

THE RELATIONSHIP BETWEEN THE LACK OF STAPEDIAL MUSCLE REFLEX AND THE PRESENCE OF (CENTRAL) AUDITORY PROCESSING DISORDERS

Relação entre ausência do reflexo do músculo estapédio e presença de distúrbios do processamento auditivo (central)

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ABSTRACT

Purpose: to characterize and relate the findings of the acoustic reflex of the stapedial muscle in individuals diagnosed with Auditory Processing Disorder. **Methods:** descriptive retrospective cross-sectional research submitted and approved by the Ethics in Research Committee, under protocol number 0047/11. The sample consisted of 83 individuals (57 males and 26 females), who showed abnormalities in auditory processing associated with the absence of acoustic reflex. **Results and Discussion:** the results showed that the frequencies which lack more in the acoustic reflex both in the ipsilateral and in contralateral research were 4000 Hz, 3000 Hz and 500 Hz, respectively for both, but without significant difference in the statistical analysis. Also, in both groups the auditory skills which presented more change frequency were the speech in noise and temporal ordering which called the attention to their number when compared to other skills without significant difference in the statistical analysis performed by the Fisher, chi-square and ANOVA tests. **Conclusion:** with shown results we can conclude that the nervous system structures for the central hearing are responsible for the bridge reflex system of the stapedial muscle, which also relate to the acoustic physiologic of the auditory skills which shows a possible relation to the lack of RA to the changes of the disorder of the (central) auditory processing

KEYWORDS: Acoustic Reflex; Hearing; Hearing Tests

■ INTRODUCTION

Currently, it is known that the acoustic reflex (RA) acts not only in the protection of the inner ear, but also in several processes. Due to the high complexity

of the neural mechanisms involved in the neural circuitry of the stapedial reflex arc, its functions also relate to the ability of sound localization, speech detection, the improved auditory attention and speech intelligibility, attenuation of the effect of environmental noise on speech understanding, as well as noise mitigation mastication and mandibular movements during speech.

The involuntary contraction of the stapedius muscle is the result to sound stimulation that occurs at a higher intensity between 70 to 90 dB of the individual hearing threshold. When such stimulation reaches the brainstem, the reflex arc is released and stimulates the facial nerve, which contracts the stapedius muscle, bilaterally.

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The presence of increasing values of the threshold and/or the absence of AR in individuals with auditory thresholds within normal limits, relates to complaints of speech comprehension in noisy environments and the ability to figure auditory background.

The structures responsible for the reflex arc mechanism are located in the brainstem, specifically in the superior olivary complex. Such structures also act on the physiological mechanisms of (central) auditory processing skills, which determine the interrelationship between changes in (central) auditory processing and the absence of AR.

The aim of this study was to characterize and relate the findings of the absence of acoustic stapedius reflex in individuals diagnosed with (central) auditory processing disorders, evaluated at the University of Franca Audiology Clinic.

■ METHODS

The present work it is a cross sectional, descriptive, retrospective study, submitted to and approved by the Ethics in Research Committee, under protocol n ° 0047/11. A selection was made of 149 patients' records that had been evaluated at the University of Franca Audiology Clinic. From these, 83 (57 males and 26 females) presented the criteria of the research: altered evaluation of (central) auditory processing (CADP) related to the absence of acoustic reflex (AR) and tympanometry curve type A.

In order to facilitate the gathering of information, a protocol for data logging was developed by the researchers, in which the following data were recorded: frequency and auditory pathways in which the AR showed absent (ipsilateral and/or contralateral), types of changes identified in CAPD evaluation (physiological mechanisms, auditory skills and processes auditory gnosis), presence of learning disorders, changes in upper airways and middle ear disorders.

In the data analysis, gender criterion was used for subdividing the protocols into two groups: male (MG) and female (FG). From this subdivision, the data was organized to demonstrate, numerically and/or by percentage, the audiological characteristics of the groups in the sample, the type and frequencies with the absence of AR, the changes of CAPD found, and the comparison between the kind of changes in the CAPD in the absence of AR.

