

Hipersensibilidade auditiva no transtorno do espectro autístico ****

Auditory hypersensitivity in the autistic spectrum disorder

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Abstract

Background: auditory hypersensitivity in the autistic spectrum disorder has been described in the literature since the very first reports. However, this symptom has not been sufficiently explored, especially regarding possible causes, diagnosis and consequences. **Aim:** to study sensory-perceptual abnormalities in the autistic spectrum disorder, emphasizing auditory hypersensitivity and to discuss their effects in speech therapy based on the literature found until September 2007 in the following database: Scielo, Lilacs, Web of Science, and Medline. **Conclusion:** sensory-perceptual abnormalities are present in approximately 90% of individuals with autism; no theory has been found to explain this fact. Although the cause of auditory hypersensitivity remains unknown, it is the most common sensory-perceptual abnormality - its prevalence ranges between 15% to 100%. A few rare studies exist on behavioral, electroacoustic and electrophysiological hearing evaluation of autistic children; these studies discuss auditory hypersensitivity. The early diagnosis of this alteration is considered relevant for the possible identification of atypical sensorial markers, especially in hearing and for the better understanding of their impact on the development of communication in autistic individuals.

Key Words: Autistic Disorder; Hearing; Hypersensitivity; Sound.

Resumo

Tema: a hipersensibilidade auditiva no transtorno do espectro autístico é citada na literatura desde os primeiros relatos, contudo ainda é pouco explorada, principalmente em relação às causas, diagnóstico e consequências da mesma. **Objetivo:** abordar as anormalidades sensório-perceptuais no transtorno do espectro autístico, enfatizando a hipersensibilidade auditiva, e discutir as repercussões no âmbito fonoaudiológico, baseando-se em artigos indexados nas bases de dados Scielo, Lilacs, Web of Science e Medline até setembro de 2007. **Conclusão:** as anormalidades sensório-perceptuais acometem em torno de 90% dos autistas, entretanto não há uma única teoria que as expliquem. Do mesmo modo, não se conhece a causa da hipersensibilidade auditiva que é a mais comum delas, com uma prevalência que varia de 15% até 100%. Raros são os estudos sobre a avaliação comportamental, eletroacústica e eletrofisiológica da audição dos autistas que abordam a hipersensibilidade auditiva. Considera-se relevante o diagnóstico precoce dessa alteração, pois assim poder-se-á identificar os marcadores sensoriais atípicos, em especial no âmbito auditivo, e compreender melhor as relações do mesmo com o desenvolvimento da comunicação dos autistas.

Palavras-Chave: Transtorno Autístico; Audição; Hipersensibilidade; Som.

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Introduction

Since the first official relate of autism carried through by Kanner in 1943 until present, there are many controversies with regards to the conceptualization, the diagnosis and the therapeutic constraints. Currently, autism is defined as a Autistic Spectrum Disorder and characterized by the behavioral triad (deficit in communication; restricted and stereotyped interests; prejudice in social interaction), which are related in a dependent form, making reference to a continuum or a spectrum, with the presence of intermediate cases, that goes from the classic autism to less significant alterations that have language as a fundamental aspect¹. The prevalence of the Autistic Spectrum Disorder varies from 5 to up to 60 for each 10.000; however, in Brazil, there are no statistical data. The Autistic Spectrum Disorder prevalence is higher in boys, in the ratio of approximately 4:12.

The first descriptions of autistic children on literature, even before Kanner, already presented reference to the sensory-perceptual abnormalities, specially the sound. The hypersensitivity to sound is the sensorial modality more evidently altered in autism. The altered auditory neurophysiological mechanisms are discussed in literature however, with little approaching to their consequences³.

The present review article has the objective to deepen the knowledge of Speech-Language Pathologists and Audiologists on the topic of auditory hypersensitivity in individuals with Autistic Spectrum Disorder. The thematic of the sensory-perceptual abnormalities in autism was approached emphasizing the auditory hypersensitivity and arguing about the repercussions in the Speech-Language Pathology field. For such, a research of scientific literature indexed until September of 2007 on the databases MedLine, Web of Science, Scielo, Lilacs was conducted.

