

TEMPORAL RESOLUTION HEARING IN MENSTRUAL MIGRAINE

Resolução temporal auditiva na migrânea menstrual

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ABSTRACT

Purpose: to verify auditory behavior of temporal resolution in women with Menstrual Migraine. **Methods:** 40 women had participated, age between 18 to 31 years, 20 of them had presented menstrual migraine (study group) and 20 had not (control group). All of them were submitted to procedures which are part of an audiology's routine. These procedures were made to characterize the peripheral hearing and to exclude people with hearing loss. They were also requested to answer a questionnaire elaborated for the researcher and submitted to the test *Gap in noise*. These procedures were carried out both in the precocious follicular phase and in the delayed luteal phase for volunteers who did not use any type of contraceptive, because in these periods the levels of the female hormones are higher and similar to those that used contraceptive. **Results:** in the group of study, the values for the threshold *gap* and the percentage of rightness, regarding to the left ear were significant and statistically different relative to the control group. Within the right ear, the results were similar considering the two groups. **Conclusion:** the temporal resolution in women with menstrual migraine, measure in a specific noise segment, regarding to the right ear, was similar for women without this complain, while in the left ear, the average of thresholds *gap* were different and those with migraine had the worst thresholds.

KEYWORDS: Hearing; Auditory Perception; Migraine Disorders.

■ INTRODUCTION

Migraine is a neurovascular disorder characterized by recurrent attacks of headache, accompanied by other signs and symptoms such as nausea, vomiting and sensitivity to light (photophobia) and to sound (phonophobia). It affects 4-6% of the population, especially females. There is a family history in most cases (41% to 78%). The crises generally begin before 20 years of age. Factors such as age, gender, hormonal disorders, oral contraceptives, menstrual cycle, pregnancy, acute stress, food, alcoholic beverages, environmental humidity and temperature, light, odors, radiological contrast, fasting, trauma and psychological factors can trigger episodes of migraine ¹.

The literature refers that a significant percentage of women (40-50%) have migraine attacks before, during or after menstruation, which indicates an association of migraine with female hormone levels. Other authors consider that hormonal contraceptives may not cause any changes or they even improve the levels of pain ².

When considering that neurovascular changes may interfere with the functional integrity of the central auditory nervous system, the hypothesis is that menstrual migraine could interfere with the neurological processing of auditory information, specifically with the ability of temporal resolution.

The auditory temporal processing can be defined as the perception of sound or change of sound within a restricted and definite period of time, in other words, it refers to the ability of perceiving or distinguishing stimuli presented in a rapid succession ³.

The temporal resolution is found among the abilities of temporal processing and refers to the shortest interval required to separate or resolve acoustic events and is critical to the understanding of speech. One way to assess the temporal resolution is through the detection of *gaps* (intervals); this

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evaluation consists of presenting sound events with and without gaps and the individual task is to detect the presence or absence of gaps ⁴.

It is important to use non-verbal stimuli, because verbal stimuli may mask the auditory processing difficulties, since the listeners can make use of their language and intellectual skills to compensate for their difficulties ⁵.

The GIN - Gap in Noise - test evaluates the gap detection thresholds to be used in clinical practice. In the first study of GIN, it was found that this test may be sensitive to detect changes in the central nervous system. This test consists of sound stimuli of noise segments with gaps ranging from 2 to 20 milliseconds inserted randomly. The answer that is sought is to identify these silent intervals or gaps. The threshold of temporal acuity is measured. Thus, it is characterized the ability of temporal resolution, which is recognized as being essential for speech perception ⁶.

It is noteworthy that no research in the literature that correlates directly with the subject of this study was found, in other words, the auditory temporal resolution in menstrual migraine.

The objective of this research was to investigate the behavior of auditory temporal resolution in women with menstrual migraine.

METHODS

The project was submitted to the Ethics Committee of UNIFESP before its beginning and approved under the number 0385/10. The volunteers signed an informed consent.