The results are organized in tables and figures. All results underwent statistical treatment by Fisher test, Chi-square and Kruskal-Wallis Test (Nonparametric ANOVA).

■ RESULTS

The numerical characterization and percentage of the total sample with changes of central auditory processing, for both genders, as well as the identification number of protocols that showed changes in processing (central) auditory associated with the absence of the acoustic reflex are described in Table 1.

Table 1 - Numerical and percentage sample characterization

Groups	CAPD Assessment Protocols		CAPD Assessment Protocols related to AC absence	
	Numbers	%	Numbers	%
MG	99	66.44%	57	38,25%
FG	50	33.56%	26	17,45%
Total	149	100%	83	55,70%

MG: male group; FG: female group.

These data were treated statistically with the Fisher's exact test, used to test if there is a nonrandom association between the category of two variables, with results of P value of 0.6010, which was not significant for the sample.

These results show that the percentage rate of protocols with changes in (central) auditory processing associated with the absence of the acoustic reflex was 55.70% of the total protocols. A comparison between groups showed that the

MG had the greatest number of altered protocols (MG-38.25 and FG-17.56%).

In tables 2 and 3 are described a number of protocols that showed absence of AR in both groups (MG and FG) for each ear and frequency in both

the contralateral condition (Table 2) and ipsilateral condition (Table 3). Table 2 shows the frequencies with the highest number in absence of contralateral AR were 4000Hz, then the frequencies of 500Hz

and 3000Hz, for both genders. In search of the ipsilateral AR, Table 3, the frequencies with most number of absence were 4000Hz, 3000Hz and 500Hz, respectively.

Table 2 - Numerical description of the absence of contralateral acoustic reflex, by frequency and ear, for both groups

Contralateral Reflex	500 Hz		1000 Hz		2000 Hz		3000 Hz		4000 Hz		WB	
	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE
MG	15	14	8	14	14	12	18	15	36	30	12	16
FG	12	10	5	5	6	5	7	8	9	16	5	9
Total	27	24	13	19	20	17	25	23	45	46	17	25

MG: male group; FG: female group; RE: right ear; LE: left ear; Hz: Hertz; WB: White Band.

Table 3 - Numerical description of the absence of ipsilateral acoustic reflex, by frequency and ear, for both groups

Ipsilateral Reflex	500 Hz		1000 Hz		2000 Hz		3000 Hz		4000 Hz	
	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE
MG	15	12	12	9	17	14	22	27	23	26
FG	7	3	4	3	4	3	14	6	13	6
Total	22	15	16	12	21	17	36	33	36	32

MG: male group; FG: female group; RE: right ear; LE: left ear; Hz: Hertz

The results from Tables 2 and 3 underwent statistical analysis with Chi-square test, which identifies the categorical variables distributed between themselves; the result from the P value was 0.7841, which shows statistically insignificant. Kruskal-Wallis Test (Nonparametric ANOVA) was also used to analyze the division of the variability into variability and then the comparison between both, which also showed no significant analysis.

Table 4 presents the description of total and per group, the number of auditory abilities that were found altered in the protocols (location, temporal ordering, temporal resolution, auditory closure and figure-ground).

The results show that the skills of figure-ground temporal ordering showed the highest frequency

of changes, both in the analysis of the total asper group. In the male group, such skills showed the same larger number of alterations (45), however, in the female group, the largest number of change is the ability to figure-ground, followed by the temporal ordering ability.

Table 5 is the description of the total per group of gnosis decoding processes, coding, organization and nonverbal, with higher numerical frequency change. The results in Table 5 show that the analysis of total and MG gnosis processes with the greatest number of changes have been coding and organization, respectively. For females (FG) greater change number changes occurred in the processes of organization and decoding.

Table 4 - Numerical description of the auditory skills for the male group (MG) and females (FG)

Groups	Localization	Temporal ordering	Temporal resolution	Closure	Background figure
MG	5	45	4	18	45
FG	0	21	5	9	28
Total	5	66	9	27	73

Table 5 - Numerical description of the changed gnosis processes for the male group (MG) and females (FG)

Grupos	Decoding	Coding	Organization	Non-verbal
GM	22	41	23	6
GF	11	9	21	3
Total	33	50	44	9

The results from Table 5 have undergone treatment with the Chi-square statistical test in which the result of the P value is 0.1711, which is not a significant value for this sample.

