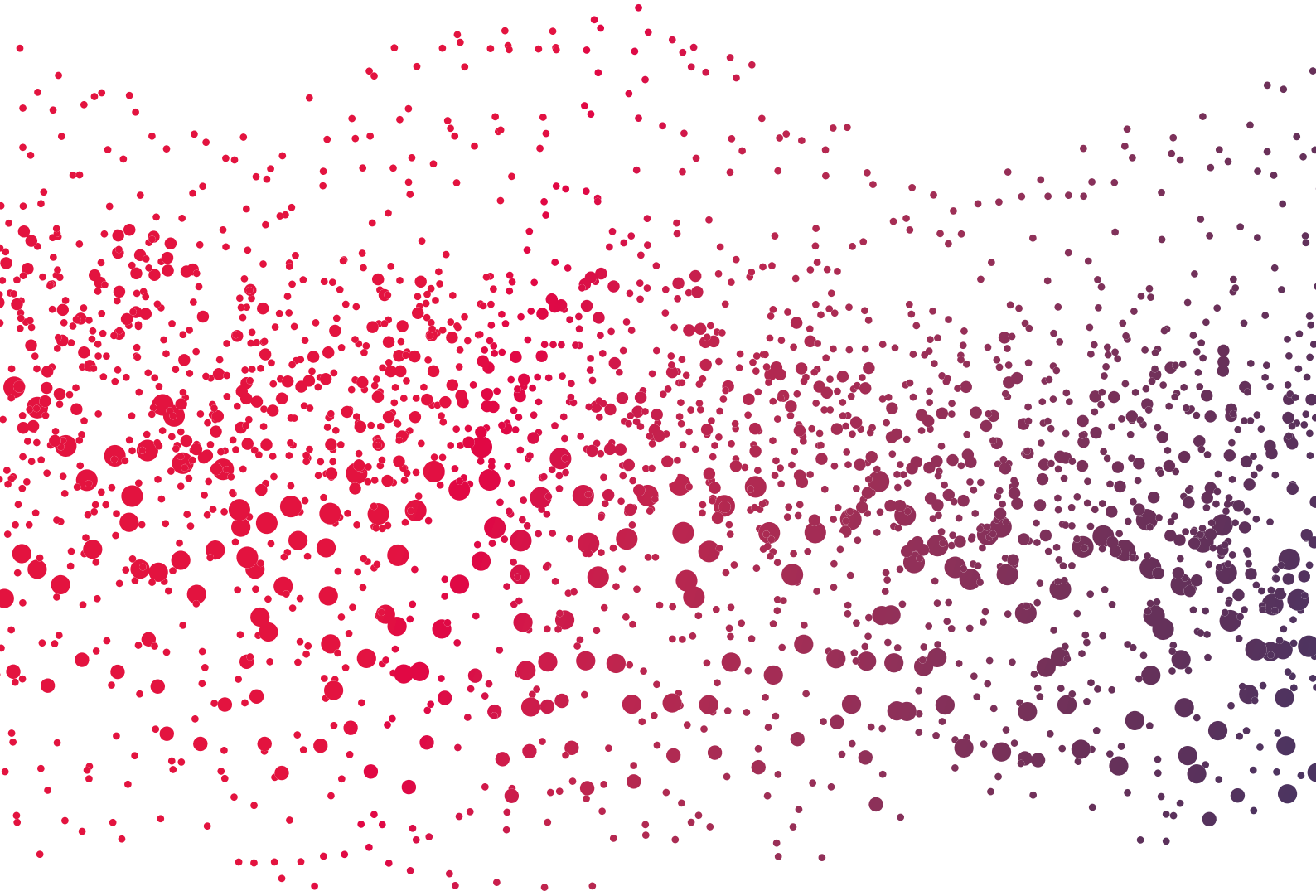

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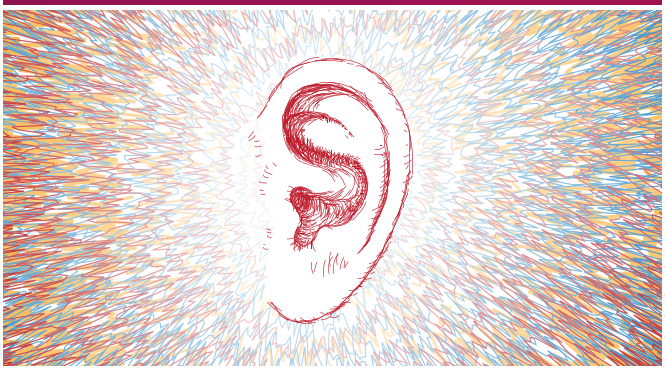
EDITORIAL



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Dear Readers,
I am an audiologist working for Amplifon New Zealand across both the Dilworth Hearing and Bay Audiology brands. For me as a clinician, the CRS provides an invaluable resource for the latest research in audiology and otology. I feel privileged to have the chance each quarter to select from hundreds of new articles to review as part of the team of CRS reviewers. These reviews provide me with the chance to read the most recent research across a range of clinically important topics, as well as to contribute to the issue produced by my colleagues across the world. In particular, I enjoy the opportunity to review articles that grow my knowledge in new areas and allow us to expand the range of services offered in our clinic, for example, through the introduction of vestibular testing.

This issue provides a series of interesting reviews covering a broad range of topics. In one article you will find a review of the aetiologies of Auditory Neuropathy Spectrum Disorder (ANSD). Based on several detailed diagnostic tests, this paper presents the prevalence of risk factors for ANSD and the results of genetic and imaging studies in a sample of children referred for cochlear implant assessment. The importance of such investigations in making appropriate management decisions for these children is discussed.

Another review presents a paper whose aim is to identify targets for intervention to increase hearing aid use. This study indicated that whereas motivation to use hearing aids was high in most adult participants, measures of volition, defined as having plans to use and cope with hearing aids, were significantly lower. Interventions designed to ensure motivation is translated into plans for action are therefore discussed as a potential target for increasing the use of hearing aids.

I hope you enjoy these and the other eight reviews presented in this issue.

Melissa Babbage,
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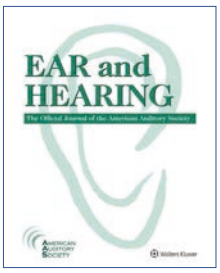
Dilworth Hearing and Bay Audiology,
New Zealand

DIAGNOSTIC ACCURACY OF OCULAR VESTIBULAR EVOKED MYOGENIC POTENTIALS

FOR SUPERIOR CANAL DEHISCENCE SYNDROME IN A LARGE COHORT OF DIZZY PATIENTS



Verrecchia L., Brantberg K., Tawfique Z. & Maoli D.

