

Perda auditiva leve: desempenho no Teste da Habilidade de Atenção Auditiva Sustentada*****

Mild hearing loss: performance in the Sustained Auditory Attention Ability Test

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Abstract

Background: hearing loss during childhood is considered a risk factor for developmental delay. Aim: to verify the performance of children diagnosed with mild hearing loss, conductive and sensorineural, in the Sustained Auditory Attention Ability Test (SAAAT). The purpose of the study was to verify if the test is influenced by the presence of hearing impairment. Method: a clinical study of the SAAAT considering three groups: Group 1 (G1) control group composed by children with normal hearing, Group 2 (G2) composed by children with mild bilateral sensorineural hearing loss and Group 3 (G3), composed by children with mild bilateral conductive hearing loss. Participants were children with ages between 7 and 11 years; 30 children in each group. A prospective study. Interventions: Pure Tone Audiometry, Acoustic Imittance Measures and SAAAT. Result: children with sensorineural and conductive hearing loss presented a lower performance in all of the SAAT results when compared to the control group. Conclusion: the SAAAT was influenced by the presence of mild hearing impairment, considering that the greatest influence was observed in the presence of sensorineural hearing loss.

Key Words: Attention; Hearing Loss; Sensorineural; Hearing Loss; Conductive.

Resumo

Tema: a perda auditiva na infância é um fator de risco para o atraso no desenvolvimento. Objetivo: verificar o desempenho de crianças diagnosticadas com perda auditiva de grau leve - condutiva e sensorineural, no Teste da Habilidade de Atenção Auditiva Sustentada (THAAS), visando constatar se este teste sofre influência da presença de uma perda auditiva. Método: estudo clínico do THAAS em 3 grupos: Grupo 1 (G1) grupo controle formado por crianças com audição normal, Grupo 2 (G2) crianças com deficiência auditiva sensorineural bilateral de grau leve e Grupo 3 (G3) composto por crianças com perda auditiva condutiva bilateral de grau leve. Estudo prospectivo. Participantes: 90 crianças com idade entre 7 e 11 anos de idade, sendo 30 de cada grupo. Intervenções: Audiometria Tonal Limiar, Imitanciométrica e THAAS. Resultados: os grupos sensorineural e condutivo apresentaram desempenho inferior ao grupo controle em todas as respostas do THAAS. Conclusão: o THAAS sofreu influência das perdas auditivas de grau leve, condutivas e sensorineurais, sendo o pior comprometimento para perdas sensorineurais.

Palavras-Chave: Atenção; Perda Auditiva Neurosensorial; Perda Auditiva Condutiva.

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Introduction

Hearing loss in children is an important issue on public health. One out of one thousand or six thousand children are estimated to be born with hearing loss. At school age, mild conductive hearing loss is the most prevalent type 1. Mild to moderate hearing loss and short-term functional disorders, especially in a noisy environment are common in children with otitis media with effusion (OME). Studies^{3,4} report significant association between otitis media and attention ability. In a study⁵ on children with and without multiples episodes of recurrent bilateral otitis media they found important deficit in attention when these children were submitted to Dichotic listening Test. OME affects the ability to persist and focus on auditory events 6. However, other studies state long-term developmental effects of OME 7,8. Implications of conductive hearing loss and otitis media are less clear than those associated with sensorineural loss 9. Thus, language and academic deficits are stated in studies 10,11 on bilateral sensorineural hearing loss contrasting another study 12 that has not found any evidence.

Attention is a multimodal process¹³ and auditory attention is essential to process the appropriate information and learn new tasks. Among all kinds of auditory attention, there is the sustained auditory attention which enables an individual to persist, keep up and accomplish a task in a certain period of time¹⁴.

Given the important role of hearing in the development of speech, language, learning and auditory ability, it is imperative to develop a prospective study on the effect of hearing loss in the auditory attention of children. This study aims to examine the performance of children with mild hearing loss on the Sustained Auditory Attention Ability Test (SAAAT).

Method

This study was accomplished at the Hearing Health Section of a hospital specialized in hearing impairment, from February 2006 to March 2007. All Procedures and Free Consent Terms were approved by the Ethics Committee in Research – Protocol 101/2006.

