Resolução temporal: análise em pré-escolares nascidos a termo e pré-termo****

Temporal resolution: analysis in term and preterm preschoolers

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****Trabalho Realizado na Universidade Federal de São Paulo.

Artigo de Pesquisa

Artigo Submetido a Avaliação por Pares

Conflito de Interesse: não

Recebido em 09.06.2005.
Revisado em 21.07.2005; 22.08.2005; 20.04.2006; 16.08.2006; 29.08.2006; 29.09.2006; 28.02.2007.
Aceito para Publicação em 28.02.2007.

Abstract
Background: auditory processing. Aim: to verify the hearing behavior of temporal resolution in children with ages from five to six years, who were born preterm, with no evidence of neurological alterations and to compare this behavior to that observed in children of the same age, who were born at term, with low risk for developmental disorders, taking into consideration the variables of: threshold detection gaps through pre-established frequency, binaural and monaural presentation, order of stimuli presentation and gender. Method: 70 children divided in two groups: Group 1 with 44 children who were born at term (20 female and 24 male) and Group 2 with 26 preterm children (12 female and 14 male). Children were submitted to audiologic evaluation composed of audiometry, speech response threshold, acoustic impedance test and the Random Gap Detection Test (RGDT). Results: children who were born at term presented lower threshold detection gaps in the RGDT, for both monaural and binaural stimuli presentation, in all of the pre-established frequencies when compared to preterm children. This difference between the groups was statistically significant. The average threshold detection gaps of Group 1 rose according to the increase of frequency. For Group 2 statistically significant differences were not found regarding the average of threshold detection gaps, for both monaural and binaural stimuli presentation. Conclusion: preterm children differ from those born at term regarding the hearing behavior of temporal resolution. The RGDT can be used as a tool to evaluate the hearing process, once the early detection of alterations in temporal processes indicates the need for intervention in order to minimize or avoid future language impairments.
Key Words: Auditory Perception; Hearing Disorders; Infant; Premature.

Resumo
Tema: processamento auditivo. Objetivo: verificar o comportamento auditivo de resolução temporal de crianças na faixa etária de cinco a seis anos, nascidas pré-termo, sem evidências de alterações neurológicas e compará-lo com o mesmo comportamento auditivo de crianças na mesma faixa etária, nascidas a termo, com baixo risco para alteração do desenvolvimento, considerando as variáveis: limiar de detecção de intervalo de tempo por freqüência sonora pré-estabelecida apresentada na forma binaural e monoaural por ordem de orelha que iniciou o teste e gênero. Método: 70 sujeitos: 44 nascidos a termo reunidos em grupos de 20 indivíduos do sexo feminino e 24 do sexo masculino, denominado Grupo 1, e 26 nascidos pré-termo, sendo 12 indivíduos do sexo feminino e 14 do sexo masculino, denominado Grupo 2, foram submetidos a avaliação audiológica composta por audiometria tonal limiar, limiar de reconhecimento de fala, imitânciometria e aplicação do teste de fusão auditiva denominado de *Random Gap Detection*. Resultados: os nascidos a termo apresentaram menores limiares de detecção de intervalo de tempo no teste de fusão auditiva, nas formas de apresentação binaural e monoaural em todas as freqüências sonoras pré-estabelecidas, do que os nascidos pré-termo com diferença estatisticamente significante. As médias dos limiares de detecção de intervalo de tempo do Grupo 1 aumentaram conforme a freqüência sonora aumentou. No Grupo 2 não foram encontradas diferenças estatisticamente significantes quanto as médias de limiares de detecção de intervalo de tempo na forma de apresentação binaural e monoaural. Conclusão: os nascidos pré-termo se diferenciam dos nascidos a termo quanto ao comportamento auditivo de resolução temporal e o teste de fusão auditiva utilizado pode servir como ferramenta para a avaliação do processamento auditivo, uma vez que a detecção precoce de alteração dos processos temporais indica uma intervenção para minimizar ou evitar futuros prejuízos de linguagem.
Palavras-Chave: Percepção Auditiva; Transtornos da Audição; Infância; Prematuro.

Referenciar este material como:
FORTES, A. B.; PEREIRA, L. D.; AZEVEDO, M. F. de. Temporal resolution: analysis in term and preterm preschoolers (original title: Resolução temporal: análise em pré-escolares nascidos a termo e pré-termo). *Pró-Fono Revista de Atualização Científica*, Barueri (SP), v. 19, n. 1, p.87-96, jan.-abr. 2007.

Introduction

The changes on the associated auditory abilities to school and behavioral impairments in born children preterm without apparent signals of neurological deficit is recently told in specialized literature. (Dupin et al. 2000, Davis et al. 2001).

