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Auditory Characteristics of Children with Autism.
Ear & Hearing. 27(4):430-441, August 2006.
Anne Marie Tharpe; Fred H. Bess; Douglas P. Sladen; Holly Schissel; Steve Couch; Teri Schery

Abstract:
Objectives: The objectives of this study were (1) to describe the auditory characteristics of children with autism relative to those of typically developing children and (2) to describe the test-retest reliability of behavioral auditory test measures with this population of children with autism.

Design: Audiometric data were obtained from 22 children diagnosed with autism and 22 of their typically developing peers. The audiologic test battery consisted of behavioral measures (i.e., visual reinforcement audiometry, tangible reinforcement operant conditioning audiometry, and conditioned play audiometry) and physiological measures (auditory brain stem response audiometry, distortion product otoacoustic emissions, and acoustic reflexes).

Results: Children with autism had physiologic test results equivalent to their typically developing counterparts. That is, no differences in auditory brain stem response audiometry, distortion product otoacoustic emissions, or acoustic reflex results were noted between the children with autism and typically developing children. However, behavioral measures revealed that about half of the children diagnosed with autism presented pure-tone averages outside of normal limits (i.e., >20 dB HL), although their response thresholds to speech were within normal limits. All behavioral test results were within normal limits (i.e., <=20 dB HL) for the typically developing children. In addition, test-retest variability was typically 15 dB or greater for children with autism as compared with variability of 10 dB or less for most of the typically developing children.

Conclusions: Children with autism demonstrated essentially equivalent results on a battery of physiological auditory tests as those obtained from typically developing children. However, on average, behavioral responses of children with autism were elevated and less reliable relative to those of typically developing children. Furthermore, approximately half of the children with autism demonstrated behavioral pure-tone averages outside of the normal hearing range (i.e., >20 dB HL) despite having normal to near-normal hearing sensitivity as determined by other audiometric measures.

Reaction Time to 1- and 4-kHz Tones as a Function of Sensation Level in Listeners with Normal Hearing.
Michael Epstein; Mary Florentine

Abstract:
Objective: Measures of reaction time (RT) near threshold have been used to indicate whether listeners with hearing losses of primarily cochlear origin experience greater loudness at elevated thresholds than at normal thresholds. These measurements have been based on the assumption that RTs near threshold are not affected by stimulus frequency in the 1- to 4-kHz range. The present study tests this hypothesis.
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Design: To gain an understanding of how RT is affected by frequency, RTs to 1- and 4-kHz tones were measured in 16 listeners with normal hearing across a wide range of sensation levels (SLs).

Results: Statistical analyses indicate that RTs are affected by frequency in some listeners. This effect is most common at low SLs but is also present at higher SLs. Learning effects could not account for the observed differences between RTs at the two frequencies.

Conclusions: Although reaction time—especially at low levels—is affected by stimulus frequency in some listeners, the effect is not large enough to account for the differences in RTs measured in all listeners with impaired hearing in other studies.

The Influence of RECD Transducer When Deriving Real-Ear Sound Pressure Level.

Kevin J. Munro; Kerri E. Millward

Abstract:
Objective: The main aim of the present study was to compare the derived and directly measured real-ear hearing instrument performance for a range of commonly used hearing instruments. A secondary aim was to compare the real-ear to coupler difference (RECD) measured using the ER-3A insert earphone and a selection of hearing instruments.

Design: The real-ear SPL was measured for four models of hearing instrument in 20 adult participants using an Audioscan RM500 real-ear system. This was compared with the derived real-ear SPL obtained by adding the RECD (measured using the ER-3A insert earphone) to the 2-cc coupler response of each hearing instrument. Measurements were made at 1/12 octave intervals from 0.2 to 6 kHz, using both the HA1 and HA2 2-cc coupler. In addition, the RECD was measured using four models of hearing instrument for comparison with the ER-3A insert earphone values.

