FREE ABSTRACTS

Comparing Cochlear Implant Users’ Speech Performance with Processor Fittings Based on Conventionally Determined T and C Levels or on Compound Action Potential Thresholds and Live-Voice Speech in a Prospective Balanced Crossover Study.
Christina Willeboer; Guido F. Smoorenburg

Abstract:
Objective: The objective of the present study is to improve the efficiency of the fitting procedure of cochlear implant processors by making use of measurements of the electrically evoked compound action potential (ECAP) and live-voice speech.

Design: In a randomised prospective cross-over design we compare speech performance of eighteen adult subjects when following the conventional fitting procedure to a procedure in which we use the profile of the ECAP threshold levels across the full electrode array measured intra-operatively. The overall level of the profile is shifted (by an equal amount of current units per electrode) until we find the threshold for live speech (new T levels) and the loudness comfort level (new C levels). Each fitting procedure is tested for 6 wk. Speech performance is measured in quiet and in noise every other week.

Results: The results show little difference between the scores (Dutch CVC words) for the conventional fitting procedure and the ECAP based fitting, although the T and C levels may differ markedly.

Conclusion: The new fitting procedure is much faster and easier in the initial phase. Further improvement of performance may be obtained in a later stage of the fitting procedure by changing some individual electrodes on the basis of subjective responses.

Wideband Reflectance Norms for Caucasian and Chinese Young Adults.
Navid Shahnaz; Karin Bork

Abstract:
Objective: This study examined differences between the middle ears of two ethnic groups, Caucasian and Chinese young adults with normal hearing, using a new middle-ear measurement technique, wideband energy reflectance. The goal of this study was to determine whether the Chinese group had different middle-ear transmission properties than the Caucasian group.

Design: There were 126 subjects (237 ears) between the ages of 18 and 32 yr, with 62 subjects in the Caucasian group and 64 subjects in the Chinese group. Wideband energy reflectance data were gathered using Mimosa Acoustics (RMS system version 4.0.4.4) wideband reflectance (WBR) equipment.

Results: The Chinese group had significantly lower wideband energy reflectance than their Caucasian counterparts at higher frequencies; however, the Caucasian group had significantly lower energy reflectance at lower frequencies than the Chinese group. The Chinese group also had significantly lower admittance magnitude than the Caucasian group at lower frequencies. Because body size indices are more comparable between Caucasian females and Chinese males, the effect of body size could be potentially adjusted for by comparing the Caucasian female subjects with the Chinese male subjects. The differences observed between the Caucasian and the Chinese groups were no longer significant when the Caucasian female subjects were compared with the Chinese male subjects. Applying the Caucasian norms to four Caucasian adults with surgically confirmed otosclerosis resulted in an improved hit rate compared with the combined Caucasian and Chinese norms and the Chinese-only norms.
Conclusion: Body size may play a role in the observed differences between the Caucasian and Chinese groups. The findings of this study suggest that further research is needed to investigate the effects of body size on wideband energy reflectance. It should be noted that factors other than body size may contribute to the observed differences. Chinese individuals may simply have different middle-ear characteristics than Caucasian individuals, which could affect WBR. In the meantime, overall test performance may be improved by using a more homogeneous norm when evaluating the middle ear of Caucasian or Chinese individuals with WBR.

Speech Recognition for Unilateral and Bilateral Cochlear Implant Modes in the Presence of Uncorrelated Noise Sources.
Todd A. Ricketts; D Wesley Grantham; Daniel H. Ashmead; David S. Haynes; Robert F. Labadie

Abstract:
Objective: The purpose of the current investigation was to compare speech recognition in noise for bilateral and unilateral modes within postlingually deafened, adult bilateral cochlear implant recipients. In addition, it was of interest to evaluate the time course of the bilateral speech-recognition advantage and the effect of changing signal-to-noise ratio (SNR) on the magnitude of the bilateral advantage.

