Hearing Review™

Making Education Easy

Issue 18 – 2009

In this issue:

Welcome to the eighteenth issue of Hearing Review and the last for 2009.

Findings from one of the studies that we have reviewed for this issue support the idea that self-perceived hearing handicap is an important issue to consider when screening elderly people who might need referral for hearing aid fitting or other hearing rehabilitation services. Hearing thresholds do not predict hearing handicap.

The results of another study suggest that there is a poor agreement across algorithms for audiometric notches and that notches can occur without a positive noise history. The study authors advise researchers to be cautious about classifying noise-induced hearing loss by notched audiograms.

I hope you enjoy the latest edition and welcome your comments and feedback. I would also like to wish everyone a very Merry Christmas and Happy New Year. Thanks for your continued support and interest throughout the year.

Kind regards,

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The effects of bilateral electric and bimodal electric – acoustic stimulation on language development

Authors: Nittrouer S, Chapman C

Summary: These researchers sought to determine whether bimodal stimulation early in the life of a deaf child facilitates the acquisition of generative language. This study enrolled 58 children with at least one cochlear implant (CI) (one CI, n=15; bilateral CIs, n=26; bimodal CI + hearing aid [HA], n=17) and tested them on four language measures spanning a continuum from basic to generative in nature. All children received their 1st CI by age 42 months. A comparison of outcomes according to the kind of stimulation children had at 42 months revealed no significant differences across the groups. Further, no between-group differences were observed when analyses were restricted to only those children who had at least 12 months to acclimatise to their stimulation configuration. While analyses found some advantages in language learning for children who had some bimodal experience (either consistently since their first implant or as an interlude to receiving a second) over children who never had bimodal stimulation, those advantages were restricted to measures assessing generative language.

Comment: Despite the success of CIs for most children, the use of binaural stimulation has been emphasised as a unilateral CI still essentially leaves a child with a unilateral hearing loss. Binaural stimulation may be achieved with a HA (bimodal stimulation) or a CI in the contralateral ear (bilateral implants). The choice would also depend on the level of residual hearing in the child's opposite ear. This study's finding that there was no significant difference between bimodal vs. bilateral stimulation for acquiring generative language, even after 12 months of acclimatisation, has clinical implications considering the cost of a second implant. The use of bimodal stimulation was shown to be beneficial for general language development, possibly due to providing access to low-frequency formant information via the HA. This allows the child to access properties of the acoustic signal children with normal hearing may use in their early acquisition of language.

Reference: Trends Amplif. 2009;13(3):190-205.
http://tia.sagepub.com/cgi/content/abstract/13/3/190

Notched audiograms and noise exposure history in older adults

Authors: Nondahl DM et al

Summary: Data from a population-based cohort study (n=2395) were used to compare four published algorithms for identifying notched audiograms. The resulting notch classifications were compared with noise exposure history. The prevalence of notched audiograms varied greatly by definition. Among participants with a notched audiogram, almost one-third (ranging from 28.1% to 33.0%, depending on algorithm) did not have a history of occupational noise exposure, and approximately 11% (ranging from 7.6% to 13.6%) did not have a history of exposure to any of the three sources of noise (occupational noise exposure, participation in noisy hobbies, and firearm usage).

Comment: It is well accepted that noise-induced hearing loss (NIHL) initially shows up on the audiogram as a drop in thresholds between 3–6 kHz, for most people. However, what constitutes a notch? How much of a drop is required? How much recovery at the higher frequencies? Should the drop be at 1 or >1 frequencies?

This article details 4 different 'notch' classifications, and examined the prevalence of notched audiograms, and the relationship between notches and noise exposure. With the different classifications, between 11.7% and 47.2% of the participants had a notched audiogram. However, almost 1/3 of them did not have a history of noise exposure, with more than 50% of women classified with a notched audiogram having no history of noise exposure. The results suggest that developing a standardised definition for a notch would help clinical practice as well as research, and that notched audiograms do not definitively differentiate a NIHL. It should be noted, though, that the use of hearing protection was not considered in this study, and as such, results may be biased towards recording greater levels of noise exposure than was actually the case.