This is a cross-sectional study. The venue of the study was the Outpatient Clinic in the Department of Hearing Disorders, service evaluation of auditory processing, neuroaudiology sector.

For this study, 40 individuals participated, female, volunteers and in the age group 18-31 years. These individuals were grouped according to the presence or absence of menstrual migraine.

Inclusion criteria consisted of women aged 18-31 years, 20 women with menstrual migraine (Study Group) and 20 without it (Control Group); not excluding the individual who has migraine out of the menstruation period.

Female women who are under 18 or over 31 years of age and males were excluded.

Table 1 shows the descriptive statistics of age (in years) per group. The mean age between the groups was similar, the mean of the Control Group was 22.3 years and the mean of the Study Group was 23.3 years. The test used was the Mann-Whitney test.

Table 1 - Descriptive measures of age (in years) in each group

Group	Age	
	Control	Study
Mean	22.3	23.3
Average	22.5	23.0
Standard Deviation	2.5	3.3
Q1	20.8	21.0
Q3	23.3	25.3
N	20	20
CI	1.1	1.5
p-value	0.380	

Mann-Whitney Test

Notes: Q1 First quartile, Q3 Third quartile, N sample number, CI confidence interval

The volunteers underwent pure tone audiometry, immittanciometry and the percentage rate of speech recognition to characterize peripheral hearing and exclude people with hearing losses. These procedures are part of the audiological routine.

The study procedures were established by interview using a questionnaire prepared by the researcher, and the application of random gap detection test, abbreviated from the GIN test ⁶.

To characterize the peripheral hearing, the volunteers underwent pure tone audiometry, also the search of speech reception threshold, immittanciometry and acoustic reflex. For these reviews, a soundproof booth was used, audiometer Maico MA 41 and immittanciometer AZ 27, calibrated according to NASI technical standards, S3:1, 1991 (sound booth): ANSI, S3:21, 1978 (pure tone audiometry): ANSI, S3.39-1997 (immittanciometer) ⁷.

A questionnaire to be applied in this study with issues relating to the identification, medical history (personal and general health history), presence or absence of Menstrual Migraine and use of contraceptive methods was developed. Based on this interview, was performed a selection and distribution of the participants in the groups of women who present Menstrual Migraine and which do not. The questionnaire is shown in Figure 1.

The test that evaluated the effect of temporal resolution is called test-GIN Gap In Noise ⁶.

The purpose of this test is to determine the detection threshold gaps (silence interval).

The instruction by demonstration is made of the training range, which is composed by gaps of longer duration. During training, the patient could be oriented again if she did not understand the task.

The stimuli consisted of track testing, each track testing had at least 32 segments of white noise, with duration of 6 seconds and 5 seconds of interval between each (track testing 1 with 35 items and track testing 2 with 32 items). In each segment was introduced from none to three interruptions, called gaps, whose duration of the silence interval varied from two to 20 milliseconds, a total of 10 different gaps. Gaps were: 2, 3, 4, 5, 6, 8, 10, 12, 15 and 20 milliseconds. Each gap was presented six times in the list of items. It was carried out in half an ear band and half in the opposite ear. The test was performed on each ear separately.

The individual was asked to identify each gap by raising her hands.

Accounting was performed by considering the percentage of correct answers in total gaps (60), and how the threshold gap was checked, namely,

the shortest time in which the individual was able to identify at least four of the six presentations.

The study procedures were performed on all participants in the same hormonal condition to avoid changes in the results due to the hormonal changes of the ovarian cycle. So the tests were performed in periods with low levels of estrogen and progesterone. These periods correspond to two subphases in women not using oral contraceptive method: the early follicular subphase or menstrual phase, corresponding to the onset of menstruation until the fifth day, on which the level of estrogen and progesterone is low; and late luteal subphase, which is up to four days before the onset of menstruation, characterized by lower levels of estrogen and progesterone ⁸.

In women using oral contraceptive method, it was followed the criterion that evaluates the population on any day of the cycle, since the use of oral contraceptives keep the ovarian hormone in similar levels during the cycle ⁹.