Design: In the first experiment, 16 postlingually deafened adults who were bilaterally implanted with the MED-EL C40+ cochlear device were evaluated in unilateral left, unilateral right, and bilateral conditions 4 to 7 mo after activation. Speech recognition in the presence of five spatially separated, uncorrelated noise sources was evaluated using both a single fixed SNR of +10 dB and an adaptive-SNR method. In a follow-up study, a subset of 10 participants was re-evaluated using an identical fixed-SNR method 12 to 17 mo after activation to examine the time course of speech-recognition performance in both unilateral and bilateral modes at a single SNR. A third study was performed with a subset of six participants to examine performance over a range of SNRs. In this study, speech recognition was measured 12 to 17 mo after activation in quiet and at +5, +10, +15, and +20 dB SNRs using the same five uncorrelated noise sources.

Results: The speech-recognition data revealed a significant bilateral advantage of 3.3 dB using the adaptive-SNR method. A significant bilateral advantage of 9% was also measured using a fixed +10 dB SNR. Results from the second study revealed that experience resulted in a significant (11 to 20%) increase in speech-recognition-in-noise performance for both unilateral and bilateral modes; however, the magnitude of the bilateral advantage was not affected by experience. Results from the third study revealed the largest bilateral advantage at the poorest SNR evaluated. In addition, performance in quiet was significantly better than that measured in the presence of noise, even at the +20 dB SNR.

Conclusions: The results of these experiments support a small but significant bilateral speech-recognition-in-noise advantage for cochlear implant recipients in an environment with multiple noise sources. This advantage is presumed to be attributable to the combined effects of binaural squelch and diotic summation. Although experience generally improved speech-recognition-in-noise performance in both unilateral and bilateral modes, a consistent bilateral advantage (approximately 10%) was measured at 4 to 7 mo and at 12 to 17 mo postactivation.
Comparison of Auditory Steady-State Responses and Tone-Burst Auditory Brainstem Responses in Normal Babies.
Gary Rance; Dani Tomlin; Field W. Rickards

Abstract:
Objective: To follow the development of tone-burst auditory brainstem response (TB-ABR) and auditory steady-state response (ASSR) thresholds in a group of normal babies through the first 6 wk of life.

Design: This longitudinal study involved assessment at four data-collection points. TB-ABR and ASSR thresholds to 500-Hz and 4-kHz stimuli were established in 17 full-term subjects at 0, 2, 4, and 6 wk of age. Stimulus-modulation rates for ASSR assessment were 74 Hz (for 500-Hz tones) and 95 Hz (for 4-kHz tones). TB-ABR responses were recorded to stimuli presented at 39.1 Hz.

Results: Mean ASSR thresholds (calibrated in dBHL) at 500 Hz ranged from 44.4 to 39.7 dB HL across the recording period, and at 4 kHz they ranged from 37.9 to 32.1 dB HL. TB-ABR thresholds (calibrated in dBnHL) were significantly lower, ranging from 36.8 to 36.2 dB nHL at 500 Hz and from 16.5 to 15.9 dB nHL at 4 kHz. However, when the stimuli used for each test were calibrated in the same units (peak equivalent dB SPL), the results were similar. That is, the differences between the two techniques were only an artifact of the calibration. ASSR thresholds were more variable than TB-ABR, particularly at the neonatal measurement point. Within-subject changes across the test period were observed for ASSR thresholds but not for TB-ABR.

Conclusions: The longitudinal findings presented in this study suggest that for normal neonates, the TB-ABR technique may offer a more reliable basis for prediction of hearing levels than ASSR assessment. This is not because TB-ABR thresholds (calibrated in dBnHL) are lower, but because the response is less affected by maturational development in the first weeks of life and is less variable across subjects.

Audiogram Notches in Noise-Exposed Workers.
Ear & Hearing. 27(6):742-750, December 2006.
Peter M. Rabinowitz; Deron Galusha; Martin D. Slade; Christine Dixon-Ernst; Kanta D. Sircar; Robert A. Dobie

Abstract:
Objectives: Diagnostic criteria for noise-induced hearing loss include the audiometric notch, yet no standardized definition exists. This study tested whether objective notch metrics could match the clinical judgments of an expert panel.

