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during this task. The authors posit that measuring verbal response times, which can easily be done in clinic, can have the potential to show effects beyond performance measures and subjective effort estimates.

- Page 14: Tom De Neve – Belgium:
  - A Prospective Randomized Crossover Study in Single Sided Deafness on the New Non-Invasive Adhesive Bone Conduction Hearing System.
    - *Griet Mertens, Annick Gilles, Rajae Bouzegta & Paul Van de Heyning.*
    - *Otology & Neurotology 2018; 39:940–949.*
    - *In general, uncertainty remains about the size of the benefit that patients may receive even under listening conditions that favors the use of Bone Conduction Devices (BCD) or CROS hearing aids and whether the magnitude of the benefit would be clinically meaningful. According to the authors, the majority of BCD trial experiences in the general Single Sided Deafness population are negative.*
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    - *Marc Jutras et al.*
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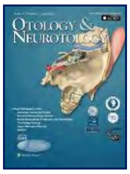
    - *Peggy B. Nelson , Trevor T. Perry , Melanie Gregan, and Dianne VanTasell.*
    - *Trends in Hearing Sept 2018, Volume 22: 1-13.*
    - *Individuals were largely consistent in their adjustments across SNRs for moderate noise levels, demonstrating that adjustments in moderate noise were not made arbitrarily, and that generally if a listener preferred more gain for one condition, that listener preferred more gain for all conditions.*
- Page 21: Mark Laureyns – Italy - Belgium:
  - Differences in Word and Phoneme Recognition in Quiet, Sentence Recognition in Noise, and Subjective Outcomes between Manufacturer First-Fit and Hearing Aids Programmed to NAL-NL2 Using Real-Ear Measures.
    - *Michael Valente, Kristi Oeding, Alison Brockmeyer, Steven Smith & Dorina Kallogjeri.*
    - *Journal of the American Academy of Audiology, (2018) Vol 29:706–721.*
    - *The Real-Ear Measurement procedure to match the NAL-NL2 fitting rule, resulted in significantly better scores for both word and phoneme recognition in quiet compared to the default Manufacturer First Fit.*

Further Beneficial Effect of Hearing Aids on Speech Recognition Performance Besides Amplification: Importance of the Restoration of Symmetric Hearing.



Min Young Kwak et al.

Otology & Neurotology, 2018; Vol 39: e618–e626

Amplification alone is insufficient to normalize the speech perception abilities of individuals with hearing impairment. Many HA users are unsatisfied with their ability to understand speech, especially in difficult listening situations, despite improvements in hearing aids to compensate for the defective auditory system. In a damaged cochlea, the response of the basilar membrane is more linear and more broadly tuned. And, as we all know, for understanding in noisy environments: symmetric hearing is very important.

The first aim of the study was to determine the improvement in auditory spectral resolution, temporal resolution, and speech recognition ability conferred by HAs when the amplification effect of the HA is excluded. A second aim was to compare the beneficial effects depending on the restoration of symmetric hearing with different amplification setting in various hearing impairment conditions.

62 subjects who had used HAs for more than 3 months were divided into four groups: bilateral HAs, unilateral HA in the better ear, unilateral HA in the worse ear and unilateral HA with symmetric hearing. All the participants used their HAs with the setting "DNR on" and in the adaptive directional microphone mode.
To exclude the effect of amplification, the tests executed at most comfortable levels, both with and without hearing aids. 4 different tests were done:
1) Spectral Ripple Discrimination: select the one of three rippled noise tokens that has an inverted ripple phase.
2) Temporal Modulation Detection: identify which interval contained the modulated noise and which the steady noise.
3) Speech Recognition Threshold in white noise: the mean SRT of three adaptive runs of mixture of speech and speech-shaped steady noise.
4) Speech Discrimination Score in quiet: percentage of words repeated correctly in an open-set format. The examiner presented 50 one-syllable words, controlling his voice intensity with speech balanced at 0 dB on a volume unit meter.

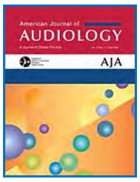
Results:
Bilateral HA Users and: SDS in quiet and SRT in noise significantly better with HAs.
Unilateral HA Users in the Better Ear: only SDS in quiet: significantly better with HAs.
Unilateral HA Users in the Worse Ear: only SRT in noise: significantly better with HAs.
Unilateral HA Users with Symmetric Hearing Thresholds: no significant differences on the four tests, with or without HAs.

Discussion
! Simply increasing the signal presented to the MCL in the unaided tests, is not the same as the amplification of the signal with an HA. !
Speech in noise: is significantly better when hearing aid(s) help(s) the restoration of symmetric hearing (2 HAs when symmetric hearing loss, or 1 HA in the worse ear).

Speech in quiet: is significantly better with bilateral HAs and in unilateral HA users in the better ear. In unilateral HA users in the worse ear, the difference showed only borderline significance (the better ear is dominant, even after signal amplification in the worse ear. The authors found no benefit of HAs in terms of auditory spectral resolution or temporal resolution, above their amplificatory effect.

Own remarks:
Measuring speech in noise: it is noted that the speech was presented monaurally, but this cannot be the case since all stimuli were presented by a loudspeaker located 1 m in front of the individuals.
SDS in quiet: why was there no objective presentation of the words? Relying on the method of “controlling his voice” cannot be regarded as being very reliable.
The MCL at which the tests were performed is not mentioned. It would be interesting to know these levels (for example: is there a difference in MCL for unilateral HA users in the worse ear?).
The very interesting research question (benefits of HAs besides amplification) should further be investigated.

Evaluating Hearing Aid Management: Development of the Hearing Aid Skills and Knowledge Inventory (HASKI).



