

Hearing Review™

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Issue 4 – 2007

In this issue:

- *Developmental changes in WRT*
- *Interactive fitting of multiple hearing aid algorithms*
- *Speech-recognition after hearing aid use*
- *Asymmetric directional microphone fitting*
- *Test-retest reliability of DPOAEs in children*
- *Racial and gender effects on DPOAEs*
- *Stimulus bandwidth and auditory skills*
- *Living with late deafness*
- *Tinnitus and quality of life*
- *Psychosocial correlates of hearing aids*

Welcome to the fourth edition of **Hearing Review**, a unique New Zealand publication bringing you some of the most important research from around the world every two months. We summarise the best we can find to save you time, and hope our interpretation of the results helps make your job easier.

Thanks to everyone who provided feedback to the first and second editions and to our sponsors for their ongoing commitment. If you have a colleague who you think might like a copy please feel free to pass it on. We trust you find it stimulating and look forward to your comments and opinions.

Kind regards,

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Developmental changes in word recognition threshold in children with different middle ear status

Authors: Hall AJ et al

Summary: This study aimed to assess developmental changes in word recognition in children with different middle ear status, in particular otitis media with effusion (OME). Longitudinal testing (involving an adaptive measure of word recognition in quiet) of around 1000 children occurred as part of the ALSPAC study. Mean word recognition thresholds (WRTs) were 28, 23 and 23 dB at 31, 43 and 61 months respectively. Between 31 and 61 months, normal development was associated with a mean improvement in WRT of 5 dB, whereas WRT increased by +5 and +15 dB when OME was present in one or two ears respectively. Greater disability was associated with early and persistent OME, but effects of previous OME were not significant by 61 months.

Comment: More longitudinal studies such as this are required to explore the link between middle ear status and word recognition thresholds. As expected, we did see an increase in WRT or reduced speech audibility with unilateral and bilateral OME. Interestingly, the WRT of children at around 5 years of age did not (statistically at least) depend upon their previous OME status.

<http://www.pubmed.com.br/abstract.php?bd=pubmed&submit=y&eword=101140017%5Bta%5D&ids=17680467>

Reference: *Int J Audiol* 2007; 46(7):355-61

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Interactive fitting of multiple algorithms implemented in the same digital hearing aid

Authors: Franck BA et al

Summary: This study examined the simultaneous fine-tuning of three hearing aid algorithms: dynamic compression, temporal signal enhancement, and noise reduction. To determine the optimal combination of the three algorithms, a multi-directional pattern search with an adaptive step size was employed. The results were validated by a round-robin procedure. Ten hearing-impaired and four normal-hearing subjects were asked to compare speech intelligibility on two consecutive, differently processed sentences in continuous and fluctuating background noise. The pattern search results showed low reliability and consistency and did not correspond closely with the round-robin results. The authors concluded that *"the current implementation of a multidirectional optimization procedure has not yet proven to be applicable for the necessary individual fine tuning of complex signal processing strategies, when the objective is to maximize speech intelligibility."*

Comment: Dynamic compression, noise reduction and temporal signal enhancement are common features of today's digital hearing aids. However, getting these strategies to work together optimally to maximise speech intelligibility, especially in the face of fluctuating background noise, is still proving to be a challenging business despite many advances on the technology front.

<http://www.pubmed.com.br/abstract.php?bd=pubmed&submit=y&eword=101140017%5Bta%5D&ids=17680471>

Reference: *Int J Audiol* 2007; 46(7):388-97

Speech-recognition performance after long-term hearing aid use

Authors: Shanks JE et al

Summary: This long-term study reports follow-up data from an earlier trial which compared hearing aid performance for three output limiting circuits in 360 adults with symmetrical sensorineural hearing loss. 108 participants from the original study were followed up after 5 to 6 years. Of these, 85% were current hearing aid users. There were significant decreases in speech-recognition ability since the original trial, which were unaffected by the speech materials (NU-6 and CST), test conditions (quiet and noise), signal-to-babble ratios (-3 and 3 dB), and stimulus level (62 and 74 dB SPL). However aided performance was significantly better than unaided performance, regardless of presentation level or noise condition, and hearing aid benefit remained similar to that in the original study.

Comment: The decrement in free field speech recognition scores in this long term study regardless of the speech materials used is indeed contrary to what we would expect with hearing aid use. Whether this decrement is associated with a corresponding decline in cognitive function and central processing of these adults remains to be investigated.