Design: A panel of occupational physicians, otolaryngologists, and audiologists reviewed audiograms of noise-exposed workers. In a two-sample process, the panel judged whether a notch was present and whether hearing loss had progressed in a notch pattern. Quantitative notch metrics were compared against expert decisions.

Results: At least five of six experts agreed about notch identification in 71 and 72% of the cases in the two samples, and agreement about notch progression was 61 and 67%. Notch depth and professional specialty appeared to affect notch judgments. Despite this variability, a notch metric showed excellent agreement with expert notch consensus in each sample (94.7 and 96.6%; kappa = 0.88 and 0.92).

Conclusions: Audiogram notch metrics can agree with expert clinical consensus and assist in the surveillance of noise-exposed workers.
**FREE ABSTRACTS**

**Does Universal Newborn Hearing Screening Identify All Children with GJB2 (Connexin 26) Deafness? Penetrance of GJB2 Deafness.**
Virginia W. Norris; Kathleen S. Arnos; Wendy D. Hanks; Xia Xia; Walter E. Nance; Arti Pandya

**Abstract:**
Objective: Deafness is the most common neurosensory defect at birth, and GJB2 (connexin 26) mutations are the most frequent genetic cause of hearing loss in many populations. The hearing loss caused by GJB2 mutations is usually congenital in onset and moderate to profound in degree. Considerable phenotypic variation has been noted however, including two anecdotal cases of apparent non penetrance at birth. The objective of this study is to document nine additional children with two pathogenic GJB2 mutations who had non penetrance of hearing loss at birth.

Design: Subjects were identified through a national repository which includes deaf probands ascertained primarily from the United States through the Annual Survey of Deaf and Hard of Hearing Children and Youth conducted at the Research Institute at Gallaudet University. The hearing of each of these children had been screened at birth using standard audiologic techniques. Parents were interviewed and available medical records were reviewed. Testing for GJB2 mutations was performed by PCR and sequencing of the entire coding exon in all nine individuals.

Results: Using parent interviews and medical records, we documented that all nine children passed newborn audiologic hearing screening. The age at which the hearing loss was subsequently identified in these nine children ranged from 12-60 mo. Of these nine children, 3 were compound heterozygotes and six were homozygous for the 35delG mutation in the GJB2 gene.

Conclusion: These nine cases demonstrate that current newborn hearing screening does not identify all infants with two GJB2 mutations. These cases suggest that the frequency of non penetrance at birth is approximately 3.8% or higher. It is important to consider connexin deafness in any child with recessive nonsyndromic hearing loss as well as simplex cases with no history of other affected family members even when the newborn hearing screening results were within the normal range.

**Simultaneous Bilateral Cochlear Implantation in Adults: A Multicenter Clinical Study.**
Ruth Litovsky; Aaron Parkinson; Jennifer Arcaroli; Carol Sammeth

**Abstract:**
Objective: To determine the efficacy of "simultaneous" bilateral cochlear implantation (both implants placed during a single surgical procedure) by comparing bilateral and unilateral implant use in a large number of adult subjects tested at multiple sites.

Design: Prospective study of 37 adults with postlinguistic onset of bilateral, severe to profound sensorineural hearing loss. Performance with the bilateral cochlear implants, using the same speech processor type and speech processing strategy, was compared with performance using the left implant alone and the right implant alone. Speech understanding in quiet (CNCs and HINT sentences) and in noise (BKB-SIN Test) were evaluated at several postactivation time intervals, with speech presented at 0[degrees] azimuth, and noise at either 0[degrees], 90[degrees] right, or 90[degrees] left in the horizontal plane. APHAB questionnaire data were collected after each subject underwent a 3-wk "bilateral deprivation" period, during which they wore only the speech processor that produced the best score during unilateral testing, and also after a period of listening again with the bilateral implants.

