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Computer-based auditory training: different type of performance analysis

Desempenho no treinamento auditivo computadorizado *Performances in computerized auditory training*

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ABSTRACT

Purpose: Analyze and correlate the auditory performance in the evaluation stage in the chosen software and electrophysiological responses pre and post computer-based auditory training. **Methods:** This is a longitudinal, comparative, clinical and experimental study, performed after the approval of the ethics committee. The sample consisted of seven children, aged 7 to 8 years and 11 months, from both genders, diagnosed with auditory processing disorder. The therapeutic intervention was based on the training with the Escuta Ativa® software and composed of 12 sessions, performed twice a week, lasting approximately 30 minutes each. The score in the evaluation stage in the chosen software and the findings of the electrophysiological measurement on Long-Latency Potential Evoked Auditory, specifically P3 component, pre and post-training, were analyzed through an adequate statistical study. **Results:** Among the three stages of the evaluation by the software, there was no statistically significant post-training result. As for the P3 component, 3 out of the 4 children started to have it post-intervention therapy. In the search for correlation between behavioral and electrophysiological results, there was no statistical significance in either moments of the evaluation. **Conclusion:** It was not possible to verify a significant difference between the pre and post-training periods in the evaluation stage of the software itself, showing the need for further studies to verify the use of this evaluation tool in a clinical setting. An effect of post-training plasticity with the appearance of P3 component was noted in some children. There was no correlation between the evaluation steps by the software and the electrophysiological measurement.

Keywords: Hearing; Auditory perception; Auditory perceptual disorders; Child; Software.

RESUMO

Objetivo: Analisar e correlacionar o desempenho auditivo na etapa de avaliação existente no *software* escolhido e respostas eletrofisiológicas pré e pós-treinamento auditivo computadorizado. **Métodos:** Trata-se de um estudo longitudinal, comparativo, clínico e experimental, realizado após aprovação do comitê de ética. A amostra foi composta por sete crianças, com idade entre 7 anos e 8 anos e 11 meses, de ambos os gêneros, diagnosticadas com transtorno do processamento auditivo. A intervenção terapêutica foi baseada no treinamento com o *software* Escuta Ativa® e composta por 12 sessões, realizadas duas vezes por semana, com duração aproximada de 30 minutos cada. Analisou-se a pontuação nas etapas de avaliação existente no *software* escolhido e os achados da medida eletrofisiológica potencial evocado auditivo de longa latência, especificamente o componente P3, pré e pós-treinamento, por meio de estudo estatístico adequado. **Resultados:** Dentre as três etapas de avaliação pelo *software*, não houve resultado estatisticamente significativo pós-treinamento. Quanto ao componente P3, 3 das 4 crianças com ausência do componente passaram a tê-lo, pós-intervenção terapêutica. Na busca de correlação entre resultados comportamentais e eletrofisiológicos, não houve significância estatística, em ambos os momentos de avaliação. **Conclusão:** Não foi possível verificar diferença significativa entre os períodos pré e pós-treinamento, usando a etapa de avaliação do próprio *software*, mostrando necessidade de mais estudos de investigação para verificar a utilização desta ferramenta de avaliação em ambiente clínico. Percebeu-se efeito da plasticidade pós-treinamento, com o surgimento do componente P3 em algumas crianças. Não houve correlação entre as etapas de avaliação pelo *software* e a mensuração eletrofisiológica.

Palavras-chave: Audição; Percepção auditiva; Transtornos da percepção auditiva; Criança; *Software.*

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INTRODUCTION

Technological advances have allowed the most accurate diagnosis of Central Auditory Processing Disorders (CAPDs) and brought more attractive approaches to therapy for hearing disorders. When you think about Auditory Training (AT) for children, the more exciting the activity is for the child, the easier it will be to get to the goal, both by adherence to the process and the pleasure in doing motivational therapeutic strategies, proposed in the session.