Reference: Ear Hear. 2009;30(6):696-703.

http://tinyurl.com/yl2dr7l

The factors associated with a self-perceived hearing handicap in elderly people with hearing impairment – results from a community-based study

Authors: Chang HP et al

Summary: These researchers sought to determine the relation between a hearing impairment and the self-perception of a hearing handicap, and the factors associated with a self-perceived hearing handicap among a group of randomly recruited, community-dwelling elderly persons aged ≥65 years (n=1220) in Taipei, Taiwan. Hearing impairment was only moderately associated with self-perceived handicap (γ_s 0.52). Only 21.4% of those with moderate-to-profound hearing impairment (PTA ≥41 dB HL; n=555) perceived themselves as hearing-handicapped (Hearing Handicap Inventory for the Elderly-Screening Version [HHIE-S] total score ≥10). In addition to hearing level, marital status (widowed) and self-perceived general health (bad or neutral) were significantly associated with a self-perceived hearing handicap among those with moderate-to-profound hearing impairment. Among those with moderate-to-profound hearing impairment, 5.0% of those with HHIE-S scores <10 and 45.4% of those with HHIE-S scores ≥10 used or felt that they required hearing aids.

Comment: As reported in previous editions of HRR, the relationship between actual hearing levels and self-perceived hearing handicap is not strong. Less than 50% of the variance in handicap can be explained from hearing thresholds, and studies have found only moderate levels of correlation for the elderly.

The fact that this Taiwanese study obtained similar findings to existing research suggests that, despite different cultural considerations, hearing handicap cannot be predicted from hearing thresholds; similar extraneous variables affect perceived handicap. However, the cultural differences should not be overlooked. There is a tendency for elderly Chinese/Asians to report lower levels of hearing handicap than Western counterparts, with only weak correlations to hearing thresholds. This may be due to differences in living arrangements (elderly often live with family), a respect for elderly in Chinese culture, different coping strategies, different acceptance levels, cultural acceptance of aging-related deficiencies, the linguistic variations of the languages, different resources available, and/or differences in health/audiology care practices, to name only a few.

Reference: Ear Hear. 2009;30(5):576-83.

http://tinyurl.com/yjs2zrt

The effect of hearing impairment in older people on the spouse: Development and psychometric testing of The Significant Other Scale for Hearing Disability (SOS-HEAR)

Authors: Scarinci N et al

Summary: This study aimed to develop an instrument to measure third-party disability experienced by spouses of older people with hearing impairment. Items for the Significant Other Scale for Hearing Disability (SOS-HEAR) were generated from results of a previous qualitative study investigating the effect of hearing impairment on a spouse's everyday life. Psychometric testing with 100 spouses was conducted using item analysis, Cronbach's alpha, factor analysis, and test-retest reliability. Principal components analysis identified six key underlying factors. A combined set of 27 items was found to be reliable (alpha = 0.94), with weighted kappa for items ranging from fair to very good.

Comment: The previous article by Chang and colleagues in this edition of HRR discussed the lack of correlation between handicap and audiometric thresholds, and hence the need to use subjective questionnaires to assess limitations. The consequences of hearing loss aren't just for the individual, though, and frequently extend to significant others and families. The questionnaire discussed here is specific to assessing the impact of hearing loss on the spouses of elderly patients. The development of such a questionnaire for audiology is long overdue, and this 27-item questionnaire has great potential for clinical application (e.g. to guide counselling, to determine a patient's rehabilitation needs, etc). It assesses 6 major sub-factors: communication changes, communicative burden, relationship changes, socialising, emotional adaptations, and concern for the partner.

Reference: Int J Audiol. 2009;48(10):671-83.

http://tinyurl.com/yhm7rsm

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.

Effects of negative middle ear pressure on distortion product otoacoustic emissions and application of a compensation procedure in humans

Authors: Sun XM, Shaver MD

Summary: These researchers examined the effect of negative middle ear pressure (MEP) on distortion product otoacoustic emissions (DPOAEs) and sought to validate a compensation procedure to account for negative MEP encountered in DPOAE measurement. The study measured DPOAEs across a broad frequency range (600 to 8000 Hz) before and after inducing negative MEPs across a large pressure range (–40 to –420 daPa). Various negative MEPs significantly decreased the DPOAE level for *f2* frequencies of 600, 750, 1000, and 1500 Hz ($p<0.01$). For *f2* = 3000 Hz, the DPOAE level was significantly reduced under all negative MEPs ($p<0.01$), except for –40 to –65 daPa. None of the changes at 2000, 4000, and 6000 Hz were significant. For *f2* = 8000 Hz, the mean DPOAE level tended to increase by approximately 2 to 4 dB for negative MEPs higher than –160 daPa. However, these changes were not statistically significant. Compensating for the negative MEP by applying an equivalent negative ear-canal pressure re-established normal DPOAE levels.

Comment: This interesting paper has significant clinical relevance, as an understanding of the effect of negative MEP on DPOAEs may allow better interpretation of DPOAE results, as well as provide greater understanding of the middle ear's transfer function. The study found that negative MEP had the most impact in the mid-frequency range with a peak at 2 kHz followed by a notch at 3 kHz evident in numerous cases. The peak and notch shifted higher in frequency as MEP became more negative. The authors suggest using a MEP compensation procedure in clinical practice, and provide some references for consideration.