The auditory ability of temporal resolution as defined by ASHA (American Speech Hearing Association) in 1996, is one of the aspects of the temporal processing, that if finds between those behaviors that are called of central auditory processing. The temporal resolution can be defined as the capacity to detect intervals of time between auditory stimulus or to detect the lesser time that a person can discriminate between two audible signals (Shinn, 2003; Phillips et. al., 2000).

Even so the relations between auditory processing disorder, language impairments and learning disorders are complex, the comorbidade is frequent and particularly many children with learning disorders present alteration in the temporal processing (Cestnik & Jerger, 2000; Bailey & Snowling,2002; Breir,2003). The temporal processing is one of the auditory behaviors that have been related with the perception of speech in children listeners. Specifically, it is associated alterations of the temporal processing to deficits in the phonological processing, auditory discrimination, receptive language and reading (Keith, 2000).

It is essential to know the auditory tests that need behavioral answers which are currently used to evaluate the temporal processing. It is known that these tests are exposed to criticism; therefore they can fail in identifying children with and without problems. And, still, there is the necessity that the appraisers have information that they can distinguish factors that commonly confuse the interpretation of the tests such as lack of motivation, attention, cooperation and understanding (Jerger and Musiek, 2000).

Results of some research (Fennimam et al. 1999, Garcia 2001, Moncrieff 2004) indicate the necessity to include in the evaluation and/or selection of the auditory processing the tests that evaluate the temporal aspects.

Costa(2002), in his study with 35 children applying the fusion test briefly named as AFT (Auditory Fusion Test) in binaural and monoaural task does not find statistically significant difference between the kind of application as for age and sex . She concludes that the threshold test of auditory fusion needs to be studied in further works due to the great influence that the temporal processing has in the development of the aspects of the language.

Results of various researches (Garcia 2001, Chermak 2002, Moncrieff 2004; Neijenhuis et al. 2001, Hautus 2003) indicates the need of including in the evaluation and/or selection of the auditory processing of tests that evaluates the temporal aspects.

Branco-Barreiro (2003) in his study with children with absence (control group) and presence (experimental group) of difficult reading, utilizes the RGDT test for verification of the auditory abilities of temporal processing. The control group's children presented average of detection of time intervals similar to the experimental group in the 500, 1000 and 4000 Hz frequencies. But in the 2000 Hz frequency and in the average the results revealed statistically significant differences, indicating that the control group showed average of interval detection significativilly less than the other group. There was not statistically significant differences between the four available frequencies and the comparisons between the groups revealed statistically significant differences, on that control group revealed average of detection of time intervals significativilly lesser. As conclusion the RGDT test revealed good to identify of reading difficult children.

Ziliotto et al (2006) utilizes the RGDT test concludes that the criterion of reference of normality for youngs and adult people for the temporal acuity is 10 milliseconds for medium value.

To know the auditory ability of temporal resolution in born children preterm, can contribute for the elaboration of intervention programs to improve the development of language of these individuals.

It is intended to show with this work the importance of test RGDT, Random Gap Detection Test, proposed by Keith (2000) as a tool for the evaluation of the temporal resolution in children born preterm reminding that this test can be used in individuals born in term or not from five years old.

This test allows the precocious detection of alteration of the temporal processes and this identification makes possible that it has an intervention to minimize or to prevent future impairments of language disturb development.

Being thus, the objective of this work is to compare the auditory behavior of temporal resolution in reunited preschool children according to the moment of preterm or term born.

Method

This work was carried through with the approval of the Committee of Ethics and Research of the Federal University of São Paulo - São Paulo Hospital under

the number 0757/03. Preschools with ages between 5 and 6 years, 11 months and 29 days and had been distributed in two groups: Group 1 composed by 44 born term children, 20 of feminine sex and 24 of masculine sex and 2 Group composed by 26 born preterm children (equal or superior gestational period time 37 weeks according to WHO - World Health Organization), 12 of feminine sex and 14 of the masculine sex. The responsible ones had signed a term of free and clarified assent and had answered to a questionnaire contend formulary of identification and questions concerning the auditory development, based in clinical history proposal for Pereira (1997) and factors of risks for hearing suggested by Azevedo (1995).

All the participants did not reveal evidence of neurological commitment. The neuropsycholinguistical processes did not been available in these chosen preschool.

The participants had been submitted to an audiometry, research of the speech reception threshold, acoustic impedance tests and research of acoustic reflex. For this evaluation a portable cabin "Sao Luiz" was used, audiometer Maico MA41 with phone TDH 39 and impedance audiometer Damplex A28. The audiometer is calibrated according to norm 60645 IEC-NBR and impedance audiometer according to norm ISO 389.

