Original Article

Artigo Original

Study on the application of the time-compressed speech in children

Estudo do teste de fala comprimida em crianças

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Keywords

Child
Speech Perception
Hearing Tests
Speech Discrimination Tests
Speech Intelligibility

ABSTRACT

Purpose: To analyze the performance of children without alteration of central auditory processing in the Time-compressed Speech Test. **Methods:** This is a descriptive, observational, cross-sectional study. Study participants were 22 children aged 7-11 years without central auditory processing disorders. The following instruments were used to assess whether these children presented central auditory processing disorders: Scale of Auditory Behaviors, simplified evaluation of central auditory processing, and Dichotic Test of Digits (binaural integration stage). The Time-compressed Speech Test was applied to the children without auditory changes. **Results:** The participants presented better performance in the list of monosyllabic words than in the list of disyllabic words, but with no statistically significant difference. No influence on test performance was observed with respect to order of presentation of the lists and the variables gender and ear. Regarding age, difference in performance was observed only in the list of disyllabic words. **Conclusion:** The mean score of children in the Time-compressed Speech Test was lower than that of adults reported in the national literature. Difference in test performance was observed only with respect to the age variable for the list of disyllabic words. No difference was observed in the order of presentation of the lists or in the type of stimulus.

Descritores

Criança
Percepção da Fala
Testes Auditivos
Testes de Discriminação da Fala
Inteligibilidade de Fala

RESUMO

Objetivo: Analisar o desempenho das crianças sem alteração do processamento auditivo central no teste de fala comprimida. **Método:** Trata-se de um estudo do tipo descritivo, observacional, transversal. Participaram do estudo 22 crianças com idade entre 7 e 11 anos, normo-ouvintes, sem transtorno do processamento auditivo central. Para descartar esse transtorno, foram aplicados o questionário *Scale of Auditory Behaviors,* a avaliação simplificada do processamento auditivo e o teste dicótico de dígitos na etapa de integração binaural. Nas crianças sem alteração, foi aplicado o teste de fala comprimida. **Resultados:** Os indivíduos apresentaram melhor desempenho na lista de monossílabos do que na de dissílabos, apesar de não haver diferença significativa. Não houve influência da ordem de apresentação das listas, das variáveis gênero e orelha no desempenho do teste. Em relação à idade, apenas na lista de dissílabos houve diferença no desempenho. **Conclusão:** Foi possível concluir que a média de acertos das crianças no Teste de Fala Comprimida foi inferior aos achados na literatura nacional em adultos. Houve diferença no desempenho do Teste de Fala Comprimida com a idade apenas na lista de dissílabos. Não houve diferença quanto à ordem de apresentação das listas de aplicação nem em relação ao tipo de estímulo.

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INTRODUCTION

The ability of the central nervous system (CNS) to analyze, process and interpret sounds is called central auditory processing (CAP). The American Speech-Language-Hearing Association (ASHA) defined CAP as the competence and consequence by which the CNS uses auditory information[1].

CAP is responsible for the mechanism and process of the localizing and lateralization of sound, auditory discrimination, recognition of auditory patterns, temporal aspects of hearing (temporal order and sequence, temporal resolution) and auditory performance with competitive and degraded acoustic signals[2].

CAP depends on factors such as neurobiological maturation, preservation of hearing and cognitive abilities such as attention, memory and language, and environmental stimuli. The involvement of any of these factors can cause auditory disabilities that characterize a functional deficit denominated Central Auditory Processing Disorder (CAPD)[3].

CAPD occurs when there is a deficit in one or more auditory abilities, which causes difficulties in the processing of auditory information, manifesting altered performance in one or more tests of the behavioral evaluation of CAP[4].

Individuals with CAPD may present peculiar characteristics such as inattention, difficulty in following dialogues with many people involved speaking at the same time or with competitive noise, show difficulty to understand jokes and "double meaning", do not answer promptly when called or need to be called multiple times, have difficulty learning to read and write and mathematics, exchange letters, do not understand what they read, have trouble memorizing and have difficulties to relate to children of the same age group[5].