<http://www.audiology.org/publications/jaaa/>

Reference: *J Am Acad Audiol* 2007; 18(4):292-303

Field evaluation of an asymmetric directional microphone fitting

Authors: Cord MT et al

Summary: The authors conducted a real-life study to further investigate evidence from laboratory findings that asymmetric microphone fitting (omni-directional processing in one ear and directional processing in the other) can deliver a directional benefit similar to that provided by binaural directional processing. A range of real-life listening situations were used to compare ease of listening with asymmetric microphone fittings and bilateral omni-directional processing. Specifically, the authors investigated whether the asymmetric fitting provided any advantages or disadvantages in settings where either directional or omni-directional microphone processing is usually preferred. Findings suggested that the asymmetric fitting may have benefits for those patients who cannot or do not switch microphone modes.

Comment: The results of this study are relevant to those clients of ours who would have to switch microphone modes but choose/prefer not to in different listening environments. Even though having one omni-directional and one directional hearing aid is less than optimal for these clients, such asymmetric fitting might still give them a better real life benefit compared with fitting them with bilateral directional or bilateral omni-directional.

<http://lib.bioinfo.pl/pmid:17479617>

Reference: *J Am Acad Audiol* 2007; 18(3):245-56

Independent commentary by Dr Ravi Sockalingam, Senior lecturer, Communications Disorders, University of Canterbury.

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Test-retest reliability of distortion-product otoacoustic emissions in children with normal hearing

Authors: Sockalingam R et al

Summary: This study investigated the test-retest reliability of distortion-product otoacoustic emissions (DPOAEs) in 24 children with normal hearing in order to provide a framework for interpreting DPOAEs. Each subject underwent the same testing with DPOAE recordings at five F2 frequencies (2,530, 3,561, 5,014, 7,029, and 10,028 Hz) in the same location, using the same equipment, but 13 to 15 days apart. Across all 5 frequencies the DPOAE level varied between -13.10 and 20.20 dBs. The variation was greatest at 10,028 Hz. Intra-correlation coefficients for DPOAE level were 0.85, 0.68, 0.62, 0.89, and 0.64 at 2,530, 3,561, 5,014, 7,029, and 10,028 Hz respectively. Retest recordings greater than 6.26, 7.67, 6.81, 5.15, and 10.58 dB SPL at 2,530, 3,561, 5,014, 7,029, and 10,028 Hz respectively could possibly be interpreted as a significant change in status of the ear.

Comment: We do know DPOAEs can be variable from one measurement to another in the clinical setting. As a result, when using DPOAEs to document changes in inner ear function, it is difficult to know if a change documented is due to normal variability or representative of a pathological or functional change. This study aims to provide a framework for interpreting DPOAEs in children.

<http://www.ncbi.nlm.nih.gov/pubmed/17680466>

Reference: *Int J Audiol* 2007; 46(7):351-4

Effect of stimulus bandwidth on auditory skills in children

Authors: Stelmachowicz PG et al

Summary: This study used 4 different auditory tasks in order to assess the effects of stimulus bandwidth in children aged 7 to 14 with normal hearing (n = 32) and sensorineural hearing loss (n = 24). The tasks were nonsense syllable perception, word recognition, novel-word learning and listening effort. Auditory stimuli recorded by a female talker were low-pass filtered at 5 and 10 kHz and presented in noise. In children with normal hearing, bandwidth affected perception of nonsense syllables and words but not novel-word learning or listening effort. For children with impaired hearing, significant improvement in monosyllabic word perception was seen under the 10-kHz bandwidth condition, but not nonsense syllables, novel-word learning, or listening effort. The perception of specific phonemes, including /s/ and /z/ was significantly improved in those with hearing loss, and to a much greater degree than in those with normal hearing. The authors concluded by discussing the importance of these phonemes to the English Language and the potential impacts on phonological and morphological development for children who are unable to perceive them.

Comment: Technological advances in digital signal processing have led to the development of wide bandwidth hearing aids. Such advancement would definitely benefit children who will perceive the high frequency phonemes better, and would have better the language and literacy outcomes. Future studies should examine if these benefits also apply to adults with normal hearing and adults with age-related hearing loss.