It has been included children whose thresholds for pure tone in the frequencies evaluated of 250, 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz if showed equal or inferior to 15 dB NA. This criterion according to Silman & Silvaman (1991) is the profile of normal hearing for children. The speech reception threshold (SRT) was established according to proposal of Redondo and Lopes Filho (1997). It was selected the children who had presented compatible SRT with the thresholds pure tone. The classifications of the tympanometry and of the presence of acoustic reflections were Jerger's (1970).

In all the participants were applied the Random Gap Detection Test - RGDT. This test was considered by Keith and has the objective to identify and to quantify the capacity of an individual in solving aspects related to the time of the acoustic event. The name given to the auditory behavior that characterizes this type of capacity is temporal resolution. In its original work, Keith found a time of detection of interval of time (gap detection) normal, equal or lesser than 20 milliseconds, result this gotten by the arithmetic average of the results gotten for each frequency daily pre-established tested (500, 1000, 2000 and 4000 Hz) in normal children.

For this test an audiometer Maico MA41 was used connected to the equipment PAC 2002 produced by the Orlandi acoustics (Industry and Commerce of equipment and accessories for Audiology) that it makes possible the accomplishment of tests that need two channels.

The RGDT test consists of a recorded presentation of a sequence with nine auditory stimulations with small intervals of time where the individual is instructed to verbally answer the appraiser if it is listening to one or two sounds.

For this work was used the subtests 1 (trainings) and the subtest 2 (standard). The answers were registered in a particular sheet (annex 1).

The subtest 1 (trainings) counts on stimulations of 500 Hz with intervals of time between 0 and 40 msec distributed in increasing order. After the training is initiated the other subtests with sequences of nine stimulations in the frequencies of 500, 1000, 2000 and 4000 Hz with random distributed intervals of time. The intervals revealed are: 0, 2, 5, 10, 15, 20, 25, 30 and 40 milliseconds.

All the individuals had been trained to hear in free field, before wearing the phone inside of the cabin and certified of the understanding of the accomplishment of the test. This test was applied in different situations that had been called according to the way of presentation of binaural (BI) and monoaural (MO). In the monoaural's presentation was used the denomination to the right and to the left, trying themselves to indicate the ear that received the stimulations separately. It was assigned binaural by means of the abbreviation BI, monoaural to the right by means of abbreviation RMO and monoaural to the left by LMO. It was initiated the evaluation for the binaural presentation followed by the monoaural's. Moreover, another situation of test, called of test order, involved the ear that received the stimulations initially.

The RGDT test was presented to 40 dB SL having for reference the average threshold of audibility for 500, 1000 and 2000 Hertz.

The groups had been subdivided using the criterion of situation of application of RGDT test according to form (binaural and monoaural presentation) and according to order, or either, ear that initiated the test in the monoaural form.

On this way the situations of application of RGDT test by the way they had been: binaural presentation for frequency (500, 1000, 2000 and 4000 Hz) and monoaural presentation for frequency (500, 1000, 2000 and 4000 Hz). And, by the order of beginning of the test for the monoaural way, they had been: monoaural test with beginning to the right ear; monoaural test with beginning to the left ear. The children had been congregated in group considering each one of these situations.

The first group composed by the term born individuals (TG), that after to carry through the test in its binaural presentation, had made it initiating for the right ear and later left ear for each subtest, it was called shortly as RTG. This group counted on twenty two children.

The second group composed by the term born individuals (TG), that after to carry through the test in its binaural presentation, had made it initiating for the left ear and later right ear for each subtest, it was called shortly as LTG. This group counted on twenty two children.

The third group composed by preterm born individuals (PtG), that after to carry through the test in its binaural presentation, had made it initiating for the right ear and later left ear for each subtest, it was called shortly as RPtG. This group counted on thirteen children.

The fourth group composed by preterm born individuals (PtG), that after to carry through the test in its binaural presentation, had made it initiating for the left ear and later right ear for each subtest, it was called shortly as LPtG. This group counted on thirteen children.

An analysis was carried out through descriptive statistics of the data of application of RGDT test for auditory frequency used considering the type, the binaural and monoaural form and order of test for group (RTG, LTG, RPtG and LPtG).

For the statistic analysis of this work non parametric tests were used: in the situations of in paired samples, the test of Friedman was used; in the presence of independent samples the test of Wilcoxon was used and in the case of independent samples in order to compare two by two it was used Mann Whitney test. The used level of significance was of 0,07 (7%).

