MED-EL BIBLIOGRAPHY

January - December 2019

1. Weiss NM, Dhanasingh A, Schraven SP, Schulze M, Langner S, Mlynski R. (2019) Surgical approach for complete cochlear coverage in EAS-patients after residual hearing loss. PLoS One. 14(9):e0223121.

Abstract

Introduction: In cases with residual-hearing (RH) loss after cochlear implantation, a safe method is needed to provide full spectral resolution and as much auditory information as possible without implant replacement. Aim of this study was to prove the feasibility of accessing a partially inserted cochlear-implant-electrode for complete insertion to its maximum length through the external ear canal using a transcanal approach. Methods: Two CI electrodes were customized with 18 stimulating channels. The electrode design enables the use of 12 active channels available for electrical stimulation inside the cochlea both after partial and full insertion. 10 CI electrodes were implanted in 10 fresh human cadaveric temporal bones. After initial partial insertion by posterior tympanotomy, the electrode was inserted to its maximum length via a transcanal approach. Radiographs and CT scans were performed to confirm the electrode position. The electrodes were investigated via x-ray after removal. Results: X-ray and CT-scans confirmed the electrode prototypes covering an angular insertion depth between 236° to 307° after initial insertion. Accessing the electrode in the middle ear space was feasible and insertion to its full length was successful. Post-insertion CT confirmed insertion of the 28mm and 31.5mm electrode arrays covering an angular insertion depth between 360° and 540° respectively. No tip foldovers were detected. Conclusion: This study confirms the feasibility of extending the electrode insertion to its maximum insertion length using a transcanal approach in temporal bone specimens. This constitutes a second stage procedure on demand in EAS-surgery. This may be beneficial for EAS-patients providing electrical stimulation beyond the basal turn of the cochlea once the functional residual hearing is lost, without replacing the entire CI.

2. Van den Berge MJC, Van Dijk JMC, Metzemaekers JDM, Maat B, Free RH, Van Dijk P. (2019). An Auditory Brainstem Implant for Treatment of Unilateral Tinnitus: Protocol for an Interventional Pilot Study. BMJ Open. 9(6):e026185.

Abstract

Introduction: Tinnitus may have a very severe impact on the quality of life. Unfortunately, for many patients, a satisfactory treatment modality is lacking. The auditory brainstem implant (ABI) was originally indicated for hearing restoration in patients with non-functional cochlear nerves, for example, in neurofibromatosis type II. In analogy to a cochlear implant (CI), it has been demonstrated that an ABI may reduce tinnitus as a beneficial side effect. For tinnitus treatment, an ABI may have an advantage over a CI, as cochlear implantation can harm inner ear structures due to its invasiveness, while an ABI is presumed to not damage anatomical

structures. This is the first study to implant an ABI to investigate its effect on intractable tinnitus. Methods and analysis: In this pilot study, 10 adults having incapacitating unilateral intractable tinnitus and ipsilateral severe hearing loss will have an ABI implanted. The ABI is switched on 6 weeks after implantation, followed by several fitting sessions aimed at finding an optimal stimulation strategy. The primary outcome will be the change in Tinnitus Functioning Index. Secondary outcomes will be tinnitus burden and quality of life (using Tinnitus Handicap Inventory and Hospital Anxiety and Depression Scale questionnaires), tinnitus characteristics (using Visual Analogue Scale, a tinnitus analysis), safety, audiometric and vestibular function. The end point is set at 1 year after implantation. Follow-up will continue until 5 years after implantation. Ethics and dissemination: The protocol was reviewed and approved by the Institutional Review Board of the University Medical Centre Groningen, The Netherlands (METc 2015/479). The trial is registered at www.clinicialtrials.gov and will be updated if amendments are made. Results of this study will be disseminated in peer-reviewed journals and at scientific conferences. Trial registration number: NCT02630589. Trial status: Inclusion of first patient in November 2017. Data collection is in progress. Trial is open for further inclusion. The trial ends at 5 years after inclusion of the last patient.

Keywords: auditory brainstem implant; neuromodulation; neurotology; tinnitus.

3. Skarzynski PH, Skarzynski H, Dziendziel B, Rajchel JJ, Gos E, Lorens A. (2019) Hearing Preservation With the Use of Flex20 and Flex24 Electrodes in Patients With Partial Deafness. Otol Neurotol. 40(9):1153-1159.

Abstract

Objective: To evaluate the impact of electrode length on hearing preservation (HP) in Partial Deafness Treatment-Electrical Complement (PDT-EC) subjects. Study design: Retrospective case review. Setting: Tertiary referral center. Patients: Twenty-three PDT-EC patients (with preoperative air-conduction thresholds ≤30 dB up to 500 Hz) were divided into two groups: Flex20 electrode (Med-EL GmbH, Innsbruck, Austria) (12 patients) and Flex24 electrode (Med-EL GmbH, Innsbruck, Austria) (11 patients). Interventions: All participants were subjected to minimally invasive cochlear implantation using the round window approach. Main outcome measure(s): Pure tone audiometry (125-8000 Hz) was performed preoperatively and at 1, 6, 12, and 24 months postoperatively. HP was established using the HEARRING group formula. Speech understanding was assessed preoperatively and at 12 and 24 months postoperatively. Results: Analysis of HP for every individual indicates that more than half the patients with Flex20 and Flex24 had complete HP at 6 months follow-up. None of the patients from either group had complete loss of hearing. At activation, average air-conduction thresholds for low frequencies (125-500 Hz) were slightly better for the short electrode (M = 29.03) than for the long (M = 39.10) but the difference was not statistically significant (p = 0.067). The effect of electrode (Flex20 versus Flex24) was not significant in terms of pure tone audiometry and speech recognition at long-term follow-up. Conclusions: In the early postoperative period, complete HP was possible in a majority of patients from both groups, but slightly better HP outcomes were achieved by Flex20. In the long term, the length of the electrodes does not affect the degree of HP or speech understanding.

Keywords: Cochlear implant; Hearing preservation; MED-EL FLEX electrodes; Partial deafness treatment

4. Nateghifard K, Low D, Awofala L, Srikanthan D, Kuthubutheen J, Daly M, Chan H, Irish J, Chen J, Lin V, Le TN. (2019) Cone Beam CT for Perioperative Imaging in Hearing Preservation Cochlear Implantation - A Human Cadaveric Study. J Otolaryngol Head Neck Surg. 48(1):65.

Abstract

Background: Knowledge of the cochlear implant array's precise position is important because of the correlation between electrode position and speech understanding. Several groups have provided recent image processing evidence to determine scalar translocation, angular insertion depth, and cochlear duct length (CDL); all of which are being used for patient-specific programming. Cone beam computed tomography (CBCT) is increasingly used in otology due to its superior resolution and low radiation dose. Our objectives are as followed: 1.Validate CBCT by measuring cochlear metrics, including basal turn diameter (A-value) and lateral wall cochlear duct length at different angular intervals and comparing it against microcomputed CT (uCT).2.Explore the relationship between measured lateral wall cochlear duct length at different angular intervals and insertion depth among 3 different length electrodes using CBCT. Methods: The study was performed using fixed human cadaveric temporal bones in a tertiary academic centre. Ten temporal bones were subjected to the standard facial recess approach for cochlear implantation and imaged by CBCT followed by uCT. Measurements were performed on a three-dimensional reconstructed model of the cochlea. Sequential insertion of 3 electrodes (Med-El Flex24, 28 and Soft) was then performed in 5 bones and reimaged by CBCT. Statistical analysis was performed using Pearson's correlation. Results: There was good agreement between CBCT and uCT for cochlear metrics, validating the precision of CBCT against the current gold standard uCT in imaging. The A-value recorded by both modalities showed a high degree of linear correlation and did not differ by more than 0.23 mm in absolute values. For the measurement of lateral wall CDL at various points along the cochlea, there was a good correlation between both modalities at 360 deg and 720 deg ($r = 0.85$, $p < 0.01$ and $r = 0.79$, $p < 0.01$). The Flex24 electrode displayed consistent insertion depth across different bones. Conclusions: CBCT reliably performs cochlear metrics and measures electrode insertion depth. The low radiation dose, fast acquisition time, diminished metallic artifacts and portability of CBCT make it a valid option for imaging in cochlear implant surgery.

5. Müller S, Kahrs LA, Gaa J, Tauscher S, Kluge M, John S, Rau TS, Lenarz T, Ortmaier T, Majdani O. (2019) Workflow Assessment as a Preclinical Development Tool : Surgical Process Models of Three Techniques for Minimally Invasive Cochlear Implantation. Int J Comput Assist Radio Surg. 14(8):1389-1401.

Abstract

Purpose: Minimally invasive cochlear implant surgery is a challenging procedure due to high demands on accuracy. For clinical success, an according assistance system has to compete against the traditional approach in terms of risk, operating time and cost. It has not yet been determined what kind of system is the most suited. The purpose of this study is a proof of concept of surgical process modeling as a preclinical development tool and the comparison of workflow concepts for this new approach. Methods: Three preclinical systems (two stereotactic and one robotic) for minimally invasive cochlear implant surgery are compared using the method of surgical process modeling. All three systems were successfully tested with ex vivo human specimen to create minimally invasive surgical access to the cochlea. Those systems where chosen for comparison, because they represent three diverse approaches with different corresponding workflows for the same intervention. The experiments were used to create a process model for each system by recording the interventions. Results: All three conceptual systems developed by our group have shown their eligibility. The recorded process models provide a convenient method for direct comparison. Reduction in the surgical time has a higher impact on the process, than time that is needed for setting up a system beforehand. The stereotactic approaches have little preparation effort and are low cost in terms of hardware compared to the robotic approach, which in return is beneficial in terms of workload reduction for the surgeon. Conclusion: Surgical process modeling is suitable for comparison of different assistant systems for minimally invasive cochlear implantation. The benefit of reduced trauma, compared to the traditional mastoidectomy, can now be assessed with consideration of the workflow of each technique. The process models enable an assessment in the regard of surgical time and workload.