Initially we characterized the complaints as to the presence or absence of Menstrual Migraine and the use of contraceptive methods and formed two groups, one with menstrual migraine and the other without it.

Subsequently, the descriptive measures of temporal acuity of thresholds in milliseconds were performed, as well as the recognition rate gap in percentage in each of the groups with and without menstrual migraine, comparing them to each other by means of relevant statistical tests.

The significance level of 0.05 was considered for statistical analysis and the study was performed with the help of a skilled professional. The statistical analysis was done using SPSS V16, Minitab 15 and Excel 2007 Office software. Values were calculated by the statistical Mann-Whitney and Equality of Two Proportions tests.

It is noteworthy that non-parametric tests and statistical techniques were used, the conditions (assumptions) for the use of techniques and parametric tests such as normality (Anderson-Darling, normality distribution chart, abbreviation AD) and homoscedasticity (homogeneity of variances, Levene's test).

A caption of the asterisk [*] type was used for the p-values considered statistically significant before the adopted level of significance. And a hash sign [#] for p-values that, by being close to the limits of acceptability, were considered likely to be significant (up to 5 percentage points above the alpha value adopted).

Interview

identification:

Name:.....Age:.....Gender:.....

Address:.....

Phone:.....email:.....

Valuation date:.....

History:

Have menstrual migraine? () yes since when? () no

Have premonitory factor? () yes how long it lasts? () no

Currently makes use of contraceptives?

() yes

() no When was your last period?

Have trouble concentrating when you know you will menstruate? () yes () no

Hearing complaints? () yes Which? () no

Tinnitus? () yes () right ear () left ear Frequency () no

Dizziness? () Yes In what situation? () no

Surgeries: () Yes Which? () no

Diseases: () Yes Which? () no

Additional notes:

Figure 1 - Questionnaire prepared by the researcher

■ **RESULTS**

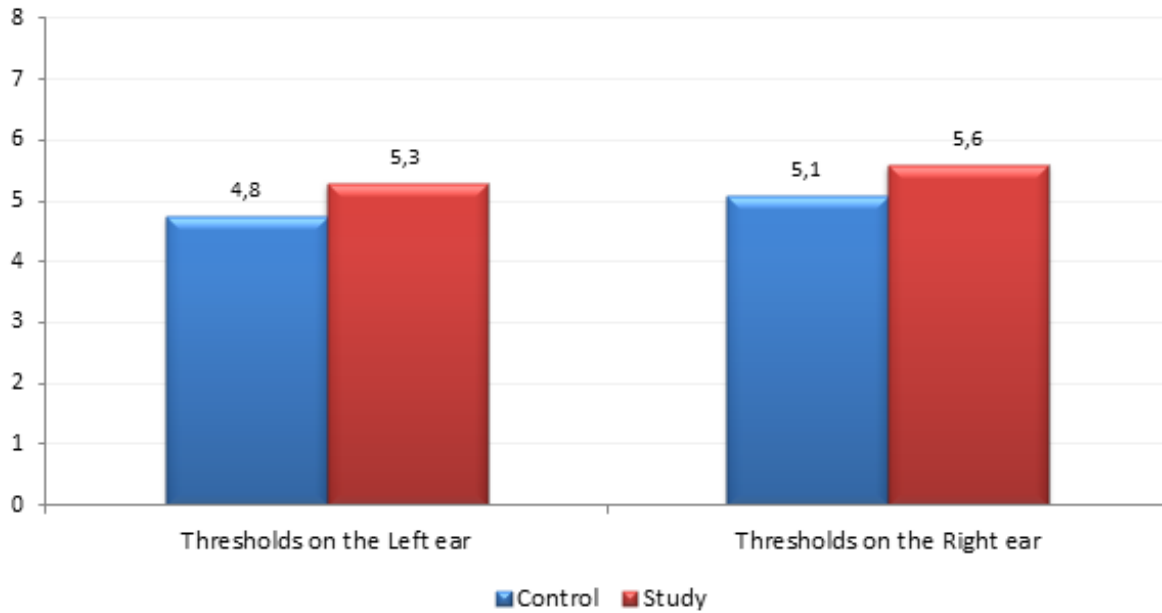
Below, we present data collected from selected procedures, Gap in Noise (GIN) test and questionnaire.

