

# Hearing Review™

Making Education Easy

Issue 9 - 2008

## In this issue:

- *Age and gender effects on postural control*
- *Expectation and motivation to use hearing aids*
- *DP-grams from preterm to early postnatal*
- *Test-retest reliability of DPOAEs*
- *Hearing protector use among musicians*
- *Music perception of CI users vs HA users*
- *Directivity-based microphone technology beneficial*
- *Binaural listening benefit for younger adults*
- *How middle ear changes affect hearing thresholds*
- *Assessing the status of the middle ear*

## Welcome to the ninth issue of Hearing Review.

This edition presents data that will probably interest anyone counselling hearing aid users. For instance, one study strongly encourages supporting positive expectations in order to motivate individuals with hearing impairment to use hearing systems, while another stipulates that education is needed to change musicians' opinion of hearing conservation and hearing protectors. In addition, audiologists should find useful the results of another study that details specific age-related deficits in certain learning situations and tasks; these data can be used as reference points when counselling older adults with hearing loss, and/or when choosing hearing aids.

I hope you enjoy the latest edition and welcome your comments and feedback.

Kind regards,

**Valerie Looi**

Lecturer in Audiology, University of Canterbury  
[valerielooi@researchreview.co.nz](mailto:valerielooi@researchreview.co.nz)

## Clinical assessment of balance: normative data, and gender and age effects

**Authors:** Vereeck L et al

**Summary:** Logistic regression analyses of clinical gait and balance tests in 318 asymptomatic adults revealed a significant age effect for standing on foam with eyes closed, tandem Romberg with eyes closed (TR-EC), and one leg stance (eyes open and closed). Both tandem gait and dynamic gait index showed a ceiling effect up to 60 years of age, with a rapid decline of performance for subjects in their seventies. According to linear regression equations, timed up and go test (TUG) times increase with age in both men and women, but even older subjects should be able to perform the TUG in  $\leq 10$  seconds. Women performed significantly worse than men on the TUG and TR-EC (30-second time limit).

**Comment:** This study incorporated simple, easily administered, office-based tests of balance requiring little equipment. Age-related differences in balance are well known, and the researchers advocate using different tests for different age groups. The tests suggested in this article all use a 10-second time limit to differentiate poor performance, making them relatively fast and easy to administer, and potentially useful for audiologists involved in vestibular-related clinical work.

<http://dx.doi.org/10.1080/14992020701689688>

**Reference:** *Int J Audiol.* 2008;47:67-75

Research Review is delighted to have the support of Bank of New Zealand as its banking partner



ReSound

ReSound Ziga...  
... synergy makes sense

Ziga™  
ReSound

The best feature list in its segment.

For more information, please go to <http://www.gnresound.co.nz>

[www.hearingreview.co.nz](http://www.hearingreview.co.nz)

a RESEARCH REVIEW publication

## Test-retest repeatability of distortion product otoacoustic emissions

**Authors:** Wagner W et al

**Summary:** Measurements of distortion product otoacoustic emissions (DPOAEs) were performed in triplicate in 80 normally hearing ears of 40 subjects. Testing combined variation of primary tone levels, assessment of both single-fit (SF) and multiple-fit (MF) modes, and comparison of the two modalities within the same subjects. The standard error of measurement averaged 0.67 dB over all frequencies and primary tone levels in the SF-mode, and 1.44 dB in the MF-mode, respectively. Test-retest repeatability values declined with decreasing primary tone levels, but remained mostly satisfactory with the lower primary tone levels. For the primary tone level combination of L1/L2 = 63/60 dB SPL (resembling the clinical setting), the difference between two DPOAE measurements under the reported test conditions could be considered statistically significant ( $p = 0.05$ ) if it exceeded 0.7 to 1.3 dB in the range 1 to 5 kHz and 2.3 dB for 6 kHz in the SF-mode, when compared with 1.8 to 2.7 dB for 1 to 5 kHz and 3.7 dB for 6 kHz in the MF-mode. As long as signal to noise ratio (SNR) was within 6 to 35 dB, it did not seem to greatly affect repeatability.