R.J. Bennett, C.J Meyer, R.H Eikelboom, M.D Atlas.

American Journal of Audiology, 2018, Vol. 27, 333-348.

Aural rehabilitation process, in which hearing aids (HA) are being fitted by the hearing health care clinicians, includes among other things counseling, education, training, programing and adjusting the HA. HA owners need sufficient HA management skills and knowledge in order to use and handle the HA on a daily basis.

In a previous study Bennett, Meyer, Eikelboom & Atlas (2018) created the HASKI - Hearing Aid Skills and Knowledge Inventory. This questionnaire examined different HA management and knowledge aspects. The first aim of the current research was to examine the psychometric properties (reliability that refers to the consistency of the questionnaire and validity that refers to the questionnaires results' accuracy) of the HASKI two versions (HASKI-self; HASKI-clin). The second aim was to identify HA owners' management and knowledge difficulties.

518 Australian HA owners participated in the research: M=71years; 38% females; 93% binaural fitting; 84% BTE HA; 57% experience HA users; 66% had their HA more than 12 months; 65% paid out of pocket; 84% reported more than 4 hr of use per day; 78% were satisfied from their HA; 70% reported better hearing with HA; 58% completed the questionnaire electronically.

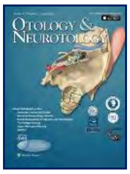
The study results showed high validity and reliability of both HASKI versions: internal consistency; interdimensional relationship; construct validity; test-retest reliability; interobserver reliability; criterion validity.

The results indicated that 99% of HA owners participated in this research had some lack of knowledge and difficulties handling their HA regarding volume and program controls, telephone compatibility, HA battery and HA cleaning. Possible explanations of those difficulties: small size of HA components; clinicians' selection of the information they provide the consumer; clinicians' need to effectively balance appointment time and requirements; high level of health literacy required to read and understand HA materials/instructions and consumers' neglect to read them.

The study results indicated that the HASKI questionnaire can help clinicians evaluate consumers' HA management skills and knowledge, improve HA use and outcome and increase benefits and satisfaction.

This research emphasizes the importance of the aural rehabilitation process beyond the hearing aid fitting itself. Clinicians must be aware of their client's difficulties and lack of knowledge, help them learn to use the technology and ensure the integrity of the consumer journey in order to enable their clients gain the full benefits from their hearing aids.

Changes to hearing levels over the first year after stapes surgery: an analysis of 139 patients.



Nash, R., Patel, B., & Lavy, J.

Otology & Neurotology, 2018; Vol 39: 829-833

Stapes surgery (stapedectomy or stapedotomy) is generally very successful in improving hearing in patients with otosclerosis. However, a small percentage of patients will have a persistent conductive hearing loss after surgery, some of who may undergo revision surgery. The reasons for the failure of surgery to improve hearing are often unclear but may include temporary causes such as otitis media with effusion, which could resolve over time, or persistent issues such as malposition of the stapes piston. The purpose of this retrospective review was to analyse changes in hearing outcomes after stapedotomy over the first postoperative year. The authors proposed that this information could be used to guide management decisions, such as the timing of revision surgery, and to counsel patients.

A retrospective case series analysis was performed of hearing outcomes from primary stapedotomy surgeries performed by a single surgeon over a 32-month period. Patients were included if they had measureable bone-conduction thresholds before surgery and underwent audiometry within 4 time periods: preoperative audiometry < 90 days before the date of operation, postoperative audiometry ("preop"), between 28 and 90 days after the date of operation (''postop''), approximately 6 months after the date of operation (+/-3 mo), and approximately 1 year after surgery (+/-6 mo). 139 adult patients met these inclusion criteria. Pure-tone averages were calculated at 500 Hz, 1, 2, and 3 kHz using air conduction and bone conduction.

Results showed a significant reduction in the mean air-bone gap at the first postoperative assessment at around 6 weeks (from 28.9 dB to 6.0 dB), with continued improvement shown at 6 months (3.3 dB). The improvement was maintained at the 12-month assessment with a mean air-bone gap of 3.1 dB. A suboptimal result, defined as a postoperative air-bone gap of 10.1 – 20 dB was documented at the initial postoperative assessment in 14 patients, with the suboptimal or poor result (air-bone gap of >20 dB) persisting at 12 months in 6 patients. A poor result was recorded in 6 patients initially, with 2 persisting at 12 months and 1 patient with a suboptimal result progressing to a poor result at 12 months. Patients with a poor hearing result tended to have larger preoperative air-bone gaps.

Bone conduction data is reported for 4 kHz only and showed a mean threshold increase of 2.8 dB at 12 months, which the authors suggest is consistent with inner ear trauma.

Overall, the results of this study show that hearing improvement after stapes surgery may continue over 12 months postoperatively, with the greatest improvement occurring in the first six months. The authors conclude that as patients with an initial poor or suboptimal result may present with improvement in hearing in the first year after surgery these patients should be treated conservatively, and revision surgery should not be performed before 12 months unless there is an urgent indication such as perilymph fistula.

The authors acknowledge that the generalisability of these results is limited by the restriction of the study to patients under the care of one surgeon using one technique and primarily one prosthesis. Although the available data suggests it is not a key issue, it is also possible that in this retrospective review that patients with good hearing outcomes were less likely to return for all follow-up appointments and thus meet the inclusion criteria for the *study. Despite these limitations, this retrospective review provides important information on the evolution of hearing loss in the year after stapes surgery that will be useful in planning further management of patients with persistent hearing loss after surgery and in counselling patients.*

This retrospective review provides detailed information on changes in hearing occurring over the first year after stapes surgery. The findings demonstrating that hearing may continue to improve several months after surgery are important for clinicians to be aware of when counselling patients regarding initial postoperative hearing outcomes. Further research detailing the likely cause of initial persistent conductive hearing loss, for example documentation of whether effusion was present, will be beneficial towards identifying which patients are likely to experience further improvement in hearing and in the counselling or managing patients appropriately.