Results: By 6-mo postactivation, a significant advantage for speech understanding in quiet was found in the bilateral listening mode compared with either unilateral listening modes. For speech understanding in noise, the largest and most robust bilateral benefit was when the subject was able to take advantage of the head
shadow effect; i.e., results were significantly better for bilateral listening compared with the unilateral condition when the ear opposite to the side of the noise was added to create the bilateral condition. This bilateral benefit was seen on at least one of the two unilateral ear comparisons for nearly all (32/34) subjects. Bilateral benefit was also found for a few subjects in spatial configurations that evaluated binaural redundancy and binaural squelch effects. A subgroup of subjects who had asymmetrical unilateral implant performances were, overall, similar in performance to subjects with symmetrical hearing. The questionnaire data indicated that bilateral users perceive their own performance to be better with bilateral cochlear implants than when using a single device.

Conclusions: Findings with a large patient group are in agreement with previous reports on smaller groups, showing that, overall, bilateral implantation offers the majority of patients advantages when listening in simulated adverse conditions.

A Systematic Review of the Nonacoustic Benefits of Bone-Anchored Hearing Aids.
Carole E. Johnson; Jeffrey L. Danhauer; Amber C. Reith; Lindsey N. Latiolais

Abstract:
Objective: This study completed an evidence-based practice systematic review of the nonacoustic benefits for adult patients receiving bone-anchored hearing aid(s) (BAHAs) relative to other forms of amplification (i.e., none, bone-conduction hearing aids [BCHAs], or air-conduction hearing aids [ACHAs]).

Design: Systematic review.

Methods: ComDisDome and PubMed were used to perform a comprehensive search for studies that were of at least level III of evidence. Three independent reviewers completed the search, quality assessment, and data extraction.

Results: Out of 28 studies, seven studies were identified, three of which were prospective and four of which were retrospective within-subject comparison designs. Nearly all of the studies were of small sample size and/or limited methodological quality, primarily because of logistics (e.g., heterogeneity of subject samples and prior experience with amplification).

Conclusions: The evidence identified in this review is limited regarding the nonacoustic benefits of BAHAs compared with unaided conditions or other types of amplification. Professionals should use caution when counseling patients about the quality of life (QOL) benefits of these devices. Routine use of QOL outcome measures and standardized methods for reporting findings are critical in demonstrating the nonacoustic benefits of BAHAs.

Effects of Childhood Hearing Loss on Organization of Semantic Memory: Typicality and Relatedness.
Susan Jerger; Markus F. Damian; Nancy Tye-Murray; Meaghan Dougherty; Jyutika Mehta; Melanie Spence

Abstract:
Objective: The purpose of this research was to study how early childhood hearing loss affects development of concepts and categories, aspects of semantic knowledge that allow us to group and make inferences about objects with common properties, such as dogs versus cats. We assessed category typicality and out-of-category relatedness effects. The typicality effect refers to performance advantage (faster reaction times, fewer errors) for objects with a higher number of a category’s characteristic properties; the out-of-category relatedness effect refers to performance disadvantage (slower reaction times and more errors) for out-of-category objects that share some properties with category members.
FREE ABSTRACTS

Design: We applied a new children's speeded category-verification task (vote "yes" if the pictured object is clothing). Stimuli were pictures of typical and atypical category objects (e.g., pants, glove) and related and unrelated out-of-category objects (e.g., necklace, soup). Participants were 30 children with hearing impairment (HI) who were considered successful hearing aid users and who attended regular classes (mainstreamed) with some support services. Ages ranged from 5 to 15 yr (mean = 10 yr 8 mo). Results were related to normative data from Jerger and Damian (2005).

Results: Typical objects consistently showed preferential processing (faster reaction times, fewer errors), and related out-of-category objects consistently showed the converse. Overall, results between HI and normative groups exhibited striking similarity. Variation in speed of classification was influenced primarily by age and age-related competencies, such as vocabulary skill. Audiological status, however, independently influenced performance to a lesser extent, with positive responses becoming faster as degree of hearing loss decreased and negative responses becoming faster as age of identification/amplification/education decreased. There were few errors overall.