60 children of both genders, with mild hearing loss were included in this study. Inclusion criteria consisted of children aged 7 to 11 years with sensorineural-conductive mild hearing loss. Exclusion criteria included: not presenting any syndrome or craniofacial anomaly, having

characteristics of hyperactivity and attention deficit, upper-airway infection and difficulty to understand the tests.

The group was divided into two subgroups: patients with sensorineural hearing loss (SN) and patients with conductive hearing loss (Cond.). Control group consisted of volunteer children, at the same age range without hearing impairment, that is, pure-tone hearing thresholds above 15 dBNA15.

Table 1 shows the distribution of the children according to age, gender and group.

Children answered a questionnaire aiming to analyze hearing health, auditory status and aspects related to attention and impulsivity. Otoscopy was performed by an otorinolaringologista. All children were submitted to Pure-tone Audiometry, Logoaudiometry and Imitancimetry, with an audiometer AD28 and phone TDH - 39 - ANSI, 1969 and imitancimeter AZ 7. Sustained auditory attention was assessed with the Sustained Auditory Attention Ability Test – SAAAT.

SAAAT¹⁶ consists of a sustained auditory attention test in which the child raises a hand every time he or she hears a target one syllable word, remaining focused on the task for a long time. By earphones the child listened to a list of a hundred one-syllable words containing 20 target words - “no”. This list was presented six times in a roll. Answers were registered at a specific protocol next to each word the child raises the hand. The test was performed at Acoustic Cabins with a CD player (Compact Player D-171, Sony) attached to a two-channel audiometer (Midimate 622-Madsen Eletronics), at 50 dBNS (deciBel sensation level), considering hearing thresholds average of 500, 1000 and 2000 Hz, for each ear, de maneira binaural e diótica.

TABLE 1. children's frequency according to group, age and gender. Distribuição de frequência das crianças segundo o grupo, a idade e o gênero.

Age	Groups					
	Control		Sensorineural		Conductive	
	Female	Male	Female	Male	Female	Male
7	2	4	5	2	3	1
8	6	3	4	2	5	2
9	3	3	3	3	2	5
10	4	4	4	6	5	7
11	0	1	0	1	0	0
Total	15	15	16	14	15	15

SAAAT performance was scored by counting the total number of errors and vigilance decrease.

The test is scored by counting the number of target words that were missed (errors of inattention) and the number of responses given when the target word “no” was not presented (errors of impulsivity).

Vigilance decrement was defined by the difference between the number of right answers to the target Word at the first time it was presented and the number of right answers after it was presented for six times.

Groups were compared firstly by a linear regression model considering: age, gender and group for each of the studied variables. Gender and age were not statistically significant ($p > 0.05$) thus, analysis was repeated by a variance analysis model considering only the group factor. Post-hoc comparisons were analyzed by Tukey correction.

Results

Table 2 was designed based on SAAAT outcomes showing the descriptive analysis for errors of impulsivity, inattention, total score and vigilance decrease of the three groups respectively in addition to the Variance Analysis (ANOVA) and the Tukey test for comparison.

Inattention and impulsivity errors and the total score of Contr and Cond groups were not significantly different ($p = 0,069$), ($p = 0,504$), ($p = 0,114$) respectively. However, there was significant difference ($p < 0,001$) between Contr and SN; SN and Cond ($p < 0,001$).

There was no significant difference between SN and Cond for Vigilance decrease ($p = 0,603$), although it was observed between Contr and SN ($p < 0,001$); Contr and Cond ($p < 0,001$).

TABLE 2. Description of impulsivity, inattention, total score and vigilance decrement of the three groups. Results of Variance Analysis (ANOVA) and the Tukey test.

Group	media	Dp	min.	mediana	max.	ANOVA	Tukey
Impulsivity	3	2,28	0	2	10	$p < 0,001^*$	Contr x SN: $p < 0,001^*$
Contr	3	2,28	0	2	10		Contr x SN: $p < 0,001^*$
Impulsivity	5,6	3,15	0	5,5	11	$p < 0,001^*$	SN x Cond: $p = 0,001^*$
SN	10	6,6	0	9,5	28		Contr x Cond: $p = 0,069$ ns
Impulsivity	13,7	9,38	0	13	36		Contr x Cond: $p = 0,504$ ns
Cond.	5,6	3,15	0	5,5	11		SN x Cond: $p = 0,001^*$
Inattention	7,7	5,69	0	5,5	23		Contr x SN: $p < 0,001^*$
Contr	4,7	4,9	0	2	19		Contr x SN: $p < 0,001^*$
Inattention	12,2	5,85	4	12	28	SN x Cond: $p < 0,001^*$	
SN	13,7	9,38	0	13	36	Contr x Cond: $p = 0,504$ ns	
Inattention	3,3	2,76	0	3	11	Contr x Cond: $p < 0,001^*$	

* - statistically significant difference ($p < 0.05$), ns – Statistically non-significant difference.