Results

Revealed on table 1, using the Mann-Whitney test the values of descriptive measures (median, average and its respective standard deviation and the quartiles) of gap thresholds obtained of the application of the RGDT test, in the monaural form to the right and left ear, and binaural form by auditory frequencies, in the preschool term born of the RGT, LGT groups and all of the term born.

Revealed on table 2 the values of median, average and its respective standard deviation and the quartiles, using the Mann-Whitney test calculated for results obtained of the application of the RGDT test, in the monaural form to the right and left ear, and binaural form by auditory frequencies, in the preschool term born of the RPtG, LPtG groups and all of the preterm born.

Revealed on table 3, the result of the statistical calculations (Mann-Whitney test) realized to compare each situation of application of the test, just as, presentation form - binaural BI, and monoaural MO, and presentation order - right ear as the first tested and left ear as the second ear tested given attention to obtained values for subgroups that started by the right ear term born, RGT, and pre-term born, the RPtG. On table 4, the same calculations are revealed for the subgroup that started the monoaural form of application of the test by the left ear, subgroup term born LGP, and pre-term born, LPtG.

On table 5 are revealed the value of statistical calculation (Mann-Withney) realized to compare the results obtained for the RGDT test by pre-established frequencies (500, 1000, 2000 and 4000Hz), in the group of term born children considering the binaural (BI), monoaural to the right (RMO) and monoaural to the left (LMO) form and the comparison of these situations between the results obtained by masculine and feminine gender.

On table 6 are revealed the values of statistical calculation (Mann-Withney test) realized to compare the results obtained for the RGDT test by pre-established frequencies (500, 1000, 2000 and 4000 Hz), in the group of pre-term born children, considering the binaural (BI), monoaural to the right ear (RMO) and monoaural to the left ear (LMO) form and the comparison of these situations between the individuals of the masculine and feminine gender.

Revealed on table 7 (Friedman and Wilcoxon test) the p-values calculated to compare the results obtained for the RGDT test by pre-established frequency (500, 1000, 2000 and 4000 Hz), in the group of born term children, considering the binaural (BI), monoaural to the right (RMO) and monoaural to the left (LMO) form.

Revealed on table 8 the values statistical calculated (Friedman's and Wilcoxon's test) realized to compare the results obtained for the RGDT test by pre-established frequency (500, 1000, 2000 and 4000 Hz), in the group of born preterm children considering the binaural (BI), monoaural to the right ear (RMO) and monoaural to the left ear (LMO) form.

On table 9 are revealed the data of the interval of confidence for the gap threshold obtained by RGDT in the group of preschool born term. These datas are illustrated in figure 1.

TABLE 1. Median, average and respective standard deviation and the quartiles established on answers given in the RGDT test in binaural and monoaural presentation to the right and left ear by pre-established frequencies obtained by individuals of the group of children term born and its subgroups: RGT and LGT.

	RGT		LGT		TG		value between the groups RGT X LGT	Quartile 1	Quartile 3
	Average (±SD)	Median	Average (±SD)	Median	Average	Median			
500 bin	9,23 (± 11,27)	5	11,77 (±13,46)	5	10,50 (±12,34)	5	0,500	2	15
1000bin	11,45 (±13,69)	5	16,05 (±16,69)	5	13,75 (±15,26)	5	0,324	2	22,50
2000bin	16,68 (±16,44)	7,5	18,82 (±17,37)	10	17,75 (±16,75)	10	0,677	2	40
4000bin	21,09 (± 15,62)	15	19,09 (±15,81)	15	20,09 (± 15,57)	15	0,675	5	40
500 RE	11,36 (±12,01)	5	21,73 (±17,77)	17,50	-----	-----	----	----	----
1000RE	16,18 (±14,56)	10	28,50 (±16,49)	40	-----	-----	----	----	----
2000RE	18,23 (±13,32)	12,5	24,95 (±16,08)	27,5	-----	-----	----	----	----
4000RE	18,50 (±15,51)	10	25,32 (±16,87)	40	-----	-----	----	----	----
500 LE	13,82 (± 11,66)	10	20,91 (±16,62)	17,50	-----	-----	-----	----	----
1000LE	14,59 (±13,89)	7,5	25,45 (±16,03)	35	-----	-----	-----	----	----
2000LE	17,32 (±13,87)	15	25,23 (±18,31)	40	-----	-----	-----	----	----
4000LE	18,64 (±13,11)	12,5	28,05 (±16,65)	40	-----	-----	-----	----	----

Heading:

RGT = group of term born children that started the test with the right ear in the monoaural presentation

LGT = group of term born children that started the test with the left ear in the monoaural presentation

TG = all of the term born children

SD = standard deviation

TABLE 2. Median, average and respective standard deviation and the quartiles established on answers given in the RGDT test in binaural and monoaural presentation to the right and left ear by pre-established frequencies obtained by individuals of the group of children pre-term born and its subgroups: RPtG and LPtG.

