

SELECCIÓN DE ARTÍCULOS SOBRE PROCESAMIENTO AUDITIVO CENTRAL

P.A.C.

Contribution of psychoacoustics and neuroaudiology in revealing correlation of mental disorders with central auditory processing disorders.

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BACKGROUND: *Psychoacoustics is a fascinating developing field concerned with the evaluation of the hearing sensation as an outcome of a sound or speech stimulus. Neuroaudiology with electrophysiologic testing, records the electrical activity of the auditory pathways, extending from the 8th cranial nerve up to the cortical auditory centers as a result of external auditory stimuli. Central Auditory Processing Disorders may co-exist with mental disorders and complicate diagnosis and outcome.* **DESIGN:** *A MEDLINE search was conducted to search for papers concerning the association between Central Auditory Processing Disorders and mental disorders. The research focused on the diagnostic methods providing the inter-connection of various mental disorders and central auditory deficits.* **MEASUREMENTS AND MAIN RESULTS:** *The medline research revealed 564 papers when using the keywords 'auditory deficits' and 'mental disorders'. 79 papers were referring specifically to Central Auditory Processing Disorders in connection with mental disorders. 175 papers were related to Schizophrenia, 126 to learning disabilities, 29 to Parkinson's disease, 88 to dyslexia and 39 to Alzheimer's disease. Assessment of the Central Auditory System is carried out through a great variety of tests that fall into two main categories: psychoacoustic and electrophysiologic testing. Different specialties are involved in the diagnosis and management of Central Auditory Processing Disorders as well as the mental disorders that may co-exist with them. As a result it is essential that they are all aware of the possibilities in diagnostic procedures.* **CONCLUSIONS:** *Considerable evidence exists that mental disorders may correlate with CAPD and this correlation could be revealed through psychoacoustics and neuroaudiology. Mental disorders that relate to Central Auditory Processing Disorders are: Schizophrenia, attention deficit disorders, Alzheimer's disease, learning disabilities, dyslexia, depression, auditory hallucinations, Parkinson's disease, alcoholism, anorexia and childhood mental retardation. Clinical awareness should be high in order for doctors of the two specialties, psychiatry and otorhinolaryngology-audiology to collaborate.*

PMID: 12793908 [PubMed - as supplied by publisher]

The use of internal speech by children with auditory processing problems.

Bench J, Maule R. *Audiology*. 1997 Nov-Dec;36(6):312-24.

School of Human Communication Sciences, La Trobe University, Victoria, Australia.

In a memory test based on the phonemic similarity effect, and using visually-presented homophone and non-homophone word lists, the serial recall of a group of 18 children with central auditory processing disorders (CAPD) was compared with that of a group of 18 normally hearing matched controls. The controls produced more errors on the homophone than the non-homophone list. The CAPD group showed only a slight bias towards more errors on the homophone list. This difference between the groups implied that, as expected, the controls used internal speech and preferred an articulatory- or auditory-rather than a visually-based processing code. The CAPD group, however, showed only a weak articulatory or auditory coding preference. Thus, *the use of internal speech seemed poorly developed in the CAPD subjects.*

PMID: 9406620 [PubMed - indexed for MEDLINE]

Can children with (central) auditory processing disorders ignore irrelevant sounds?

Elliott EM, Bhagat SP, Lynn SD. Res Dev Disabil. 2007 Oct-Nov;28(5):506-17. Epub 2006 Aug 4.

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This study investigated the effects of irrelevant sounds on the serial recall performance of visually presented digits in a sample of children diagnosed with (central) auditory processing disorders (CAPD) and age- and span-matched control groups. The irrelevant sounds used were samples of tones and speech. Memory performance was significantly disrupted in the presence of irrelevant sounds in all three groups of children. While irrelevant speech was more disruptive than irrelevant tones in the two control groups, children diagnosed with (C)APD did not show larger disruption from irrelevant speech compared to irrelevant tones. Children diagnosed with (C)APD appear to process speech differently from their typically developing peers, and this may be remediated with auditory training procedures and the placement of these children in smaller classes.

PMID: 16889933 [PubMed - indexed for MEDLINE]

Central auditory processing disorders: review and case study.

Palfery TD, Duff D. Axone. 2007 Spring;28(3):20-3.

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In this review paper, the prevalence and characteristics of central auditory processing disorder (CAPD) are reviewed. The causes, pathology and diagnosis of CAPD are also discussed. Recommendations are made for classroom interventions and a case study is presented. CAPDs are complex, heterogeneous disorders involving the process of auditory stimuli within the mechanisms of the central nervous system that can result in profound personal, social and academic consequences. Specificity in diagnosis, support by family members, neuroscience and allied health professionals and educators, and self-management and advocacy are required for children, adolescents and adults to have successful academic and work outcomes.

PMID: 17682688 [PubMed - indexed for MEDLINE]

(Central) Auditory Processing Disorders in Childhood--a Chimera or are Useful Clinical Diagnostic Tests Missing?

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BACKGROUND: (Central) Auditory Processing Disorders (C)APD are becoming ever more diagnosed in children, though there is no agreement on diagnostic markers (gold standard for (C)APD diagnosis). In Germany, the diagnostics of (C)APD in the paediatric population is based on test measurements including phonological processing rather than on a valid theoretical model to guide clinicians. The evaluation of the clinical significance of central auditory functions as well as the number of the behavioural tests which should be performed are left to the diagnostician. **PATIENTS AND METHODS:** The present study reviewed retrospectively test scores from a health care research database containing 167 children suspected of having a (C)APD. A total of 51 children participated in the study: 39 children identified with monosymptomatic (C)APD (on the basis of commonly used

(C)APD tests with scores \geq 2 SDs below the mean on at least 2 tests) and 12 children who did not receive a (C)APD diagnosis (non-(C)APD). A stepwise discriminant analysis was performed with the five phonological measures of the psychological (C)APD-diagnostics in the German language: Nonword repetition by the Mottier-Test; the subtest "Recall of sentences" by the Heidelberger Sprachentwicklungstest for Language Development; "Digit Recall" by the German version of the K-ABC-subtest; "Auditory Closure" and "Sound Blending" by the subtests of the German version of the Illinois Test of Psycholinguistic Abilities. Next the discriminant function of the model was examined. RESULTS: Performance in the normed tests (K-ABC Digit Recall: T-score 44.2, $p = 0.0029$; Sentence Recall: T-score 42.4, $p = 0.0002$; Auditory Closure: T-score 49.9, $p = 0.0130$; Sound Blending: T-score 47.2 $p = 0.0121$) and in nonword repetition (Mottier: 15.9 raw scores, $p < .0001$) was on average significantly reduced in the (C)APD group compared to the non-(C)APD-group, although the mean test results in the standardized tests were in the norm range. Only nonword repetition ($F = 21.05$; $R(2) = 0.30$; $p < 0.0001$) and recall of sentences ($F = 3.74$; $R(2) = 0.07$; $p = 0.059$) differentiated significantly in both groups. The posterior probability to classify the children was 80 % respectively the error-rate estimate was 20 %. CONCLUSIONS: *Children with (C)APD have a diminished temporal processing and perception ability which expresses itself in the limited capacity of their phonological short-term memory. A success in the discriminant function of no more than 80 % makes possibly aware of deficits in both validity and reliability of the diagnostic instruments.*

PMID: 18543168 [PubMed - indexed for MEDLINE]

Neuroimaging features in a case of developmental central auditory processing disorder.

Kim MJ, Jeon HA, Lee KM, Son YD, Kim YB, Cho ZH. J Neurol Sci. 2009 Feb 15;277(1-2):176-80. Epub 2008 Dec 6.

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We describe a case of developmental central auditory processing disorder (CAPD) that was diagnosed with a multidisciplinary approach including structural and functional neuroimaging. A patient with developmental CAPD was investigated using diagnostic tools of MRI and (18)F-FDG HRRT-PET as well as neuropsychology and electrophysiology. Besides impaired auditory processing, our patient also showed some impediments in supramodal, cognitive and linguistic processes. His MRI showed selective atrophy in the bilateral auditory cortices, and the PET images showed hypometabolism in the bilateral auditory cortices and the precuneus. Such a multidisciplinary diagnostic approach that includes neuroimaging methods will be helpful in differentiating developmental CAPD from other developmental cognitive disorders.

PMID: 19058816 [PubMed - indexed for MEDLINE]

Effects of speech in noise and dichotic listening intervention programs on central auditory processing disorders.

Putter-Katz H, Adi-Bensaid L, Feldman I, Hildesheimer M. J Basic Clin Physiol Pharmacol. 2008;19(3-4):301-16.

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Twenty children with central auditory processing disorders [(C)APD] were subjected to a structured intervention program of listening skills in quiet and in noise. Their performance was compared to that

of a control group of 10 children with (C)APD with no special treatment. Pretests were conducted in quiet and in degraded listening conditions (speech noise and competing speech). The (C)APD management approach was integrative and included top-down and bottom-up strategies. It focused on environmental modifications, remediation techniques, and compensatory strategies. Training was conducted with monosyllabic and polysyllabic words, sentences and phrases in quiet and in noise. Comparisons of pre- and post-management measures indicated increase in speech recognition performance in background noise and competing speech for the treatment group. This improvement was exhibited for both ears. A significant difference between ears was found with the left ear showing improvement in both the short and the long versions of competing sentence tests and the right ear performing better in the long competing sentences only following intervention. No changes were documented for the control group. *These findings add to a growing body of literature suggesting that interactive auditory training can improve listening skills.*

PMID: 19025038 [PubMed - indexed for MEDLINE]

TDA

Comorbidity of central auditory processing disorder and attention-deficit hyperactivity disorder.

J Am Acad Child Adolesc Psychiatry. 1994 Jul-Aug;33(6):849-57. Riccio CA, Hynd GW, Cohen MJ, Hall J, Molt L.

Center for Clinical and Developmental Neuropsychology, University of Georgia, Athens 30602.