Studies have shown the effects of the Computer-Based Auditory Training (CBAT) in different populations: people with hearing loss[1-3], people with normal hearing and Central Auditory Processing Disorder (CAPD)[4,5], people with normal hearing, auditory processing disorder and language[6,7] or speech disorder[5,8], and others.

Central auditory processing disorder (CAPD) occurs when the sound stimuli are heard, however, there is a loss at processing them, either in the interpretation, transmission, analysis, organization, transformation, elaboration, storage and/or recovery of the information received[9]. Among the complaints found in the population with CAPD are: difficulty in understanding verbal stimuli in the presence of competitive noise, difficulty at music appreciation, lack of attention in class and school difficulties[10]. Thus, it is essential to investigate the effectiveness of therapeutic interventions in children diagnosed with CAPD, since such interventions have the function of minimizing the functional consequences of the changes in the central auditory abilities[4,5, 7,11-13] and researches on this subject contribute to directing the speech-language pathology practices.

In general, research that aims to investigate the effectiveness of the auditory training use the same behavioral tests of the auditory processing assessment[5,7,11-13] and/or electrophysiological tests, such as the Long Latency Auditory Evoked Potential (LLAEP)[12,14,15], performed in the pre-training evaluation (usually evaluation in which the CAPD was diagnosed), to prove it´s results in different populations.

The LLAEP is composed of five components (P1, N1, P2, N2 e P3) and P3, specifically, is an endogenous potential, consisting of a positive component with latency of approximately 300 ms post-stimuli with origin in the primary and secondary areas of the auditory cortex[16]. It´s importance is justified, because, to be present in the evaluation, it is necessary that the subject has capacity of perception and cognition, as well as motivation to carry out the requested task. Thus, for the measurement of the P3 it is required the identification of a rare stimuli among a series of frequent stimuli, which are randomly presented, characterizing the oddball paradigm[16]. As previously mentioned, scientists have emphasized the importance of therapeutic monitoring by the use of P3, in particular, the latency measure of this component of the LLAEP, comparing pre and post-therapy performance.

In addition, some software developed ways to measure the auditory performance of it´s users, in the CBAT, with activities and/or evaluation questionnaires inserted in the own utilities, such as, for example, the evaluation stage of the Escuta Ativa® software[17]. The present research used this resource as another behavioral assessment parameter, which sought to verify possible modifications in this process of reorganization, coming from a CBAT.

The aim of this research was to analyze the effect of the CBAT, through the Escuta Ativa® software evaluation[17] and the findings in the LLAEP-P3, in addition to correlating the evaluation stages, with the results in the PEALL-P3.

METHODOLOGY

It is a longitudinal study, clinical, comparative, and experimental. It was approved by the Research Ethics Committee with Humans at the *Universidade Federal de Santa Maria*, with the Protocol number 43171715.0.0000.5346. The parents and/or guardians who agreed that their children took part in this research received and signed a Free and Informed Consent Form (FICF), as well as the participants' consent through the children's consent form. Respecting the integrity, 466/12 Resolution, of the Brazilian National Health Council.

For the composition of the sample, a survey for children in internships and outpatient services of a undergraduate and postgraduate program in Speech and Language Pathology from the institution in question was conducted. Moreover, collections were made in public Elementary Schools, by exposing to the teachers the characteristics and complaints related to the CAPD, to identify children and give a referral to an assessment. In addition, social networks were used to spread the research and thus identify candidates interested in participating on the study.

As an eligibility criteria, the following requirements for inclusion were chosen: Legal guardians had consented the participation by signing the FICF; consent of the child; children aged 7 to 8 years and 11 months; have a normal peripheral hearing; show CAPD symptoms previously diagnosed with behavioral assessments (show auditory skills change after the behavioral tests battery but accompanied by a complaint of a functional skill dependency[9]); have Brazilian Portuguese as the native and only language; have typical phonological acquisition; show left manual preference. Criteria for exclusion were: children with evident neurological, emotional and/or cognitive problems, followed by parental report, or show motor or obvious organic changes; make regular use of musical instruments; have previously performed language therapy or auditory stimulation.