Ear & Hearing (2019): 40, 287-294.

By Melissa Babbage
New Zealand

The typical symptoms of superior canal dehiscence syndrome (SCDS) include pulsatile tinnitus, autophony, and increased vestibular sensitivity to sound and pressure changes. However, patients may also present with only dizziness without the classic symptoms of cochlear and vestibular hypersensitivity. Vestibular evoked myogenic potential (VEMP) testing has been shown to be a valuable tool in diagnosing SCDS.

The typical symptoms of superior canal dehiscence syndrome (SCDS) include pulsatile tinnitus, autophony, and increased vestibular sensitivity to sound and pressure changes. However, patients may also present with only dizziness without the classic symptoms of cochlear and vestibular hypersensitivity. Vestibular evoked myogenic potential (VEMP) testing has been shown to be a valuable tool in diagnosing SCDS. Patients with SCDS typically show decreased thresholds in the affected side for both cervical VEMPs (cVEMPs) and ocular VEMPs (oVEMPs), higher amplitude responses, and longer latencies for oVEMPs to bone-conducted stimuli. Previous research has shown good differentiation in VEMPs between SCDS patients and healthy subjects, but the diagnostic value of VEMPs for identifying SCDS in a population of dizzy patients has not previously been demonstrated.

• *METHOD*

This prospective study assessed the diagnostic accuracy of oVEMPs for SCDS in an unselected sample of dizzy patients referred for vestibular testing. 145 dizzy patients without middle ear disorders were included in the study: 10 who had SCDS; and 135 who had an alternative condition (such as Ménière's, acute unilateral vestibulopathy, or "undefined dizziness").

For each subject, oVEMPs were recorded in response to 500 Hz tone-bursts via air conduction (AC) and 125 Hz tone-bursts via bone-conduction produced by a Minishaker at the vertex (Cz) and the midline forehead (Fz). Because the oVEMP is primarily a crossed response, potentials recorded under each eye were considered to represent the vestibular response of the contralateral ear. Four oVEMP parameters were measured: n1–p1 peak to peak amplitude; n1 latency; amplitude asymmetry ratio (AR); and interaural latency difference (ILD). Diagnostic accuracy was assessed using receiver operating characteristic analysis and an area under the curve of >0.8 was considered adequate for clinical use.

• *RESULTS*

Analyses indicated four parameters accurate enough for clinical use across the three modalities: response amplitude for each stimulus; and response latency for BC Cz stimulation only. Regardless of stimulus modality, oVEMP amplitude was the best parameter for differentiating between patients with and without SCDS. Using a cut-off value of 16.7 µV, AC oVEMP amplitude achieved sensitivity of 100% and specificity of 89% in identifying patients with SCDS. Larger overlap in responses between the SCDS and non-SCDS groups was noted for all BC oVEMP parameters compared to AC oVEMP parameters.

• *DISCUSSION*

This study shows that oVEMP testing has high accuracy for the identification of patients with SCDS among a large group of dizzy patients. Accuracy was optimal when response amplitude was measured for oVEMPs evoked by 500 Hz tone-bursts delivered via AC. The sensitivity value of 100% for oVEMP amplitude indicated that all SCDS patients in the group were correctly identified, however the specificity value of 89% indicated a false positive rate of 11%. The authors suggest that this highlights the need for oVEMP testing to be

performed as part of a comprehensive test battery including evaluation of clinical symptoms at CT scanning.
The authors conclude that the high diagnostic accuracy of assessing AC oVEMP amplitude, in conjunction with the fact that it is a low cost and non-invasive test, means it is an ideal test for SCDS in dizzy patients. This is clinically useful given that only around 30% of SCDS patients present with the typical symptoms of vestibular sensitivity to sound and pressure change, whereas most will present with dizziness. AC oVEMPs could therefore be a useful screening tool for dizzy patients, particularly those who do not clearly fit other diagnostic criteria, to identify those with SCDS.
It is notable that BC oVEMP parameters had lower diagnostic accuracy than for oVEMPs elicited by AC stimuli. AC oVEMPs cannot be reliably recorded in patients with conductive hearing losses, therefore BC oVEMPs must be used in these cases. The authors recommend that an amplitude cut off criteria favouring specificity (i.e. a higher value) should be used to minimise false positives when BC oVEMPs are performed.

CRITICAL NOTE

This prospective study provides good evidence for the use of AC oVEMPs as a screening tool for SCDS in dizzy patients. It also highlights the need for screening for SCDS in patients who are dizzy but do not fit clear diagnostic criteria for any other disorders. It is important for audiologists to be aware that only around 30% of patients with SCDS present with the characteristic vestibular and cochlear hypersensitivity, and some patients may report dizziness as their only symptom. Referral for vestibular testing including oVEMPs in these patients may assist with the correct diagnosis.

Overall, the study concludes that oVEMP testing is a valid clinical test for SCDS in dizzy patients, and that AC oVEMP amplitude alone may be a valuable SCDS screening tool. •

THE CHRONIC CARE MODEL AND CHRONIC CONDITION SELF-MANAGEMENT:

AN INTRODUCTION FOR AUDIOLOGISTS

Convery, E., Hickson, L., Keidser, G. & Meyer, C.

Seminars in Hearing (2019): 40(1), 7-25.

By Jo Ritchie
New Zealand

This paper offers an introduction to models for the management of chronic conditions: chronic condition self-management, which refers to the skills and knowledge which patients acquire to manage all aspects of their chronic condition; and chronic condition self-management support, which focuses on the role the clinician must play in ensuring that patients have adequate support to acquire these skills.

• *INTRODUCTION:*

The health care system generally applies a biomedical framework and uses a clinician-led and technology-focused approach to treat medical conditions. The authors suggest that this approach is designed for addressing acute rather than chronic conditions. This study offers audiologists an alternative, called the Chronic Care Model, which sets out best-practice when managing chronic health conditions. The article discusses the concept of chronic condition self-management, where patients use their knowledge and skills to manage their condition. Clinicians can provide self-management support which can improve clinical outcomes. The article examines the degree to which chronic condition self-management has been incorporated into clinical practice and offers some suggestions for further research in this field.

• *WHAT IS THE CHRONIC CARE MODEL?*

The Chronic Care Model emphasises a collaborative relationship between the health care provider and the

patient. The six elements in the model are: (1) community; (2) health system; (3) delivery system design; (4) decision support; (5) clinical information systems; and (6) self-management support. Items 3-6 are components of the health system which are needed to provide effective care for chronic conditions. The community element recognises the role that community programs and advocacy groups play in chronic condition management.

