THE AUDITORY PROCESSING IN THE SPECIFIC LANGUAGE IMPAIRMENT: A CASE REPORT

Mariana Sodário Cruz[1]
Daniela Polo Camargo da Silva[1]
Carolina Ferreira Campos[1]
Mariza Ribeiro Feniman[2]

[1]*Student, Course of Speech Therapy. School of Dentistry of Bauru – University of São Paulo*

[2]*Professor, Department of Speech Therapy. School of Dentistry of Bauru– University of São Paulo*

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ABSTRACT

The aim of this study was to verify the relation between the central auditory abilities and the development of the language under evaluation of the auditory processing, in an individual with specific language impairment. It was identified central auditory disorder in several abilities. It is conclude that auditory processing evaluation in these individuals is a fundamental clinic process for the complete diagnosis as well as its therapeutic program, and must be in the routine clinic evaluation for all this population.

KEY WORDS: disorder; language; auditory processing

INTRODUCTION

The development of normal language depend on many factors such as the environment, which should provide enough and correct models in a favorable emotional ambient in the initial steps of the individual life when organic systems are in the best phase to take

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advantage of stimulus. The combination of genetic characteristic, physical health, nutritional status, stimulation and affective ambient constitute the synthesis responsible for the quality and efficiency of the individual development of language (SPINELLI, 1983).

During the start of the process of language acquisition, the human body is immature from the neurological point of view and, facing stimulation from the environment, develops functions linked to the development of language allowing in this way the exercise of the speech system. Delay in this process of acquisition may be associated to a retard in the overall development or may be an isolated trace in the child's maturation process. However, in the specific language impairment (RICE et al., 1995; LEONARD, 1998) one or more of the skills that constitute language could either not be manifest or could be done so slowly, leading to disturb or distortion of the normal pattern (SYDER, 1997).

Many children show language impairment that cannot be explained by a deficit of sensorial perception, limitation of intellectual capacity, invasive disturbs of development or clear cerebral damage. The persistence of the alteration also cannot be justified by interactional and affective factors. Language difficulties in these children arise as they grow up (HAGE, 2000).

For the adequate codification and decodification of environmental stimulus it is basic that the hearing abilities be enough developed since hearing is the main way for acquisition and development of speech and language. Among the hearing abilities involved in this process there are sound localization, sequential hearing memory, selective attention, discrimination and figure-background perception, among others, that are essential to an adequate interpretation of the sound stimulus (ASHA, 1996).

The auditive system analyses speech sounds identifying language phonemes. If the auditive perception is impaired, possibly there will be language and/or communication problems.

The maturation of the central nervous system (CNS) occurs in the first years of life and this period has been considered as the critical period for the development of hearing. Deviations in this route may provoke future alterations in the language and learning that may even be worsened when associated to low social and cultural levels and to a reduced experience of audition and language. Physical condition of children whenever impaired by disease, mainly middle ear otitis with reduction of hearing, may also interfere in the perception of the acoustic stimulus (AZEVEDO et al., 1995).

Reports in the literature confirm that children with language problems have also problems with one or more hearing abilities

(CRUZ; PEREIRA, 1996; CARMO, 1998; MENDONÇA et al 2002). Due to this reason children with disturbance of the hearing process are not stimulated showing difficulties in the school and, in contact with normal classmates, are regarded as "loosers".

Another important fact is that children with symptoms compatible with specific disturbance of speech development and a normal tonal audiometry usually shows dysfunction in the hearing process at any level. According to Lemos (1999) these children show some delay in automatizing new sounds and may show some dysfunction in two or more perceptive modalities. The same author also reported a greater occurrence of articulatory disturbs and deficit in the hearing process among males.

In a program for speech therapy intervention the evaluation of the hearing abilities helps not only in the diagnosis but also in the follow-up of the therapeutics. The early identification of a disorder of the hearing process, associated with an adequate verbal hearing training, permit to minimize or even to prevent such communication disturbances from occuring in the future. This, in brief, is an efficient way of prevention.

There are reports in the literature of many therapeutic techniques such as the specific training of hearing abilities following the hierarchy that establishes four levels of increasing complexity: detection (ability to respond to the presence or absence of a sound), discrimination (ability to perceive similarities and differences among verbal sounds), recognition (ability to identify the verbal stimulus) and understanding (ability to understand the meaning of speech while answering to questions, following instruction, paraphraseating and participating in the conversation); each step has an internal grade of increasing difficulty (AZEVEDO; PEREIRA, 1997). There are other alternatives for rehabilitation, such as the adaption of techniques inside an acoustic cabin using special hearing tests. This training is a facilitator in the auditory development and it is believed that it may lead to modification in the functional aspects of the nervous system when the individual experiences a situation of sensorial stimulation (PINHEIRO et al, 2002).

