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Central Auditory Processing Functions in Learning Disabled Children: Electrophysiological and Behavioral Study

Thesis

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Abstract

BACKGROUND: There is a high prevalence of auditory processing disorders in children diagnosed with learning disability; the deficits identified determine the appropriate management. So it is important to identify any auditory processing disorders in this population for optimum interventions so as not to compromise their learning process.

OBJECTIVE: To assess central auditory processing functions in children with learning disability through electrophysiological and behavioral testing, and to correlate between electrophysiological and behavioral test battery in learning disabled children.

SUBJECTS AND METHODS: The present study comprised 60 normal hearing children of both genders. Cases included 30 learning disabled children and the controls included 30 healthy children. Each group was further subdivided into three subgroups according to the age: Subgroup a: age ranging from 6-8 years, Subgroup b: age ranging > 8-10 years, Subgroup c: age ranging >10-12 years. All subjects were submitted to full history taking, otologic examination, basic audiological evaluation, central auditory processing testing and speech-ABR testing.

RESULTS: This study showed that the prevalence of CAPD in children with LD was 80 %. There were a statistically significant difference between the cases and controls regarding all the central tests except the LPFT and the youngest subgroup regarding the SPIN test. All LD children showed statistically significant delayed latencies of waves V, A and F in both ears in all tested subgroups, compared to their controls. Concerning the amplitude of the waves, there was statistically significant diminished amplitude of wave F in all tested subgroups in both ears when compared to their controls. In addition to a statistically significant decreased amplitudes of waves D and E in 6-8 years subgroup and waves C and D in 8-10 years subgroup. Wave F was the most common wave to correlate with the behavioral central tests especially SPIN, DDT and PPS tests, followed by wave E.

CONCLUSION: The high prevalence of auditory processing disorders in children diagnosed with learning disability suggests that central auditory processing disorder can be an underlying etiology for learning disability. Speech evoked response parameters were highly correlated with most of psychophysical tests in LD children, so it is a valuable tool in testing young children who are too young to perform the psychophysical test battery.

KEYWORDS: Learning disability, central auditory processing disorders, Speech evoked auditory brain stem response.

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List of Abbreviations

ABR	Auditory brainstem response
ADHD	Attention-deficit hyperactivity disorder
AFT-R	Auditory fusion test–Revised
CANS	Central auditory nervous system
CAP	Central auditory processing
CAPD	Central auditory processing disorders
CAS	Central auditory system
CD	Compact discs
CLD	Cultural learning disability
CTOPP	Comprehensive test of phonological processing
CV	Consonant vowel
DDT	Dichotic digit test
DSM IV	Diagnostic and statistical manual of mental disorder 4th edition.
FFR	Frequency-following response
GDRT II	Gray's diagnostic reading tests–2nd edition
GORT IV	Gray oral reading test IV – Fourth edition
ICD 10	International classification of disease (version 2010).
IEP	Individual education plan
IPI	Inter pulse interval
IQ	Intelligence quotient
LD	learning disability
LP	learning problems
LPFT	Low pass filtered speech test

NJCLD	National joint committee on learning disabilities
NL	Normal-learning
PIQ	Performance IQ
PPS	Pitch pattern sequence test
PPD	Pitch pattern discrimination
PTA	Pure tone audiometry
RTI	Response to intervention
SES	Socioeconomic status
SLD	Specific learning disabilities
SPIN	Speech intelligibility in noise test
SRT	Speech reception threshold
TORCS	Tests of oral reading and comprehension skills
TORCS-3	Test of reading comprehension 3
TOWRE	Test of word reading efficiency
TIQ	Total IQ
VIQ	Verbal IQ
WIAT II	Wechsler individual achievement test II
WRAT III	Wide range achievement test III
WJ III	Woodcock-Johnson III

Introduction

Learning Disabilities (LD) are chronic difficulties in learning to read, write, spell, or calculate, which are believed to have a neurological origin. Though their causes and nature are still not fully understood, it is widely agreed that the presence of a learning disability does not indicate subnormal intelligence. Rather it is thought that the learning-disabled have a neurologically based difficulty in processing language or figures, which must be compensated for with special learning strategies or with extra effort and tutoring. Examples of learning disabilities include difficulty in reading (dyslexia), writing (dysgraphia), and mathematics (dyscalculia) **(Wright and Digby, 1996; Pandit, 2006).**

LD is associated with a variety of behavioral signs including oral language, reading, and writing deficits. These three domains require a common facility with speech sounds, whether realized as auditory processing, phonological decoding, or sound symbol translation. Therefore, the auditory processing capabilities of individuals with LD deserve scrutiny **(Norrix et al., 2006).**

Prevalence of auditory processing disorder in children diagnosed with LD is estimated to be as high as 30–50% **(King et al., 2002; Ramus, 2003).** Learning Disabilities are diagnosed when a subject's achievement on individually administered standardized tests in reading, mathematics or written expression is substantially below (defined as a discrepancy of more than 2 standard deviations from the mean) that expected for age, schooling and level of intelligence **(Iliadou et al., 2009).**