Figures 1 and 2 show the description of the comparison between the number of absence contralateral AR and change number of skills hearing, by frequency, for both MG (F1) as to FG (F2).

Figures 3 and 4 show the description of the comparison between the number of absent ipsilateral AR and change number of auditory skills, by frequency, for both MG (F3) and for FG (F4).

Figures 1 and 2 show that, when comparing the number of absence AR contralateral to the number of changes in auditory abilities, by frequency, both

groups (MG and FG), for the frequencies with the highest number of amendment were 4 Hz and 3 Hz and 500 Hz, respectively. At all frequencies, coincidentally in both groups, with greater numerical abilities frequency changes were background figure and temporal ordering.

In Figures 3 and 4, the comparison between the number of ipsilateral absence of AR and the number of changes of auditory skills, with frequencies greater number of alterations were 3 Hz, 4 Hz, 2 Hz and 500 Hz, for MG. To FG frequencies with larger number of alterations were 3 Hz, 4 Hz and 500 Hz. Also, in ipsilateral AR, skills with higher numerical frequency changes were background figure and temporal ordering.

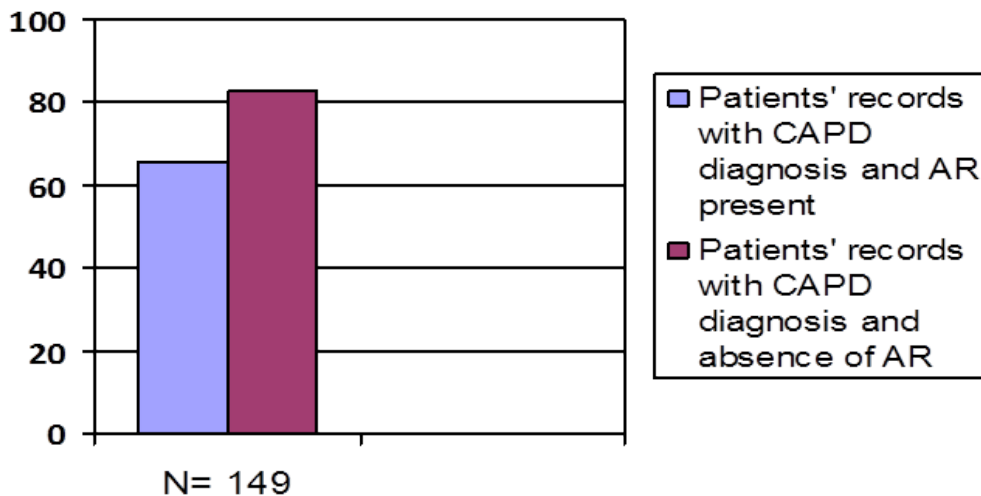


Figure 1 - Total of patients' records with CAPD diagnosis.