Keywords: Cochlear implant; Minimally invasive surgery; Surgical process model; Surgical robotics; System evaluation.

6. Muigg F, Bliem HR, Kühn H, Seebacher J, Holzner B, Weichbold VW. (2019) Cochlear Implantation in Adults with Single-Sided Deafness: Generic and Disease-Specific Long-Term Quality of Life. Eur Arch Otorhinolaryngol. Nov 27 [Epub ahead of print].

Adults

Purpose: To determine the 2-year outcome of health-related quality of life (HRQoL) in adults who received a cochlear implant (CI) for single-sided deafness (SSD). Methods: Twenty adults (mean age at implantation: 47 ± 11 years) with SSD (PTA worse ear: 113 dB HL, PTA better ear: 14 dB HL) were administered the Nijmegen Cochlear Implant Questionnaire (NCIQ), and the Health Utility Index 3 (HUI 3). Questionnaire administration occurred before cochlear implantation and 3, 6, 12, and 24 months after implant activation. Results: Of the 20 patients, 2

discontinued CI use within the observation period due to poor benefit. The NCIQ total score of the sample increased significantly over time (p = 0.003). The largest increase occurred within the first 3 months of CI use. Also, the HUI 3 multi-attribute utility score increased significantly (p = 0.03). The post-treatment increase of this score (+ 0.11 points) indicated that the gain in HRQoL was clinically relevant. Patients with a duration of deafness > 10 years had in all measures an equal HRQoL improvement than had patients with a duration of deafness < 10 years. Conclusion: Cochlear implantation led to significant improvement of hearing-specific and generic HRQoL in our patients. The improvement was seen after 3 or 6 months but did not increase further at later intervals. Patients with long-lasting SSD may be at higher risk of discontinuing CI use. However, if they adapt to the CI, they can experience an equal increase of HRQoL as patients with a short duration of SSD.

Keywords: Cochlear implant; Duration of deafness; Health-related quality of life; Single-sided deafness.

7. Kuthubutheen J, Grewal A, Symons S, Nedzelski J, Shipp D, Lin V, Chen J. (2019) The Effect of Cochlear Size on Cochlear Implantation Outcomes. Biomed Res Int. eCollection 2019, 5849871.

Abstract

Objectives: To determine if cochlear duct length and cochlear basal diameter, measured using routinely available radiology software, affect hearing outcomes after cochlear implantation with two different length electrodes. Methods: 55 patients who received a Med-El Flex electrode were retrospectively reviewed. 34 patients received the Flex 31 electrode (31mm) and 21 patients received the Flex 28 electrode (28mm). Preoperative high-resolution CT scans of the temporal bone were reformatted in the axial and coronal plane. The basal diameter of the cochlear (A-value) and the outer-wall lengths of the cochlear duct were measured using readily available imaging software. Postoperative plane X-rays were used to determine the degree of electrode insertion and the number of electrodes within the cochlea and speech discrimination scores at 6 months were evaluated. Results: The cochlear metrics obtained were comparable with those previously published in the literature. There was no significant difference in the degree of insertion or speech outcomes between the two electrode lengths. However, when the group who had received the shorter electrode were analysed, there was an association seen between both cochlear duct length and cochlear diameter and speech outcomes. Conclusions: Cochlear size may be a factor in determining speech outcomes that cannot be explained solely by insertion depth or degrees of insertion. Further studies are required to determine if cochlear duct length is an independent predictor of speech outcomes.

8. Koroleva IV, Kuzovkov VE, Levin SV, Ogorodnikova EA, Yanov YK, Astashchenko SV. (2019) [Sequential Bilateral Cochlear Implantation with Long Interval Between Surgeries in Deaf-Blind Patient]. Vestn Otorinolaringol. 84(2):29-35.

Abstract

The efficacy of sequential bilateral cochlear implantation with long interval between surgeries (18 years) was investigated in deaf-blind patient (22 years old man, lost hearing and vision after meningitis at the age 2.5 years). At the age 4 years he got cochlear implant at right ear. His speech skills completely disappeared before the implantation. Auditory-speech rehabilitation with cochlear implant was successful - patient has good auditory, language, speech, cognitive skills. At the age 22 years patient made decision to get cochlear implant at the left ear after breakdown of internal part of cochlear implant at right ear in spite of successful reoperation. After activation of new processor (all electrodes were activated) the patient got daily auditory training with cochlear implant at left ear (Concerto/Opus 2, Medel) on the base of 'auditory' method, in daily life patient uses 2 devices. After 1 month of using cochlear implant at left ear the patient recognized environmental sounds and music instruments, words and sentences in close set tests EARS battery, the score for OLSA test in quiet was 90%, but the perception in noise was complicated. The balance of parameters of fitting for 1-st and 2-nd processors and special auditory training with two cochlear implants provided the development of initial binaural interaction. Perilinqually deaf patients can achieve high effect after sequential bilateral cochlear implantation with long interval between surgeries. The necessary conditions are - preservation of electrical activity of auditory nerve, intensive structured auditory training with new 'ear', patient's motivation of using of cochlear implant at 'new' ear.

Keywords: auditory rehabilitation; cochlear implants; deafness; sequential bilateral cochlear implantation.

9. Jeyaraman J, Rebecca CG, Pokala P, Ramamoorthy R, Punniyaraj P, Dhinakaran P, Rajeswaran R, Kameswaran M. (2017) Auditory, Speech, and Language Outcomes in Paediatric Auditory Brainstem Implant Users: an Indian Experience. JAIISH. Vol 36, 67-74.

Abstract

Auditory brainstem implantation (ABI) can provide auditory stimulation in cases where cochlear implantation is contraindicated. The purpose of this study was to assess the development of auditory, speech, and language skills of Indian paediatric ABI recipients. Five children between January 2009 and April 2012, with ages ranging from 13 to 94 months received an auditory brainstem implant. The auditory, speech, and language development of the participants were assessed using formal and informal assessment tools, at regular intervals up to 36 months after activation of audio processor of the ABI. All these participants attended post-operative auditory habilitation sessions. There was an improvement in all the participants in terms of auditory perception, speech intelligibility, and, receptive and expressive language scores over

time, although none achieved maximum scores on any test. Only three participants were assessed beyond the 12-month interval. The development stagnated after the habilitation program ended. Informal assessment (AuSpLan) gave a detailed information regarding development of the participants in these three domains. Auditory brainstem implantation provided access to sounds in environment and supported development of auditory, speech, and language skills in paediatric recipients. Informal assessment tools provided a more nuanced and complete picture of development than formal tests alone and could be a valuable addition to the test batteries. The auditory habilitation professionals should consider the skills and needs of an ABI recipient, prior to choosing an appropriate communication approach for habilitation. Further aspects to be considered include extending the post-operative habilitation support for longer duration and/or; developing an effective home-training program to maximize benet from an auditory brainstem implant.

Keywords: Auditory brainstem implant; AuSpLan; ABI

10. Karltorp E, Eklöf M, Östlund E, Asp F, Tideholm B, Löfkvist U. (2019) Cochlear Implants Before 9 Months of Age Led to More Natural Spoken Language Development Without Increased Surgical Risks. Acta Paediatr. Jul 27 [Epub ahead of print]

Abstract

Aim: Evidence suggests that cochlear implants are beneficial for language development, but there is no consensus about the ideal age for surgery. We investigated how language development and surgical safety were affected by patients' ages. Methods: This study comprised 103 children (52 boys) aged 4.3-16 years who received cochlear implants at 5-29 months at the Karolinska University Hospital, Stockholm, Sweden, between 2002 and 2013. All showed typical development and were from monolingual homes. Bilateral implants were common (95%). The children were regularly assessed on language understanding, vocabulary and speech recognition by a multi-disciplinary team for 10.0 ± 3.7 (4.7-16.0) years. Results: There were no associations between complications after surgery and the age when children had their first implant. Children implanted at 5-11 months reached an age-equivalent level of language understanding and better vocabulary outcome sooner than subgroups implanted later. Children who had surgery at 12-29 months demonstrated more atypical and delayed language abilities over time. Early implantation, preferably before 9 months, may lead to a more typical trajectory of spoken language development. Conclusion: Our findings showed that cochlear implantation before 9 months was safe. Early implantation may reduce the negative effects of auditory deprivation and promotes more natural and synchronised language development.

Keywords: cochlear implantation; hearing impairment; language development; paediatric implantation; surgical safety.

11. Imsiecke M, Krüger B, Büchner A, Lenarz T, Nogueira W. (2019) Interaction Between Electric and Acoustic Stimulation Influences Speech Perception in Ipsilateral EAS Users. Ear Hear. Oct 7 [Epub ahead of print]

Abstract

Objectives: The aim of this study was to determine electric-acoustic masking in cochlear implant users with ipsilateral residual hearing and different electrode insertion depths and to investigate the influence on speech reception. The effects of different fitting strategies-meet, overlap, and a newly developed masking adjusted fitting (UNMASKfit)-on speech reception are compared. If electric-acoustic masking has a detrimental effect on speech reception, the individualized UNMASKfit map might be able to reduce masking and thereby enhance speech reception. Design: Fifteen experienced MED-EL Flex electrode recipients with ipsilateral residual hearing participated in a crosssover design study using three fitting strategies for 4 weeks each. The following strategies were compared: (1) a meet fitting, dividing the frequency range between electric and acoustic stimulation, (2) an overlap fitting, delivering part of the frequency range both acoustically and electrically, and (3) the UNMASKfit, reducing the electric stimulation according to the individual electric-on-acoustic masking strength. A psychoacoustic masking procedure was used to measure the changes in acoustic thresholds due to the presence of electric maskers. Speech reception was measured in noise with the Oldenburg Matrix Sentence test. Results: Behavioral thresholds of acoustic probe tones were significantly elevated in the presence of electric maskers. A maximum of masking was observed when the difference in location between the electric and acoustic stimulation was around one octave in place frequency. Speech reception scores and strength of masking showed a dependency on residual hearing, and speech reception was significantly reduced in the overlap fitting strategy. Electric- acoustic stimulation significantly improved speech reception over electric stimulation alone, with a tendency toward a larger benefit with the UNMASKfit map. In addition, masking was significantly inversely correlated to the speech reception performance difference between the overlap and the meet fitting. Conclusions: (1) This study confirmed the interaction between ipsilateral electric and acoustic stimulation in a psychoacoustic masking experiment. (2) The overlap fitting yielded poorer speech reception performance in stationary noise especially in subjects with strong masking. (3) The newly developed UNMASKfit strategy yielded similar speech reception thresholds with an enhanced acoustic benefit, while at the same time reducing the electric stimulation. This could be beneficial in the long-term if applied as a standard fitting, as hair cells are exposed to less possibly adverse electric stimulation. In this study, the UNMASKfit allowed the participants a better use of their natural hearing even after 1 month of adaptation. It might be feasible to transfer these results to the clinic, by fitting patients with the UNMASKfit upon their first fitting appointment, so that longer adaptation times can further improve speech reception.