The Influence of Hearing Aid Gain on Gap-Detection Thresholds for children and Adults With Hearing Loss.

Brennan MA, McCreery RW, Buss E, & Jesteadt W.

Ear & Hearing, 2018 Vol 39(5), 969-979.

Introduction
The perception of gap-detection is an important aspect of auditory temporal processing with its high-performance correlating to better speech recognition. Traditionally gap-detection studies have been performed with equal sensation level and/or sound pressure level. However, there is a lack of literature investigating the effects of hearing aid amplification these in gap-detection tasks, especially in children.
Previous studies have shown that in adults with a sensorineural hearing loss (SNHL) have a poorer gap-detection threshold than adults with normal hearing when the test was administered at the same Sound Pressure Level (SPL). Interestingly, when the adults were tested at the same Sensation Level (SL), there was little difference in gap detection thresholds. Furthermore, administering the test in NH adults with masking noise mimicking a SNHL could generate poorer gap-detection thresholds. The combination of these results suggests that the poorer gap-detection thresholds seen in SNHL adults are attributable to the diminished audibility.
Hearing aid amplification can compensate for the reduced audibility by providing frequency-specific gain based on audiometric thresholds and a prescriptive procedure based on this. Depending on the prescription chosen, this will alter how the larger dynamic range would be mapped onto the reduced range of somebody with SNHL and affect various aspects of sound such as the audibility and intelligibility.
It is important to consider the differences in children versus adults in auditory temporal processing tasks, with children generally having poorer gap-detection thresholds than adults. This is thought to be mostly attributed to differences in maturation of the nervous system, as well as the limited auditory experience in children compared to adults. Thus children with SNHL would have even less auditory experience and hence expected to have a poorer gap-detection threshold than children with NH.

With hearing aid prescription, there are differences between prescriptive measures given to children (DSL-C) and adults (DSL-A), with the former prescribing greater gain overall than the latter. This results in greater audibility and greater dynamic range mapped onto the hearing, however it is poorly accepted by adults, as they are unable to tolerate the higher input levels of DSL-C.

Methods
The dynamic range of hearing is impaired with a sensorineural hearing loss, and improved albeit not wholly, with the use of a hearing aid. This limits the stimulus levels used in testing. Therefore, instead of attaining a gap-detection with respect to seconds, the authors of this study used a fixed gap-detection task whilst adapting the stimulus-level.

Experiment I: to determine the effect of the prescriptive procedure, age, and hearing status on the ability to detect a gap in noise. 30 adults (mean age 54 years old) with NH and SNHL, 28 children (mean age 11 years old) with NH and SNHL were recruited for the study. All participants undertook the gap-detection task unaided, with the stimulus-level threshold *obtained. Furthermore, adult participants with SNHL were fitted with a DSL-A and DSL-C prescription with fast compression. Children with SNHL were fitted with a DSL-C fast prescription only. All amplification was delivered by a hearing aid simulator with a faster WDRC time constant than in commercially available hearing aids.*

Experiment II: to determine the extent to which varying the compression speed influences gap-duration thresholds. 8 adults with SNHL (mean age 50 years old) and 7 adults with NH (mean age 34 years old) were used in this study. Adults with SNHL were fitted with a DSL-C with either fast compression or slow compression and undertook the gap-detection task.

Experiment III: to examine the validity of using stimulus-level thresholds as a measure of temporal resolution compared to obtaining gap-duration thresholds. This was done by measuring a traditional gap-duration threshold and comparing this to a gap-detection threshold obtained by modulating the stimulus level at the fixed gap duration.

Results
Experiment I: Adults with SNHL fitted with a DSL-C prescription had better gap-detection thresholds than those fitted with the DSL-A prescription and had similar gap-detection thresholds to adults with NH across all gap durations.
Children with SNHL fitted with the DSL-C prescription had similar results apart from a poorer gap detection threshold at 5ms compared children with NH. Children with SNHL had thresholds poorer than adults with SNHL at 5 and 10ms.
Experiment II: Compression speed (DSL-C fast vs DSL-C slow) did not affect gap duration in adults with SNHL fitted with amplification.
Experiment III: Stimulus-level thresholds decreased as gap duration increased, and there was no statistical difference between gap duration thresholds and gap duration obtained with each stimulus level. This suggests that the thresholds obtained by varying the stimulus level or by varying the gap duration provide similar information about temporal resolution.

Discussion & Clinical Implications
The outcomes of the study provide supporting evidence that auditory temporal processing is dependent on both age and audibility. Adult patients perform better in the gap detection task than children and restoring the dynamic range of hearing in both adults and children with SNHL improves their ability to detect a gap in noise, similar to those with NH.

Note that children with SNHL performed poorly at detecting the 5ms gap duration compared to children with NH even after audibility correction. This suggests that SNHL in children, apart from audibility, could adversely affect their ability to perceive a gap compared to children with NH, which may be related to the reduced auditory experience as a result of the hearing loss.

Further studies should look into the improvement of gap detection thresholds with the use of commercially available hearing aids, which have a relatively slower WRDC and less restricted maximum presentation levels than the hearing aid simulator used in this experiment. It could also be beneficial to see whether other aspects of temporal processing improve with age and audibility.

A Nonsense Consonant-Vowel-Consonant Word Test to Assess Auditory Processing

Cheyney MN & Moncrieff DW.

Journal of the American Academy of Audiology, Vol 29 Aug: 675-684 (2018).