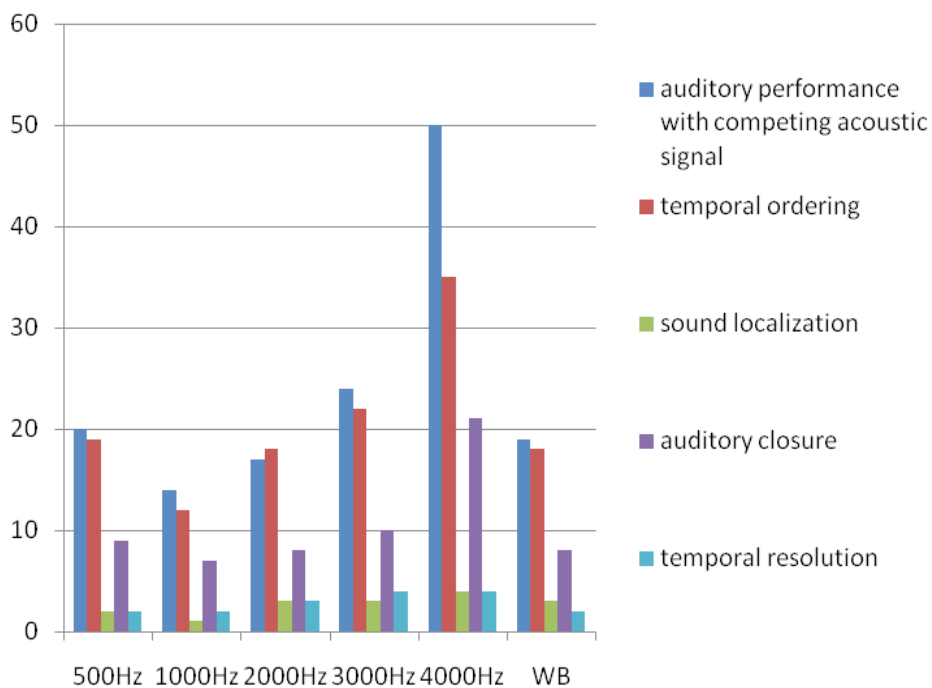


Figure 2 - Comparison between the number of absences of the contralateral AR and the number of auditory processing disorders, per frequency, for the Male Group.

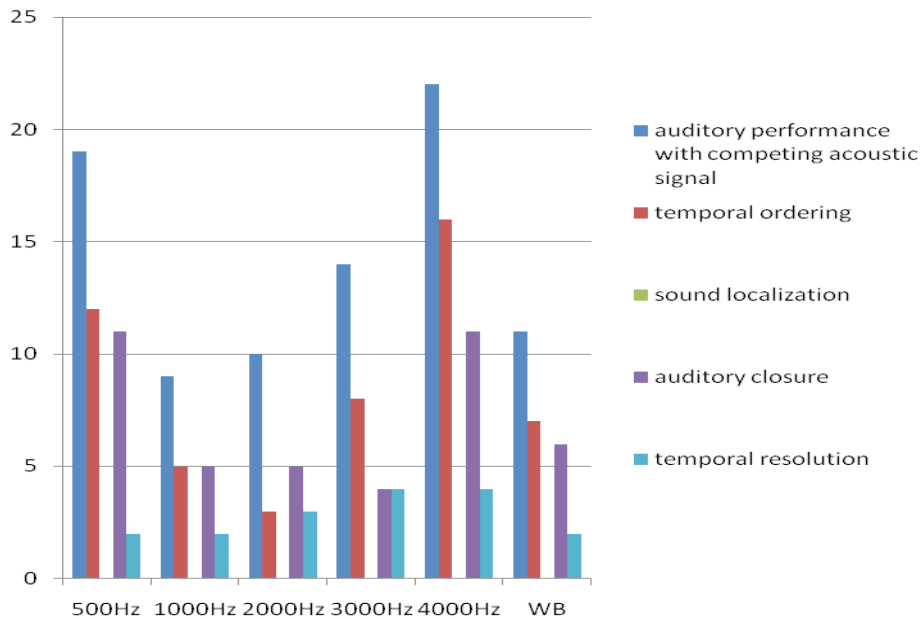


Figure 3 - Comparison between the number of absences of the contralateral AR and the number of auditory processing disorders, per frequency, for the Female Group.