The findings also suggest that: i) the primary resonant frequency of human middle ear systems is <2000 Hz in humans, but shifts upward with greater negative MEPs, and ii) the total resonance of a normal middle ear system occurs at multiple frequencies and/or over a broad frequency range.

Reference: Ear Hear. 2009;30(2):191-202.
http://tinyurl.com/ygcw77h

Hearing aid outcomes: Effects of gender and experience on patients' use and satisfaction

Authors: Williams VA et al

Summary: The 7-item International Outcome Inventory for Hearing Aids (IOI-HA) and a 12-item practice-specific questionnaire were used to assess satisfaction and benefit for patients using advanced hearing aid (HA) technology. Results were compared with norms, and the effects of gender and experience were also analysed. Sixty-four adults responded to questionnaire mailouts; all participants had worn their newly purchased multi-channel digital HAs with directional microphones for ≥3 months. The practice-specific questionnaire assessed patients' demographics and the quality of services received. The IOI-HA was analysed according to an overall score and on two different factor scores. Neither gender nor HA experience had any significant influence on patients' responses on the IOI-HA and all respondents were satisfied with their HAs and the practice that dispensed them. T-tests on the IOI-HA satisfaction and quality of life items revealed significant differences in favour of these participants' scores over those in the normative study.

Comment: The IOI-HA is a short 7-item questionnaire that clinicians can administer with HA recipients to determine satisfaction and HA use. The items can be divided into 2 categories: i) Items related to the patient's view of their HAs (e.g. use, benefit, satisfaction, quality of life), and ii) items related to the effect HAs have on their social interactions (e.g. activity limitations, participation restrictions, impact on others). There was no effect of gender or experience on IOI-HA scores. However, this may be in part due to ceiling effects, with very high satisfaction scores recorded, and/or the few items of the IOI-HA not being sensitive enough to detect gender/experience differences. With only 7 questions, it does not address factors which may differ between genders and/or experience levels (e.g. coping in different communication situations).

Reference: J Am Acad Audiol. 2009;20(7):422-32.
http://www.ingentaconnect.com/content/aaa/jaaa/2009/00000020/00000007/art00004

Vestibular evoked myogenic potential (VEMP) testing: normative threshold response curves and effects of age

Authors: Janky KL, Shepard N

Summary: These researchers examined the effects of vestibular evoked myogenic potential (VEMP) characteristics on age. VEMP responses at threshold to click and 250, 500, 750, and 1000 Hz tone burst stimuli and at a suprathreshold level (123 dB SPL) to 500 Hz toneburst stimuli were measured in 46 normal participants aged 20–76 years. Participants were separated by decade into five age categories from 20 to 60-plus years. Participants had normal hearing sensitivity, no history of neurological or balance/dizziness involvement, and negative results on a vestibular examination. No significant differences existed between ears for any of the test parameters and no significant differences were seen between age groups for n23 latency or amplitude in response to any of the stimuli. Significant between-group differences were seen for p13 latency (250, 750, and 1000 Hz) and threshold (500 and 750 Hz). Age was positively correlated with VEMP threshold (250, 500, 750, 1000 Hz) and negatively correlated with amplitude (500 Hz maximum). The threshold response curves revealed best frequency tuning at 500 Hz with the highest thresholds in response to click stimuli. However, the frequency tuning curve flattened with increased age, as did VEMP response rates.

Comment: The VEMP provides information on the integrity of the saccule and inferior vestibular nerve. This study recorded cervical VEMPS by delivering auditory stimuli to the ipsilateral ear and measuring the release of the sternocleidomastoid muscle. Although this is the traditional procedure for recording VEMPs, a more recent development is the measurement of ocular VEMPS from the extra-ocular muscles by activating the otoliths using acoustic stimuli. The latter measurement procedure is less uncomfortable for the patient in that they need only sit quietly and gaze at a stationary target. Research suggests that, regardless of which method is used to record VEMPs, there is a significant age effect, with reduced amplitude in individuals older than 60 years being the most consistent finding. This article discusses the effects that various stimuli and recording parameters have on VEMP results for different age groups, and would be of interest to professionals involved with vestibular disorders.

