Case study of sudden onset, bilateral auditory, visual and vestibular neuropathy

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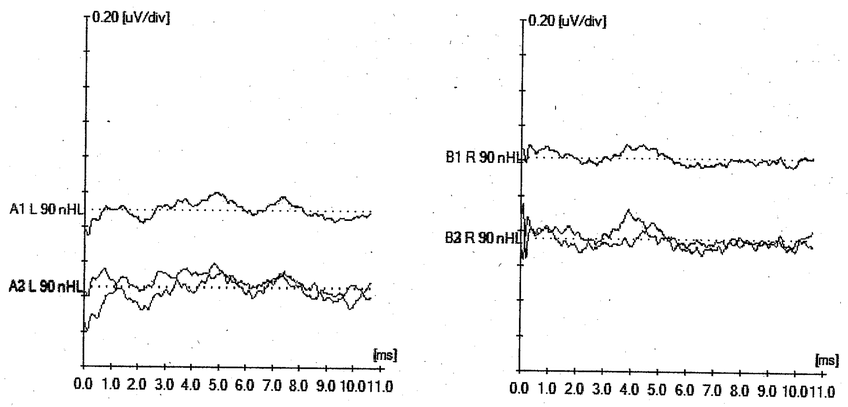
Brief Overview of Case

- 66 year old afro-carribean male
- No previous audiological or neurological significant history
- Keen runner (run marathons and runs regually)
- No recent foreign travel
- On no medications and not seen GP for several years
- Presented via A+E and admitted with sudden onset blindness and profound hearing loss

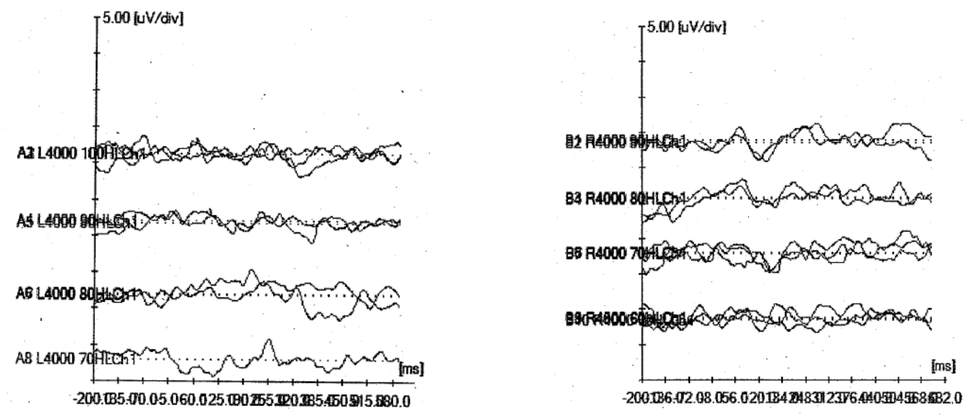
Tests performed

Over the 6 weeks in hospital patient had the following tests:

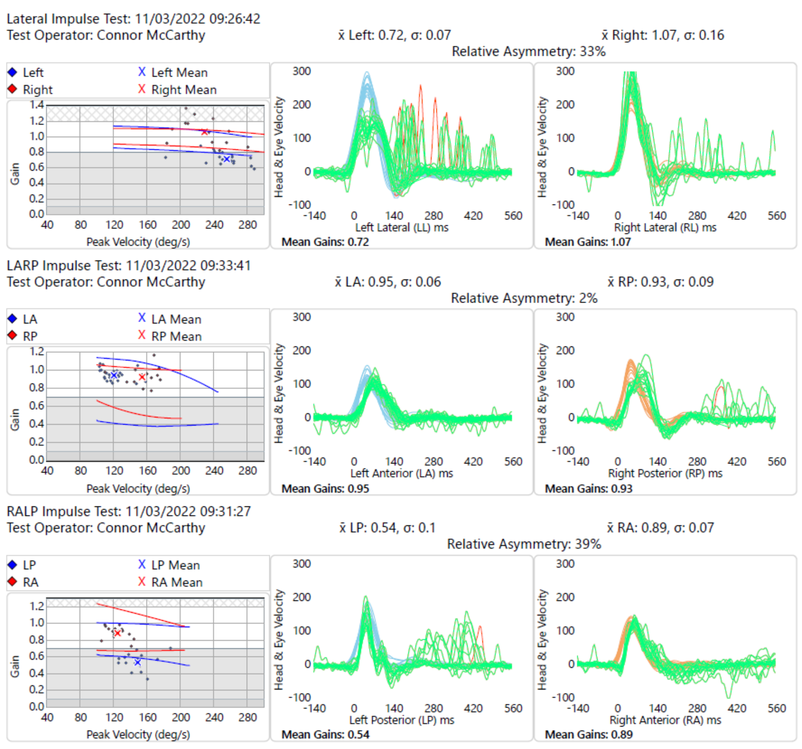
- Full neurological work up including EEG
- Visual evoked response testing (PERG, SERG, VEP, MFVEP, MFERG)
- Auditory evoked response testing (PTA, Tympanometry, OAE, ACR, NABR, TABR)
- Vestibular function tests – vHIT, VNG



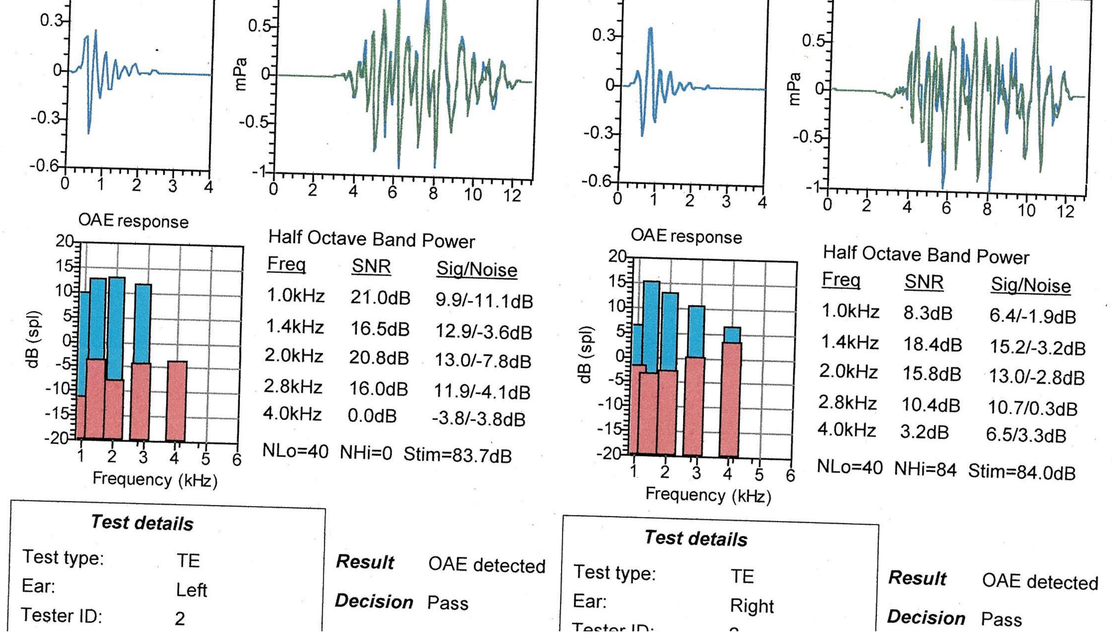
90dBnHL Neurological Click ABR



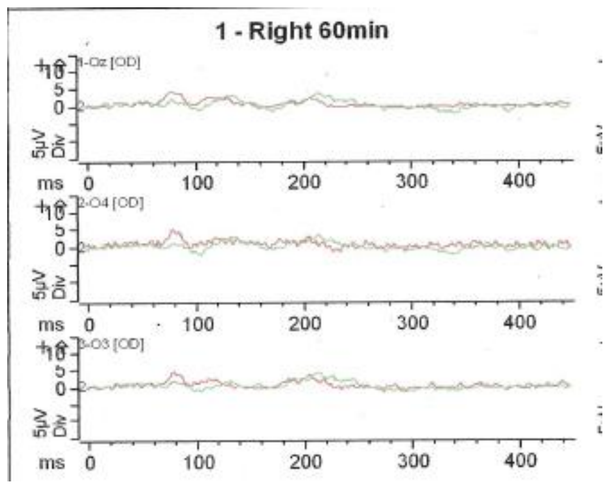
4kHz Cortical Responses



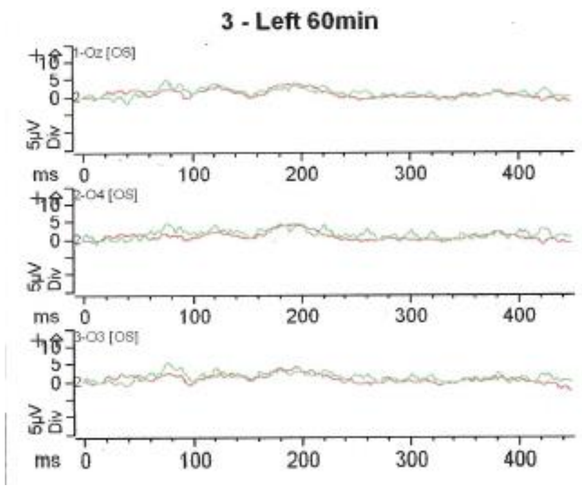
vHIT



TE-OAEs



VEP



Results

- Profound pure-tone audiometry and cortical thresholds bilaterally
- Present TE-OAEs bilaterally
- Absent / poor morphology 90dBnHL click neurological ABR
- Abnormal left horizontal canal vHIT
- Absent / vastly reduced VEP's

Discussion

- Results appear to show sudden onset bilateral auditory and visual neuropathy of unknown cause
- Not progressing well with hearing aid but does not want to consider CI
- Investigations have shown no clear cause (possible carbon monoxide history with faulty boiler)

The New BSA Auditory Steady-State Response Guidance in Clinical Practice

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Introduction

- New BSA ASSR Guidance document was published in 2022
- Auditory Steady-State Responses (ASSRs) are evoked potentials that are used for the subjective estimation of hearing threshold in patients of all ages
- Clinical applications include: timely hearing threshold estimation for hearing aid fitting, corroborating ABR results, hearing level monitoring for CMV patients, assessment of older children and adults with learning difficulties or suspected non organic hearing loss, theatre recordings.
- Document enhances understanding of the technique and includes suggested applications, testing protocol and limitations
- The current ongoing project looks into how well ABR and ASSR results correlate when the BSA protocols are applied exclusively.

Methods

- Neonates referred by the Newborn Hearing Screening Programme were assessed with ABR and ASSR under natural sleep
- Only results suggesting a hearing loss (>20dBeHL) were included to avoid floor effects
- Results reflecting a conductive hearing loss were included only when results were obtained in the same session making them comparable.
- Results were obtained with the Interacoustics Eclipse system. Both techniques used the same Narrow Band CE-Chirp stimuli
- The differences between the results obtained with the two techniques were expressed in dBeHL and dBnHL (before and after corrections were applied), before they were analysed

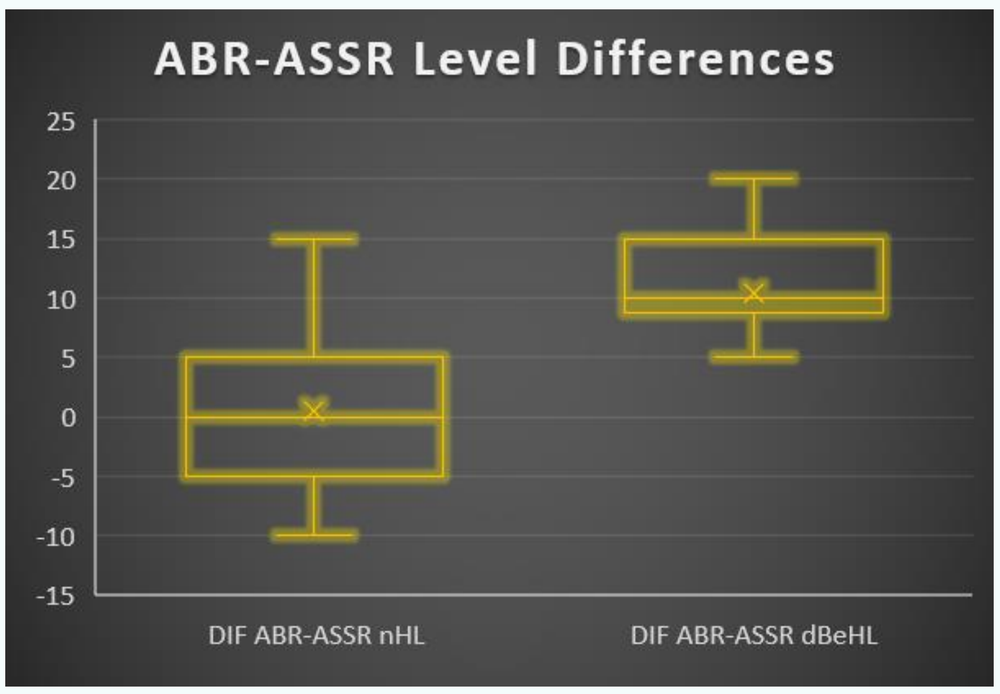

Fig 1 Threshold Differences between ABR and ASSR results, without corrections (left) and after corrections (right) were applied.

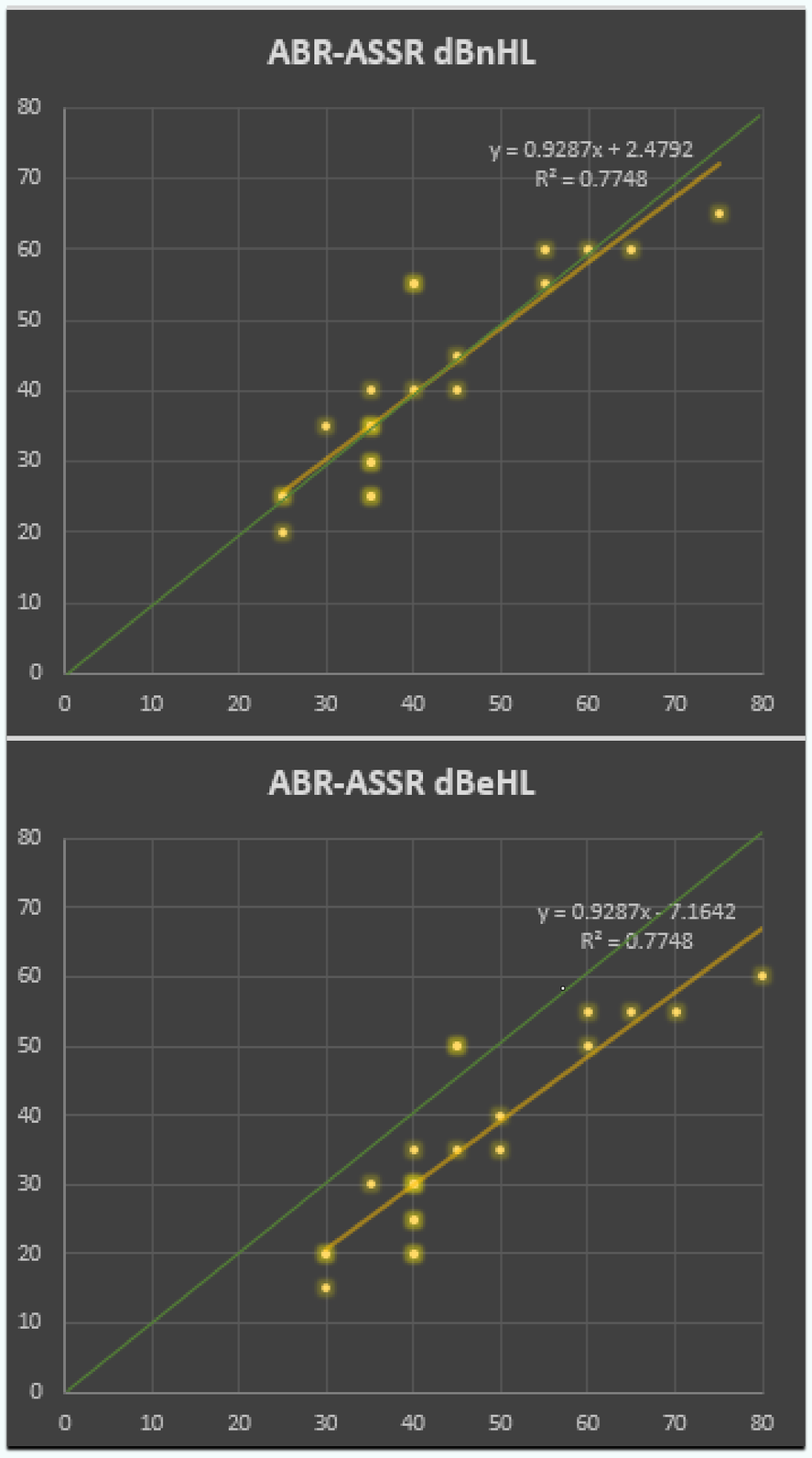

Fig 2 Correlation between ABR (vertical axis) and ASSR (horizontal axis) results before (top) and after (bottom) corrections were applied.

Results

- 21 sets of results were included for analysis
- There is a strong correlation between ABR and ASSR results (Fig. 2)
- The mean difference between ABR and ASSR results was 0dB before corrections and 10dB after corrections (Fig. 1)

Discussion

- Using the BSA Guidance, ASSR technique can be an accurate method for threshold estimation at least in neonates.
- The result differences between the techniques is lower before corrections are applied. This could be due to the fact that the set of corrections differ although both use the same stimuli.
- It is suggested that when one technique is used to inform a starting point for the other, the dBnHL levels are used.

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1. BRITISH SOCIETY OF AUDIOLOGY (2022), Auditory Steady State Response (ASSR) Testing. Available at: https://www.thebsa.org.uk/resources/ [2022]
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Vestibular dysmorphia and cochlear hearing impairment in Down's syndrome

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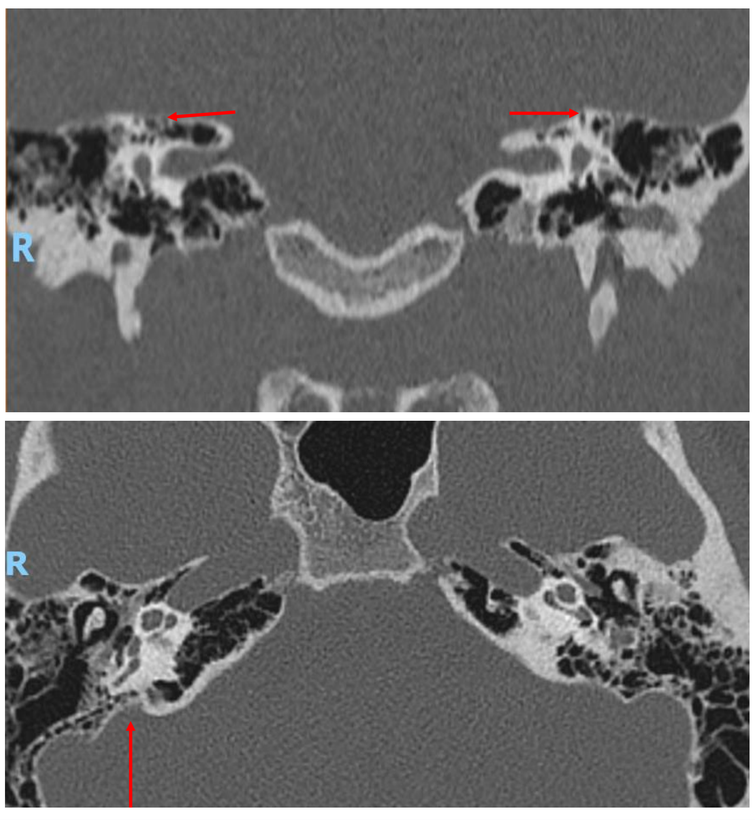
Introduction

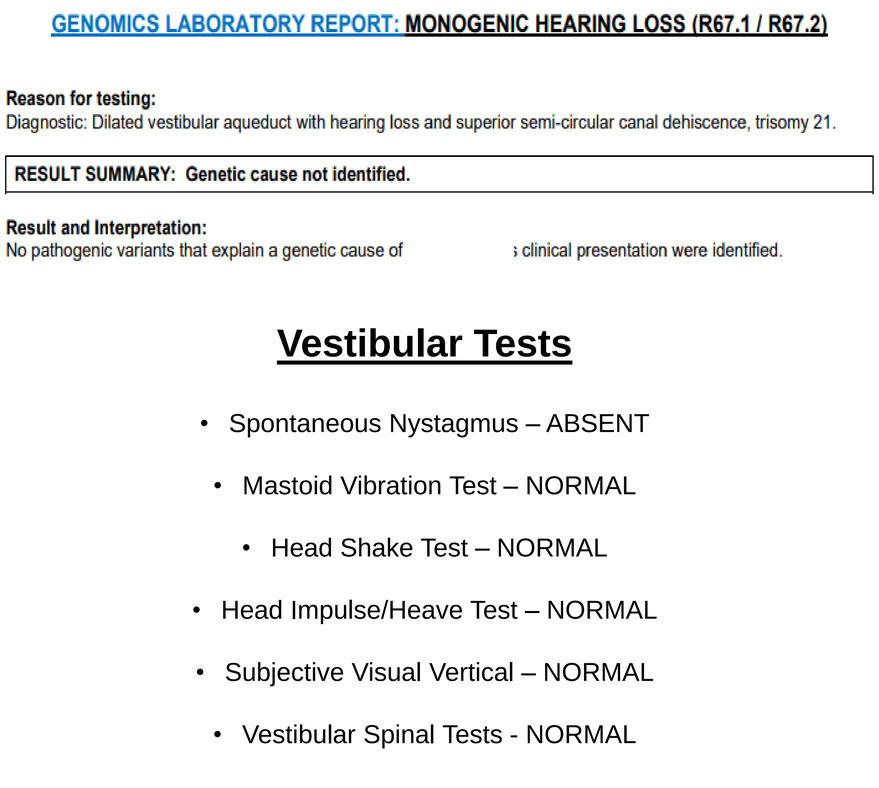
Patients with Down's Syndrome (DS) typically present with conductive hearing impairments in more than 75% of cases. Sensorineural hearing loss is rare and found in about 4.5%. Temporal bone abnormalities have been identified but the true prevalence is not known as children with this condition do not undergo routine temporal scans. In those who do, 75% have been reported with various abnormalities where less than 10% constitute third windows. This presentation highlights a mixed hearing loss in a child with DS and multiple third windows in the same subject that has not been reported before.

Patient history

A child diagnosed with DS was identified and regularly monitored in the Audiology department. The child presented with mild aural dysplasia and persistent otitis media with effusion. Pure tone audiometry and tympanometry testing were performed in accordance with BSA guidelines and a conductive hearing loss was identified. In 2017 the conductive air-bone gap increased and this was reflected in tympanometry testing which showed a flat response. Two years later a mixed loss appeared in the left ear, with the right side still presenting with a mild conductive impairment. The patient was fitted with a contact-mini bone conductor hearing aid at this time. Post pandemic, the child then presented with a more pronounced mixed hearing loss in the left ear, with middle ear recovery proven by normal, peaked tympanometry suggesting a 3rd window pathology. The patient received some benefit from the hearing aid use and continued to use it even when the conductive element of the hearing impairment had resolved.
This phenotype led to aetiological investigations to determine the underlying cause, including the full vestibular test battery. A high resolution CT scan of the temporal bones showed bilateral superior semicircular canal dehiscence and a right sided enlarged vestibular aqueduct. R65 and R67 gene panel testing and karyotype testing to investigate sensorineural hearing loss were normal. Vestibular function tests assessing static, low, mid, and high frequency semicircular canal function and gravitational sensor function were all normal. The child did not exhibit any 3rd window symptoms.



(Top) Bilateral Superior Semi-Circular Canal Dehiscence **(Bottom)** Right Enlarged Vestibular Aqueduct



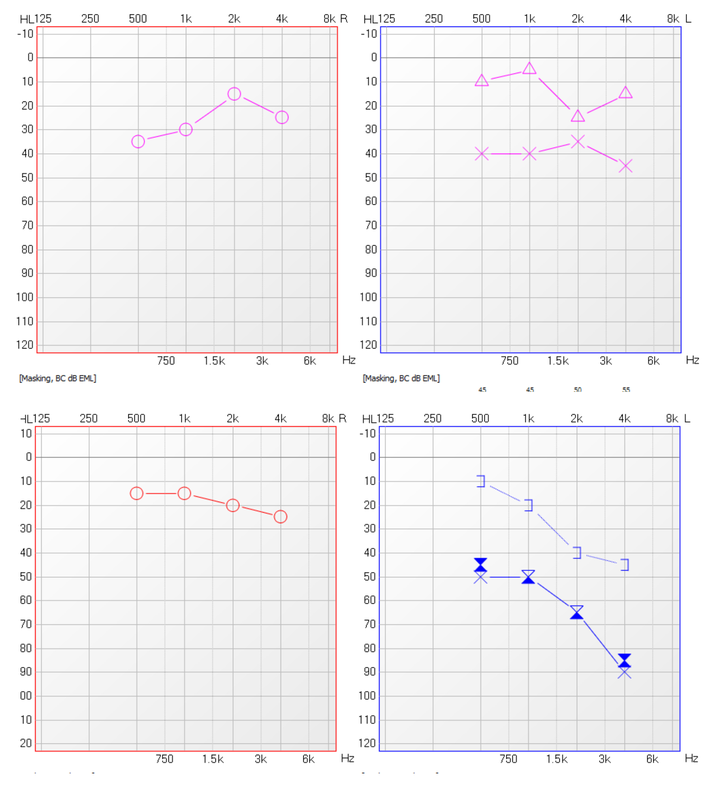
GENOMICS LABORATORY REPORT: **MONOGENIC HEARING LOSS (R67.1 / R67.2)**

Reason for testing:
Diagnostic: Dilated vestibular aqueduct with hearing loss and superior semi-circular canal dehiscence, trisomy 21.

RESULT SUMMARY: Genetic cause not identified.

Result and Interpretation:
No pathogenic variants that explain a genetic cause of ; clinical presentation were identified.

(Top, middle) Genetics Report



(Top) Audiogram June 2015 **(Bottom)** Audiogram Sept 2021

Vestibular Tests

- Spontaneous Nystagmus – ABSENT
- Mastoid Vibration Test – NORMAL
- Head Shake Test – NORMAL
- Head Impulse/Heave Test – NORMAL
- Subjective Visual Vertical – NORMAL
- Vestibular Spinal Tests - NORMAL

Discussion

The commonest cause of hearing loss in Down's syndrome is persistent conductive hearing loss due to otitis media with effusion. Sensorineural hearing loss is very rare and usually occurs in approximately 5% of patients, manifesting in the mid-teens. Temporal bone abnormalities are sporadically reported and this cohort of paediatric patients do not routinely undergo temporal CT scans. When such abnormalities are found in temporal bone structures, less than 10% present with a 3rd window pathology.
Our child initially presented with persistent otitis media with effusion, followed by recovery of middle ear function but the conductive hearing loss continued and we began to see the development of a mixed hearing impairment on the left side. The patient was extensively investigated and it was proven through imaging investigations that the bilateral 3rd window was the underlying cause of the hearing impairment. Therefore, we cannot discount the possibility of a mixed hearing loss developing in the right ear in the future.

Conclusions

It is crucial that children with DS, with persistent conductive/mixed hearing losses are fully investigated for future management implications. Our case highlights the sensorineural aspect in Down's, therefore such children must undergo regular monitoring and situational counselling as to how to manage these audio vestibular phenotypes and mitigate risk factors for optimal function. Vestibular quantification is also important as vestibular structural abnormalities may accompany such a hearing loss as was in our case, with the mixed loss being caused by the third windows.
Alongside the hearing impairment and canal dehiscence, our child was identified as having a second vestibular abnormality in the right ear, therefore we should not rule out the possibility that multiple vestibular dysmorphias may be present in the same patient and look closely at the vestibular system holistically through imagining. Multiple third windows have not been reported as yet as shown in our case. Such findings have important connotations for future vestibular symptom manifestation and management. Parents and patients need to be educated on the distinct possibility of hearing loss progression and vestibular deterioration as part of the individualised management plan.