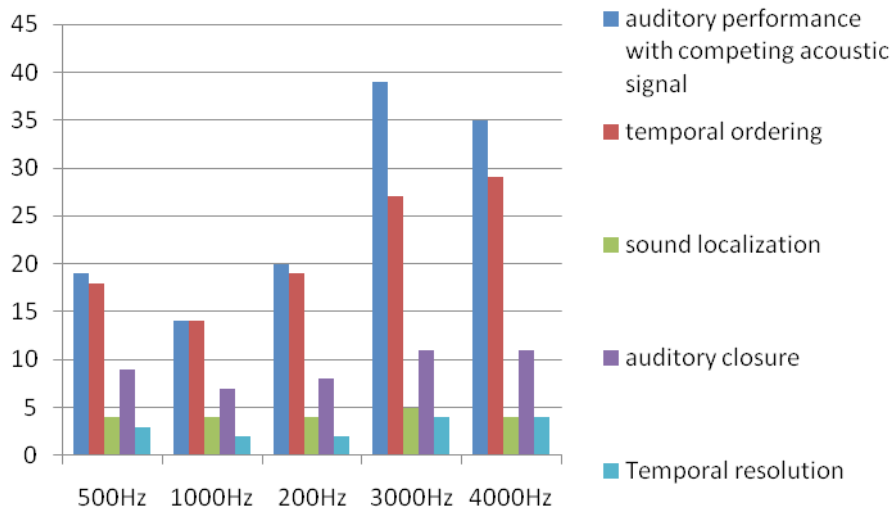


Figure 4 - Comparison between the number of absences of the ipsilateral AR and the number of auditory processing disorders, per frequency, for the Male Group.

■ DISCUSSION

More than half of the patients' records (55.75%) showed the absence of AR, a fact that led us to consider that this result already signals the possible presence of (central) auditory processing disorders.

Studies on AR have reported a significant relation of the absence of the AR with (central) auditory processing disorder when comparing subjects with and without AR, with the latter group having a higher numerical frequency of alterations of auditory skills ^(1,2).

Analysis of the number of AR absences according to the criteria ear, gender and pathway research (contralateral and ipsilateral) shows that there was no significant difference in the number of AR absences for any of these criteria.

For frequency, there was a larger number of absences at the frequencies of 4000, 3000 and 500 Hz, in both groups (Male and Female) and in the contralateral and ipsilateral pathways. These findings differ from the literature regarding gender but agree with previous reports regarding the

frequency of 4000 Hz as the most affected one by the absence of AR ^(1,2,7).

The comparisons shown in Figures 2, 3 4 and 5 between the number of AR absences and the number of auditory skill disorders, according to frequency, confirm literature data, demonstrating that the 4000 and 500 Hz frequencies were the most altered ones. These comparisons also demonstrate that the auditory performance with competing

acoustic signal and temporal ordering skills are the most altered ones in the absence of AR

■ CONCLUSION

Although not statistically significant, we conclude that the numerical differences found show a relationship of the absence of acoustic reflex with changes in physiologic auditory mechanisms and consequently with the auditory processing disorder.

RESUMO

Objetivo: caracterizar e relacionar os achados do reflexo acústico do músculo estapédio em indivíduos com diagnóstico de distúrbios do processamento auditivo (central). **Métodos:** pesquisa transversal descritiva retrospectiva, submetida e aprovada pelo Comitê de Ética em Pesquisa, sob o protocolo nº 0047/11. Amostra constituiu-se de 83 prontuários de indivíduos de ambos os gêneros (57 masculino e 26 feminino) que apresentaram alteração na avaliação do processamento auditivo (central) associada à ausência do reflexo acústico. **Resultados e Discussão:** os resultados demonstraram numericamente que as frequências com maior número de ausência do reflexo acústico, tanto na pesquisa contralateral quanto na ipsilateral, foram 4KHz, 3KHz e 500Hz respectivamente, para ambos os gêneros, mas, sem diferença significativa no tratamento estatístico. Também, em ambos os grupos, as habilidades auditivas que apresentaram maior frequência de alterações foram figura fundo e ordenação temporal, que sobressaíram em número quando comparadas com as demais habilidades, e sem diferença significativa no tratamento estatístico realizado com os testes de Fisher, Quiquadrado e Anova. **Conclusão:** os resultados da presente pesquisa nos levam a concluir que as estruturas do sistema nervoso auditivo central responsáveis pelo sistema do arco reflexo do músculo estapédio, também relacionam-se aos mecanismos fisiológicos auditivos das habilidades auditivas, o que evidencia a possível relação entre a ausência do RA com alterações do distúrbio do processamento auditivo (central).

DESCRIPTORIOS: Reflexo Acústico; Audição; Testes Auditivos

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