• *WHAT IS CHRONIC CONDITION SELF-MANAGEMENT AND CHRONIC CONDITION SELF-MANAGEMENT SUPPORT?*

Chronic condition self-management refers to the skills and knowledge which patients acquire to manage all aspects of their chronic condition. Chronic condition self-management support refers to the way in which clinicians must ensure patients have adequate support for acquiring and using these skills.

CRITICAL NOTE

A strength of this article is that it provides a clear explanation of the chronic care model and chronic condition self-management. Audiologists are given clear guidance about the need to provide chronic care self-management support to patients. Some programmes for implementing self-management support in clinical practice are discussed. There is some evidence that the programmes provide positive clinical outcomes, but they are time intensive.

Overall, the article provides a good summary of the chronic care model and chronic condition self-management. Further research is needed to assess chronic condition self-management and develop clinically efficient systems for providing self-management support.

• *IMPLEMENTING SELF-MANAGEMENT SUPPORT IN CLINICAL PRACTICE*

- The Flinders Chronic Condition Management Program assesses patient self-management of any chronic condition through patient and clinician ratings on various items. The results assist with goal setting, but the assessment process is time intensive and the program does not provide any tools or interventions for improving self-management.
- The Chronic Disease Self-Management Program (CDSMP) is a group education program. The group is made up of patients with a range of chronic conditions who meet weekly for 2.5 hours over a 6-week period. The sessions are facilitated by two leaders, at least one of whom must be a layperson with a chronic condition. The benefit of peer facilitators is that they can role model positive behaviours. However, the group dynamic can make addressing individual needs more challenging.

• *EVIDENCE THAT SELF-MANAGEMENT RESULTS IN BETTER PATIENT OUTCOMES*

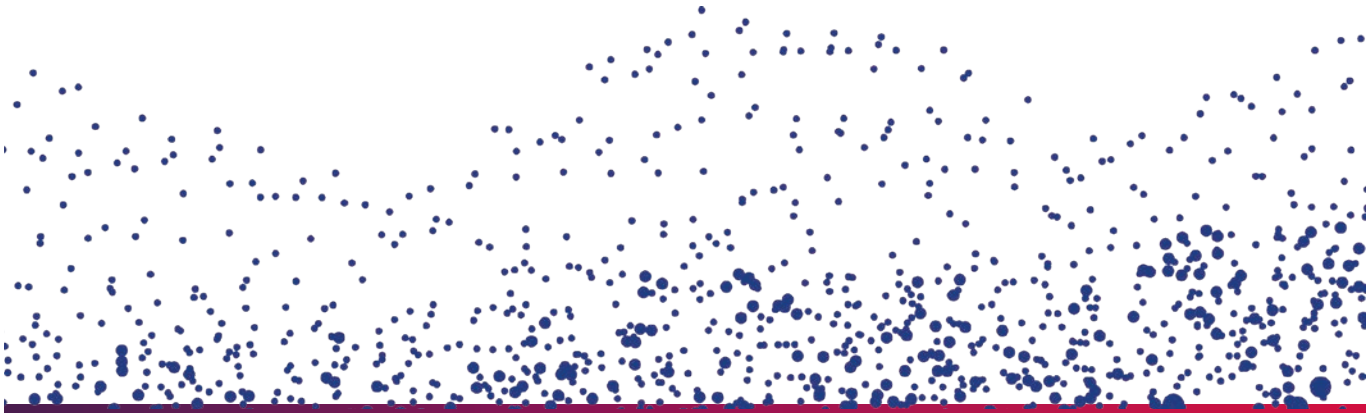
Chronic condition self-management support has been associated with improved patient outcomes. There is some evidence that the CDSMP provides small but significant improvements in self-reported self-efficacy and self-management activities. A limitation of the CDSMP is that it does not properly assess self-management skills prior to participation in the group education program. Research which combined use of the CDSMP and the Flinders Chronic Condition Management Program (which assesses self-management) indicated improvements over time across most aspects of self-management. A systematic review found that the most successful interventions are (1) multifaceted (2) tailored to meet individual needs; and (3) provided as part of a patient-clinician relationship that is collaborative.

• *EXTENT TO WHICH SELF-MANAGEMENT SUPPORT HAS BEEN ADOPTED IN HEARING HEALTH CARE*

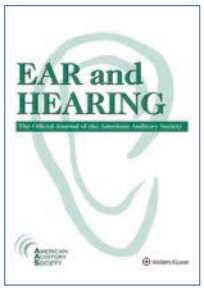
Aspects of self-management support have been adopted in aural rehabilitation programs. There is some evidence that these programs improve well-being and quality of life, but the evidence base is weak.

• *FURTHER RESEARCH*

Future research should focus on establishing a method for evaluating chronic condition self-management and developing effective interventions to improve self-management techniques. •



CLINICAL ASSESSMENT OF FUNCTIONAL HEARING DEFICITS:
SPEECH-IN-NOISE PERFORMANCE



Phatak SA., Brungart DS., Zion DJ. & Grant KW.

Ear & Hearing (2019): 40(2), 426-436.

By Min Roh
New Zealand

This clinical study investigates different speech-in-noise testing paradigms to identify which tests are more sensitive to elevated hearing thresholds, so that they can complement the pure-tone audiogram in identifying supra-threshold speech-in-noise deficits in both normal hearing individuals and those with hearing loss.

• *INTRODUCTION*

People with hearing loss report difficulty hearing in a variety of environments. Of these, perhaps the most common scenario would be hearing speech in the presence of background noise. This is because this involves higher-order processing skills to utilize various auditory cues and scene analysis. Clinical testing, therefore, can be very complex as it is impossible to replicate many of the soundscapes with which listeners are confronted.

It has been well established that the pure-tone audiogram alone does not give sufficient information about patients' listening difficulties. With the introduction of various speech-in-noise tests, audiologists now have the ability to investigate listeners' functional hearing capacity in a variety of environments, and the importance of these tests has been growing in the field of audiology research today.

The purpose of this study was to investigate various speech-in-noise testing paradigms in normal-hearing people and those with a range of hearing losses. The researchers sought to identify conditions/paradigms of speech-in-noise testing which are more sensitive to elevated hearing thresholds. That is, which speech-in-noise tests are predominantly affected by hearing loss. Having this information would allow a more complete assessment of auditory function and speech-in-noise processing in the clinic, creating the potential to offer better and/or more efficient solutions for the person.