Keywords: Cochlear implant, Electric-acoustic stimulation, Fitting strategy, Ipsilateral masking, Residual hearing, Speech reception.

12. Hofkens-Van den Brandt A, Mertens G, Gilles A, Fransen E, Lassaletta L, Gavilan J, Calvino M, Yanov Y, Kuzovkov V, Kliachko D, Zernotti M, Di Gregorio MF, Van Rompaey V, Van de Heyning P, Sugarova S. (2019) Otol Neurotol. 40(8):e787-e795.

Abstract

Objective: To evaluate the hearing outcomes of cochlear implantation in different age groups by using data collected in the HEARRING registry. Methods: A multicenter study. Data of 146 patients were collected in a HEARRING registry. Patients were divided into three different age groups; ≤ 55 years old (age group 1, n = 66), 56 to 69 years old (age group 2, n = 45), and ≥ 70 years old (age group 3, n = 35). Speech in quiet (SPIQ), speech in noise (SPIN), and hearing implant sound quality index (HISQUI19) scores were evaluated for the different age groups at different test moments (preoperatively, 3, 6, 12, and 24 mo after first fitting). Results: A statistically significant difference ($p < 0.01$) was found between preoperative scores and the scores on all the follow-up moments across all age groups. For SPIQ and SPIN, none of the time points showed a statistically significant age effect ($p = 0.88$ and $p = 0.89$). For HISQUI19 scores, a statistically significant age effect was found at 12 months after first fitting. The oldest age group scored significantly lower on the HISQUI19 compared with the youngest age group. Conclusion: Hearing outcomes of adult cochlear implant users of different age groups were evaluated. The SPIQ and SPIN tests showed no significant differences between the different age groups. Nevertheless, the youngest group scored significantly better on self -perceived benefit (HISQUI19) with a cochlear implant compared with the oldest age group.Further research is needed to receive more insight into cochlear implantation in the elderly and its implications on rehabilitating and supporting this expanding older population.

Keywords: Adults—Cochlear implantation—Hearing outcomes—Registry.

13. Hagen R, Radeloff A, Stark T, Anderson I, Nopp P, Aschbacher E, Möltner A, Khajehnouri Y, Rak K. (2019) Microphone Directionality and Wind Noise Reduction Enhance Speech Perception in Users of the MED-EL SONNET Audio Processor. Cochlear Implants Int. Sept 16, 1-13 [Epub ahead of print]

Abstract

Objectives: Speech understanding in noise remains a challenge for many cochlear implant users. To improve this, the SONNET audio processor features three microphone directionality (MD) settings and three wind noise reduction (WNR) settings. The primary aim of this study was to assess if speech understanding in noise and hearing in real life was superior with the SONNET or with the OPUS 2, which does not feature MD or WNR. Methods: 31 of 33 participants completed the study. Speech understanding was assessed in two types of acoustic noise, in wind noise, and in quiet. A 4-speaker setup was used and speech was presented from 0° and noise from 90°, 180°, and 270°. Wind noise was simulated with a fan. Sound quality and hearing-related abilities were assessed via two subjective questionnaires. Results: Speech understanding in acoustic noise with the SONNET was significantly better or equal to than with the OPUS 2. Speech understanding in wind with the OPUS 2 was

significantly better than with the SONNET in some settings. Sound quality and hearing-related abilities were both significantly better with the SONNET. Conclusions: The SONNET provides the same or significantly improved speech understanding than the OPUS 2 in quiet and in noise. While OPUS 2 was superior in wind than the SONNET in some settings, this was offset by SONNET's superiority in real-life listening situations. We therefore conclude that the front-end processing of the SONNET provides users with better hearing than does the OPUS 2.

Keywords: Beamforming; Cochlear Implant; Hearing-Related Sound Quality; Microphone Directionality; Speech Understanding in Noise; Wind Noise Reduction.

14. Ehrmann-Mueller D, Kurz A, Kuehn H, Rak K, Mlynski R, Hagen R, Shehata-Dieler W. (2019) Usefulness of Cochlear Implantation in Children With Single Sided Deafness. Int J Pediatr Otorhinolaryngol. Nov 30, 130, 109808 [Epub ahead of print]

Abstract

Objectives: Children with single sided deafness (SSD) show a poorer performance at school, which is attributable to reduced speech discrimination in noise, to reduced localization ability, and to a decreased power of concentration due to faster hearing exhaustion. Therefore, it is important to provide children with SSD with adequate hearing amplification to restore binaural hearing. This can only be achieved by provision with a cochlear implant (CI). But these treatment option in children with SSD is still under discussion. The aim of the present study is to evaluate audiological and clinical results in children with SSD following cochlear implantation. A special focus was placed on the duration of deafness before implantation and on the frequency of CI-use in everyday life. Methods: Seven children with SSD of different etiologies who were provided with a CI between 3 and 16 years of age were evaluated. Every child underwent multiple audiological tests before and after cochlear implantation. After cochlear implantation speech recognition tests in noise using the HSM (Hochmair, Schulz and Moser 1997) test and localization tests were performed. Furthermore, the frequency of implant use was evaluated. Results: Speech recognition in noise with CI compared to the unaided condition significantly improved in all children in different settings. Improvement of the localization ability measured by the root mean square error (RMSE) was shown in all children. All children are very satisfied with the decision to have undergone cochlear implantation and are all full-time users. Conclusions: Cochlear implantation benefits speech recognition in noise and sound localization ability in children with SSD at different ages. All implanted children are full-time users regardless of age or duration of deafness before implantation.

Keywords: Cochlear implantation; Single sided deafness; Speech recognition; Use of device.

15. Dorman MF, Natale CS, Zeitler DM, Baxter L, Noble JH. (2019) Looking for Mickey Mouse™ But Finding a Munchkin: The Perceptual Effects of Frequency Upshifts for Single-Sided Deaf, Cochlear Implant Patients. J Speech Lang Hear Res. 62(9):3493-3499.

Abstract

Purpose Our aim was to make audible for normal-hearing listeners the Mickey Mouse™ sound quality of cochlear implants (CIs) often found following device activation. Method The listeners were 3 single-sided deaf patients fit with a CI and who had 6 months or less of CI experience. Computed tomography imaging established the location of each electrode contact in the cochlea and allowed an estimate of the place frequency of the tissue nearest each electrode. For the most apical electrodes, this estimate ranged from 650 to 780 Hz. To determine CI sound quality, a clean signal (a sentence) was presented to the CI ear via a direct connect cable and candidate, and CI-like signals were presented to the ear with normal hearing via an insert receiver. The listeners rated the similarity of the candidate signals to the sound of the CI on a 1- to 10-point scale, with 10 being a complete match. Results To make the match to CI sound quality, all 3 patients need an upshift in formant frequencies (300-800 Hz) and a metallic sound quality. Two of the 3 patients also needed an upshift in voice pitch (10-80 Hz) and a muffling of sound quality. Similarity scores ranged from 8 to 9.7. Conclusion The formant frequency upshifts, fundamental frequency upshifts, and metallic sound quality experienced by the listeners can be linked to the relatively basal locations of the electrode contacts and short duration experience with their devices. The perceptual consequence was not the voice quality of Mickey Mouse™ but rather that of Munchkins in The Wizard of Oz for whom both formant frequencies and voice pitch were upshifted.

16. Dorman MF, Natale CS, Baxter L, Zeitler DM, Carlson ML, Noble JH. (2019) Cochlear Place of Stimulation is One Determinant of Cochlear Implant Sound Quality. Audio Neurootol. 24(5):264-269.

Abstract

Objective: Our aim was to determine the effect of acute changes in cochlear place of stimulation on cochlear implant (CI) sound quality. Design: In Experiment 1, 5 single-sided deaf (SSD) listeners fitted with a long (28-mm) electrode array were tested. Basal shifts in place of stimulation were implemented by turning off the most apical electrodes and reassigning the filters to more basal electrodes. In Experiment 2, 2 SSD patients fitted with a shorter (16.5-mm) electrode array were tested. Both basal and apical shifts in place of stimulation were implemented. The apical shifts were accomplished by current steering and creating a virtual place of stimulation more apical that that of the most apical electrode. Results: Listeners matched basal shifts by shifting, in the normal-hearing ear, the overall spectrum up in frequency and/or increasing voice pitch (F0). Listeners matched apical shifts by shifting down the overall frequency spectrum in the normal-hearing ear. Conclusion: One factor determining CI voice quality is the location of stimulation along the cochlear partition.

Keywords: Cochlear implant; Single-sided deafness; Sound quality.

17. Dillon MT, Buss E, Rooth MA, King ER, Pillsbury HC, Brown KD. (2019) Low-Frequency Pitch Perception in Cochlear Implant Recipients with Normal Hearing in the Contralateral Ear. J Speech Lang Hear Res. 62(8):2860-2871.