Results: The procedures were very reliable with mean differences on retest of less than 1 dB. Repeated-measures analysis of variance revealed statistically significant differences between the measured and derived real-ear SPL (p < 0.001) for several models of hearing instrument. The derived responses using the HA1 coupler yielded good accuracy, whereas the HA2 yielded less accuracy. For three models of hearing instrument, the maximum difference was between 5 and 10 dB when using the HA2 coupler. The mean RECD measured with the ER-3A insert earphone and HA2 coupler was not always equivalent to the RECD measured with the hearing instruments.

Conclusions: The accuracy of the derived real-ear response obtained using an RECD, measured with an ER-3A insert earphone, is very good when an HA1 is used for the coupler component of the RECD. The accuracy diminishes somewhat with the HA2 coupler, especially for undamped hearing instruments. The accuracy of the derived real-ear response is very good when the RECD is measured using the hearing instrument and the HA1 or the HA2 coupler.
Auditory Neuropathy Characteristics in Children with Cochlear Nerve Deficiency.
Ear & Hearing. 27(4):399-408, August 2006.
Craig A. Buchman; Patricia A. Roush; Holly F. B. Teagle; Carolyn J. Brown; Carlton J. Zdanski; John H. Grose

Abstract:
Objective: To describe a group of children exhibiting electrophysiologic responses characteristic of auditory neuropathy (AN) who were subsequently identified as having absent or small cochlear nerves (i.e., cochlear nerve deficiency).

Design: A retrospective review of the clinical records, audiological testing results, and magnetic resonance imaging (MRI) studies. Fifty-one of 65 children with AN characteristics on auditory brain stem response (ABR) testing had MRI available for review. Nine (18%) of these 51 children with ABR characteristic of AN have been identified as having small (N = 2; 4%) or absent (N = 7; 14%) cochlear nerves on MRI.

Results: Of the nine children with cochlear nerve deficiency, five (56%) were affected unilaterally and four (44%) bilaterally. Eight of nine presented after failing a newborn infant hearing screening, whereas one presented at 3 yr of age. On diagnostic ABR testing, all 9 children (9 of 13 affected ears; 69%) had evidence of a cochlear microphonic (CM) and absent neural responses in at least one ear. In the unilateral cases, AN characteristics were detected in all affected ears. In bilateral cases, at least one of the ears in each child demonstrated the AN phenotype, whereas the contralateral ear had no CM identified. Only one ear with cochlear nerve deficiency had present otoacoustic emissions as measured by distortion-product otoacoustic emissions. In children with appropriate available behavioral testing results, all ears without cochlear nerves were identified as having a profound hearing loss. Only 4 (31%) of the 13 ears with cochlear nerve deficiency had a small internal auditory canal on MRI.

Conclusions: Children with cochlear nerve deficiency can present with electrophysiologic evidence of AN. These children frequently refer on newborn screening examinations that use ABR-based testing methods. Similar to other causes of AN, diagnostic ABR testing will show a CM with absent neural responses. Given that 9 (18%) of 51 children with available MRI and electrophysiologic characteristics of AN in our program have been identified as having cochlear nerve deficiency makes this a relatively common diagnosis. These findings suggest that MRI is indicated for all children diagnosed with AN. Moreover, electrophysiologic evidence of unilateral AN in association with a profound hearing loss should make the clinician highly suspicious for this problem. Although children with cochlear nerve deficiency who have a small nerve may benefit from cochlear implantation or amplification, these interventions are obviously contraindicated in children with completely absent cochlear nerves.
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Daniel J. Freed; Sigfrid D. Soli

Abstract:
Objective: This study evaluated the performance of nine adaptive antifeedback algorithms. There were two goals: first, to identify objective procedures that are useful for evaluating these algorithms, and second, to identify strengths and weaknesses of existing algorithms.

Design: The algorithms were evaluated in behind-the-ear implementations on the Knowles Electronics Manikin for Acoustic Research (KEMAR). Different acoustic conditions were created by placing a telephone handset or a hat on KEMAR. Electroacoustic techniques were devised to measure the following performance aspects of each algorithm: (1) additional gain made available before oscillation, (2) gain lost in specific frequency regions, (3) reduction of suboscillatory peaks in the frequency response, (4) speed of adaptation to changing acoustic conditions, and (5) robustness in the presence of tonal input signals.