Reference: J Am Acad Audiol. 2009;20(8):514-22.
http://www.ingentaconnect.com/content/aaa/jaaa/2009/00000020/00000008/art00008

Cochlear implantation in postlingually hearing-impaired adults: choosing the most appropriate ear

Authors: van den Broek E, Dunnebier EA

Summary: These researchers reviewed the surgical, audiological, and patient factors that influence the choice of ear for cochlear implantation (CI) in postlingually hearing-impaired adults and formulated a flowchart to aid decision making. Surgical factors include anatomical variation and otological medical history, classified in absolute and relative contraindications. Duration of deafness and residual hearing are combined in the audiological factor. Likeliness of improvement of speech perception after CI at different durations of deafness is estimated. This is followed by comparison of between-ear differences in duration of deafness. If there is a large difference, above the presented 5% interval, the ear with the shortest duration is preferred.

Comment: The decision on which ear to implant has changed over time. Initially, the audiologically worse ear was selected as there was 'less to lose' for the patient. In the 1990s the trend reversed to implanting the better ear, as studies suggested that better preserved peripheral neural pathways lead to better post-CI outcomes. However, more recent research suggests that the central auditory pathway can compensate for the degeneration, and similar results are attained, regardless of which ear is implanted. Duration of deafness and degree of residual hearing are the principal concerns.

This study reviews factors that influence choice of ear, and provides a flowchart to assist the decision-making process. An excellent model is provided that correlates potential outcome (maximum speech score) with duration of deafness. The authors suggest that if from this model the predicted improvement is >5%, the better ear should be implanted. If the predicted difference is <5%, either ear can be chosen. A 5%-interval corresponds to a between-ear difference in duration of deafness of 10 years for durations of deafness up to 20 years, and 5 years for durations >20 years.

Reference: Int J Audiol. 2009;48(9):618-24.

http://tinyurl.com/yz6ouuf

Hearing status, need for recovery after work, and psychosocial work characteristics: Results from an internet-based national survey on hearing

Authors: Nachtegaal J et al

Summary: This study addressed the relationship between hearing status and need for recovery after work, as well as the role of hearing status in the association between the psychosocial work characteristics (i.e. job demands and job control) and need for recovery, among 925 normally-hearing and hearing-impaired working adults aged 18–65 years. Regression analyses revealed a significant association between hearing status and need for recovery after work; poorer hearing resulted in an increasing need for recovery and a higher odds for risky levels of need for recovery. Hearing status did not influence the significant relationship between psychosocial work characteristics (i.e. job demand and job control) and need for recovery after work.

Comment: This is a sub-study from a larger Dutch research project – The Dutch National Longitudinal Study on Hearing (NH-SH). An overview is available at:

http://www.ac-vumc.nl/onderzoek/models.htm#_M3

http://www.onderzoekinformatie.nl/nl/oi/nod/onderzoek/OND1327627/

For people with hearing loss, extra effort and concentration is required for communication, leading to higher levels of fatigue. This study's findings are consistent with this; for every dB drop in hearing, the need for post-work recovery increased by 1.35 points. For every dB signal-to-noise ratio decrease in hearing status, the need for recovery increased by 9%. Psychological job demand and job control was not associated with the need for recovery. The double workload experienced by hearing-impaired workers is important for counselling, both of the individual and their significant other and/or family. Previous research shows that those with a hearing loss report higher rates of lacking energy, social isolation, and greater perceived imbalance between job demands and job control. In short, potential 'burn out' is a genuine concern for many hearing-impaired workers.

Reference: Int J Audiol. 2009;48(10):684-91.

http://www.informaworld.com/smpp/content~content=a915520410~db=all~jumptype=rss

Children with speech, language and communication needs: their perceptions of their quality of life

Authors: Markham C et al

Summary: Outcomes are reported from a qualitative, child-centred, investigation into the quality of life (QoL) experiences of children and young people with speech, language and communication needs. Seven focus group interviews were conducted with a range of children and young people in full-time education and receiving speech and language therapy. Grounded Theory and Framework analyses identified a number of key themes as to children's QoL experiences, ranging from the participant's perceptions of what improves their daily lives to the difficulties they experience, and consequently the negative impacts perceived on their QoL.

Comment: A couple of other articles in this edition of HRR (the above-mentioned study by Nachtegaal et al., as well as that by Scarinci et al. on page 2) have looked at the effect of hearing loss on QoL for adults. This study addresses the relatively under-considered issue of QoL in children, as reported by the child. Although the children in this study were not necessarily hearing-impaired, there is no reason that the study's findings cannot be generalised to the hearing-impaired paediatric population, as both conditions impact on speech and language development.

Results from focus group discussions identified 8 main themes children reported to affect their QoL: Achievement, emotions, independence, individual needs, relationships, relaxation, school, and support. The success of using focus group discussions to obtain information suggests that young people have the desire and ability to discuss factors impacting on their QoL, and that clinicians should actively involve the child or young person in decisions related to their care.

Reference: Int J Lang Commun Disord. 2009;44(5):748-68.

http://tinyurl.com/yl9z2er