From the total of 105 children selected, only 77 were contacted, it was not possible to get in touch with the other 28 due to wrong phone numbers and/or refusal in participating on the research. From the 77 children contacted, 44 attended the evaluation on the previously scheduled date.

The initial assessment for the sample composition was composed by the following procedures: anamnesis general view, visual inspection of the external acoustic meatus, pure tone audiometry, logoaudiometry, acoustic immitance measures and behavioral assessment of the central auditory processing, through three tests involving the cognitive processes of encoding, decoding and nonverbal gnosis, being them: Random Gap Detection Test, Pediatric Speech Intelligibility and Dichotic Non-Verbal Test. The decision for these tests was determined by the existence of a normality criteria in accordance with the sampling age, applicability without interference on language issues and choice of a minimum battery to evaluate different gnosis process.

The initial sample was composed of 18 children who had alterations in at least one behavioral test, however, eight were excluded for showing speech disorders and three others chose not to continue participating on the research. For this reason, the final sample was with seven children from both genders, that met all the eligibility criteria.

After the final composition of the sample, the LLAEP was conducted in all children. For the completion of this assessment, the electrophysiological equipment two-channel Smart Ep Intelligent Hearing Systems (IHS) was used. The parents or guardians of the children were advised to avoid the use of medicine during the 24 hours before the examination and not have stimulating foods or drinks (tea, coffee or chocolate) during the 4 hours prior to it. In addition, the children could not practice exhausting physical or mental activities.

To perform the electrophysiological assessment, the child was positioned sitting comfortably on an armchair and was oriented to stay relaxed and alert to the sounds that would be presented; on every rare hearing stimulus, he/she should take a note on a sheet of paper[18]. The LLAEP was conducted with the pair of syllables /ba/ and /di/, presented in a binaural form, through insert headphone, with an intensity of 75 dB nHL. For each type of stimulus, the Oddball[16] paradigm was adopted, were presented around 240 frequent stimuli and 60 rare ones, in a window of 510ms, high-pass filter from 30 Hz and low-pass 1 KHz and alternating polarity. The electrodes were positioned using electrolytic paste, to improve the conduction of the stimuli, after cleaning the skin with abrasive Nuprep® folder, as follows: A1 on the left mastoid, A2 on right mastoid, Cz on the vertex and the ground (Fpz) on the forehead. In the current research, as done by other researchers[15], there was no record of reproduction of these waves, since the collection replication could cause fatigue and implicate on the result of the evaluation, as it depends on the attention. To maintain the quality of all traces of LLAEP-P3, changes were done in placement of electrodes for the subjects who showed some kind of myogenic interference. Changes in the position of the chair and pre amplifier were also done. Moreover, when necessary, the assessment was repeated. The value of the electrode impedance was equal to or less than 3 kohm. P1, L1, P2 and N2 were considered as exogenous components, the traces corresponding to the frequent stimuli, like the P3 component, only the traces formed by rare stimuli. In the analysis of the presence of the P3, it was taken into consideration the biggest positive peak after the other components, and their latency between 220 and 380, ms, as suggested in the literature[16]. In order for the test to be consider appropriated, the child should hit anywhere from 90 to 95% of the total of the rare stimuli presented, at most, 10% of artifacts. Otherwise, the test was paused, again and restarted, or, depending on the case, rescheduled. It should be mentioned that the initial assessments and LLAEP were done on more than one day, to avoid fatigue and interference on the result, which could compromise the research. The LLAEP-P3 was conducted pre and post CBAT and the markings of the components were verified by three judges (Audiologists), with theoretical knowledge and practical experience in electrophysiological assessment, especially LLAEP-P3. Two judges received a copy of the traces without the appropriate markings and entered each of the components, considering their experience in marking and the criteria specified above. The third judge made the final analysis of such markings. The current study analyzed only the P3 latency data pre-and post-intervention. It is appropriate to use just the latency values, as it varies when compared to the values of amplitude, suffers less influence from change by the lack of attention to the assessment[19].