**Comment:** Test-retest reliability for DPOAEs is critical, particularly with their increased use as a monitoring tool over time. This article provides information for clinicians using DPOAE measurements as a monitoring tool of cochlear status. It not only confirms the clinical validity of this test, but also provides dB values which could be considered as a significant change between subsequent DPOAE measurements. It additionally supports the use of a 6dB SNR criterion for clinical work, given the time limitations faced in clinical practice.

<http://dx.doi.org/10.1097/AUD.0b013e31816906e7>

**Reference:** *Ear Hear.* 2008;29:378-91

## The relationship between pre-fitting expectations and willingness to use hearing aids

**Authors:** Meister H et al

**Summary:** 100 adult hearing aid candidates (mean age 68.6 years) completed a questionnaire investigating different aspects of expectation and some additional variables potentially influencing willingness to use hearing aids. Among 11 parameters evaluated in a linear regression model, three were significant predictors of motivation to use hearing aids; expectations towards improvement in quality of life, stigmatisation, and self-rated hearing ability. They accounted for about 55% of the variability in the data for willingness. A subset of participants was sampled again three months after the survey; a distinct relationship was observed between willingness and the decision to obtain or decline hearing aids.

**Comment:** This study has implications for counselling potential and new hearing aid (HA) users, and shows the importance of conducting post-fitting patient evaluations. For example, many first time HA users have an expectation that HAs will provide similar speech benefits in quiet and in noise. Also of interest is that self-assessed hearing ability and motivation to get HAs correlates to actual HA use. This suggests the need for audiologists to adequately address the patient's perception of their hearing loss, and also that alternative rehabilitation options may be more appropriate for some individuals, regardless of actual hearing thresholds.

<http://dx.doi.org/10.1080/14992020701843111>

**Reference:** *Int J Audiol.* 2008;47:153-9

## Changes in the DP-gram during the preterm and early postnatal period

**Authors:** Abdala C et al

**Summary:** DP-gram results were examined from one ear of 290 healthy infants ranging in age from 31 weeks postconceptional age to 6 months. Recordings comprised 2f1 – f2 DP-grams (DPOAE level x f2) with primary tones at 65/55 dB SPL, f2/f1 = 1.2, and f2 frequencies ranging from 1500 to 9000 Hz. Distortion product otoacoustic emission (DPOAE) level increased for mid-frequencies (significantly for 4500 and 6000 Hz) throughout the preterm period, from 31 to 33 weeks until the time period associated with term birth. DPOAE level decreased as f2 frequency increased. In many infants, a shallow trough was observed with peak amplitude at 1500 Hz, a reduction in response amplitude through 4500 Hz, and a second peak around 6000 Hz. During the postnatal period from birth through 6 months, DPOAE level did not change significantly as a function of age and the DP-gram was relatively flat across f2 frequency. Mean infant DPOAE levels were 4 to 12 dB higher than adult levels.

**Comment:** This study provides informative guidelines for audiologists who use DPOAEs to monitor prematurely born infants, through to 6 months of age. The results show that DP-grams and DPOAE levels continue to change from ~31 weeks postconception through to the equivalent of full-term birth. That is, a preterm infant in NICU for example, would be expected to show lower DPOAE levels than a full-term infant, irrespective of their hearing thresholds. Once the child is at a full-term age, though, DPOAE levels do not change in the subsequent 6 months. This is also important when monitoring ototoxic drug administration; natural age-related increases in DPOAE levels need to be differentiated from medication-related changes.

<http://www.ncbi.nlm.nih.gov/pubmed/18349704>

**Reference:** *Ear Hear.* 2008;29 (Published online ahead of print)

*Independent commentary by Dr Valerie Looi, a Lecturer in Audiology for the Department of Communication Disorders at the University of Canterbury. Her primary areas of research are in the field of cochlear implants, along with the music perception of those with a hearing impairment. She is particularly interested in developing a music training programme for cochlear implant users.*

*Research Review publications are intended for NZ Medical Professionals.*

ReSound

# X-plore life without limits

For every dimension of an active life.

X-plore™  
ReSound

## Questionnaire investigation of musicians' use of hearing protectors, self reported hearing disorders, and their experience of their working environment

**Authors:** Laitinen H and Poulsen T

**Summary:** Musicians from three Danish symphony orchestras were surveyed about their use of hearing protectors (HPs), the prevalence of self-reported hearing disorders, and how important they considered these hearing disorders to be. The results revealed an awareness of the dangers of loud music, but infrequent and not always correct use of HPs; however, musicians with hearing disorders use HPs more frequently.