Conclusions: The presence of a typicality effect indicates that 1) the structure of conceptual representations for at least one category in the HI group was based on characteristic properties with an uneven distribution among members, and 2) typical objects with a higher number of characteristic properties were more easily accessed and/or retrieved. The presence of a relatedness effect indicates that the structure of representational knowledge in the HI group allowed them to appreciate semantic properties and understand that properties may be shared between categories. Speculations linked the association 1) between positive responses and degree of hearing loss to an increase in the quality, accessibility, and retrievability of conceptual representations with better hearing; and 2) between negative responses and age of identification/amplification/education to an improvement in effortful, postretrieval decision-making proficiencies with more schooling and amplified auditory experience. This research establishes the value of our new approach to assessing the organization of semantic memory in children with HI.

Acoustic Change Complexes Recorded in Adult Cochlear Implant Listeners.
Lendra M. Friesen; Kelly L. Tremblay

Abstract:
Objectives: The objectives of this study were to determine: 1) whether the acoustic change complex (ACC) could be reliably recorded in cochlear implant listeners and, 2) whether different speech sounds evoke distinct ACC patterns.

Design: Eight adults wearing the Nucleus-24 cochlear implant (CI) were tested using naturally produced speech tokens /si/ and /[Latin small letter esh]/. Stimuli were tokens from the standardized UCLA version of the Nonsense Syllable Test. Using a repeated-measures design, participants were tested and retested within a 3-wk period.

Results: Intraclass correlation coefficients for grand mean and individual-response waveforms recorded from the syllables /si/ and /[Latin small letter esh]/ ranged from 0.63 to 0.89 from test to retest. Also, ACC latencies signaling the onset of a vowel in /[Latin small letter esh]/ were significantly earlier than those evoked by /si/.

Conclusions: The ACC can be reliably recorded in individuals wearing CI. Furthermore, the naturally produced speech syllables /si/ and /[Latin small letter esh]/ evoke distinct ACC patterns. Because of its good stability and the ease with which it can be recorded in individual CI listeners, the ACC can be evoked using complex signals (such as naturally produced speech syllables) when studying central auditory function in CI listeners.
Effects of Vowel Context on the Recognition of Initial and Medial Consonants by Cochlear Implant Users.
Gail S. Donaldson; Heather A. Kreft

Abstract:
Objective: Scores on consonant-recognition tests are widely used as an index of speech-perception ability in cochlear implant (CI) users. The consonant stimuli in these tests are typically presented in the /alpha/ vowel context, even though consonants in conversational speech occur in many other contexts. For this reason, it would be useful to know whether vowel context has any systematic effect on consonant recognition in this population. The purpose of the present study was to compare consonant recognition for the /alpha/, i, and /u/ vowel contexts for consonants presented in both initial (Cv) and medial (vCv) positions.

Design: Twenty adult CI users with one of three different implanted devices underwent consonant-confusion testing. Twelve stimulus conditions that differed according to vowel context (/alpha/, i, u/), consonant position (Cv, vCv), and talker gender (male, female) were assessed in each subject.

Results: Mean percent-correct consonant-recognition scores were slightly (5 to 8%) higher for the /alpha/ and /u/ vowel contexts than for the /i/ vowel context for both initial and medial consonants. This general pattern was observed for both male and female talkers, for subjects with better and poorer average consonant-recognition performance, and for subjects using low, medium, and high stimulation rates in their speech processors. In contrast to the mean data, many individual subjects demonstrated large effects of vowel context. For 10 of 20 subjects, consonant-recognition scores varied by 15% or more across vowel contexts in one or more stimulus conditions. Similar to the mean data, these differences generally reflected better performance for the /alpha/ and /u/ vowel contexts than for the /i/ vowel context. An analysis of consonant features showed that overall performance was best for the voicing feature, followed by the manner and place features, and that the place feature showed the strongest effect of vowel context. Vowel-context effects were strongest for the six consonants /d, j, n, k, m/, and /l/. For three of these consonants (/j, n, k/), the back vowels /alpha/ and /u/ produced substantially (30 to 35%) higher mean scores than the front vowel /i/. For each of the remaining three consonants, a unique pattern was observed in which a different single vowel produced substantially higher scores than the others. Several additional consonants (/s, g, w, b/, and /d/) showed strong context effects in either the initial consonant or medial consonant position. Overall, voiceless stop, nasal, and glide-liquid consonants showed the strongest effects of vowel context, whereas the voiceless fricative and voiceless affricate consonants were least affected. Consistent with the feature analysis, a qualitative assessment of phoneme errors for the six key consonants indicated that vowel-context effects stem primarily from changes in the number of place-of-articulation errors made in each context.