Results: For each measurement, performance varied widely across algorithms. No single algorithm was clearly superior or inferior to the others. Generally, the feedback cancellation algorithms were less likely to sacrifice gain in specific frequency regions and better at reducing suboscillatory peaks, whereas the algorithms that used noncancellation techniques were more tolerant of tonal input signals. For those algorithms equipped with special operational modes intended for music listening, the music mode improved the response to tonal inputs but sometimes sacrificed other performance aspects. Algorithms that required an acoustic measurement for initialization purposes tended to perform poorly in acoustic conditions dissimilar to the condition in which initialization was performed.

Conclusions: The objective methods devised for this study appear useful for evaluating the performance of adaptive antifeedback algorithms. Currently available algorithms demonstrate a wide range of performance, and further research is required to develop new algorithms that combine the best features of existing algorithms.

Comparison of the Head Elevation Versus Rotation Methods in Eliciting Vestibular Evoked Myogenic Potentials.
Chi-Te Wang; Yi-Ho Young

Abstract:
Objectives: Because active and tonic sternocleidomastoid (SCM) muscle contraction is essential for recording the vestibular evoked myogenic potential (VEMP), false-negative VEMPs are sometimes encountered in those who cannot sustain SCM muscle contraction by head elevation. Hence, the goal of this study was to investigate whether the effortless head rotation method can replace the head elevation method in eliciting VEMP responses.

Design: Twenty healthy volunteers underwent VEMP testing, using monaural tone burst stimulation. First, the subject was instructed to keep the head elevated in the pitch plane for recording, followed by rotating the head sideways toward one shoulder as head down in the yaw plane for another recording (elevation-rotation sequence). On the next day, VEMP testing was performed in reverse order (rotation-elevation sequence). Twelve patients with cochleo-
vestibular disorders were also enrolled in this study and underwent VEMP testing, using the two methods in random order.

Results: In the elevation-rotation sequence for subjects without cochleo-vestibular disorders, the response rate for the elevation method (100%) was significantly higher than the response rate for the rotation method (70%). In contrast, no significant difference existed in the response rate between the two methods in the rotation-elevation sequence (85% versus 88%). Comparison of the response rates for the initial elevation (100%) and initial rotation methods (85%) revealed a significantly lower response rate for the initial rotation method. Mean latencies of the onset waveform and peaks p13 and n23 showed significant differences between the two methods when using the elevation-rotation sequence but no differences on the rotation-elevation sequence. Furthermore, the rotation method displayed significantly smaller amplitude than the elevation method when using the elevation-rotation sequence but no significant difference in amplitude between the two methods when applying rotation-elevation sequence. In 12 patients with cochleo-vestibular disorders, the response rates for the elevation method (67%) and rotation method (58%) were significantly reduced compared with the rates for subjects without cochleo-vestibular pathology. However, when either the elevation or the rotation method response was considered, VEMPs were present in 11 (92%) of the 12 patients with cochleo-vestibular disorders.

Conclusions: The head rotation method may serve as an alternative for eliciting VEMPs in those who cannot sustain SCM muscle contraction by head elevation. However, the lower response rate with smaller amplitude prevents the use of the head rotation method as an initial screening test for VEMPs. We therefore recommend that when VEMP responses cannot be elicited by the head elevation method, the head rotation method should be utilized to reduce false-negative results.

Peter M. Rabinowitz; Martin D. Slade; Deron Galusha; Christine Dixon-Ernst; Mark R. Cullen

Abstract:
Objectives: Studies have suggested that hearing loss due to recreational noise exposure may be on the rise among adolescents and young adults. This study examines whether the hearing status of young US adults entering an industrial workforce has worsened over the past 20 yr.

Design: The baseline audiograms of 2526 individuals ages 17 to 25 beginning employment at a multisite US corporation between 1985 and 2004 were analyzed to determine the yearly prevalence of hearing loss.

Results: Approximately 16% of the young adults in the sample had high frequency hearing loss (defined as hearing thresholds greater than 15 dB in either ear at 3, 4, or 6 kHz). In a linear regression model, this prevalence decreased over the 20-yr period (odds ratio (OR) = 0.96, 95% confidence interval (CI): 0.94, 0.99). Almost 20% of subjects had audiometric "notches" consistent with noise exposure; this rate remained constant over the 20 yr, as did the prevalence (5%) of low frequency hearing loss.