**Comment:** This Danish study may help when counselling not only professional musicians, but anyone who plays music for a hobby. It highlights the need to counsel and provide direct instruction on using and adjusting to HPs; providing them is not sufficient. Custom-made HPs need to be optimally fitted – discomfort and the occlusion effect led to nearly half of the musicians ceasing use of these plugs. Two other 'tips': i) Those reluctant to use 2 HPs could consider using one in the ear nearest the noise. For example, if they play the violin, a HP in the left ear may provide some benefit. ii) For professional musicians – finding a quiet place during breaks may be beneficial.

<http://dx.doi.org/10.1080/14992020801886770>

**Reference:** *Int J Audiol.* 2008;47:160-8

## Music perception of cochlear implant users compared with that of hearing aid users

**Authors:** Looi V et al

**Summary:** A series of music perception tests compared the music perception skills of 15 adult cochlear implant (CI) users with those of 15 hearing aid (HA) users who had similar levels of hearing impairment. All subjects were postlingually deafened adults, with the HA subjects being required to meet the current audiological criteria for CI candidacy. The test battery was administered to each subject on two separate occasions, approximately 4 months apart. Rhythm test scores were similar between the groups, whereas scores for the pitch and melody tests were significantly higher in the HA group compared with the CI group. While mean instrument recognition test scores did not differ significantly between the groups, both groups obtained significantly higher scores for the subtest incorporating single instrument stimuli than those incorporating multiple instrumentations.

**Comment:** Current CI music perception studies have compared CI users to normally hearing subjects, which may not be fair, considering CI users have a significant hearing loss. This study compares CI users to HA users with similar levels of loss. The findings suggest that even after accounting for factors associated with significant hearing losses, electrical stimulation via a CI does adversely impact on music perception. Also of interest is that HA users were not as accurate on the music tests as those with normal hearing. These are issues to address when counselling potential or current CI recipients, and HA users who listen to music.

<http://dx.doi.org/10.1097/AUD.0b013e31816a0d0b>

**Reference:** *Ear Hear.* 2008;29:421-34

## Head angle and elevation in classroom environments: implications for amplification

**Authors:** Ricketts TA and Galster J

**Summary:** Data were examined regarding children's head orientation relative to the arrival angle of competing signals and the sound source of interest in actual school settings, to provide information relative to the potential for directional benefit. The study involved 40 children (aged 4–17 years) with and without hearing loss. The data revealed similarly accurate head orientation across children with and without hearing loss, when focusing on the 33% proportion of time in which children were most accurate. Orientation accuracy was not affected by age. Children with hearing loss were significantly more likely to orient toward brief utterances made by secondary talkers than were children with normal hearing.

**Comment:** Existing research suggests that although directional microphone systems are advantageous for some situations, their full-time use is not recommended. For children, appropriate switching between omni- and directional modes is imperative. This study confirms that school children, regardless of age, can benefit from directivity-based microphone technology; there was no correlation between age and head orientation accuracy. FM systems would be the system of choice for single-talker situations, as they are less affected by head orientation and extraneous noises between the speaker and listener. Classroom seating is also important as hearing impaired children use more visual monitoring.

[http://dx.doi.org/10.1044/1092-4388\(2008\)037](http://dx.doi.org/10.1044/1092-4388(2008)037)

**Reference:** *J Speech Lang Hear Res.* 2008;51:516-25

➤ **Available Now – Rehabilitation Research Review by Professor Kath McPherson.**

Update your subscription by logging onto the member's area at [www.researchreview.co.nz](http://www.researchreview.co.nz)

**Privacy Policy:** Research Review will record your email details on a secure database and will not release it to anyone without your prior approval. Research Review and you have the right to inspect, update or delete your details at any time.

**Disclaimer:** This publication is not intended as a replacement for regular medical education but to assist in the process. The reviews are a summarised interpretation of the published study and reflect the opinion of the writer rather than those of the research group or scientific journal. It is suggested readers review the full trial data before forming a final conclusion on its merits.

ReSound

ReSound Ziga...  
... synergy makes sense

Ziga™  
ReSound

The best feature list in its segment.

