Auditory Sensory Memory and Working Memory Processes in Children with Normal Hearing and Cochlear Implants

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Abstract

There can be wide variation in the level of oral/aural language ability that prelingually hearing-impaired children develop after cochlear implantation. Automatic perceptual processing mechanisms have come under increasing scrutiny in attempts to explain this variation. Using mismatch negativity methods, this study explored associations between auditory sensory memory mechanisms and verbal working memory function in children with cochlear implants and a group of hearing controls of similar age. Whilst clear relationships were observed in the hearing children between mismatch activation and working memory measures, this association appeared to be disrupted in the implant children. These findings would fit with the proposal that early auditory deprivation and a degraded auditory signal can cause changes in the processes underpinning the development of oral/aural language skills in prelingually hearing-impaired children with cochlear implants and thus alter their developmental trajectory.

Clinical Characteristics of a Dutch DFNA9 Family with a Novel COCH Mutation, G87W

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Abstract

The present study aims to report audiological and vestibular characteristics of a Dutch DFNA9 family with a novel mutation, G87W, in the LCCL domain of COCH. From the family with the novel G87W COCH mutation audiometric data were collected and analyzed longitudinally. Results were compared with those obtained in previously identified P51S COCH mutation carriers (n = 74) and with those obtained in G88E mutation carriers. Special attention was also given to a comparison of age-related features, such as progressive hearing loss and vestibular impairment. A novel mutation (G87W) in COCH is indicative of hearing impairment and vestibular dysfunction in the present family. Pure-tone thresholds, phoneme recognition scores, and vestibular responses of the G87W mutation carriers were essentially similar to those previously established in the P51S and G88E mutation carriers. Deterioration of hearing and vestibular function in the G87W mutation carriers started at the age of 43 years. Remarkably, similar to G88E mutation carriers, the proportion of patients over 40 years of age who developed complete vestibular areflexia was significantly lower for the G87W mutation carriers than for the P51S mutation carriers. In conclusion, the phenotype associated with the novel COCH (G87W) mutation is largely similar to that associated with the P51S and G88E mutation carriers. However, subtle differences in terms of onset age and rate of progression seem to exist.
Multifrequency Immittanceometry in Experimentally Induced Stapes, Round Window and Cochlear Lesions

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Abstract

Objectives: To establish that admittance (Y) and susceptance (B) conductance (G) tympanograms at 2 kHz can reflect the status of the annular ligament and the cochlear pressure. Methods: Seven experiments were set up in 22 guinea pigs: ventilation of the bulla, blockage of the stapes and round window membrane (RWM), fistula, fluid removal from the cochlea, injection of saline in the scala tympani and acoustic trauma. Resonance frequency, Y, B and G at 2 kHz and curve shapes were analyzed before and after lesions. Results: A supplementary peak was observed in Y/G tympanograms in all RWM fistulas and in some cases of acoustic trauma; injection of saline into the scala tympani induced constant, immediate and reproducible changes; RWM and stapes blockages induced foreseeable peaking at 2 kHz; fluid removal from the cochlea induced multiple peak curves. Conclusion: Experimentally induced modifications at the AL result in noticeable, constant and reproducible changes in tympanogram curves at 2 kHz and seem to reflect inner ear pressure.