Research and literature review articles that approached the proposed topic were included. The following describers: autistic disorder, hearing, hypersensitivity and sound were used in the research.

Sensory-perceptual abnormalities

The theories concerning the sensory-perceptual abnormalities in autism differ in relation to the nature of the alteration (structural or functional), the affected modality (sensorial or cognitive), the involved processes (integration,

modulation among cortical areas, neural connectivity), although unanimous for the fact that the atypical sensorial processing is inherent to autism⁴.

The theories of the historical development of sensorial theories in autism were divided in the first review into: theories of super-stimulation and sub-stimulation (deficit in cerebral component; the reticular system influences the limbic system): the autistic individuals react more easily to sensory stimulation, as well as they fail or are slower accustoming to sensory stimulation; inconsistent theories (alteration in the systems that regulate the sensorial entrance): there is difficulty in recognizing the stimulations, because sometimes autistic individuals are excited and sometimes inhibited by the sensory stimulations; theories of the damaged linked processing (abnormalities of hippocampus and neuronal pathways): there is an imperfection on the information processing with context⁵.

It is important to highlight that the alteration in autism is paradoxical: at certain moments there is a lack of response or a insufficiency of the same (hyposensitivity or hyper-responsiveness); in other moments there is an exaggerated behavioral response (hypersensitivity or hyper-responsiveness)⁶⁻⁷. In this article the expressions hyposensitivity and hypersensitivity will be used.

The sensory-perceptual alterations can be presented in up to 90% of autistics, with prevalence for the auditory, visual and tactile hypersensitivity, as well as hyposensitivity to pain^{6,8-10}. In the only national study conducted, it was evidenced that 23.9% of the autistic subjects presented tactile and auditory hypersensitivity and the hyposensitivity to pain was present in 41.3% of the sample¹¹.

Auditory hypersensitivity

The auditory hypersensitivity can appear in three different forms in affected subjects:

- . hyperacusis (hyper = excess, akousis = hearing) - it occurs in individuals with normal hearing; abnormal sensitivity to sounds of low or moderate intensity, independently of frequency and are caused by an alteration in the central processing of sounds that brings discomfort sensation;
- . phonophobia - discomfort caused by some sounds, a factor related with its meaning or associations; pleasant sounds to the subject are tolerated even in high intensities; without hearing impairment and deriving from the increase of connections between the auditory and limbic

systems;

. auditory recruitment - associated with the peripheral neurosensorial hearing loss; it is caused by a reduction in the sensorial elements of the inner ear¹²⁻¹³.

The pathogenesis of hypersensitiveness to sound is not yet known. A variability of supposed causes exists. It is considered a mechanical disorder, providing alterations of auditory sensibility in the middle or inner ear, causing autistic individuals to listen in an inferior level, approaching abnormalities of auditory pathways up to alterations in the Central Nervous System. There are also authors who mention that hypersensitivity to sound occurs in the absence of auditory abnormalities, and approach the relations to social factors^{11,14-15}.

It is difficult to test autistic individuals for behavioral and social reasons, as well as for the inconsistency of responses answers. Giving these factors, there are few studies on behavioral and electroacoustic evaluation of auditory function in this population. In the past few years concomitantly with technological advances, the electrophysiological hearing evaluation of autistic individuals has received prominence. To follow, some studies that refer the prevalence of auditory hypersensitivity through other methods will be mentioned and following, studies concerning auditory evaluation related to the auditory hypersensitivity will also be presented.

The prevalence of auditory hypersensitivity in the autistic population varies depending on the criteria utilized and the procedures of research. In natural observation, that is, through clinical conditions for the event, the prevalence ranges from 15% to up to 40%. In studies using parent questionnaires, the prevalence ranges from 16% to up to 100%; studies using teacher questionnaires, the prevalence is around 30%; and studies using combined methods parents/teachers the prevalence is 23.9%^{6,8,11}.