To do the monitoring and verify the resulting evolution of the CBAT after two weeks of the end of the therapeutic intervention, the revaluation was done in each child, following the same protocol consisting of the behavioral tests of processing auditory, applied at the time of the diagnostic assessment. However, the pre and pos CBAT acting in testing standardized behavior were not considered in this study, because it is a topic for another research and the goal of this study was to the behavioral analysis in the evaluation step present in the software used and electrophysiologic-P3.

The entire rehabilitation process was based on a Computer-based Auditory Training (CBAT) program, composed of 12 individual sessions, with each session lasting 30 minutes, done at the setting Therapeutic-School clinic of the institution in question. Sessions were held twice a week, a different activity done per each session, in the same sequence for all children. The software used was the Escuta Ativa®[17], with the use of Sony supra-auriculares headphones, model MDR-ZX100. Among the auditory skills stimulated by the 12 activities available in the software, there were steps of stimulation of auditory abilities of figure-background, resolution, temporal standardization, integration, and binaural auditory discrimination and separation[5,17]. The activities had a timeout so that the child could respond to the objective proposed in the current study, however, it was not considered because it was insufficient for the child to think and respond appropriately, particularly during first sessions. This way, there is the possibility of "pause" to allow longer reasoning for the children. It should be noted that we chose an only 12-session software, because the study is an analysis through the use of a specific software, in order to investigate the effect of this type of training without extra sessions, taking care of the standardization among the subjects.

To measure the effect of the intervention, It was analysed the auditory performance of the children in the pre and post-CBAT moments, considering the reviews proposed by the software itself, that is, monitoring of the therapeutic effectiveness. The Escuta Ativa® software[17] introduces a section of assessment that analyzes the performance in three steps: speech in noise, whistles, and listen dicótica. In the step of assessment "speech in noise", the child must identify and understand what he/she heard in the presence of competitive non-verbal stimuli and has, as the objective, to evaluate the speech perception in non-optimal listening environment; in the "identification of whistles" step the child must perform the same sequence of sounds previously heard; This step evaluates the ability of temporal pattern. In "bug dichotic", which evaluates ability of binaural integration, the child listens to four different words, two on the right ear and two on the left ear. At the end of the assessment, the software shows the number of hits in each of the three steps. It should be noted that this assessment section occurs immediately after the end of the tenth session of CBAT, before two bonus activities, which

do not work directly with hearing skills, yet seek to improve those skills, like visual attention, visomanual coordination and processing speed/agility of response. The software review section does not present the same exhibition activity later in therapy, because it would bring replay and would invalidate its post-therapy use.

Considered as variables of this study: Behavioral performance in the chosen software assessment and electrophysiologic P3 component latency. For analysis of the results obtained, we used the 13.0 Statistical software. In all the inference statistics analysis, using a significance level of 5% ($p<0.05$). All the variables analyzed in this study were discrete quantitative. The distribution of the variables was estimated with the Shapiro Wilk Test and all variables achieved normal distribution. This way, we used the parametric paired t-test, test for comparison of pre-and post-intervention moments in a dependent group, and parametric test of Pearson correlation, to correlate the results with respect to behavioral performance of participants in the evaluation section of the chosen software and the latency of the electrophysiological P3 component, both for the pre-intervention and post-intervention moment.

RESULTS

Pre and pos CBAT results in the assessment of the Escuta Ativa® software[17] are set out in Table 1. It was observed that there was no significant difference in any of the stages of the evaluation.

It is necessary to emphasize that these results refer to a score of hits calculated by the software itself.