References

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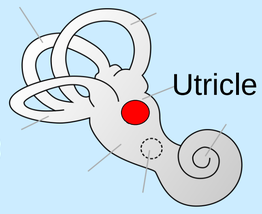
Clinical Utility of the Ocular Counter Roll test:

A new test for Utricular Function



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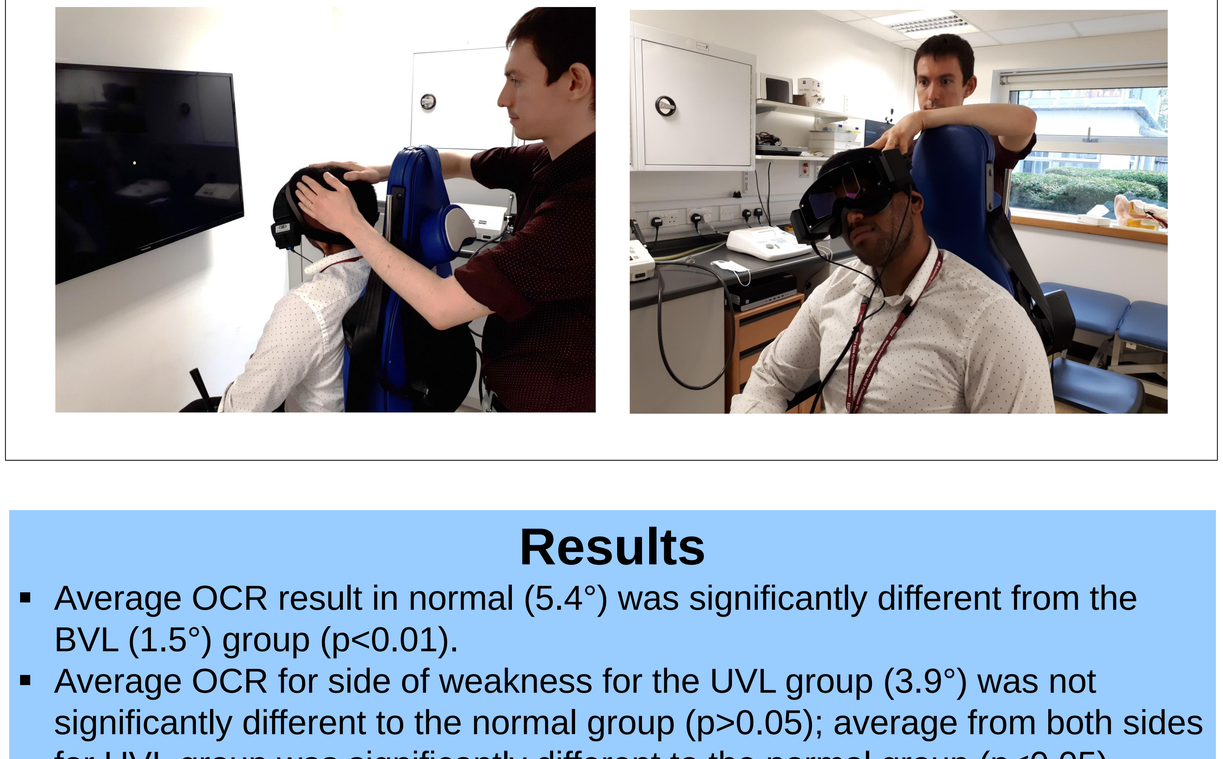
Introduction

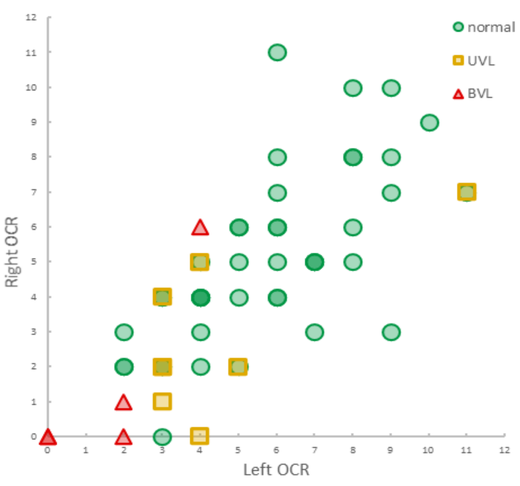
- Ocular counter roll (OCR) is where the eyeball rotates torsionally in response to lateral head tilt.
- There are two parts to the reflex:
  - Dynamic OCR – driven by the vertical semicircular canals.
  - Static OCR – driven by the utricle, one of the Otoliths
- **Similar sensitivity and specificity to oVEMPs[1] but much quicker and easier to perform.**
- Previously, only performed in laboratory conditions with small sample sizes but Interacoustics' latest VisualEyes and VNG goggles now allows the test to be performed in a clinical setting.
- The aim is to establish its utility in a clinical environment, obtain normative data and compare to previous studies.[1 2]

Methods

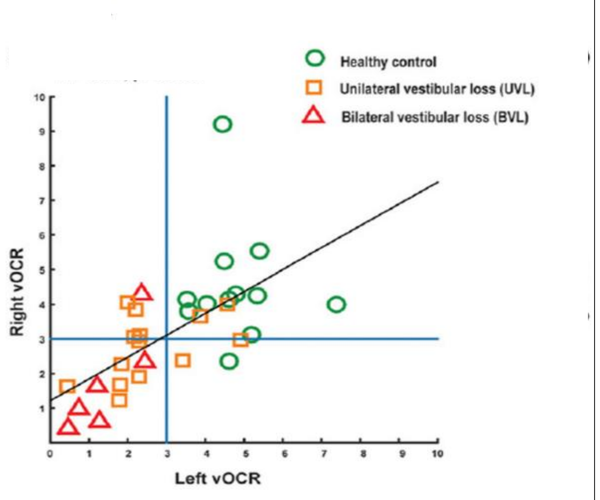
- 23 healthy controls, 22 patients with normal vestibular function, 5 with bilateral vestibular loss (BVL) and 7 with unilateral vestibular loss (UVL) confirmed with caloric or vHIT were tested.
- OCR was performed with OCR setting on Interacoustics' VisualEyes software with VNG goggles. Patient sat facing a fixed point 1m away. Calibration performed for pupil tracking and torsion. Baseline measurement was recorded for at least 5 seconds and the head tilted approximately 30° for at least 20 seconds to the left side, the patient's head was then tilted to the right for at least another 20 seconds before returning to centre.
- OCR was measured by comparing baseline measurement to the maximum OCR after 20 seconds on each side.
- 10 controls were retested with the leading head tilt to the right side initially to compare any impact of the side that is tested first and also to measure test retest reliability.
- Two sample T-tests were used to assess significant differences and a Receiver Operator Characteristic Curve was produced and Geometric mean calculated to find the optimum threshold.



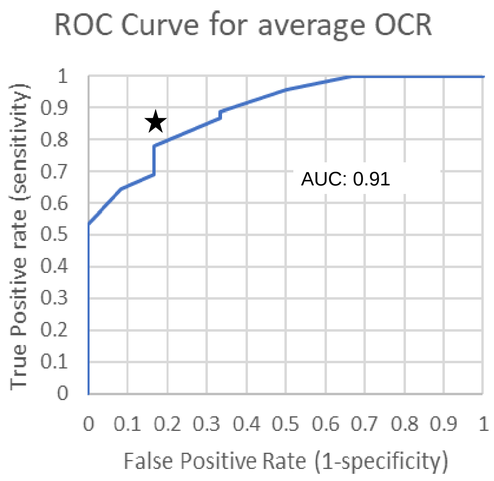
https://www.interacoustics.com/news/ocular-counter-roll



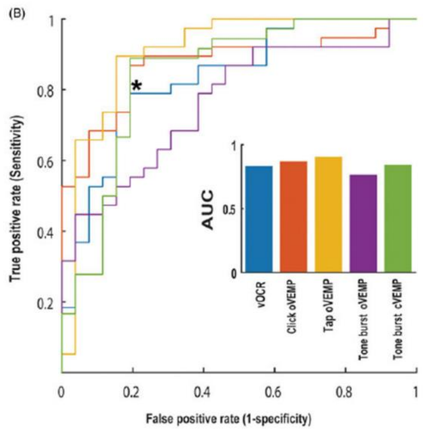
Ranger & Jay (2022)



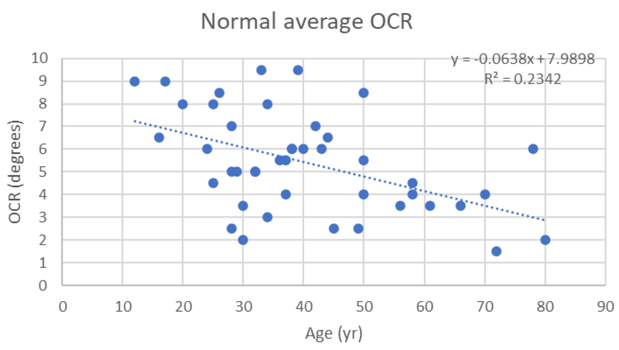
Otero-Millan et al (2017)



Ranger & Jay (2022)



Otero-Millan et al (2017)



Results

- Average OCR result in normal (5.4°) was significantly different from the BVL (1.5°) group ($p<0.01$).
- Average OCR for side of weakness for the UVL group (3.9°) was not significantly different to the normal group ($p>0.05$); average from both sides for UVL group was significantly different to the normal group ($p<0.05$).
- No significant difference between controls and normal patients ($p>0.2$)
- No significant difference in OCR for the side that was tested first and test-retest reliability was within 1° similar to previous studies.[1 2]
- The normal group average OCR showed a weak negative correlation with age.
- **AUC using average OCR provided 0.91 with an optimum threshold of ≤3° as a positive result with sensitivity of 78% and specificity 83%.**

Discussion

- Results match closely to Otero-Millan et al.(2017) despite using patients with varied aetiologies and without confirming Utricular weakness (e.g. oVEMPs, nerve section).
- UVL group did not reveal significant asymmetries on the side of lesion compared to the normal group. All of these patients apart from one have chronic UVL over years. Sadeghpour et al. (2021) showed improvement in OCR over time in UVL.
- **Average OCR from testing both sides showed a significant difference compared to the normal group in this study despite chronic UVL** therefore, this could be a more sensitive measure in chronic UVL but cannot lateralise the side of lesion.
- Normal patients showed a weak negative correlation with age; with a larger sample size with truly health controls, OCR may require age-corrected normative values. There are no studies that have reviewed differences in age.
- OCR is a quick, simple and tolerable test for Utricular function with high sensitivity and specificity. Results from this study compare well with previous studies suggesting a 3° threshold for positive utricular dysfunction.
- Clinicians should consider keeping lights on during testing to provide a larger iris to improve tracking precision and, measure maximum OCR results at least 20 seconds post-head tilt to avoid dynamic OCR artefacts.

References

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Listening preferences of new adult hearing aid users: a registered, double-blind, randomised clinical trial of initial fit versus real-ear fit

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INTRODUCTION

- Hearing aids are typically programmed using validated audiogram-based prescription methods and verified using real-ear measures.
- Hearing aid software can estimate prescribed targets (initial fit).
- Manufacturers' initial fits are now more accurate than ever due to developments in technology and computation; thus, the benefit of routinely using real-ear measurements (REM) for new adult users is unclear (1,2).

Aims:

- Determine whether new adult hearing aid users prefer REM or the initial fit using a preference diary on a daily basis.
- Question users about the reason for their preference

METHODS

- This double-blind, randomised, mixed method study was pre-registered in the Open Science Framework platform (OSF; osf.io/d2bjm) and approved by the North-West Liverpool Central Research Ethics Committee (Ref: 20/NW/0283).

Participants

- Direct referrals of adults with mild-to-moderate sensorineural hearing loss and who had no previous experience with hearing aids were asked to participate in this clinical trial.

Procedures

- All participants were fitted (in accordance with the BSA guidelines) with one or two NHS Oticon Engage behind-the-ear hearing aids.
- Each hearing aid was fitted with two programmes—the REM and initial fitting approaches—with modifications based on the user's feedback, as per the clinics normal practice.
- Both fitting approaches were saved as two hearing aid programmes (A and B). The participants and their audiologists were blinded to the order of the programmes.
- Participants were told to compare the two fitting approaches in many listening environments on a daily basis for six weeks and record their preferences.

Preference diary and follow-up questionnaire

- Each participant was provided with a diary with one page for each day of the 6-week trial. Each page contained the following:
  - Four 7-point Likert scales measuring the participant's preferences for the clarity and comfort of sounds in quiet and noisy environments; and
  - A question about the participant's overall preference.
- All participants were asked to complete the follow-up questionnaire, which contained a question about the reasons for the participant's preferences.

RESULTS

Participants

- 58 participants were deemed eligible for inclusion and were fitted with the two fitting approaches. Of these, 45 participants (aged between 27 and 89 years) completed this clinical trial.
- The pure-tone average for those who completed the study (averaged across 0.25, 0.5, 1, 2 and 4 kHz) was 34 dB HL (SD = 12). The configuration was typical of age-related hearing loss.

Adjustments to the initial settings

- 13 participants (22%) requested modifications to their initial REM and initial fit programmes.
- All adjustments were relatively small (the mean absolute difference in gain before and after adjustment was 1.7dB).

Deviation from prescription targets

- The median mismatches from NAL-NL2 targets for the initial fit and REM programmes were generally close (see Fig. 1).
- Both fitting approaches resulted in less gain at high frequencies compared to the NAL-NL2 target, especially the initial fit.
- The difference in the root-mean-square errors (of deviations from 0.5–4 kHz) between the fitting approaches at average input levels was statistically significant ($p < 0.05$), with the REM values being closer to targets (3.2 vs 5.3 dB).

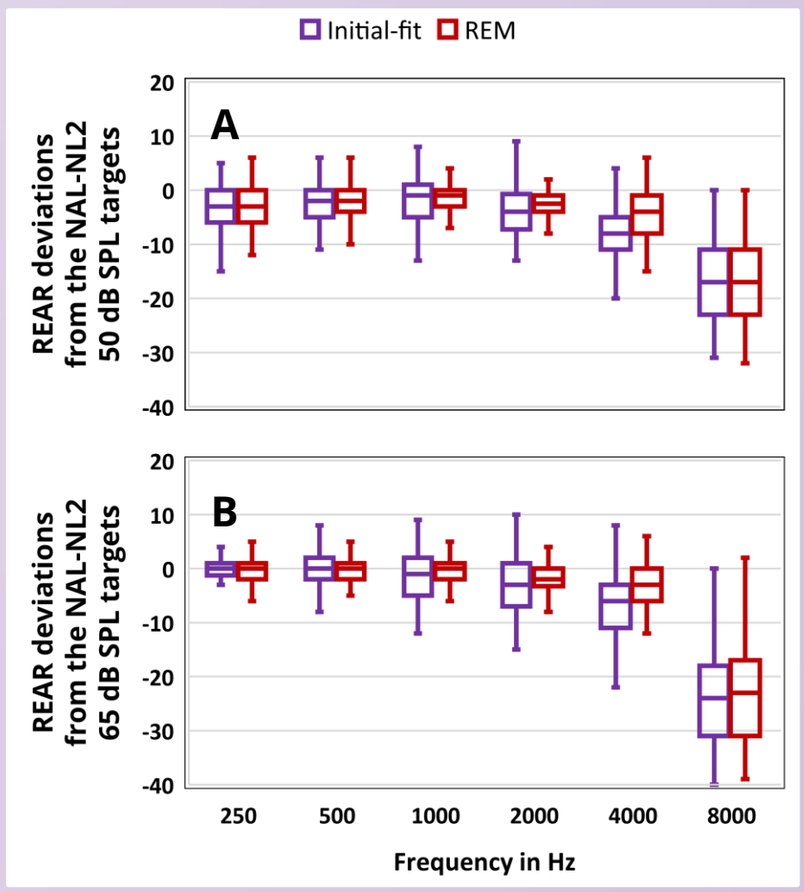

Fig. 1. *Box plots of the mismatches between the measured real ear aided responses and NAL-NL2 targets for REM and initial fittings at 50 dB SPL (top panel) and 65 dB SPL (bottom panel) input levels. Medians and interquartile ranges are represented by the middle lines and the upper and lower ends of each box. The minimum and maximum values are represented by the whiskers.*

Aim 1: Listening preferences

- Regarding the clarity and comfort of sounds in quiet and noisy environments, participants' ratings were averaged from weeks 3 to 6. Fig. 2 shows the medians and interquartile ranges for all listening conditions. Positive ratings indicated preferences for the REM programme.
- The median clarity ratings in quiet and noisy environments were around zero, whereas the ratings for comfort were in favour of initial fit (see Fig. 2). As indicated by the sign test, only comfort in quiet and noisy conditions significantly favoured initial fit ($p < 0.05$)
- In terms of the participants' final preference, more preferred the initial fit than REM (60% vs. 22%), and the difference was statistically significant ($p < 0.05$).

Aim 2: reason for preference

Thematically analysing participants' responses revealed that:

- The main reason for initial fit was that 'is mellow and sounds are less annoying'.
- The main reason for REM was that 'is clearer and provides access to treble sounds'.

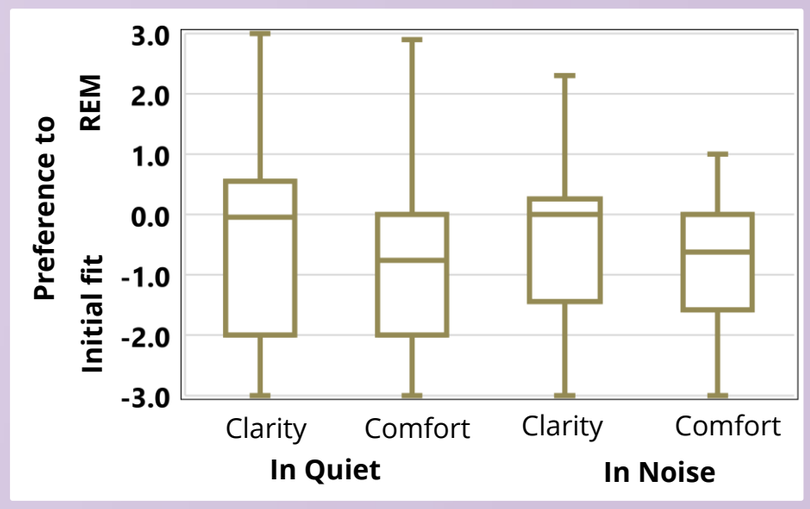

Fig. 2. *Medians and interquartile ranges for the participants' preferences.*

TAKE HOME MESSAGES

- The findings suggest that manufacturers' estimations of perceptions have become more accurate than before.
- At least for the model of hearing aid used in the present study, initial fit is sufficient for new adult fittings with instead of REM, time could be spent to provide, for example, more patient-focused support that addresses unique hearing difficulties.

POTENTIAL LIMITATIONS

- We do not know if initial dislike for one setting means the participants did not give due time to both programmes and prevented possible acclimatisation; and
- It may have been possible to manipulate user preference if, for example, we were able to demonstrate that persevering with a particular programme would result in better performance.

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https://doi.org/10.3766/jaaa.19057
[2] Narayanan et al . IJA 2022
https://doi.org/10.1080/14992027.2022.2053594

ACKNOWLEDGMENTS

IA is partially funded, and KJM and HD supported, by the NIHR Manchester Biomedical Research Centre. IA is also supported by the Deanship of Scientific Research at the College of Applied Medical Sciences Research Center at King Saud University. Special thanks to all audiologists at Withington Community Hospital

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SUPPORTED BY NIHR | National Institute for Health Research

Evaluation of North Wales Cochlear Implant Remote Check Service: Including Service User and Clinician Feedback.

Rhianwen Clwyd Davies, Advanced Practitioner Audiologist.
Betsi Cadwaladr University Health Board

Introduction

The North Wales Cochlear Implant service introduced Cochlear™ Remote Check in August 2020. During this period the team needed to adapt how they delivered certain aspects of the service due to COVID-19. Cochlear™ Remote Check was seen as a good alternative to our annual review appointments and was offered to all patients who were suitable.

Cochlear™ Remote Check allows CI users who have a Nucleus N7 or Kanso 2 processor to complete a battery of tests using their compatible mobile device via the Nucleus Smart app, while in the comfort of their home.

In March 2022, as restrictions were easing, we evaluated the change made to the service. We felt it was important to obtain both service users' and clinicians' opinions regarding the implementation of Cochlear™ Remote Check to replace routine annual review face to face (F2F) appointments.

Historically annual review appointments were an hour long and held at the service user's closest clinic. A partial booking letter and questionnaire would be sent annually for the user to arrange an appointment if they felt it was warranted. We would encourage them to attend an appointment every 3 years.

Aim

To analyse the data since the roll out of Cochlear™ Remote Check service from September 2020 to March 2022. To evaluate the completed service user and clinician questionnaires to obtain their view of Cochlear™ Remote Check in comparison to a F2F appointment.

Method

Data was collated from Cochlear Portal and Auditbase. Two questionnaires were designed, one for service users and one for clinicians. The service user questionnaire had six objective questions, four multiple choice questions and two open-ended questions for comments. The clinician questionnaire consisted of seven questions which included three multiple choice and four open ended questions. The questions were aimed at capturing ease of use, preferred method (remote check or F2F) and time to complete the check.

Service user questionnaires were sent to 22 patients who had completed a remote check in the last 3 months (December 2021-March 2022) Clinician questionnaires were sent to all audiologists who work in the North Wales Cochlear Implant service (N=6). The questionnaire was sent via an email with word attachment, or a link to a Microsoft form.

Results

Data collected from Cochlear Portal Aug 2020 – March 2022.

- Total enrolled onto Cochlear™ Remote Check N= 54 (12% caseload)
- Total of remote checks completed since August 2020 N= 99

Actions from the completed checks:

- No further action**:** **70%**
- Clinic visit required: **22%**
- Other action' required: **8%** e.g. sending links to info video

Cochlear Remote checks took on average ~30 minutes for a clinician to review, instead of an hour for a face to face appointment. This generated a clinician time saving of 35 hours over a period of 18 months.

Questionnaire Data:

Service user questionnaires were sent to 22 users with 7 responses (31% response rate).

Question 1, 3 and 5 results are presented opposite.

Question 4 and 6 were open-ended questions asking why they felt it was more or less convenient and to obtain any further suggestions or comments. Question 2 asked how long it took to complete the remote check. The most common answer was 15-30 minutes (N=4).

Clinician questionnaires were sent to 6 staff with 5 responses (83% response rate).

The first 3 question's results are presented opposite. Q4, 5 and 7 were open ended questions, around how Cochlear™ Remote Check could be improved, what do you like about Cochlear™ Remote Check and any further comments. Question 6: "I feel confident discussing and enrolling a patient onto Cochlear™ Remote Check" showed an average score of 4.6 out of 5, with 5 being strongly agree.

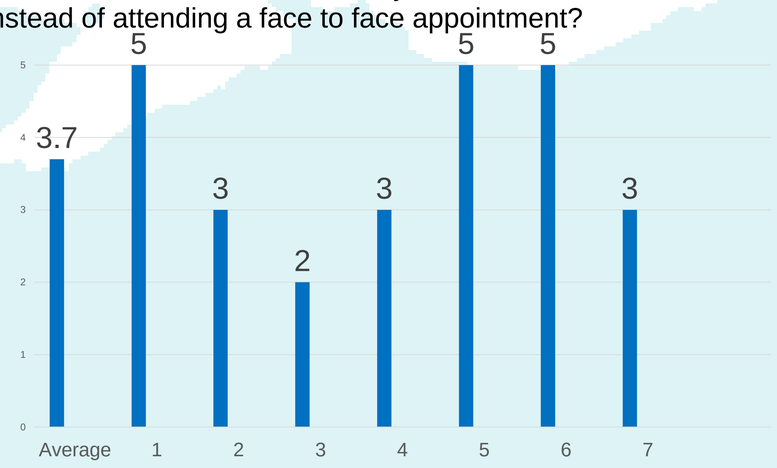
Service user comments:

…'as I'm immunosuppressed, even though clinics take extra care with Covid etiquette some members of the public do not and that's always a worry for me. Yes, I do miss face to face and the personal experience but the remote checks are quicker and safer for all concerned. The remote checks are similar to clinic checks and I can see no difference except for the surroundings….'…'Even with remote checks I still feel the cochlear team are always on hand to deal with anything…'. For someone who attends a lot of outpatient clinics because of my condition, it's a relief not having to attend and to do remote checks.

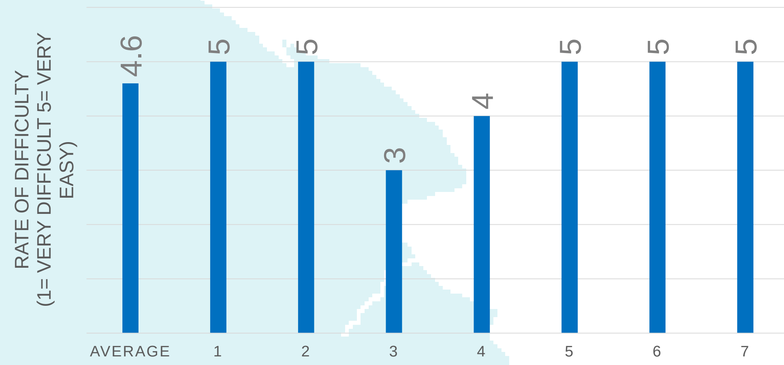
I was able to complete this in my own time without having to arrange childcare or time off work to attend F2F clinic

Sometimes things you want to try and explain what was happening so adjustments can be made. Cannot do that in remote check

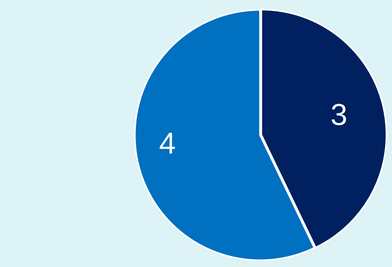
Q3 Was it less or more convenient completing a Cochlear™ Remote Check in your own time instead of attending a face to face appointment?



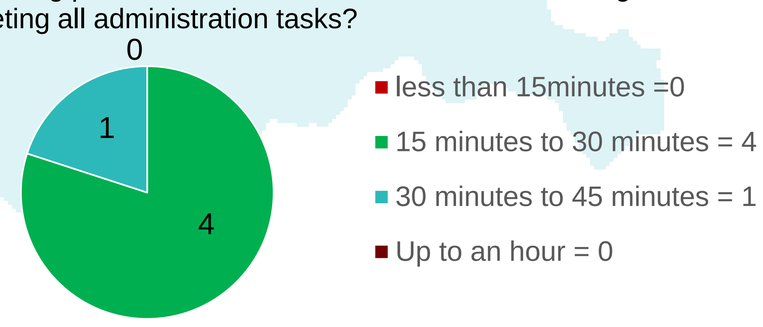
Q1 How would you rate the ease of use of Cochlear™ Remote Check?



Q5 Which method do you prefer for your annual review appointment?

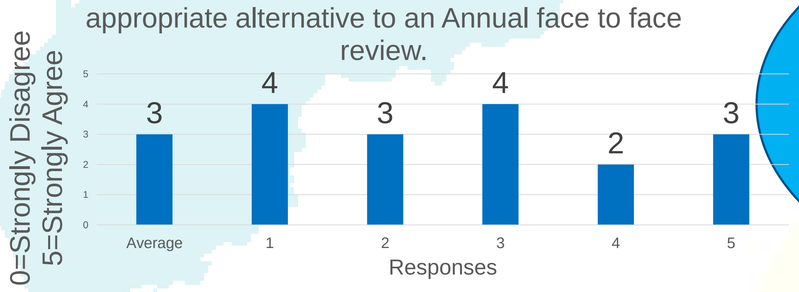


Q1 How long does it take to complete the whole process of reviewing patients Cochlear™ Remote Check including completing all administration tasks?