Conclusions: Vowel context has small but significant effects on consonant-recognition scores for the "average" CI listener, with the back vowels /alpha/ and /u/ producing better performance than the front vowel /i/. In contrast to the average results, however, the effects of vowel context are sizable in some individual subjects. This suggests that it may be beneficial to assess consonant recognition using two vowels, such as /alpha/ and /i/, which produce better and poorer performance, respectively. The present results underscore previous findings that poor transmission of spectral speech cues limits consonant-recognition performance in CI users. Spectral cue transmission may be hindered not only by poor spectral resolution in these listeners but also by the brief duration and dynamic nature of consonant place-of-articulation cues.
Psychophysical Assessment of Spatial Spread of Excitation in Electrical Hearing with Single and Dual Electrode Contact Maskers.
J Gertjan Dingemanse; Johan H. M. Frijns; Jeroen J. Briaire

Abstract:
Objective: To evaluate psychophysically the spatial spread of excitation in electrical hearing with a new dual contact masker and to investigate under which conditions it is possible to stimulate fibers in the immediate neighborhood of an electrode contact, which were not excited by neighboring electrode contacts.

Design: In this study a psychophysical forward masking paradigm with a dual contact masker was used to avoid off-site listening, the electrical analogue of off-frequency listening. The masker stimulus (300 msec) is presented nonsimultaneously on two electrode contacts, one on the apical side and another on the basal side of the probe contact, followed by a probe stimulus of 20 msec.

Unmasked probe thresholds were compared with masked ones at a number of masker-probe distances, whereas growth of masking curves were measured for a fixed masker contact pair.

Standard selectivity measurements (single contact masking) and the recovery of forward masking with one masker contact were included for comparison with existing methods.

All experiments were carried out with six participants who use the Clarion CII device with a HiFocus I electrode array.

Results: For dual contact masking the amount of masking was significantly greater than for single contact masking and the width of the masking patterns was on average 1.1 mm broader than for single contact masking, resulting in a broad region of excitation, with masker-probe overlap for distances greater than 3 mm. Masking widths for dual and single contact masking were highly correlated.

Growth of masking curves were highly nonlinear. They showed a strong elevation of the slope that starts for most subjects around the middle of the dynamic range or above. For 4 out of 6 subjects, no probe threshold was found above a masker amplitude of about 400-500 [μA]. The ratio of the maximum measurable masked probe thresholds and unmasked probe threshold ranged from 1.7 to 2.6 (S4 excluded).

Recovery of masking functions follow an exponential decay. Time constants [τ] for the recovery process ranged from 21.6 msec to 114.9 msec.

Conclusions: With a dual contact masker (1) off-site listening can be avoided, leading to larger estimates of the width of excitation patterns than in single contact masking, (2) it can be estimated for which stimulation level there is complete overlap of excitation patterns of adjacent electrode contacts, (3) it can be shown that stimulation of nerve fibers in the immediate neighborhood of an electrode contact which were not excited by neighboring electrode contacts is only possible if the probe stimulation amplitude is sufficiently high in comparison with amplitudes on neighboring contacts.
FREE ABSTRACTS

The Age at Which Young Deaf Children Receive Cochlear Implants and Their Vocabulary and Speech-Production Growth: Is There an Added Value for Early Implantation?
Carol McDonald Connor; Holly K. Craig; Stephen W. Raudenbush; Krista Heavner; Teresa A. Zwolan

Abstract:
Objective: The age at which a child receives a cochlear implant seems to be one of the more important predictors of his or her speech and language outcomes. However, understanding the association between age at implantation and child outcomes is complex because a child's age, length of device use, and age at implantation are highly related. In this study, we investigate whether there is an added value to earlier implantation or whether advantages observed in child outcomes are primarily attributable to longer device use at any given age.