Discussion

At Table 1, gender and age, Contr. group and the groups with sensorineural (SN) and conductive hearing loss (Cond.) were assimilated so that results could be accurately compared. Once impulse control is developed earlier at girls 18, boys were expected to have poorer scores for impulsivity, however there was no significant difference

between genders, agreeing with other studies 16,19,20. Poorer scores for boys were found in another study, though 21. Results showed in this study agreed with previous studies in which there was no significant difference among all errors at SAAAT regarding gender. 16,20.

As for the groups with or without hearing loss, more impulsivity was found for the SN, followed by Cond. when compared to Contr. (Table 2). Thus, this study suggests that children with sensorineural and conductive hearing loss are more impulsive than those with normal hearing (Contr). No information associating impulsivity and hearing loss types was found in literature.

Children with SN and Cond had poorer scores and were statistically different regarding inattention errors when compared to Contr. Group. Inattention is found in children who have difficulty in lexical decoding, take a long time to process stimuli and completely miss the word or give a delayed answer. It makes the child miss or not register information in memory to process. This way, the child spends a long time doing homework assignments, trying to remember the missed information (inattention) and as a result information processing is delayed.

Literature states that children with conductive hearing loss present long periods of sensorial deprivation due to middle ear dysfunctions which affects attention ability, negatively interferes in structure and function of central auditory system and affects cognitive and language development, in addition to cause permanent hearing loss. However, OME long-term effects are still inconclusive. A 10-year prospective study contrasts the hypothesis of long-term damage in language.

SN and Cond. Groups (with hearing loss) showed more inattention than impulsivity, like the results for the group without hearing loss which agrees with literature. This important outcome points out the therapeutical process, since the reference to specific compensatory strategies depend on the kind of error made by the child. According to other authors, impulsively errors are a key factor to make a differentiated diagnosis of Auditory Processing Disorder or Auditory Processing Disorder and Attention Deficit and Hyperactivity Disorder.

Since the SAAAT total score is measured by the number of impulsively and inattention errors, it is relevant to state that its value and statistic

study are analogous to the scores for impulsivity and inattention. It demonstrates that children with conductive (Cond) and sensorineural (SN) hearing loss had poorer performance than those without it (Contr). Statistically significant difference between SN and Cond Groups was found, though. SN presented a mean score of 23.7, which is three times the number of errors of the Contr Group, and practically the Double of Cond (12.2). Thus, this study indicates that auditory attention is more seriously affected by sensorineural hearing loss than conductive, that, although the inconsistency at the sound reception had higher scores.

Vigilance decrement is the decrease in attention during the time on a task of attentional focus. As SAAAT is an auditory vigilance test, the results of this study indicate that hearing impaired children obtained significantly poorer scores (3.3 and 3.9, respectively) than those with normal hearing (0.5). It shows a deficit in sustained auditory attention when compared to the mean score obtained in previous studies normal hearing children. In which attention decay was smaller in children without Attention Deficit Hyperactivity Disorder (ADHD) if compared to children with ADHD during a vigilance task. que encontraram menor declínio na atenção de crianças sem déficit de atenção e hiperatividade, quando comparado ao das crianças com este déficit, durante uma tarefa de vigilância.

Given the significant differences among the studied groups, the SAAAT showed to be essential at the clinical routine and may be included at the speech pathology test battery and the follow assessment to hearing impaired. In addition, it might enable monitoring the therapeutic evolution of the child in hearing rehabilitation.

Conclusions

Children with conductive and sensorineural mild hearing loss had poorer performance at the SAAAT than the control group. The worst damage caused by sensorineural losses. Inattention, impulsively errors and sustained attention abilities were not affected by the age and gender in none of the groups.

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