• *METHODS*

Auditory tests used in this study involved assessing how each of these factors affected performance across people with a variety of hearing losses:

1. Speech Signal – ranging from open-set (NU6) to closed-set (Call signs)
2. Background Noise – ranging from steady-state noise to fluctuating noise
3. Signal-to-Noise Ratio (SNR) – measured at a variety of SNR levels
4. Spatial separation – modulating spatial separation of speech and masker
5. Spatial attention and stream segregation – assessment of this was included to assess auditory attention

Participants aged 18-55 years old, mostly recruited from a military population, were classified into four groups based on their audiometry configuration:

1. Normal hearing (Control)
2. Near-normal hearing
3. Mild hearing loss
4. Moderate hearing loss

A total of 12 tests from three testing paradigms were administered to each participant:

1. Speech Reception in Noise Test (SPRINT)

a. Participants were asked to repeat back a target word from the NU6 list, presented amongst multi-talker babble.

2. Speech in Noise Benefit Assessment Test (SINBAT)

a. Participants were asked to either repeat back (NU6) or type (call-signs) the target word presented among four different masker conditions (humvee noise, talker left, talker front, talker right)

b. Performed at various SNRs to obtain a performance curve and an SNR-50 score.

3. Spatial Attention Test (SAT)

a. Participant to identify the location of the target alphanumeric callsign (left, front, right) with simultaneous callsigns from the other speakers.

4. Functional Hearing Questionnaire (FHQ)

a. A self-report questionnaire administered to participants to quantify functional hearing ability/deficits which correspond to an aspect of auditory skill/ability.

• *RESULTS*

SPRINT

• No significant difference between performance of near-normal and mild hearing loss groups.

• Significant difference between performance of the moderate hearing loss group and the other three groups.

SINBAT

• Callsigns (closed-set) had a lower SNR50 and steeper performance slope than the NU6 words (open-set) as expected.

• Competing talker as maskers (fluctuating noise) resulted in a lower SNR50 and shallow performance slope than the Humvee noise (steady-state noise) as expected.

• Hearing thresholds impacted SNR50 as expected, but not the performance slope.

• For SNR50, the mild and moderate hearing loss groups were significantly different from the normal hearing control groups. Near-normal hearing groups were not significantly different from the normal hearing control groups.

SAT

• Significant difference between performance of the moderate hearing loss group and the normal hearing (control) group only.

• Participants performed better when presentation was on either side rather than when in front, most likely due to an ipsilateral ear SNR advantage.

OVERALL PERFORMANCE

• To compare and contrast overall test performance, that is, the global speech in noise performance, participants' scores were normalised with the normal hearing (control) group as the standard and combined to give a composite score of overall speech in noise performance.

• There was no significant difference between the normal hearing and near-normal hearing groups.

• A significant difference was found between the mild hearing loss group and moderate hearing loss group, as well as between the normal hearing (control) and near-normal hearing groups.

CRITICAL NOTE

In light of the fact that administering these two tests would take approximately 10 minutes, the clinical use of these tests may be efficient and beneficial for identifying functional speech-in-noise deficits in a way which enables clinicians to match these up with the patient complaints of their perceived hearing difficulties.

None of the speech-in-noise tasks were able to segregate performance between near-normal hearing and normal hearing groups. Consequently, future studies should endeavour to identify parameters which are more sensitive to tease out perceived listening difficulties in these people based on their audiometric configuration.

FHQ

• Participants with hearing loss reported greater perceived difficulties compared to the normal hearing group.

• The audiometric configuration alone accounted for only 9.25% of the variance, whereas the composite speech in noise score accounted for 17.25% of the variance, suggesting that the composite score was a better predictor for perceived listening difficulties.

• The specific questions that were significantly correlated with the composite score related to processing speed and the robustness of acoustic distortions, which suggests that the composite score and hence the speech in noise deficits found in this study were likely related to these aspects of speech processing rather than to the other areas of the questionnaire such as auditory attention.

• Of the 12 speech-in-noise tests, the tests involving speech recognition in the presence of multi-talker babble were most-closely correlated to the functional hearing deficits.

• *DISCUSSION*

Of the 12 tests administered, the SPRINT and six of the SINBAT tests showed significant speech in noise deficits across both the mild and moderate hearing loss groups. Of these, the SINBAT tasks involving NU6 +TkL and NU6 + TkR (open-set speech recognition in the presence of lateralised multi-talker babble) were the most sensitive to elevated hearing thresholds, as shown by increased failure rates and worst scores for both the mild and moderate hearing loss groups. This, in combination with the participants age and audiogram, accounted for approximately 80% of the variance in the composite scores from the 12 tests combined. •

FINDINGS FROM AETIOLOGICAL INVESTIGATION OF AUDITORY NEUROPATHY SPECTRUM DISORDER

IN CHILDREN REFERRED TO COCHLEAR IMPLANT PROGRAMS

Rajput K., Saeeda M., Ahmeda J. et al.

International Journal of Pediatric Otorhinolaryngology (2019): 116, 79–83.

By Reddy Sivaprasad – India

The authors studied the prevalence of various aetiologies leading to ANSD and recommended a two-level practical guideline for differentiating between them.

As defined by the authors, Auditory Neuropathy Spectrum Disorder (ANSD) a hearing disorder characterised by intact outer hair cell (OHC) function in the cochlea, evidenced by normal otoacoustic emissions (OAEs) or cochlear microphonics (CMs) in conjunction with severely atypical or absent auditory brainstem responses (ABR). The site of lesion can be located at the level of one or several of the following: the inner hair cells; the inner hair cell-auditory nerve synapse; the auditory nerve; and or/ the brainstem auditory pathways. Pathophysiology of this condition can involve inner hair cell (IHC) loss, synaptic dysfunction, auditory neural fibre/cell loss or dys-synchrony of neural impulses.

ANSD can result from a number of genetic conditions, or from external factors, the most common of which include premature birth, infections such as CMV, neonatal hypoxia, tumours, and trauma at birth. It is estimated that of the overall population of paediatric CI users, 7-10% present an ANSD aetiology. This paper studies the prevalence rate of several aetiological factors of ANSD using detailed diagnostic processes so as to define a set of guidelines for assessing patients presenting with this condition.

The authors performed a retrospective analysis of CI data from different hospitals in the UK. Factors studied were: age at diagnosis; aetiology; predisposing factors; syndromic and genetic insights. Two levels of study were used to differentiate between subtypes of ANSD children. Level 1 included imaging, CMV screening and genetic testing (for Connexin 26 and m.1555AG and Otoferlin; as well as OTOF and DFNB59 when relevant). Level 2 investigations were carried out only when there was sufficient clinical suspicion. In some neuro-metabolic conditions, hearing loss due to ANSD can be the first presenting symptom. The researchers identified a total of 97 children with ANSD.