The evaluating scales are also used to determine auditory hypersensitivity; on the other hand, the same ones do not propose such definition. Through the Diagnostic and Statistical Manual of Mental Disorders (DSM-III) the prevalence was 53%, using the Structured Interview for Assessing Perceptual Anomalies - Child Version (SIAPA-CV) the prevalence was 90% with sensibility alteration for the auditory modality and the prevalence was 45% in the auditory modality when using the Diagnostic Interview for Social and Communication Disorders (DISCO)¹⁶⁻¹⁸.

The mostly cited study in literature on autism and auditory behavior evaluated 199 autistic children and adolescents. Of these subjects, 18% presented normal auditory thresholds and auditory hypersensitivity with intolerance to click above 70dBnHL, when submitted to the Brainstem Audiometry. It is important to highlight that the subjects with neurosensorial alteration were excluded with the purpose to eliminate the auditory recruitment risk¹⁵.

There are studies that investigate the electrophysiological aspects of hearing in autism through the Brainstem Audiometry. However, studies that make reference to questions of auditory hypersensitivity are rare. In a study 1980s, the authors found an increase in latency time and variability in the brainstem evoked response; from the findings the authors related the electrophysiological alteration to the sensory-perceptual inconsistencies¹⁹. More recently, the electrophysiological evidence of the left frontal cortex dysfunction and the relation with hypersensitivity to sounds was demonstrated, inferring that in autistic individuals the latency is smaller and followed by a abnormal left frontal component²⁰.

Through two psychoacoustic tests (Discomfort Threshold and Categorical Loudness Scaling), the increase of the perception in autistic children and adolescents was demonstrated and quantified for the first time. The authors suggest that subjective measures could be used as routine to measure such abnormality in autistic individuals. According to the authors, auditory normality derives from central processing, assuming alterations on cortical levels. In relation to the auditory hypersensitivity using the Discomfort Threshold, 63% of the autistic individuals did not support stimulations above 80dB²¹. The same group of authors a few years earlier, utilized Otoacoustic Emissions to evaluate the mechanism of cochlear activity, demonstrating that there was a reduction of the amplitude with the age, which can correspond to auditory hypersensitivity reduction with age increase²².

In another study that presented the objective to describe the auditory characteristics of autistic children, the authors conducted diverse relations with sensitivity to sounds. After presenting the results where the autistic children had not differed from the control group in behavioral audiometry, research of acoustic reflex, Otoacoustic Emissions and Brainstem Audiometry, the authors argued about the necessity of more inquiries on the auditory characteristics of the autistic individuals,

especially involving sensitivity and perception to sounds. The authors suggested, at the same time, that the deficit in orientation and response to sounds is more related to attention than to sensorial processing²³.

A group of researchers, using the magnetoencefalography, suggests that the autistic individuals with abnormal responses to sounds fail in the pre-conscious stages of the cortical auditory discrimination. Disorders on cerebral areas as amygdala and hippocampus can influence the ability to process the sensory information correctly, as well as the memory²⁴.

Recently in Brazil, a study indicated that the autistic individuals do not present alterations on behavioral evaluations (audiometry) and electroacoustic (immittance measures) of the hearing. Instead, the autistic individuals would present cognitive alterations and alterations in the brainstem auditory evoked potentials. The study does not state the auditory hypersensitivity, however it suggests that there is a cortical alteration of the auditory pathway on brainstem and cortical regions²⁵.

In another study, also national, the objective was to verify whether the clinical behavior of auditory hypersensitivity of autistic individuals corresponded to the audiological findings. The results of that study showed that the behavioral manifestations to sounds are not associated to the hypersensitivity of auditory pathways, but instead are associated to the difficulties in superior processing, involving systems that are commonly compromised in individuals of the autistic spectrum, as the limbic system¹¹.