Abstract

Purpose Three experiments were carried out to evaluate the low-frequency pitch perception of adults with unilateral hearing loss who received a cochlear implant (CI). Method Participants were recruited from a cohort of CI users with unilateral hearing loss and normal hearing in the contralateral ear. First, low-frequency pitch perception was assessed for the 5 most apical electrodes at 1, 3, 6, and 12 months after CI activation using an adaptive pitch-matching task. Participants listened with a coding strategy that presents low-frequency temporal fine structure (TFS) and compared the pitch to that of an acoustic target presented to the normal hearing ear. Next, participants listened with an envelope-only, continuous interleaved sampling strategy. Pitch perception was compared between coding strategies to assess the influence of TFS cues on low-frequency pitch perception. Finally, participants completed a vocal pitch-matching task to corroborate the results obtained with the adaptive pitch-matching task. Results Pitch matches roughly corresponded to electrode center frequencies (CFs) in the CI map. Adaptive pitch matches exceeded the CF for the most apical electrode, an effect that was larger for continuous interleaved sampling than TFS. Vocal pitch matches were variable but correlated with the CF of the 3 most apical electrodes. There was no evidence that pitch matches changed between the 1- and 12-month intervals. Conclusions Relatively accurate and asymptotic pitch perception was observed at the 1-month interval, indicating either very rapid acclimatization or the provision of familiar place and rate cues. Early availability of appropriate pitch cues could have played a role in the early improvements in localization and masked speech recognition previously observed in this cohort.

18. Dhanasingh A. (2019) Cochlear Duct Length Along the Outer Wall vs Organ of Corti: Which One Is Relevant for the Electrode Array Length Selection and Frequency Mapping Using Greenwood Function? World J Otorhinolaryngol Head Neck Surg. 5(2):117-121.

Abstract

Cochlear duct length (CDL) measurement or estimation is a hot topic for various research groups in the cochlear implant (CI) field as of today. Getting the CDL along the outer wall (LW) and organ of corti (OC) is possible but considering the clinical application especially in the selection of the electrode array length and applying Greenwood's frequency function, we need to have a clear understanding on the CDL in general and as well on the Greenwood's frequency function. It is very clear from the histology images of the cochlea with straight electrode inside, that the electrode locates itself right under the basilar membrane. Also the Greenwood's frequency function involves a variable that corresponds to the CDL at the basilar membrane/organ of corti level. This brings us to conclude that the CDL at the OC is relevant for the selection of electrode array length and in applying Greenwood's frequency function. The ratio between CDL (LW) and CDL (OC) is 0.9 which is a very important number that needs to be remembered when converting CDL (LW) to CDL (OC).

Keywords: Cochlear duct length; Electrode selection; Greenwood frequency function; Organ of corti; Outer wall.

19. Ciprut A, Adigül C. (2019) The Relationship Between Electrical Stapedius Reflex Thresholds and Behaviorally Most Comfortable Levels in Experienced Cochlear Implant Users. J Int Adv Otol. Jul 9 [Online ahead of print]

Abstract

Objectives: Programming the cochlear implant's speech processor with subjective methods in young, uncooperative children is difficult. Since young children cannot provide adequate feedback to the clinician, objective methods which do not require patient's response were often used. Electrical Stapedius Reflex Test is one of the most common procedures used. The goal of this study was to investigate the relationship between electricalstapedius reflex thresholds and behaviorally most comfortable levels in experienced cochlear implant users. Materials and methods: The patients implanted with two brands of cochlear implants were compared in terms of electrical stapedius reflex thresholds versus most comfortable levels. Speech tests results were also compared between the two groups. 46 cochlear implanted patients who had at least 1 year of cochlear implant experience were included in the study. 28 patients were implanted with Nucleus, 18 patients with Med-El devices. Results: Moderate correlations were obtained between ESR thresholds and C levels in Nucleus users; higher correlations were obtained for Med-El patients. ESR thresholds were present at higher levels than MCL/C levels in both Nucleus and Med-El users. No significant difference was obtained between the two groups in terms of speech tests. Conclusion: ESR test can be very informative for programming young and uncooperative patients.

Keywords: Electrical Stapedius Reflex Test, cochlear implant, MCL, comfort level.

20. Caversaccio M, Wimmer W, Anso J, Mantokoudis G, Gerber N, Rathgeb C, Scheider D, Hermann J, Wagner F, Scheidegger O, Huth M, Anschuetz L, Kompis M, Williamson T, Bell B, Gavaghan K, Weber S. (2019) Robotic Middle Ear Access for Cochlear Implantation: First in Man. PLoS One. 14(8):e0220543.

Abstract

To demonstrate the feasibility of robotic middle ear access in a clinical setting, nine adult patients with severe-to-profound hearing loss indicated for cochlear implantation were included in this clinical trial. A keyhole access tunnel to the tympanic cavity and targeting the round window was planned based on preoperatively acquired computed tomography image data and robotically drilled to the level of the facial recess. Intraoperative imaging was performed to confirm sufficient distance of the drilling trajectory to relevant anatomy. Robotic drilling continued toward the round window. The cochlear access was manually created by the surgeon. Electrode arrays were inserted through the keyhole tunnel under microscopic supervision via a tympanomeatal flap. All patients were successfully implanted with a cochlear

implant. In 9 of 9 patients the robotic drilling was planned and performed to the level of the facial recess. In 3 patients, the procedure was reverted to a conventional approach for safety reasons. No change in facial nerve function compared to baseline measurements was observed. Robotic keyhole access for cochlear implantation is feasible. Further improvements to workflow complexity, duration of surgery, and usability including safety assessments are required to enable wider adoption of the procedure.

21. Büchner A, Schwebs M, Lenarz T. (2019) Speech Understanding and Listening Effort in Cochlear Implant Users – Microphone Beamformers Lead to Significant Improvements in Noisy Environments. Cochlear Implants Int Oct 7:1-8.

Abstract

Objectives: To evaluate the effect of microphone directionality, i.e. beamforming, on speech understanding in noise with the SONNET audio processor. Methods: Speech reception thresholds (SRTs) were tested in three different microphone settings (omnidirectional, adaptive, and fixed beamformer (natural)) and assessed via the Oldenburg Sentence Test and the Just Understanding Speech Test. Subjects rated the listening effort needed to understand speech in different signal-to-noise ratios (-10, -5, 0, 5, 10, 15 dB SNR) via a Visual Analogue Scale. For all test methods, speech was presented at 0° azimuth while fixed and uncorrelated masking noise was presented simultaneously from five loudspeakers positioned at ±70°, ±135°, and 180° azimuth. Results: Compared to the omnidirectional mode, significant improvements ($p<0.001$) were shown in mean SRTs for both the natural (3.3 dB SNR) and adaptive (5.2 dB SNR) settings. Using the natural or the adaptive setting required significantly less listening effort than using the omnidirectional setting for the SNR conditions -5 dB SNR ($p=0.002$) and 0 dB SNR ($p<0.001$). Discussion: The beamformer settings significantly improved speech understanding in noise over the omnidirectional setting. Due our multi-speaker test setup, we conclude that beamforming should yield significantly better and less stressful speech understanding in demanding real-life listening situations.

Keywords: Audio Processor; Beamformer; Cochlear implant; Directionality; Listening effort; Speech in noise.

22. Boutros PJ, Schoo DP, Rahman M, Valentin NS, Chow MR, Ayiotis A, Morris BJ, Hofner A, Rascón AM, Marx A, Deas R, Fridman GY, Davidovics NS, Ward BK, Treviño C, Bowditch SP, Roberts DC, Lane KE, Gimmon Y, Schubert MC, Carey JP, Jaeger A, Della Santina CD. (2019) Continuous Vestibular Implant Stimulation Partially Restores Eye-Stabilizing Reflexes. JCI Insight 4(22).

Abstract

BACKGROUNDBilateral loss of vestibular (inner ear inertial) sensation causes chronically blurred vision during head movement, postural instability, and increased fall risk. Individuals who fail to compensate despite rehabilitation therapy have no adequate treatment options. Analogous to hearing restoration via cochlear implants, prosthetic electrical stimulation of

vestibular nerve branches to encode head motion has garnered interest as a potential treatment, but prior studies in humans have not included continuous long-term stimulation or 3D binocular vestibulo-ocular reflex (VOR) oculography, without which one cannot determine whether an implant selectively stimulates the implanted ear's 3 semicircular canals.METHODSWe report binocular 3D VOR responses of 4 human subjects with ototoxic bilateral vestibular loss unilaterally implanted with a Labyrinth Devices Multichannel Vestibular Implant System vestibular implant, which provides continuous, long-term, motion-modulated prosthetic stimulation via electrodes in 3 semicircular canals. RESULTSInitiation of prosthetic stimulation evoked nystagmus that decayed within 30 minutes. Stimulation targeting 1 canal produced 3D VOR responses approximately aligned with that canal's anatomic axis. Targeting multiple canals yielded responses aligned with a vector sum of individual responses. Over 350-812 days of continuous 24 h/d use, modulated electrical stimulation produced stable VOR responses that grew with stimulus intensity and aligned approximately with any specified 3D head rotation axis.CONCLUSIONThese results demonstrate that a vestibular implant can selectively, continuously, and chronically provide artificial sensory input to all 3 implanted semicircular canals in individuals disabled by bilateral vestibular loss, driving reflexive VOR eye movements that approximately align in 3D with the head motion axis encoded by the implant.

Keywords: Medical devices; Neuroscience; Otology.

23. Batuk MO, Aslan F, Sennaroglu G, Akgoz A, Bilginer B, Sennaroglu L. (2019) Contralateral Non-Auditory Stimulation in Auditory Brainstem Implantation: A Case Report. Int J Pediatr Otorhinolaryngol 125, 71-78.