Research has indicated that children with attention-deficit hyperactivity disorder (ADHD) demonstrate significant difficulty on tasks used to assess central auditory processing skills. These findings have raised the question of whether ADHD and central auditory processing disorder (CAPD) represent a singular disorder. **OBJECTIVE:** The current study explored the incidence of ADHD in a group of 30 children who met diagnostic criteria for CAPD. **METHOD:** Consecutive referrals specifically for this project were assessed on a variety of measures. In addition, rating scales were completed by teachers and structured interviews were completed with parents. **RESULTS:** Results indicate that although the incidence rate of ADHD (50%) in this sample significantly exceeds that found in the normative population ($p < .001$), not all children with CAPD demonstrated behaviors consistent with diagnostic criteria for ADHD. Furthermore, there was a low incidence of any other behavioral disorder in this sample. *In contrast, it was found that the sample as a whole demonstrated impaired language abilities.* No significant differences emerged across cognitive, auditory, or language measures. **CONCLUSION:** This study further supports the need for increased collaboration of those professionals who work with these children given the extent of overlap of language and behavioral difficulties in this sample.

PMID: 8083142 [PubMed - indexed for MEDLINE]

Behavioral signs of central auditory processing disorder and attention deficit hyperactivity disorder.

J Am Acad Audiol. 1998 Feb;9(1):78-84; quiz 85. Chermak GD, Somers EK, Seikel JA.

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Central auditory processing disorder (CAPD) and attention deficit hyperactivity disorder (ADHD) present overlapping symptomatology. Attention and listening problems, maladaptive behavior, distractibility, instruction-following difficulty, and increased time required to complete tasks appear on checklists purportedly characterizing behaviors exhibited by individuals with CAPD and ADHD. The present study compared audiologists' and pediatricians' rankings of 41 behavioral symptoms associated with ADHD and CAPD. Audiologists ranked the degree to which each item pertained to individuals with CAPD and pediatricians ranked the same items as related to ADHD. Item analysis revealed that only two of the most frequently cited behaviors were judged as characteristic of both disorders (i.e., inattention and distractibility). The majority of frequently cited behaviors were not seen as common to ADHD and CAPD.

PMID: 9493945 [PubMed - indexed for MEDLINE]

Central auditory processing ability in children with ADHD with and without learning disabilities.

Gomez R, Condon M. J Learn Disabil. 1999 Mar-Apr;32(2):150-8.

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A few studies have shown more central auditory processing deficits in children with attention-deficit/hyperactivity disorder (ADHD) than in nondisabled children. Because these studies failed to screen participants with ADHD for learning disabilities (LD), it is not clear whether these deficits are correlates of ADHD or LD or both. In the present study, the central auditory processing ability of children with ADHD, ADHD with LD, and no disabilities was examined. Results indicated lower central auditory processing ability, and significant correlations between reading and ADHD symptoms and reading and central auditory processing ability in the ADHD with LD group compared with the other two groups. These findings suggest that central auditory processing deficits are more likely to be associated with LD than ADHD.

PMID: 15499715 [PubMed - indexed for MEDLINE]

Working memory impairments in children with attention-deficit hyperactivity disorder with and without comorbid language learning disorders.

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Our objectives were to examine whether children with attention-deficit hyperactivity disorder (ADHD) are impaired on one or more components of working memory (WM) independent of comorbid language learning disorders, and whether WM impairments are more strongly related to symptoms of inattention than to symptoms of hyperactivity-impulsivity. Four groups of children participated: ADHD (n = 62); ADHD+RD/LI (n = 32); RD/LI (n = 15); and a typically developing comparison group (n = 34). Four simple and brief measures of WM were used that varied in modality (auditory-verbal; visual-spatial) and processing demands (temporary storage versus manipulation of information). Children with ADHD without comorbid language learning disorders exhibited deficits in visual-spatial storage and verbal and visual-spatial central executive (C.E.) functions that were independent of comorbid

psychiatric disorders. Children with language learning disorders, regardless of comorbidity with ADHD, exhibited impairments in both verbal and spatial storage as well as C.E. domains of WM. Symptoms of inattention, but not symptoms of hyperactivity/impulsivity, predicted performance on verbal and visual-spatial C.E. measures independent of age, verbal cognitive ability, and reading and language performance. Findings are consistent with data implicating neuropsychological impairments in ADHD. The dimensional results are also consistent with prior research demonstrating the neuropsychological impairments are more strongly associated with the inattention symptom dimension than with the hyperactive-impulsive dimension.

PMID: 16840237 [PubMed - indexed for MEDLINE]

Lectura / Dislexia

The mismatch negativity in evaluating central auditory dysfunction in dyslexia

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The mismatch negativity (MMN), a brain response elicited by a discriminable change in any repetitive aspect of auditory stimulation even in the absence of attention, has been widely used in both basic and clinical research during recent years. The fact that the MMN reflects the accuracy of auditory discrimination and that it can be obtained even from unattentive subjects makes it an especially attractive tool for studying various central auditory-system dysfunctions both in adults and children. In this review, we will discuss the applicability of the MMN to studies in dyslexia, which is currently thought, in the majority of the cases, to primarily result either from a dysfunction of the phonological system or a more general auditory deficit. Recent evidence indicates that the MMN enables one to determine which aspects of auditory information are deficiently processed in dyslexia. The MMN might also be helpful in the early definition of the dyslexia type, which would make it possible to start correctly-targeted training programmes before any major learning delays occur. Furthermore, the MMN holds promise of showing plastic changes in the brain of dyslexic individuals underlying the alleviation or remediation of dyslexia in the course of a successful training programme.

Pre-attentive processing of auditory patterns in dyslexic human subjects

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It has been hypothesized that auditory temporal processing plays a major role in the aetiology of dyslexia. Event-related brain potentials (mismatch negativity, MMN) of auditory temporal processing were assessed in 15 dyslexic adults and 20 controls. A complex tonal pattern was used where the difference between standard and deviant stimuli was the temporal, not the frequency structure. Dyslexics had a significantly smaller MMN in the time window of 225–600 ms. This result shows that dyslexics have a significant pre-attentive deficit in processing of rapid temporal patterns suggesting that it may be the temporal information embedded in speech sounds, rather than phonetic information per se, that resulted in the attenuated MMN found in dyslexics in previous studies. MMN scalp topographies were similar for both groups, showing a maximum over fronto-central leads.

Identification of auditory laterality by means of a new dichotic digit test in Spanish, and body laterality and spatial orientation in children with dyslexia and in controls

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INTRODUCTION: In this study, a new dichotic digit test in Spanish (NDDTS) was applied in order to identify auditory laterality. We also evaluated body laterality and spatial location using the Subirana test. **SUBJECTS AND METHODS:** Both the dichotic test and the Subirana test for body laterality and spatial location were applied in a group of 40 children with dyslexia and in a control group made up of 40 children who were paired according to age and gender. The results of the three evaluations were analysed using the SPSS 10 software application, with Pearson's chi-squared test. **RESULTS:** It was seen that 42.5% of the children in the group of dyslexics had mixed auditory laterality, compared to 7.5% in the control group ($p < \text{or} = 0.05$). Body laterality was mixed in 25% of dyslexic children and in 2.5% in the control group ($p < \text{or} = 0.05$) and there was 72.5% spatial disorientation in the group of dyslexics, whereas only 15% ($p < \text{or} = 0.05$) was found in the control group. **CONCLUSIONS:** *The NDDTS proved to be a useful tool for demonstrating that mixed auditory laterality and auditory predominance of the left ear are linked to dyslexia. The results of this test exceed those obtained for body laterality. Spatial orientation is indeed altered in children with dyslexia. The importance of this finding makes it necessary to study the central auditory processes in all cases in order to define better rehabilitation strategies in Spanish-speaking children.*

PMID: 16075396 [PubMed - indexed for MEDLINE]

Central Auditory Processing, MRI Morphometry and Brain Laterality: Applications to Dyslexia

Authors: Hugdahl K.; Heiervang E.; Nordby H.; Smievoll A.I.; Steinmetz H.; Stevenson J.; Lund A.

Source: Scandinavian Audiology, Volume 27, Supplement 49, 31 December 1998 , pp. 26-34(9)

We review data from our laboratory related to a view of dyslexia as a biological disorder, or deficit, caused by both structural and functional brain abnormalities. *The review is focused on central auditory processing in dyslexia, and the possibility that impairments in the auditory or acoustic features of the phonological code may be at the heart of the impairments seen in dyslexia.* Three methodological approaches by which to investigate central auditory processing deficits are outlined: dichotic listening (DL) to consonant-vowel syllables; magnetic resonance imaging (MRI), and the use of event-related potentials (ERPs). Consonant-vowel syllable DL is a technique for probing the functional status of phonological processing areas in the superior temporal gyrus, particularly in the left hemisphere. MRI is a corresponding structural, or morphological, measure of anatomical abnormalities in the same brain region, particularly covering the planum temporale area. *The ERP technique, and particularly the mismatch negativity (MMN) component, reveals cortical dysfunctions in sensory processing and memory related to basic acoustic events. For all three approaches, the dyslexic children were seen to differ from their control counterparts, including absence of modulation of the right ear advantage (REA), in DL through shifting of attention, smaller left-sided planum temporale asymmetry, and prolonged latency in the MMN ERP complex, particularly in the time-deviant stimulus condition.*

Auditory processing disorder in children with reading disabilities: effect of audiovisual training.

VeUILLET E, Magnan A, Ecalle J, Thai-Van H, Collet L. *Brain*. 2007 Nov;130(Pt 11):2915-28. Epub 2007 Oct 5.