Conclusions: These results indicate that despite concern about widespread recreational noise exposures, the prevalence of hearing loss among a group of young US adults has not significantly increased over the past two decades.
Early Otitis Media with Effusion, Hearing Loss, and Auditory Processes at School Age.


Judith S. Gravel; Joanne E. Roberts; Jackson Roush; John Grose; Joan Besing; Margaret Burchinal; Eloise Neebe; Ina F. Wallace; Susan Zeisel

Abstract:
Objectives: To examine the effect of conductive hearing loss (HL) secondary to otitis media with effusion (OME) in the first 3 years of life on physiologic, peripheral, and higher-order behavioral auditory processes examined at school age.

Methods: Peripheral hearing sensitivity for conventional and extended high-frequency audiometric ranges, physiologic (distortion product otoacoustic emissions, contralateral and ipsilateral acoustic middle ear muscle reflexes), auditory brain stem response (ABR), and higher-order auditory processing measures (masking level difference; Virtual Auditory Localization, Speech Intelligibility Gain; adaptive Pediatric Speech Intelligibility task) were examined at the end of the second grade of elementary school in two cohorts (North Carolina, N = 73, and New York, N = 59). All participants (mean age, 8 years) were followed prospectively in infancy and early childhood (7 to 39 months) for middle ear status and hearing loss (using pneumatic otoscopy/tympanometry and repeated conditioned behavioral audiometric response procedures). Multivariate analyses were conducted to address whether early OME and early conductive HL were related to physiologic, peripheral, and higher-order auditory processes.

Results: Early hearing loss and OME were significantly associated with peripheral hearing at school age; extended high-frequency thresholds accounted for the result. Similarly, hearing loss in early life and OME were significantly associated with the acoustic middle ear muscle reflex: The contralateral stimulation condition accounted for the association. Significant associations with both early OME and early HL were also found for the auditory brain stem response measure and were explained by the correlations between early hearing loss and the ABR Wave V latency but not other ABR indices. There were no reliable associations between either early OME or early HL on any other auditory processes evaluated at the end of second grade.

Conclusions: Extended high-frequency hearing and brain stem auditory pathway measures in childhood were significantly associated with children's experiences with OME and hearing loss from 7 to 39 months of age. However, no significant associations were found for psychoacoustic measures of binaural processing or a behavioral adaptive speech-in-noise test at school age.
Eye Fixations of Deaf and Hearing Observers in Simultaneous Communication Perception.
Carol Lee De Filippo; Charissa R. Lansing

Abstract:
Objectives: The purpose of this study was to examine characteristics of eye gaze behavior, specifically eye fixations, during reception of simultaneous communication (SC). SC was defined as conceptually accurate and semantically based signs and fingerspelling used in conjunction with speech. Specific areas of focus were (1) the pattern of frequency, duration, and location of observers' eye fixations in relation to the critical source of disambiguating information (signs or speech) in SC, and (2) how the pattern of an observer's eye fixations was related to the source of critical information (sign or speech), expectations regarding the location of the critical information after exposure to the stimulus set, observer characteristics, and sender.

Design: The investigation used eye tracking technology to monitor eye fixations of observers who watched silent video clips of sentences rendered in SC by three senders. Each sentence contained one of a pair of sign-critical (e.g., "sleeves"/"leaves") or speech-critical (e.g., "invited"/"hired") contrast items designed to depend on information at the hands or mouth, respectively, to resolve its ambiguity. Observers were 20 adults: five faculty/staff with early onset deafness, five faculty/staff with normal hearing, and ten college students with early onset deafness. Faculty and staff were identified by a sign language assessment specialist to be experienced and skillful users of SC. Students, exposed to SC in classroom instruction, were recruited through paper and electronic ads.