In relation to the objective measure analyzed (LLAEP-P3), pointing out the absences and the latencies (ms), when such a component was present, they were considered themselves above the values indicated by the literature, as mentioned (latency between 220 and 380ms [16]), because the goal of the study was to compare the pre-and post-intervention changes. It was observed that the results showed a improvement in the responses, considering that 4 children did not show the component searched on the registry and LLAEP analysis (P3) pre-CBAT on the right ear, and 3 children, on left ear, and after the CBAT, only one child showed response to the P3 component. However, there was no statistically significant difference in latencies on the two of the moments searched. Pre and post CBAT results are described in Table 2.

Table 1. Children's performance in the evaluation of the Escuta Ativa® software, pre-and post- Computer-based Auditory Training, the entire sample (n=7)

SUBJECT	IDENTIFICATION OF WHISTLES		SPEECH IN NOISE		DICHOTIC LISTENING			
					RIGHT EAR		LEFT EAR	
	PRE-CBAT	POS-CBAT	PRE-CBAT	POS-CBAT	PRE-CBAT	POS-CBAT	PRE-CBAT	POS-CBAT
S1	40	20	66	83	30	50	15	30
S2	20	10	33	66	35	10	15	55
S3	10	40	66	66	70	45	0	15
S4	10	0	33	66	05	05	35	40
S5	10	10	0	33	20	40	20	05
S6	20	10	66	50	35	0	10	75
S7	30	30	66	83	30	50	10	40
*p-valor	0.654		0.058		0.712		0.063	

*p<0.05 – Test -T Paired

Caption: CBAT = computer-based auditory training; S1 = Subject 1; S2 = Subject 2; S3 = Subject 3; S4 = Subject 4; S5 = Subject 5; S6 = Subject 6; S7 = Subject 7

Table 2. P3 component analysis on electrophysiological assessment, pre-and post-computer based auditory training, the entire sample, whereas the responses as absence and presence with latency (ms) of this component (P3 component analysis on electrophysiological assessment, pre-and post- computer based auditory training, the entire sample, whereas the responses as absence and presence with latency (ms) of this component (n=7)

SUBJECT	RIGHT EAR		LEFT EAR	
	PRE-CBAT	POS-CBAT	PRE-CBAT	POS-CBAT
S1	ABS	ABS	ABS	ABS
S2	ABS	336	363	338
S3	357	361	364	360
S4	ABS	335	ABS	334
S5	363	356	357	352
S6	ABS	370	ABS	364
S7	360	353	371	336
*p-valor	0.459		0.109	

*p<0.05 – Test -T Paired

Caption: CBAT= computer based auditory training; ABS= absent; S1 = Subject 1; S2 = Subject 2; S3 = Subject 3; S4 = Subject 4; S5 = Subject 5; S6 = Subject 6; S7 = Subject 7

Table 3. Correlation between the performance in this review session on Escuta Ativa® software and the P3 component latency in electrophysiological assessment, pre-and post- computer based auditory training in the entire sample (n=7)

VARIABLES	PRÉ-CBAT		PÓS-CBAT	
	R	*p- value	r	*p- value
IDENTIFICATION OF WHISTLES				
P3 RE	0.866	0.333	-0.137	0.796
P3 LE	-0.866	0.333	-0.522	0.288
SPEECH IN NOISE				
P3 RE	0.866	0.333	-0.551	0.257
P3 LE	0.000	1.000	-0.644	0.168
LISTEN DICÓTIC				
RE-P3 RE	0.292	0.811	-0.206	0.696
RE-P3 LE	0.682	0.522	-0.377	0.462
LE-P3 RE	-0.500	0.667	0.038	0.942
LE-P3 LE	-0.500	0.667	0.151	0.775

*p<0.05 – Test of Correlation of the Person

Caption: CBAT = computerized auditory training; RE = right ear; LE = left ear; r = correlation coefficient (r=0 to 0.25, very weak; 0.25 to 0.50: weak, 0.5 to 0.75: moderate, 0.75 to 0.9: strong, 0.9 to 1: very strong)

For the performance evaluation session of the Escuta Ativa® software[17] and correlation with the LLAEP-P3 component on electrophysiological evaluation, it was noted that the analysis had significant values (Table 3).