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Reading disability is associated with phonological problems which might originate in auditory processing disorders. The aim of the present study was 2-fold: first, the perceptual skills of average-reading children and children with dyslexia were compared in a categorical perception task assessing the processing of a phonemic contrast based on voice onset time (VOT). The medial olivocochlear (MOC) system, an inhibitory pathway functioning under central control, was also explored. Secondly, we investigated whether audiovisual training focusing on voicing contrast could modify VOT sensitivity and, in parallel, induce MOC system plasticity. The results showed an altered voicing sensitivity in some children with dyslexia, and that the most severely impaired children presented the most severe reading difficulties. These deficits in VOT perception were sometimes accompanied by MOC function abnormalities, in particular a reduction in or even absence of the asymmetry in favour of the right ear found in average-reading children. Audiovisual training significantly improved reading and shifted the categorical perception curve of certain children with dyslexia towards the average-reading children's pattern of voicing sensitivity. Likewise, in certain children MOC functioning showed increased asymmetry in favour of the right ear following audiovisual training. The training-related improvements in reading score were greatest in children presenting the greatest changes in MOC lateralization. Taken together, these results confirm the notion that some auditory system processing mechanisms are impaired in children with dyslexia and that audiovisual training can diminish these deficits.

PMID: 17921181 [PubMed - indexed for MEDLINE]

Cortical activity of children with dyslexia during natural speech processing: evidence of auditory processing deficiency.

Putter-Katz H, Kishon-Rabin L, Sachartov E, Shabtai EL, Sadeh M, Weiz R, Gadoth N, Pratt H. *J Basic Clin Physiol Pharmacol*. 2005;16(2-3):157-71. Department of Communication Disorders, Tel Aviv University, Tel Aviv, Israel. hanna.putterkatz@sheba.health.gov.il

Children with dyslexia have difficulties with phonological processing. It is assumed that deficits in auditory temporal processing underlie the phonological difficulties of dyslectic subjects (i.e. the processing of rapid acoustic changes that occur in speech). In this study we assessed behavioral and electrophysiological evoked brain responses of dyslectic and skilled reading children while performing a set of hierarchically structured auditory tasks. Stimuli consisted of auditory natural unmodified speech that was controlled for the parameter of changing rate of main acoustic cues: vowels (slowly changing speech cues: /i/ versus /u/) and consonant-vowel (CV) syllables (rapidly changing speech cues: /da/ versus /ga/). Brain auditory processing differed significantly between groups: reaction time of dyslectic readers was prolonged in identifying speech stimuli and increased with increased phonological demand. Latencies of auditory evoked responses (auditory event related potentials [AERPs]) recorded during syllable identification of the dyslectic group were prolonged relative to those of skilled readers. Moreover, N1 amplitudes during vowel processing were larger for the dyslectic children and P3 amplitudes during CV processing were smaller for the dyslectic children. From the results of this study it is evident that the latency and amplitude of AERPs are sensitive measures of the complexity of phonological processing in skilled and dyslectic readers. These results may be signs of deficient auditory processing of natural speech under normal listening conditions as a contributing factor to reading difficulties in dyslexia. Detecting a dysfunction in the central auditory processing pathway might lead to early detection of children who may benefit from phonetic-acoustic training methods.

PMID: 16285467 [PubMed - indexed for MEDLINE]

Are there auditory processing and perception disorders in children with dyslexia?

Schmidt R, Winter K, Tesch-Römer C, Behrndt SM, Steffen M, Nawka T. *Laryngorhinootologie*. 2007 Jan;86(1):22-6. Klinik und Poliklinik für Hals-Nasen-Ohrenkrankheiten, Kopf- und Hals-Chirurgie, Greifswald. audiomet@uni-greifswald.de

BACKGROUND: In this paper the dichotic tests and the CERA (Cortical Evoked Response Audiometry) of children with dyslexia had been examined, in order to find out if there are auditory processing and perception disorders. PATIENTS AND METHODS: 33 children with dyslexia had been compared with 28 children without problems of writing and reading. The mean age of the children was 9 years. All of the children had been examined by the following audiometric measurements: tympanometry, pure-tone-audiometry, speech-audiometry, dichotic Tests by Uttenweiler and Feldmann and the Cortical Evoked Response Audiometry (CERA) rated according to Esser. RESULTS: The intelligence quotients were in the group of dyslexic children significantly lower. The Uttenweiler and Feldmann tests were in dyslexic children significantly lower in the control group as well. The late cortical responses were normal or near normal in both groups. CONCLUSION: Dichotic speech tests indicate central auditory processing and perception deficits in dyslexia. These tests are confounded, however, by attention and memory deficits. The CERA rated according to Esser does not point out to these auditory disorders in dyslexia.

PMID: 17283496 [PubMed - indexed for MEDLINE]

Auditory temporal processing deficits in children with reading disabilities.

Cohen-Mimran R, Sapir S. *Dyslexia*. 2007 Aug;13(3):175-92.

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The role of central auditory processing in reading skill development and reading disorders is unclear. The purpose of this study was to examine whether individuals with specific reading disabilities (SRD) have deficits in processing rapidly presented, serially ordered non-speech auditory signals. To this end, we compared 12 children with SRD and 12 children without SRD on their ability to detect differences and similarities in pure tones of 1000 and 2000 Hz when these signals were presented in pairs (same or different tones, randomly ordered) with short (50 ms) versus long (500 ms) inter-stimulus intervals (ISI). Results showed that the children with SRD had significant difficulty in discriminating between pure tones with short, but not long ISI, whereas the controls performed well with both short and long ISI. The two groups did not differ significantly on measures of attention (d2) and performance IQ, and there were no significant correlations between these measures and ISI performance. There were significant correlations between the short ISI performance and phonologic awareness test results when the two groups were combined. These findings support the specific rapid auditory processing deficit hypothesis of SRD. Examination of intra-subject variability in performance indicated that children from the SRD group showed both decrement in performance with time on task and high overall variability in performance as compared to the controls. These findings underpin the importance of using time-series analyses of performance. Copyright (c) 2006 John Wiley & Sons, Ltd.

PMID: 17624911 [PubMed - indexed for MEDLINE]

Low-level defective processing of non-verbal sounds in dyslexic children.

Uclés P, Méndez M, Garay J. *Dyslexia*. 2009 May;15(2):72-85.

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We compared processing of non-verbal auditory stimuli by dyslexic and non-dyslexic children using electrophysiological methods. The study included 39 children (17 with dyslexia plus 22 controls) assessed via frontal, central, parietal, and temporal electrodes. As an extension of previous P300 event-related potential studies, we analysed variations in the power values of 40-Hz oscillations (gamma-band oscillations involved in cognitive processing) during a specific time window in response to the auditory 'oddball' paradigm that entail target (random 2 kHz) and standard (frequent 1 kHz) stimuli. Dyslexic children differed significantly from controls ($P < 0.001$) in the mean power of the wavelet-transformed 40-Hz oscillation in a time interval starting at 25 ms after stimulus onset up to 50 ms. This means defective processing of sounds. Within groups, standard and target tones elicited significantly different power values ($P < 0.001$). Correlations of values between standard and target responses at each electrode position were not significant within either group, although dyslexics showed a lower correlation than controls. Significant differences in the mean power of these oscillations detected at very early stages of auditory processing in dyslexic children and the wide range of mean values reveal impairment in processing non-verbal sounds in dyslexia. Our results also support recent findings using behavioural and electrophysiological methods suggesting that dyslexia is a general auditory deficit instead of a speech-specific deficit.

PMID: 18324649 [PubMed - indexed for MEDLINE]

Percepción del habla / Lenguaje

Central auditory processing disorder (CAPD) in children with specific language impairment (SLI). Central auditory tests.

Dlouha O, Novak A, Vokral J. *Int J Pediatr Otorhinolaryngol*. 2007 Jun;71(6):903-7. Epub 2007 Mar 26.

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The aim of this project is to use central auditory tests for diagnosis of central auditory processing disorder (CAPD) in children with specific language impairment (SLI), in order to confirm relationship between speech-language impairment and central auditory processing. We attempted to establish special dichotic binaural tests in Czech language modified for younger children. Tests are based on behavioral audiometry using dichotic listening (different auditory stimuli that presented to each ear simultaneously). The experimental tasks consisted of three auditory measures (test 1-3)-dichotic listening of two-syllable words presented like binaural interaction tests. Children with SLI are unable to create simple sentences from two words that are heard separately but simultaneously. Results in our group of 90 pre-school children (6-7 years old) confirmed integration deficit and problems with quality of short-term memory. Average rate of success of children with specific language impairment was 56% in test 1, 64% in test 2 and 63% in test 3. Results of control group: 92% in test 1, 93% in test 2 and 92% in test 3 ($p < 0.001$). Our results indicate the relationship between disorders of speech-language perception and central auditory processing disorders.

PMID: 17382411 [PubMed - indexed for MEDLINE]

Using mismatch negativity to study central auditory processing in developmental language and literacy impairments: where are we, and where should we be going?

Bishop DV. Psychol Bull. 2007 Jul;133(4):651-72.

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A popular theoretical account of developmental language and literacy disorders implicates poor auditory temporal processing in their etiology, but evidence from studies using behavioral measures has yielded inconsistent results. The mismatch negativity (MMN) component of the auditory event-related potential has been recommended as an alternative, relatively objective, measure of the brain's ability to discriminate sounds that is suitable for children with limited attention or motivation. A literature search revealed 26 studies of the MMN in individuals with dyslexia or specific language impairment and 4 studies of infants or children at familial risk of these disorders. Findings were highly inconsistent. Overall, attenuation of the MMN and atypical lateralization in the clinical group were most likely to be found in studies using rapidly presented stimuli, including nonverbal sounds. The MMN literature offers tentative support for the hypothesis that auditory temporal processing is impaired in language and literacy disorders, but the field is plagued by methodological inconsistencies, low reliability of measures, and low statistical power. The article concludes with recommendations for improving this state of affairs. Copyright 2007 APA

PMID: 17592960 [PubMed - indexed for MEDLINE]

Discrimination of speech sounds based upon temporal envelope versus fine structure cues in 5- to 7-year-old children.

Bertoncini J, Serniclaes W, Lorenzi C. J Speech Lang Hear Res. 2009 Jun;52(3):682-95.