Introduction
Auditory processing is the aspect of hearing relating to how the brain integrates all of the auditory information constantly flooding into the brain. One aspect of auditory processing is dichotic listening or binaural integration, which is the ability to discriminate differing and simultaneous signals to the ears. It requires the brain to force the integration of signals that differ in time and intensity.

Dichotic listening tasks measure the listener's ability to successfully engage in binaural integration, requiring the listener to repeat all information, when independent presentations are made to both ears. This forces the brain to integrate more stimuli than possible, resulting in a difference in scores between the ears, also known as an ear advantage.

Dichotic listening tasks can also be used to assess the listener's ability to direct attention to one ear over the other ear. Most of the population generally have a right ear advantage, due to a dominance of auditory processing occurring in the left hemisphere. One can, however, attain to a left ear advantage when their attention is directed to the left ear.

Traditionally a dichotic listening task would consist of repeating back digits heard, which is more likely to display ceiling effects and thus making it difficult to determine ear advantage. The use of language/word tasks have been suggested as an alternative as they will not easily reach these ceiling affects, making it a more useful tool to assess dichotic listening. Open-set, single-syllable words places a high verbal workload onto the listener, making it ideal to assess ear dominance for language. Non-sensical words on the other hand do not place a burden onto the listener's semantic language. This is especially important as performance varies heavily on word familiarity, enhancing the use of the dominantly auditory pathway and artificially increasing the ear advantage. Using non-sensical words, allows for a universal test that can be administered to both native and non-native English speakers independent of semantic familiarity/bias.

At present, no normative data exists for young adult performance on dichotic nonsensical word (DNW) tests. Thus, the purpose of this study was to observe performance on the DNW test and compare these results with current dichotic listening tasks in the normal hearing population. This will determine the clinical validity and usefulness of the new DNW test in auditory processing.

Methods
A total of 100 young adult participants (mean age 23) with normal hearing were recruited for the study.

Dichotic listening tasks (Dichotic Words Test (DWT) & Dichotic Non-sensical Word (DNW) test) were administered (in that order) under three conditions: non-directed, directed right, and directed left conditions.

The DWT is recorded in a male voice, while the DNW was tested using both a male and female voice, to investigate the effects of fundamental frequency on test performance.

Test procedures for administering the DWT and DNW test differed due to the fact that DNW test had been predicted to be more difficult given the lack of semantic content. Nonetheless, statistical analyses were compared within tests for the directed test conditions and across tests for the non-directed test conditions.

Results
Scores for both ears were significantly higher on the DWT than with the DNW test.
Scores for the right ear was higher than the left ear for both DWT and DNW tests.
The prevalence of a right ear advantage was lower on the DWT than the DNW test, and the prevalence of no ear advantage was greater on the DWT than the DNW test.
Using a female voice for the DNW test yielded greater performance in the right ear but not the left ear and increased average ear advantage scores.
Diverting the attention to either the right or the left improved scores for the DNW test but not the DWT. This did not, however, alter the ear advantage score.

Discussion
Overall, the results of this study suggest that the DNW test proved to be a more difficult task than the traditional DWT. This is mainly due to the non-sensical speech recognition, inhibiting any interference from the language centres dealing with familiar vocabulary. As a result, there is more need for the listener to encode the phonological information from each stimulus, which is more actively processed in the left hemisphere and hence resulting in a greater right ear advantage from the DNW test.

The authors hypothesize that the DNW test is a more appropriate tool to use as it reflects binaural integrations tasks more accurately: Children learning new words at school are continually presented with new words that contain unfamiliar patterns of phonemes, and hence is reflected in the non-semantic biased DNW test. It mimics the listening situations and processing strategies faced by children during routine learning in school, providing important information about binaural integration skills apart from lexicon input.

Further studies should investigate in refining the methodology such as: a wider variety of subject recruitment, a protocol with the DNW test presented first, and investigating into the effects of voice-onset time, which can overcome a structural right ear advantage, was not investigated in this study.

Conclusively, the DNW test may be more sensitive to bottom-up sensory differences by reducing the semantic content that can be influenced by cognitive control and may present greater potential for use with non-native English speakers, enhancing its universal design for auditory processing testing. It also reduces the likelihood of reaching ceiling effects for other dichotic listening tasks with digits.

Verbal Response Times as a Potential Indicator of Cognitive Load During Conventional Speech Audiometry With Matrix Sentences.

Meister H, Rahlmann S, Lemke U, & Besser J.

Trends in Hearing Aug 2018, Volume 22: 1-11.

This study investigated the response times for people with speech in noise testing, and its potential use as a measurement of cognitive load during this task. The authors hypothesize that measuring verbal response times, which can easily be done in clinic, can have the potential to show effects beyond performance measures and subjective effort estimates.

Introduction
The traditional approach for assessing hearing in conventional audiometry is based on task accuracy. However, in light of more and more research regarding the concept of listening effort, it has emerged that there are other aspects of listening task performance.

The Framework for Understanding Effortful Listening (FUEL) concept explores the fact that effort and hence processing resources, are limited in both capacity and speed. Thus when there are more difficult listening situations, there is a greater activation of cognitive resources (such as working memory, speech processing, etc.), meaning that the understanding of speech may be maintained at the cost of slower overall process and reduced processing for other tasks.

The degree of resource activation and hence, effort is influenced by many factors such as: the level of task performance, the internal motivation to perform the task, and the perceptual difficulty of the listening situations. It can be measured either by self report, behavioural, and/or physiological measures. Behavioural measures can involve either a dual-talk or a single-task approach, with the former assessing a priority on a single task while the other task receives a lower priority. This paradigm is difficult to assess, as it is difficult to determine whether the listener continues to prioritise the primary task. Thus in this study a single-task assessment was used.