Clinicians results and comments:

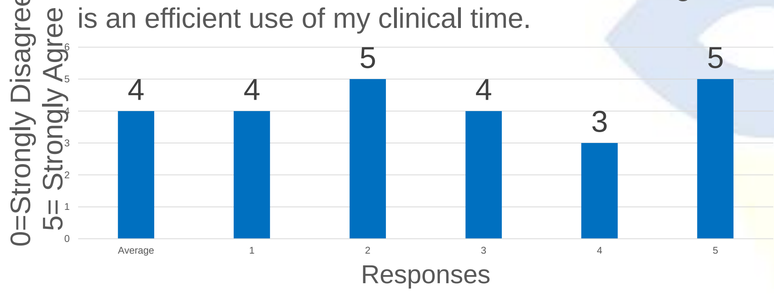
Q3 How much do you agree with the following statements: Cochlear™ Remote Check is an appropriate alternative to an Annual face to face review.



Great use of technology and patients who are suitable for remote check are generally happy to try this. I think there are some significant problems with the software that need sorting out otherwise I feel this is a great service to offer to patients.

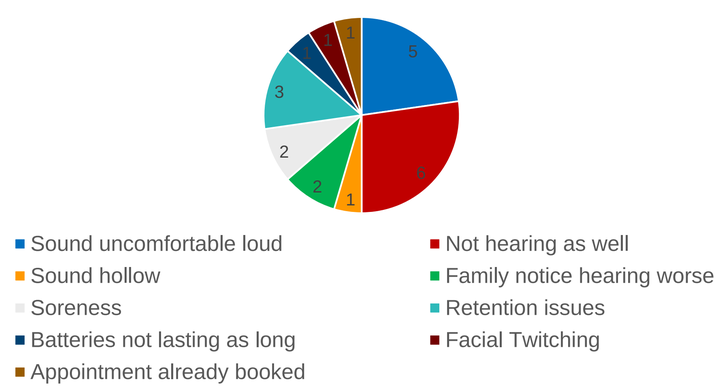
For a subgroup of patients it is convenient, modern way of keeping in touch with the CI centre and also allows a quick check/reassurance should there any problems arise.

Q2 How much do you agree with the following statements: Cochlear™ Remote Check reviewing is an efficient use of my clinical time.



I would like to be able to compare impedance results from one remote check to another (similar to the CS software where you can lay previous results on top of each other). I think also the navigation of the remote check software could be improved.

Custom Sound results:
Reason for Clinic Visit after completed Cochlear™ Remote Check



Summary

Service users feel that Cochlear™ Remote Check is more convenient, however when it comes to choosing the preferred method of review, more preferred F2F appointments. One service user commented that having the ability to adjust the processor settings would make remote check more convenient. As a service we will continue to offer cochlear Remote Check as an option, with the understanding that annual reviews can be continue to be requested via the service user's preferred method. We feel there remain barriers to overcome to create a smoother remote care service, including patient education and training and patient access to technology. Significant clinician time has been used to support the initial set-up and delivery of Remote Check, but hopefully once established this will become a time-releasing development.

The future: Once remote programming is available alongside remote check, remote care may be more attractive to our CI users.

Gwasanaeth Awdioleg Gogledd Cymru
North Wales Audiology Service

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Betsi Cadwaladr University Health Board

Our Paediatric CROS experience in Bristol

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Janine Matthews (Janine.Matthews@uhbw.nhs.uk)
University Hospitals Bristol and Weston NHS Foundation Trust

Introduction

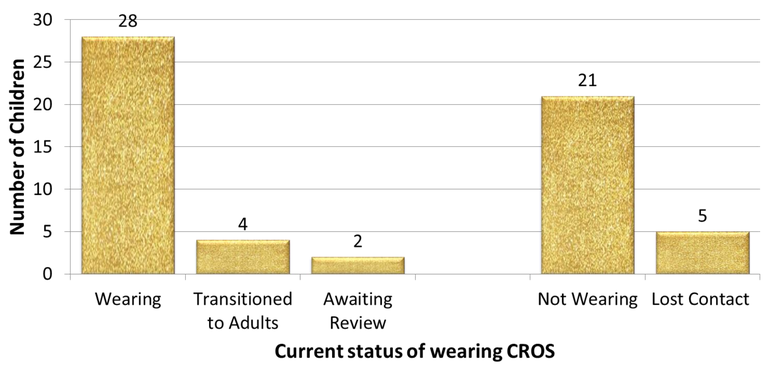
- Bristol Children's Hearing Centre started fitting Phonak CROS devices to children with single-sided deafness and unilateral hearing loss in 2016.
- We recently decided to complete an evaluation to understand:
  - How many children trialled a CROS device.
  - How many children continued with their CROS device.
  - How many suspended use, when and why.
  - Does age have any correlation with usage of the CROS device?

Method

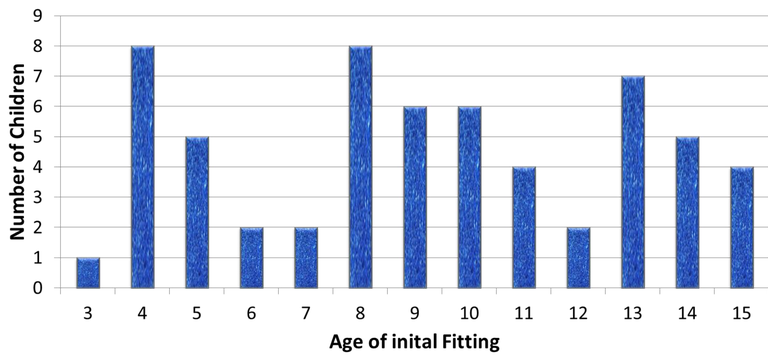
- For our data collection we used Auditbase to search for children issued with CROS devices since 2016 (6 year period).
- We looked at their hearing aid review report to collect the following data:
  - Age of children at time of fitting and now.
  - How many children are still wearing the device.
  - The average hours of use and the main places of use.
  - How many children have suspended use, age at suspension, length of time before suspension and reason why suspended.

Results

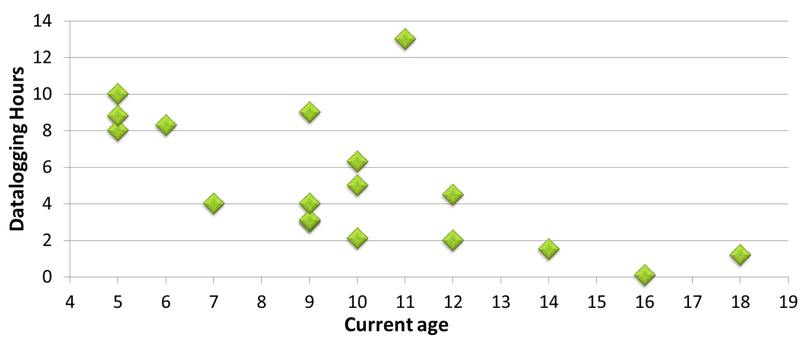
60 Children trialled a CROS device (53 CROS and 7 BiCROS), which 56% continued wearing.



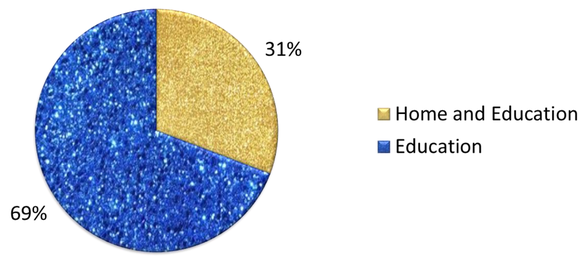
CROS devices were fitted to children between the ages of 3 and 16 years old.



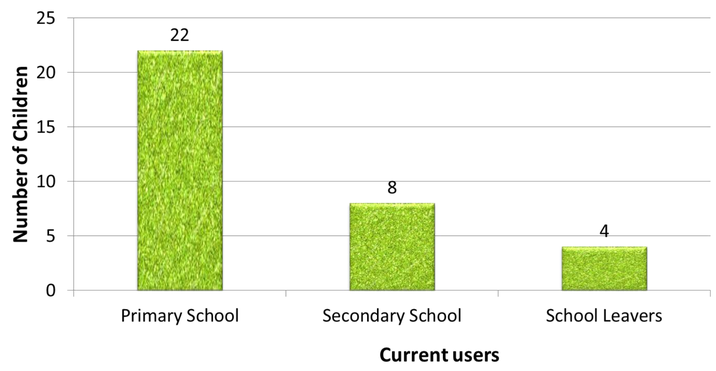
Younger children consistently wore their devices more than older children.



The main place of use was in Education.



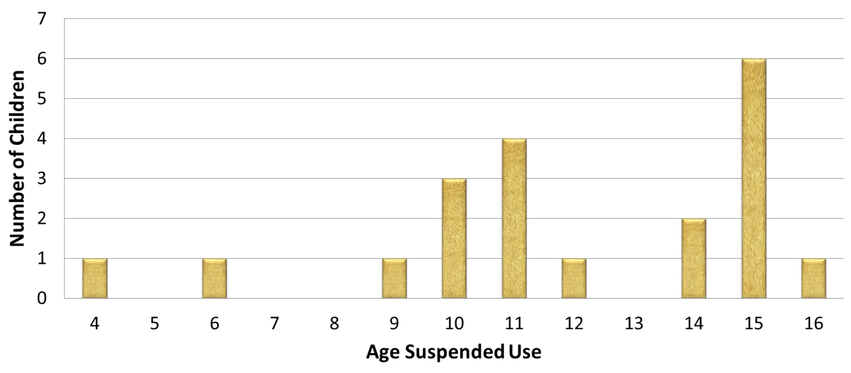
Two thirds of children successfully wearing their devices are in primary school.



Most of those that suspended use, did so at their first review appointment.

	Suspended at 1st Review	Suspended at 2nd Review	Suspended at 3rd Review
Number of Children Suspended	19	6	1
Percentage of Total CROS Users	**32%**	**42%**	**43%**

Older children were more likely to suspend use.



Most common reason for suspension was finding no or limited benefit.

Discussion

- It has been possible for us to fit CROS devices to children from 3 years old and above.
- CROS devices were accepted and used consistently by approximately half of children who were fitted with a CROS device.
- Data shows lower adherence and use when fitted during teenage years.

Next Steps

- We would like to look into who had Hearing Support Service involvement and whether this helped set expectations resulting in better use.
- We would need to find a viable outcome measure to assess benefit during their appointments.

Investigating the use of a GN Multi Microphone within a classroom setting and daily life for children with longstanding hearing loss

Areesa Javed[1], Nadine McCreadie[2], Lydia Paniccia[2]
Hillingdon Hospital Trust [1] & GN Hearing UK Ltd [2]

danalogic GN

METHOD

Initial fitting
All fitted with Ambio aids and paired with Multi Mic

6-week review
Fine tuning and adjustments completed

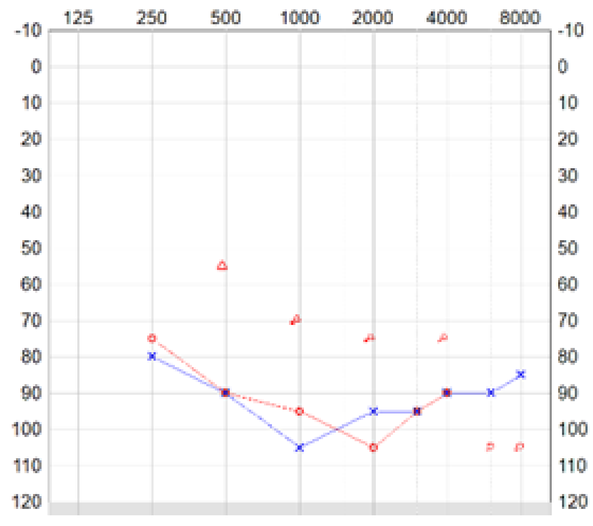
Further 6 week review
Postponed due to COVID lockdowns (telephone consultation completed)

Final 6-month review
After COVID lockdown

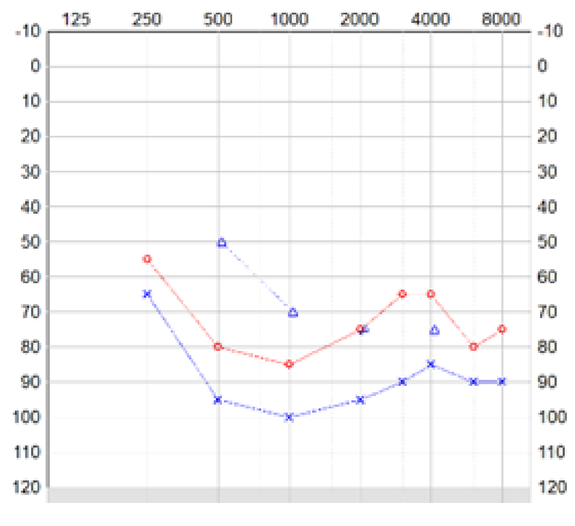
INTRODUCTION

In the United Kingdom, assistive listening devices are widely used in schools for children with hearing loss. FM (frequency modulation) consists of a transmitter and a receiver and uses radio waves to transmit audio signals to the listener. The GN Multi Mic is a wireless streamer that can stream speech and audio directly to a GN compatible hearing aid(s). The objective of this investigation is as follows:

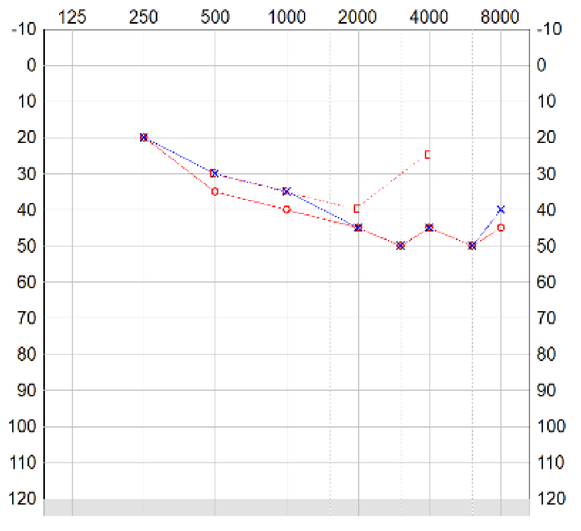
1. To evaluate patient experience of the GN Multi Mic in a classroom setting as well as within an extra curricular setting
2. To evaluate patient experience of the GN Multi Mic in a home setting
3. To evaluate the use of the GN Multi Mic in daily living



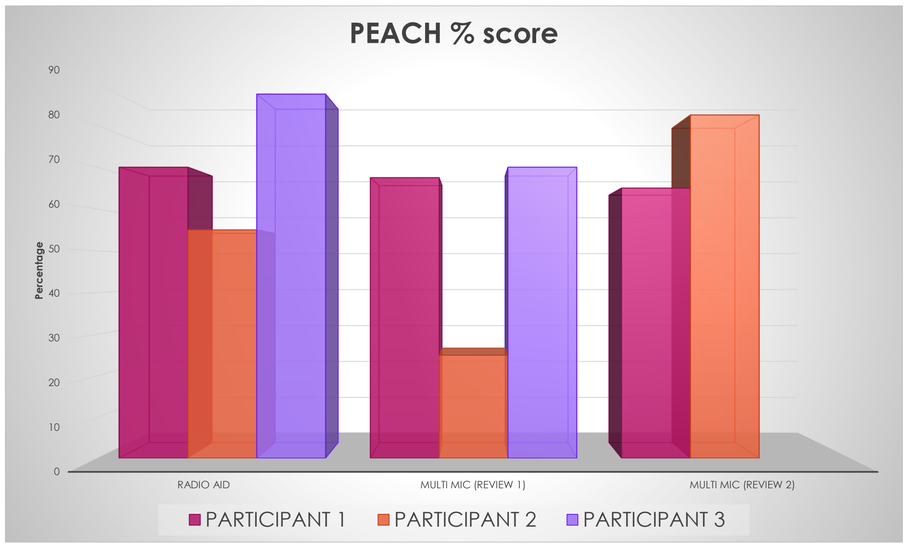
Participant 1

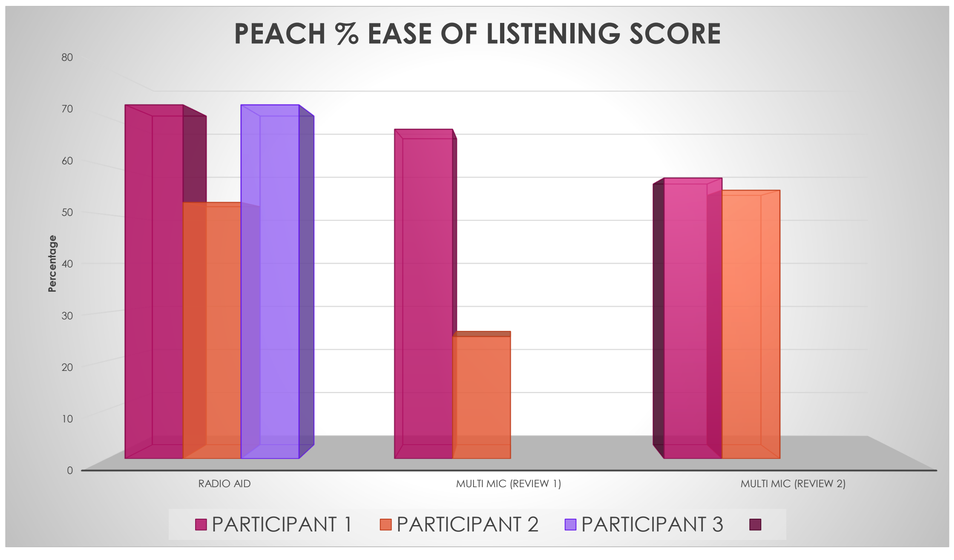


Participant 2



Participant 3





	Pros	Cons
Participant 1	• Taking calls, reports clearer and easier to converse. • Used for listening to music on the phone or laptop • Portable • Mute button • Took ownership • Used during all lessons at school and online • Charging in 1-2 hrs	• Reduction in use time • Unsure of conference mode • Difficult to hear students in back • Not always muted and can hear unwanted conversations
Participant 2	• Laptop use with mic • Utilized during online school lessons • Streamed use with PlayStation and online gaming • Successfully used during Arabic lessons with improved pronunciation • Successfully used during extra-curricular activity (Marital Arts)	• Charging daily due to high usage • Increased background noises when teacher walked away • Conference mode was not beneficial • Required focus when pairing/unpairing • Intermittent use during lockdown
Participant 3	• Increased use of hearing aids when fitted with GN instruments • Time saver in morning with no additional devices to add on • Good sound quality • Connection to Alexa and iPad	• Limited range in PE class • Extra equipment required reinstruction to ensure correct usage • Reduction in use time during lockdown • Only used for short time to start

Summary

- All participants used the devices during lessons & while at home.
- Two eldest partcipants connected the Multi Mic to telephones, laptops and PlayStation to maximise listening in all situations
- Two participants gave positive feedback on the Multi Mics during COVID lockdown, took full ownership of unpaiting/pairing when teachers did not mute
- Challenges of device control could be overcome with further training and support for school teachers and hearing impairment specialist teachers.
- Conference mode did not prove to be beneficial in this review and did not result in reduced use in class from the older participants.
- Decreased usage was only observed due to COVID lockdowns for all participants.
- All participants reported the sound of the Multi Mic to be clear and comfortable.
- One parent remarked on clearer pronunciation of participant's speech with Multi Mic usage.

Conclusion: Multi Mic can be a functional and portable streaming device which is appropriate for a school setting. It benefitted learning both in class and online lessons. Participants and parents engaged in home and extra-curricular use. We noted support and training for all involved would be required to ensure successful use.

Adoption and patient experience of remote hearing care in a large NHS service.

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Lauren Archer

Royal Berkshire NHS Foundation Trust

Introduction

The Royal Berkshire Hospital was one of the first NHS departments to offer remote care options for Audiology patients. We began extensive data collection in 2017 to assess patient interest in using an app to manipulate their hearing aid settings or to contact and receive remote hearing care from the Audiology department. In June 2020, we began fitting Danalogic Ambio hearing aids which are compatible with the BeMore app and GN Assist.

The BeMore app allows patients to change their hearing aid programme, manipulate the volume, adjust the bass, middle and treble pitches as well as activate 'noise filter' and 'speech clarity' amongst other functions. Patients can also use the BeMore app to access GN Assist. This allows patients to send a request for assistance to the department. The Audiology department can send new hearing aid settings 'asynchronously' for patients to install when they can (Remote Assist) or 'synchronously' by arranging a video call using the hearing aid software.

Objectives:

- **To share the data obtained regarding patient interest in using remote hearing care.**
- **To share the data regarding our patient's experience and how they are using the BeMore app.**
- **To identify areas for further improvement.**

Methods

Preliminary Work:

- We conducted a trial for 10 patients using the LiNX hearing aids compatible with an app
- We completed a service evaluation of our drop-in repair clinic
- We asked patients to complete a questionnaire to assess their interest in using an app to manipulate their hearing aids
- We asked patients to complete a questionnaire to assess their interest in using an app to contact the department and receive remote hearing care

Review following the introduction of the Ambio hearing aids:

- We have sent a satisfaction questionnaire to all adult patients fitted with Ambio hearing aids
- We have asked those using the BeMore app to complete a questionnaire regarding their use of the app to manipulate their hearing aid and their experience of GN assist to contact the department and to receive remote hearing care
- We have conducted monthly audits of the assistance requests received

Results

Preliminary Work:

From a sample of 101 patients:

- The majority of patients (65%) would consider using an app to adjust their hearing aids (figure 1)
- The majority of patients (53%) feel remote adjustments would reduce the need to attend our drop in (repair) clinic (Figure 2)
- Patients of all age groups answered that a hearing aid app could be useful for them (Figure 3)

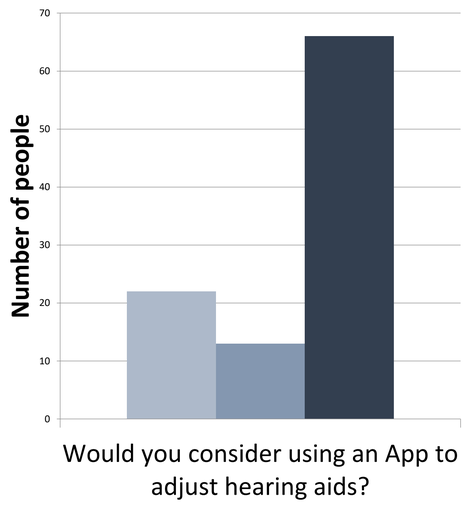

Figure 1: Number of patients who would consider using an app to adjust their hearing aid (n = 101)

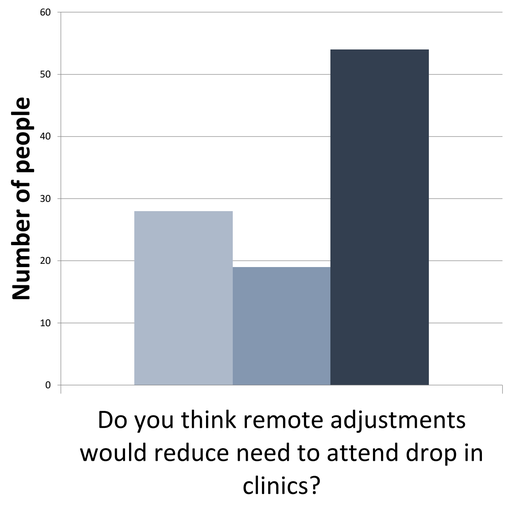

Figure 2: Number of patients who feel that remote adjustments would reduce the need to attend the department (n = 101)

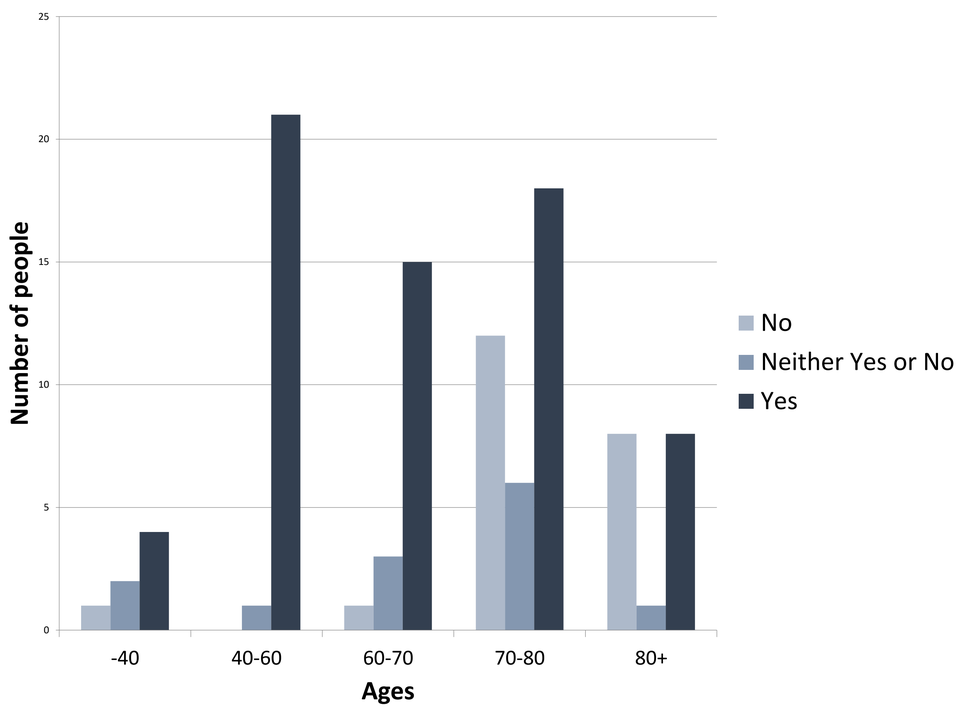

Figure 3: Number of people who would consider using an app to adjust their hearing aid settings across different age groups (n = 101)

Following the introduction of the Ambio hearing aids:

"Easy to download & use the App. Very positive experience!"

- Anonymous hearing aid user

Key findings from the questionnaires completed after introducing Ambio hearing aids:

- The majority of people are using the app to adjust the volume (70%), the speech clarity (47%) and noise filter (47%) function and to change programmes (45%) (Figure 4)
- Over half of patients using the app are using it daily and over a third are using it weekly (Figure 5)
- The majority of patients using the app report positive findings in several areas and more benefit compared to their previous hearing aids which did not have remote technology (Figure 6)
- Of 2206 questionnaires sent to all adult patients, 39% are using the app. Of those using the app, 97% find it is useful, 79% feel it reduces their need to attend the department and 32% have used remote assistance

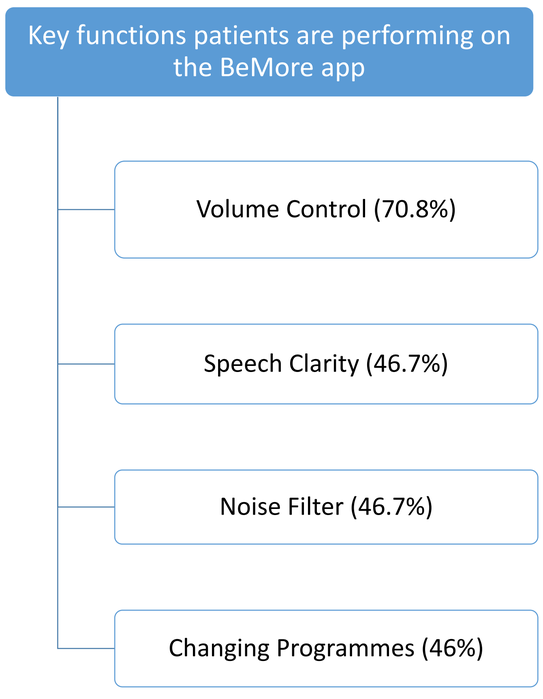

Figure 4: Lists the top four functions patients are using on the BeMore app (n = 140)

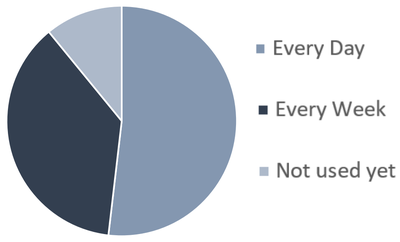

Figure 5: Shows the majority of people using the BeMore app are using it daily (n = 140)

"Remote assist is a game changer. I think in general, it saves both me, and the NHS time which has to be a good thing."