Epub 2008 Oct 24. Université Paris Descartes, Paris, France. [corrected]
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PURPOSE: *To investigate the capacity of young children and adults with normal hearing to discriminate speech on the basis of either relatively slow (temporal envelope, E) or fast (temporal fine structure, TFS) auditory cues.* **METHOD:** *Vowel-consonant-vowel nonsense disyllables were processed to preserve either the E or the TFS information in 16 adjacent frequency bands. The band signals were then recombined and resulting stimuli were presented for discrimination to adults or 5-, 6-, and 7-year-old children using an odd-ball paradigm. Discrimination scores (d') and response latencies were measured in each listener. No training was given to listeners.* **RESULTS:** *Overall, discrimination scores were high (d' >or=1) in all speech-processing conditions, and did not differ across age groups. Overall, and irrespective of age, greater discrimination scores and shorter response latencies were observed for E speech than for TFS speech.* **CONCLUSIONS:** *These results suggest that normal-hearing children are able to encode and use E and TFS speech cues at adult levels by the age of 5 years. TFS- and E-coded speech stimuli might therefore prove to be a useful tool for the investigation of the developmental time course of speech perception, and for the early diagnosis of peripheral and central auditory processing disorders.*

PMID: 18952853 [PubMed - indexed for MEDLINE]

Pathophysiology of auditory and speech perception.

Dauman R. Rev Prat. 2009 May 20;59(5):625-9.

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Auditory perception or hearing can be defined as the interpretation of sensory evidence, produced by the ears in response to sound, in terms of the events that caused the sound. We do not hear a window but we may hear a window closing. We do not hear a dog but we may hear a dog barking. And we do not hear a person but we may hear a person talking. Hearing impairment can result in anxiety or stress in everyday life. Pure-tone hearing loss (or threshold shift) is a measure of hearing impairment. Aging and excessive noise are the main causes of hearing impairment. Speech perception is another concept. The difference with the former is best illustrated by the disabled individual declaring "I can hear that someone is talking to me, but I don't understand what she says". Being unable to understand easily and clearly significant others, especially in understanding speech in a noisy environment, can give rise to considerable psychosocial and professional consequences (disability). Presbycusis is the decline in hearing sensitivity caused by the aging process at different levels of the auditory system. However, it is difficult to isolate age effects from other contributors to age-related hearing loss such as noise damage, genetic susceptibility, inflammatory otologic disorders, and ototoxic agents. Therefore, presbycusis and age-related hearing loss are often used synonymously. In this report pathophysiology is mostly described with regard to presbycusis, and the main peripheral types of presbycusis (sensory or Corti organ-related, strial, and neural) are summarized. An original experimental model of strial presbycusis, based on chronic application of furosemide at the round window, is further described. Central presbycusis is mainly determined by degeneration secondary to peripheral impairment (concept of deafferentation). Central auditory changes typically affect speed of processing and result in poorer speech understanding in noise or with rapid or degraded speech. Last, age-related cognitive factors can be associated to peripheral hearing impairment and increase disability in speech understanding in noise.

PMID: 19552199 [PubMed - indexed for MEDLINE]

Procesamiento auditivo en el trastorno específico del lenguaje.

FUENTE: REVISTA DE NEUROLOGÍA. 2008 FEB;46(1)

M.A. Idiazábal-Aletxa, M. Saperas-Rodríguez

Introducción. El trastorno específico del lenguaje (TEL) se diagnostica cuando un niño manifiesta dificultades para producir o entender el lenguaje hablado sin motivo aparente. El diagnóstico se establece cuando el desarrollo del lenguaje no sigue la pauta de los demás aspectos del desarrollo, y han quedado excluidas otras posibles causas. Desarrollo. Durante los últimos años, las neurociencias se han aproximado al estudio del TEL. Se cree que la clave para una adquisición correcta del lenguaje es la capacidad de procesar dos o más estímulos auditivos que se presentan en una sucesión rápida. Una hipótesis que se ha planteado es que el TEL es una consecuencia de unas anomalías de bajo nivel en la percepción auditiva. Además, los niños con TEL manifiestan un déficit específico en la discriminación automática de las sílabas. Es posible que los métodos electrofisiológicos revelen una inmadurez u otra anomalía subyacente del procesamiento auditivo, incluso cuando los umbrales conductuales parecen normales. Conclusiones. Hay mucha polémica sobre el papel de dichos déficit en la etiología de las dificultades lingüísticas, y ha sido difícil establecer unos resultados consistentes y repetibles en esta área debido a la heterogeneidad de la población y también porque no se ha prestado suficiente atención a los aspectos relacionados con la maduración del procesamiento auditivo.

Dificultades de aprendizaje

Learning disabilities and central auditory dysfunction.

Welsh LW, Welsh JJ, Healy MP. *Ann Otol Rhinol Laryngol.* 1996 Feb;105(2):117-22.

Hearing loss, whether peripheral or central, compounds the communication and educational problems of the learning disabled student. A central auditory processing disorder uniquely interferes with both the input and integration of verbal information, further resulting in a potentially permanent cognitive dysfunction during the developmental period of acquisition of language. Illustrative cases are presented that indicate the panorama of cognitive dysfunction associated with the learning disabled status. Methods of evaluation and identification and diagnostic criteria are correlated with auditory, visual, and academic performance. Comments regarding clinical awareness, prompt recognition, and ensuing individualized remediation are submitted.

PMID: 8659932 [PubMed - indexed for MEDLINE]

Auditory processing disorder in children diagnosed with nonverbal learning disability.

Keller WD, Tillery KL, McFadden SL. *Am J Audiol.* 2006 Dec;15(2):108-13.

East Amherst Psychology Group, East Amherst, NY, USA.

PURPOSE: *To determine whether children with a nonverbal learning disability (NVLD) have a higher incidence of auditory processing disorder (APD), especially in the tolerance-fading memory type of APD, and what associations could be found between performance on neuropsychological, intellectual, memory, and academic measures and APD.* **METHOD:** Eighteen children with NVLD ranging in age from 6 to 18 years received a central auditory processing test battery to determine incidence and subtype of APD. Psychological measures for assessment of NVLD included the Wechsler Scales, Wide Range Assessment of Memory and Learning, and Wechsler Individual Achievement Test. Neuropsychological measures included the Category Test, Trails A and B, the Tactual Performance Test, Grooved Pegs, and the Speech Sounds Perception Test. Neuropsychological test scores of the NVLD+APD and NVLD groups were compared using analysis of covariance procedures, with Verbal IQ and Performance IQ as covariates. **RESULTS:** *Sixty-one percent of the children were diagnosed with APD, primarily in the tolerance-fading memory subtype. The group of children with APD and NVLD had significantly lower scores on Verbal IQ, Digit Span, Sentence Memory, Block Design, and Speech Sounds Perception than children without APD. An ancillary finding was that the incidence of attention deficit/hyperactivity disorder was significantly higher in children with NVLD (with and without APD) than in the general population.* **CONCLUSION:** *The results indicate that children with NVLD are at risk for APD and that there are several indicators on neuropsychological assessment suggestive of APD. Collaborative, interdisciplinary evaluation of children with learning disorders is needed in order to provide effective therapeutic interventions.*

PMID: 17182875 [PubMed - indexed for MEDLINE]

Auditory processing disorders, verbal disfluency, and learning difficulties: a case study.

Jutras B, Lagacé J, Lavigne A, Boissonneault A, Lavoie C. *Int J Audiol.* 2007 Jan;46(1):31-8.

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This case study reports the findings of auditory behavioral and electrophysiological measures performed on a graduate student (identified as LN) presenting verbal disfluency and learning difficulties. Results of behavioral audiological testing documented the presence of auditory processing disorders, particularly temporal processing and binaural integration. Electrophysiological test results, including middle latency, late latency and cognitive potentials, revealed that LN's central auditory system processes acoustic stimuli differently to a reference group with normal hearing.

PMID: 17365053 [PubMed - indexed for MEDLINE]

Auditory processing disorder and brain pathology in a preterm child with learning disabilities.

Iliadou V, Bamiou DE, Kaprinis S, Kandylis D, Vlaikidis N, Apalla K, Psifidis A, Psillas G, St Kaprinis G. *J Am Acad Audiol.* 2008 Jul-Aug;19(7):557-63.

Clinical Psychoacoustics Laboratory, Neuroscience Division, 3rd Psychiatric Department, AHEPA Hospital, Aristotle University of Thessaloniki, Greece. viliad@auth.gr

BACKGROUND: *Auditory processing disorders involve deficits in the processing of information in the auditory domain that are not due to higher order language, cognitive or other related factors.*
PURPOSE: To evaluate the possibility of structural brain abnormalities in preterm children manifesting as auditory processing disorders. **RESEARCH DESIGN:** A case report of a young girl, preterm at birth, with language difficulties, learning problems at school, and additional listening problems. **RESULTS:** *A diagnosis of a central auditory processing disorder was made on the basis of severe deficits in three nonspeech temporal tests (the frequency and duration pattern and the random gap detection tests). Her brain MRI revealed large porencephalic cysts and thinning of the corpus callosum.*
CONCLUSIONS: *The observed auditory deficits would be compatible with a pressure effect of the cysts at a brainstem or higher level for the random gap detection test, and with the thinning of the corpus callosum for the pattern tests, the latter requiring interhemispheric transfer of information. The case highlights that preterm children with learning difficulties may suffer from an auditory processing disorder, in the presence of structural brain abnormalities that are due to birth and neonatal complications.*

PMID: 19248732 [PubMed - indexed for MEDLINE]

Depresión

Efectos de la terapia antidepresiva en el proceso auditivo en pacientes severamente deprimidos: Un estudio combinado de espectroscopia de resonancia magnética y magnetoencefalografía.

FUENTE: JOURNAL OF PSYCHIATRIC RESEARCH. 2006 JUN;40(4)

Melanie Tollkötter, Bettina Pfliederer, Peter Sörös and Nikolaus Michael.