In CAP evaluation, it is necessary to analyze all hearing abilities through behavioral tests, as an isolated test alone is not enough to diagnose a CAPD. The complete battery should be composed of monaural tests of low redundancy, dichotic, temporal processing and binaural interaction tests[6].

Monaural low redundancy tests are characterized by an extrinsic reduction of the speech signal, that is, the auditory stimulus is presented in a degraded way by means of electroacoustic modifications, which serve to evaluate the ability of auditory closure[7].

In auditory closure ability, the functions of auditory discrimination and decoding are involved; such ability is necessary for the individual to be able to complete the information when part of it is lost during the speech by a degradation of the speech signal. A change in this ability may interfere with the capacity of speech recognition, which can lead to learning difficulties, especially in children[8].

Among the tests that evaluate auditory closure, there is the Time-compressed Speech Test (TCST), which has the auditory signal degraded by temporal changes (compression). The TCST was translated, adapted and standardized for Brazilian Portuguese for normal hearing young adults in 2007, available for clinical practice in 2011[9], containing lists of monosyllables and disyllables with 60% time compression[10].

There are few studies in the national literature on TCST and no studies with the child population have been found. Because of this, the importance of the study is justified, as this will help in the standardization of TCST for the child population, besides bringing more data on the diagnosis of the CAPD.

Therefore, the present study had as a main objective to analyze the performance of children without alteration of CAP in TCST. As specific objectives, we looked to compare the results according to the variables: gender, age and ear; and compare performance between the monosyllable and disyllables TCST word lists to see if there was a difference in the order of presentation of the application lists.

METHODS

The present study is a descriptive, quantitative, observational, cross-sectional study approved by the Research Ethics Committee of the *Universidade Federal de Santa Catarina* (UFSC), under the number 95.472. Before starting the collection, those responsible who agreed to participate gave written informed consent and were informed about the confidentiality of the information. The research was carried out at the Clinical School of Speech and Hearing Therapy of UFSC from June to October 2016.

Twenty-two normal-hearing schoolchildren aged 7 to 11 years were part of the sample. For the children who did not present CAP changes verified through the Scale of Auditory Behaviors (SAB) questionnaire[11], the Simplified Auditory Processing Assessment (SAPA)[9] and the Dichotic Digit Test (DDT) of the binaural integration stage[12], the TCST was applied.

As inclusion criteria, the following items were considered: age group between 7 and 11 years old, DDT (binaural integration stage) with values within the normal range for the age group, normality in the SAPA and SAB questionnaire and absence of oral language deficits, auditory and conductive impairments[13].

The population that was part of the study was distributed in the following groups: Group 1 (G1) - children who performed the TCST initially by the list of monosyllables and later by the list with disyllables and Group 2 (G2) - children who performed the test first by the list of disyllables and later by the list of monosyllables. Both groups, regardless of the list of stimuli selected to start the test, always performed initially on the right ear followed by the left, and later the list of stimuli was changed, and the same procedure was performed starting with the right ear.

At the beginning of the study, the SAB questionnaire was given for parents or guardians to respond. After the delivery of the questionnaires answered, the individuals who presented scores within the established reference values were referred for basic audiological evaluation consisting of meatoscopy, pure tone audiometry (PTA) and immittance measures.

The SAB questionnaire has 12 questions, which have the option of answering from 1 to 5, with 1 being "frequently" and 5 "never". The questions are related to the day-to-day behavior of the child and must be answered by parents, guardians or teachers. The questionnaire helps identify possible CAPD and should have a minimum score of 36 to enter the study[11].

In ATL, the auditory thresholds were searched via air conduction, within the sound frequencies of 250 to 8000 Hz and in immitanciometry, the tympanometric curve and contralateral

acoustic reflexes were investigated within the frequencies of 500Hz, 1kHz, 2kHz and 4kHz[6]. Individuals with ATL[6] and immitanciometry within normality patterns performed SAPA and DDT.

At SAPA, the following diotic tests were used: five-way sound localization (SL), sequential memory for verbal sounds (SMV) and sequential memory for non-verbal sounds (SMNV). In this evaluation, auditory abilities of sound localization and temporal ordering were analyzed[9].