DISCUSSION

It was difficult to find studies analyzing the performance of the CBAT with the use of the evaluation held in the therapeutic program itself, as the one discussed on this publication. Current studies have been demonstrating test-retest analysis by behavioral tests [7,11,13], or CAP electrophysiological [12,14].

As shown in Table 1, to analyze the performance of children in the Escuta Ativa® software evaluation[17], considering the three steps assessed, there was a greater tendency to difference pre and post-CBAT in the test "speech in noise", which involves the ability to Figure-background hearing and attention. It is believed that this skill plays an essential role on the child's good social and educational development, since the ability allows the child to separate important main auditory information from secondary auditory information, such as, for example, separate the teacher's speech from the classroom noise. This result in the evaluation in question demonstrates improvement in the information retention process, related to the attention to the sound of interest, against the distracting sounds, especially in situations of non-ideal communication. However, it is believed that it is not a statistically significant result, due to the small amount of subjects. This is a limitation of the therapeutic intervention studies, due to the loss of subjects during the therapeutic process. Another research has shown improvement in the ability of the figure-background in the post-CBAT assessment[4], noticing a better performance on speech perception, both in acoustic environment unfavorable (that requires more of the figure-background skill from subject for understanding), as in a quiet environment[1].

As in other stages of the evaluation, it was noticed that on "identification of whistles", responsible for analyzing the perception of the intensity and frequency patterns from the sound stimuli presented, there was no statistically significant difference between pre-CBAT and post-CBAT, because only one of the children showed improvement. This finding disagrees with the research conducted on 8-year old children, diagnosed with reading disorder and treated with CBAT sessions, through the Fast Forward Language software, in which the results were statistically significant for the tests on frequency pattern and duration, involved in temporal ordering, pre-and post-CBAT[7]. It is believed that this difference between the findings can be explained by the fact that the software used in the research mentioned aims to stimulate specifically the auditory temporal processing of the subject, while the software used in the current research stimulates the auditory processing in general, without emphasis on one or another specific skill, as it also occurred in the absence of significance to step "dichotic listening". This way, the software, as it was used, turned out not to be enough to rehabilitate or improve skills related to intensity and frequency patterns in the population studied by the stage of evaluation of the software itself. As previously referenced in the methodology, in this study we decided to perform only the 12 sessions provided for the software. Maybe extra sessions could assist in the rehabilitation of such skills. It is worth mentioning that other training modalities have shown that, even without a specific skill training, global skills improvement may occur[20-22], which was not the case on this study.

In the "dichotic listening" step, it was assessed the skills of selective attention and hearing directed to verbal sounds, which, although show important changes post-CBAT, bilaterally, did not show any significant difference. The average pre-CBAT hit on the right ear was 32.14 and 15 on the left ear and, post-CBAT, 28.57 on the right ear and 37 in his left ear, noticing a inversion of performance by ear. This data can be explained when it analyzing the brain's anatomy and its physiology because the brain's hemispheres are organized in a non-symmetrical form and relate to distinct functions, such as, the left hemisphere language-oriented and the right hemisphere oriented to visual and spatial components[23,24]. It is believed that the occurrence of the reversal of performance by ear pre and post-CBAT is related to the effect of compensation between the cerebral hemispheres post-stimulus. Moreover, it was observed that there were decreases on the right ear and improvements on the left ear to verbal stimulus post-CBAT, what draws attention because of the hemispheric functions already mentioned (left hemisphere, right ear, relate to language), expecting a reverse result in the

skill assessed, after stimulation, hindering it to make an inference to justify this finding.