Electrically Evoked Auditory Steady-State Responses in Guinea Pigs

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Abstract

Most cochlear implant systems available today provide the user with information about the envelope of the speech signal. The goal of this study was to explore the feasibility of recording electrically evoked auditory steady-state response (ESSR) and in particular to evaluate the degree to which the response recorded using electrical stimulation could be separated from stimulus artifact. Sinusoidally amplitude-modulated electrical stimuli with alternating polarities were used to elicit the response in adult guinea pigs. Separation of the stimulus artifact from evoked neural responses was achieved by summing alternating polarity responses or by using spectral analysis techniques. The recorded response exhibited physiological response properties including a pattern of nonlinear growth and their abolition following euthanasia or administration of tetrodotoxin. These findings demonstrate that the ESSR is a response generated by the auditory system and can be separated from electrical stimulus artifact. As it is evoked by a stimulus that shares important features of cochlear implant stimulation, this evoked potential may be useful in either clinical or basic research efforts.
Relationship between Intraoperative eCAP Thresholds and Postoperative Psychoacoustic Levels as a Prognostic Tool in Evaluating the Rehabilitation of Cochlear Implantees Dietmar Basta\textsuperscript{a}, Andreas Dahme\textsuperscript{b}, Ingo Todt\textsuperscript{a}, Arne Ernst\textsuperscript{a} \textsuperscript{a}Department of Otolaryngology at ukb, Hospital of the University of Berlin (Charité Medical School), Berlin, \textsuperscript{b}Cochlear Implant Rehabilitation Center (HTZ), Potsdam, Germany

Abstract

A sufficient correlation between objective (e.g. eCAP of the auditory nerve) and psychoacoustic data has not yet been possible due to high interindividual variability in cochlear implantees. Therefore, the application of objective data in the evaluation of speech rehabilitation after cochlear implantation was investigated. eCaps of all electrodes were measured intraoperatively. The 'threshold' and 'comfort' levels, speech recognition and pure tone thresholds were determined at follow-up. The correlation coefficient was calculated between eCap thresholds and psychoacoustic levels. This correlation coefficient was ranked with other individual items in relation to their influence on the development of speech recognition. Only the duration of preimplant deafness, the pure tone hearing threshold and the correlation between eCAP and psychoacoustic levels have a significant influence on the rehabilitation within this selection of variables. Based on these results, an individualized mathematical modeling approach was introduced to predict the development of postoperative speech recognition by incorporating objective data.

Sendai Virus Vector-Mediated Transgene Expression in the Cochlea in vivo Sho Kanzaki\textsuperscript{a}, Akihiro Shiotani\textsuperscript{a, b}, Makoto Inoue\textsuperscript{c}, Mamoru Hasegawa\textsuperscript{c}, Kaoru Ogawa\textsuperscript{a} \textsuperscript{a}Department of Otolaryngology, Keio University, Tokyo, \textsuperscript{b}Department of Otolaryngology, National Defense Medical College, Tokorozawa, and \textsuperscript{c}DNAVEC Corporation, Tsukuba, Japan

Abstract

We injected a recombinant Sendai virus (SeV) vector into the guinea pig cochlea using two different approaches - the scala media and scala tympani - and investigated which cell types took up the vector. The hearing threshold shift and distribution of transfected cells in animals using the scala media approach were different compared to those using the scala tympani approach. SeV can transfect very different types of cells, including stria vascularis, spiral ganglion neurons, and sensory epithelia of the organ of Corti, and fibrocytes of the scala tympani. Because SeV vectors can potentially deliver stimuli to the cochlea to induce hair cell regeneration, it may be a powerful tool for repairing the organ of Corti.

Middle Ear Admittance and Hearing Abnormalities in Individuals with Osteoarthritis Vishakha W. Rawool, Brian T. Harrington \textsuperscript{a}West Virginia University, Morgantown, W. Va. and \textsuperscript{b}Main Line Audiology Consultants, PC, Narberth, Pa., USA

Abstract

In osteoarthritis, the joint cartilage breaks down. Cartilage exists within the incudomalleolar and incudostapedial joints. In addition, the cartilage-covered base of the stapes footplate is bound to the cartilage-covered rim of the oval window by the annular ligament. Thus, higher prevalence of middle ear abnormalities and hearing loss can be expected in osteoarthritis due to degeneration of the cartilage and the subsequent abnormal repair response. In this study,
tympanometric and audiometric data were obtained from 15 individuals diagnosed with osteoarthritis and 15 gender- and age-matched individuals without the diagnosis of arthritis. Results showed a significantly higher prevalence of middle ear abnormalities and hearing loss in ears with arthritis when compared to the control group. Interestingly, osteoarthritis and hearing loss are considered among the top chronic health concerns in older individuals although the connection between these two conditions has not been previously reported.