The DDT[12] is composed of four lists with 20 items, being formed by four disyllabic numerals. The presentation was made at 50dBNS of the tritonal average of 500, 1000 and 2000 Hz. In this study, only the binaural integration step was evaluated, in which the individual needs to repeat the four numbers regardless of the order in which they were presented. Ten items were presented and the earphone was reversed to rule out any possibility of interference in the evaluation. This test is available on Track 12 of the MP3 accompanying the auditory behavioral testing material for the assessment of central auditory processing.

The binaural integration step was selected because it was considered the most sensitive test to exclude CAP difficulties[14]. Individuals who presented results within the normal range of SAPA and DDT performed TCST.

The TCST[10] is composed of four lists, each of 50 words, available on tracks 6-9 of MP3 in the evaluation material of Behavioral Auditory Tests for the evaluation of CAP. In the four lists, the words underwent electroacoustic compression at a rate of 60%. Bands 6 and 7 are composed of monosyllable words and were applied to the right and left ears, respectively. Bands 8 and 9 are composed by disyllable words and were also applied in the right and left ears, respectively. The intensity used in the test was 40dBNS above the tritonal average of 500, 1000 and 2000 Hz. The results were recorded in a specific protocol. The children were instructed to listen to every word and then repeat it as they heard. The evaluator performed an orthographic transcript of the children's responses on the side of the respective test word.

The study was performed using Interacoustics brand AC40 audiometer and TDH39 earphones (Interacoustics USA, Eden Prairie, MN). Prior to the start of the test, a 1000 Hz tone was presented at each receiver for stimulus calibration by adjusting the VU meter.

The data were registered in an Excel Office 2010 spreadsheet containing the numerical identification of each individual, age, age group of 7 to 11 years, gender, performance in the right and left ear and number of correct or incorrect words in each ear as well as performance on every word list. Subsequently, the data underwent a descriptive and inferential statistical analysis through SPSS software for Windows version 13.0 with application of the Mann-Whitney *U* test and Spearman's rank correlation coefficient.

The Mann-Whitney *U* test was used to verify the order of presentation of the TCST lists and to verify the association of age with test performance and order of presentation of the lists.

The Spearman's rank correlation coefficient (*r*) was used to verify the correlation between age, ear and gender with the lists of stimuli.

The Spearman's rank correlation coefficient from 0 to 0.3 is considered negligible; from 0.31 to 0.5, weak; from 0.51 to 0.7, moderate; from 0.71 to 0.9, strong and > 0.91, very strong. *P*-value was considered significant for values smaller than 0.05 ($p < 0.05$) and was represented with superscript asterisks (*). Values of 0.051 to 0.09 were considered when there was an association tendency and were represented by two superscript asterisks (**).

TCST performance was compared considering the previously determined variables. Finally, a quantitative and qualitative analysis of the errors presented by the children was carried out.

RESULTS

The study population consisted of 22 children, with a mean age of 8.9 years (± 1.23); 13 (59%) of the female gender and 9 (41%) of the male gender.

Table 1 shows descriptive statistics of performance in the SAB questionnaire and the auditory tests that were performed to select the study population. Table 1 also shows that the data are homogeneous, since there is no great variability in the standard deviation in the performance of the tests. The SAB questionnaire presented the greatest variability. In relation to TDD, the right ear in the children presented better performance than in the left ear.

Table 1. Descriptive statistics of the performance in the questionnaire SAB, SAPA, DDT-RE, TDD-LE

	Mean/Standard deviation	Minimum - Maximum	Median
SAB	47.9 ± 7.39	36 - 60	49.5
SL	4.55 ± 0.51	5 - 4	5
SVM	2.86 ± 0.35	2 - 3	3
SNVM	2.34 ± 0.49	2 - 3	2
7-8 years - DDT – RE (%)	96.11 ± 1.09	97.5 - 100	100
9-11 years - DDT – RE (%)	99.42 ± 1.09	97.5 - 100	100
DDT – RE (%) - general	98.07 ± 3.07	90 - 100	100
7-8 years DDT– LE (%)	92.7 ± 5.78	85 - 100	100
9-11 years DDT– LE (%)	98.46 ± 1.65	95 - 100	100
DDT – LE (%) - general	96.25 ± 5.16	85 - 100	98.75

Legend: SAB = Scale of Auditory Behavior; SL = sound location in 5 directions; SVM = sequential verbal memory; SNVM = sequential non-verbal memory; DDT-RE = dichotic digit test for right ear; DDT–LE = dichotic digit test for left ear

In Table 2 and Figure 1 shows TCST performance by age group.