	RPtG		LPtG		PtG		p-value between the groups RPtG X LPtG	Quartile 1	Quartile 3
	Average (±SD)	Median	Average (±SD)	Median	Average	Median	----	----	----
500 bin	25,69 (±17,14)	40	22,15 (±17,99)	20	23,92 (±17,31)	32,50	0,543	5	40
1000bin	25,46 (±17,82)	40	22,69 (±19,47)	40	24,08 (±18,34)	40	0,691	2	40
2000bin	31,31 (±13,80)	40	30,31 (±16,12)	40	30,81 (±14,71)	40	0,904	26,25	40
4000bin	28,85 (± 12,77)	40	29,92 (±16,31)	40	29,38 (±14,71)	40	0,725	16,25	40
500 RE	30,00 (±12,42)	40	31,92 (±15,35)	40	-----	-----	----	----	----
1000RE	32,31 (±14,67)	40	32,31 (±14,67)	40	-----	-----	----	----	----
2000RE	33,50 (±13,27)	40	32,69 (±14,09)	40	-----	-----	----	----	----
4000RE	34,23 (±11,15)	40	30,77 (±14,56)	40	-----	-----	----	----	----
500 LE	30,00 (±13,84)	40	30,54 (±15,15)	40	-----	-----	----	----	----
1000LE	34,33 (±13,34)	40	31,08 (±15,42)	40	-----	-----	----	----	----
2000LE	34,33 (±13,34)	40	31,85 (±15,61)	40	-----	-----	----	----	----
4000LE	34,23 (±11,15)	40	34,23 (±11,15)	40	-----	-----	----	----	----

Heading:

RPtG = group of preterm born children that started the test with the right ear in the monoaural presentation

LPtG = group of preterm born children that started the test with the left ear in the monoaural presentation

PtG = all of the preterm born children

SD = standard deviation

TABLE 3. P-value calculated to comparison of the result of the RGDT test between the term and preterm subgroups that started the test with the right ear considering the binaural and the monoaural presentation to the right ear (1st and 2nd tested ear)

Frequency (Hz)	Group of born term children x Group of preterm born children that started by the right ear (RGT X RPtG)		
	BI	MO (right ear = 1st tested ear)	MO (left ear = 2nd tested ear)
500	0,013*	<0,001*	0,003*
1000	0,037*	0,007*	0,002*
2000	0,017*	0,006*	0,003*
4000	0,069*	0,003*	0,002*

Heading:

BI = binaural presentation

MO = monoaural presentation

RTG = term born that started the test by the right ear in the monoaural presentation

RPtG = preterm born that started the test by the right ear in the monoaural presentation

* = statistically significant

TABLE 4. P-value calculated to comparison of the result of the RGDT test between the term and preterm subgroups that started the test with the left ear considering the binaural and the monoaural presentation to the left ear (1st and 2nd tested ear)

Frequency (Hz)	Group of born term children x Group of pre-term born children that started by the left ear (LGT x LPtG)		
	BI	MO (left ear = 1st tested ear)	MO (right ear = 2nd tested ear)
500	0,181	0,074#	0,077#
1000	0,404	0,363	0,406
2000	0,078#	0,273	0,103#
4000	0,071#	0,262	0,306

Heading:

BI = binaural presentation

MO = monoaural presentation

LTG = group of term born that started the test by the left ear in the monoaural presentation

LPtG = group of pre-term born that started the test by the left ear in the monoaural presentation

= tendency to significance

TABLE 5. P-value calculated to comparison of the results of the RGDT test between the preschool term born of the masculine and feminine gender considering the subgroup according to the ear that started the test in the monoaural form, RTG – right ear, LTG – left ear, the presentation of binaural (BI), monoaural to the right (RMO) and monoaural to the left (LMO) form by pre-established auditory frequencies.