The concept of using response times as a measure of cognitive load while listening has been used in numerous studies in the past, with response times delayed with increasing signal to noise ratio. Other studies on young normal-hearing listeners have shown that the verbal response time (VRT) had varied with speech-intelligibility level, as well as different noise types. This study sought to investigate any listener-group differences as well, by administering the same assessment to older listeners with clinically normal hearing, and older listeners with a hearing aid.

Methods
46 listeners were sub-divided into groups of either younger normal hearing listeners (YNH), older adults with near normal hearing thresholds (ONH), and older hearing aid users (OHA). Speech testing to obtain a target intelligibility level was done using a German speech matrix test (Oldenburg sentence test), presented against two different masker signals (Speech-shaped stationary noise (SN), speech-shaped noise with amplitude fluctuations (FN)).

Verbal response times were then obtained using a test list with 30 sentences at estimated SNR levels at two target intelligibility levels, with a dynamic microphone to automatically log the time (participants were not required to respond as quickly as possible).
Following this, subjective scaling of perceived listening effort was also measured using a 13-point scale.

Results
Verbal response times were different for the two different speech-intelligibility levels, which was expected given that the near maximum speech intelligibility (90%) results in less cognitive load than high but below maximum speech intelligibility (85%).

The two noise types of (stationary noise & fluctuating noise) were used to determine whether there was any fluctuating masker benefit, as a result of speech information extraction from periods with low masking energy in fluctuating noise. The verbal response times for all three groups were shorter for the fluctuating noise compared with the stationary noise, independent of target intelligibility level.

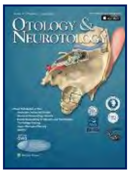
Comparing the different listening groups shows that the YNH had significantly faster verbal response times than both older listener groups (ONH, OHA). This could have arisen from cognitive differences due to ageing, as well as the fact that the younger listeners were more certain about their responses than the older listeners.

The ONH group had slightly faster verbal response times than the OHA group, suggesting that the aiding of a hearing loss has an additional effect on response times compared with clinically normal hearing. Other research also suggests that more experienced hearing aid users have a shorter verbal response time (the mean use of hearing aids in this study was 3 years), and future investigations may look into this.

The subjective measure of listening effort primarily reflected the different intelligibility levels, with no differences between study groups or noise types. Thus, this serves as an estimation of the individual's speech recognition performance and may not fully represent the objective amount cognitive load obtained using verbal response times.

The results of this present study suggest that verbal response times are reflective of listening effort with respect to different levels of speech intelligibility, listener groups, and different noise types. It has the potential to give information beyond speech accuracy in conventional audiometry. The authors assume that the current method has good practical applicability, but that more complex paradigms (dual-task paradigms) will yield more sensitive results that may be more clinically relevant.

A Prospective Randomized Crossover Study in Single Sided Deafness on the New Non-Invasive Adhesive Bone Conduction Hearing System.



Griet Mertens, Annick Gilles, Rajae Bouzegta & Paul Van de Heyning.

Otology & Neurotology, 2018; Vol 39: 940–949

Intro:
In case of SSD (Single Sided Deafness), a BCI (Bone Conduction Implant) implanted on the deaf side, transduces sound via the skull to the healthy cochlea contralateral to the deaf ear. Consequently, the BCI does not restore binaural hearing in SSD but it enhances the monaural function of the healthy cochlea by reducing the disadvantages imposed by the head shadow effect.
Earlier studies on the application of BCI's in SSD showed on the one hand important improvement in speech perception in noise (greatest improvement, where speech sound was delivered to the BCI side and noise was delivered to the contralateral healthy cochlea). On the other hand, no great differences were found in terms of improvement for sound localization. Subjective questionnaires for satisfactory outcomes and quality of life showed improved hearing capacities and reduced hearing handicap in SSD BCI users compared with the unaided condition.

Aim of the study.
Was to compare the objective and subjective results in two non-invasive solutions for SSD; a new adhesive hearing system (nonsurgical bone conduction device) and the conventional CROS as a control.
Population and method:
17 adult SSD patients, (age: 19-59 years) participated in a randomized crossover study with a two weeks trial for both devices. All participants had a pure tone average of 20 dBHL or better in the normal ear. The ADHEAR hearing system comprises an adhesive adapter (securing the audio processor and provides good physical contact between the vibrating portion and the scull) and an audio processor. The CROS hearing aid was a Phonak Bolero v50 in the good ear and CROSII device in the bad ear.

Results:
In general, 70% of the participants reported after a 2-weeks trial that the adhesive hearing system was partially to very useful to them.
Speech-in-noise:

- *No significant improvement was found for speech perception in noise using the adhesive hearing system,*
- *A significant improvement was found for the control device (CROS) in the SSSDNNH condition.*
- *A negative influence of the control device (CROS) was found for the S0NSSD condition and not for the adhesive hearing system.*

Sound localization was found to be degraded when using the control device (CROS). For the adhesive hearing system on the other hand, minor-improved localization skills were observed when using the omnidirectional microphone. However, due to the limited significant improvement (5.1 degrees), the small sample size, and the lack of subjective

localization improvement, there is no conclusive evidence of clinically significant improved sound localization with the adhesive device.
In general, uncertainty remains about the size of the benefit that patients may receive even under listening conditions that favours the use of BCD or CROS hearing aids and whether the magnitude of the benefit would be clinically meaningful. According to the authors, the majority of BCD trial experiences in the general SSD population are negative. Main reported reasons for negative BCD trials are perceived limited benefit, cosmetic reasons, no effect on tinnitus. Prognostic factors that predict the BCD trial outcome are missing. Therefore, counselling is very important in SSD candidates. Patients should be given the opportunity to test the device in different listening situations (e.g., at home, at work, in a restaurant,) and therefore a trial period should last for at least 2 weeks.