<http://www.ear-hearing.com/>

Reference: *Ear Hear* 2007; 28(4):483-94

Racial and gender effects on pure-tone thresholds and DPOAEs in young adults

Authors: Dreisbach LE

Summary: Racial and gender effects on pure-tone behavioural and distortion-product otoacoustic emissions (DPOAEs) were examined in this study. Subjects were normal-hearing young adults of Caucasian, (n = 20) Asian, (n = 20) and African-American (n = 20) ethnicity, with 10 males and 10 females in each ethnic group. Assessments included Békèsy tracking at 1,000 through 16,000 Hz (pure-tone behavioural threshold) and a DPOAE frequency sweep with primary stimulus levels of L(1)/L(2)=60/45 dB SPL, and an f(2)/f(1) of 1.2 at discrete f(2) frequencies between 2,000 through 12,000 Hz. At 14,000 and 16,000 Hz there were significant differences in behavioural thresholds between ethnic and gender groups, but no significant differences were observed among DPOAE frequency sweeps. The authors suggest that further studies "should include larger numbers of subjects, measurement of body size and middle ear reflectance, and examine emission generators."

Comment: Unlike previous studies highlighting gender and ethnic differences in DPOAEs and hearing thresholds, this study has noted differences in the higher frequencies, namely, 14,000 Hz and 16,000 Hz. There is at least one commercially available DPOAE measurement system that is able to record DPOAEs up to 16,000 Hz. The larger study the authors are proposing should also include a systematic comparison of the behavioural thresholds with DPOAEs at these frequencies.

<http://www.informaworld.com/smpp/content~content=a780754021~db=all>

Reference: *Int J Audiol* 2007; 46(8):419-426



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Living with late deafness: Insight from between worlds

Authors: Barlow JH et al

Summary: In-depth, face-to-face, semi-structured interviews conducted with 8 adults aged 33 to 60 who had 'late' deafness, were used to examine the psychosocial impacts of this condition. Framework analysis was used to identify common themes. Participants experienced severe psychological, social, and employment consequences from their hearing loss. They felt caught in-between the hearing and the prelingually deaf worlds, without belonging to either. Participants found peer support and training from intensive rehabilitation programmes delivered by deafened people were valuable, but reported mixed levels of support from health and social care professionals. The authors comment that these findings highlight the need for support and advice for adults with late deafness.

Comment: This study is very timely as there is very little information, let alone research, on the psychosocial impact of hearing loss in adults who are deafened late in life. This study stresses the need for support and rehabilitation training for this population in the same way deafened children are supported and habilitated.

<http://www.informaworld.com/smp/content~content=a780756997~db=all~jumptype=rss>
Reference: Int J Audiol 2007; 46(8):442-8

The impact of tinnitus on quality of life in older adults

Authors: Nondahl DM et al

Summary: The authors obtained self-reported data on tinnitus and quality of life during the first follow-up examination of 2,800 subjects aged 52 to 97 who participated in the 'epidemiology of hearing loss study'. Quality of life was assessed using the Medical Outcomes Study Short Form Health Survey (SF-36). Quality of life decreased significantly in the domains of Role-Physical, Bodily Pain, Vitality, and Mental Health, and in the overall Physical Component Summary score with increasing severity of tinnitus. Those with more recent onset tinnitus (ie first reported at follow-up) had generally lower quality of life scores than those whose tinnitus had persisted from baseline to follow-up.

Comment: This is yet another much needed report on the correlation between the severity of tinnitus and quality of life, particularly in the mental health domains. One interesting finding from this study was that those who reported tinnitus in the follow-up interview presented with worse quality of life survey scores compared with those who reported tinnitus at baseline measurement. One plausible explanation for this finding is that the former group of individuals were more maladjusted to their tinnitus.

http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=Retrieve&db=PubMed&list_uids=17479618&dopt=Citation

Reference: Am Acad Audiol 2007; 18(3):257-66

Psychosocial correlates of hearing aid adjustment

Authors: Kricos PB et al

Summary: Data from the 'long term follow-up of patients in the national institute on deafness and other communication disorders/veterans affairs hearing aid clinical trial' and its original trial were used to compare psychosocial influences and outcomes for hearing aid users and nonusers. The communication performance score of hearing aid users had improved significantly as measured by the social, work and home scales, whereas nonusers showed no beneficial changes. Participants associated hearing aid use with perceptions of major life events such as illness and retirement.

Comment: Whilst this study clearly demonstrated the psychosocial benefit of hearing aid use, it also underscored the need for effective counselling that will allow our hearing aid using clients to positively adjust to their hearing loss. So long as hearing aid use is still viewed as sign of old age, retirement and illness, they will continue to be rejected.

<http://lib.bioinfo.pl/pmid:17580726>

Reference: J Am Acad Audiol 2007; 18(4):304-22

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