No abstract available

Keywords: Auditory brainstem implantation; Brainstem hypoplasia; Case report; Cochlear implantation; Facial nerve stimulation; Non auditory stimulation.

24. Aragón-Ramos P, Pedrero-Escalas MF, Gavilán J, Pérez-Mora R, Herrán-Martín B, Lassaletta L. (2019) Auditory Skills Following Cochlear Implantation in Children with the Charge Syndrome. Audiol Neurootol 24 (3), 139-146.

Abstract

Objectives: To assess the auditory outcomes and skills of pediatric cochlear implant (CI) users with the CHARGE syndrome. To determine the influence of inner ear malformations on the surgical procedure and speech understanding outcomes in this population. Study design: Observational, retrospective study. Materials and methods: Imaging, auditory testing, intraoperative findings, complications, and postoperative auditory skills and outcomes of pediatric CI users with CHARGE syndrome were recorded. Results: 6 children (8 ears) were included, 5 of whom had prelingual deafness. Their mean age at implantation was 37 months. Six of the 8 ears presented cochlear malformation; the most frequent was hypoplasia type III. Intraoperatively, the transmastoid facial recess approach was used in 5 ears, and

abnormalities of facial nerve anatomy were found in 5 ears. All electrode insertions were complete. All children were, to a varying degree, able to detect and identify sound. Verbalization skills were developed by 2 children, 1 of whom used oral language as his primary mode of communication. Conclusions: Cochlear implantation performed by an experienced surgeon in patients with the CHARGE syndrome is a safe procedure with adequate treatment planning. All children had improved auditory skills although the improvement was variable.

Keywords: Auditory skills; CHARGE syndrome; Cochlear implantation.

25. Adel Y, Nagel S, Weissgerber T, Baumann U, Macherey O. (2019) Pitch Matching in Cochlear Imlant Users with Single-Sided Deafness: Effects of Electrode Position and Acoustic Stimulus Type. Front Neurosci. Nov 29;13:1119.

Abstract

Previous studies in patients with single-sided deafness (SSD) have reported results of pitch comparisons between electric stimulation of their cochlear implant (CI) and acoustic stimulation presented to their near-normal hearing contralateral ear. These comparisons typically used sinusoids, although the percept elicited by electric stimulation may be closer to a wideband stimulus. Furthermore, it has been shown that pitch comparisons between sounds with different timbres is a difficult task and subjected to various types of range biases. The present study aims to introduce a method to minimize non-sensory biases, and to investigate the effect of different acoustic stimulus types on the frequency and variability of the electric-acoustic pitch matches. Pitch matches were collected from 13 CI users with SSD using the binary search procedure. Electric stimulation was presented at either an apical or a middle electrode position, at a rate of 800 pps. Acoustic stimulus types were sinusoids (SINE), 1/3-octave wide narrow bands of Gaussian noises (NBN), or 1/3-octave wide pulse spreading harmonic complexes (PSHC). On the one hand, NBN and PSHC are presumed to better mimic the spread of excitation produced by a single-electrode stimulation than SINE. On the other hand, SINE and PSHC contain less inherent fluctuations than NBN and may therefore provide a temporal pattern closer to that produced by a constant-amplitude electric pulse train. Analysis of mean pitch match variance showed no differences between stimulus types. However, mean pitch matches showed effects of electrode position and stimulus type, with the middle electrode always matched to a higher frequency than the apical one ($p < 0.001$), and significantly higher across-subject pitch matches for PSHC compared with SINE ($p = 0.017$). Mean pitch matches for all stimulus types were better predicted by place-dependent characteristic frequencies (CFs) based on an organ of Corti map compared with a spiral ganglion map. CF predictions were closest to pitch matches with SINE for the apical electrode position, and conversely with NBN or PSHC for the middle electrode position. These results provide evidence that the choice of acoustic stimulus type can have a significant effect on electric-acoustic pitch matching.

Keywords: cochlear implant, pitch perception, single-sided deafness, simulation, pulse-spreading harmonic complex, binary search procedure, non-sensory bias.

26. Zarifian T, Movallali G, Fotuhi M, Harouni GG. (2019) Validation of the Persian version of the LittlEARS® auditory questionnaire for assessment of auditory development in children with normal hearing. Int J Pediatr Otorhinolaryngol. 123:79-83.

Abstract

OBJECTIVES: To adapt the LittlEARS® Auditory Questionnaire into Persian and evaluate the psychometric properties of the Persian version of the questionnaire for children with normal hearing. METHODS: A "back-translation" method was used to translate and adapt the LittlEARS Auditory Questionnaire into Persian. The translated version was first evaluated by means of an expert-appraisal method. After having improved the Persian version of LittlEARS with the results obtained from that evaluation, various psychometric analyses were carried out to determine the validity and reliability. A group of 240 Persian speaking parents of children below 24 months of age with normal hearing completed the LittlEARS® Auditory Questionnaire. Various psychometric analyses (scale analysis and item analysis) were conducted. RESULTS: In the current study, the following scale and item characteristics were investigated: Corrected item-total correlations ranged from 0.14 to 0.74; Cronbach's alpha coefficient value was 0.960; the split-half reliability r was 0.734; predictive accuracy Guttman's lambda was 0.965; the correlation between the overall score and age of the children was 0.808 ($p < 0.001$). The regression curve, which reflects the age-dependence of auditory behavior, was produced. The regression analysis that was conducted to obtain normative data showed that 80% of the variance in the total scores could be explained by age. CONCLUSION: The data obtained from psychometric analysis support the use of the Persian version of the LittlEARS Auditory Questionnaire as a reliable and valid tool to assess the development of auditory behavior in Persian speaking children who are 24 months old or younger.

27. Weissgerber T, Stöver T, Baumann U. (2019) Speech perception in noise: Impact of directional microphones in users of combined electric-acoustic stimulation. PLoS One. 14(3):e0213251.

Abstract

OBJECTIVES: Combined electric-acoustic stimulation (EAS) is a well-accepted therapeutic treatment for cochlear implant (CI) users with residual hearing in the low frequencies but severe to profound hearing loss in the high frequencies. The recently introduced SONNETeas audio processor offers different microphone directionality (MD) settings and wind noise reduction (WNR) as front-end processing. The aim of this study was to compare speech perception in quiet and noise between two EAS audio processors DUET 2 and SONNETeas, to assess the impact of MD and WNR on speech perception in EAS users in the absence of wind. Furthermore, subjective rating of hearing performance was registered. METHOD: Speech perception and subjective rating with SONNETeas or DUET 2 audio processor were assessed in 10 experienced EAS users. Speech perception was measured in quiet and in a diffuse noise setup (MSNF). The SONNETeas processor was tested with three MD settings omnidirectional/natural/adaptive and with different intensities of WNR. Subjective rating of auditory benefit and sound quality was rated using two questionnaires. RESULTS: There was

no significant difference between DUET 2 and SONNETeas processor using the omnidirectional microphone in quiet and in noise. There was a significant improvement in SRT with MD settings natural (2.2 dB) and adaptive (3.6 dB). No detrimental effect of the WNR algorithm on speech perception was found in the absence of wind. Sound quality was rated as "moderate" for both audio processors. CONCLUSIONS: The different MD settings of the SONNETeas can provide EAS users with better speech perception compared to an omnidirectional microphone. Concerning speech perception in quiet and quality of life, the performance of the DUET 2 and SONNETeas audio processors was comparable.

28. Thompson NJ, Dillon MT, Bucker AL, King ER, Pillsbury HC 3rd, Brown KD (2019) Electric-Acoustic Stimulation After Reimplantation: Hearing Preservation and Speech Perception. Otol Neurotol. Feb;40(2):e94-e98.

Abstract

OBJECTIVE: Hearing preservation after cochlear implantation allows for fitting of acoustic and cochlear implant technologies in the same ear, known as Electric-Acoustic Stimulation (EAS). Cochlear implant recipients with EAS who experience an internal device failure face the additional risk of residual hearing loss during reimplantation. This report reviews the case of an EAS recipient with long-term hearing preservation and significant benefit who experienced a device failure and underwent cochlear reimplantation. PATIENT: Case study who presented with an internal device failure after nearly 10 years of hearing preservation and significant benefit with an EAS device. INTERVENTION: Reimplantation with hearing preservation electrode array. MAIN OUTCOME MEASURES: Unaided residual hearing and aided speech perception with an EAS device using CNC words in quiet and CUNY sentences in noise. RESULTS: Low-frequency thresholds were similar when comparing residual hearing pre- and post-reimplantation. The patient does not use the acoustic portion of the EAS device due to normal low-frequency hearing sensitivity-even after two cochlear implantation procedures. At the 3-month follow-up interval, the patient demonstrated restoration of aided speech perception performance with the EAS device. CONCLUSIONS: Hearing preservation can be maintained with long-term use of EAS devices. Those with preserved low-frequency hearing who experience a device failure may maintain hearing preservation after reimplantation. Normal low-frequency hearing thresholds were maintained in the present case, and the patient continued to listen with the EAS device without the acoustic component. EAS recipients may experience rapid restoration in speech perception after reimplantation in the presence of hearing preservation.

29. Távora-Vieira D, Rajan GP, Van de Heyning P, Mertens G. (2019) Evaluating the Long-Term Hearing Outcomes of Cochlear Implant Users With Single-Sided Deafness. Otol Neurotol. 40(6):e575-e580.

Abstract

OBJECTIVES: To investigate the long-term outcomes of cochlear implantation in individuals with single-sided deafness (SSD) in terms of speech perception, subjective hearing

performance, and sound localization. METHODS: Thirty-four subjects with SSD were recruited across two large cochlear implant (CI) centers (Antwerp, Belgium and Perth, Australia). The long-term hearing outcomes (between 4 and 10 years of CI use) were evaluated using speech in noise tests, a subjective hearing performance questionnaire (Speech, Spatial and Qualities Questionnaire [SSQ12]), and sound localization tests. RESULTS: Statistically significant improvements were observed in speech perception in noise and sound localization results postoperatively with the use of a CI in comparison to preoperative measurements. Subjective hearing abilities also significantly improved after long-term CI use. CONCLUSION: Access to binaural hearing is important for subjects with SSD. CI users with SSD experience long-term benefits in speech understanding, sound localization, and quality of life.