Additional findings about the ADHEAR device
25% of the (adult) study population reported an unexpected falling off of the adhesive adapter during the 2-week trial.
Correct placement was reported to be very easy by the (adult) SSD participants and in no cases did their hair need to be shaved.

Limitation of the study: In the current study, only the preprogramed maps were available; the fitting software to program the device could have been an effective way to reduce feedback and could have dealt with the inter-subject variation in interaural attenuation.
Future research: comparing the results of the adhesive hearing system and results of a soft-band trial, may enable to further investigate the outcomes of different BC treatment options available for SSD.

Targeting the psychosocial and functional fitness challenges of older adults with hearing loss: a participatory approach to adaptation of the walk and talk for your life program

Clark JG, Brady M, Earl BR, Scheifele PM, Snyder L, & Clark SD.

International Journal of Audiology, 2018; Vol 57 (7), 519–528.

In this study, guided interviews with hearing-impaired older adults have been undertaken to explore the acceptability of the WTL programme in addressing both socialisation and fitness challenges and how the programme might be adapted to better suit their needs of persons with hearing loss.
The WTL is a University of British Columbia Okanagan community-based programme that aims to reduce loneliness and isolation and improve physical function in ambulatory adults 55 years and older. The research questions are:
1. What are the personal consequences and challenges of hearing loss in older adults, and what is their previous experience (if any) with any forms of audiological rehabilitation?
2. How acceptable were the socialisation and fitness aspects of the WTL programme?
3. What do participants feel might improve the programme to address the impact (if any) of hearing loss?

Results
1. Personal effects and experiences of hearing loss involves
  a. practical problems: > 70%
  b. withdrawal or relational discomfort/challenges: +/- 45%
  c. loss of identity: WTL + group: 18%, WTL – group: 27%
  d. challenges related to group settings: WTL + group: 30%, WTL – group: 45%
  e. difficulties with comfort or adjusting to hearing aids: +/- 50%
2. Quality and benefits of WTL program in relation to hearing loss
  a. meeting with new people an increasing social connectedness: 47%
  b. increasing or maintaining physical activity level: WTL + group: 100% (of the eight that responded to that question), WTL – group: 45%
  c. connecting with others with hearing loss: WTL + group: 94%, WTL – group: 64%
  d. integrating hearing-impaired with normal-hearing participants: WTL + group: 88%, WTL – group: 73%
  e. communication partner involvement: WTL + group: 82%, WTL – group: 45%
3. Improvements in delivery of WTL program: no spontaneous suggestions for improvement were made
  a. room acoustics/size: +/- 50% (major factor of influence)
  b. session ground rules (one speaker at a time, use of microphone): WTL + group: 70%, WTL – group: 27%
  c. session characteristics (small group size,…): WTL + group: 90%, WTL – group: 60% aggreed with the proposed options for structure
  d. program follow-up: WTL + group: 71%, WTL – group: 45%
  e. learning aids (handouts, …): 88% of the WTL+ group felt it was a good idea

f. experience with audiological rehabilitation (AR): only 1 respondent had knowledge of AR -> after explanation >80% believed it would be beneficial to include AR in a WTL program

The "ideal" WTL programme for hearing impaired adults should include

- *<20 participants*
- *both with and without hearing loss*
- *In rooms with optimised acoustics*
- *incorporate coaching and communication strategies*
- *A physical activity component*
- *include visual learning aids*
- *Enforcement of certain ground rules (one speaker at a time, use of microphone)*
- *Involvement of the communication partner*

Discussion

This study has collected data from a small number of older adults from one location. Possibly the opinions and conclusions regarding the "ideal" programme may not be generalisable in other cultures, etc. Further research is needed.

Conclusion

This WTL programme has demonstrated some success in alleviating the psychosocial and functional physical decline associated with loneliness and isolation among the elderly. Recommendations for the future WTL programme for people with hearing loss are made. The adapted programme will provide a holistic and unique approach to the treatment of hearing loss.

Personal thoughts

- Very interesting is the unique approach that takes into account the physical aspect! Age >55 is a large range of age differences.
- Loneliness, isolation and physical fitness can be very different in a person of 55 years old and another of 85 years old.
- The degree hearing loss is not measured in this study. Only the results of the Hearing Handicap in Elderly are taken into account.
- Unfortunately, the interviewers may have had an influence on the outcome as they participated on a WTL programme before.
- In my opinion there is a need of a structured approach. First of all, the diagnosis of hearing impairment should be made by an ENT specialist. Secondly, whenever possible, hearing aids in combination with audiological rehabilitation should be addressed. Finally, this WTL programme can be very meaningful to help avoid loneliness, isolation, and physical decline. Selection criteria for inclusion in an adapted WTL programme for individuals with hearing loss should be defined.

Self-Adjusted Amplification Parameters Produce Large Between-Subject Variability and Preserve Speech Intelligibility.

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Trends in Hearing Sept 2018, Volume 22: 1-13.

This study used a self-fitting algorithm to allow listeners to self-adjust hearing-aid gain or compression parameters to select gain for speech understanding in a variety of quiet and noise conditions. Thirty listeners with symmetric mild to moderate sensorineural hearing loss adjusted gain parameters in quiet and in several types of noise. Outcomes from self-adjusted gain and audiologist-fit gain (the user's custom prescriptive settings of NAL-NL2 verified using real-ear speech mapping) indicated consistent within-subject performance but a great deal of inter -subject variability. Gain selection did not strongly affect intelligibility within the range of signal-to-noise ratios tested. Implications from the findings are that individual listeners have consistent preferences for gain and may prefer gain configurations that differ greatly from National Acoustic Laboratories-based prescriptions in quiet and in noise.