Term born of feminine gender x Term born of masculine gender					
Auditory frequencies pre-established of the RGDT test					
		500 Hz	1000 Hz	2000 Hz	4000 Hz
BI	RTG	0,970	1,000	0,700	0,482
	LGT	0,657	0,704	0,731	0,520
RMO	RTG	0,279	0,676	0,109#	0,288
	LTG	0,508	0.939	0,314	0,942
LMO	RTG	0,059*	0,398	0,121	0,459
	LTG	0,541	0,646	0,823	0,759

Heading:

RTG = group of term born children that started the test by the right ear in the monoaural presentation

LTG = group of term born children that started the test by the left ear in the monoaural presentation

RMO = right ear in the monoaural presentation

LMO = left ear in the monoaural presentation

BI = binaural presentation

* = statistically significant

= tendency to significance

TABLE 6 – P-value calculated (Mann-Withney test) to comparison of the results of the RGDT test between the preschool pre-term born of the masculine and feminine gender considering the subgroup according to the ear that started the test in the monoaural form (RGPt – right ear, LGPt – left ear), the presentation of binaural (BI), monoaural to the right (RMO) and monoaural to the left (LMO) form by pre-established auditory frequencies.

Preterm born of the feminine gender x Pre-term born of the masculine gender					
Auditory frequencies pre-established of the RGDT test					
		500 Hz	1000 Hz	2000 Hz	4000 Hz
BI	RPtG	0,425	0,337	0,210	0,873
	LPtG	0,093#	0,261	0,116#	0,117#
RMO	RPtG	0,151	0,197	0,265	0,276
	LPtG	0,040*	0,042*	0,042*	0,014*
LMO	RPtG	0,112#	0,695	0,695	0,198
	LPtG	0,137	0,116#	0,042*	0,042*

Heading:

RPtG = group of preterm born children that started the test by the right ear in the monoaural presentation

LPtG = group of preterm born children that started the test by the left ear in the monoaural presentation

RMO = right ear in the monoaural presentation

LMO = left ear in the monoaural presentation

BI = binaural presentation

* = statistically significant

= tendency to significance

TABLE 7. p-value calculated to comparison of the results of the RGDT test in the presentation of binaural form with right ear and left ear in monoaural form considering the group of preschool term born that started the test with the right ear, RGT and the left ear LGT.

		500 Hz	1000 Hz	2000 Hz	4000 HZ
BI X RMO X LMO	RTG	**0,042***	**0,026***	0,232	0,346
Friedman's test	LTG	**0,011***	**0,003***	0,283	0,285
BI X RMO	RTG	0,289	**0,012***	-----	-----
Wilcoxon's test	LTG	**0,011***	**0,002***	-----	-----
BI X LMO	RTG	**0,007***	0,103#	-----	-----
Wilcoxon's test	LTG	**0,003***	**0,008***	-----	-----
RMO X LMO	RTG	0,375	0,344	-----	-----
Wilcoxon's test	LTG	0,683	0,181	-----	-----

Heading:

RTG = group of term born children that started the test by the right ear in the monoaural presentation

LTG= group of term born children that started the test by the left ear in the monoaural presentation

RMO = right ear in the monoaural presentation

LMO = left ear in the monoaural presentation

BI = binaural presentation

* = statistically significant

= tendency to significance

TABLE 8. p-value calculated to comparison of the results of the RGDT test in the preschool born preterm that started the test by the left ear, RPtG and by the left ear, LPtG as for the presentation of binaural form BI, with the right ear in the monoaural form RMO and left ear in the monoaural form LMO.

		500 Hz	1000 Hz	2000 Hz	4000 HZ
BI X RMO X LMO	RPtG	0,260	**0,022***	0,472	**0,041***
Friedman's test	LPtG	**0,004***	**0,034***	0,174	**0,047***
BI X RMO	RPtG	------	0,075#	-----	**0,066***
Wilcoxon's test	LPtG	**0,017***	**0,039***	-----	0,715
BI X LMO	RPtG	-------	**0,068***	-----	**0,066***
Wilcoxon's test	LPtG	**0,027***	0,078#	-----	**0,068***
RMO X LMO	RPtG	-------	0,655	-----	1,000
Wilcoxon's test	LPtG	0,593	0,102#	-----	**0,049***

Heading:

RPtG = group of preterm born children that started the test by the right ear in the monoaural presentation

LPtG= group of preterm born children that started the test by the left ear in the monoaural presentation