- An experienced hearing aid user

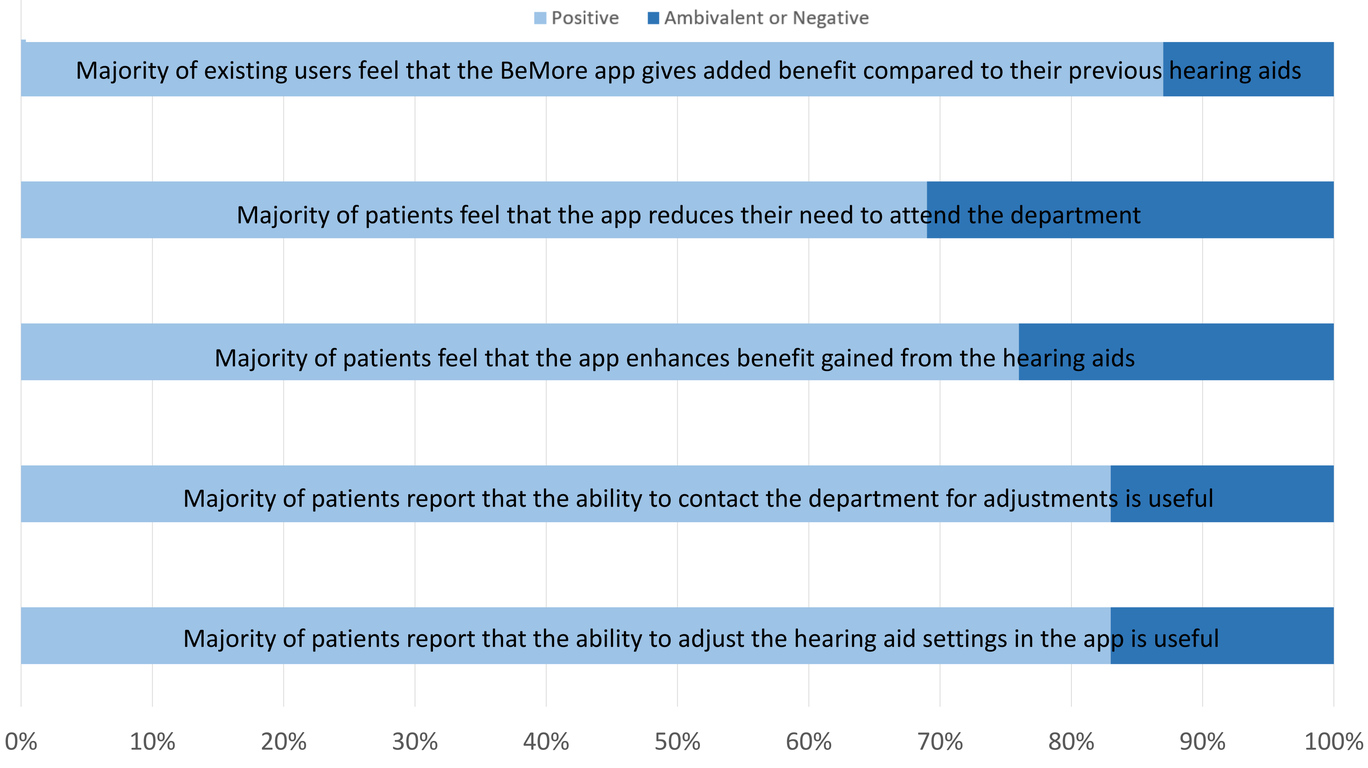

Figure 6: Key data from a questionnaire completed by 142 people using the BeMore app

Benefits

- The majority of patients using the app have reported benefit regarding the app and remote care
- Experienced hearing aid users have reported more benefit from hearing aids with the app compared to previous hearing aids without this technology
- The app provides another pathway for patients to contact the department
- It has potential to reduce footfall in the hospital as we can provide more hearing care remotely
- Our data shows patients of all ages may be interested in using remote hearing care
- Increased flexibility when using remote assist (asynchronous), patients can contact us at any time and we can respond to their request when our timetable allows
- Can be used in real-time (synchronous) to monitor subjective feedback to adjustments

Considerations

- Not suitable for all patients and not all patients are interested in remote hearing care
- Some functions are not available using remote technology
- Potential for patients to skip the acclimatisation period
- Need to address expectations of the adjustments available in the app and recommendations for use
- A remote care pathway is another service for the Audiology department to manage
- The app is not fully compatible with all smartphones or tablets
- Requires software updates

"I always feel like I'm the first deaf person they have ever met"

Deaf Awareness, Accessibility and Communication in the NHS: What could we do better?

Bhavisha Parmar[1, 2], Helen Henshaw [2,6], Sarah Hughes[2,8], Crystal Rolfe[2,3], Zara Musker[2,5], Shahad Howe [2,4], Emma Stapleton[2,5,7], Laura Turton [2,9]

[1]Sound Lab, Department of Clinical Neurosciences, University of Cambridge, UK- [2]British Society of Audiology- [3]Royal National Institute for Deaf People- [4]Advanced Bionics- [5]University of Manchester, [6]NIHR Nottingham BRC, School of Medicine, University of Nottingham, UK- [7]Manchester Royal Infirmary, Manchester, UK-[8]Centre for Patient Reported Outcome Research, University of Birmingham, Birmingham, UK- [9]NHS Tayside, Scotland, UK

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Background

- Few healthcare professionals receive training in Deaf awareness and missed diagnoses and inadequate treatment of deaf and hard-of-hearing patients are estimated to cost the National Health Service £30 million per year.
- Barriers to communication, such as a lack of interpreters, and difficulty accessing health services (for example where telephone-only access is provided) mean that deaf people are less likely to seek healthcare, have poorer access to adequate health information, and consequently experience adverse health outcomes.
- **Our working group was created by the British Society of Audiology to understand accessibility, communication and deaf awareness in the NHS.** Overall, this group aims to create recommendations and strategies to improve the healthcare experience for deaf people.

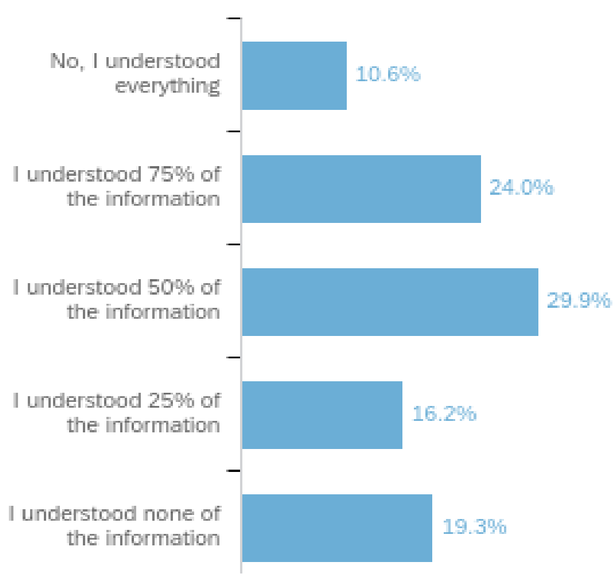
Methods

- A cross sectional **survey study focusing on NHS patients' experiences of communication and accessibility in healthcare**, using both rating scales and open questions to elicit data on communication barriers faced in NHS settings, and effects on psychological wellbeing.
- BSL videos were provided for survey information/consent and all questions. The survey was created and piloted by researchers and people with hearing loss who have used NHS services.
- The Cambridge University Psychology Research Ethics Committee has provided ethical approval for this study (PRE.2021.076).

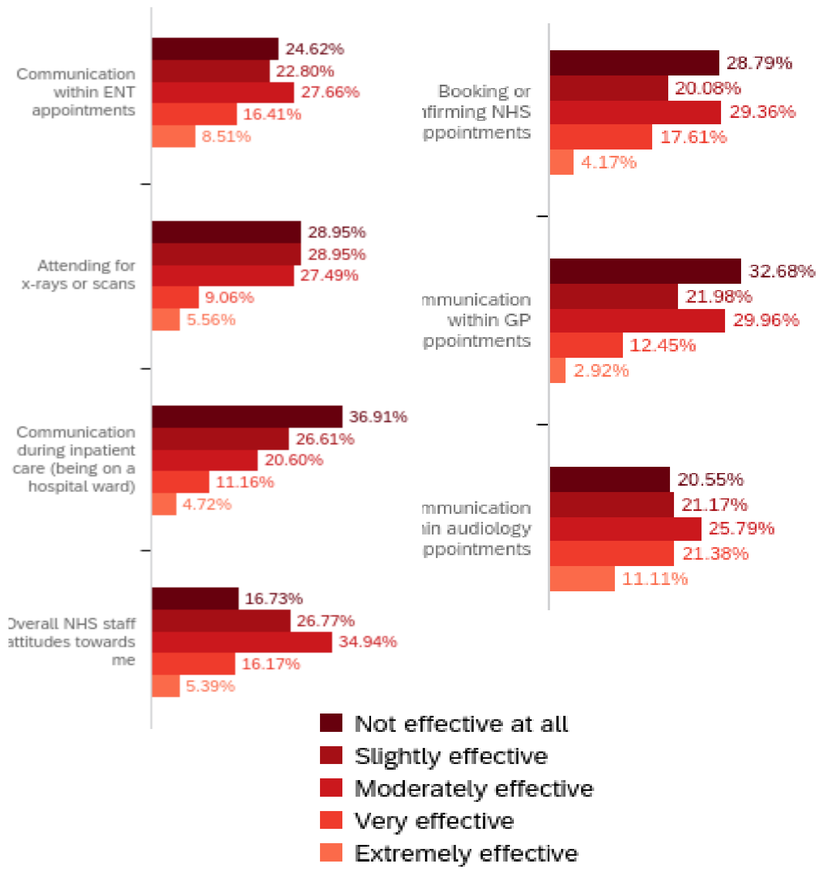
Results

In total, there were 549 responses to the survey. Of these, 502 were people with hearing loss who have used NHS services in the last 24 months and 47 respondents were parents/caregivers who have accompanied a person with hearing loss to attend NHS services. 10% of respondents reported that British Sign Language was their preferred language.

Information missed during NHS appointments due to unaddressed hearing loss related communication needs



Communication in the NHS



Qualitative analysis has identified the following main themes (so far):

1. **All health professionals need ongoing communication training**

   a) *"getting people to understand that anyone can be deaf ..and we are all different and have different needs",*
   b) *"Permanent awareness… have all staff think through what they should do (and what they should definitely not do) if a patient can't hear what they're saying"*

2. **NHS infrastructure is not suitable for deaf people**

   a) *"Very difficult to communicate regarding appointments or making arrangements. Tends to be phone call which means I have to get someone to do this for me or through a text relay system"*

3. **Breakdown of communication across the healthcare pathway impacts patients' emotional wellbeing**

   a) *"It feels like in all settings the system relies on self-advocacy, which can be exhausting"*
   b) *"I've hidden away from getting medical help. I've felt mortified and small when I've wasted NHS time due to miscommunication."*
   c) *"I have suffered anxiety and distress and my independence and confidence has been affected"*

Conclusion

This study presents the largest cross-sectional dataset of its kind and **highlights diverse communication barriers faced by NHS patients with deafness.** Understanding service user perspectives can inform the future adaptation and improvement of health services and service delivery. **Our working group will use this dataset to create a list of core recommendations for healthcare,** to help improve deaf awareness and effective communication across the NHS, including primary care.

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Medical Devices Training and Monitoring

Sueann Meyer, Clinical Scientist. Betsi Cadwaladr University Health Board (BCUHB).

Introduction

BCUHB Medical Device Training Policy (MP03) outlines the strategy for ensuring all relevant staff are suitably trained in the safe use of medical devices.

Medical Devices encompass equipment used for diagnosis, treatment, prevention and monitoring in healthcare.

The departmental Audiology Standard Operating Procedure (SOP) was rolled out in July 2022.

This presentation outlines the elements that make up that SOP.

Standard 2.9 of the Health and Care Standards for Wales (2015)

- *"all health service settings should have an on-going program of medical device competency training"*

MP02: BCUHB Medical Device and Equipment Management Policy (2020)

- *'all staff are expected to undergo suitable medical device training and that managers ensure that staff are appropriately trained and competent with medical devices used'.*

MP03: BCUHB Medical Device Training Policy (2022)

- *"sets out a 'risk based approach' to staff training: ie. that training should be in proportion to the risk of harm from user error. This approach is aimed at maximising the benefit to patients, and optimizing the support to staff"*

BCU Audiology Medical Devices Training SOP (2022)

- *"outlines the strategy that should be adopted by Secondary Care and Area Teams to ensure that all relevant staff are suitably trained in how to use medical devices safely and effectively for the benefit of patients in their care."*

Green/Low Risk: These devices are those devices that are unlikely to cause any serious consequences, meaning the user can continue in a safe and sensible manner, referring to the manufacturer's instructions as needed.

Amber/Medium Risk: These devices would have significant impact in patient care or cause temporary adverse health consequences should they be misused or fail. The device must only be operated by a user who is deemed competent in the use of the device following a formal written self-assessment, to be completed every 3 years. The user must take advice and instruction from a senior, knowledgeable colleague, and read the manufacturer's Instructions For Use if they have any queries about the device.

Red/High Risk: These devices are those that have the potential to cause serious adverse consequences or death should they be misused or fail. Any high-risk device carries a 'STOP' element, meaning that the device MUST NOT be used unless the user has received formal training to do so.

Equipment Risk Assessment

Equipment was risk assessed by departmental Health & Safety and Equipment Teams.

Classification was based on the Risk Classification System defined in policy MP03. This is different to the routine 5 x 5 matrix Risk Assessment.

Under these definitions the majority of Audiological equipment was classified as **LOW** risk.

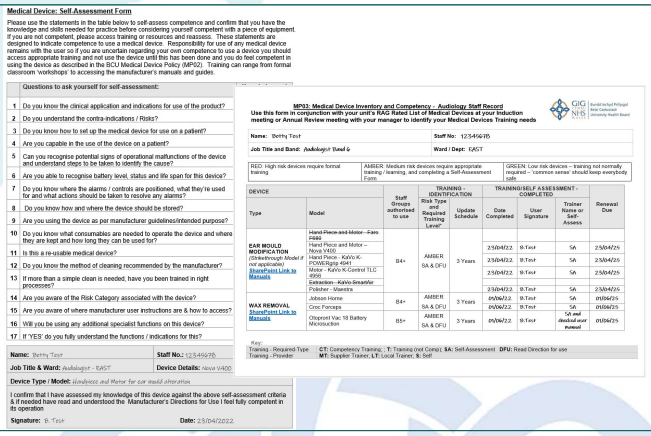
A few devices were assigned **MEDIUM** risk.

Self-Assessment Checklist and Staff Compliance Record

Staff complete a Self-Assessment Checklist for each Amber/Medium Risk device every 3 years.

An Individual Competency Record form summarises each staff members competency and this is reviewed annually at PADR.

Links to electronic equipment manuals available on Microsoft SharePoint are on the Individual Competency Records for ease of reference.



Medical Device: Self Assessment Form

Please use the statements in the table below to self-assess competence and confirm that you have the knowledge and skills needed for practice before considering yourself competent with a piece of equipment. If you are not competent, please access training or resources and reassess. These statements are designed to indicate competence to use a medical device. Responsibility for use of any medical device remains with the user so if you are uncertain regarding your own competence to use a device you should access appropriate training and not use the device until this has been done and you do feel competent in using the device as described in the BCU Medical Device Policy (MP02). Training can range from formal classroom 'workshops' to accessing the manufacturer's manuals and guides.

	Questions to ask yourself for self-assessment:
1	Do you know the clinical application and indications for use of the product?
2	Do you understand the contra-indications / Risks?
3	Do you know how to set up the medical device for use on a patient?
4	Are you capable in the use of the device on a patient?
5	Can you recognise potential signs of operational malfunctions of the device and understand steps to be taken to identify the cause?
6	Are you able to recognise battery level, status and life span for this device?
7	Do you know where the alarms / controls are positioned, what they're used for and what actions should be taken to resolve any alarms?
8	Do you know how and where the device should be stored?
9	Are you using the device as per manufacturer guidelines/intended purpose?
10	Do you know what consumables are needed to operate the device and where they are kept and how long they can be used for?
11	Is this a re-usable medical device?
12	Do you know the method of cleaning recommended by the manufacturer?
13	If more than a simple clean is needed, have you been trained in right processes?
14	Are you aware of the Risk Category associated with the device?
15	Are you aware of where manufacturer user instructions are & how to access?
16	Will you be using any additional specialist functions on this device?
17	If 'YES' do you fully understand the functions / indications for this?

Name: Betty Test | Staff No.: 123456/B

Job Title & Ward: Audiologist - EAST | Device Details: Nova V400

Device Type / Model: Handpiece and Motor for ear mould alteration

I confirm that I have assessed my knowledge of this device against the above self-assessment criteria & if needed have read and understood the Manufacturer's Directions for Use I feel fully competent in its operation

Signature: B. Test | Date: 25/04/2022

MP03: Medical Device Inventory and Competency - Audiology Staff Record

Use this form in conjunction with your unit's RAG Rated List of Medical Devices at your induction meeting or Annual Review meeting with your manager to identify your Medical Devices Training needs

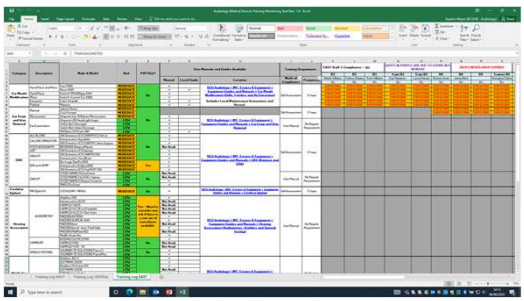
Name: Betty Test | Staff No.: 123456/B

Job Title and Band: Audiologist Band 6 | Ward / Dept.: EAST

RED: High risk devices require formal training | AMBER: Medium risk devices require appropriate training / learning, and completing a Self-Assessment Form | GREEN: Low risk devices – training not normally required – 'common sense' should keep everybody safe

DEVICE		Staff Groups authorised to use	TRAINING - IDENTIFICATION		TRAINING/SELF ASSESSMENT - COMPLETED			
Type	Model		Risk Type and Required Training Level	Update Schedule	Date Completed	User Signature	Trainer Name or Self-Assess	Renewal Due
EAR MOULD MODIFICATION (Breakthrough Model if not applicable) SharePoint Link to Manuals	Hand Piece and Motor – Kaltenbach & Voigt Nova V400	B4+	AMBER 5A & DFU	3 Years	25/04/22	B.Test	5A	25/04/25
	Hand Piece - KaVo K-POWERgrip 4041 Motor - KaVo K-Control TLC 4995 Extraction - KaVo SmartAir				25/04/22	B.Test	5A	25/04/25
					25/04/22	B.Test	5A	25/04/25
	Polisher - Maestro				25/04/22	B.Test	5A	25/04/25
WAX REMOVAL SharePoint Link to Manuals	Jobson Horne	B4+	AMBER 5A & DFU	3 Years	09/04/22	B.Test	5A	01/04/25
	Croc Forceps				09/04/22	B.Test	5A	01/04/25
	Otoprint Vac 10 Battery Microsuction	B5+	AMBER 5A & DFU	3 Years	09/04/22	B.Test	5A and checked wax removal	01/04/25

Key: Training - Required Type | Training - Provider | CT: Competency Training; T: Training (not Comp.); SA: Self-Assessment DFU: Read Direction for use | MT: Supplier Trainer; LT: Local Trainer; S: Self



Compliance Monitoring

The Monitoring Tool Spreadsheet is used to track service level compliance

The Monitoring Tool returns individual staff % compliance, as well as automatically highlighting competencies that have either expired or are due to expire in the next 6 months.

It also monitors overall service % compliance which is reported via Governance functions up to Trust Level Leadership.

Implementing a process for training and monitoring the use of medical devices is essential to ensure good governance and to comply with national guidance.

References:
NHS Wales (2015) Health and Care Standards. Available at: Health standards framework english (gov.wales)

Gwasanaeth Awdioleg Gogledd Cymru
North Wales Audiology Service

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Betsi Cadwaladr University Health Board

Estimates of interaural attenuation in children and the implications for masking in clinical audiometry

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Email: Jacqueline.young@uhs.nhs.uk

NHS
University Hospital Southampton
NHS Foundation Trust

Introduction

- What is the smallest difference in hearing threshold levels between the left and right ears that requires masking in children?
- With asymmetrical hearing loss, there is a risk that sound presented to the test ear could cross the head and be detected by the (better) non-test ear. When this cross hearing happens, masking noise can be applied to the non-test ear to allow the true hearing threshold level (HTL) of the test ear to be established (BSA, 2018).
- The risk of cross hearing is determined by Interaural attenuation (IA), defined as the drop in intensity of the acoustic signal from the test ear transducer to the non-test cochlea [1]. IA is highly variable between individuals, and it can be influenced by transducer type, transducer-ear coupling, test frequency, and the ear canal size and condition [1].
- Values of IA measured in adult participants (e.g. [2], [3]) can be used to infer the minimum asymmetry at which masking should be recommended in clinical audiometry. For air-conduction stimuli, this minimum asymmetry is currently ≥ 40 dB for supra-aural earphones or ≥ 55 dB for insert earphones [4].
- We wanted to understand if estimates of IA in children, under clinical test conditions, are different from those seen in the adult studies under controlled research conditions, and what implications this may have for the application of masking in clinic.

Methods

With HRA approval, we reviewed our clinical database of audiograms for children (aged 8 months to 16 years) showing ear-specific results obtained using the relevant age-appropriate behavioural clinical procedures. They were measured during standard clinical care using a mix of Otometrics Aurical, Kamplex KC35, and Grason Stadler GSI 67 audiometers with either supra-aural Telephonics TDH-39P headphones or E-A-RTONE 3A insert earphones with foam tips.

Audiograms were selected for analysis if all of the following criteria were satisfied at that frequency:

I. Values of better ear air conduction hearing threshold level (HTL), poorer ear not-masked air conduction HTL, poorer ear masked air conduction HTL were all documented at single clinic visit
II. Any air-bone gaps recorded were ≤ 15 dB
III. The transducer type was clearly indicated
IV. There was evidence of cross hearing, operationally defined as a deterioration of more than 15 dB in the HTL of the poorer ear when comparing the masked and not-masked conditions.

Estimated IA was calculated for each subject for each stimulus frequency at which cross hearing had been identified, using the difference between the not-masked air-conduction HTL of the poorer and better ears.

Results & Discussion

Results

Table 1 shows estimated IA values for a range of stimulus frequencies for each transducer. The number of subjects per condition varies from 2 to 21 as data was not available for every stimulus frequency for every child. Any repeated measures from the same subject on different clinic dates are excluded from table 1, instead only the smallest IA value is retained for each subject. Based on 10 participants who had a retest, the difference in estimated IA values was less than 5 dB for 75% of the estimates and less than 10 dB for 88% of the estimates.

Table 2 shows values of estimated IA grouped into age ranges (0-3 years, 4-7 years, 8-12 years, and 13-16 years) for each transducer type. These data are not separated into different stimulus frequencies, as there was no statistically significant effect of frequency on estimated IA.

Shaded cells in table 1 & 2 indicate where the values of estimated IA fall below 40 dB for supra-aural headphones or 55 dB for inserts.

Transducer	Supra-aural headphones								Insert earphones with foam tips							
Stimulus Frequency	250	500	1000	2000	3000	4000	6000	8000	250	500	1000	2000	3000	4000	6000	8000
Number of subjects (n)	8*	17	19	18	3*	19	7*	10	2*	11	16	21	4*	16	2*	5*
Mean IA (μ), dB	53.8	58.2	60.0	63.1	71.7	60.3	67.9	59.1	67.5	70.9	68.4	67.6	61.3	70.6	72.5	71.0
Median IA, dB	50.0	55.0	60.0	65.0	75.0	55.0	75.0	65.0	67.5	75.0	67.5	65.0	65.0	75.0	72.5	70.0
Variance	241	65	106	83	33	165	149	184	1513	274	175	100	240	160	13	30
Minimum IA, dB	40	50	40	45	65	35	45	30	40	40	40	40	40	40	70	65
Maximum IA, dB	90	75	75	80	75	80	80	70	95	95	90	80	75	85	75	80
5th percentile, dB		50	45	45		35		30		40	40	42		42		

Table 1 *Estimated interaural attenuation (IA) for different stimulus frequencies and transducers. Values of IA which fall below 40 dB (for supra-aural headphones) or 55 dB for inserts are highlighted. Conditions with fewer than 10 subjects are marked with *, and were excluded statistical analysis. Blank cells indicate absent data, due to low subject numbers for the corresponding test condition.*

Table 2*. Estimated interaural attenuation (IA) for different age groups. The highlighting and * are used in the same way as table 1.*

Transducer	Supra-aural headphones				Insert earphones			
Age group (years)	0-3	4-7	8-12	13-16	0-3	4-7	8-12	13-16
No. of data points	4*	31	58	34	9*	32	30	20
Mean (dB)	62.5	60.0	64.0	57.7	60.0	69.8	66.5	78.3
Median (dB)	60	60	65	55	65	72.5	70	77.5
Variance	175	82	116	140	113	91	195	109
Minimum (dB)	50	40	35	30	40	50	40	60
Maximum (dB)	80	75	90	85	70	85	85	95
5th percentile (dB)	50	46	45	38	40	53	40	60

Discussion: Variations with Age or stimulus frequency

Test frequency: For all children (aged 8 months -16 years) collectively there was no significant effect of stimulus frequency on the mean estimated IA, for either type of transducer.

Age: For insert earphones, there were significant differences in the mean estimated IA between the oldest age group and the younger ones. Given this age effect is most prominent for insert earphones, we surmise that shallow foam tip insertion depth of foam tips may be responsible. In contrast, for supra-aural headphones, there is no significant difference in the mean estimated IA between any of the age categories. In fact, all the values of mean IA are within ± 5 dB of 60 dB for each of the age groups.

Discussion: Study limitations

IA measures published for adults subjects are based on small subject numbers (between 6 and 30 [5, 6]). Our study extends that data to include IA estimates in children aged 8 months to 16 years, with some caveats associated with the retrospective use of our clinical data:
① Low subject numbers as shown in tables 1 and 2 ② Not-masked bone conduction values were not typically available, which could lead to under-estimates of IA but reflects the compromised data available to paediatric audiologists when attempting to make decisions about the need for masking in clinics ③ The transducers in this study are still widely used but newer models are available that may differ in their IA properties ④ The fit of the transducers was not monitored and so, for insert earphones, the selected tip size and insertion depth is not known and there is no record of factors that may have limited optimal insertion in individual cases.

Despite these caveats, the mean and median IA values for the oldest age group in our study (13-16 years), shown in table 2, are within ±10 dB of published frequency-averaged IA mean [7] and median [3] values for adults.

Discussion: Implications for masking

In our clinic, audiologists are encouraged to apply masking in cases where they suspected cross hearing, even if the asymmetry would not have been sufficient to require masking based purely on BSA guidelines [4]. This means masking was sometimes applied for asymmetries less than 40 dB for supra-aural headphones and 55 dB for inserts. Looking at audiograms showing evidence of cross hearing, how many would have contained one or more inaccurate thresholds had the audiologist not applied this extra masking?

For s**upra-aural headphones,** only 2 out of 38 audiograms (5%) would have contained inaccurate thresholds. But with **inserts**, 5 out of 30 audiograms (17%) would have contained at least one inaccurate threshold. Figure 1 shows two example audiograms exhibiting low IA with insert earphones.

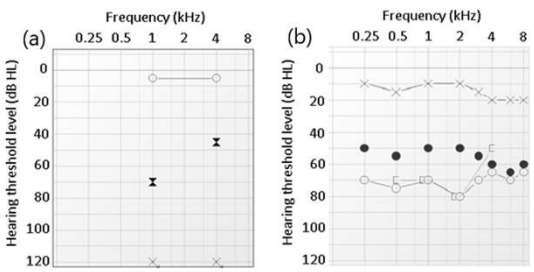

Figure 1*. Audiograms obtained with inserts for children with low interaural attention (IA) aged (a) 2 years and (b) 10 years. Audiogram symbols are consistent with BSA (2018). Tympanometry was within normal limits bilaterally in both cases.*

Conclusions

Under clinical conditions, cross hearing in children should be considered when the difference between the better ear and poorer ear not-masked air conduction thresholds is ≥ 40 dB for inserts with foam tips in children under 13 years. Cross hearing can also occur for interaural differences as small as 30 dB with supra-aural headphones in some individuals. For insert earphones we speculate that the deep and snug fitting of foam tips which could be achieved with adult subjects under laboratory conditions was not replicated by audiologists in this paediatric clinical setting, resulting in the lower values of estimated IA for inserts for children in this study compared to published adult data. Further work is needed to confirm these findings in a larger cohort of children and to monitor any impact of foam tip positioning in clinical practice. Measures of bone conduction for the better ear could also be informative.