Methods

Three noisy restaurant conditions were chosen. The recordings were made of three local area restaurants during the lunch hour, along with a quiet conference room to mimic a ''living room'' setting. Stereo recordings approximately 5min in length were made of the background noise in each restaurant. A steady noise with the same frequency spectrum as the PB restaurant was included as an additional noisy environment. In this condition, the PB steady-state noise was played through the entire 48-channel loudspeaker array but without any spatial processing applied in order to approximate a diffuse noise environment.

1. *Restaurant 1 (FG): 58' x 24' x 9'*
2. *Restaurant 2 (PB): 38' x 30' x 25'*
3. *Restaurant 3 (PO): 80' x 56' x 13'*
4. *Conference room (''living room''): 16' x 14' x 90'*
5. *Steady PB*

The recorded binaural room recordings were spatialized to a 48-channel loudspeaker system (in a double-walled sound chamber) by presenting the left portion of the signal to all loudspeakers on the left hemisphere and vice versa for the right portion of the signal. Recordings from the Connected Speech Test (CST; Cox, Alexander, & Gilmore, 1987) were used and processed to approximate a listener's experience of being seated in the middle of a restaurant (or quiet room) and listening to the female talker at a short distance. Listeners used a mobile application developed by Ear Machine LLC, running on the Apple iOS platform and implemented on an iPod Touch (fourth generation). The device was coupled to the listeners' ears using Etymotic foam ear tips. The sound in the booth was picked up by the microphone of the iPod and delivered dichotically to both ears. The iPod was held in front of the listener at approximately chin height. The application was designed to simulate a nine-channel hearing aid with slow-acting compression. Specifically, the application used a nine-channel multiband wide-dynamic range compressor or limiter with fast attack (approximately 1ms) and slow release (approximately 500ms) times. Compression centre frequencies were as follows: 125, 500, 1000, 1500, 2250, 3250, 4625, 6750, and 15025Hz.

Each listener was instructed that the goal of the task was to use the control on the iPod until the talker's voice (i.e., CST passages) was as clear as possible in the background noise. To summarize the data for all subjects, insertion gain for the NAL fit and the self-adjusted fit for each subject was averaged into a low frequency band (125, 250, 500, and 1000Hz) and a high frequency band (2000, 3000, 4000, 6000, and 8000Hz).
Each experimental trial began with the user's custom prescriptive settings of National Acoustic Laboratories (NAL)-NL2, derived from the stand-alone clinical software and verified using real-ear speech mapping techniques.
Speech understanding was assessed using Harvard or IEEE sentences (IEEE Transactions, 1969) spoken by a female talker. The talker's voice was presented at 65 dBC from the front speaker in the presence of diffuse steady noise (i.e., presented through the entire 48 speaker array) which had the same long-term spectrum as the PB restaurant noise.
Subjects listened through the iPod running the Ear Machine app, as they did during the self-adjustment trials. However, the gain and compression was locked at either that subject's NAL fit or at the self-adjusted settings, which had been previously selected by each subject for the corresponding listening condition. Conditions included quiet (living room), -10, -5, 0, and 5dB SNR.
Gain adjustment results:
Large inter subject variability in self-adjusted fits was observed in each listening environment, including the quiet (living room) environment.
Subjects tended to select less and less gain as the noise level increased, across the different listening environments. Gain adjustments made in noise followed similar overall trends as those made in quiet. In the low-frequency band, most subjects chose more gain than NAL in the quiet environment, but as noise was added and as the level of noise was increased. Self-adjusted fits tended to result in less gain with increasing SNR. On average, gain deviation from NAL in the high frequency band was negative, and with increasing SNR, self-adjusted fits resulted in less insertion gain compared with NAL fits.
The test–retest correlation coefficient across both frequency bands indicated a moderately high degree of reliability.

Speech intelligibility results:
Speech intelligibility was assessed to compare the subjects' speech understanding when using their self-adjusted fits with their performance using their NAL fits. Speech understanding was evaluated in a quiet environment and in the steady noise, which had the same long-term spectrum as the PB restaurant noise. Sentences were presented in four different SNRs (5, 0, -5, and -10dB)
Although there were trends in the 0dB and -5dB SNR conditions for subjects to have poorer intelligibility with the self-adjusted fit as they decreased gain relative to the NAL fit, none of the correlations were statistically significant (all adjusted p>.05). Listener adjustments of gain and compression settings did not appear to have a systematic impact on speech understanding.

Conclusion
Individuals were largely consistent in their adjustments across SNRs for moderate noise levels (SNRs between -5 and +5dB), demonstrating that adjustments in moderate noise were not made arbitrarily, and that generally if a listener preferred more gain for one condition, that listener preferred more gain for all conditions. Gain adjustments were more variable in the quiet background and in the most unfavourable noise (-10dB SNR), suggesting that individuals might weight criteria (e.g., comfort, sound quality) differently when speech is trivially easy or extremely challenging to understand. These findings imply

that allowing self-adjustment of gain provides listeners with the opportunity to significantly and uniquely finetune their hearing-aid amplification settings.

Discussion

- While listeners showed good test–retest results using the self-adjustment algorithm, indicating consistent performance across days and trials, the variability among participants was striking.
- The fact that on average listeners chose more low-frequency gain than prescribed by NAL-NL2 may not be too surprising, as most listeners were prescribed 0-dB gain in the low frequencies.
- It may be noted that listeners were not asked to talk for long periods of time during the fitting process, and so the effect of listeners' own-voice experience may be minimized by the methodology.
- As noise levels increased, preferred gain decreased slightly, even though the NAL-NL2 prescriptions themselves were compressive and resulted in less overall gain with increasing level. For the most part, those adjustments did not significantly reduce speech intelligibility in quiet or in noise, what is somewhat surprising
- What would have been the result of using hearing aids verified with REM / producers fitting software? The influence of directionality of the microphones? The position of the microphones of hearing aids is different than the position of the microphone of the iPod placed in front.
- What if fast compression was used instead of slow compression?