From the bibliographic references, the aim of this study is to establish if the deficit in the central auditory abilities has any relations with the development of language in all its aspects in an individual diagnosed with specific language impairment.

CASE REPORT

This is a case report on the central auditory aspects of one individual carrying a specific language impairment as previously diagnosed at the Phono audiology Clinic at FOB-USP.

RMS, male, 8 years old, regular elementary public school student. Referred to the Phono Audiology Clinic at FOB-USP in April 2001 with suspicion of showing hearing deficit. In August 2000, during anamnesis, the father could not precise any information of the clinical problem of his son and the diagnosis was made without familiar input. After starting the therapeutic process (August 2002) his mother gave more information about the child. She reported that her son showed speech problems since he was 3 years old that jeopardize speech understanding and comprehension by family members. She also reported that, by the time of the interview, the son's speech was quite understandable although some alteration was still present. She mentioned in addition that her son is restless and does not pay attention to things, leading to problems in school. In this regard, the main complaint was related to reading and writing. The patient was showing difficulties in mastering these processes.

Regarding the anamnesis data it is interesting to point out that the mother used alcohol beverages during pregnancy, underwent physical stress and tell over her belly, report anemia around the 7th month and use of drugs to delay delivery.

The father has problems in the intelligibility of speech, reporting that showed some delay to acquire oral language.

The linguistic development of the patient reveals that he spoke for the first time at 2 years of age and stopped speaking when he was 3 years old, using than gestual language. For this reason he was referred to a psychologist which gave some orientation and stimulated oral language. The patient was in a nursery when he was 3 years and started learning to read and to write at the age 6.

From the past evaluation we stress the follwing:

April, 2001 (nursery-training in preventive speech therapy – FOB/USP): alteration in the syntactic, semantic, pragmatic, narrative discourse, cognitive aspects, perceptual process and graphic communication levels. Dropping of syllables while speaking, which has compromised intelligibility.

October, 2001 (speech therapy clinics – FOB/USP): language alteration in the pragmatic (narrative discourse), morpho-syntactic, lexical-semantic, phonetic and phonologic aspects, showing an inferior stage considering what could be expected from his age. Vocal alteration in what regards resonance (hyper nasality) and alteration

of the perceptual process regarding audibilization (memory, discrimination, analysis-synthesis and rhythm). No alterations where noted regarding hearing, comprehension, stomatognatic functions and fluency.

In what regards the phonologic aspect, the most common alteration were delay mainly those related to dropping of phonemes and syllables and the deviant phonologic disturb. There was also semi vocalization, anteriorization, posteriorization and reduplication, but no excessive.

Taking into consideration the results of the psychological and phono audiologic evaluation and the interview with parents, a hypothesis of specific language disturb was raised.

August, 2002 (Clinic of speech therapy – FOB-USP, reading and writing): the child is in the pre-syllabic period, showing great influence of the nominal realism.

The process of auditory evaluation, earlier reported, consisted in the application of a questionnaire targeted in the family (FISCHER, 1976) with questions pertinent to the study in what refers to the auditory history and in the application of central auditory tests.

The tests were selected considering the age range and the development of hearing and language: diotic tests, monotic tests and dichotic tests conducted with verbal and non-verbal stimulus send to the individual by means of a two channel audiometer linked to a CD player and using an acoustic cabin.

The diotic tests are those where the equal stimuli are presented simultaneously to both ears (PEREIRA; SCHOCHAT, 1997).

Auditory localization test in five directions (right, let, behind, above and in front).

Test for memory to verbal and non-verbal sounds in sequence.

The Auditory Fusion Test Revised – AFT-R (MCCROSCKEY; KEITH, 1996) is a procedure to measure the ability for temporal processing determining the duration (in ms) in which the individual can detect short interval of silence between two sounds and to report if he/she heard one or two sounds.

The monotic tests are those in which different stimuli are presented simultaneously in the same ear, ipsilateraly:

Test of words and phrases with ipsilateral competing message – PSI in Portuguese. The verbal stimuli used in the application of PSI are 10 phrases that should be identified through the indication of figures that represents the situation of the sentence. The competing message is a children's history.