Results: Generally, observers looked toward the face, regardless of whether signs or speech disambiguated the message, suggesting that eye fixations toward the hands of the sender are not necessary to apprehend essential information to accurately identify an ambiguous part of the message during SC. However, other aspects of eye behavior indicated sensitivity to type of critical contrast. In particular, fixations were shorter during sign-critical items compared to speech-critical items, even after adjusting for stimulus length. In addition, experienced, adult deaf users of SC made more, brief eye fixations than observers who had normal hearing. Finally, differences in eye fixation patterns toward different senders indicates that sender characteristics affect visual processes in SC perception.

Conclusions: This study provides supportive evidence of brief, frequent eye movements by deaf perceivers over small areas of a video display during reception of visuospatial linguistic information. These movements could be used to enhance activation of brain centers responsible for processing motion, consistent with neurophysiological evidence of attentional mechanisms or visual processes unique to perception of a visual language.
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Hearing in Nonprofessional Pop/Rock Musicians.
Nicolas Schmuziger; Jochen Patscheke; Rudolf Probst

Abstract:
Objective: The purpose of this study was to evaluate the hearing and subjective auditory symptoms in a group of nonprofessional pop/rock musicians who had experienced repeated exposures to intense sound levels during at least 5 yr of musical activity.

Design: An evaluation of both ears in 42 nonprofessional pop/rock musicians included pure-tone audiometry in the conventional and extended high-frequency range, the measurement of uncomfortable loudness levels, and an assessment of tinnitus and hypersensitivity to sound. Exclusion criteria were (a) the occurrence of acoustic trauma, (b) excessive noise exposure during occupational activities, (c) a history of recurrent otitis media, (d) previous ear surgery, (e) a fracture of the cranium, (f) ingestion of potentially ototoxic drugs, and (g) reported hearing difficulties within the immediate family. These audiometric results were then compared with a control group of 20 otologically normal young adults with no history of long-term noise exposure.

Results: After adjusting for age and gender, relative to ISO 7029, the mean hearing threshold in the frequency range of 3 to 8 kHz was 6 dB in the musicians and 1.5 dB in the control group. This difference was statistically significant (Mann-Whitney rank sum test, p < 0.001). A significant difference was also observed between musicians using regular hearing protection during their activities (average 3 to 8 kHz thresholds = 2.4 dB) and musicians who never used such hearing protection (average 3 to 8 kHz thresholds = 8.2 dB), after adjusting for age and gender (Mann-Whitney rank sum test, p = 0.006). Eleven of the musicians (26%) were found to be hypersensitive to sound, and seven (17%) presented with tinnitus. Tinnitus assessment, however, did not reveal any clinically significant psychological distress in these individuals.

Conclusions: Tinnitus and hypersensitivity to sound were observed in a significant minority within a group of nonprofessional pop/rock musicians who had experienced repeated exposure to intense sound levels over at least 5 yr but with minimal impact on their lives. Moreover, hearing loss was minimal in the subjects who always used ear protection, being only 0.9 dB higher than the control group. In contrast, hearing loss was significantly more pronounced, at 6.7 dB higher than the control group, in those musicians who never used ear protection. Continued education about the risk to hearing and the benefits of the persistent use of ear protection is warranted for musicians who are exposed frequently to intense sound levels.

Psychic Stress and Quality of Life in Parents During Decisive Phases in the Therapy of Their Hearing-Impaired Children.
Thorsten Burger; Claudia Spahn; Bernhard Richter; Susanne Eissele; Erwin Löhle; Jürgen Bengel

Abstract:
Objective: This study was performed to analyze psychic stress and quality of life in the parents of children with hearing impairment in the course of various phases of treatment.

Design: At three measuring points over a course of 12 months, the degree of parental stress and the quality of life was surveyed prospectively. In addition, the children’s hearing and speech status was surveyed. Parents whose children were treated with hearing aids or cochlear
implants were the target of this survey. At the outset of the study, data of 123 parents were available. The average age of the children was 38 months.

Results: It was not possible to demonstrate generally heightened psychic stress in any phase of treatment. Differentiation into subgroups must be performed, as parental stress depends on possible changes of treatment and the child's speech status. Initially, quality of life was clearly reduced but gradually became statistically insignificant.

Conclusions: The results point out the necessity of supporting the parents with counseling and psychosocial support, especially in the initial fitting phase and in the various decision and orientation phases.

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