## Contralateral suppression of distortion product otoacoustic emissions and the middle-ear muscle reflex in human ears

**Authors:** Sun X-M

**Summary:** Distortion product otoacoustic emissions (DPOAEs) were measured in the absence and presence of contralateral noise at five levels; below, equal to, and above the middle-ear muscle (MEM) reflex threshold. The resultant changes in DPOAE level and phase were dependent on stimulus frequency and noise level. Both low-level noise, believed to elicit the medial olivocochlear (MOC) reflex, and high-level noise, thought to activate both MOC and MEM reflexes, significantly decreased the DPOAE level. Low-level noise resulted in a minimum DPOAE phase change, whereas high-level noise caused a substantial phase lead for 1 and 2 kHz. With increasing frequency, phase lag became more notable.

**Comment:** The acoustic reflex test (ART), which triggers the MEM, is a common clinical test for assessing the status of the middle ear. A lesser known acoustic reflex is the MOC reflex that is elicited at levels below the MEM reflex. This article shows that further research is warranted: i) to determine whether using DPOAE contralateral suppression to assess the MOC reflex and efferent system may be an informative clinical tool; ii) whether assessing additional DPOAE parameters (e.g. phase) is worthwhile, and iii) whether different OAE recording approaches may provide further information on the middle ear sound transmission system.

<http://dx.doi.org/10.1016/j.heares.2007.12.004>

**Reference:** *Hear Res.* 2008;237:66-75

## Binaural advantage for younger and older adults with normal hearing

**Authors:** Dubno JR et al

**Summary:** The benefit of spatial separation, benefit of binaural listening, and masking-level differences (MLDs) were examined in a series of experiments involving younger and older adults with normal hearing through 4.0 Hz, to assess age-related differences in binaural advantage. Spatial-separation benefit for speech did not differ significantly between age groups but was smaller than predicted by an audibility-based model for older adults and larger than predicted for younger adults. Binaural listening benefit was observed for younger participants only, specifically in the use of interaural difference cues during noise dips for signals out of phase. No age-related differences were seen for tonal or speech MLDs.

**Comment:** This study would be useful for audiologists when counselling older adults with hearing loss, and/or when deciding between monaural vs binaural aid fittings. It details specific listening situations and tasks where older adults may be more affected than younger adults. It is worth considering that although the reported differences may be small and statistically insignificant, the real-world significance may be greater. For example, the authors report that a 1dB difference in spatial benefit for the head shadow effect can translate into a 10% change for sentence perception in noise.

[http://dx.doi.org/10.1044/1092-4388\(2008/039\)](http://dx.doi.org/10.1044/1092-4388(2008/039))

**Reference:** *J Speech Lang Hear Res.* 2008;51:539-56

## Combined effect of fluid and pressure on middle ear function

**Authors:** Dai C et al

**Summary:** These researchers created an otitis media with effusion (OME) model by injecting saline solution and air pressure simultaneously into the middle ear of human temporal bones, to examine the combined effect of fluid and pressure on middle ear function. According to laser vibrometer outputs, tympanic membrane movement at the umbo was reduced by up to 17 dB in response to 90 dB SPL sound input. Tympanometry measurements revealed that the fluid and pressure effects on the umbo movement in the fluid–pressure combination are not additive. The combined effect of fluid and pressure on the umbo movement is different compared with that of only fluid or pressure change in the middle ear. Negative pressure in fluid–pressure combination had more effect on middle ear function than positive pressure.

**Comment:** This article provides a clear overview of how fluid in the middle ear (ME) and/or pressure changes affect TM movement and ME function, and the affect of this on hearing. It would be of interest to audiologists who want a better understanding of the reasons for Type B/C tympanograms associated with OME, and how these ME changes affect hearing thresholds at low vs high frequencies. Although the study was conducted using temporal bones, results from clinical patients are provided that show how the average level of low-frequency conductive loss seen clinically is greater than that predicted in the study.

<http://dx.doi.org/10.1016/j.heares.2007.11.005>

**Reference:** *Hear Res.* 2007;236:22-32

### Subscribing to Hearing Review

To subscribe or download previous editions of Research Review publications go to [www.hearingreview.co.nz](http://www.hearingreview.co.nz)

To unsubscribe reply to this email with unsubscribe in the subject line.

ReSound

# X-plore life without limits

For every dimension of an active life.

X-plore™  
ReSound