The dichotic tests are those tests in which different stimuli are presented simultaneously in both ears.

Dichotic test with non-verbal competing sounds. We used six ambient sounds (thunder, church bell, slapping door, mewing of a cat, a barking dog and singing cock) that should be identified trough the indication of the figures they represent. These sounds were combined among them and synchronized in time in order to compose 12 pairs. It has also three stages of attention, such as the dichotic consonant-vowels test.

Test of words and phrases with a contralateral competing message – PSI in Portuguese.

The Dichotic Digits Test proposed by Santo and Pereira (1997). It is constituted by 12 pairs of digits that represent disyllables in the Portuguese language. This test evaluates the ability to group components of the acoustic signal in a background figure and to identify it, as well as the inter-hemispheric communication in the callous corpus.

Initially, the child received verbal instructions. Only after he understood the task the test was presented to him using a 2-channel audiometer with stimuli presented in a CD.

Results were classified according to the that follows score:

Diotic tests:

Auditory localization test in five directions: it is expected that the individual cold localize at least 4 out of the 5 proposed directions.

Test of memory for verbal sounds: it is expected to answer correctly 3 out of the 3 presented sequences.

Test of memory for non-verbal sounds in sequence: it is expected to answer correctly at least 3 out of the 4 presented sequences, respectively.

Auditory Fusion Test Revised (AFT-R): to children over 7 years = 8ms (SD=3).

Monotic Tests:

Test of Words and Phrases with ipsilateral competing message – PSI in Portuguese

F/R= 0 ≥80% of correct answers
F/R= -10 ≥70% of correct answers
F/R= -15 ≥60% of correct answers

Dichotic Tests:

Dichotic test for non-verbal competing sounds – from 8 years of age:

Binaural separation RE=LE= 12 correct answers (up to one wrong answer)

Test of words and phrases with contra lateral competing message – PSI in Portuguese.

F/R= -40 >90% of correct answers

Dichotic test with digits

Dichotic task F/R= 0

Binaural integration for children ranging from 7 to 8 years old.

RE = 85% of correct answers

LE = 82% of correct answers

RESULTS

1 – FISCHER questionnaire (Appendix) as applied to parents regardins risk factor for disorders of the auditory process:

non marked items = 2 x 4 = 8

2- Report of the Test for Auditory Processing

Conventional audiologic evaluation: pure tone audiometry and immittance test. Results shows air conduction threshold within the normal standards and a normal function of the middle ear with present contra and ispilateral reflexes.

Central Auditory Function: the following special tests were employed,

Sound Sequentialization Test (organization category) – *instruments sounds* that evaluate the auditory ability for sequential sounds, showed result with no alteration since the patient has identified correctly two out of three sequences of four sounds in three attempts.

Sound Sequentialization Test (organization category) –*verbal sounds* that evaluate the auditory ability for sequential sounds, showed result with no alteration since the patient identified correctly two sequences of three syllables in three attempts.

Test of sound localization (decodification category) – which evaluates the temporal resolution, showed abnormal result since the threshold of ascending fusion was 66ms and he did not presented descendent fusion threshold.

Pediatric speech intelligibility test – PSI in Portuguese (codification category) that evaluates the auditory ability for background figure and for association of auditory and visual stimuli showed alteration in the ipsilateral competing condition for both ears and without alteration in the contra lateral competing condition for both ears.

For the dichotic task;

F/R= -40 -100% of correct answers for RE and LE
For the monotic task:
F/R = 0 -70% for RE
F/R = -10 - 50% for LE

Dichotic test for digits (decodification and organization categories), which evaluates the ability of background figure for linguistic sounds, showed alteration.

Binaural integration = correct answers:
RE: 78.78% LE: 23.75%

Dichotic test with non-verbal competing sounds (codification category), that evaluates the dichotic processing for non-linguistic sounds, showed alteration.

Free attention - RE: 12 LE: 9
Right attention- RE: 10 LE: 10
Left attention - RE: 10 LE: 5

From the analyzes of the questionnaire and the special test it is identified the presence of a disorder of the auditory processing with alteration in the ability of temporal resolution, background-figure perception, association of visual and auditory stimuli, background-figure perception for linguistic sounds, binaural integration and dichotic processing for non linguistic sounds.

DISCUSSION

In the present case there is alteration in the abilities for temporal resolution. According to the literature, speakers have an elaborated system of temporal control, controlling both the specific duration of each speech element and the connection among them. This control depends on the neurological maturation, anatomic functional characteristics of the speech articulators and of the linguistic code. The temporal factors should be respected in order that the speech unit, the syllable, can be analyzed. An alteration in the temporal perception could lead to severe compromise in the understanding of speech from the listeners to and also to difficulties to the analyzis of the enunciate.