Design: Using hierarchical linear modeling, we examined latent-growth curves for 100 children who had received their implants when they were between 1 and 10 yr of age, had used oral communication, and had used their devices for between 1 and 12 yr. Children were divided into four groups based on age at implantation: between 1 and 2.5 yr, between 2.6 and 3.5 yr, between 3.6 and 7 yr, and between 7.1 and 10 yr.

Results: Investigation of growth curves and rates of growth over time revealed an additional value for earlier implantation over and above advantages attributable to longer length of use at any given age. Children who had received their implants before the age of 2.5 yr had exhibited early bursts of growth in consonant-production accuracy and vocabulary and also had significantly stronger outcomes compared with age peers who had received their implants at later ages. The magnitude of the early burst diminished systematically with increasing age at implantation and was not observed for children who were older than 7 yr at implantation for consonant-production accuracy or for children who were over 3.5 yr old at implantation for vocabulary. The impact of age at implantation on children's growth curves differed for speech production and vocabulary.

Conclusions: There seems to be a substantial benefit for both speech and vocabulary outcomes when children receive their implant before the age of 2.5 yr. This benefit may combine a burst of growth after implantation with the impact of increased length of use at any given age. The added advantage (i.e., burst of growth) diminishes systematically with increasing age at implantation.

Outcomes of Long-Term Outpatient Tinnitus-Coping Therapy: Psychometric Changes and Value of Tinnitus-Control Instruments.
Philipp P. Caffier; Heidemarie Haupt; Hans Scherer; Birgit Mazurek

Abstract:
Objectives: Increasing tinnitus compliance and coping are desirable aims of successful treatment in chronic tinnitus. However, application of established procedures such as tinnitus retraining therapy (TRT) is often relatively short. In addition, the value of tinnitus control instruments (TCI) is questionable, especially for minor severity levels of tinnitus, and the comparability of treatment results is low. To evaluate long-term changes of tinnitus-related distress, defined psychometric data were collected in patients with compensated tinnitus (cT) or decompensated tinnitus (dT) during a standardized 2-yr outpatient tinnitus-coping therapy (TCT).

Design: In a prospective clinical investigation, the data of 70 tinnitus patients were recorded at the beginning and at 6-mo intervals, with a final investigation after 24 mo. The first group consisted of 40 patients with cT and dT who were randomly assigned to a treatment group and a waiting-list control group. After a period of 12 mo without treatment, the control group was treated similarly. The tinnitus questionnaire (TQ) of Goebel and Hiller, visual analog scales (VAS), and a severity questionnaire for tinnitus-associated complaints were used as psychodiagnostic instruments. Therapy components consisted of counseling, fitting patients with
TCIs (TCI provision), auditory and relaxation training, and psychosomatic care if necessary. A second group of 30 patients with cT receiving TCT without TCI devices was investigated to evaluate the additive efficacy of TCI in cT.

Results: The initial TQ score did not differ between the treatment group and the waiting-list control group. After 12 mo, the control group did not show any significant changes, but the treatment group had improved significantly. During TCT, the combined data of both groups showed a statistically significant decrease of the TQ score in dT (59.1 to 34.8) and cT (32.8 to 24.0). These changes were especially reflected by the subscales of cognitive and emotional distress and also by the VAS and the severity questionnaire. dT patients benefitted without dependence on age or duration of pre-existing tinnitus; for cT patients, this was true mainly of the younger and older subjects and for tinnitus lasting for less than 1 yr. TCI provision improved the efficacy of TCT in patients with cT.

Conclusions: The psychometric changes demonstrate a clear decrease of tinnitus-related distress in all severity levels of sufficiently treated chronic tinnitus. Long-term TCT induces improvement even up to the time of 24 mo. With TCIs established particularly in patients with dT, our results suggest that a supporting adjustment of TCI devices is helpful in cT to foster quicker rehabilitation. The outpatient interdisciplinary TCT, consisting of cognitive tinnitus desensitization, TCI provision, and psychosomatic support if required, represents a successful treatment strategy for both dT and cT patients.