References

[1] Goldstein & Newman, 1994. [2] Martin & Blosser, 1970. [3] Munro & Agnew, 1999. [4] BSA PTA recommended procedure, 2018. [5] Martin and Blosser, 1970, [6] Gumus et. al., 2016, [7] Killion et. al., 1985.

Acknowledgements

Thank you to all the Audiology staff at the Royal South Hants Hospital, Southampton, UK for supporting this study and providing valuable comments on the presentation of results.

Endolymphatic hydrops in children

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Dr Sudhira Ratnayake, Consultant Audiovestibular Physician
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Introduction

Idiopathic Meniere's Disease (MD) is one of the commonest vestibular disorders in adults that presents with episodic vertigo, tinnitus and aural fullness/sensorineural hearing loss. In the early part of the disease, they may present with third window conductive hearing loss[1]. The Barany criteria defines probable or definite MD by a set of criteria[1]. MD is attributed to an accumulation of endolymphatic fluid in the membranous labyrinth (endolymphatic hydrops ELH) and can be due to primary or secondary causes. The idiopathic variety is primary whilst secondary endolymphatic hydrops can be due to various causes e.g. head injury, brain tumours, autoimmune ear conditions, vestibular migraine (VM) and metabolic conditions[2]. The secondary variety is called Meniere's syndrome (MS). MD in children is very rare due to endolymphatic fluid metabolism and MS is more common[3,4]. Diagnosis in children depends on a robust medical algorithm for best outcomes[3,4]. We present 4 such cases of MS in children who have had extensive investigations to detect the secondary causes of MS for the first time in literature.·

Barany Criteria for Meniere's Disease/Syndrome

Definite Meniere's Disease/Syndrome

A. Two or more spontaneous episodes of vertigo each lasting 20 minutes to 12 hours
B. Audiometrically documented low- to medium frequency sensorineural hearing loss in one ear, defining the affected ear on at least one occasion before, during or after one of the episodes of vertigo
C. Fluctuating aural symptoms (hearing, tinnitus or fullness) in the affected ear
D. Not better accounted for by another vestibular diagnosis

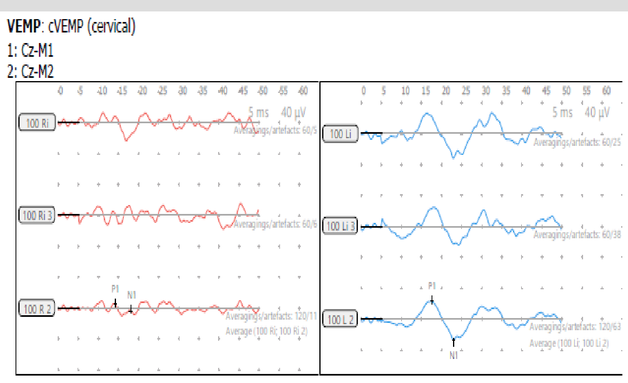
Probable Meniere's Disease/Syndrome

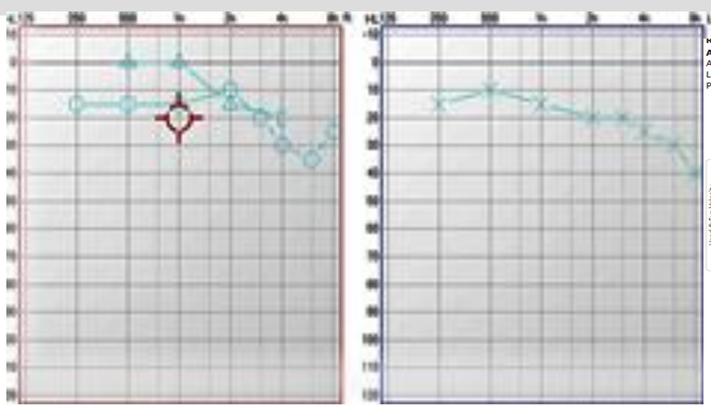
A. Two or more episodes of vertigo or dizziness, each lasting 20 minutes to 24 hours.
B. Fluctuating aural symptoms (hearing, tinnitus or fullness) in the affected ear
C. Not better accounted for by another vestibular diagnosis

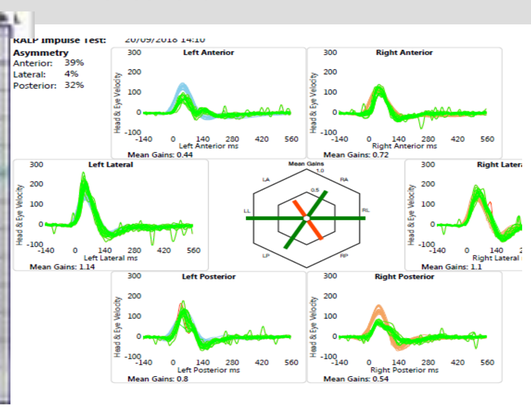
The Children

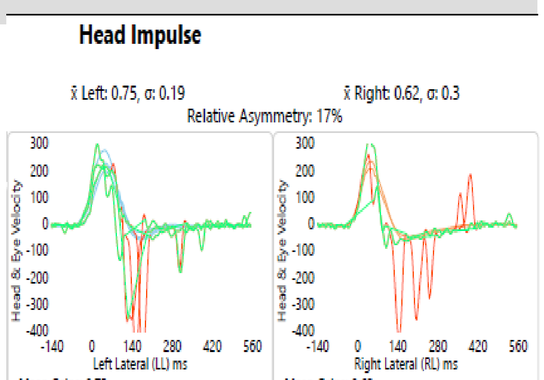
Out of 580 children seen in Alder Hey paediatric vestibular clinic between June 2018 and December 2019, only 0.7% fulfilled Barany criteria for definite or probable ELH. They all underwent audiovestibular investigations with peripheral hearing test battery, objective vestibular quantification with videonystagmography (VNG), video head impulse test (vHIT), suppression head impulse test (SHIMP), cervical vestibular evoked myogenic potential test (cVEMP) and static posturography in addition to a genetic, infective, metabolic and autoimmune profile; average age being 14 years.

Feature	Child 1	Child 2	Child 3	Child 4	Feature	Child 1	Child 2	Child 3	Child 4
History	Classical definite MS +Tullio	Classical definite MS with headache	Classical definite MS with VM and recent onset travel sickness	Probable MS with VM	**Imaging**	Normal	Normal	Normal	Orbit, parietal and pituitary involvement of tumour
Family history	Absent	Present	Absent	Absent	**Inflammatory markers**	Raised ESR and IgA	Raised ESR and Hep 2 positive ANA	Raised ESR	Normal
Aetiology	Coeliac disease	Hep 2 positive ANA	One episode of acute vestibular event	Cranial Langerhans histiocytosis treated with chemotherapy	**Other medical comorbidities**	Coeliac disease	Nil	Nil	Pan hypopituitarism diabetis insipidus
Hearing	Flat 30dBHL mild SNHL right	Bilateral mixed loss in high frequencies	Low frequency 30 dBHL CHL left	Normal	**Other investigations**	Normal	Normal	Normal	Normal
Balance	Functional deficit; positive headshake; absent cVEMP right	Functional deficit and positive HT	Functional deficit and SHIMP asymmetry	Functional deficit; abnormal SHIMP and OCR	**Treatment and outcome**	Betahistine, diuretics and intratympanic steroids; cognitive support; excellent	Betahistine and prochloperazine; excellent	Betahistine and topiramate; excellent	Betahistine and propranolol; cognitive support; excellent









. **cVEMP Child 1** **PTA Child 2** **vHIT Child 3** **SHIMP Child 4**

Discussion

ELH is rare in children. In our cohort, the observed systemic/cranial autoimmune disease as well as vestibular migraine are recognised associations of ELH. ELH can present with a conductive element or a mixed hearing loss due to a third window effect. MS in children follow a different trajectory to those in adults probably as a result of the difference in stria vascularis integrity. In a vast majority, the cause is secondary, so active effort is recommended to detect an aetiology. Children are symptomatic, therefore, the diagnosis should be reliable as this will dictate management. Holistic management with pharmacological/vestibular rehabilitation/cognitive intervention leads to excellent prognosis. This is the first study investigating secondary causes of paediatric ELH in detail.

Conclusions

The condition ELH in children can be reliably identified with a rigorous paediatric diagnostic algorithm that must include the vestibular system and systemic investigations to detect a cause. Management is rewarding with a favourable outcome.

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The experience of tinnitus in adults who are Deaf or have severe-profound hearing loss in Saudi Arabia

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[3] Sir Peter Mansfield Imaging Centre, School of Physics and Astronomy, University of Nottingham, Nottingham, United Kingdom.

INTRODUCTION

Tinnitus is a common complaint among those with hearing loss. However, little research involves tinnitus in participants who are Deaf or have severe-profound hearing loss. There are no validated tinnitus questionnaires or clinical guidelines for tinnitus in this population. Reportedly, congenitally deaf people rarely complain of tinnitus due to lack of prior auditory experience.

The aim of this project was to examine the experience of tinnitus in deaf adults, their main complaints, how it impacts them, and what they want from healthcare providers.

METHODS

A mixed method approach (concurrent design) was used. Participants completed the Tinnitus Handicap Inventory (THI), Depression Anxiety Stress Scales (DASS), and a semi structured interview about the experience of tinnitus, with sign-language interpretation where needed.

Questionnaire data were analyses descriptively to determine the number of participants in each category of severity of symptoms. Interview data were analyzed using an inductive thematic analysis approach.

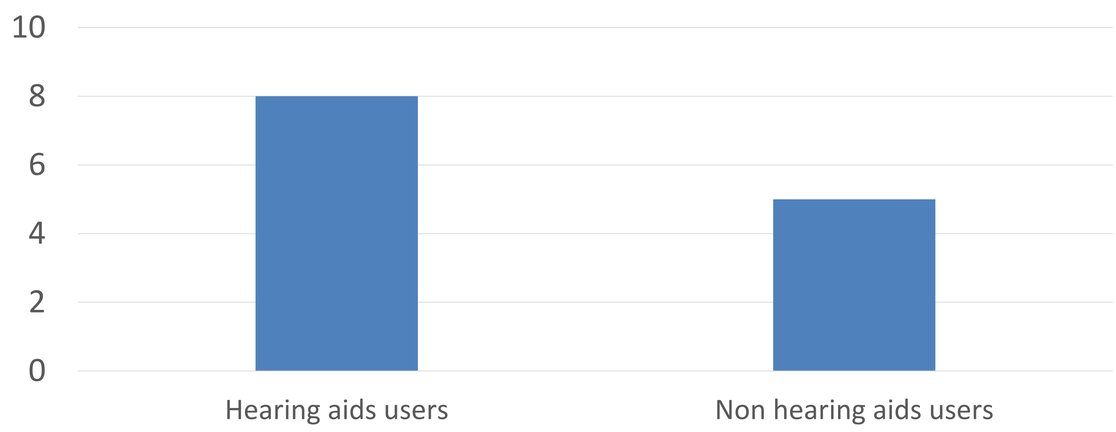

Figure 1: Number of participants who were and were not hearing aids users

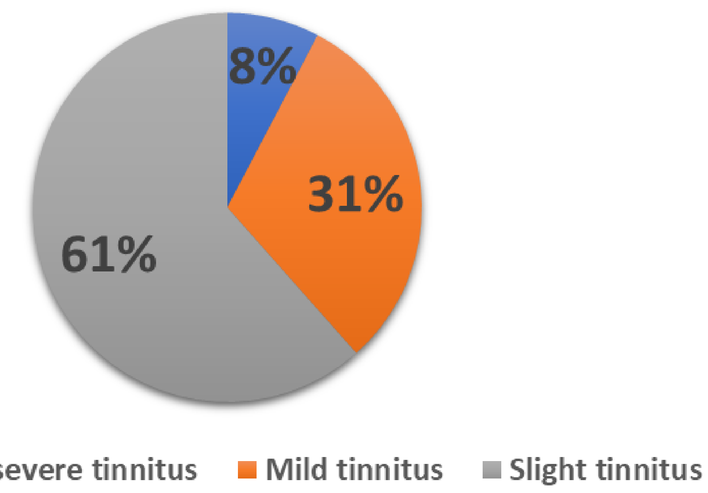

Figure 2: THI tinnitus severity categories of participants.

RESULTS

Thirteen participants (age range: 23-60 years; mean 41.5 years) were included. Twelve participants were prelingually deaf since birth or early childhood and one post-lingually. Eight participants wore hearing aids (Fig.1). THI (Tinnitus Handicap Inventory) scores and DASS (Depression, Anxiety and Stress Scale) are given in Fig.2 & 3. Finally, themes and subthemes are described in Fig. 4.

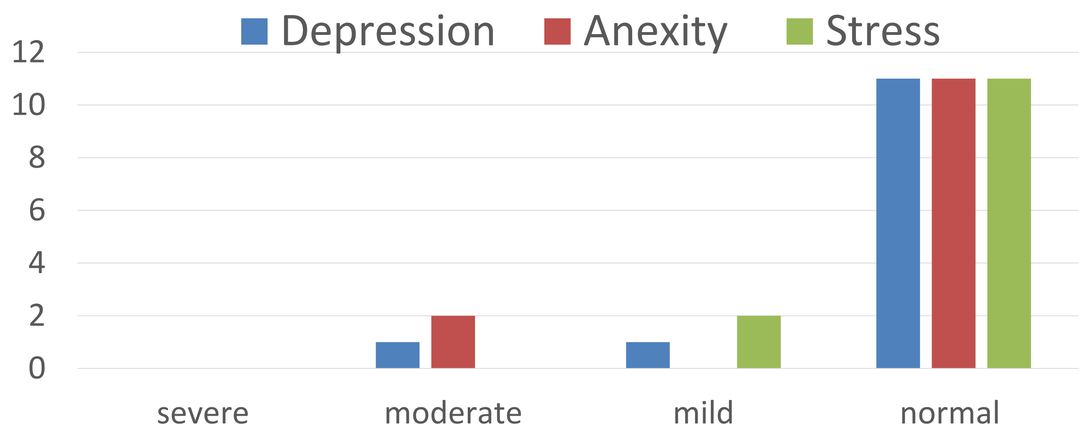

Figure 3: DASS score among included participants

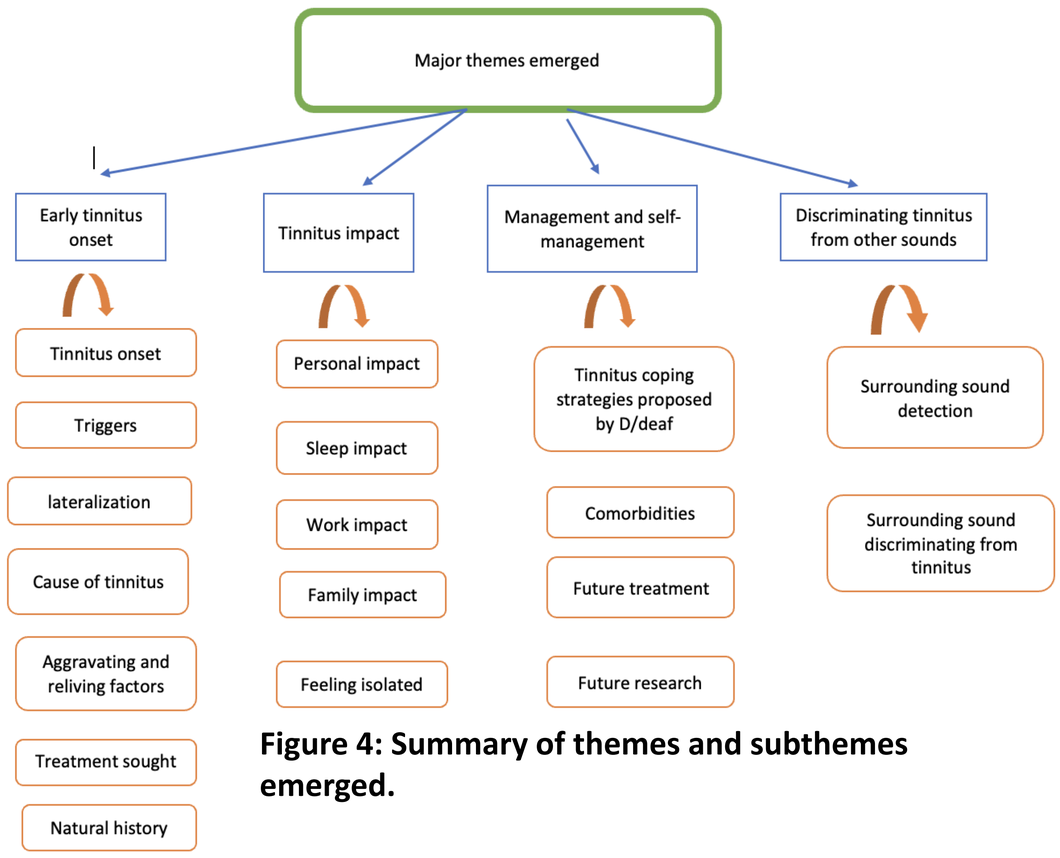

Figure 4: Summary of themes and subthemes emerged.

CONCLUSION

Tinnitus affects D/deaf and severe-profound hearing-impaired adults similarly to hearing adults. However, specific challenges include discriminating tinnitus sounds from external sounds and communicating their tinnitus to healthcare providers when seeking medical advice.

This research was funded by the NIHR Nottingham Biomedical Research Centre. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care.

The NIHR Nottingham Biomedical Research Centre is a partnership between Nottingham University Hospitals NHS Trust and the University of Nottingham, supported by Nottinghamshire Healthcare NHS Foundation Trust and Sherwood Forest Hospitals NHS Foundation Trust. We are hosted by Nottingham University Hospitals.

NIHR Nottingham Biomedical Research Centre

EARWAYS MEDICAL

A Novel Tool for Cerumen Removal

The EarWay® Pro Results of Clinical Assessments by Audiologists

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Abstract

Impacted cerumen is a common condition that causes hearing loss and prevents accurate audiological assessment. Waiting time for referral to an otorhinolaryngology specialist can be long, resulting in significant delay in completion of audiological assessment.
The EarWay® Pro is designed to facilitate safe and effective cerumen removal by audiologists and general practitioners. It can reduce referrals, costs and waiting time.
Our goal was to present data from pilot assessments, and to evaluate the safety and efficacy of the device.

Introduction

Cerumen impaction is a very common medical and audiological condition, accounting for 12M patient visits in the United States and resulting in about 8M **removal procedures** annually. In the UK, the number of irrigations performed is estimated at 4M per year, making it **the most common ear, nose and throat procedure performed in primary care**. Approximately 4% of primary care patients will consult their physician for cerumen impaction annually. Cerumen impaction is the number one cause of treatable hearing loss worldwide, with a direct impact on quality of life and productivity. When cerumen becomes impacted it can cause also, pain, tinnitus and sensation of fullness.
When patients with cerumen complain of otalgia or fever, physical examination of the tympanic membrane cannot be completed by general practitioners and patients are often referred to an otolaryngology specialist. **Another common source for referrals are audiologists that cannot complete audiological assessment or hearing aid fitting due to cerumen.**
The current methods used for the removal of cerumen include irrigation and manual removal under direct visualization of the ear canal. Patients can also use oil based or water-based preparations which are relatively safe. However, these tend to be only minimally effective and require multiple doses over several days to achieve results. The American Academy of Otolaryngology banned the use of cotton swabs and ear candling since they are ineffective and potentially dangerous. Recently published guidelines recommended educating populations at risk for cerumen impaction (**elderly**, children, **hearing aid users**) about proper ear canal hygiene.
The UK's National Health Service reported on over 72,000 patients who were waiting for completion of hearing assessment during February 2020. The mean waiting time was 3.4 weeks, with data showing that 60% of patients do not complete their assessment pathway (including referral to E.N.T specialist for cerumen removal and return to audiologist evaluation afterwards) [NHS].

Materials & Methods

The EarWay® Pro device [figure 1] is a handheld, disposable device. Made of plastic polymer and coated by a thin layer of silicone. Its design comprises a flexible helical open profile tip and measurement markers indicating the depth of engagement.
The device is rotated inward into the ear canal, collecting the cerumen and then pulled out, extracting with it the cerumen as a single cluster.
The EarWay® Pro is intended to use without direct visualization.

Participants

Data was collected from clinical assessments performed in 8 organizations, in 4 countries: United Kingdom, United States, Canada and Australia. Participants were all professional audiologists, hearing care specialists and all received training by EARWAYS Medical team, or by certified trainers. After each procedure, participants answered a short questionnaire. **Success** was graded according to the ability to complete audiological assessment (paitent ear canal, and at least partial exposure of the tympanic membrane allowing exclusion of gross pathology). A scale of 1 (unsuccessful procedure) to 5 (highly successful procedure) was used. **Safety** was reported based on the appreciation of safety based on participants' own experience. A scale of 1 (very unsafe procedure) to 5 (highly safe procedure) was used.
Participants were instructed to report any complications, whether device-related, procedure-related or associated with anatomical variations. Patients with known aural anomalies or patients that previously underwent otologic surgical procedure were excluded from assessment.
Since most participants had limited experience during pilot studies, interviews were held with experienced users. Four audiologists and an otolaryngologist, all with over a decade of experience in cerumen removal, who used the EarWay® Pro for a minimum of 50 cases were interviewed.

Results

General

The procedure success rate was approximately 70% among non-experienced users, while experienced users reported over 80% success. The safety rate was around 85% among both experienced and non-experienced users, with a 1.2% of complications reported among non-experienced users, all of them were merely minor.

Clinical assessments by non experienced users

Our cohort includes data from 8 centers worldwide, who participated in clinical assessments between January 2020 and April 2021. A total of 43 participants (users) were included. Two hundred and fourteen patients were treated in these assessments, with a mean of 26.8 per center, and a total of 330 ears, with a mean of 41.3 ears per center. The mean duration of the procedure was 37 seconds. The mean success grade given to the use of the EarWay® Pro device was 3.45 (on a scale of 1 to 5). Figure 2, Figure 3.
A total of 4 complications were reported – a rate of 1.2% (4/330). Reported complications included slight bleeding in all four cases.
The mean safety grade given was 4.2 (on a scale of 1 to 5).

Clinical Assessment by Experienced users

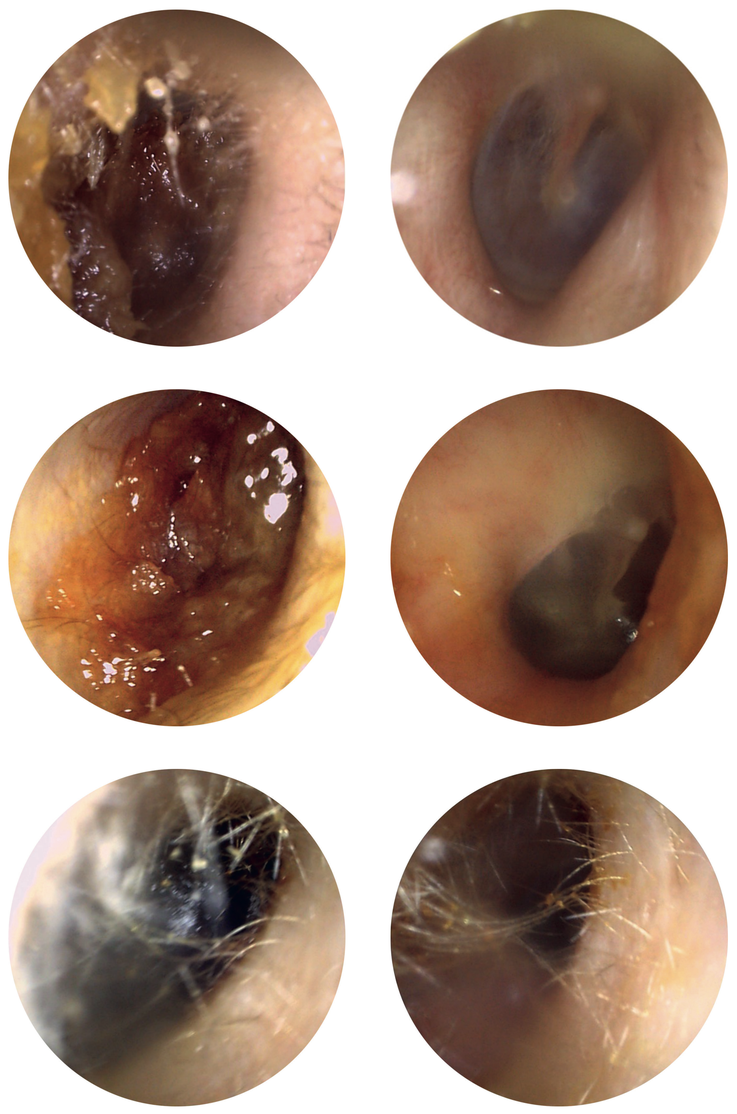
Five experienced users replied. All had over a decade of experience in cerumen removal and used the EarWay® Pro for at least 50-200 cases. Based on their experience, they rated in a 1-5 scale, device efficacy as 4.1/5, safety as 4.41/5.

None encountered device related complications

Some patients mentioned mild discomfort or pressure sensation when the device reaches the bony external ear canal. Discomfort was tolerable and only momentary when the patient was counselled and prepared well. One responder reported less discomfort with better angling of the device. None had to abort the procedure due to discomfort.

Cases Documentation*

Pre-Procedure | **Post Procedure**

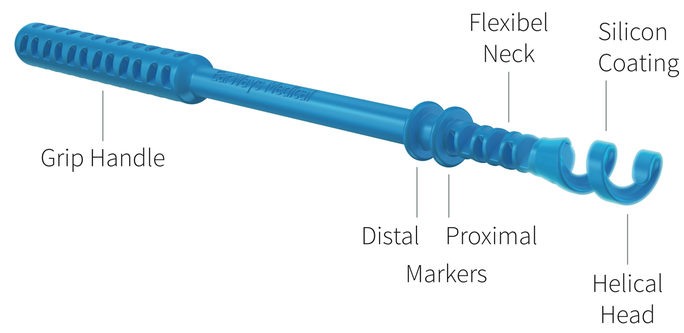


* Procedures preformed by Christiane Basilio, Canada

Results Tables & Graphs

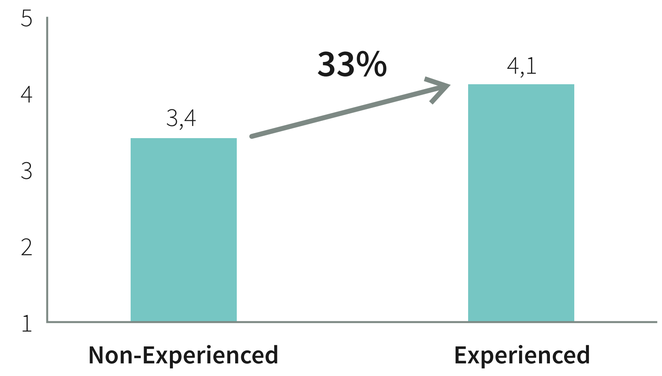
EarWay® Pro

Figure 1



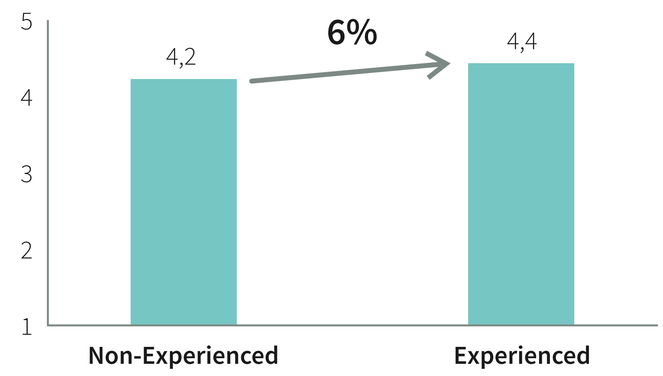
Success

Figure 2



Safety

Figure 3



Conclusion

The EarWay® Pro device presents a safe, effective and efficient method for cerumen removal by healthcare professionals. The high success rate and safety of this device make it very useful, enabling the removal cerumen prior to audiologist evaluation without the need for referral to an E.N.T specialist, and thus significantly shortening waiting time and dropout rate of patients.