Resumen

Antecedentes: Pueden observarse en pacientes severamente deprimidos alteraciones en el metabolismo del cerebro, así como en la función en diversas áreas de éste.

Métodos: El presente estudio combinó la espectroscopia de resonancia magnética (1H E-RM n =16; controles sanos n = 27) y la magnetoencefalografía (MEG, n=17, controles n=18) de la corteza auditiva izquierda en pacientes hospitalizados severamente deprimidos antes y después de una terapia antidepresiva exitosa. Para las MEG, los pacientes fueron estimulados con una serie de 4 vocales sucesivas o de 4 tonos, respectivamente. Para cada uno de los 4 estímulos, se calculó la amplitud y el status latente del N1m. Como medida de habituación, se calculó la disminución de las amplitudes individuales del segundo, tercer y cuarto N1m, comparado al primer N1m.

Resultados: *Antes de la terapia, un subconjunto de pacientes presentó un proceso auditivo claramente disfuncional hacia los estímulos (faltando el distinto de N1m1 y de la habituación subsecuente; 5 de 17 pacientes (vocales) y 9 de 17 (tonos, respectivamente)). Después del tratamiento, comparado a los controles, se observó un patrón de habituación normalizado en todos los pacientes para las vocales, pero no para los tonos. En contraste, el E-RM no reveló ninguna diferencia significativa entre las concentraciones del metabolismo de los pacientes y los controles sanos en ambas medidas.*

Conclusión: *La depresión puede estar acompañada por el proceso auditivo dañado, el cual parece mejorar con la reducción de síntomas depresivos. La disfunción cortical auditiva refleja probablemente solo una parte de las disfunciones más extensas del cerebro que ocurren con trastornos severos del estado de ánimo.*

Para acceder al texto completo consulte las características de suscripción de la fuente original www.sciencedirect.com/science/journal/00223956

Serotonin dysfunction and suicide attempts in major depressives: an auditory event-related potential study.

Chen TJ, Yu YW, Chen MC, Wang SY, Tsai SJ, Lee TW. Kai-Suan Psychiatric Hospital, Kaohsiung, Taiwan, ROC.

BACKGROUND: *Serotonergic dysfunction is believed to be involved in suicide attempts. The loudness-dependent auditory evoked potential (LDAEP) is one of the validated indicators of the activity of the central serotonin system in humans.* **OBJECTIVES:** This study was designed to investigate possible differences in the LDAEP and P300 between those depressed patients who attempted suicide and those who did not. **METHODS:** The LDAEP and P300 levels were recorded for 66 depressive patients (among which 16 had attempted suicide). **RESULTS:** *Those who had attempted suicide showed a sharper slope of the LDAEP and increased frontal P300 amplitude. A high correlation between the LDAEP and P300, and a gender difference were also noted.* **Conclusions:** *Our results are concordant with previous assumptions about serotonin dysfunction in depressives who attempt suicide.* Copyright 2005 S. Karger AG, Basel

PMID: 15942261 [PubMed - indexed for MEDLINE]

Ansiedad

Increased whole-body auditory startle reflex and autonomic reactivity in children with anxiety disorders.

Bakker MJ, Tijssen MA, van der Meer JN, Koelman JH, Boer F. J Psychiatry Neurosci. 2009 Jul;34(4):314-22.

Department of Neurology and Clinical Neurophysiology, Academic Medical Centre, University of Amsterdam, The Netherlands.

BACKGROUND: *Young patients with anxiety disorders are thought to have a hypersensitive fear system, including alterations of the early sensorimotor processing of threatening information. However, there is equivocal support in auditory blink response studies for an enlarged auditory startle reflex (ASR) in such patients.* We sought to investigate the ASR measured over multiple muscles (whole-body) in children and adolescents with anxiety disorders. **METHODS:** Between August and December 2006, we assessed ASRs (elicited by 8 consecutive tones of 104 dB, interstimulus interval of about 2 min) in 25 patients and 25 matched controls using a case-control design and in 9 nonaffected siblings. We recorded the electromyographic activity of 6 muscles and the sympathetic skin response. We investigated response occurrence (probability %) and response magnitude (area under the curve in microV x ms) of the combined response of 6 muscles and of the single blink response. **RESULTS:** In patients (17 girls, mean age 12 years; 13 social phobia, 9 generalized anxiety, 3 other), the combined response probability ($p = 0.027$) of all muscles, the combined area under the curve of all muscles ($p = 0.011$) and the sympathetic skin response ($p = 0.006$) were enlarged compared with matched controls. The response probability ($p = 0.48$) and area under the curve ($p = 0.07$) of the blink response were normal in patients compared with controls. The ASR pattern was normal with normal latencies in patients compared with controls. In nonaffected siblings, the sympathetic skin response ($p = 0.038$), but not the combined response probability of all muscles ($p = 0.15$), was enlarged compared with controls. **LIMITATIONS:** Limitations are the sample size and restricted comparison to the psychophysiological ASR paradigm. **CONCLUSION:** The results point toward a hypersensitive central nervous system (fear system), including early sensorimotor processing alterations and autonomic hyperreactivity. *The multiple muscle (whole-body) ASR is suggested to be a better tool to detect ASR abnormalities in patients with anxiety disorders than the blink response alone. Abnormalities in ASR serve as a candidate endophenotype of anxiety disorders.*

PMID: 19568483 [PubMed - indexed for MEDLINE]

PMCID: 2702449

Disfemia

Alteración auditiva en la disfluencia verbal revelada con potenciales evocados

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La tartamudez es un trastorno del habla de inicio gradual y de etiología no del todo conocida. Estudios recientes evidencian una anatomía cortical anómala en áreas auditivas y procesos disfuncionales en las regiones perisilvianas del lenguaje, sugiriendo una alteración en la función auditiva. Probamos esta hipótesis con potenciales evocados (PE) mediante una batería de evaluación de la representación del sonido, basada en el potencial de disparidad (MMN). Se contrastaron varias condiciones: sonidos simples, abstractos y fonemas.

Siete sujetos disfluentes ($x = 21,8$ años) y ocho controles emparejados en edad, género y educación, recibieron las secuencias auditivas mientras miraban una película sin voz con instrucciones de ignorar los sonidos. Se hallaron diferencias entre grupos en el contraste de frecuencia (CF) y en el abstracto (CA). En CF se presentaron cuatro tonos discrepantes ($p=0,005$; $D1=1015$ Hz, $D2=1030$ Hz, $D3=1060$, $D4=1090$ Hz) aleatoriamente entre tonos estándar (1000Hz, $p=0,8$). En CA, se presentaban parejas de tonos con relación de frecuencia ascendente (en diez niveles diferentes), caracterizándose el estímulo discrepante por una razón de frecuencia entre los estímulos del par mayor que en los estándar. En el CF, se obtuvo para D4 una MMN similar en ambos grupos, aunque su latencia fue mucho mayor en los disfluentes (Fz ; $t_{(13)}=-2,74$ $p<0,02$). En CA, los fluentes generaron una clara MMN, ésta no se observó en los disfluentes, revelando el ANOVA diferencias marginalmente significativas en MMN ($F_{(1,12)}=3,78$, $p<0,08$). Estos resultados sugieren una representación neuronal del sonido difusa, pudiendo subyacer al déficit articulatorio en la disfluencia verbal.

Disfasia

Attenuated auditory event-related potential (mismatch negativity) in children with developmental dysphasia.

Holopainen IE, Korpilahti P, Juottonen K, Lang H, Sillanpää M. *Neuropediatrics*. 1997 Oct;28(5):253-6.

Department of Pediatric Neurology, University Hospital of Turku, Finland.

An attention-independent negative wave-form termed 'mismatch negativity' (MMN) of the auditory event-related potentials (ERPs) was studied in ten children (3-6 years) with developmental dysphasia and in fourteen control children (3-7 years) with normal speech and language development. The MMNs were elicited with pure sine tone stimuli using the oddball paradigm. The peak latency and peak amplitude of MMN response to frequency (500/553 Hz) difference was measured. The grand average amplitude of frequency MMN was significantly attenuated in dysphasic children as compared to controls, but no significant difference was observed in the latency of peak frequency MMN. *The results indicate that dysphasic children have a defect in automatic auditory processing of frequency differences. Because the MMN response reflects central auditory processing and is modal specific for auditory stimuli we argue that the MMN method can serve as an objective tool to assess central auditory deficits in children.*

PMID: 9413003 [PubMed - indexed for MEDLINE]

Cortical auditory evoked potentials in children with developmental dysphasia.

Dlouhá O. Prague Med Rep. 2008;109(4):305-14.

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Like all auditory evoked potentials, the cortical auditory evoked potentials are nonspecific for the disease, but they provide information about the auditory system function. It appears that the cortical auditory potentials can be used to study the disorders of speech comprehension and their pathology is related to the role of the temporal processing of the auditory stimuli. Cortical auditory potentials were studied in children with developmental dysphasia (DD) to examine maturation of the central auditory pathways. Study 1 (group of 6-7 yr. old children with DD): the responses to verbal stimuli (P3 waves) were recorded with prolonged latencies from the left dominant hemisphere. Study 2: the latencies of P2 waves (to tonal stimuli) were being shortened within age-comparison of groups of 6-7 and 9-10 yr. old children with DD. Great variability in P2 and P3 latencies, and their prolongation, compared to normal healthy children, reflects functional changes in the central hearing function. *Latency differences may be related to a common temporal deficit to be one of the possible underlying factors in developmental dysphasia. The underlying phenomenon may be connected to cortical auditory processing.*

PMID: 19537681 [PubMed - indexed for MEDLINE]

A longitudinal study of children with developmental dysphasia.

Dlouhá O. Prague Med Rep. 2007;108(4):324-32.