Significant results were found when the lists of disyllable words in both the right and left ear related to age were presented.

Figure 1 shows that in the TCST performance by age group, the list of disyllables in the right ear was the one that presented the greatest difference.

Regarding gender, no difference was verified according to the order of presentation of the lists (p-value = 0.387) and also there was no influence of this variable on the performance of the lists: MRE (p-value = 0.734), MLE (p-value = 0.331), DRE (p-value = 0.438) and DLE (p-value = 0.209).

Subsequently, TCST performance according to the group in which the stimulus list was initiated is presented in Table 3.

In Table 3, shows that the means found in each list had similar results. There was little difference between the means of the ears and between the means of the lists of monosyllables and disyllables.

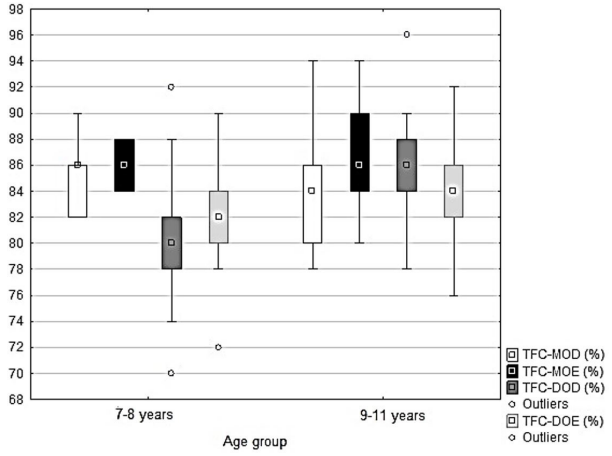
The variables grouped in the order of presentation of the stimulus lists of the TCST and according to the ear variable is presented in Figure 2.

Figure 2 shows that there was a tendency for individuals to present different TCST results with monosyllabic stimuli in the left ear, depending on the order of presentation of the test; that is, when individuals listened to the list with monosyllabic words lastly performed better, but there was no significant value. In the other stimuli, the order of presentation did not influence.

Whether there was difference of the variable age was also analyzed according to the order of presentation of TCST lists and no statistically significant difference was verified (p-value = 0.664).

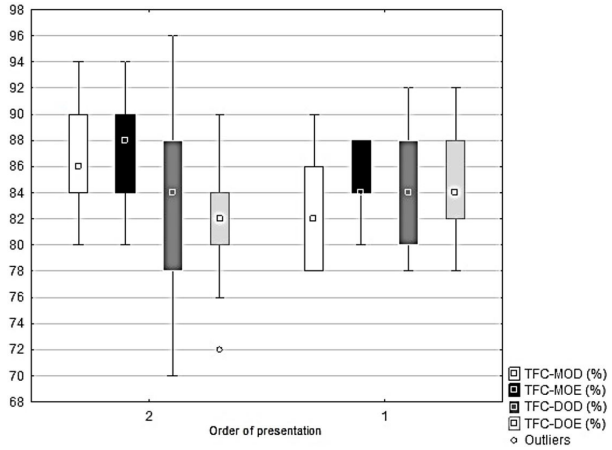
Table 4 shows the correlation between age and performance with TCST application lists.

It was observed that there was a positive and weak correlation between age and TCST performance in the right ear in the list of disyllables words; that is, the higher the age the better in the list of disyllables in the right ear. There was also a positive and weak correlation between the performance of TCST with monosyllable in the right ear with the left; that



Legend: TCST-MRE = monosyllable compressed speech test of right ear; TCST-MLE = monosyllable compressed speech test of the left ear; TCST-DRE = Disyllable test of the right ear; TCST-DLE = Disyllable test of the left ear. 1- Age range from 7 to 8 years; 2- Age range from 9 to 11 years

Figure 1. Box Plot of multiple variables grouped by age group according to the performance of individuals in the compressed speech test