Effects of Programming Threshold and Maplaw Settings on Acoustic Thresholds and Speech Discrimination with the MED-EL COMBI 40+ Cochlear Implant.

Paul J. Boyd

Abstract:
Objectives: The principal task in the programming of a cochlear implant (CI) speech processor is the setting of the electrical dynamic range (output) for each electrode, to ensure that a comfortable loudness percept is obtained for a range of input levels. This typically involves separate psychophysical measurement of electrical threshold ([theta]e) and upper tolerance levels using short current bursts generated by the fitting software. Anecdotal clinical experience and some experimental studies suggest that the measurement of [theta]e is relatively unimportant and that the setting of upper tolerance limits is more critical for processor programming. The present study aims to test this hypothesis and examines in detail how acoustic thresholds and speech recognition are affected by setting of the lower limit of the output ("Programming threshold" or "PT") to understand better the influence of this parameter and how it interacts with certain other programming parameters.

Design: Test programs (maps) were generated with PT set to artificially high and low values and tested on users of the MED-EL COMBI 40+ CI system. Acoustic thresholds and speech recognition scores (sentence tests) were measured for each of the test maps. Acoustic thresholds were also measured using maps with a range of output compression functions ("maplaws"). In addition, subjective reports were recorded regarding the presence of "background threshold stimulation" which is occasionally reported by CI users if PT is set to relatively high values when using the CIS strategy.

Results: Manipulation of PT was found to have very little effect. Setting PT to minimum produced a mean 5 dB (S.D. = 6.25) increase in acoustic thresholds, relative to thresholds with PT set normally, and had no statistically significant effect on speech recognition scores on a sentence test. On the other hand, maplaw setting was found to have a significant effect on acoustic thresholds (raised as maplaw is made more linear), which provides some theoretical explanation as to why PT has little effect when using the default maplaw of c = 500. Subjective reports of background threshold stimulation showed that most users could perceive a relatively loud auditory percept, in the absence of microphone input, when PT was set to double the
behaviorally measured electrical thresholds ($\theta_e$), but that this produced little intrusion when microphone input was present.

Conclusions: The results of these investigations have direct clinical relevance, showing that setting of PT is indeed relatively unimportant in terms of speech discrimination, but that it is worth ensuring that PT is not set excessively high, as this can produce distracting background stimulation. Indeed, it may even be set to minimum values without deleterious effect.

John J. Guinan Jr

Abstract:
This review covers the basic anatomy and physiology of the olivocochlear reflexes and the use of otoacoustic emissions (OAEs) in humans to monitor the effects of one group, the medial olivocochlear (MOC) efferents. MOC fibers synapse on outer hair cells (OHCs), and activation of these fibers inhibits basilar membrane responses to low-level sounds. This MOC-induced decrease in the gain of the cochlear amplifier is reflected in changes in OAEs. Any OAE can be used to monitor MOC effects on the cochlear amplifier. Each OAE type has its own advantages and disadvantages. The most straightforward technique for monitoring MOC effects is to elicit MOC activity with an elicitor sound contralateral to the OAE test ear. MOC effects can also be monitored using an ipsilateral elicitor of MOC activity, but the ipsilateral elicitor brings additional problems caused by suppression and cochlear slow intrinsic effects. To measure MOC effects accurately, one must ensure that there are no middle-ear-muscle contractions. Although standard clinical middle-ear-muscle tests are not adequate for this, adequate tests can usually be done with OAE-measuring instruments. An additional complication is that most probe sounds also elicit MOC activity, although this does not prevent the probe from showing MOC effects elicited by contralateral sound. A variety of data indicate that MOC efferents help to reduce acoustic trauma and lessen the masking of transients by background noise; for instance, they aid in speech comprehension in noise. However, much remains to be learned about the role of efferents in auditory function. Monitoring MOC effects in humans using OAEs should continue to provide valuable insights into the role of MOC efferents and may also provide clinical benefits.

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