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This study reports longitudinal follow-up of 300 children with developmental dysphasia. Their expressive disturbances are a manifestation of their auditory decoding impairment. These children were investigated on battery of tests of spoken language, of phonological processing and of different audiometric procedures, in order to register all the information necessary to be able judge the speech-language development. *The tests focused on diagnosis of central auditory disorder, confirmed the difficulties in association area in children with developmental dysphasia. In speech perception, the temporal processing is one of the functions necessary for the discrimination of phonemes, and of similar words. Our results confirmed long-term problems of children with developmental dysphasia with central auditory perception disorder.*

PMID: 18780644 [PubMed - indexed for MEDLINE]

Autismo

Similarities in the phenotype of the auditory neural substrate in children with Asperger syndrome and their parents.

E Jansson-Verkasalo; T Kujala; K Jussila; M L Mattila; I Moilanen; R Näätänen; K Suominen; P Korpilahti.

The European journal of neuroscience. Eur J Neurosci. 2005 Aug;22(4):986-90

Asperger syndrome (AS) is a developmental disorder of brain function characterized by deficits in social interaction including difficulties in understanding emotional expressions. Children with AS share some of the behavioural characteristics with their parents and AS seems to run particularly in the male members of the same families. The aim of the present study was to determine whether similarities could be found between children with AS and their parents at central auditory processing. It was found that in children with AS the sound encoding, as reflected by the exogenous components of event-related potentials, was similarly abnormal as in both their mothers and fathers. However, their abnormal cortical auditory discrimination, as indexed by the prolonged latency of the mismatch negativity, resembled that of their fathers but not that of their mothers. The present results suggest that complex genetic mechanisms may contribute to auditory abnormalities encountered in children with AS

Pre-attentive auditory sensory processing in autistic spectrum disorder. Are electromagnetic measurements telling us a coherent story?

Seri S, Pisani F, Thai JN, Cerquiglini A. Int J Psychophysiol. 2007 Feb;63(2):159-63. Epub 2006 Jun 6.

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Sensory processing is a crucial underpinning of the development of social cognition, a function which is compromised in variable degree in patients with pervasive developmental disorders (PDD). In this manuscript, we review some of the most recent and relevant contributions, which have looked at auditory sensory processing derangement in PDD. The variability in the clinical characteristics of the samples studied so far, in terms of severity of the associated cognitive deficits and associated limited compliance, underlying aetiology and demographic features makes a univocal interpretation arduous. We hypothesise that, in patients with severe mental deficits, the presence of impaired auditory sensory memory as expressed by the mismatch negativity could be a non-specific indicator of more diffuse cortical deficits rather than causally related to the clinical symptomatology. More consistent findings seem to emerge from studies on less severely impaired patients, in whom increased pitch perception has been interpreted as an indicator of increased local processing, probably as compensatory mechanism for the lack of global processing (central coherence). This latter hypothesis seems extremely attractive and future trials in larger cohorts of patients, possibly standardising the characteristics of the stimuli are a much-needed development. Finally, specificity of the role of the auditory derangement as opposed to other sensory channels needs to be assessed more systematically using multimodal stimuli in the same patient group.

PMID: 16757049 [PubMed - indexed for MEDLINE]

Electrophysiologic assessment of central auditory processing by auditory brainstem responses in children with autism spectrum disorders.

Kwon S, Kim J, Choe BH, Ko C, Park S. J Korean Med Sci. 2007 Aug;22(4):656-9.

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In addition to aberrant features in the speech, children with Autism Spectrum Disorder (ASD) may present unusual responses to sensory stimuli, especially to auditory stimuli. We investigated the auditory ability of children with ASD by using Auditory Brainstem Responses (ABR) as they can directly judge both hearing status and the integrity of auditory brainstem pathways. One hundred twenty-one children (71: ASD; M 58/ F 13, mean age; 41.8 months, 50: control group; M 41/ F 9, mean age; 38 months) were included in the study. As compared with the values in the control group, the latency of wave V, wave I-V, and wave III-V inter-peak latencies were significantly prolonged ($p < 0.05$) in the ASD group. The findings indicate that children with ASD have a dysfunction or immaturity of the central auditory nervous system. We suggest any children with prolonged III-V inter-peak latencies, especially high functioning children should be further evaluated for central auditory processing to set up a more appropriate treatment plan.

PMID: 17728505 [PubMed - indexed for MEDLINE]

Hiperacusia

Mechanisms and management of hyperacusis (decreased sound tolerance)

Herráiz C, Plaza G, Aparicio JM. Acta Otorrinolaringol Esp. 2006 Oct;57(8):373-7.

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Hyperacusis is a decreased sound tolerance. Prevalence of the disease is described in 9-15% of the population, but this percentage increases among the tinnitus patients. Pathophysiological mechanisms involve some disruptions in the amplification and regulation processes of the external hair cells or affect the central sound processing at the subcortical level. The role of the serotonin, also involved in other diseases related with hyperacusis (migraine, depression), can be crucial in this disorder. Other theories confirm the effect of the endorphins that activate the excitatory function of the glutamate, the auditory neurotransmitter, increasing its toxicity. The activation of the limbic and autonomic nervous systems produces the emotional reaction of the hyperacusis (anxiety, fear and depression). Proposed treatments are based on acoustic stimulation by a progressive introduction of sound (tinnitus retraining therapy TRT). Noise generators and hearing aids can be fitted in severe cases. The role of some drugs involved in the metabolism of the serotonin open new approaches for the management of hyperacusis.

PMID: 17117696 [PubMed - indexed for MEDLINE]

PPAC en mayores de 65 años

Desórdenes del Procesamiento Central Auditivo en mayores de 65 años

Bellis (2002), afirma que en los Desórdenes de Procesamiento Central Auditivo se puede presentar un compromiso de la sensibilidad auditiva periférica, ya que en los adultos que consultan por dificultades auditivas, aumenta la sospecha de desorden de procesamiento central auditivo al no corresponder la dificultad auditiva presentada por el individuo con el grado de pérdida auditiva periférica y en los test de desempeño dicótico se han visto afectados por el proceso de envejecimiento en el sistema auditivo, observando que los adultos presentan mayor dificultad para el desempeño de tareas que involucren discriminación del lenguaje en ruido de fondo con respecto a la población joven.

La reciente evidencia indica que las pruebas de procesamiento auditivo central ayudan a explicar por qué algunos adultos mayores no se sienten bien con amplificación binaural. Por otro lado, los hallazgos de estas pruebas pueden apoyar la necesidad de proporcionar amplificación binaural para retardar el deterioro de habilidades de procesamiento auditivo central en el paciente por envejecimiento.

<http://www.auditio.com/revista/index.php3?articulo=32>

Acúfenos

Investigation of functional hemispheric asymmetry of language in tinnitus sufferers.

Cuny C, Chéry-Croze S, Bougeant JC, Koenig O. *Neuropsychology*. 2004 Apr;18(2):384-92.

Neurosciences et Systemes Sensoriels, Institut Federatif des Neurosciences de Lyon, Centre National de la Recherche Scientifique, Claude Bernard University, Lyon, France.

The authors tested functional hemispheric asymmetry through word dichotic listening and lateralized lexical decision tasks in tinnitus patients and controls stimulated by a continuous tinnitus-like noise to test the influence of a tinnitus-like external stimulation. A classic right-ear advantage was shown in the auditory task for all but right-ear tinnitus patients, who performed as equally badly when the stimuli were presented to the right and left ears. Concerning the visual task, all participants demonstrated the expected right visual field advantage for word stimuli. Moreover, those who submitted to external stimulation demonstrated normal asymmetric patterns. *These data suggest a specific effect of tinnitus on central processing and provide evidence for a functional reorganization induced by this auditory phantom perception.*

PMID: 15099161 [PubMed - indexed for MEDLINE]

Esquizofrenia

ERP Study of Pre-Attentive Auditory Processing in Treatment-Refractory Schizophrenia

Event-related potential (ERP) studies have demonstrated impaired auditory sensory processing in patients with schizophrenia, as reflected in abnormal mismatch negativity (MMN). We sought to extend this finding by evaluating MMN in 13 treatment-refractory patients with schizophrenia, and 14 age- and gender-matched healthy controls. Subjects responded to infrequent visual stimulation while ignoring binaurally presented auditory tones. The amplitude and topographical pattern of the MMN were analyzed. The control group presented the expected reduction in the amplitude of the MMN from frontal to central and parietal locations. In comparison, the MMN amplitude was not reduced in the treatment-refractory patients, and was largest at the central-posterior electrode location.

In addition, patients displayed larger negativities at left frontal, and left- and right-temporal electrode locations than the control subjects. These findings are consistent with pre-attentive abnormalities in treatment-refractory patients with schizophrenia.

http://www.eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_ERICExtSearch_SearchValue_0=EJ730606&ERICExtSearch_SearchType_0=eric_accno&accno=EJ730606

EEG coherence measures during auditory hallucinations in schizophrenia

Anusha Sritharan, Per Line, Alex Sergejew, Richard Silberstein, Gary Egan and David Copolov. Mental Health Research Institute, Locked Bag 11, Parkville, Victoria 3052, Australia. Brain Sciences Institute, Hawthorn, Victoria, Australia. Howard Florey Institute, Centre for Neuroscience.

Received 6 September 2004; revised 20 April 2005; accepted 5 May 2005.

We studied the change in EEG alpha-band average coherence between auditory hallucination (AH) and non-auditory hallucination (non-AH) states in seven auditory hallucinating schizophrenia patients.

Four cortical regions were considered based on the existing dominant models for auditory hallucinations, the inner speech model and the central auditory processing deficit (CAPD) model.

Coherences between electrodes located over Broca's area (BA 44/45) and Wernicke's area (BA 22/42) and between electrodes located over left-right temporal cortices were examined. There was no significant change observed in the coherence between Broca's and Wernicke's areas, but a significant increase was observed in coherence between the left and right superior temporal cortices during AHs compared with non-AHs, suggesting increased bilateral coherence between auditory cortical areas.