Differences in Word and Phoneme Recognition in Quiet, Sentence Recognition in Noise, and Subjective Outcomes between Manufacturer First-Fit and Hearing Aids Programmed to NAL-NL2 Using Real-Ear Measures

Michael Valente, Kristi Oeding, Alison Brockmeyer, Steven Smith & Dorina Kallogjeri.

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Intro: Real Ear Measurement (REM) is a procedure, where the response of the open ear is compared with the aided response with the hearing aid in the ear using a probe tube microphone. This is an objective procedure, which allows fitting and verification of the gain and output in hearing aids to match the target of a specific fitting rule. According to the authors, although this procedure is the gold standard for the British Society of Audiology (BSA), the American Academy of Audiology (AAA) and the American Speech, Language and Hearing Association (ASHA), only 20 to 30% of the audiologists in the US are routinely using this procedure. The other professionals use the Manufacturer Default First Fit as proposed in the fitting software, without a REM verification procedure. Since ear canals differ significantly in size and shape, the risk of a non-appropriate gain and output is high when no verification is carried out during a fitting procedure. According to most studies, the Manufacturer Default First Fit results in too little gain and output particularly for high frequencies.

The objective of this double-blind cross-over study, was to evaluate if there were significant differences for speech understanding in quiet and in noise, for subjective aided performance using questionnaires and for the overall user preference between the REM NAL-NL2 procedure and the Manufacturer Default First Fit procedure.

25 participants, mean age 72 years, 68% male, symmetric sloping hearing loss (average 15dBHL at 250Hz to 67dBHL at 8000Hz) and all first-time hearing aid users were enrolled in this study. During the study, one subject dropped out, so the results are based on 24 subjects.

One investigator performed the fitting and REM verification of gain and output; even if at the end, the Manufacturer Default First Fit (MDFF) was programmed in the premium (16 channel) hearing aids. A second investigator performed all the speech tests and organised the questionnaires. No information was exchanged between the two investigators during the study. The subjects were assigned at random to start with the REM NAL-NL2 or the MDFF procedure and after and acclimatisation of four weeks the tests and questionnaires completed, and the subjects were fitted according to the other procedure. Again after 4 weeks of acclimatisation the next round of tests was performed, and the final preferences of the users was evaluated.

Results:

- *REM Real Ear Insertion Gain: The Manufacturer Default First Fit resulted in under-amplification at mid and high frequencies (avg 20 dB under-amplification at 4000Hz for soft levels) with a wide spread of individual results.*
- *Overall preference: 19 of the 24 subjects (79%) preferred the REM NAL-NL2 fit.*

- *Speech audiometry in quiet (CNC words presented in Free Field at 50, 65 and 80 dBSPL at 0° using word score):*
    - *CNC at 50 dBSPL – significantly better (p< 0,001) with REM NAL-NR2 (79%) versus MDFF (64%).*
    - *CNC at 65 dBSPL - significantly better (p< 0,01) with REM NAL-NR2 (92%) versus MDFF (90%).*
    - *CNC at 80 dBSPL – no difference with REM NAL-NR2 (94%) versus MDFF (93%).*
- *Speech audiometry in quiet (CNC words presented in Free Field at 50, 65 and 80 dBSPL at 0° using phoneme score):*
    - *CNC at 50 dBSPL – significantly better (p< 0,001) with REM NAL-NR2 (92%) versus MDFF (84%).*
    - *CNC at 65 dBSPL - no difference with REM NAL-NR2 (97%) versus MDFF (96%).*
    - *CNC at 80 dBSPL – no difference with REM NAL-NR2 (98%) versus MDFF (97%).*
- *Speech audiometry in noise (HINT Reception Threshold for Sentences in Free Field – speech at 0° and restaurant noise at 65 dBA from 8 loudspeaker at 45° separation in a circle): no difference with REM NAL-NR2 (RTS +1,8dB) versus MDFF (RTS +1,9dB)*
- *APHAB Questionnaire – Abbreviated Profile of Hearing Aid Benefit (lower is better):*
    - *EC "Ease of Communication" no difference*
    - *BN "understanding in Background Noise" significantly better (p < 0.04) for REM NAL-NR2 (23%) versus MDFF (34%).*
    - *RV "understanding in ReVerberation" no difference*
    - *AV "AVersiveness to loud sounds" no difference*
    -
- *SSQ Questionnaire (Speech, Spatial and Qualities of hearing scale): no difference between REM NAL-NR2 versus MDFF*

REMARKS

The strong aspects of this study are the double-blind cross-over design and the well selected evaluation tools, both objective (REM), audiometric (Speech audiometry in Quiet and Speech audiometry in Noise) and the questionnaires (APHAB and SSQ).

The weakness of this study is the limited number of participants (24), the acclimatization period of only 4 weeks and the fact that only the combination of fitting rule and verification procedure are evaluated. It would have been more appropriate to compare the NAL-NL2 fitting rule by only using the fitting software and by using a REM verification procedure and/or the Manufacturer fitting rule with both procedures.

Overall the conclusion that speech audiometry in quiet at soft levels, the APHAB benefit poor speech in noise situations and the overall preference was higher for the REM NAL-NL2 procedure, is a strong argument to implement this procedure in quality professional hearing care.