Another alteration deserving note was the difficulty of the background-figure perception in which is included the ability to understand speech in presence of noise, for example. This finding reflects those of Mendonça et al. (2002) who concluded that chil-

dren with complaints regarding speech delay and incompatible articulatory changes need additional care for the development of abilities of background-figure and auditory closing. They also suggested that these children should be stimulated as early as possible in order to achieve an adequate development of these abilities resulting in less compromise of the language.

The dichotic test with digits, with abnormal results, if compromised that the right ear may lead to problem in the understanding of verbal messages with difficulties in the differentiation of speech sounds, accentuation, word intonation and rhythm. When the alteration is present in the answers to the left ear the implication in speech understanding can be problems in the analyses of the speech affective emotional contents that may have implications in the understanding of jokes, double-sense words and inferences. Since the patients presented altered answers for both ears and that in the phono audiologic evaluation conducted in 2001 there was speech alteration, including the pragmatic aspect, the present findings could be correlated and the clinical situation is consisted with the expected out of the result of the central auditory tests.

Difficulties associated to visual and auditory stimuli, found in the auditory processing evaluation, confirm the phono audiologic evaluation conducted in August 2002 when it was proved the nascence of phoneme-grapheme relation. This alteration can be characterized by the difficulty to perform tasks that requires the inter hemispheric communication. The problem can lie in one or more modalities and/or in their crossing relation. This factor may explain the patients' difficulty to reading and writing learning, which was beneath the expectations for his age.

Finding in the evaluation of this case stress the studies by Lemos (1999) in which most of the children with alteration in the processing showed symptoms compatible with specific disturb of the development of speech. The author also stressed that these children with normal pure tone audiometry showed behavior of an auditory deficient person, which was the first diagnostic suspicion for the case in this report. Once discharged this hypothesis, its was confirmed the alteration for auditory abilities adequantity the patient's performance with the diagnosis.

From these results and the available literature it was proposed an intervention with the aim of developing central auditory abilities in order to allow patients to become aware of the phonologic process involved in the production of oral language. The intervention consisted of:

- Working in the recognition and identification of stimuli

- Recognizing segmental traces (onomatopoeia, words with variable number of syllables, same length word with variable tonicity, a constant vowel with varying consonant according to the type, point and sonority).
- Activities for auditory memory
- Understanding speech (with ear lids and background noise)
- Stimulating the phonologic conscience

FINAL CONSIDERATION

The reported case leads to reflect whether the alterations in the auditory processing were related to each other, occurred concomitantly or could be one of the aspects responsible for the specific speech disturbance of this patient taking into consideration the difficulties in the auditory abilities and language performance. In any case, it is concluded that the evaluation of the auditory processing in children with Specific Language Disturbance is a clinical procedure to the complete diagnosis of such cases as well as for the therapeutic planning and should be included in the routine of clinical evaluation of this population.

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ANNEX

FISCHER'S QUESTIONNAIRE

Mark with an X each item observed in the child:

( ) story of hearing loss
( ) story of ear infection
(x) does not pay attention to instruction 50% of the time or more
(x) requently needs the instruction to be repeated
(x) Says "ah"? or "What?" at least five or more times a day

(x) Can not pay attention to an auditory stimulus for more than a few seconds

(x) Shows poor attention (If yes, mark the period below)

(x) 0-2’ ( ) 2-5’ ( ) 5-15’ ( ) 15-30’

(x) he/she daydreams

(x) he/she is easily entertained by background noise

(x) Shows difficulties with phonemes

(x) Shows problems with sound discrimination

(x) Shows problems to remind a heard sequence

(x) Forgets within a few second what was said

(x) Does not remind routine and daily life things

(x) Shows problems to remind what was heard last week, month or year

(x) Shows difficulty to follow auditory direction (localization)

(x) Frequently misunderstands what is said

(x) Does not understand most words and verbal concepts for the age and school level

(x) Shows slow answer to verbal stimulus

(x) Has language problems (morphology, syntax, vocabulary, phonologic)

(x) Shows articulation problems

(x) Does not correlated what was heard with what was seen

(x) Poor learning through the auditory channel

(x) Shows lack of motivation to learn

(x) His/her performance is below average in one or more areas.

Performance: 4% for each item not marked

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