30. Távora-Vieira D, Marino R. (2019) Re-training the deaf ear: Auditory training for adult cochlear implant users with singlesided deafness. Cochlear Implants Int. 20(5):231-236.

Abstract

OBJECTIVE: While cochlear implant (CI) provision for adults with single-sided deafness (SSD) is now an accepted treatment option, auditory training programs specific to this group of CI users have not been described. This paper details the auditory training protocol and critical factors required to rehabilitate CI users with post-lingual SSD. OUTCOMES AND RESULTS: Several key factors are integral to the success of the rehabilitation program; these include 1) CI users with SSD require a map that is balanced as closely as possible to their normal hearing ear and has optimal mapping levels; 2) the auditory training program needs to be stimulating, rewarding, and directly stimulate the implanted ear via Direct Auditory Input (DAI); 3) CI users need to achieve some success in the early post-implantation stages to maintain or increase their motivation; 3) CI users need to be fully committed to the auditory training; and 5) a well-defined structured auditory training program with immediate feedback and markers of success helps ensure optimal communication outcomes. As an indication of success, from the foundation of the program in 2008 until the present all adults with SSD who have received a CI at our clinic (N = 114) only 5 have elected to stop using their device. CONCLUSION: The auditory training program described herein has been developed to optimize hearing and quality of life outcomes for adult CI users with SSD.

31. Schneider D, Stenin I, Ansó J, Hermann J, Mueller F, Pereira Bom Braga G, Rathgeb C, Wimmer W, Schipper J, Kristin J, Caversaccio M, Anschuetz L, Weber S, Klenzner T. (2019) Robotic cochlear implantation: feasibility of a multiport approach in annex vivo model. Eur Arch Otorhinolaryngol. 276(5):1283-1289.

Abstract

PURPOSE: A recent clinical trial has shown the feasibility of robotic cochlear implantation. The electrode was inserted through the robotically drilled tunnel and an additional access through the external auditory canal was created to provide for means of visualization and manipulation. To obviate the need for this additional access, the utilization of multiple robotically drilled tunnels targeting the round window has been proposed. The objective of this study was to

assess the feasibility of electrode insertion through a robotic multiport approach. METHODS: In four ex vivo human head specimens (left side), four trajectories through the facial recess (2x) and the retrofacial and suprameatal region were planned and robotically drilled. Optimal three-port configurations were determined for each specimen by analyzing combinations of three of the four trajectories, where the three trajectories were used for the electrode, endoscopic visualization and manipulative assistance. Finally, electrode insertions were conducted through the optimal configurations. RESULTS: The electrodes could successfully be inserted, and the procedure sufficiently visualized through the facial recess drill tunnels in all specimens. Effective manipulative assistance for sealing the round window could be provided through the retrofacial tunnel. CONCLUSIONS: Electrode insertion through a robotic three-port approach is feasible. Drill tunnels through the facial recess for the electrode and endoscope allow for optimized insertion angles and sufficient visualization. Through a retrofacial tunnel effective manipulation for sealing is possible.

32. Schepers K, Steinhoff HJ, Ebenhoch H, Böck K, Bauer K, Rupprecht L, Möltner A, Morettini S, Hagen R. (2019) Remote programming of cochlear implants in users of all ages. Acta Otolaryngol. 139(3):251-257.

Abstract

BACKGROUND: Remote programming for adult cochlear implant (CI) users is feasible, safe, and effective. Limited evidence, however, exists on if remote CI programming can also be productively done with pediatric CI users. AIMS/OBJECTIVES: To assess the safety and feasibility of remote CI programming in CI users for all ages. MATERIALS AND METHODS: Forty-six (25 children, 21 adults) experienced CI users were fit locally and remotely. The results of these two fitting sessions were compared in terms of safety, Impedance Field Telemetry (IFT), Maximum Comfortable Levels (MCL), Threshold Levels (THR), audiometry, fitting duration, and speech understanding. RESULTS: The subjects' safety was not compromised during any of the fitting procedures. No significant difference was found for IFT, MCL, THR, audiometry, or speech understanding for either remote or local fitting. Remote fittings took slightly longer than local fittings when only the fitting time itself was measured. CONCLUSIONS AND SIGNIFICANCE: Remote follow-up fitting is as safe, feasible, and effective as local fitting for CI users of all ages. A more extensive adoption of remote fitting may allow many CI users greater access to clinics and therefore increased benefit from CI use.

33. Schaefer K, Coninx F, Fischbach T. (2019) LittlEARS auditory questionnaire as an infant hearing screening in Germany after the newborn hearing screening. Int J Audiol. 58(8): 468-47.

Abstract

OBJECTIVE: To investigate the feasibility of using the LittlEARS® Auditory Questionnaire (LEAQ®) as part of the infant hearing screening programme in Germany. DESIGN: LEAQ®s were distributed to 47 paediatric practices and were completed by the parents/guardians of the infants (aged between 9-14 months) involved in the study (= LEAQ® screening). The infants

who failed the LEAQ® screening were invited to a LEAQ rescreening. Infants who failed the LEAQ® rescreening were sent to a paediatric ENT specialist. After 3 years, a follow-up was performed on two groups: the first group comprised infants who failed the LEAQ screening; the second group (control group) comprised 200 infants who passed the LEAQ screening. STUDY SAMPLE: 5316 questionnaires were returned. RESULTS: Six infants with permanent hearing loss were identified using the LEAQ® as a screening tool. CONCLUSIONS: An infant hearing screening using the LEAQ® is easily implementable in paediatric practices and may be a good alternative in countries where no objective screening instruments are available. The LEAQ® was suitable for monitoring hearing development in infants in general and could help to identify a late-onset or progressive hearing loss in infants.

34. Sanderson AP, Roers ETF, Verschuur CA, Newman TA. (2019) Exploiting Routine Clinical Measures to Inform Strategies for Better Hearing Performance in Cochlear Implant Users. Front Neurosci. 12:1048.

Abstract

Neuroprostheses designed to interface with the nervous system to replace injured or missing senses can significantly improve a patient's quality of life. The challenge remains to provide implants that operate optimally over several decades. Changes in the implant-tissue interface may precede performance problems. Tools to identify and characterize such changes using existing clinical measures would be highly valuable. Modern cochlear implant (CI) systems allow easy and regular measurements of electrode impedance (EI). This measure is routinely performed as a hardware integrity test, but it also allows a level of insight into the immune-mediated response to the implant, which is associated with performance outcomes. This study is a 5-year retrospective investigation of MED-EL CI users at the University of Southampton Auditory Implant Service including 176 adult ears (18-91) and 74 pediatric ears (1-17). The trend in EI in adults showed a decrease at apical electrodes. An increase was seen at the basal electrodes which are closest to the surgery site. The trend in the pediatric cohort was increasing EI over time for nearly all electrode positions, although this group showed greater variability and had a smaller sample size. We applied an outlier-labeling rule to statistically identify individuals that exhibit raised impedance. This highlighted 14 adult ears (8%) and 3 pediatric ears (5%) with impedance levels that deviated from the group distribution. The slow development of EI suggests intra-cochlear fibrosis and/or osteogenesis as the underlying mechanism. The usual clinical intervention for extreme impedance readings is to deactivate the relevant electrode. Our findings highlight some interesting clinical contradictions: some cases with raised (but not extreme) impedance had not prompted an electrode deactivation; and many cases of electrode deactivation had been informed by subjective patient reports. This emphasizes the need for improved objective evidence to inform electrode deactivations in borderline cases, for which our outlier-labeling approach is a promising candidate. A data extraction and analysis protocol that allows ongoing and automated statistical analysis of routinely collected data could benefit both the CI and wider neuroprosthetics communities. Our approach provides new tools to inform practice and to improve the function and longevity of neuroprosthetic devices.

35. Rak K, Völker J, Schendzielorz P, Shehata-Dieler W, Radeloff A, Hagen R. (2019) Bilateral cochlear implantation is regarded as very beneficial: results from a worldwide survey by online questionnaire. Eur Arch Otorhinolaryngol. 276(3):679-683.

Abstract

PURPOSE: Bilateral cochlear implant (CI) provision is now widely regarded as the most beneficial hearing intervention for acceptable candidates. This study sought to determine if a number of well-regarded hearing professionals at highly reputable clinics shared similar practices and beliefs regarding bilateral CI provision, use, and rehabilitation in children and adults. METHODS: An 11-question online questionnaire was created and distributed to all 27 clinics in the HEARRING group. Questions 1-5 asked for facts; questions 6-11 asked for opinions. RESULTS: 20 completed questionnaires were returned. All 20 respondents reported that their clinics perform bilateral cochlear implantation in children; 18 do so in adults. Regarding the fact-based questions, bilateral CI provision is more commonly performed and more likely to be reimbursed in children than in adults. Children are also much more likely to be implanted simultaneously than are adults. Regarding the opinion-based questions, respondents gave broadly similar answers. Communication between the CIs and speech coding strategies specifically developed for bilateral CI users were regarded as the two future technologies that would most enhance the benefit of bilateral CI use. CONCLUSIONS: Most clinics in the HEARRING group are very familiar with bilateral CI provision and hold similar opinions on its results and benefits. Hopefully the results described herein will lead to a greater acceptance and regular reimbursement of bilateral CI provision, especially in adults.

36. Moteki H, Nishio SY, Miyagawa M, Tsukada K, Noguchi Y, Usami SI. (2018) Feasibility of hearing preservation for residual hearing with longer cochlear implant electrodes. Acta Otolaryngol. 138(12):1080-1085.