Repercussions to Speech-Language Pathology and Audiology

Recent study has approached the bases of sensorial abnormalities in autistic individuals and the neurophysiologic mechanisms, estimating that the sensorial functioning has been crucial in the autistic individuals development and considering that many of the sensorial dysfunctions can contribute for the poor social interaction^{4,9}.

In agreement with the displayed above, when inferring that the cerebellum is closely involved with sensorial function and cognition, a dysfunction of this structure is attributed to symptoms of the autistic spectrum as: restricted, repetitive and stereotyped profile of activities and

behaviors, attention and orientation alterations, abnormal response to the sounds, among others¹⁰.

The consequences of the sensorial abnormalities would be: attention and learning mechanisms less socially and more physically focused; alterations related to complex cognitive abilities; alterations in language development⁵. In a recent study, some authors had also correlated the sensorial abnormalities with attention, demonstrating that the fact of being very reactive is related to attention increase, and vice versa²⁶. The sensorial alterations are attributed to the imperfections of reception, discrimination and interpretation, and such alterations can present language consequences.

There are citations in literature^{3,7,15,22,27-28} regarding the relation between auditory abnormalities and communication deficits in autism, especially language development, even so it has not been found any specific study comparing autistic children language with the sensorial-perceptual abnormalities, specially with sound.

There are authors who suggest that auditory sensorial abnormality in older autistic children can take to impairments in development of complex cognitive abilities, as language. This is a cascade theory of development exploring that alterations in the simplest processes directly damage the development of most complex abilities. These authors suggest that the physiological findings in older autistic individuals represent not the preliminary deficit, but a marker of the advanced abnormal processes that were unchained during the development. They had also suggested that studies that try to identify preliminary abnormal processes in autism need to be conducted with younger children²⁸.

Correlation was not found when comparing the severity of the auditory disorder with the autistic symptomatology, considering the cognitive aspect of language in the same population²⁷; however, no comparison with the auditory hypersensitivity was carried through. Another group of authors, when correlating long latency auditory potential (temporal region) with the linguistic abilities, brought attention to the absence of relation between the temporal auditory responses and the auditory hypersensitivity, creating the hypothesis that the cortical pathways involved in cognitive and communicative processes differ from the ones involved in sensorial processes²⁹.

Conclusion

The sensory-perceptual abnormalities in autism are widely described in the literature; however there are still many controversies that surround the topic. In the studied material, some authors relate that the sensory-perceptual abnormalities would have to be part of the spectrum, since the prevalence is almost the total number of individuals. Amongst the main abnormalities, one gives credit that abnormality to the sound can be the one that generates more controversy. Many autistic children, at some moment in life, are diagnosed as deaf for not responding to the interlocutor; at the same time, they can respond to determined sounds as if the sounds were painful.

As described in this article, the cause of the hypersensitivity to sound is not known. Such fact is probably related to the difficulty in carrying through a trustworthy behavioral evaluation for autism. In recent years, in contrast to what was presented in older diagnosis form of abnormalities to sounds, many studies evaluating the auditory function in autism have been found, however still with little reference to the hypersensitivity topic.

Another equally important and controversial point is the consequence of hypersensitivity to sound mainly in the communicative and social aspect. One knows that the auditory function exerts a fundamental profile in acquisition and development of language for every individual; however, there is no consensus whether the characteristic of hypersensitivity to the presented sound in some autistic children has influence on their language.

At the end, it is agreed with the authors who emphasize that the sensory-motor in autism deserve special attention. Even so the sensorial alterations are registered in the clinical scope, there is a deficit concerning this topic in literature. This could contribute for the diagnosis and, consequently, to a more precocious treatment³⁰. The same authors also cite that there is a necessity in understanding how the central and peripheral auditory process occurs in autistic individuals, as well as in identifying the atypical sensorial markers in the development, mainly in order to better understand the communicative behavior (verbal and non-verbal) of these individuals.

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