The study found the following predisposing factors and their corresponding prevalence: prematurity (58%); jaundice (51%); ototoxicity (25%); septic (22%); vision (19%); CNS insult (13%); meningitis (7%). Of all the subjects, 52% showed a motor milestone delay, and 28% of children presented an Ophthalmological abnormality. Genetic anomalies were found for 13% of patients, and only 3 cases showed a CMV infection. In addition to this, 38% of subjects presented with a concomitant neurological

condition. Overall, imaging studies identified 33 cases of cochlear nerve deficiency, 29 cases of cerebral abnormality, 14 cases of widened vestibular aqueduct, 10 and 5 cases of vestibular and cochlear dysplasia respectively, and 34 cases of other anatomical abnormalities.
The authors demonstrate the wide heterogeneity of ANSD aetiology in children, thereby demonstrating the need for such assessments to be carried out in order to make appropriate management decisions. •

CRITICAL NOTE
Above and beyond finding prevalence rates of various ANSD aetiologies in a relatively large group, this study also successfully makes a case for a practical two-level assessment process for identifying these aetiologies. Such a guidelines could be of great assistance in predicting the success of CI.

HEARING LOSS IN UNILATERAL AND BILATERAL ENLARGED VESTIBULAR AQUEDUCT SYNDROME

Hunter DA, Ascha M., Gupta A., et al.

International Journal of Pediatric Otorhinolaryngology (2019): 118, 147–51.

By Reddy Sivaprasad – India

The study compares the difference in radiological and audiological test results in unilateral vs bilateral EVA across a large sample population.

Enlarged vestibular aqueduct (EVA) is the most common radiological abnormality in children or adults with progressive hearing loss. This can lead to a severe or profound degree of hearing loss often necessitating cochlear implantation. When a bilateral EVA is associated with thyroid dysfunction it is referred to as Pendred Syndrome, an autosomal recessive genetic condition resulting from a mutation in the SLC26A4 gene. However, some patients present with a unilateral enlargement of the vestibular aqueduct, with hearing loss in the corresponding side. In such cases, the underlying cause of the unilateral EVA is not Pendred syndrome.
The authors set out to examine the link between radiographic abnormalities of EVA and the resulting audiological differences between ears with bilateral and unilateral EVA by means of a retrospective-longitudinal study.
A total of 89 ears matched the inclusion criteria of the study. Of these, 45 belonged to male subjects and 44 to female subjects. Mean age at first audiogram was 5.68 years. 84% (n=75 of 89) of the ears came from patients with bilateral EVA and 16% (n=14 of 89) from patients with unilateral EVA. 37% (n=33 of 89) had an incomplete partition (IP II).

CRITICAL NOTE
Even though the groups under study did not present differences in their audiological characteristics, no genetic known mutations were found in unilateral EVA. This study did not include genetic analysis. The authors conclude that there is no difference in audiological characteristics of unilateral vs bilateral EVA.

Mean speech reception threshold (SRT), speech awareness threshold (SAT), and word recognition score (WRS) were 46.88 dB, 70.00 dB, 88.42%, respectively. No statistical difference was observed between bilateral and unilateral EVA ears across the entire spectrum of audiometric measures used in the study: Pure tone average (PTA); Speech Reception Threshold (SRT); Speech Awareness Threshold (SAT); and Word Recognition Score (WRS). In addition, the authors determined that with each passing year since the first audiogram, SAT increased while the WRS decreased. The data further showed a 9.13 dB increase in SRT for every mm. increase in VA midpoint width. •

AUDITORY TRAINING:
EFFECTS ON AUDITORY ABILITIES IN CHILDREN WITH HISTORY OF OTITIS MEDIA

Donadon C., Dominici Sanfinsa M., Reis Borgesa L. & Colella-Santosb MF.

International Journal of Pediatric Otorhinolaryngology (2019): 118, 177–80.

By Reddy Sivaprasad – India

The authors studied children with repeated episodes of otitis media with effusion leading to a central auditory dysfunction. Of a group of 34 paediatric subjects with this condition, 20 children were given auditory training and 14 others underwent visual training. Those who underwent the auditory training showed a significant improvement in all the tests after eight weeks of therapy.

The mere presence of otitis media can result in a hearing loss ranging from 0-40 dB. Whether fluctuating or permanent, Otitis Media affects sound perception during a critical language-learning stage of life. Such inadequate sound perceptions seem to affect neural function, structure, and connectivity. In other words, it can result in a permanent central auditory dysfunction. It is known that children with central auditory processing disorder (CAPD) experience difficulties in a range of auditory situations, such as discriminating, identifying and decoding acoustic signals; organizing and storing auditory information and assigning meaning to information in linguistic and non-linguistic contexts.

The authors set out to determine whether appropriate auditory training can remediate auditory processing deficits seen in children and adolescents with a history of otitis media. The study covered a population of 34 children and adolescents aged 8 to 14. Inclusion criteria for the study were: a history of otitis media with effusion and bilateral ventilation tubes placement; at least three episodes of otitis media with effusion; and one surgery performed for placement of bilateral ventilation tube in their first five years of life. All children were diagnosed with CAPD and none had received any form of therapy. Before and after auditory training for eight consecutive weeks, they underwent a series of tests: Dichotic Digits test; Pitch Pattern test; Gaps in Noise test; and Synthetic Sentence Identification test.

CRITICAL NOTE

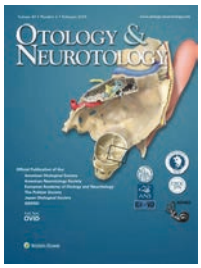
This innovative study might offer seminal insights on this important topic. The design was appropriate and met the purpose clearly. Although the results are positive, one week after ending the training sessions, the real question is, how long do the results last?

The population under study was divided into two groups. Group 1 included 20 subjects who received auditory training. This was done by way of a stimulation protocol designed to stimulate the auditory abilities of the subjects, composed of: (i) binaural integration using dichotic listening exercises; (ii) minimum time interval perception exercises to improve aspects of temporal resolution; (iii) nonverbal tasks related to frequency, intensity and duration to improve temporal ordering; and (iv) exercises with competitive noise to improve figure-ground working. Group 2 consisted of the remaining 14 subjects with the same history and diagnosis. These received visual training.

Pre-therapy, no significant difference was found across the four CAP test results between the two groups. Post-therapy, however, Group 1 (who received auditory training) improved across all measures and achieved statistically significant improvements. Group 2 did not show any improvements post visual training. The authors conclude that CAPD shown in children with ventilation tubes can be treated successfully with auditory training. •

HEARING PRESERVATION IN COCHLEAR IMPLANT SURGERY:

A META-ANALYSIS



Snels C., IntHout J., Mylanus E., et al.