Presentation of the data collected through the Gap-in-Noise Test, GIN

The results will be described by sample performance in the GIN test.

Figures 2 (Control Group) and 3 (Study Group) show the percentage of responses identifying gaps, short of GIN_% and the values of gap thresholds, abbreviated GIN_LI of individuals in the Control Group and Study Group.

Distribution of answers in milliseconds



*Comparative of the Groups to the Thresholds on the Left and Right Ears. Limiar OE – Threshold LE, Limiar OD – Threshold RE, Blue – Control, Red - Study

Figure 2 - Distribution of answers in milliseconds of GIN_LI right ear and GIN_LI left ear per group

Distribution of responses

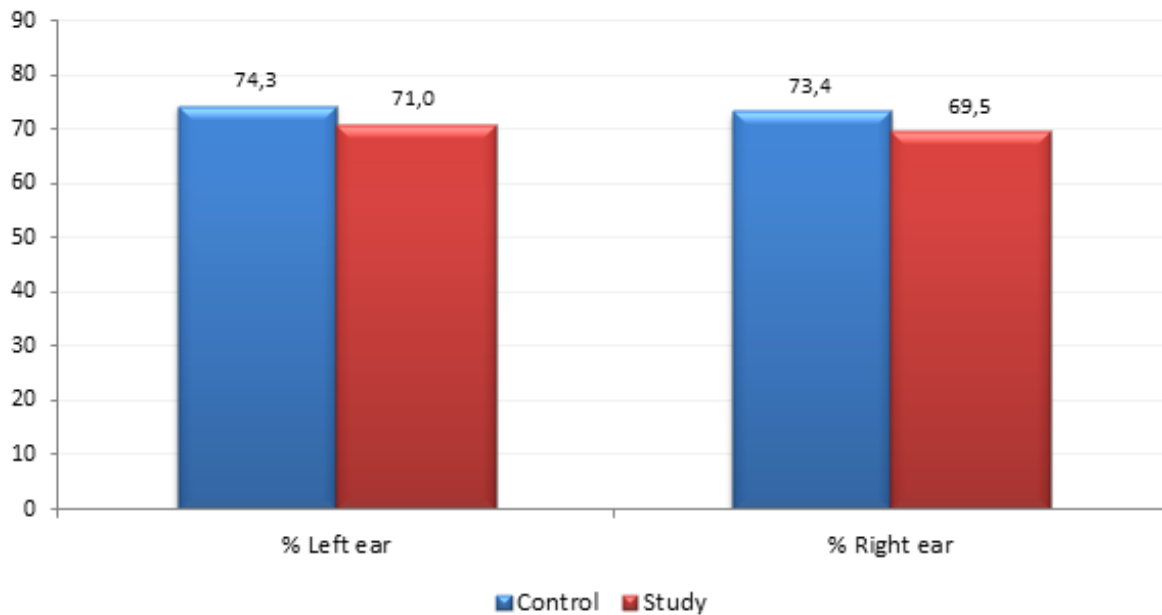


Figure 3 - Distribution of responses GIN_% right ear and GIN_% left ear per group

Table 2 (GIN_%) and Table 3 (GIN_LI) show the descriptive statistics of the responses GIN_% and GIN_LI by ear and by group, as well as the values calculated by statistical test Mann-Whitney.

It was found that groups tend to be statistically different to the percentage of correct responses in the right ear, with the highest average being in the Control group.

There was no statistically significant difference between the responses of GIN_LI between the Control and Study Groups for the variable "Threshold left ear."

Presentation of responses obtained through the questionnaire

All subjects responded to the questionnaire prepared for this survey shown in Figure 1.

It is noteworthy that none of the individuals in the selected sample showed the presence of some type of hearing complaints.