*Mann-Whitney U test. Statistically significant values (p≤0.05). TCST-MRE (1) X TCST-MRE (2): p-value 0.132; TCST-MLE (1) X TCST-MLE (2): p-value 0.064**; TCST-DRE (1) X TCST-DRE (2): p-value 0.791; TCST-DLE (1) X TCST-DLE (2): p-value 0.256

Legend: 1 = started by the list of monosyllable words; 2 = started by the list of disyllable words; TCST-MRE = monosyllable compressed speech test of the right ear; TCST-MLE = monosyllable compressed speech test of the left ear; TCST-DRE = disyllable test of the right ear; TCST-DLE = disyllable test of the left ear

Figure 2. Box Plot of multiple variables grouped by order of presentation of the stimulus lists of the Compressed Speech Test and according to the variable ear

Table 2. Performance of compressed speech test by age group

		Mean/SD	Min - Max	Median	p-value
TCST MRE	**7 - 8 years**	85 ± 2	82 - 86	86	0.394
	9 - 11 years	87.14 ± 5.01	80 - 94	86	
TCST MLE	**7 - 8 years**	86 ± 1.63	84 - 88	86	0.500
	9 - 11 years	88 ± 4.61	80 - 94	90	
TCST DRE	**7 - 8 years**	78.50 ± 8.06	70 - 88	78	0.024*
	9 - 11 years	85.71 ± 5.93	78 - 96	86	
TCST DLE	**7 - 8 years**	81 ± 7.39	72 - 90	81	0.022*
	9 - 11 years	82.85 ± 4.14	76 - 90	82	

*Mann-Whitney U test: Statistically significant values ($p \leq 0.05$)

Legend: TCST-MRE = monosyllable compressed speech test of right ear; TCST-MLE = monosyllable compressed speech test of the left ear; TCST-DRE = disyllable test of the right ear; TCST-DLE = disyllable test of the left ear

is, when individuals performed well in one ear, they also presented in the other.

Next, the words with the highest occurrence of errors in the TCST according to the list of stimuli will be presented. Verified in the study was that in the list of disyllables of TCST there was error in 40 words of 50 presented, whereas in the list of monosyllables, there was error in 44 words of 50.

Figure 3 shows that the percentage of errors was higher in the monosyllable words *pá*, *nho* and *pau* and in the disyllable words *pago tombo* and *grito.*

Table 3. Descriptive analysis of the performance of the Compressed Speech Test according to the age group and the presentation group of the lists

	Group 1 (n = 11)			Group 2 (n = 11)			Total
	Mean/SD	Min - Max	Median	Mean/SD	Min - Max	Median	
TCST-MRE (%) 7-8 years	85.6 ± 3.57	82 - 92	86	85 ± 2	82 - 86	86	84.44
TCST-MRE (%) 9-11 years	81 ± 3.94	78 - 86	79	87.14 ± 5.01	80 - 94	86	84.30
TCST-MRE (%) General	83.09 ± 4.32	78 - 90	82	86.36 ± 4.17	80 - 94	86	84.36
TCST-MLE (%) 7-8 years	85.6 ± 2.19	78 - 92	82	86 ± 1.63	84 - 88	86	86.22
TCST-MLE (%) 9-11 years	83.66 ± 3.2	80 - 88	84	88 ± 4.61	80 - 94	90	86
TCST-MLE (%) General	84.54 ± 2.84	80 - 88	84	87.27 ± 3.82	80 - 94	88	86.09
TCST-DRE (%) 7-8 years	82.4 ± 5.54	78 - 92	80	78.5 ± 8.06	70 - 88	78	80
TCST-DRE (%) 9-11 years	85.66 ± 3.44	80 - 90	86	85.71 ± 5.93	78 - 96	86	85.69
TCST-DRE (%) General	84.18 ± 4.60	78 - 92	84	83.09 ± 7.34	70 - 96	84	83.36
TCST-DLE (%) 7-8 years	82.8 ± 4.6	78 - 90	82	81 ± 7.39	72 - 90	81	80.88
TCST-DLE (%) 9-11 years	86 ± 3.57	82 - 92	85	82.85 ± 4.14	76 - 90	82	84.33
TCST-DLE (%) General	84.54 ± 4.20	78 - 92	84	82.18 ± 5.25	72 - 90	82	82.91