RMO = right ear in the monoaural presentation

LMO = left ear in the monoaural presentation

BI = binaural presentation

* = statistically significant

= tendency to significance

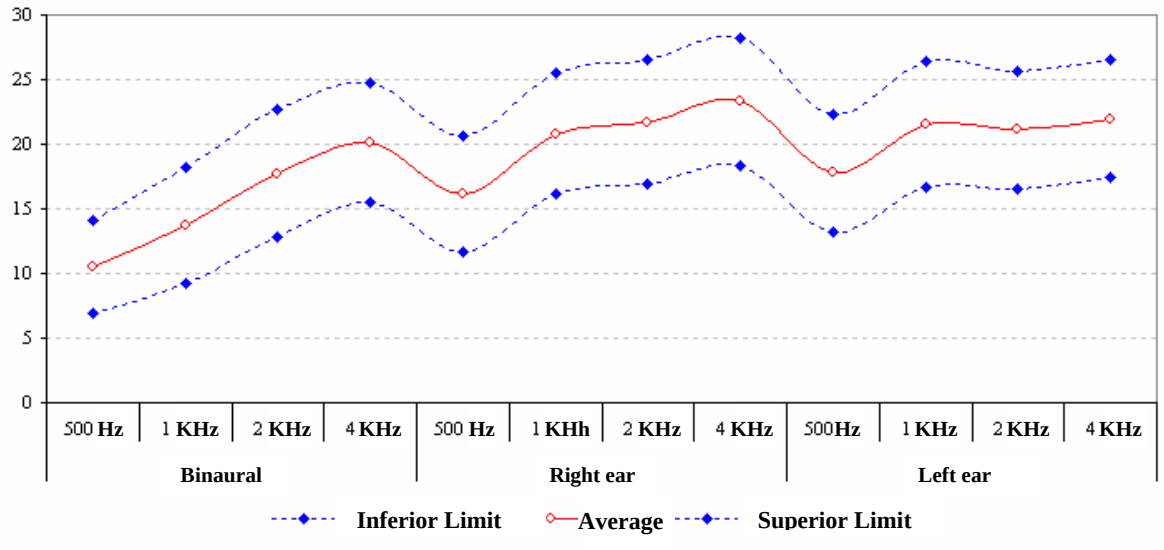
TABLE 9. Values of the inferior limit, average and superior limit that constitute the interval of confidence for the gap limiar in miliseconds obtained by RGDT test in preschool born term (TG).

TG		Inferior Limit	Average	Superior Limit
Binaural	500 Hz	6,86	10,5	14,14
	1 KHz	9,24	13,75	18,26
	2 KHz	12,8	17,75	22,7
	4 KHz	15,49	20,09	24,69
Monoaural Right Ear	500 Hz	11,67	16,14	20,6
	1 KHz	16,14	20,82	25,5
	2 KHz	16,94	21,73	26,52
	4 KHz	18,36	23,27	28,18
Monoaural Left Ear	500 Hz	13,23	17,77	22,32
	1 KHz	16,63	21,55	26,46
	2 KHz	16,6	21,14	25,67
	4 KHz	17,45	21,98	26,5

Heading:

TG = group of all born term children

Figure 1. Interval of confidence to the gap limiars in miliseconds obtained by RGDT test in the binaural and monoaural to the right and left ear presentation in the group of preschool born term.



Discussion

Before presenting the commentaries on the results properly said it is considered essential to show some concepts on the studied subject.

The time is one of the basic components of an acoustic signal and must be considered in the interpretation of an auditory transmitted information (Shinn, 2003). The auditory ability of temporal processing is an important factor for the perception of speech, contributing for the identification of small phonetic elements presented in the speech and alterations in this auditory ability suggest interference in the perception of normal speech and recognition of phonemes (Keith, 2000; Au and Lovegrove, 2001).

The binaural hearing has its importance for the auditory localization, but it has as main benefit auxiliary in the detection of sounds in noisy environments (Moore, 1991).

The processing of temporal information can occurs monoaurally and/or binaurally in agreement already al tells by Strouse et al (1998). The monoaural processing would become related to the one that occurs with the signal that arrives in an ear (even so normally this occurred parallel in the two ears). The binaural processing would become related to the analysis of the difference between the signals that arrive in the two ears. Because these processing would occur with time differences (monoaural in milliseconds and binaural fractions of milliseconds) the monoaural temporal processing would be more related with the signal of speech while the binaural temporal processing would be more related with the separation of the signal with the competitive sounds.

In the present study, the differences of performance in RGDT test founded between the born term and preterm children shows a difference in the auditory behavior of the temporal resolution between the groups. For the born term individuals (table 1), in the form of binaural application of RGDT test, did not have significant statistically differences between the sub-groups RTG and LTG, and despite the binaural form showing lesser thresholds of that the found ones in the monoaural form, the differences had not been statistically significant. The threshold of lesser interval of time, gap detection, of this measure of the temporal acuity, did not exceed 15 milliseconds, in medium, and for evaluated sonorous frequency it was 5 to 10 milliseconds better for low frequencies (500 and 100 Hz) than for high (2000 and 4000 Hz) in the group been born term listeners.

In the preterm individuals (table 2), the medium of the threshold of gap in the binaural and monoaural form of application was around 40 msec. In all the test situations, the preterm group possessed thresholds of detection of bigger interval than the term group.