Since coherence is a pairwise measure of functional correlation between regions, our findings suggest abnormally increased synchrony between the left and right auditory cortices during AHs in schizophrenia. Further, a significant increase in relative power was observed in the left, but not in the right auditory cortex during AHs. Thus our findings support the CAPD model and are consistent with that which postulate reduced prosodic processing during AHs.

Central auditory processing in schizophrenia

Prosjektsammendrag:

Auditory hallucinations represent a key symptom in schizophrenia, which severely disables the patient. "Hearing voices" in the absence of an external acoustic source is a form of speech mis-perception. In a psychotic episode, the voices heard are "inside the head", whereas the "person speaking" is localized "outside of the head". Since speech perception activates the left upper posterior part of the temporal lobe, a case could be made that auditory hallucinations are related to disturbance of speech perception, lateralized to the left temporal lobe.

Lateralization of speech perception to the left temporal lobe can be studied experimentally in a dichotic listening (DL) paradigm. We predict that frequency of auditory hallucinations will go together with reduction or abolishment of a right-ear advantage in DL situation, accompanied by reduced neuronal activation in the vicinity of the STG/STS areas in the left hemisphere, as measured with fMRI. We further predict that patients with schizophrenia will lack the ability to cognitively modulate processing of a speech signal by focused attention. This should be accompanied by reduced neuronal activation bilaterally in a fronto-parietal cortical network.

In a second series of studies, we will study structural MR imaging, focused on grey matter volume reductions in the same areas. i.e. STG/STS areas. *We predict that the reduction in neuronal activation in the fMRI studies will be accompanied by a corresponding loss of grey matter volume, and that this will be positively related to illness duration, i.e. suggesting a degenerative component in schizophrenia.* First episode and chronic patients will be recruited from the BMH-Center. Hallucinations will be scored from the PANSS scale. Control subjects will be age, sex and education matched.

The project group predicts that frequency of auditory hallucinations will go together with reduction or abolishment of a right-ear advantage in DL situation, accompanied by reduced neuronal activation in the vicinity of the STG/STS areas in the left hemisphere, as measured with fMRI.

The project group further predicts that patients with schizophrenia will lack the ability to cognitively modulate processing of a speech signal by focused attention. This should be accompanied by reduced neuronal activation bilaterally in a fronto-parietal cortical network.

<http://dbh.nsd.uib.no/nfi/rapport/?keys=29494&language=no>

Altered parallel auditory processing in schizophrenia patients.

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Patients with schizophrenia have impaired auditory processing that has been demonstrated by diminished P50 response to paired auditory stimuli in event-related potential (ERP) studies. Cerebral processing can also be studied with magnetoencephalography (MEG). With a whole-head MEG, which enables one to simultaneously measure brain activity in both hemispheres, we investigated whether early parallel auditory processing is impaired in schizophrenia.

Sequences of tones were monaurally presented to schizophrenia patients and healthy controls in a passive condition, and the event-related magnetic fields were recorded simultaneously over both auditory cortices. *The interhemispheric latency difference of the P50m, but not that of the N100m, was significantly shorter in the patient group in the right-ear but not in the left-ear stimulus condition. Further, the ipsilateral P50m was significantly earlier in schizophrenia patients in the right-ear condition. This result suggests that schizophrenia affects the consecutive preconscious auditory processing in a different manner.*

PMID: 10478792 [PubMed - indexed for MEDLINE]

Central auditory dysfunction in schizophrenia as revealed by the mismatch negativity (MMN) and its magnetic equivalent MMNm: a review.

Nääätänen R, Kähkönen S. *Int J Neuropsychopharmacol.* 2009 Feb;12(1):125-35. Epub 2008 Sep 4.

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Since the early 1990s, the auditory change-detection response, mismatch negativity (MMN) and its magnetoencephalographic (MEG) equivalent MMNm have been applied in a large number of studies on schizophrenia. These studies have enhanced our understanding of the central auditory dysfunction underlying schizophrenia. The attenuation of the MMN amplitude is a systematic and robust neurophysiological finding in these patients. The gradual attenuation of the MMN amplitude resulting from frequency change reflects the progress of the disease, particularly the impairment occurring as a function of illness duration, whereas the MMN deficiency for duration change may be more closely linked to the genetic aspect of the illness. Electroencephalographic (EEG) and magnetoencephalographic (MEG) studies, together, suggest that both the temporal and frontal cortices contributing to MMN generation are affected in schizophrenia patients. Furthermore, abnormalities in auditory perception and discrimination revealed by a deficient temporal MMN generator process might be associated with patients' positive symptoms, whereas the dampened frontal attention-switching function, suggested by the attenuated responses of the frontal MMN generator, might contribute to the negative symptoms such as social withdrawal. In addition, gradual MMN amplitude reduction, in particular that for frequency change, reflects cognitive and functional impairment occurring as a function of illness duration. Finally, as MMN can be detected even in animals such as the mouse, it might provide a useful biomarker for assessing the effects of the drugs developed to fight the cognitive and functional impairments in schizophrenia patients.

PMID: 18771603 [PubMed - indexed for MEDLINE]

Event-related potential abnormalities in schizophrenia: a failure to "gate in" salient information?

Brenner CA, Kieffaber PD, Clementz BA, Johannesen JK, Shekhar A, O'Donnell BF, Hetrick WP. *Schizophr Res.* 2009 Sep;113(2-3):332-8. Epub 2009 Jul 23.

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Sensory gating refers to the central nervous system's ability to filter sensory inputs, and can be measured by comparing the suppression of event-related brain potential (ERP) amplitudes in a paired auditory stimulus procedure. *Poor gating scores in schizophrenia may be caused by abnormal responses to the first (S1), the second (S2) or both of the paired stimuli.* However, since S1 and S2 responses may index separate psychological phenomenon, corresponding to the ability to "gate in" and "gate out" sensory stimuli respectively, the precise mechanism affected in schizophrenia remains unclear. To examine the extent to which saliency processing abnormalities may contribute to S1 response deficits, standard and rare (15% probability) paired stimuli were presented to 21 participants with schizophrenia and 22 healthy controls. P50 and N100 ERP amplitude as well as low, beta and gamma frequency power were measured to examine the time course and relative contributions of oscillatory activity affecting auditory processing in schizophrenia. In this study, schizophrenia patients exhibited less evoked beta 1 power (12-20 Hz) in response to salient stimuli at S1, and lower N100 amplitude in response to all S1 stimuli. No group differences were found in the low, beta 2 (20-30 Hz), or gamma frequency ranges. *These findings suggest aberrant sensory processing during stages of stimulus evaluation and saliency detection in schizophrenia.*

PMID: 19628376 [PubMed - indexed for MEDLINE]

Alzheimer

Impaired preconscious auditory processing and cognitive functions in Alzheimer's disease.

Pekkonen E, Jääskeläinen IP, Hietanen M, Huotilainen M, Näätänen R, Ilmoniemi RJ, Erkinjuntti T. Clin Neurophysiol. 1999 Nov;110(11):1942-7.

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OBJECTIVE: To study whether preconscious auditory processing is deteriorated in patients with Alzheimer's disease (AD) having mild to moderate cognitive symptoms. To investigate whether auditory processing correlates with the impairment of the higher cortical functions. **METHODS:** P50m and N100m responses elicited by a sequence of repetitive tones were recorded with a whole-head magnetometer from 22 patients with probable AD and from 18 healthy age-matched controls. In addition, an extensive neuropsychological test battery assessing main cognitive domains was administered to all subjects. **RESULTS:** *The patients with AD had significantly delayed N100m responses in the left hemisphere that correlated with the impairment of the language functions.* **CONCLUSIONS:** *N100m auditory responses measured with magnetoencephalography may be useful in evaluating the severity and progression of the cortical dysfunction in dementia.*

PMID: 10576491 [PubMed - indexed for MEDLINE]

Mismatch negativity in aging and in Alzheimer's and Parkinson's diseases.

Pekkonen E. Audiol Neurootol. 2000 May-Aug;5(3-4):216-24.

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Mismatch negativity (MMN) is an auditory event-related potential (ERP) that reflects automatic stimulus discrimination in the human auditory system. By varying the interstimulus intervals (ISIs), the MMN can be used as an index of auditory sensory memory. This paper focuses on MMN findings in aging and in Alzheimer's (AD) and Parkinson's diseases (PD). The accumulated data suggest that MMN to duration deviance, unlike MMN to frequency deviance, is reduced in amplitude in aging at short ISIs. The attenuated MMN to frequency deviance observed at long ISIs in elderly subjects seems to be caused by age-related memory trace decay. Existing results suggest that automatic discrimination for the frequency change is not affected in the early phase of AD, whereas the memory trace seems to decay faster in AD patients. The present findings on PD are not as conclusive, although they tentatively suggest deteriorated automatic change detection. The MMN appears to offer an objective tool for studying auditory processing and memory trace decay in different neurological disorders. Copyright 2000 S. Karger AG, Basel

PMID: 10859416 [PubMed - indexed for MEDLINE]

Clinical psychoacoustics in Alzheimer's disease central auditory processing disorders and speech deterioration.

Iliadou V, Kaprinis S. Ann Gen Hosp Psychiatry. 2003 Dec 22;2(1):12.