Table 4 shows the distribution of responses for the presence of contraceptive use.

The following compares the frequency distribution between the groups for the variable Early Follicular Subphase. These values are shown in table 5. And the distribution for the variable Late Follicular Subphase is shown in Table 6.

There was no difference between groups for the variable Early and Late Follicular Subphase.

Table 7 shows the presence or absence of difficulty in concentration during menstruation period.

It was observed that there is no statistical difference between the Control and Study Groups, and in both groups there is a prevalence of women who do not have concentration problems in menstruation.

Table 2 - Descriptive statistics of the percentage of correct answers GIN by ear and by group

Group	GIN_% Hit LE		GIN_% Hit RE	
	Control	Study	Control	Study
Mean	74.3	71.0	73.4	69.5
Average	75.8	70.8	75.0	68.3
Standard Deviation	11.4	9.4	9.5	7.8
Q1	66.2	64.6	70.8	66.2
Q3	82.5	76.7	77.1	75.0
N	20	20	20	20
CI	5.0	4.1	4.2	3.4
p-value	0.266		0.080#	

Mann-Whitney Test

Notes: # tendency towards significance, Q1 First quartile, Q3 Third quartile, N sample number, CI confidence interval, LE Left Ear, RE Right Ear

Table 3 - Descriptive statistics of responses GIN by ear and by group

Group	Threshold LE		Threshold RE	
	Control	Study	Control	Study
Mean	4.8	5.3	5.1	5.6
Average	5.0	5.0	5.0	5.0
Standard Deviation	1.3	0.7	1.2	1.2
Q1	4.0	5.0	5.0	5.0
Q3	5.0	6.0	5.0	6.0
N	20	20	20	20
CI	0.6	0.3	0.5	0.5
p-value	0.045*		0.054#	

Mann-Whitney Test

Notes: * statistically significant, # tendency towards significance, Q1 First quartile, Q3 Third quartile, N sample number, CI confidence interval, LE Left Ear, RE Right Ear

Table 4 - Distribution of contraceptive use

Contraceptive Use	Control		Study		p-value
	N	%	N	%	
No	13	65.0%	11	55.0%	0.519
Yes	7	35.0%	9	45.0%	

Testing for Equality of Two Proportions

Note: N sample number

Table 5 - Distribution of early follicular subphase

Early follicular subphase	Control		Study		p-value
	N	%	N	%	
No	7	35.0%	6	30.0%	0.736
Yes	6	30.0%	5	25.0%	0.723

Testing for Equality of Two Proportions

Note: N sample number

Table 6 - Distribution of late luteal subphase

Late Luteal Subphase	Control		Study		p-value
	N	%	N	%	
No	6	30.0%	5	25.0%	0.723
Yes	7	35.0%	6	30.0%	0.736

Testing for Equality of Two Proportions

Note: N sample number

Table 7 - Distribution of concentration problems in menstruation

Concentration Problems in Menstruation	Control		Study		p-value
	N	%	N	%	
No	12	60.0%	14	70.0%	0.507
Yes	8	40.0%	6	30.0%	

Testing for Equality of Two Proportions

Note: N sample number

■ DISCUSSION

The analysis of temporal acuity thresholds with noise and percentage, identification of gaps in the Control and Study Groups through the GIN test and comparative analysis (Table 2 for GIN percentage of correct answers and Figure 3, and Table 3 for GIN threshold and Figure 2) revealed that:

The variation of GIN_LI for the Control Group was 2-8 milliseconds for the left ear and 3-8 milliseconds for the right ear; and for the Study Group was 3-6 for the left ear, and 4-10 for the right ear. These differences were significant between groups

for the left ear, with an average lowest threshold of the Control Group.

Both groups showed gap thresholds close to five milliseconds and no voluntary showed a threshold value greater than 10 milliseconds.

The results obtained in the Control Group and Study Group approached those found in the literature¹⁰⁻¹⁵. It can be considered that the samples of the present study are within the normal ranges.