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Learn more

Disclosure

Conflict of interest disclosure:
Prof. Ohad Hilly, author of this poster consults for the company on clinical aspects.

Long-Term Stability of Speech Outcomes for Adults with Cochlear Implants

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Linor Llwyd Jones, Principal Clinical Scientist; Glan Clwyd Hospital; Betsi Cadwaladr University Health Board
Rebecca E. Millman; Manchester Centre for Audiology and Deafness

Introduction

Cochlear Implants (CIs) offer long-term improvements in speech perception. However, studies show that there is substantial variation in speech recognition amongst CI recipients. At the North Wales Auditory Implant Service (NWAIS) we wanted to investigate long-term performance of our CI users to help guide long-term outcomes counselling for prospective patients.

Many factors could affect long-term speech perception. This retrospective study aimed to better understand long-term performance on speech perception tests in adult CI users and explore whether age at implantation, or years of profound hearing loss (HL) pre-implantation, affected the stability of scores.

Methods

Existing records of 158 CI users within the NWAIS database were examined for speech perception scores in quiet on the Arthur Boothroyd (AB) word and/or Bamford-Kowal-Bench (BKB) sentence tests. Participants were excluded if they were <18 years old, had a congenital HL, revision surgery, missing speech perception data, or changed CI configuration. Speech perception stability was measured as the difference between speech scores at 1 and 5, or 1 and 10 years post-activation. Correlation analyses examined associations between the 5-year change in speech scores and age at implantation or duration of profound HL.

Results

Due to missing data and the application of the above exclusion criteria, 26 eligible records of adult CI users were identified. The included participants ranged from 40 to 81 years old at implantation (mean 64.1 years, SD = 11.3). Thirteen right and 13 left ears were implanted. The duration of profound HL in the implanted ear ranged from 0.5 to 22 years (mean 4.2 years, SD = 5.6).

The mean change in 5-year scores was +5.8% on AB words, +8.2% on AB phonemes, +2.7% on BKB sentences, and -6.5% over 10 years on BKB sentences (Figure 1). Due to the small number of participants at 10 years (n = 8), statistical analyses were only performed on 5-year data.

No statistically significant correlation was found between age at implantation and change in AB word scores (τ_b= -0.16, p = 0.53; Figure 2), AB phonemes (τ_b = 0.14, p = 0.59; Figure 4), or BKB scores (τ_b = -0.082, p = 0.65; Figure 6) over 5 years. Therefore, age at implantation was not associated with long-term performance on the AB word or BKB sentence tests in quiet in this cohort.

No statistically significant correlation was found between duration of profound HL and change in AB word scores (τ_b = 0.58, p = 0.025; Figure 3), AB phoneme scores (τ_b = 0.22, p = 0.40; Figure 5), or BKB scores (τ_b = 0.032, p = 0.87; Figure 7) over 5 years. These analyses revealed that the duration of profound HL was not associated with long-term performance on the AB word or BKB sentence tests in quiet in this cohort.

Discussion and Summary

Patients can expect to receive good benefit from their CI over 5 years, similar to the findings of multiple studies[1-3], although a slight deterioration was noted over 10 years. This small dataset suggests that no relationship exists between changes in AB word, AB phoneme, or BKB sentence scores and age at implantation or longer durations of profound HL. However, this study was considerably limited by missing data at follow-up appointments and the lack of variability in duration of profound HL.

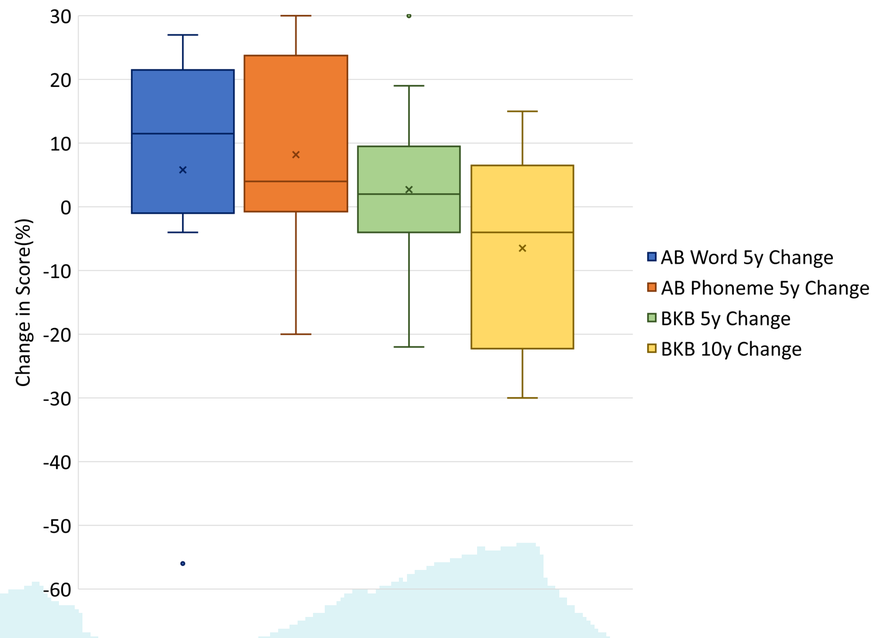

Figure 1 – Change in speech perception scores for the AB Word test over 5 years and the BKB sentence test over 5 years and 10 years

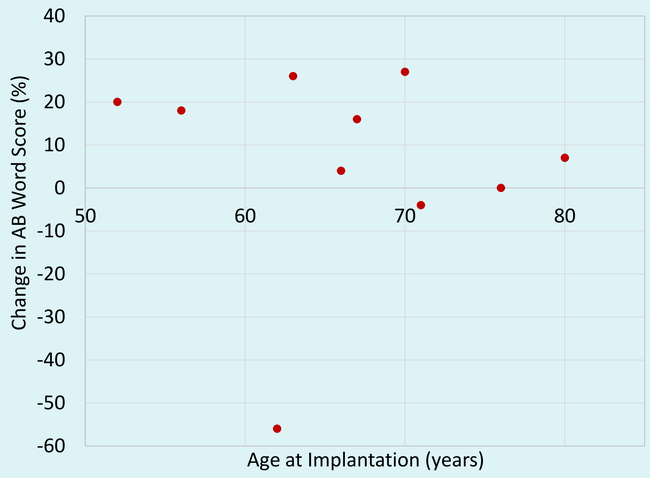

Figure 2 – Effect of age at implantation on the change on AB word scores over 5 years

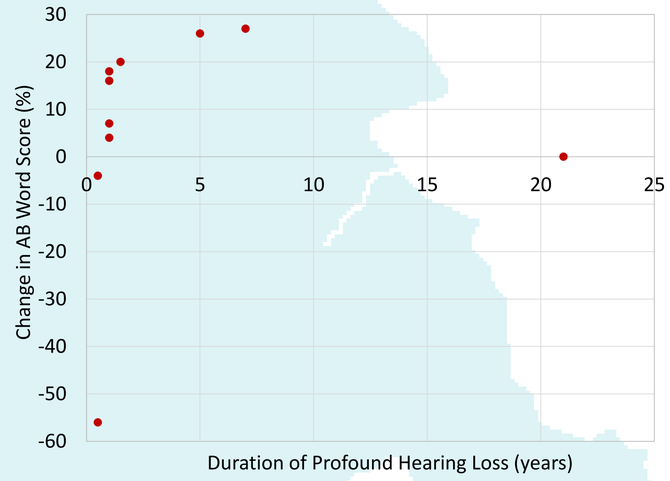

Figure 3 – Effect of duration of profound hearing loss on the change on AB word scores over 5 years

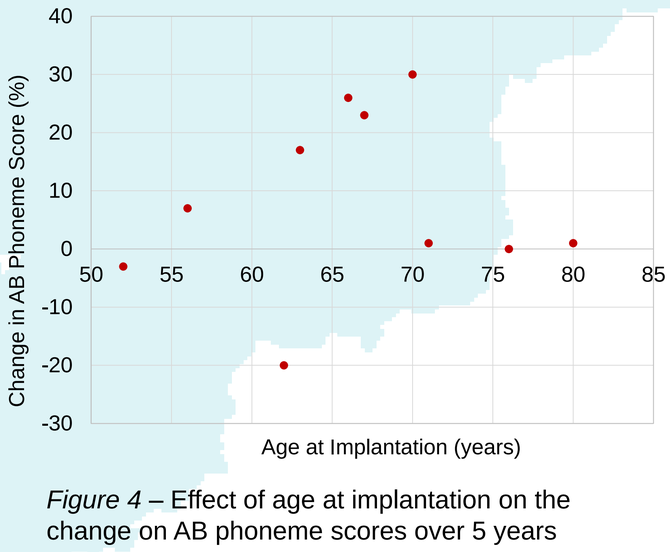

Figure 4 – Effect of age at implantation on the change on AB phoneme scores over 5 years

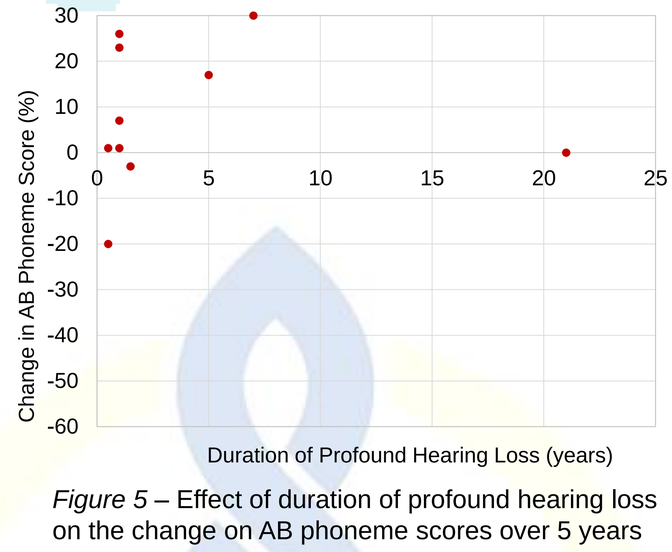

Figure 5 – Effect of duration of profound hearing loss on the change on AB phoneme scores over 5 years

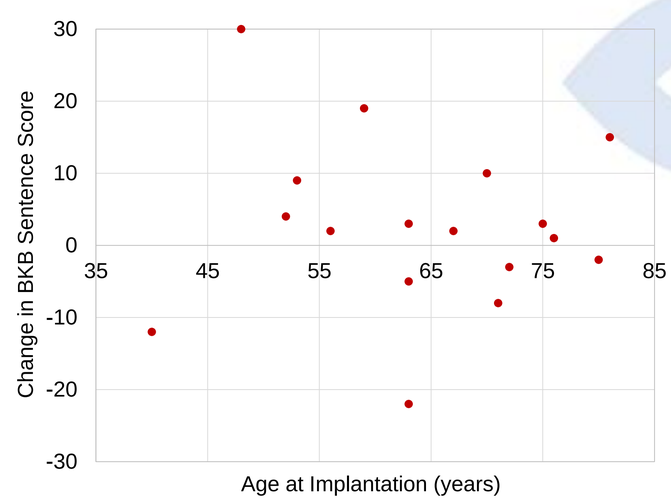

Figure 6 – Effect of age at implantation on the change on BKB scores over 5 years

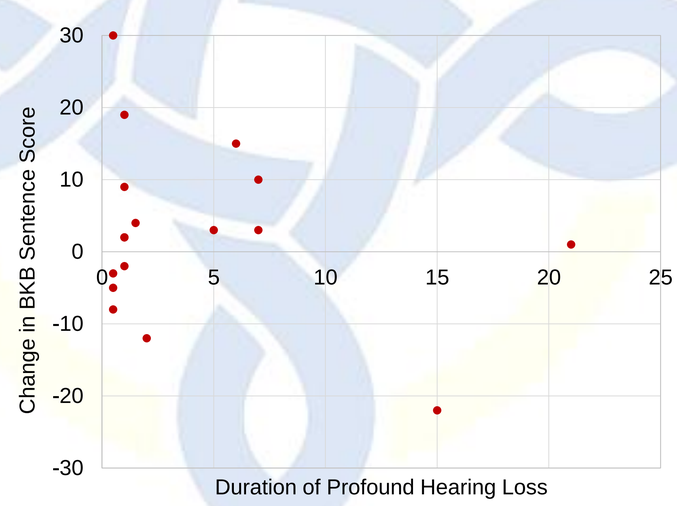

Figure 7 – Effect of duration of profound hearing loss on the change on BKB scores over 5 years

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Gwasanaeth Awdioleg Gogledd Cymru
North Wales Audiology Service

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Betsi Cadwaladr University Health Board

Audiological Profile of Recovered SARS-COV-2 Patients

Hedayat Elfouly, Mariam Magdy, Abdelrahman Nabil | hedayat.fouly@kasralainy.edu.eg
Audiovestibular unit, ENT department, faculty of medicine, Cairo university

1. Introduction

- Coronaviruses are large enveloped RNA viruses that cause mild respiratory diseases in animals and humans.
- In December 2019, several pneumonia cases with an unidentified etiology were reported in Wuhan, China.
- A novel coronavirus was identified on 6 January 2020 as the cause of these cases and named Coronavirus Disease 2019 [COVID-19].
- On 30 January 2020, WHO declared the novel coronavirus as an outbreak.
- Several studies reported auditory symptoms and affection of hearing assessment tests as PTA and OAEs.

Aim:

- To assess hearing in recovered SARS-COV-2 patients using PTA, TEOAEs and ETF. Also, to correlate between the complaint of the patient, the disease severity and hearing affection.

2. Methods

- A case control study, each of cases and controls group comprised 58 subjects age and sex matched with age ranged between 18 to 50 years.
- All subjects were submitted to the following:

1. Full history taking.
2. Otologic examination, including otoscopy and tuning fork tests.
3. Basic audiological evaluation including:
   - Extended PTA
   - TEOAEs
   - Immittancemetry and ETF test.

Table : Affection of PTA and TEOAEs in right and left ears.

		NO.	%
Right PTA	Normal	37	63.80%
	Affected	**21**	**36.20%**
Left PTA	Normal	35	60.30%
	Affected	**23**	**39.70%**
Right TEOAEs	Normal	22	37.90%
	Affected	**36**	**62.10%**
Left TEOAEs	Normal	18	31.00%
	Affected	**40**	**69.00%**

Table: Correlation between PTA threshold affection and COVID-19 severity

		Disease severity (Covid-19)						P value
		Mild		**Moderate**		**Severe**		
		Count	%	Count	%	Count	%	
Right PTA	**Affected**	**6**	20.0%	**10**	45.5%	**5**	83.3%	0.006
	Normal	24	80.0%	12	54.5%	1	16.7%	
Left PTA	**Affected**	**7**	23.3%	**10**	45.5%	**6**	100.0 %	0.001
	Normal	23	76.7%	12	54.5%	0	0.0%	

3. Results & Discussion

- PTA showed a statistical significant difference between cases and controls in right ear thresholds at 250 Hz, 500 Hz, 4 KHZ, and 8 KHz and in left ear thresholds at 250 Hz, 4 KHZ, 8 KHz and 12.5 KHz.
- Also, a statistical significant difference was found between cases and controls regarding TEOAEs overall reproducibility and amplitude (SNR).
- There is a relation between patient's complaint of hearing loss and PTA affection and between patient's complaint of tinnitus and OAE affection.
- Furthermore, there is a relation between patient's complaint of fullness and ETF affection.
- Correlation between PTA thresholds affection and COVID 19 disease severity showed a statistical significant difference in both ears.
- The high frequency hearing loss noticed in the current study and other studies could be attributed to the vascular theory (Ischemia, endothelial dysfunction and micro thrombosis) which affects more the basal part of cochlea (Saniasiaya, 2021). Other theories as brainstem damage, oxidative stress and cytokine storm could explain hearing loss present at any frequency range (Jafari et al., 2021).
- Moreover, middle ear affection resulted in the study could be explained by the spreading of the infection from the nasopharynx which may lead to effusion of the middle ear or potential changes in the middle ear (Fidan, 2020) and (Saniasiaya, 2021).

4. Conclusions

- COVID-19 has unfavorable effect on hearing either in patients with audiological symptoms or not.
- COVID-19 affects hearing threshold at different frequencies.
- COVID-19 affects TEOAEs in patients even with normal PTA.
- There is a relation between patient's complaint of hearing loss and PTA affection and between complaint of tinnitus and TEOAEs affection
- PTA is sensitive in detection of hearing loss while TEOAEs is sensitive in detection of tinnitus in COVID-19 patients.
- There is a relation between patient's complaint of fullness and ETF affection.
- Severity of COVID-19 correlate with the severity of affection of PTA threshold and OAEs.
- Severity of COVID-19 correlate with patient's complaint of hearing loss and fullness.

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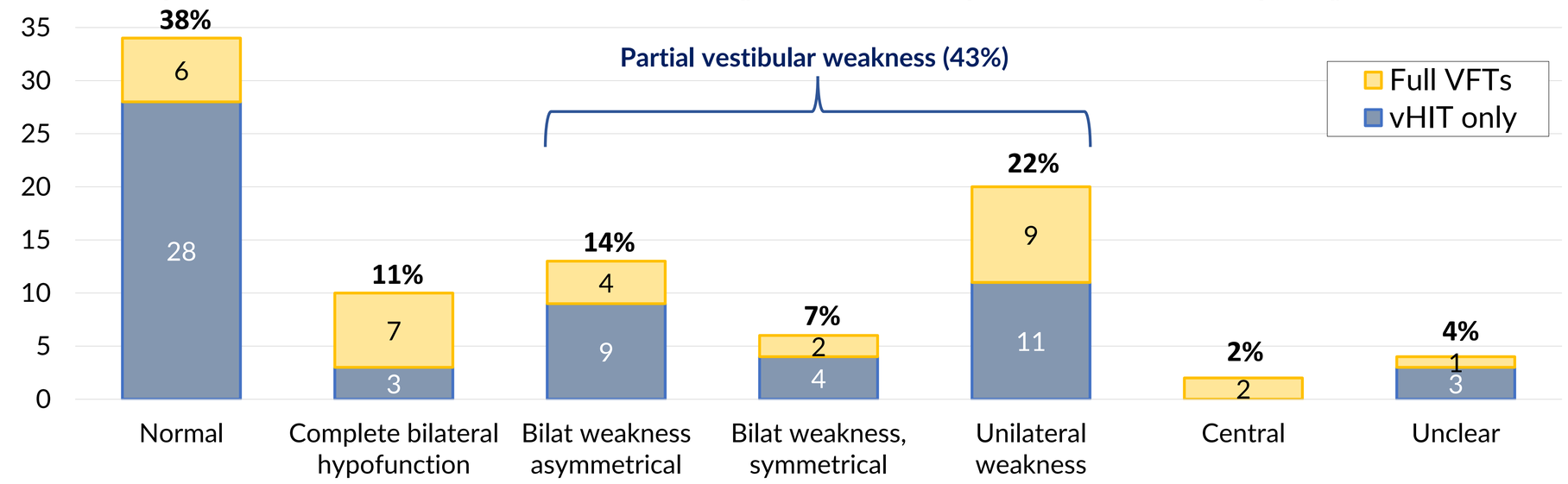
Assessment of the vertical semi-circular canals using vHIT: preservation of anterior canal function in patients with severe to profound hearing loss in criteria for cochlear implant.

David Jay, Rosie Adams, Sam Ranger, Amy Nelson, Jonathan Elilnesan, Martin O'Driscoll

Audiology (Hearing and Balance) Centre, Manchester Royal Infirmary

- **Vestibular assessment or screening on 90 patients with severe to profound hearing loss listed for cochlear implant**
- **38% of patients had normal vestibular function in all six canals**
- **11% had absent high frequency vestibular-ocular reflexes in all canals (Bilateral Vestibular hypofunction)**
- **43% had partial vestibular weakness, often involving the lateral and posterior canals but sparing the anterior canals**



PARTICIPANTS

- 90 patients with bilateral severe to profound hearing loss awaiting surgery for cochlear implant
- Patients had a diverse range of aetiologies, most common was idiopathic progressive hearing loss.
- Mean age: 60 years (SD: 19.7)
- 32 met departmental criteria for full vestibular assessment, which included Video Head Impulse Testing (vHIT)
- 58 had did not meet criteria and had vHIT alone
- Of the 90 patients, 61 had all six semicircular canals assessed by vHIT

METHODS

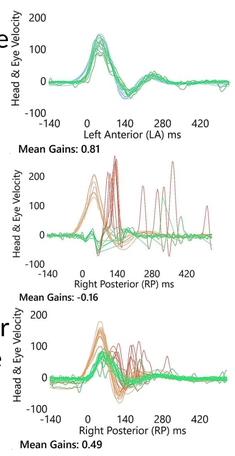
- Full vestibular assessments include a targeted and patient-specific battery which might include vHIT, VNG, mCTSIB, positioning, SVINT, Calorics and cVEMPS.
- vHIT performed using Natus ICS Impulse and OtosuiteV v4.1
- Vertical canal vHIT used method with head at 45°, target visualized out of eccentric gaze and head movements towards and away from the target (in LARP or RALP planes)

vHIT RESULTS

NORMAL A normal vHIT result shows gain within the normal range, a normal curve morphology, and no saccades of a significant size

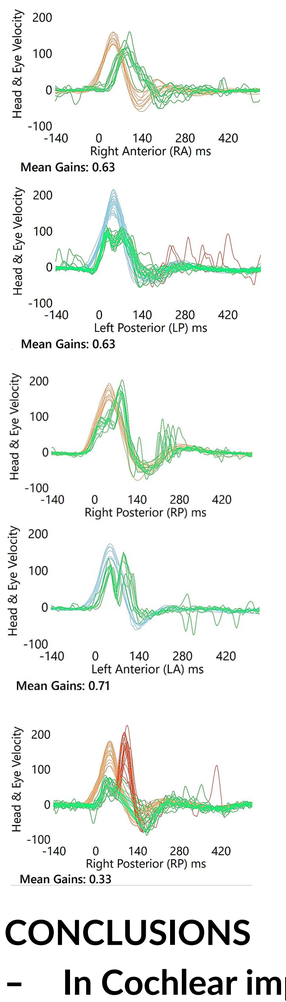
ABSENT VOR A vHIT result suggesting absent VOR shows no curve (or very shallow curve), large covert and/or overt saccades and typically gain will be <0.1

WEAKNESS A vHIT result suggesting weakness in that canal shows a shallow curve, covert and/or overt saccades, and a gain value below the normal range (0.8 laterals, 0.7 verticals),



ARTEFACTS

The ICS Impulse is the only vHIT device which is validated against scleral search coils for the vertical canals (MacDougall *et al.*, 2013). However, vertical canals are particularly prone to artefact, and eliminating and identifying these is vital to accurate testing. In some cases it is very difficult to tell artefactual trace from a truly pathological result.



'Phase shift' caused by stimulation out of canal plane – causes lowered gain

Typical eyelid artefact in left posterior canal – causes low gain and small 'double peak' or flat top

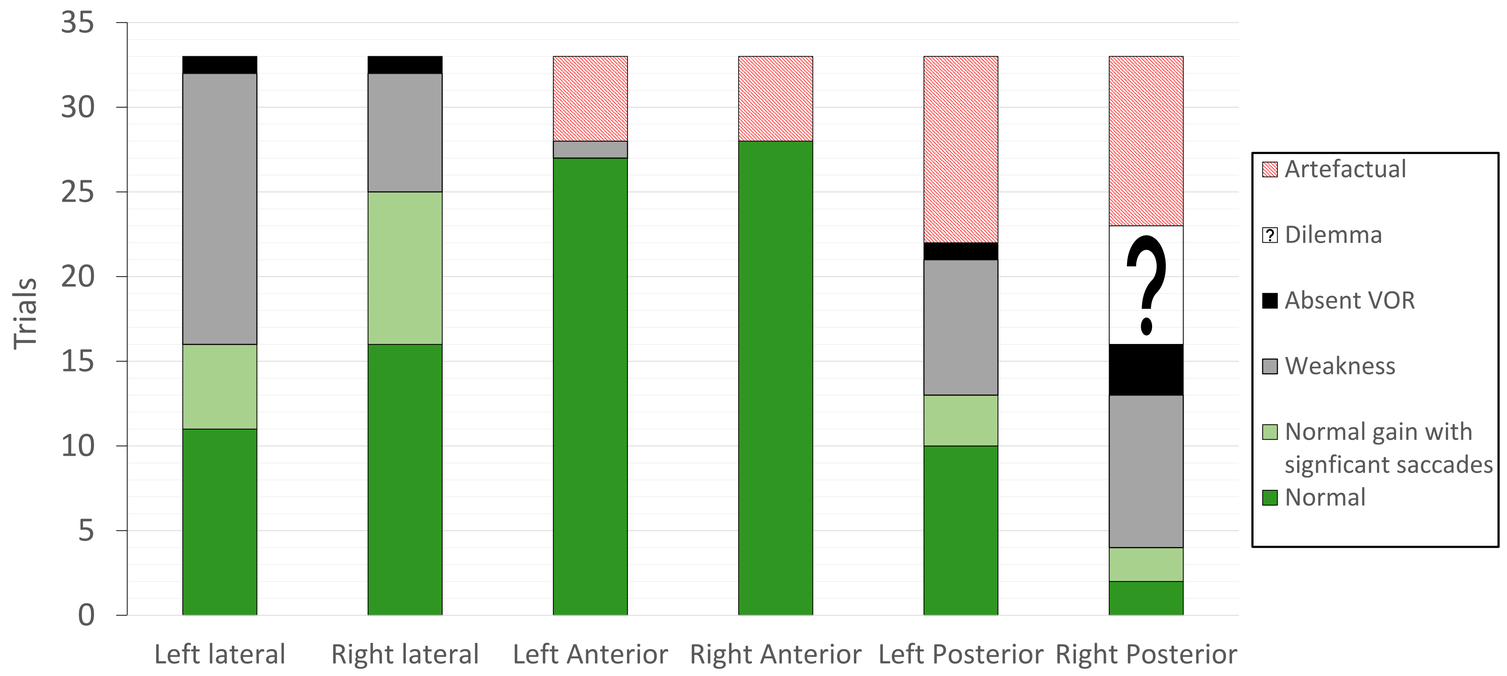
Typical eyelid artefact in right posterior canal – can resemble covert saccades. Saccade reanalysis tab can be used to disqualify

Typical biphasic eyelid artefact in left anterior canal –large 'double peak' and can lower gain

DILEMMA. This trace may well represent eyelid artefact, though could represent low gain with a cluster of covert saccades. Video playback can be used to review whether the pupil tracking is affected by the eyelid, though slower frame rates may not always catch very quick blinks.