In the binaural form, the differences between the results of the born term and preterm children had been statistically significant (table 3). When the test were carried through monoaurally initiating from the left ear the greaters average had continued belonging to the group prematurely been born, however without statistically difference (table 4).

In the researched Brazilian works, Garcia (2001) and Costa (2002) using the AFT-R and AFT tests (Auditory Fusion Test - Revised and Auditory Fusion Test) had found significant statistically differences between the binaural and monoaural application. It is necessary to detach that in these studies the threshold of fusing of the auditory acuity was considered and not the threshold of the time interval, gap, as the evaluated one in this research.

Analyzing the gender variable, in the group RTG (table 5) and having the monoaural form of presentation of the test was observed, for the left ear that in the 500 Hz frequency had significant statistically difference.

Once more, focusing the gender variable in the group of preschool preterm born (table 6), there wasn't statistical relevance on the form of binaural presentation. Instead in the monoaural form revealed significant statistically differences mainly in the group that started the test by the left ear LPtG.

Garcia (2001) and Branco Barreiro (2003) had not included the gender variable in their research. Costa (2002) in his study did not find significant statistically difference between the results as in gender variable, however the thresholds found in the masculine sex had been lesser in relation to the feminine sex, fact this also witnessed in this study.

In the comparison study of the results of the sub-group RTG as for the presentation forms (binaural vs monoaural) of the RGDT test in pre-established auditory frequencies (table 7), it was verified that the threshold of detection of time intervals were smaller (table 1) statistically significant (table 7), in the binaural presentation on the 500 and 1000 Hz frequencies when compared to the monoaural presentation. The 2000 and 4000 Hz frequencies

did not revealed statistically significant differences.

In the LTG sub-group the comparisons of the results as for the presentation forms of the RGDT test on its pre-established auditory frequencies (table 7) revealed that the 500 and 1000 Hz frequencies in binaural form presented statistically significant differences when compared with the monoaural presentation: the threshold of detection of binaural intervals of time were smaller in the left and the right on both frequencies. The 2000 and 4000 Hz did not revealed statistically significant differences.

The results as for the combination between the presentation forms of the RGDT test in its pre-established frequencies (table 8) in the RPtG, revealed statistically significant differences when compared the binaural with the monoaural presentation. The thresholds of detection of intervals of time were smaller in 1000 and 4000 Hz on the left and in 4000 Hz on the right than the obtained in binaural form. In the 500 and 2000 Hz frequencies there weren't statistically significant differences. In the LPtG subgroup, it was observed statistically significant differences (table 8) when compared the binaural with the monoaural presentation on the 500, 1000 and 4000 Hz frequencies. The thresholds of binaural presentation were smaller than the ones obtained on the monoaural form (table 2).

Garcia (2001) did not find statistically significant differences between the answers according to the ear that the stimulus was presented right and left ear on the 1000 and 4000 Hz tested frequencies.

The interval of confidence of the results for the RGDT test in its binaural and monoaural form (table 9 and figure 1) revealed that the thresholds gap do not exceed 20 milliseconds in the binaural on the auditory frequencies of 500, 1000 Hz and do not exceed 25 milliseconds in 2000 and 4000 hertz. In the monoaural form these limits were raised in about 5 to 10 milliseconds.

Then, the one sends regards that the RGDT test would be applied in the binaural form because it seems to be easier, faster and the one that revealed smaller thresholds in this study.

According to this research, the preterm born children had presented an ability of temporal resolution inferior to the term born ones, indicated mostly on binaural form of attainment of the threshold of gap. As long as the RGDT test was used for new studies, these results must be compared.

In specialized literature examine some authors (Dupin et al., 2000; Davis et al., 2001; Demanez et al, 2003) tells in their studies inferior performance in the auditory behavior in been born preterm when compared with been born in term.

It is known that the inability of temporal resolution tells about the difficult to feel stimulus that modify quickly and this may affect the phonological processing of the language the discrimination of these sounds and so may interfere with the comprehension of the speech mostly in faster speed. According to the data on this work it is believed that the preterm born children may be considered of risk to present alterations of language, reading and learning once that their development on the temporal resolution were inferior to the term born children of the same ages. As so, it is recommended that it would be realized an evaluation for the behavior to temporal resolution in preterm born children making possible when necessary intervention to minimize difficulties on the development of audition and language that possibly may happen.

Conclusion

The preterm born children revealed an ability to temporal resolution inferior to the term born ones, indicated mostly in the binaural form of attainment of the threshold of gap between pure tones of different auditory frequencies.

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