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BACKGROUND: *Difficulty in speech understanding in the presence of background noise or competing auditory signals is typically present in central auditory processing disorders. These disorders may be diagnosed in Alzheimer's disease as a result of degeneration in the central auditory system. In addition perception and processing of speech may be affected.* **MATERIAL AND METHODS:** *A MEDLINE research was conducted in order to answer the question whether there is a central auditory processing disorder involved in Alzheimer's disease. A second question to be investigated was what, if any is the connection, between central auditory processing disorders and speech deterioration?* Articles were retrieved from the Medline to find relevance of Alzheimer's disease with central auditory processing disorders, they summed up to 34. Twelve papers were studied that contained testing for CAPD through psychoacoustic investigation. An additional search using the keywords 'speech production' and 'AD' produced a result of 33 articles, of them 14 are thoroughly discussed in this review as they have references concerning CAPD. The rest do not contain any relevant information on the central auditory system. **RESULTS:** *Psychoacoustic tests reveal significantly lower scores in patients with Alzheimer's disease compared with normal subjects. Tests concerning sound localization and perception of tones as well as phoneme discrimination and tonal memory reveal deficits in Alzheimer's disease. Central auditory processing disorders may exist several years before the onset of clinical diagnosis of Alzheimer's disease. Segmental characteristics of speech are normal. Deficits exist concerning the supra-segmental components of speech.* **CONCLUSIONS:** *Central auditory processing disorders have been found in many cases when patients with Alzheimer's disease are tested. They may present as an early manifestation of Alzheimer's disease, preceding the disease by a minimum of 5 and a maximum of 10 years. During these years changes in the central auditory system, starting in the temporal lobe, may produce deficits in speech processing and production as hearing and speech are highly connected human functions. Another theory may be that spread of degeneration of the central nervous system has as a consequence, speech deterioration. Further research and central auditory processing disorders testing in the elderly population are needed to validate one theory over the other.*

PMID: 14690547 [PubMed - as supplied by publisher]

Síndrome de Down

Relationships between hearing and auditory cognition in Down syndrome youth

Marcell MM. Relationships between hearing and auditory cognition in Down syndrome youth. *Down Syndrome Research and Practice*. 1995;3(3);75-91.

Twenty-six adolescents and young adults with Down syndrome and 26 IQ- and CA-matched youth with other causes of intellectual impairment (comparison group) repeated a battery of audiological and auditory-cognitive tests on three annual assessments. Audiological tests revealed the following differences between the group with Down syndrome and the comparison group: a) *Poorer acuity and longitudinal declines at each frequency from 250-8000 Hz for the group with Down syndrome*, particularly at the highest frequencies; b) A tendency for the middle ear problems of Down syndrome individuals to be bilateral, chronic, and to reflect no mobility, retraction, or reduced mobility of the tympanic membrane; and c) *Poorer reception and discrimination of speech in the group with Down syndrome*. Correlational analyses revealed the following reliable relationships between performance on audiological and auditory-cognitive tests: a) *individuals with Down syndrome who had lower speech discrimination scores, poorer acoustic reflexes, or bilaterally impaired tympanograms repeated spoken sentences less accurately*; b) *individuals with Down syndrome who had lower speech discrimination scores performed more poorly on a language comprehension task*; and c) *individuals with Down syndrome with impaired hearing (regardless of how it was measured) identified fewer spoken words when the words were rapidly followed by a masking noise or made discriminable by brief consonant sounds*. It was suggested that *poorer performance by hearing-impaired subjects with Down syndrome on auditory-cognitive tasks may have been due to an interaction of lower auditory acuity and slower processing speed*. Also, because relationships between hearing and cognitive variables were not present in the comparison group, it was tentatively suggested that hearing loss may be more detrimental to cognitive abilities in intellectually impaired individuals with Down syndrome.

<http://www.down-syndrome.org/reports/54/>

Impaired verbal short-term memory in Down syndrome reflects a capacity limitation rather than atypically rapid forgetting.

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Individuals with Down syndrome suffer from relatively poor verbal short-term memory. Recent work has indicated that this deficit is not caused by problems of audition, speech, or articulatory rehearsal within the phonological loop component of Baddeley and Hitch's working memory model. Given this, two experiments were conducted to investigate whether abnormally rapid decay underlies the deficit. In a first experiment, we attempted to vary the time available for decay using a modified serial recall procedure that had both verbal and visuospatial conditions. No evidence was found to suggest that forgetting is abnormally rapid in phonological memory in Down syndrome, but a *selective phonological*

memory deficit was indicated. A second experiment further investigated possible problems of decay in phonological memory, restricted to item information. *The results indicated that individuals with Down syndrome do not show atypically rapid item forgetting from phonological memory but may have a limited-capacity verbal short-term memory system.*

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Delayed auditory processing underlying stimulus detection in Down syndrome

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Down syndrome (DS) is characterized by intellectual disability and development of dementia that are attributed to similar neuropathological features as observed in Alzheimer's disease (AD). *The aim of this study was to investigate whether DS patients have similar impairment of preattentive auditory processing as observed in AD.* Sinusoidal tones were presented to DS patients and healthy controls, and evoked auditory evoked fields (AEF) were measured with a whole-head magnetoencephalography (MEG) system. *Patients with DS had significantly delayed and attenuated N100m, and delayed but not attenuated P50m responses over both hemispheres. Present results indicate that preattentive auditory processing underlying stimulus detection is impaired in DS.* Given that anticholinergic drugs modulate AEFs, degeneration of cholinergic system in DS could contribute to the damaged auditory processing.

Cerebro

Neural plasticity following auditory training in children with learning problems.

Hayes EA, Warrier CM, Nicol TG, Zecker SG, Kraus N. Clin Neurophysiol. 2003 Apr;114(4):673-84. Northwestern University, 2299 N. Campus Drive, Evanston, IL 60208, USA. e-hayes@northwestern.edu <e-hayes@northwestern.edu>

OBJECTIVE: *This study examined the plasticity of the central auditory pathway and accompanying cognitive changes in children with learning problems.* **METHODS:** Children diagnosed with a learning disability and/or attention deficit disorder worked with commercial auditory processing training software for 8 weeks; control groups consisted of normal-learning and learning-impaired children who did not participate in any remedial programs. Auditory brainstem function was evaluated in response to click and speech stimuli in quiet; cortical responses to speech stimuli were obtained in quiet and noise. Academic achievement and cognitive abilities were assessed with standardized measures. **RESULTS:** *Compared to controls, the trained group improved on measures of auditory processing and exhibited changes in cortical responses in quiet and in noise.* In quiet, cortical responses reflected an accelerated maturational pattern; in background noise, cortical responses became more resistant to degradation. Brainstem responses did not change with training. **CONCLUSIONS:** *Children with learning problems who practiced with auditory training software exhibited plasticity of neural encoding of speech sounds at the cortical, but not subcortical, level of the auditory pathway. This plasticity was accompanied by improvement in behavioral performance.* **SIGNIFICANCE:** *This study demonstrates that in learning-impaired children working with commercial auditory processing training programs affects both the perception and the cortical representation of sound.*

PMID: 12686276 [PubMed - indexed for MEDLINE]

Hemispheric lateralization of bilaterally presented homologous visual and auditory stimuli in normal adults, normal children, and children with central auditory dysfunction.

Bellis TJ, Billiet C, Ross J. *Brain Cogn.* 2008 Apr;66(3):280-9. Epub 2007 Oct 24.

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Two experiments were conducted to examine the performance of normal adults, normal children, and children diagnosed with central auditory dysfunction presumed to involve the interhemispheric pathways on a dichotic digits test in common clinical use for the diagnosis of central auditory processing disorder (CAPD) and its corresponding visual analog. Results of the first experiment revealed a significant right ear advantage (REA) for the dichotic listening task and a left-visual-field advantage (LVFA) for the corresponding visual analog in normal adults and children. In the second experiment, results revealed a significantly larger REA in the children with CAPD as compared to the normal children. Results also revealed a reversed cerebral asymmetry (RVFA) for the children with CAPD on the visual task. Significant cross-modal correlations suggest that the two tasks may reflect, at least in part, similar interhemispheric processing mechanisms in children. Findings are discussed in relation to differential diagnosis and modality-specificity of CAPD.

PMID: 17950968 [PubMed - indexed for MEDLINE]

Tests

Psychoacoustic tests for central auditory processing: normative data.

Shemesh R. *Basic Clin Physiol Pharmacol.* 2008;19(3-4):249-59. *HNO.* 2008 Jun;56(6):638-44.

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The comprehension of spoken language is based on the analysis of complex acoustic signals by the central auditory system, direct relationships between gradual, spectrotemporal modifications of speech sounds and the impairment of the comprehension of such altered sounds have been found in many psychophysical studies. Thus, it is reasonable to assume that deficits in the understanding of speech seen in patients with acquired brain lesions may, to a certain degree, result from impaired central processing of acoustic signals. We report normative data collected from 94 young normal-hearing subjects on a battery of psychoacoustic tests designed to evaluate signal processing at different levels of the central auditory system. Monaural pure tone thresholds were used to evaluate the performance of peripheral hearing. The integrity of auditory brainstem processing was evaluated by quantifying masking level difference (MLD) values and gap detection (GD) thresholds. Three monaural speech tests (time-compressed speech [CS], filtered speech [FS] and speech in noise [SIN]) were conducted to evaluate the processing of distorted speech materials by cortical auditory processing mechanisms. Evaluating performance of naïve, young normal-hearing subjects, as we did here, is indispensable for (a) evaluating the effectiveness of potential tests, (b) evaluating their suitability for the examination of patients, and (c) the revision and further development of central auditory tests.

PMID: 19025035 [PubMed - indexed for MEDLINE]

Varios

Prolonged P300 latency in eating disorders.

Otagaki Y, Tohoda Y, Osada M, Horiguchi J, Yamawaki S. *Neuropsychobiology*. 1998;37(1):5-9.

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This study investigated event-related potential (ERP) indices of information-processing in eating disorders. ERPs during an auditory two-tone discrimination task were recorded at midline at 3 sites in 28 anorexic patients, 12 low-weight bulimic patients (body mass index (BMI) under 17.5), 12 normal-weight bulimic patients (BMI over 17.5), and 40 control subjects. The P300 latency was significantly prolonged at all sites in both bulimic groups compared with that in controls, and at frontal and central electrode sites in anorexics. In contrast, the P300 amplitude did not differ between these groups at any site. The prolonged P300 latency in eating disorders suggests a task-related slowing of perceptual decisions that reflects their cognitive impairment.

PMID: 9438266 [PubMed - indexed for MEDLINE]