Abstract

BACKGROUND: Hearing preservation is thought to be achievable following atraumatic surgery with thin cochlear implant electrodes; therefore, the surgical approach and implant electrode design are crucial considerations. OBJECTIVE: To assess the feasibility of hearing preservation with long electrodes for patients meeting the criteria for conventional cochlear implantation. METHODS: One hundred and two patients (132 ears) who underwent cochlear implant surgery were analyzed. Inclusion criteria included measurable residual hearing in the low frequency before implantation and not meeting the criteria for electric acoustic stimulation (EAS). RESULTS: Of the 18 patients with residual hearing in the low frequency enrolled, 17 subjects (94.4%) retained low frequency hearing. A younger age at surgery tended to contribute to better hearing preservation than that observed in older patients. There was no clear trend regarding the influence of insertion depth angle of the electrode on hearing preservation. CONCLUSION: It is possible to achieve hearing preservation in the lower frequency by the use of longer electrodes. This study underscores the importance of atraumatic surgery, even for patients with only limited residual hearing, and longer electrodes should be adopted for EAS.

37. Mehanna AM, Gamaleldin OA, Fathalla MF. (2019) The misplaced cochlear implant electrode array. Int J Pediatr Otorhinolaryngol. 117:96-104.

Abstract

OBJECTIVES/HYPOTHESIS: Evaluation of the clinical, electrophysiologic findings, the management plans of the misplaced cochlear implant electrode array and the possible causes of misplacement. Also to provide recommendations to prevent a repeat of cochlear implant electrode misplacement into abnormal sites. STUDY DESIGN: Retrospective study. METHODS: Pediatric cochlear implant recipients implanted from January 2012 till January 2018 whose electrode arrays were misplaced outside the cochlea into the surrounding structures. RESULTS: Eight pediatric cochlear implant recipients, were identified to have a misplaced cochlear implant electrode array. Different sites of improper placement included one case in the eustachian tube, another one in the vestibule, one electrode array was found to be in the petrous apex lateral to the internal carotid canal, and another one in the internal auditory canal (IAC), and in three cases the electrode arrays were packed in the hypotympanum, and lastly an electrode array recoiled after perfect insertion and was found to be in the facial recess. Six cases were initially identified immediate because of their poor intraoperative implant testing which prompted imaging while in two cases, the one found in the petrous apex and the other one in the internal auditory canal (IAC) were diagnosed several months after surgery due to unsatisfactory auditory skills development or absent behavioral responses following implantation. CONCLUSIONS: Electrode array misplacement may be due to either failure to identify the anatomical landmarks during surgery specially the infracochlear air cell track or unidentified inner ear malformation. The routine use of intraoperative electrophysiologic testing and postoperative imaging should help to avoid such complications. Misplacement is a rare but still correctable complication after cochlear implant surgery. The diagnosis of misplacement can be delayed for years and in this occasion, it is suspected when benefit from the implant is limited or absent. Once misplacement is diagnosed revision surgery has to be done.

38. Lopez-Poveda EA, Eustaquio-Martín A, Fumero MJ, Stohol JS, Schatzer R, Nopp P, Wolford RD, Gorospe JM, Polo R, Revilla AG, Wilson BS. (2019) Lateralization of virtual sound sources with a binaural cochlear-implant sound coding strategy inspired by the medial olivocochlear reflex. Hear Res. 379:103-116.

Abstract

Many users of bilateral cochlear implants (BiCIs) localize sound sources less accurately than do people with normal hearing. This may be partly due to using two independently functioning CIs with fixed compression, which distorts and/or reduces interaural level differences (ILDs). Here, we investigate the potential benefits of using binaurally coupled, dynamic compression inspired by the medial olivocochlear reflex; an approach termed "the MOC strategy" (Lopez-Poveda et al., 2016, Ear Hear 37:e138-e148). Twelve BiCI users were asked to localize wideband (125-6000 Hz) noise tokens in a virtual horizontal plane. Stimuli were processed

through a standard (STD) sound processing strategy (i.e., involving two independently functioning sound processors with fixed compression) and three different implementations of the MOC strategy: one with fast (MOC1) and two with slower contralateral control of compression (MOC2 and MOC3). The MOC1 and MOC2 strategies had effectively greater inhibition in the higher than in the lower frequency channels, while the MOC3 strategy had slightly greater inhibition in the lower than in the higher frequency channels. Localization was most accurate with the MOC1 strategy, presumably because it provided the largest and less ambiguous ILDs. The angle error improved slightly from 25.3° with the STD strategy to 22.7° with the MOC1 strategy. The improvement in localization ability over the STD strategy disappeared when the contralateral control of compression was made slower, presumably because stimuli were too short (200 ms) for the slower contralateral inhibition to enhance ILDs. Results suggest that some MOC implementations hold promise for improving not only speech-in-noise intelligibility, as shown elsewhere, but also sound source lateralization.

39. Lenarz T, Timm ME, Salcher T, Büchner A. (2019) Individual Hearing Preservation Cochlear Implantation Using the Concept of Partial Insertion. Otol Neurotol. 40(3):e326-e335.

Abstract

OBJECTIVE: Aim of this study was to evaluate the method of partial insertion of flexible lateral wall electrodes in patients with residual hearing and potential electric-acoustic stimulation (EAS) users. PATIENTS AND INTERVENTION: N=6 patients with a high-frequency hearing loss were treated with a partial insertion using atraumatic lateral wall electrodes. In three cases, an electrode of 24 mm length was inserted with the aim to achieve a 16 mm insertion depth and in three cases an electrode of 28 mm length to achieve a 20 mm insertion depth. MAIN OUTCOME MEASURE: Differences between the pre- and postoperative unaided air-conducted pure tone thresholds in low frequencies (125 Hz-1.5 kHz) were analyzed. Freiburg monosyllables (FBM) at 65 dB and Hochmair-Desoyer sentence test in noise (10 dB SNR) were performed. The pre- and postoperative cochlea images were analyzed. RESULTS: Residual hearing could be preserved in all patients (n=6) and is stable up to 6 months follow-up. All patients could use EAS with an average speech understanding score of 65% in monosyllables (FBM) and 76% in sentences in noise. All patients benefit significantly compared to the preoperative best aided situation. CONCLUSION: First results of patients treated with partially inserted atraumatic lateral wall electrodes show good hearing preservation rates and very good speech perception results in EAS. Partial insertion appears to be a method for an individualized cochlea implantation. In case of postoperative hearing loss, the electrode can be further inserted, so the patients can benefit from deeper insertion using electric stimulation only equivalent to larger electrodes.

40. Landsberger DM, Marozeau J, Mertens G, Van de Heyning P. (2018) The relationship between time and place coding with cochlear implants with long electrode arrays. J Acoust Soc Am. 144(6):EL509.

Abstract

The auditory system can theoretically encode frequencies by either the rate or place of stimulation within the cochlea. Previous work with cochlear implants has demonstrated that both changes in timing and place can be described as pitch changes but are perceptually orthogonal. Using multidimensional scaling, the present experiment extends the previous findings that timing and place changes are perceptually orthogonal into the cochlear apex using long 31-mm electrode arrays. However, temporal cues seem to be more reliable across subjects at the apex while place cues seem to be more reliable at the middle of the cochlea.

41. Keilmann A, Friese B, Hoffmann V. (2019) Receptive and productive speech and language abilities in hearing-impaired children with German as a second language. Int J Pediatr Otorhinolaryngol. 120:100-107.

Abstract

OBJECTIVES: Many studies examining early bilingualism in migrant populations focus on the development of the first language. As language acquisition is closely related to the hearing development, there is a critical need to investigate language development in hearing-impaired children being raised bilingually who were fitted with cochlear implants and/or hearing aids. Therefore, this research project aimed to study the linguistic development of hearing-impaired children being raised with German as a second language who were provided with hearing aids or cochlear implants. Further, the language development of these children is compared with that of hearing-impaired children being raised in a monolingual environment and with normal-hearing children being raised bilingually. METHODS: In this prospective study, we analyzed data from 95 typically developing children with hearing loss (43 bilingual and 52 monolingual) aged 3;0 to 10;11 (years; months) on four language measures in German: receptive vocabulary, productive vocabulary, receptive grammar, productive grammar (sentence repetition). Additionally, 30 bilingual children with normal hearing were included in this study. RESULTS: 44 children were provided with hearing aids in both ears; 34 used cochlear implants bilaterally and 17 were fitted bimodally. Statistical analysis showed that bilingual hearing-impaired children scored significantly poorer than monolingual hearing-impaired children. CONCLUSION: Hearing-impaired children being raised bilingually should have speech and language examinations on a regular basis. An examination of both languages would be desirable in order to be able to fully assess speech and language acquisition.

42. Bräcker T, Hellmiss S, Batsoulis C, Petzold T, Gabel L, Möltner A, Stöver T, Mlynski R, Lenarz T, Büchner A. (2019) Introducing real-life listening features into the clinical test environment: Part II: Measuring the hearing performance and evaluating the listening effort of individuals with a hearing implant. Cochlear Implants Int. 20(4):165-175.

Abstract

Objectives: The controlled clinical test environment is very different from real-life listening situations, where the presence of additional speakers and variations in background noise signals can affect listening performances. The primary objective of this study is to reduce the gap between clinical results and real-life performances that are reported for many hearing implant users. Methods: Similar to Part I of this study, hearing performance and sound perception are evaluated using the following tests: (i) the Roving Level Test, (ii) the Just Understanding Speech Test, (iii) the Performance Perceptual Test, (iv) the Visual Analogue Scale to evaluate the perceived listening effort required for a range of background noise levels, and (v) the Hearing Implant Sound Quality questionnaire. All subjects recruited for this study used MED-EL hearing implant systems. Results: Results show that, similar to normal hearing listeners, hearing implant users tend to accurately estimate their hearing abilities, and both listening effort and speech recognition thresholds tend to increase with increasing noise. Discussion: The proposed test battery for evaluating speech understanding and listening effort were suitable for use in this study as all of the implant users were able to complete the tests. This test battery can be used to provide audiologists with further information relating to real-life listening performances. Conclusion: Evaluating the self-estimated and verified performance measurements of hearing implant users in real-life listening situations are essential for providing information regarding the discrepancies observed between the objective and subjective reports of hearing difficulties.