Legend: TCST-MRE = monosyllable compressed speech test of right ear; TCST-MLE = monosyllable compressed speech test of the left ear; TCST-DRE = disyllable test of the right ear; TCST-DLE = disyllable test of the left ear

Table 4. Correlation of numerical variables with each application list of the compressed speech test

		TCST-MRE	TCST-MLE	TCST-DRE	TCST-DLE	Age
Age	*r*	-0.105	-0.001	0.437	0.077	1.000
	p	0.643	0.998	0.042*	0.732	-
TCST-MRE	*r*	1.000	0.446	0.049	-0.187	-0.105
	p	-	0.038*	0.828	0.406	0.643
TCST-MLE	*r*	0.446	1.000	-0.037	-0.133	-0.001
	p	0.038*	-	0.871	0.555	0.998
TCST-DRE	*r*	0.049	-0.037	1.000	0.194	0.437
	p	0.828	0.871	-	0.387	0.042*
TCST-DLE	*r*	-0.187	-0.133	0.194	1.000	0.077
	p	0.406	0.555	0.387	-	0.732

*Spearman´s rank correlation coefficient (*r*); Statistically significant values ($p \leq 0.05$)

Legend: r = Spearman's rank correlation coefficient; TCST-MRE = monosyllable compressed speech test of right ear; TCST-MLE = monosyllable compressed speech test of the left ear; TCST-DRE = disyllable compressed speech test of the right ear; TCST-DLE = disyllable compressed speech test of the left ear

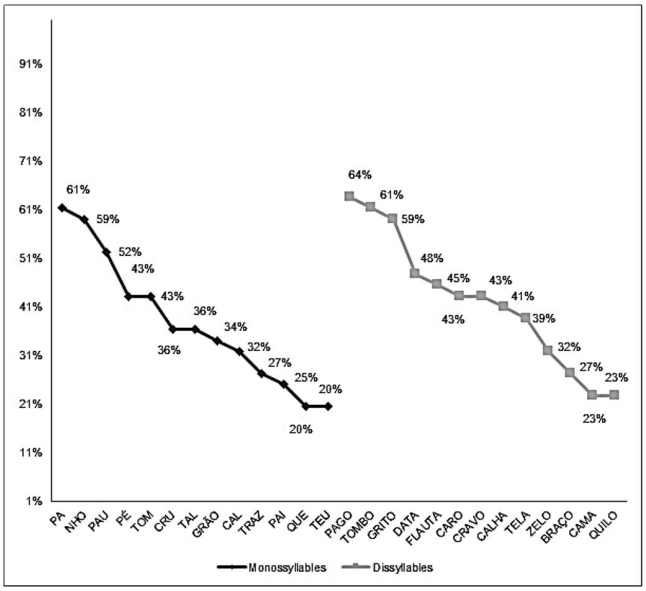


Figure 3. Percent distribution of the words with the highest occurrence of errors in the Compressed Speech Test, (n = 44 ears)

DISCUSSION

CAPD can generate several communication disorders and is correlated with learning difficulties in schoolchildren[15].

In order to evaluate these communication disorders, a simplified evaluation of auditory processing was used in combination with questionnaires and special auditory processing tests to track or identify possible alterations[14].

One of these questionnaires is the SAB, a simple, objective and easy-to-use questionnaire that has questions regarding the child's behavior in daily situations. There are no studies in the national literature that have proposed to study and standardize the questionnaire for Brazilian Portuguese. Nunes, Pereira and Carvalho[11] translated it into European Portuguese and found a mean of 46.1 (± 10.6) for children aged 8-11 years; when answered by parents or guardians, these findings are lower than the mean found in the present study (47.9).

Regarding DDT, another study reports that the test is quite sensitive and may be a good indicator of CAPD because it is an evaluation of dichotic listening and low level of linguistic requirement[14]. This study reinforces the adequate performance that the population of the present study presented (Table 1).

In the national literature, there are several studies with special tests with children[16,17]; however, with TCST, there is a lack of studies that present normality standards to be used in clinical practice.