Studies show that there is an advantage of the right ear over the left ear with the use of pure tone^{16,17}, whereas in other studies asymmetry between the ears was not found¹⁸. The reaction time to the

presence of the gap was also used as a means of analysis. In studies that the right ear advantage over the left was found, the rate of false-alarm^{16,17} was evaluated and the study in which there was no asymmetry between the ears, the percentage of correct responses was evaluated¹⁸.

There are several parameters to explain the different results involving symmetry and asymmetry between ears for the temporal resolution, but it does not mean that there is no left hemisphere advantage rather than the existence of insensitive procedures to assess this difference. It is noteworthy that in situations of monochotic review, the ipsilateral and contralateral pathways are activated and therefore there should be no advantage for any ear¹⁰.

As for the significant difference between groups for the left ear, besides the primary auditory cortex, probably other cortical areas may participate in auditory processing of rapid stimuli, but there are no detailed studies on this subject, therefore, definitive conclusions regarding the topodiagnosis cannot be made^{19,20}.

In this study it can be seen that there is a disadvantage of processing as the temporal resolution ability in women with migraine compared to their peers who do not have the same discomfort.

All individuals in this research answered the questionnaire drawn up. It is noteworthy that none of the sample showed the presence of some type of hearing complaints.

Studies show that most women who use hormonal contraceptives report higher latency in migraine than other women²¹.

A large percentage of women had migraine attacks before, during and after menstruation, indicating an association of migraine with female

hormone levels². Unlike other studies, which believe that hormonal contraceptives may cause no change or even improve the levels of pain²².

For there to be a more specific conclusion, it would be necessary to assess the duration of use and type of hormonal contraceptive used. In the literature, there is no consensus on this matter, since there is variability of current contraceptives, and many of these combinations are tested for the treatment of migraine. The use of hormonal contraceptives may worsen the pre-existing migraine, not causing any changes, or even presenting improvements, being one individual variability of humans one factor which contributes to this to occur, factors such as stress and diet^{2,22}.

■ CONCLUSION

In this study the objective was to verify the behavior of auditory temporal resolution in women with menstrual migraine, measured by applying the Gap in Noise Test. The gap detection thresholds in 40 subjects were established, female and with normal hearing and based on the analysis of the data set, one can conclude that:

- 1) Both groups show gap thresholds, also called temporal acuity threshold of around five milliseconds, which is considered normal¹.
- 2) Temporal resolution in women with menstrual migraine, as a segment of noise, in the right ear was similar to that of women without such complaint, as in the left ear the groups differed and the one with migraine had the lowest thresholds.

RESUMO

Objetivo: verificar o comportamento auditivo de resolução temporal em mulheres com Migrânea Menstrual. **Métodos:** participaram 40 mulheres, na faixa etária de 18 a 31 anos, das quais 20 apresentaram migrânea menstrual (grupo estudo) e 20 não apresentaram (grupo controle). Todas foram submetidas a procedimentos que fazem parte da rotina audiológica para caracterizar a audição periférica e excluir pessoas com perdas auditivas. Ainda, foram submetidas a um questionário elaborado pela pesquisadora e a uma aplicação do teste *Gap in noise*. Os procedimentos foram realizados na fase subfolicular precoce e na subfase lútea tardia para voluntárias que não faziam uso de anticoncepcional, uma vez que nestas fases a taxa de hormônios femininos esta mais elevada e semelhante daquelas que faziam uso de anticoncepcional. **Resultados:** os valores dos limiares de *gap* e porcentagem de acertos da orelha esquerda, no grupo de estudo foram significativamente e estatisticamente diferentes em relação ao grupo controle. Em relação à orelha direita, os achados foram similares entre os grupos. **Conclusão:** a resolução temporal em mulheres com migrânea menstrual, medida a um segmento de ruído, na orelha direita foi semelhante à das mulheres sem essa queixa, já na orelha esquerda os grupos se diferenciaram e os com migrânea obtiveram os piores limiares.

DESCRITORES: Audição; Percepção Auditiva; Transtornos de Enxaqueca.

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