In a general analysis of the performance presented by the children in the activities of the software Escuta Ativa®[17], there was no significant improvement, possibly due to the short time between the end of the activities and the reassessment proposed by the computer program. The revaluation was performed right after the end of the tenth session of CBAT and before two bonus activities, not allowing the display of positive changes on the children's responses. It is important to mention a research[25] which defends the existence of different stages of learning to acquire the effects of auditory training, being one fast and the other slow. The fast step would be the one that occurs during the session, in which the child becomes aware of the task; on the other hand the slow step is developed during the consolidation phase, which can take 6 to 8 hours, or even weeks, to learn, enabling the change in long-term memory. Moreover, another factor that may have influenced negatively to the achievement of the results was the sample size of only seven students, being this a bias. Another hypothesis being addressed is that such a procedure has not yet been through a careful evaluation of its sensitivity and specificity, according the literature consulted. To suggest the use of Escuta Ativa® software assessment[17] it would require a more robust clinical sample study and correlation analysis with behavioral tests of auditory processing to assess auditory skills related.

In this study, the effect of hearing plasticity after stimulation can be observed in Table 2 because four children had absence of P3 and, after the CBAT, only one remained without the potential in both ears. A study published in 2013 showed the effect of auditory training in children with language change after the therapy, through the LLAEP-P3[26], confirming the relationship between stimulation and plasticity[27]. It should be remembered that the LLAEP-P3 has been used to measure the therapeutic efficacy[12,14,15], as well as to complement the diagnosis of CAPD[28].

In the analysis of the correlation between behavioral assessments (stage of evaluation of the software itself) and electrophysiological evaluation (P3 latency) it was demonstrated the absence of a meaningful result (Table 3), not showing correlation between the two measures, both on pre and post-CBAT. This finding is consistent with other studies[11,29], that there have been weak correlation between findings obtained in behavioral and electrophysiological evaluation. According to a recent research[29], the presence of weak correlation is justified, as a result of the condition/essence of the evaluation. While behavioral assessment analyzes the function of auditory skills, electrophysiological assessment checks the integrity of the auditory forms, in other words, auditory function evaluates the behavior of the child as a whole, considering the auditory system altogether, while electrophysiological checks the neural synchrony, which varies from individual to individual and can suffer interference from external factors. However, other authors report that the correlation with behavioral assessments has LLAEP-P3 of the CAP, when matched[28], being an additional mean of diagnostic evaluation for CAPD.

A new research to investigate the findings brought from the step evaluation of CBAT would be interesting, both to assist the work of the therapist as a practical mean of assessing test-retest, since the subject will be familiar with the software, how to show the patient their performance with the auditory stimulation. It is known that many subjects with therapeutic indication of auditory training have no financial conditions to afford a complete assessment of the CAP, or cannot wait to be called in the health system, thus it is necessary and important to have, in practice, more accessible alternative forms of assessment, in order to measure the effect of the therapy. However, it cannot be considered as a mean to replace the complete evaluation performed by behavioural tests of CAP, being useful for the measurement of the professional treatment.

It is noteworthy that, in the current study, we chose not to have a control group, since the sample, considering the eligibility criteria, was restricted and prioritized an offer for auditory training to all subjects. Soon, it was analyzed by comparing the subject themselves, pre and post-CBAT, to measure the effect of the intervention, because this way, the variability of environmental, socioeconomic and cultural factors could be avoided.

CONCLUSION

From the analysis of the children's performance against the assessment section of the software, it was possible to conclude that there were no significant results after the therapeutic intervention. However, there was improvement in LLAEP-P3 after auditory stimulation, with the appearance of the component in three children, demonstrating the effect of brain plasticity on stimulation.

Regarding the analysis of the correlation between the stages of behavioral and electrophysiological assessment, there was no correlation between the variables studied in both moments of evaluation.

It was not possible to verify a significant difference between the pre- and post-training periods, using the evaluation stage of the software itself. The post-training plasticity effect was observed, with the appearance of the LLAEP-P3 component in some children. There was no correlation between the evaluation steps by the software and the electrophysiological measurement. Plus, there's a strong need to conduct further research in the field of computerized auditory training, aiming to study and prove its effectiveness as a resource of therapeutic intervention in CBAT, as well as new studies that seek to measure the effects of the CBAT be means of an evaluation through the training software to make its use reliable as a clinical tool of assistance to the therapist.

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