43. Bräcker T, Opie J, Nopp P, Anderson I. (2019) Introducing real-life listening features into the clinical test environment: Part I: Measuring the hearing performance and evaluating the listening effort of individuals with normal hearing. Cochlear Implants Int. 20(3):138-146.

Abstract

OBJECTIVE: Controlled clinical test environments are very different from real-life listening situations in which speaker and background noise level variations can hinder a person's ability to hear and follow conversations. This study was performed to evaluate the ability of people with normal hearing to follow a single speaker in the presence of background noise, and to explore relations between those measures and the listeners' subjective assessments, listening effort, and sound quality judgements. METHODS: A group of adults with normal hearing were evaluated using the following battery of tests: (i) Roving Level Test, (ii) the Just Understanding Speech Test, (iii) Performance Perceptual Test, (iv) the Visual Analogue Scale to evaluate listening effort, and (iv) with a sound quality questionnaire. RESULTS: The results show that people with normal hearing tend to accurately estimate their hearing abilities, and both the listening effort required and speech recognition thresholds tend to increase with increasing

background noise. DISCUSSION: Implementing a battery of tests that evaluate speech-in-noise listening abilities, listening effort, and subjective hearing perception might provide greater insight into hearing performance than traditional measures. Additionally, the data generated in this study can be used for comparison with measures obtained from hearing impaired and hearing device listeners, and as such, has the potential to guide counselling and rehabilitation to a range of clinical populations. CONCLUSION: The examination of both the self-estimated and verified performance measurements in simulated real-life listening situations can provide audiologists with a comprehensive and realistic profile of a person's hearing performance.

44. Garrido LC, Schwarz K, Lauss K, Vernetta CP, Kontides A, Gomez MD, Calvete AG, Carceller MA. (2018) Comparison of a Traditional and Novel Evoked Compound Action Potentials Recording Approach and Evoked Auditory Brainstem Responses in Pediatric Cochlear Implants Users. J Int Adv Otol. 14(3):353-358.

Abstract

OBJECTIVES: Electrically evoked compound action potentials (eCAP) recordings are widely used in functional evaluation and fitting of cochlear implants (CI) in clinics. We compared the results from two eCAP recording approaches (StandardART and FineGrain, MED-EL, Austria). The FineGrain method is more advanced than the Auditory Nerve Response Telemetry (StandardART) method in terms of the stimulation and algorithm for the eCAP threshold detection. To understand the benefits of these alterations, we compared the two methods on a larger scale in pediatric CI users alongside evoked auditory brainstem responses (eABR). MATERIALS AND METHODS: We collected the eCAP recordings obtained with both methods from a population of pediatric subjects with CI, either intra- or post-operatively. The eABR recordings were only collected post-operatively. For comparability reasons, we used the same stimulation rate and similar amplitude levels for all three approaches. RESULTS: Our results demonstrate that, although the success rates are similar, the FineGrain method outperforms traditional StandardART in terms of robustness and measurement duration. The eCAP recordings in general outperform the eABR in terms of speed. CONCLUSION: We conclude that the eCAP recordings are the method of choice for measuring the auditory neural activity, and FineGrain outperforms StandardART. From the three investigated approaches, we conclude that FineGrain performed best and should be the first-choice method in pediatric patients.

45. Faes J, Gillis S. (2019) Auditory brainstem implantation in children with hearing loss: Effect on speech production. Int J Pediatr Otorhinolaryngol. 119:103-112.

Abstract

Auditory brainstem implantation (ABI) is a recent technique in children's hearing restoration. Up till now the focus in the literature has mainly been the perceptual outcomes after implantation, whereas the effect of ABI on spoken language is still an almost unexplored area of research. This study presents a one-year follow-up of the volubility of two children with ABI. The volubility of signed and oral productions is investigated and oral productions are examined in more

detail. Results show clear developmental trends in both children, indicating a beneficial effect of ABI on spoken language development.

46. Doubi A, Almuhawas F, Alzhrani F, Doubi M, Aljutaili H, Hagr A. (2019) The effect of cochlear coverage on auditory and speech performance in cochlear implant patients. Otol Neurotol. 40(5):602-607.

Abstract

OBJECTIVE: To determine the effect of cochlear coverage on audiological and speech parameters in patients with cochlear implants. Previous work has investigated the effect of tailoring electrode size to a cochlear implant recipient's individual cochlear duct length (CDL). However, no clear relationship has been found between speech development and the extent of electrode insertion, and the benefits of apical stimulation are not yet clear. METHODOLOGY: In this retrospective study, we assessed the effect of cochlear coverage on audiological and speech performance. Participants were prelingually deaf children who received cochlear implants between June 2013 and December 2014 under the care of a single cochlear implant surgeon. Cochlear coverage was estimated for each ear according to electrode type, depth of insertion, and the number of active electrodes. Electrode type and length were determined by the individual's CDL, measured by computed tomography (CT), and full insertion was documented intraoperatively. The number of active electrodes was recorded using intraoperative audiological response telemetry. Audiological assessments were obtained 6 months and 1 year postoperatively. Results of the categories of auditory performance-II and speech intelligibility rating scales were obtained after 3 years. Patients were divided into two groups based on their cochlear coverage and their audiological and speech outcomes were compared. RESULTS: Of the 97 children recruited, 47 were girls. Temporal bone CT scans showed the right and left mean CDLs among girls were 27.7 and 27.9 mm, respectively, and 29.2 mm for both ears in boys. For each sex, the right and left CDLs did not differ significantly ($p = 0.07$). Twenty patients were lost to follow-up, leaving 77 patients (120 ears), which were divided into groups according to cochlear coverage (complete vs. incomplete). Significant between-group differences were not found in assessments of audiology, categories of auditory performances, or speech intelligibility ratings after 3 years. CONCLUSION: Audiological parameters do not differ according to the degree of cochlear coverage, specifically for low-frequency tones. Speech parameters are also comparable. Therefore, complete cochlear coverage does not appear to provide significant benefit over incomplete coverage for prelingually deaf cochlear implant recipients.

47. Dorman MF, Natale SC. (2018) AutoAdaptive: A noise level-sensitive beamformer for MED-EL cochlear implant patients. J Am Acad Auidol. 30(8): 731-734.

Abstract

BACKGROUND: When cochlear implant (CI) listeners use a directional microphone or beamformer system to improve speech understanding in noise, the gain in understanding for speech presented from the front of the listener coexists with a decrease in speech

understanding from the back. One way to maximize the usefulness of these systems is to keep a microphone in the omnidirectional mode in low noise and then switch to directional mode in high noise. PURPOSE: The purpose of this experiment was to assess the levels of speech understanding in noise allowed by a new signal processing algorithm for MED EL CIs, AutoAdaptive, which operates in the manner described previously. RESEARCH DESIGN: Seven listeners fit with bilateral CIs were tested in a simulation of a crowded restaurant with speech presented from the front and from the back at three noise levels, 45, 55, and 65 dB SPL. DATA COLLECTION AND ANALYSIS: The listeners were seated in the middle of an array of eight loudspeakers. Sentences from the AzBio sentence lists were presented from loudspeakers at 0 or 180° azimuth. Restaurant noise at 45, 55, and 65 dB SPL was presented from all eight loudspeakers. The speech understanding scores (words correct) were subjected to a two-factor (speaker location and noise level), repeated measures, analysis of variance with posttests. RESULTS: The analysis of variance showed a main effect for level and location and a significant interaction. Posttests showed that speech understanding scores from front and back loudspeakers did not differ significantly at the 45- and 55-dB noise levels but did differ significantly at the 65-dB noise level-with increased scores for signals from the front and decreased scores for signals from the back. CONCLUSIONS: The AutoAdaptive feature provides omnidirectional benefit at low noise levels, i.e., similar levels of speech understanding for talkers in front of, and in back of, a listener and beamformer benefit at higher noise levels, i.e., increased speech understanding for signals from in front. The automatic switching feature will be of value to the many patients who prefer not to manually switch programs on their CIs.

48. Dhanasingh A. (2019) Variations in the size and shape of human cochlear malformation types. Anat Rec (Hoboken). 302(10):1792-1799.

Abstract

The objective of this study is to determine the variations in size and shape of the most widely recognized cochlear malformation types using three-dimensional (3D) visualization. Using 3D slicer freeware, the complete inner-ear structures were segmented from 46 anonymized high-resolution computed tomography (HRCT) image datasets. Cochlear height, internal auditory canal height, and width were measured from the axial plane. Cochlear basal turn diameter was measured from the oblique coronal plane. Number of cochlear turns was measured from the 3D images and the corresponding cochlear duct length (CDL) was estimated using the CDL equations given in Alexiades et al. [Otol Neurotol 36 (2015) 904-907]. Out of 46 preoperative HRCT image datasets of human temporal bone, cochlear anatomy types including normal anatomy (4), enlarged vestibular aqueduct syndrome (3), cochlear aplasia (2), incomplete partition Types I (8), II (Mondini's deformity) (3), and III (X-linked) (4), cochlear hypoplasia (CH) (17), and common cavity (CC) (5) were identified. Majority of CH cases had cochlear height shorter than 4 mm whereas the CC cases measured cochlear height above 6 mm. For all the other malformation types, cochlear height was between 4 and 6 mm. In terms of "A" value, majority of CH cases showed shorter "A" value of <7.5 mm, which is in the lower end in comparison to the rest of the malformation types reported in this study. 3D-visualization shows the size and shape variations of all the structures of inner ear and also improves the clinicians'

ability to visualize cochlear anatomy and nearby structures much easier than from the 2D image slices.