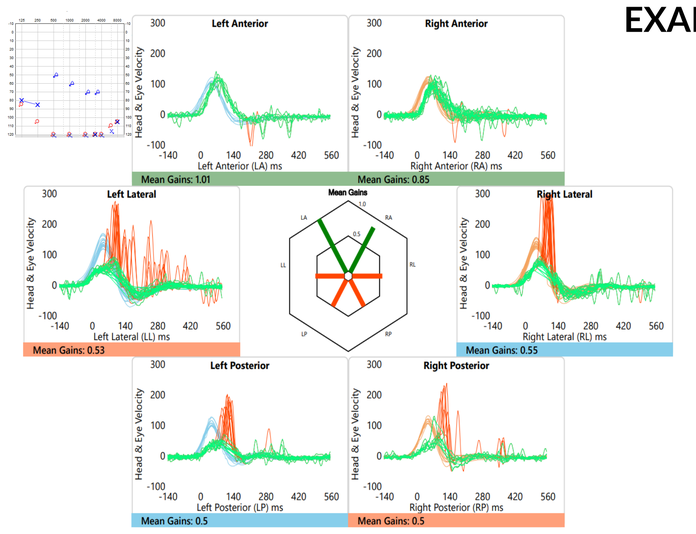
Results for 33 patients (66 ears) with partial vestibular weakness, stratified by canal

These patients had weakness in one or more canals, with some functioning remaining in one or more canals

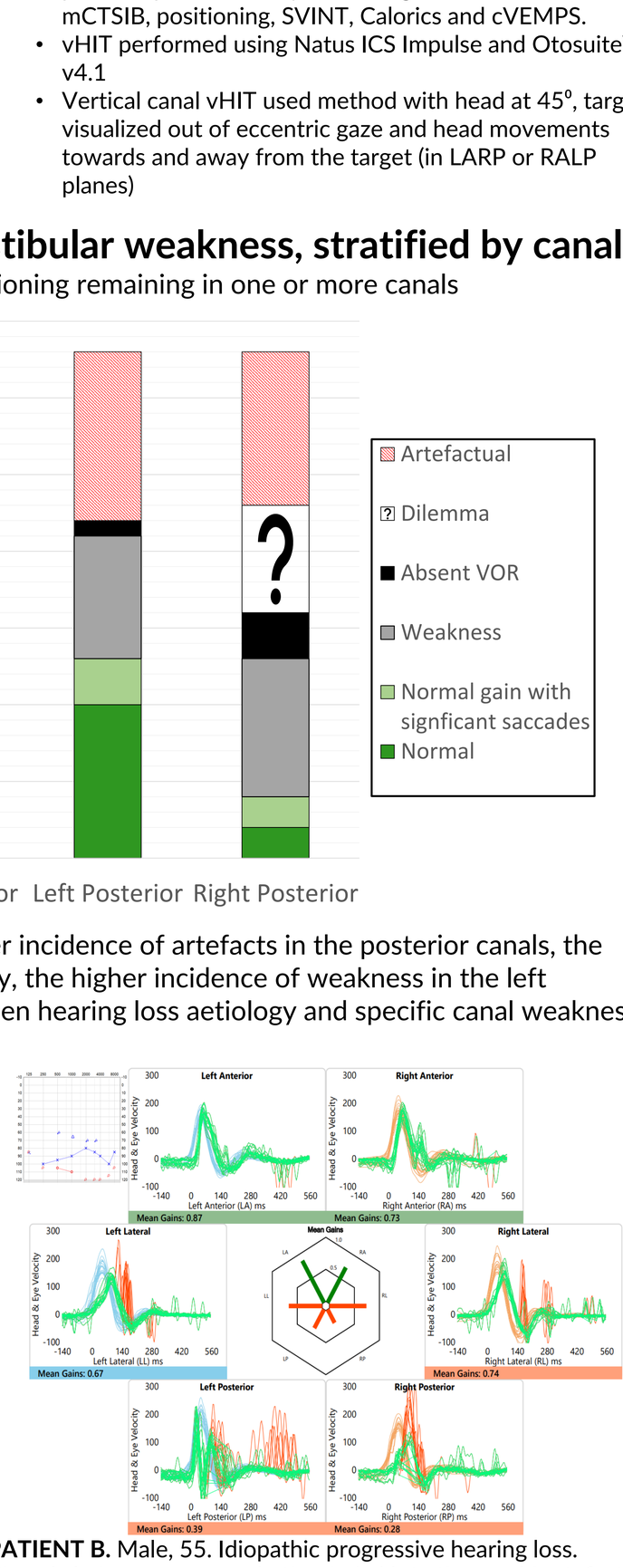


These results reflect not only anterior canal sparing but also the higher incidence of artefacts in the posterior canals, the difficulties of interpretation for the right posterior canal, and unusually, the higher incidence of weakness in the left compared with the right lateral canal. There was no correlation between hearing loss aetiology and specific canal weaknesses.

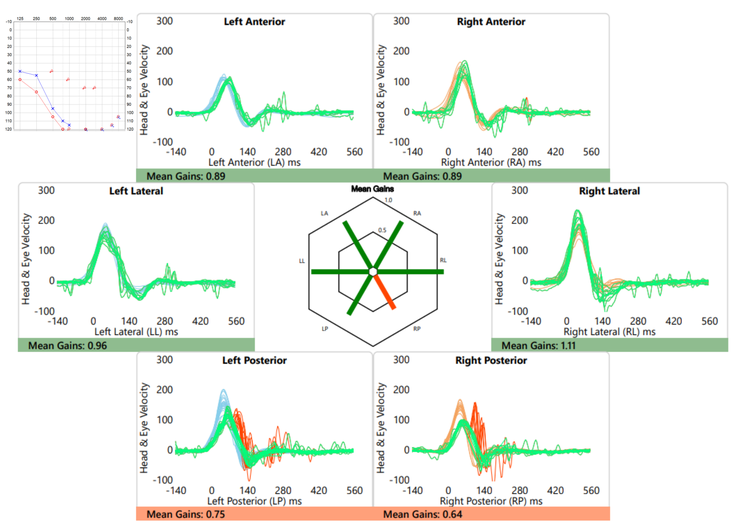
EXAMPLES



PATIENT A. Female, 41. Childhood meningitis + progression. No imbalance or dizziness. Clustered, covert saccades suggest that weakness are longstanding and likely well compensated.



PATIENT B. Male, 55. Idiopathic progressive hearing loss. Chronic imbalance, worse in the dark. Note the eyelid artefact in left posterior with genuine covert and overt saccades.



PATIENT C. Female, 59. Idiopathic progressive hearing loss. No imbalance or dizziness. Bilateral posterior canal weaknesses

CONCLUSIONS

- **In Cochlear implant candidates where vestibular function was not normal or completely absent, partial vestibular weaknesses tended to occur in the lateral and posterior semicircular canals.**
- **With one exception, anterior canal function was only abnormal in cases of bilateral vestibular hypofunction**
- **These results reflect previous work that describes' anterior canal sparing' in certain pathologies such as Meniere's disease, aminoglycoside vestibulotoxicity and idiopathic cases (Tarnutzer *et al.*, 2016; Van Stiphout *et al.* 2022).**
- **No clear patterns were seen in this cohort with respect to aetiology of hearing loss.**
- **Speculatively, sparing of anterior canal function may explain why vertical gaze stability exercises are often less provoking than horizontal**
- **There were also several cases of isolated posterior canal weakness, which has previously been linked to age-related bilateral vestibular deterioration or 'Presbyastasis' (Lerchundi *et al.* 2020)**
- **Further work may examine whether vertical canal function has any bearing on post-operative dizziness**

Presented by David Jay: Clinical Scientist in audiology, specialising in vestibular audiology and cochlear implants.

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Download poster and references

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Nottingham University Hospitals NHS Trust

The University of Manchester

The Impact of COVID-19 on the Newborn Hearing Screening Programme in a Large Teaching Hospital

Malik S, Smalley J, Prendergast G and Hole K.

Nottingham University Hospitals Trust, The University of Manchester

Service Evaluation for MSc Research Project as part of the Scientist Training Programme

INTRODUCTION

- The Newborn Hearing Screening Programme (NHSP) aims to identify permanent, moderate, severe and profound deafness and hearing impairment in new-born babies ensuring appropriate assessments and habilitation for infants with hearing loss, whilst supporting their parents and guardians.
- Offering hearing screening for new-borns enables early identification of a hearing impairment to reduce the effects of impaired speech and language development, thus aiming for a better quality of life for individuals.
- In response to the initial COVID-19 outbreak, Nottingham University Hospitals (NUH) altered many of their services, which included changes to the NHSP and ceasing of audiological evoked potential diagnostic testing. The national consensus was to discharge patients rapidly where appropriate to reduce the risk of COVID-19 spreading and to keep beds free for those who require them.
- The British Academy of Audiology (BAA) and Public Health England (PHE) published recommended alterations to the conventional pathway, advising to conduct Automated Otoacoustic Emissions 1 as close to discharge as possible, with enough time to conduct an Automated Auditory Brainstem Response where no clear response is obtained, thus skipping Automated Otoacoustic Emissions 2 where time is limited.

OBJECTIVES:

- To evaluate whether the changes of The NHSP at NUH in response to COVID-19 impacted
  - i. the identification age,
  - ii. referral rate,
  - iii. number of infants identified with Permanent Childhood Hearing Impairment (PCHI),

METHODS:

- **DESIGN:** A service evaluation of the NHSP data from 1/12/2016 to 28/02/2021 obtained retrospectively through the Smart4Hearing software.
- **SAMPLE:** 31,489 infant data sets divided into five birth cohorts including a 'COVID-19' cohort (1st March 2020 - 28th February 2021).

RESULTS:

- For infants born during the COVID-19 cohort, the mean chronological screening age in weeks was significantly earlier (0.15 weeks) and infants were over twice as likely to refer the screen.
- The mean chronological age in weeks at diagnostic assessment was also greatest for this cohort (8.83 weeks) as was the mean chronological age at identification of a permanent childhood hearing impairment (12.39 weeks).
- Infants born during COVID-19 did not show an increase likelihood of permanent childhood hearing impairment or a temporary conductive hearing loss at diagnostic testing, compared to other cohorts.

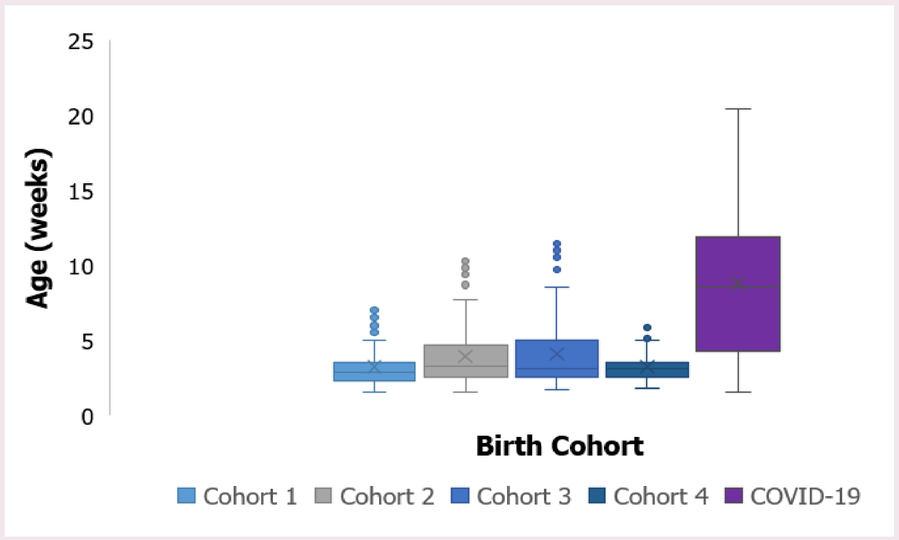

Figure 1. Box plot to display the chronological age at diagnostic testing (in weeks) per birth cohort.

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	COVID 19
Total Babies Screened (n)	1861	7992	7470	7454	6712
Infants Referred/Failed Screen (n)	45	160	139	162	287
Referral Rate (%)	2.42	2.00	1.86	2.17	4.28

Figure 2. Calculated referral rates to diagnostic testing following a no clear response result per birth cohort

DISCUSSION:

Age at Screening:

- Implications of screening early can result in a high number of false positives.

Number of infants who referred the screen:

- Infants being twice as likely to refer the screen in turn could have implications on cost to patients/parents, healthcare services and parental anxiety, especially where diagnostic audiological testing is delayed.

Age at Diagnostic Assessment:

- 36% of infants were seen within the required 4 week time frame, in comparison to the previous 4 years. This suggests that infants were without care for longer periods as a result of the changes to the service.
- A delay in diagnostic audiological assessment can lead to a delay in identification and intervention of hearing loss, which can negatively impact the development of the infants speech and communication.

TAKE HOME MESSAGES:

- Screening infants early can lead to an increase in referral rate to diagnostic audiological assessment
- In comparison to previous years, significant differences in age at identification of PCHI were not noted
- The number of infants identified with a PCHI and temporary conductive hearing loss did not differ greatly from the numbers obtained from the previous 4 birth cohorts.

RECOMMENDATIONS:

- Services to explore the impact COVID-19 may have had on their NHSP service, as this could impact timely identification and intervention.
- Evaluating the lost-to-follow-up rate to contact parents or guardians of infants who were not brought for diagnostic audiological assessments, reducing the risk of unidentified hearing loss.
- Future investigation into the long-term audiological effects of maternal COVID-19 infection on infants may also warrant future research.

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National School of Healthcare Science

NHS Health Education England

Examining speech recognition with the use of adaptive gain receivers and ReSound Multi Microphone technology

Megan Quilter, AuD[1], Neil Wright, Au.D[1]

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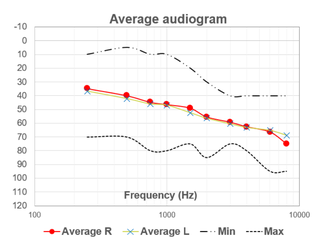
This project compliments a previous investigation that studied the GN Hearing's Multi Microphone's behavior when used in tandem with digital modulation (DM) technology, which discussed and confirmed the preservation of the adaptive gain benefits of digitally modulated receivers when coupled to a Multi Microphone. The intention of this study is to explore and confirm that patient speech recognition scores obtained with the use of adaptive gain receivers coupled to the Multi Microphone, remain uncompromised between the two technologies.

Phase I (2017) Objective validation of equipment
Examine adaptive gain advantage exists and/or benefit is reserved for users of the particular manufacturer's hearing aids

Phase II (2020) Subjective validation of equipment
Examine speech recognition scores obtained with the use of adaptive gain receivers coupled directly to hearing aids versus an adaptive gain receiver coupled to the ReSound Multi Microphone

Design and Methods

20 participated in this research study



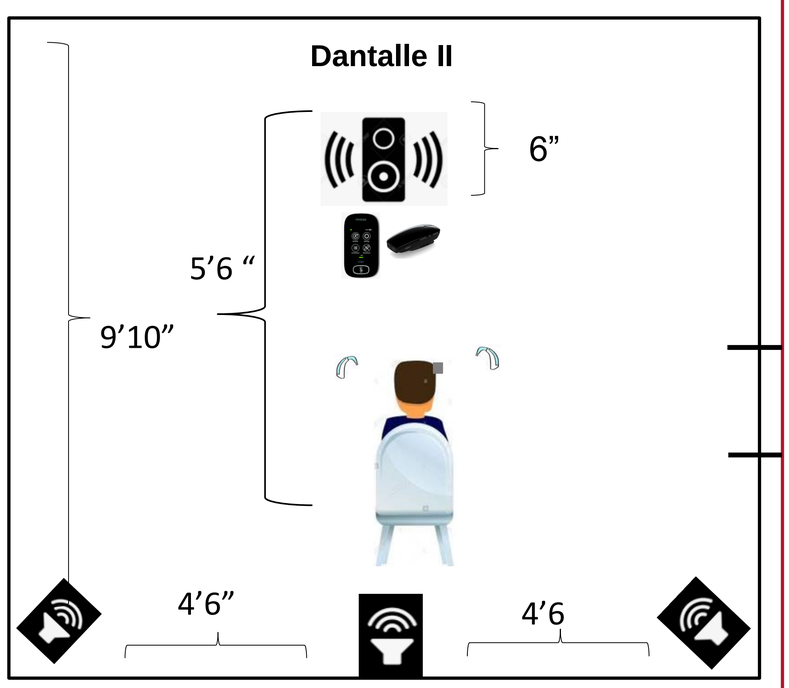
Equipment: Phase I
- ReSound LiNX[2]
- Phonak Sky V M13
- Roger 15 integrated receiver
- Phonak Roger X universal receiver
- ReSound audioshoe
- Roger Pen transmitter
- ReSound Multi Mic

Equipment: Phase II
- ReSound Quattro 962 RIE x2
- ReSound remote control
- Phonak Roger X universal receiver x3
- ReSound audioshoe x2
- Roger Touch Screen transmitter
- ReSound Multi Microphone

Dantalle II Test Setup
- Speech presented from front
- Starting level: 65 dB
- Speech level varied w/ performance
- 65 dB static noise

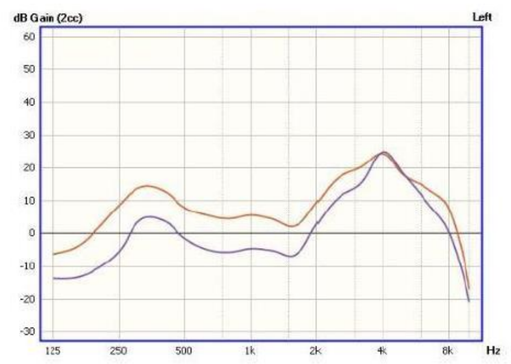
Double-blind
- Tester & Operator

Conditions
- Counter-balanced, randomized
  1) HA only
  2) Adaptive rxs/audioshoe
  3) Adaptive rxs/MM
  4) MM only

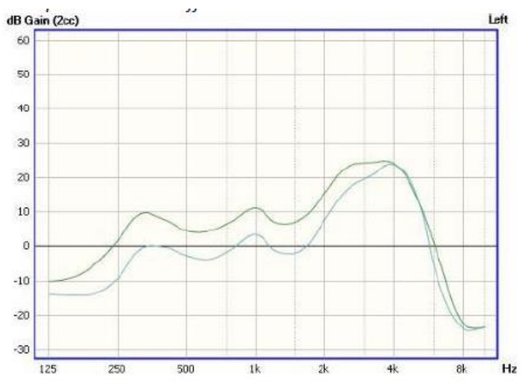


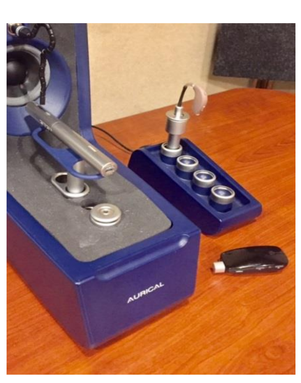
Results

Phase I: 2017; Objective validation



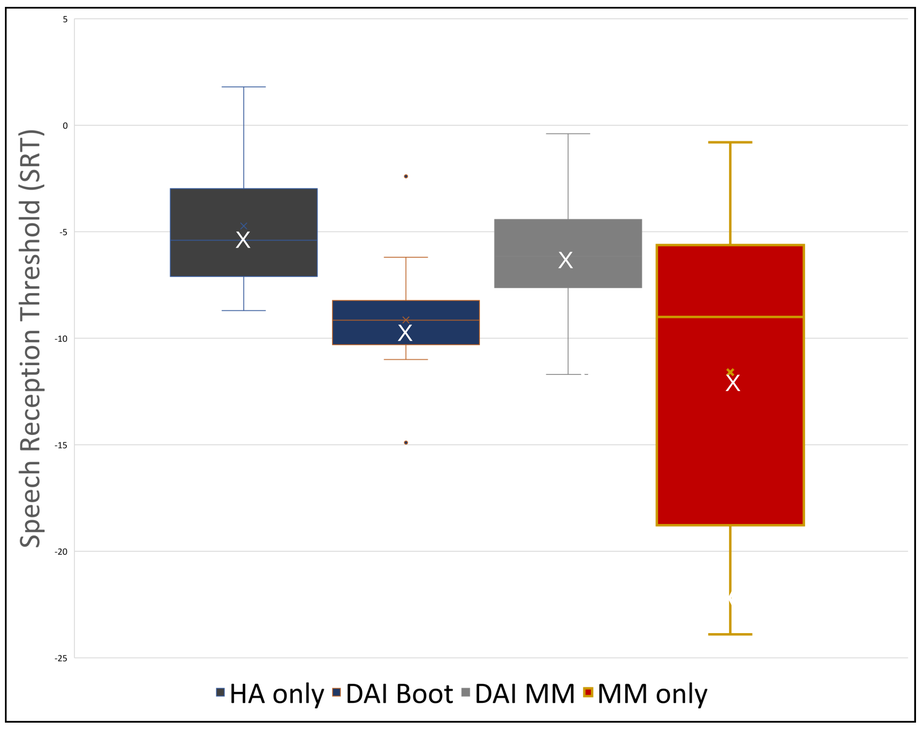
The Purple curve measured with ISTS babble at 75 dB SPL with pink noise and is the pre-adaptive gain adjustment. Red curve shows the post-adaptive gain adjustment for ISTS babble at 75 dB with pink noise. The difference between the two curves shows adaptive gain benefit.





ReSound LiNX2 hearing instrument with adaptive gain receiver via MM. Blue curve measured with ISTS babble at 75 dB SPL with pink noise and is pre-adaptive gain adjustment. Green curve shows post-adaptive gain adjustment for ISTS babble at 75 dB SPL with pink noise. Difference between two curves shows preservation of adaptive gain benefit.

Phase II: 2020; Subjective validation



Data analysis with ANOVA & post hoc analysis withTukey Kramer multiple comparison test:

- No significant differences between adaptive gain rxs via audioshoe or via Multi Microphone
- No significant differences between adaptive gain rxs via audioshoe and Multi Microphone only.
- Multi Microphone only is significantly better than HA only
- Adaptive gain rxs via audio shoe are significantly better than HA only
- Multi Microphone only is significantly better than adaptive gain receivers via Multi Microphone

GN Hearing and ReSound technology have shown proven benefits when using the Multi Microphone on speech recognition in the presence of noise. The preservation of the adaptive gain advantage seen by competitors is possible when using ReSound hearing instruments with receivers streaming through ReSound Multi Microphone technology. Verification is necessary when you are mixing manufacturers technology.

Evaluating the Effectiveness of Using Different Directional Algorithms per Ear with Bimodal Solutions

Megan Quilter AuD[1], Neil Wright AuD[1], Holly Mergist BA[2], Taylor Arenz BS[2], Bryan McDonald AuD[2], George Cire AuD[2], Aaron Parkinson AuD[2]

GN Hearing A/S[1] & Cochlear Americas[2]

Smart Hearing Alliance

Abstract

Introduction: Directional sound processing provided by hearing aids (HA) and cochlear implants (CI) can enhance wearers' speech understanding while in complex listening environments[1,2,3]. GN ReSound and Cochlear™ devices each apply unique directional processing algorithms to help with speech understanding in noise, but the specific algorithms act independently. It is of interest to know whether people fit bimodally can benefit by having both distinct directional systems active while in complex listening environments. This study describes a clinical investigation that evaluated the effectiveness of utilizing different ear algorithms in bimodal systems to assess hearing outcomes of bimodal users in a laboratory and field settings.

Methods: This observational cohort study evaluated hearing outcomes with users' bimodal systems using speech in noise testing (AzBio Sentence Test) and a subjective hearing performance questionnaire (Speech, Spatial and Qualities Questionnaire (SSQ-12)). To evaluate the efficacy in the participants daily lives, an ecological momentary assessment (EMA) tool was also used. Nine adults with moderate to profound hearing loss in the aided ear participated in this study. All participants had at least 6 months of regular experience with their CI speech processor and were experienced HA users.

Results: Statistical analysis was performed using a one-way repeated analysis of variance (ANOVA). Statistically significant improvements in mean AzBio scores in quiet conditions were seen while wearing a bimodal system (default settings) compared to CI alone (p=<.02). Statistically significant improvements in mean scores were seen in both the +10 SNR and +5 dB conditions when using a bimodal directional program compared to CI alone (p=<.01, p=<.03, respectively). The results are hypothesized to be that utilizing bimodal stimulation in noisy environments can provide improvement over unilateral CI stimulation alone. This data also suggests that providing full access to sound in quiet by providing bimodal listening even in quiet environments can provide benefit over CI alone.

Conclusions: This study illustrates how ReSound ONE™ hearing aids and Nulceus®7/ Kanso® 2 sound processors each apply a unique directional processing algorithm. Despite being independent from one another, each can provide benefit to individuals who are fit with a Smart Hearing Alliance bimodal hearing solution. The ReSound ONE™ HA utilizing directional sound processing, in combination with Cochlear's™ ForwardFocus, can enhance users' speech understanding while in complex listening environments.

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2. Gifford RH, Dorman MF. Bimodal Hearing or Bilateral Cochlear Implants? Ask the Patient. Ear Hear. 2019 May/Jun;40(3):501-516. doi: 10.1097/AUD.0000000000000657. PMID: 30285977; PMCID: PMC6447482.

3. Hoppe U, Hocke T, Digeser F. Bimodal benefit for cochlear implant listeners with different grades of hearing loss in the opposite ear. Acta Otolaryngol. 2018 Aug;138(8):713-721. doi: 10.1080/00016489.2018.1444281. Epub 2018 Mar 19. PMID: 29553839.

Methods

Characteristic	Mean (S.D.) (N=9)
Age at Implantation	58.2 years (±18 yrs) Range: 26-72 years
Gender	6 males (67%) 3 females (33%)
Duration of Hearing Loss	9.9 years (±4.7 yrs)
Right Ears Left Ears	67% 22%

Table 1

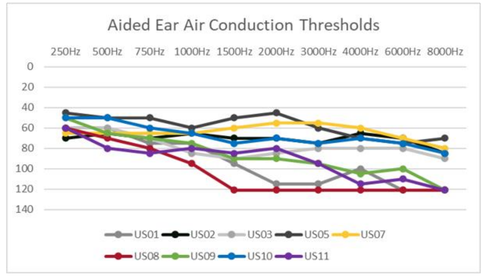

Figure 1

Participant demographic data is detailed in Table 1. Participant audiograms for the aided ear shown in Figure 1. Hearing aids were fit using the ReSound proprietary fitting prescription, Audiogram+, and programmed to the Smart Hearing Alliance bimodal default settings. Participants were given two hearing aid programs: Program 1 utilized Soft Switching Directionality as the directional microphone settings, while Program 2, "Restaurant", used Multiscope Adaptive Directionality manually set to narrow. The contralateral ear was fit with either a Cochlear™ Nucleus®7 or Nucleus® Kanso® 2 sound processor using Custom Sound® Pro Fitting Software with their stable MAP prior to the study and enabled Cochlear's™ ForwardFocus. Participants wore their hearing instruments and processors in their daily lives for two weeks.

AzBio Sentence testing was completed in a sound treated booth at both visits across three test conditions; speech in quiet, and two speech in noise (SIN) conditions. Speech was presented through a single loudspeaker from 0 degrees azimuth. For SIN conditions, competing background noise was presented as a ten-talker babble from speakers behind the participant from 90 through 270 degrees. Each condition consisted of one, 20-sentence list presented at 65 dBA in sound field, with SIN conditions presenting babble at 55 dbA (+10dB SNR) and 60 dBA (+5 dB SNR) in sound field. Speech recognition performance was compared across three hearing device configurations: CI alone, CI + HA and directional CI + HA. The SSQ-12 was administered at both visits. EMA mobile app (RealLife Exp) was downloaded to capture daily use information.

Results

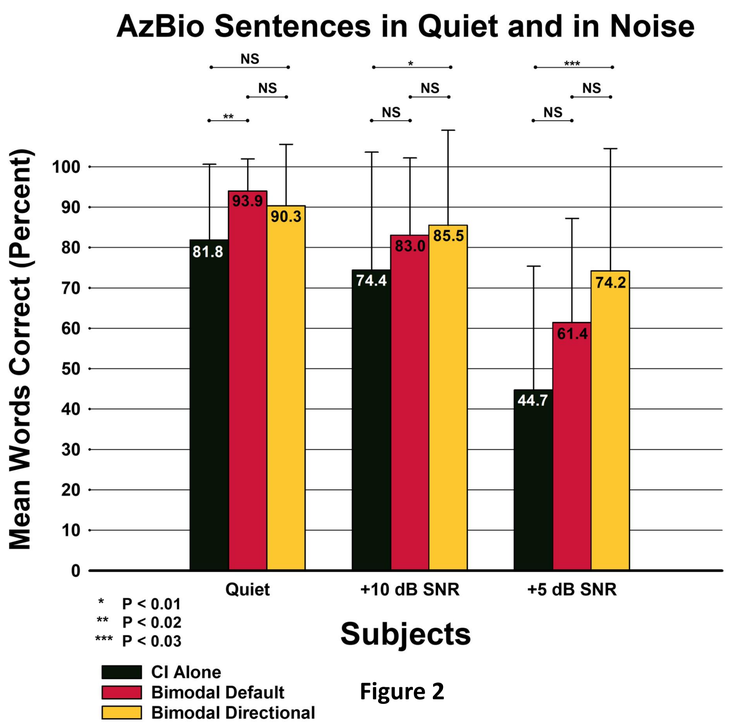

Figure 2

AzBio Results

Statistical analysis was performed utilizing a 1-way ANOVA. Figure 2 shows mean percent correct by listening condition (CI alone, Bimodal default, Bimodal directional), across all noise conditions (Quiet, +10 dB SNR, +5 dB SNR). Figures 3, 4 and 5 detail subject-specific performances in different listening conditions across noise conditions. Statistically significant improvements in mean scores in quiet were seen in bimodal default settings compared to the CI alone (p=.01). Statistically significant improvements in mean scores were seen in both the +10 SNR and +5 dB conditions when using a bimodal directional program compared to CI alone (p=.006, p=.026).