Research with children and young adults[18,19] corroborates with the present research that shows that there is an improvement in the intelligibility of compressed speech with increasing age, that is, the higher the age the better the performance on the list of disyllabic words for the right ear. This result may be related to the maturation of the central auditory system. In the present study, there was relationship with age only in the list of disyllables, in both the right and left ears (Table 2 and Figure 1).

A study on the maturation of CAP in children with and without difficulties in school evaluated the ability of auditory closure by means of the speech test with noise and in children without difficulties in school found an improvement in the performance of the test with increasing age. This study verified an evident difference in performance between the ages of eight and ten years, corroborating the findings of the present study[20].

A national study with TCST determined an index of 90% as a normality standard for adults[10]. In the American version, the normality standard used for the adult population is 82%[21]. In the current study, we obtained a mean closer to the American adult population. In an international study of 18 to 30-year-olds with normal hearing, a TCST with 60% compression was used with monosyllabic stimuli and found, as a mean, 53.50%[22]. These data are lower than those found in the present study with the child population.

Rabelo and Schochat[10] found no influence on the order of presentation of the lists, agreeing with the findings of the present study (Table 3 and Figure 2). Thus, in clinical practice, the order of presentation of monosyllabic or disyllabic stimuli does not interfere with the test result.

In the present study, in the order of presentation of the lists, there was no improvement observed in the performance of the last list applied; however, G2 individuals had a tendency of association in MOL (Figure 2), namely, they had better performance when this list was the last to be heard. One study[23] showed that exposure to compressed speech for a prolonged period allows an adaptation of the individual, consequently, an improvement in their performance, thus justifying the findings found in the G2 individuals of the present study.

Another study shows that monosyllabic words are more used, simpler and less redundant, reducing lexical and semantic influence, which may explain why the improvement occurs only in the monosyllables, and the current study showed that when better MRE, better MLE and did not make any improvement regarding the lists of disyllables[24].

A national study (10) showed that there was no statistically significant difference between the ears, both in the monosyllabic lists and in the disyllabic lists, since it differs from the findings in the present study, which shows that there is a weak correlation in performance between monosyllabic stimuli in the right ear in relation to the left ear (Table 4).

Of the words with the highest occurrence of TCST errors, regardless of whether they were monosyllable or disyllabic words (Figure 3), it was observed that the vast majority started with a plosive sound. The characteristic of the plosive sounds is the obstruction of the articulators, which have as consequence the interruption of the airflow, perceived acoustically as silence, followed by the opening of the vocal tract and consequent total release of the air[25]. Plosives can be silent, as in [p], [t], [k], or voiced as [b], [d], [g]. Additionally, plosives have a rapid emission that reduces their intelligibility. The test itself already decreases the intelligibility of the words due to time compression, consequently, information loss occurs, favoring omissions and exchanges, corroborating the findings of the present study[23,24]. Only one of the words began with a palatal nasal consonant and was characterized by being less known and less used among those who obtained more errors. Thus, it is believed that semantic and pragmatic issues influenced the low number of correctness of this word.

The importance of this study is justified because it is unprecedented and shows that TCST in Portuguese can be applied in children, and new studies are needed with TCST in children with other disorders of human communication.

Based on the results obtained, further studies on TCST in the Brazilian population are suggested, as they are still very scarce in the national literature, especially in the child population, in addition to research comparing the performance of TCST with and without CAPD and comparison between the tests that evaluate the ability of auditory closure to verify its specificity.

CONCLUSION

It was possible to conclude that the mean number of correct answers of the children in the TCST was inferior to the findings in the national literature in adults. There was a difference in TCST performance with age only in the list of disyllables. In relation to the ear variable, there was a positive and weak correlation between the performance of the monosyllables list. There was no difference in the performance of the test regarding gender or the order of presentation of the application lists and the type of stimulus (mono- or disyllabic).

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Author contributions

FYOMMP carried out this research as a theme of her work to complete the course, and also participated in the collection, analysis and interpretation of the data and writing of the article; MMCP was adviser to the work, participated in the idealization of the topic, in the analysis and interpretation of the data and writing of the article.