Otology & Neurotology (2018): 40, 145-53.

By Reddy Sivaprasad – India

This meta-analysis of 26 published studies on hearing preservation measures a number of variables in a different way and their effect on the hearing preservation after cochlear implantation.

Though the initial focus of cochlear implantation was to restore hearing, continuous evolution of surgical techniques and technology have enabled us to also take into account hearing preservation (HP) at low frequencies in the implanted ears. HP methods range from different surgical techniques to different electrode array designs, and also include the administration of corticosteroids during surgery.

The authors observe that several studies, reviews and meta analyses have been published on the matter of HP in CI, but that these have failed to demonstrate conclusively the best strategies for preserving HP. For instance, one systematic review did not find benefits of cochleostomy or the round window approach. Another meta-analysis, however, showed that the cochleostomy approach, a slow electrode array insertion, a soft tissue cochleostomy seal, and the use of postoperative systemic steroids were associated with better HP.

Through an extensive meta-analysis, the authors set out to assess the effects of different HP methods, including: type of surgery; electrode array design; steroid use on residual hearing in patients undergoing CI surgery. Alongside this, their study also analysed the effect of follow-up time on HP results.

The authors carried out a systematic search of randomised controlled trials and other studies in search engines like PubMed, Embase, and Cochrane Library published before January 29, 2018. After successive screening to meet inclusion criteria, the results of 26 articles (936 CI users) were included in the meta-analysis. The authors used the following formula for HP%, which was first introduced by Skarzynski, et al. PTA of 250 Hz, 500 Hz and 1000 Hz was used.

HP% = [1 – (PTA postoperative – PTA preoperative)/(120 – PTA preoperative)] X 100.

There are four categories of HP%:

HP1 is complete or near-complete preservation with a HP of more than 75%.
HP2 is partial preservation with a HP of 25 to 75%.
HP3 is minimal HP with a HP of 0 to 25%.
HP4 is loss of hearing/no hearing when no measurable hearing is preserved.

The authors carried out a random-effects meta-regression statistical test for the HP outcome (HP%) in relation to each of the HP methods (surgical technique, electrode array design, inserted electrode length, insertion speed, and corticosteroid use) and for the different follow up times - 1 month, 6 months, and 12 months or more. It was found that:

- All patients fall in either category HP1 or HP2. After the surgery, HP decreases with time.
- The mean differences in HP% between cochleostomy and the round window approach at 1 month, 6 months, and 12 months or more post-op were 13.1, 18.6, and 1.7%, respectively. Overall, the round window approach resulted in better HP%.

- The differences in HP% outcome between the straight and the perimodiolar electrode array at 1 month and 6 months post-op were 24.7 and 1.2% respectively, in favour of the straight electrode array. However, this difference disappeared after a month.
- No significant difference was found in HP% between a short (<17mm) and a long insertion of the electrode (>17mm) at all post-op milestones.
- There was no significant difference in HP% outcome between a slow and unreported insertion speed postoperatively.
- No significant difference was found between the four categories of corticosteroid use at 1 month, 6 months, and 12 months or more postoperatively.

Even though the studies under review in this paper are very heterogeneous in nature and therefore difficult to compare, some of the results hold good and show the value of conducting this kind of meta-analysis the scope for a meta-analysis is clearly available. Age and other health conditions were not included in this study; these would require further clarification in order to avoid basic confusions. •

CRITICAL NOTE

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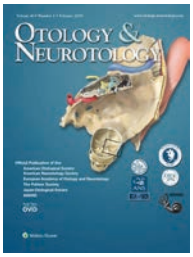
OBJECTIVE MEASURES OF TINNITUS: A SYSTEMATIC REVIEW



Jackson R., Vijendren A. & Phillips J.

Otology & Neurotology (2018): 40, 154–63.

By Reddy Sivaprasad – India

A systematic review of tinnitus publications was conducted to find objective tests which could be used to detect the presence of tinnitus in human subjects. There is a growing need for such a measure but, to date, the quality of evidence has proved inadequate to recommend any particular measure.

Tinnitus is a significant issue affecting several millions of people worldwide, and which has significant consequent morbidity to patients. In some medicolegal cases tinnitus can even have financial implications for employers and the health care system as a whole. Currently there is no routine objective diagnostic process for tinnitus. The purpose of this review was to identify the published work in the area of developing a diagnostic process for objective verification the presence of tinnitus.

The authors define "objective measure" as being a diagnostic measure which cannot be manipulated or exaggerated by the subject and therefore is particularly useful in identifying the presence of tinnitus. They carried out a systematic literature search using the MEDLINE, EMBASE, CINAHL, and BNI databases, for papers published up to May of 2018. This covered only articles on research on human subjects. After discarding articles related to categories including behavioural, psychoacoustic, cognitive, and audiometric, a total of 21 studies were included in this review. The following potential objective measures were reported in these studies:

- Two studies analysed the use of brain-derived nerve growth factor (BDNF), a neuropeptide which plays a key role in synaptic plasticity and neurogenesis, in tinnitus patients and control subjects. Both studies reported higher levels of BDNF in the blood samples of subjects with mild tinnitus.
- DPOAEs in 10 participants with tinnitus and 16 controls found that participants with tinnitus presented significantly lower mean DOPAE amplitudes at 1281 to 1560 Hz, 5120 to 6250 Hz, and 7243 to 8837 Hz

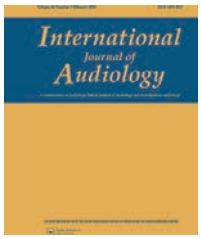
- Late Latency auditory evoked potentials such as like P300. Mean latency of P300 was higher in tinnitus subjects compared to control subjects. Some studies showed that ABR mean amplitude of wave 1 (originating in the distal part of the VIII CN) was significantly smaller within the tinnitus group; and that of wave V, with a central origin, was not significantly different between the groups.
- Quantitative electroencephalography (QEEG) is a type of EEG with strategically placed scalp electrodes for assessing conditions such as depression and dementia. Tinnitus patients presented stronger waveform patterns at certain frequencies, also called bands. One QEEG study with a sample population of 155 controls and 304 subjects with tinnitus found that female subjects with tinnitus demonstrated higher average in alpha waves, whereas male tinnitus patients showed lower average power across all bands compared to control group male subjects.
- fMRI recordings in tinnitus patients while exposed to monaural and binaural sounds the volume of which they were asked to continuously adjust as compared to the loudness level of their tinnitus. Patients with unilateral tinnitus had unusually low activity in the contralateral Inferior Colliculus (to the side of tinnitus). The study found symmetrical IC activity in bilateral or central and non-tinnitus sufferers

CRITICAL NOTE

There is a legal, diagnostic and therapeutic need for an objective measure of tinnitus. This study made significant effort to unify existing knowledge for further discussion and action.