SSQ-12 and EMA Results

The SSQ-12 was administered to all participants on the first fitting appointment and the last appointment. Responses were averaged and the mean score for each subsection were calculated, and results are shown in Figure 6. Paired t-tests revealed no significant differences. Overall results for the EMA data indicate that users were satisfied while wearing their bimodal system (Figure 7). When users were asked how tired they felt by the end of the day, 45% reported they were not tired at all, 30% reported being only a little tired and 26% reported feeling moderately tired (Figure 8).

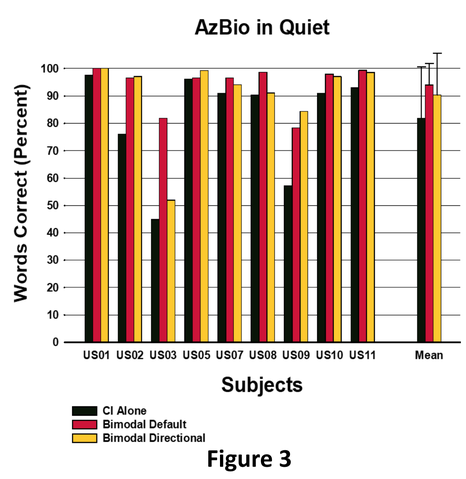

Figure 3

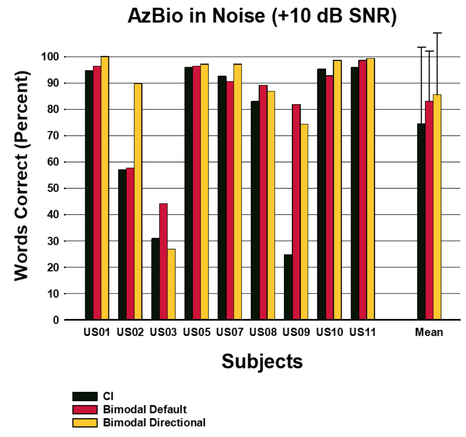

Figure 4

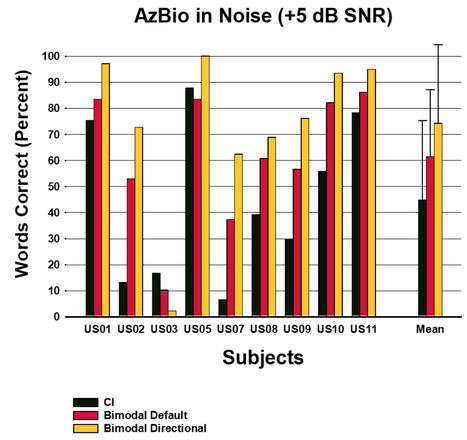

Figure 5

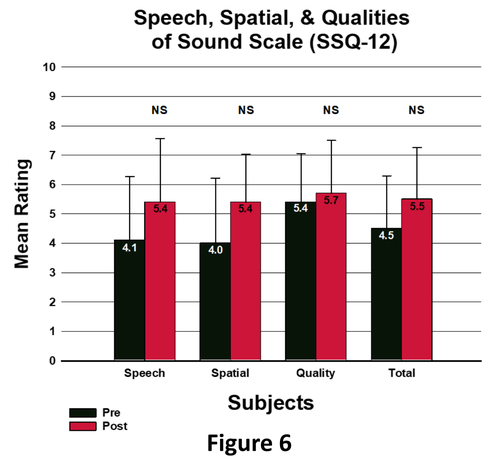

Figure 6

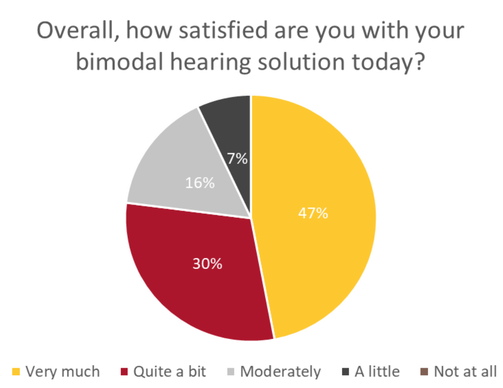

Figure 7

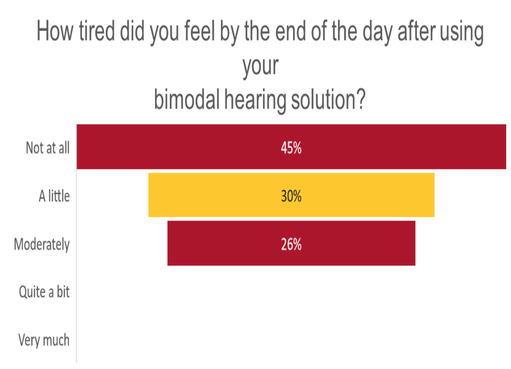

Figure 8

Discussion

Results showed a significant bimodal advantage evident at +5 dB SNR and +10 dB SNR compared to CI alone. Results were less impacted by ceiling effects in +5 dB SNR test condition, and 8 of 9 participants' best score was achieved using the bimodal solution. Participants did not always perform best using directional settings, but participants generally performed better in the bimodal solution than with a cochlear implant alone. Notably, one subject appeared to show a bilateral disadvantage in the directional settings which should be considered in further habilitation. Limitations to the study included having a small sample size and ceiling effects likely impacted the results of the AzBio scores in Quiet and at +10 dB SNR.

Conclusion

The Smart Hearing Alliance bimodal solution has shown to provide better speech understanding in the presence of noise over a cochlear implant alone. While the use of directional sound processing in the ReSound ONE™ and Cochlear's™ ForwardFocus showed further improvement in sound field testing, the most benefit was seen when a bimodal solution was utilized. Having a psycho-social domain for clinicians to analyze allows a collection of real-world information about situations that are relevant to the user and can gain valuable information about dimensions beyond speech understanding which can affect communication.

Newborn diagnostic auditory assessment from NHSP during COVID lockdowns in England

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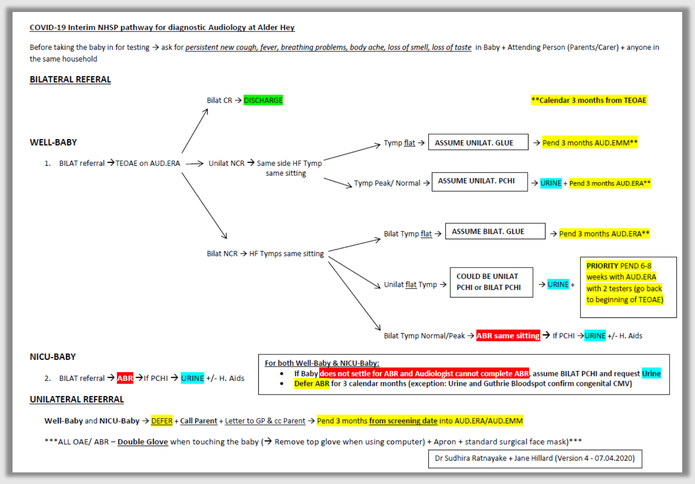
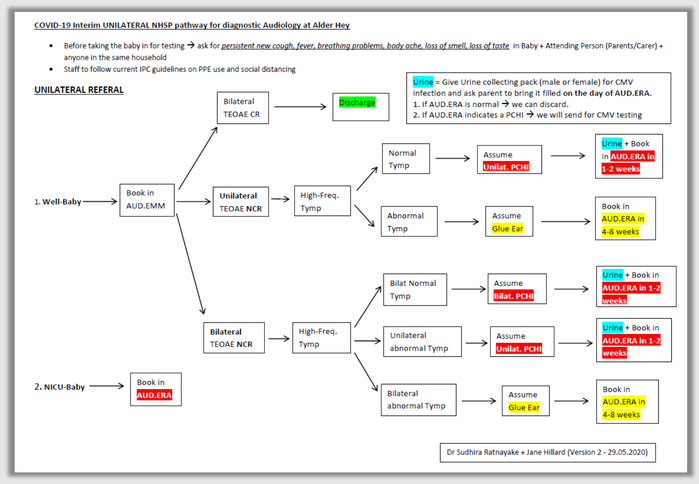
Dr Sudhira Ratnayake [1 & 2], Consultant Audiovestibular Physician
Mrs Jane Hilliard [1], Chief Audiologist
Mrs Neera Chopra [1], Chief Audiologist
Mrs Maureen O'Hare [1], Chief Audiologist & Audiology Manager
Prof Soumit Dasgupta [1 & 2], Consultant Audiovestibular Physician

1. Department of Audiovestibular Medicine & Audiology | Alder Hey Children's Hospital | Liverpool, UK
2. School of Medicine | University of Liverpool | Liverpool, UK

Background

- During the COVID Pandemic, England had 3 national lockdowns from 23rd March 2020 to March 2021.[1]
- The national Audiology organisations issued various interim guidelines at different stages of the pandemic.
- Alder Hey Children's Hospital provide diagnostic Auditory Brainstem Response (ABR) tests to 2x Newborn Hearing Screening Programme (NHSP) sites, namely Liverpool and West Lancashire, and babies referred from Isle of Man.
- In addition to the diagnostic services, we provide a full medical deafness aetiology assessment (as per national guidelines from the British Association of Audiological Physicians [2]) and auditory rehabilitation service.
- During the COVID lockdowns, we adopted interim diagnostic pathways for bilateral and unilateral NHSP referrals, with approval from the Hospital's ethical and COVID taskforces.





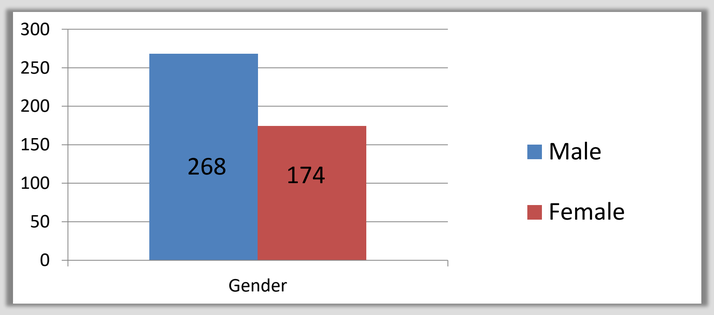
Methods

- A retrospective case note review, registered with the Governance and Quality Assurance Department, was undertaken of all newborns who had at least one post-NHSP auditory assessment (Transient-Evoked Oto-Acoustic Emissions, TEOAE and/or ABR) during the 12-month period of COIVD lockdowns.
- All diagnostic equipment undergo regular calibration as per national and departmental guidelines.
- Data collected: NHSP referral details, diagnostic auditory test details, type and degree of hearing loss detected from auditory tests, deafness aetiology.

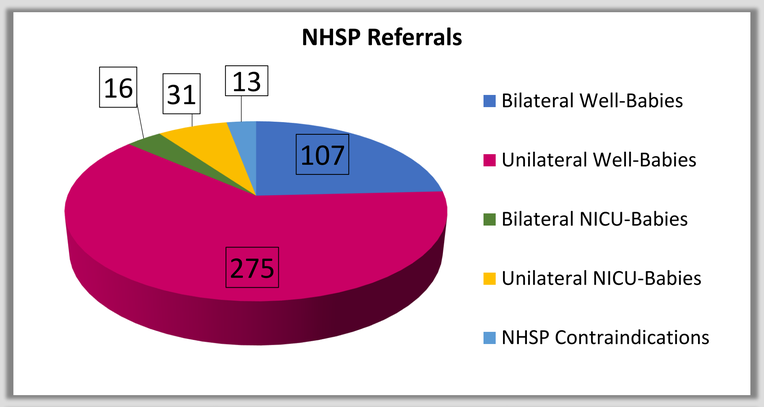
Results

Demographics

- Newborn cohort that had at lease one auditory assessment: n = 442
- Male: Female = 268 (61%) : 174 (39%)

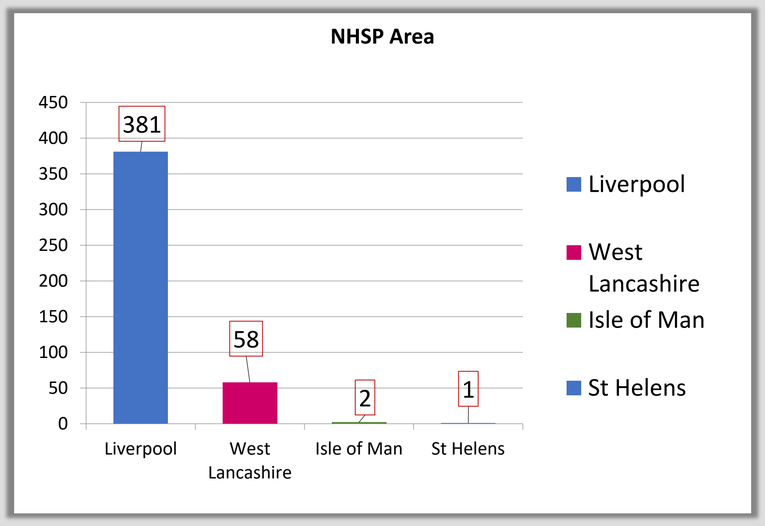


NHSP referrals

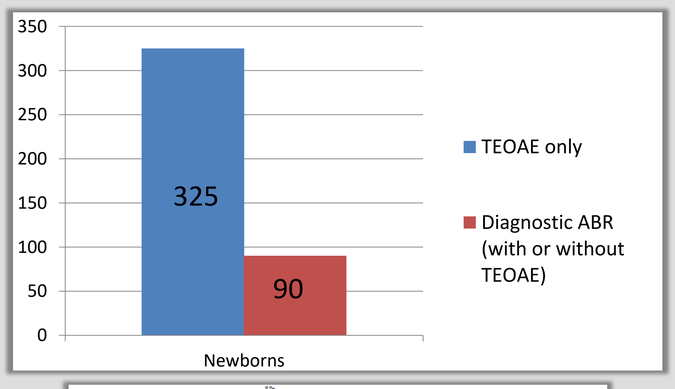


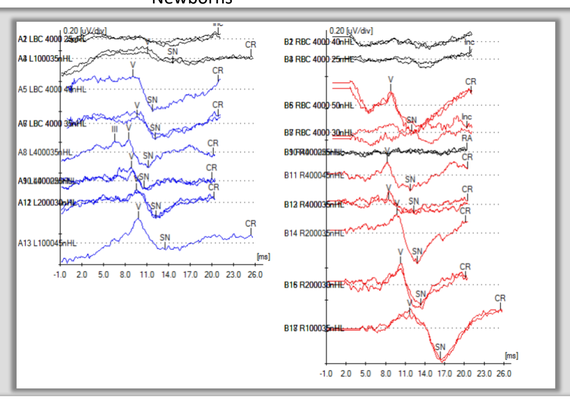
NHSP Contraindications	NICU - Neonatal Intensive Care Unit prolonged stay	Craniofacial condition (Microtia / Atresia)
Newborns	11	2

NHSP area coverage



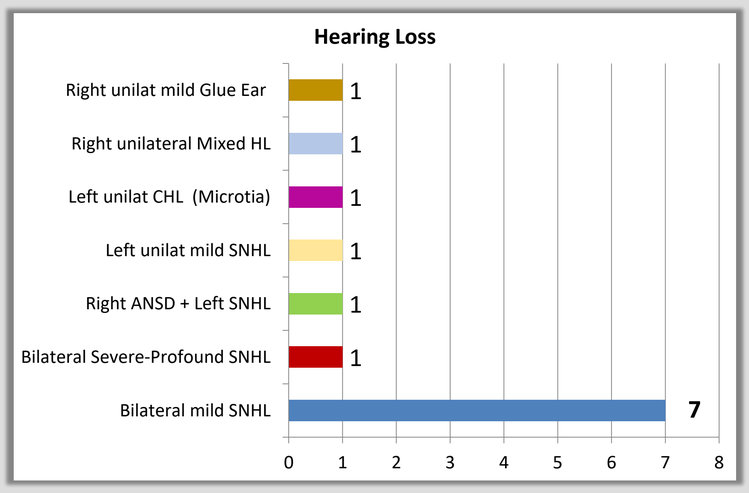
Post-NHSP auditory tests





Summary ABR - Bilateral mild SNHL in Congenital CMV with Cystic Fibrosis

Hearing Loss



LEGEND
SNHL = Sensorineural Hearing Loss
CHL = Conductive Hearing Loss
ANSD = Auditory Neuropathy Spectrum Disorder

Normal Hearing	Targeted Follow-up at 8 months	Discharged after Diagnostic Auditory tests
Newborns	37	392

Deafness Aetiology & Amplification

Hearing loss	Medical Aetiology and Amplification
Bilateral mild SNHL = 7	Vohwinkle Syndrome = 1 - unaided (Autosomal Dominant Connexin 26 condition + family members with affected skin and hearing
	Congenital Cytomegalovirus (CMV) with Cystic Fibrosis = 1 - unaided
	Autosomal Recessive Genetic Deafness = 2 (One each - Homozygous *TECTA* gene variants and Homozygous *OTOGL* variants) – both BTE aided
	Unknown Aetiology = 3 – 1 baby BTE aided
Bilateral Severe-Profound SNHL = 1	Unknown Aetiology - *Cochlear Implant referral*
Right ANSD + Left SNHL = 1	Johanson-Blizzard syndrome – *Cochlear Implant referral*
Left unilateral mild SNHL = 1	Unknown Aetiology - unaided
Left unilateral Moderate permanent Conductive Hearing Loss	Ocular-Auricular-Vertebral Spectrum (Goldenhar Syndrome) with Left Microtia, Craniofacial dysmorphism and Cardiac anomalies - unaided
Right unilateral moderate Mixed hearing loss	Unknown Aetiology (ongoing) - Subtle Right Craniofacial dysmorphism - unaided
Right unilateral mild Glue Ear (Conductive Hearing Loss)	Trisomy 21 (Down's syndrome) – born prematurely at 31 weeks - unaided

Conclusions

- By adopting modified interim pathways, it was possible to deliver a safe diagnostic auditory NHSP pathway during the COVID pandemic.
- There was no compromise in time-critical aetiological investigations (e.g. urine for CMV) or auditory interventions (e.g. cochlear implant referrals).
- Close multi-disciplinary working ensured completion of both audiological and medical assessments for babies referred from newborn hearing screening.

References

1. Brown J and Kirk-Wade E. (2021) **Coronavirus: a history of 'Lockdown Laws' in England.** House of Commons Library. https://commonslibrary.parliament.uk/**.**
2. British Association of Audiovestibular Physicians. (2015) - **Guidelines for aetiological investigations of permanent childhood hearing impairment (mild to moderate bilateral / severe to profound bilateral / unilateral) :** https://www.baap.org.uk/documents-guidelines-pathways-and-clinical-standards.html

An Evaluation of the Cochlear BAHA 5 Super Power and Power Bone Anchored Hearing Devices (BAHD); Cochlear BP110 and Oticon Ponto Pro Power

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Introduction

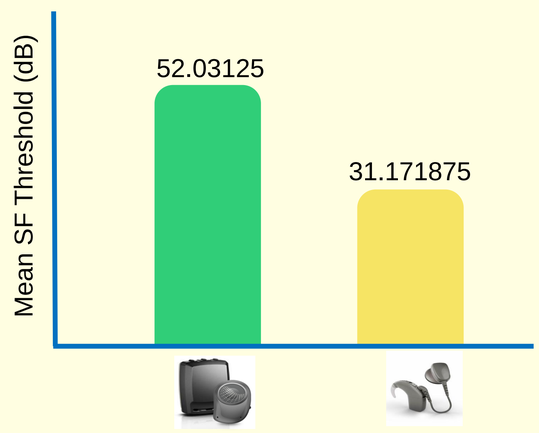
- We are seen to be very social beings, communicating in many ways, with understanding spoken language being the most dominant. Every day we are faced with differing situations, where listening to speech and hearing environmental sounds are immensely important.
- Successful hearing rehabilitation can lead to a reduction in hearing loss induced deficits of function, activity, participation, and quality of life
- Percutaneous bone conduction devices are an important rehabilitation option for hearing impaired individuals with conductive or mixed hearing loss whom unable to wear conventional hearing aids.
- Historically, BAHDs come in two strengths depending on an individual's hearing loss: standard and power devices providing gain for individuals with a Bone Conduction (BC) hearing loss of 45-55dB.
- The question does arise as to what happens if a long-term wearer of a BAHD starts to develop a further hearing loss due to presbycusis.
- Cochlear Ltd launched their new sound processor in 2015. By using the BAHA 5 in conjunction with Cochlear Implant sound processing technology, the new BAHA 5 Super Power aimed to provide amplification to individuals with an average 65dB BC threshold.
- Would the comparison of current PBAHDs with the new Cochlear BAHA 5 Super Power provide a solution to the difficulties faced?

Method

- The aim of the study was to investigate how the BAHA 5SP benefits those patients that were aided with PBAHD such as Cochlear BP110 or Oticon Medical's Ponto Pro Power.
- This study did this by evaluating information retrospectively collected from 16 participants.
- Every individual had a minimum of 3 years' experience with their previous power BAHD. The study consisted of 16 patients with equal subjects that had Cochlear BP110 device (8) and Oticon Ponto Pro Power devices (8).
- Comparison were made of objective aided outcomes in the form of aided SF audiometry, aided speech tests from AB word lists (HOSRT scores) and aided SNR loss scores from QUICKSIN, equating to their PBAHD and their BAHA 5SP.
- Subjective information in the form of global scores and subscales from the APHAB questionnaire and SSQ were compared for each participant.

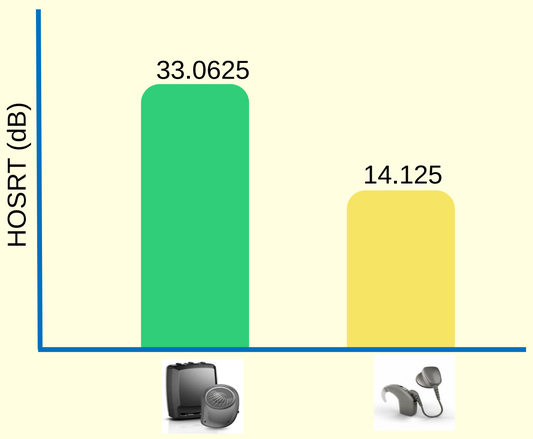
Results

Comparison of Mean SF Thresholds



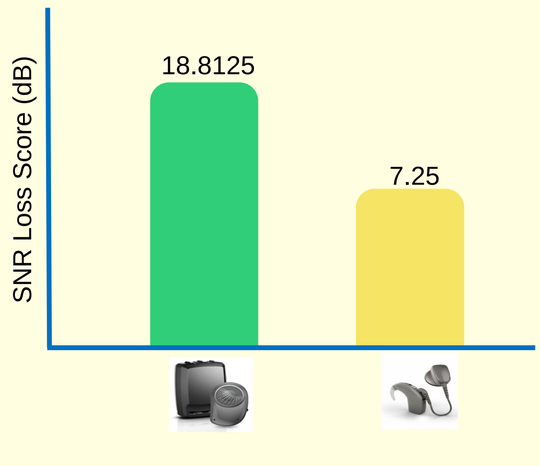
A graph demonstrating the comparison of average sound field measurements for Power BAHD and BAHA 5 SP with a **20.9dB** average improvement.

Comparison of HOSRT



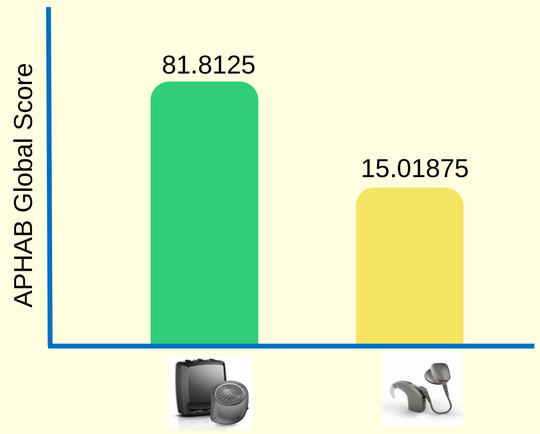
A graph demonstrating the comparison of average HOSRT for Power BAHD and BAHA 5 SP with a **18.9dB** HOSRT average improvement.

Comparison of QuickSIN SNR Loss



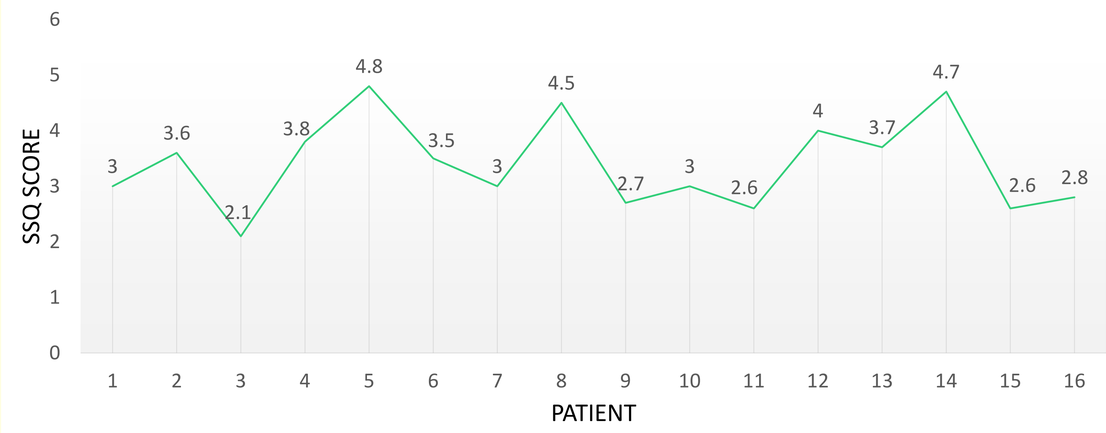
A graph demonstrating the comparison of average QuickSIN SNR Loss for Power BAHD and BAHA 5 SP with a **11.56dB** average SNR Loss improvement.

Comparison of APHAB Global Score



A graph demonstrating the comparison of average APHAB Global Score for Power BAHD and BAHA 5 SP with a **66.6** average improvement. The BAHA 5SP provided improved EC scores of 52.3, BN scores of 70.3 and RV scores of 70.7 in APHAB subscales.

Speech, Spatial and Qualities of Hearing Scale Score



A graph demonstrating the SSQ scores for each patient. A clear benefit can be observed as the data is all positive with a mean improvement of **3.40.**

Conclusion and Discussion

- This study provided a multifaceted approach in evaluating if there was a significant benefit from using a Cochlear BAHA 5SP sound processor compared to Cochlear BP110 and Oticon Ponto Pro Power BAHD.
- A significant benefit was seen in all objective and subjective measurements.
- In conclusion the Cochlear BAHA 5SP sound processor is significantly beneficial and more favourable compared to Cochlear BP110 and Oticon Ponto Pro Power BAHD.

References

1. Bosman, A.J., Kruyt, I.J., Mylanus, E.A.M., Hol, M.K.S. and Snik, A.F.M. (2018). Evaluation of an abutment-level superpower sound processor for bone-anchored hearing. *Clinical Otolaryngology,* 43(4), pp.1019–1024.
2. Busch, S., Giere, T., Lenarz, T., Maier, H. (2015). Comparison of Audiologic Results and Patient Satisfaction for Two Osseointegrated Bone Conduction Devices: Results of a Prospective Study. *Otology & Neurotology*, 36, 842-848.