The authors conclude that, although existing literature provides many attempts by researchers to find an objective measure of tinnitus, there is insufficient evidence to support the use of a universally recognised objective measure. The quality of evidence was low due to the small group size of the studies and because of the varying criteria of any given test. •

BEYOND MOTIVATION: IDENTIFYING TARGETS FOR INTERVENTION TO INCREASE HEARING AID USE IN ADULTS



Chelsea S., Munro KJ., Dawes P., et al.

International Journal of Audiology (2019): Vol. 58(1), 53-8.

By Sofie Peeters – Belgium

Participants scored very high on being motivated to use their hearing aids, but mean scores for volitional variables were lower. The differences between motivation and volitional variables were large.

• *INTRODUCTION AND METHOD*

Hearing impairment is a worldwide health problem that is associated with many negative outcomes. Studies have shown that hearing impairment is associated with poor quality of life, cognitive decline, feeling of depression, anxiety, frustration, loneliness and fatigue, etc.

In most cases permanent hearing loss is treated with hearing aids, but there is also considerable non-use of hearing aids (from 5% to 40%). In order to investigate how interventions could increase hearing aid use, this study – the first to do so – applied the Health Action Process Approach (HAPA, Schwarzer 2008) in the domain of hearing health care. The HAPA model posits a motivational and volitional phase. In the first phase a person forms an intention to change his/her behaviour. Variables in this phase are behavioural intention and self-efficacy. The second phase (volitional phase) is

Motivational phase		Volitional phase	
Behavioural intention	**Self-efficacy**	**Action planning** (Planning when to perform the behaviour)	**Coping planning** (Planning how to deal with barriers)
		The items were answered on 7 point scales ranging from strongly disagree to strongly agree	
I intend to wear a hearing aid as advised definitely do not-definitely do	My wearing a hearing aid as advised would be difficult-easy	I have made a plan regarding when to wear my hearing aid.	I have made a plan regarding what to do if something interferes with my plans to wear my hearing aid.
I want to wear a hearing aid as advised definitely do not-definitely do	I believe I have the ability to wear a hearing aid as advised definitely do not-definitely do	I have made a plan regarding where to wear my hearing aid.	I have made a plan regarding how to cope with possible setbacks to wearing my hearing aid.
How likely is it that you will wear a hearing aid as advised? Not likely-Very likely	How confident are you that you will be able to wear a hearing aid as advised? Not at all-Very much so	I have made a plan regarding how often to wear my hearing aid.	I have made a plan regarding how to wear my hearing aid in difficult situations.
		I have made a plan regarding in which situations to wear my hearing aid.	I have made a plan to prevent lapses in wearing my hearing aid.

characterised by variables such as action planning and coping planning.

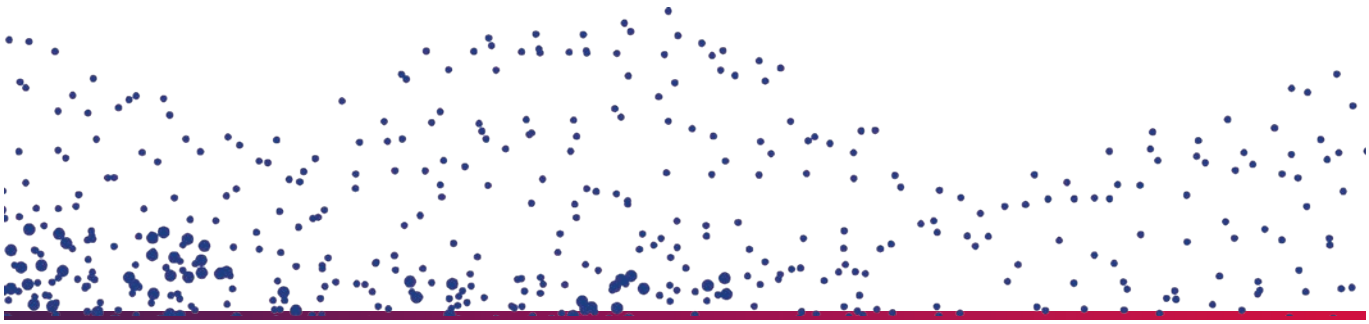
In order to investigate the hypothesis that whereas adult hearing aid users can be highly motivated to wear hearing aids, they simultaneously report a deficit in the very volitional variables which have demonstrated to be important in translating that motivation into action, a questionnaire (14 items) based on the HAPA model was used. Patients, referred for a hearing assessment by their general practitioner, completed the questionnaire after audiologists screened the patients and before hearing aids were prescribed and fitted.

• *RESULTS*

Participants scored very high on being motivated to use their hearing aids, but mean scores for volitional variables were lower. The differences between motivation and volitional variables were large. The differences between behavioural intention and self-efficacy (motivational phase) and the differences between action planning and coping planning (volitional phase) were small to medium. These findings confirmed the hypothesis that the motivation of participants was higher than their volition.

• *DISCUSSION AND CONCLUSIONS*

The high level of motivation could be expected because the participants had both acknowledged the possibility of a hearing loss and attended the hearing assessment appointment (In addition, of the 253 patients who were invited to join the study only 125 were eligible to take part and only 67 participants completed and returned the questionnaire).
Volition, before hearing aid fitting, scored lower in this study. This may be an indication that interventions to increase hearing aid use should therefore focus more volitional processes to ensure that the motivation of patients is translated into action, rather than trying to boost motivation further.
On the other hand, further research is needed to specify the role of volitional variables after hearing aid fitting. Could they predict hearing aid use? Or could interventions, using behaviour change techniques around volitional variables, boost hearing aid use? •



A REVIEW OF THE EFFECTS OF UNILATERAL HEARING LOSS ON SPATIAL HEARING

Kumpik DP. & King AJ.
Hearing Research (2019): 372, 17-28.

By Paul Van Doren – Belgium

The auditory system can adjust to changes in the available sound localisation cues, either by relying more heavily on spectral cues, or by learning a new relationship between the altered cues. The plasticity of auditory localisation mechanisms requires the development of practical training protocols.

This overview reviews the effects of unilateral and asymmetric hearing loss on spatial hearing. More specifically, it focuses on whether or not, and to what extent, adaptive changes in the brain compensate for the imbalance in inputs as a result of this asymmetry.

The asymmetry due to unilateral hearing loss has implications on the performance of tasks relating to sound localisation and spatial release from masking. This type of hearing loss triggers other compensatory cues. Such strategies can compensate to a large degree for this type of hearing loss. Training should further help develop these coping skills even after hearing loss in adulthood. The question is whether the capacity to generate these skills can be generalised so as to develop potential rehabilitation strategies.

CRITICAL NOTE

This article shows very clearly that the consequences of asymmetric or unilateral hearing loss can be partially resolved through training, at least for localisation in the horizontal plane. But there is no evidence that this type of localisation (mostly on spectral cues) affects the spatial masking release in a positive way and provides better understanding in noisy situations.

At the same time, trying to address the issue by using hearing aids, or CIs also involves an adaptation period, depending on the plasticity of the brain, for the reorganisation of the cortex to take place. This process also merits a proper training method so as to minimise the duration of this adaptation.

BINAURAL PROCESSING, IMPORTANCE AND LIMITATIONS.

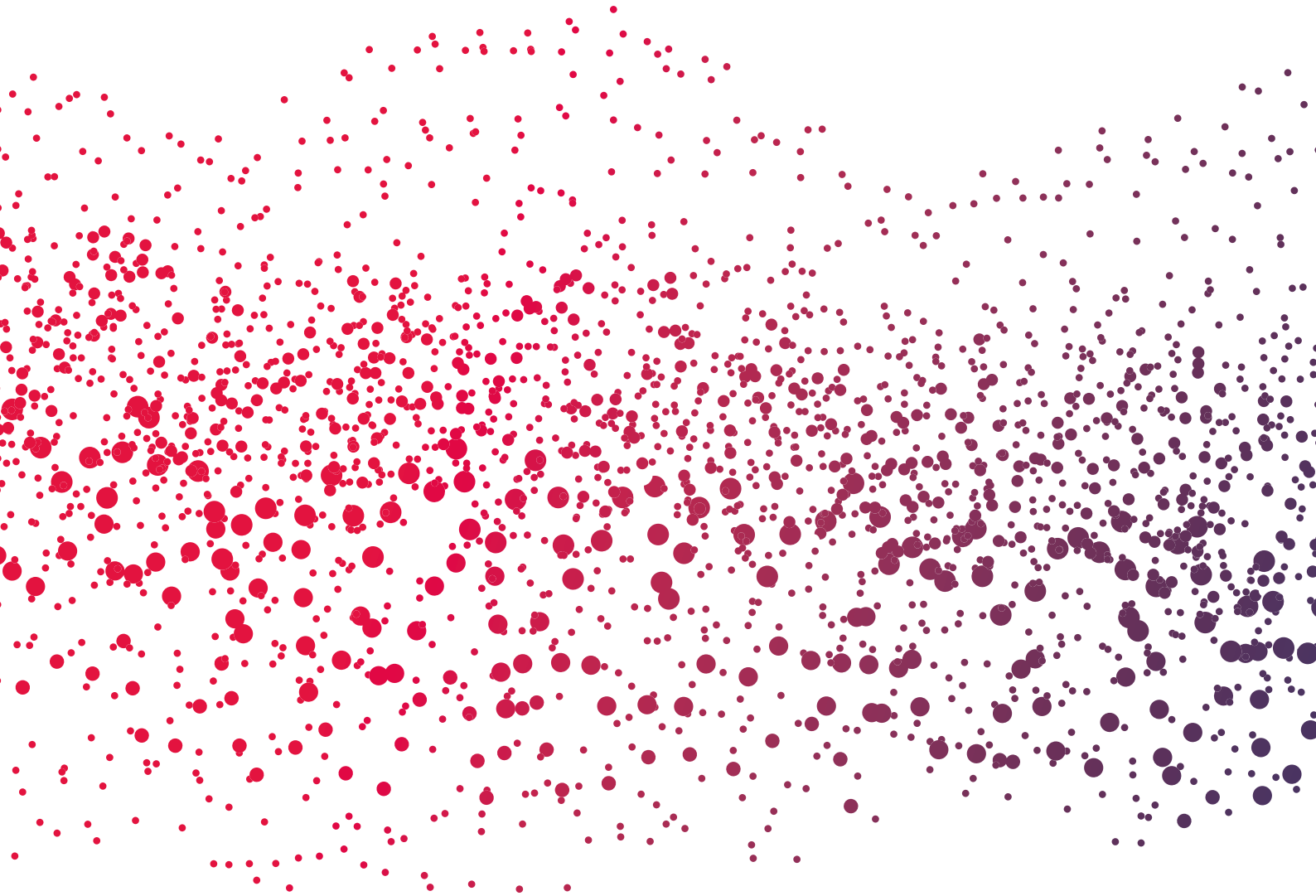
The duplex theory of sound localisation uses the interaural level differences (ILDs) for higher frequencies and interaural time difference (ITD) for lower frequencies in the horizontal plane; while vertical localisation depends more on spectral cues and their variations. Nevertheless, these spectral cues can add information in the horizontal plane to resolve confusion. Binaural processing also provides better speech understanding in noise, using the "spatial release from masking" phenomenon, which provides a segregation between the talker and the surrounding noise, e.g. what is referred to as the cocktail-party phenomenon.

Less attention has been given to the role of spectral cues this process.

Of the sampled schoolchildren, 3% show an asymmetry of 15-40 dB HI. Temporary losses (due to otitis media, for example) can influence localisation and masking release. Unilateral treatment (e.g. CI) can exacerbate these differences. Regarding the development of the auditory system, studies show that even a temporary unilateral hearing loss causes reorganisation in the primary auditory cortex, and less so in the inferior colliculus, resulting in amblyaudia or "lazy ear". Due to the plasticity of the brain, spectral cues become more important for localisation. So, localisation with only one working ear can be learned. In animal experiments this learning ability has been successfully proven.

As for the mature brain, experiments with mammals have shown that auditory brain plasticity still functions in adults, even for humans, and can generate (at least in part) the localisation in the horizontal plane. For example, studies on the matter have shown that with a specific training regime, impaired listeners were able to improve their ability to localise broadband noises and monosyllabic words.

The authors conclude that the auditory system can adjust to changes in the available sound localisation cues either by relying more heavily on spectral cues, or by learning a new relationship between the altered cues. The plasticity of auditory localisation mechanisms requires the development of practical training protocols. Recent studies have suggested sensorimotor feedback to improve the rate and extent this adaptation. The question remains whether the improvements can be transferred to daily life, and, very importantly, can lead to improved speech-in-noise perception. •



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