Normative study of the Token Test (short version): preliminary data for a sample of Brazilian seniors

Estudo normativo do *Token Test* versão reduzida: dados preliminares para uma população de idosos brasileiros

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Abstract

Introduction: The preservation of oral comprehension in the elderly is correlated with the preservation of their cognitive functions. Oral comprehension is a key feature for communication and its evaluation allows for the identification of more specific cognitive deficits, in addition to facilitating the development of more effective, early intervention strategies. **Objective:** Provide contemporary standards for the use of an instrument to assess oral comprehension, the Token Test, in a sample of healthy seniors. **Method:** A sample of 120 patients (76 women) with mean age of 71.1 years and 6.9 years of formal education, was assessed using the Mini Mental State Examination to identify the existence of cognitive impairment, and the Token Test to assess oral comprehension. **Results:** There were significant correlations ($p < 0.01$) between the token test scores for education and age, which accounted for 5% and 21% of shared variance, respectively. These two variables were considered on the normative data tables. **Discussion:** The data obtained indicate that the standards provided here are sufficiently representative. This study identifies the need for future studies comparing the Token Test performance in elderly people either healthy or in the process of cognitive decline.

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Keywords: Oral comprehension, cognitive functions, evaluation, Token Test.

Resumo

Introdução: A preservação das habilidades de compreensão da fala nos idosos está correlacionada com a preservação das funções cognitivas. Essa habilidade é característica fundamental para a comunicação e sua avaliação possibilita a identificação de déficits cognitivos mais específicos, além de facilitar o desenvolvimento de estratégias de intervenção mais precoces e eficientes. **Objetivo:** Disponibilizar normas contemporâneas para a utilização de um instrumento de avaliação da compreensão verbal, o *Token Test*, para idosos brasileiros saudáveis. **Método:** Uma amostra 120 idosos (76 mulheres), com médias de 71,1 anos para idade e de 6,9 anos de educação formal para escolaridade, foi avaliada utilizando o Miniexame de Estado Mental, para identificação da existência de comprometimento cognitivo, e o *Token Test*, para avaliação da compreensão da fala. **Resultados:** Foram encontradas correlações significativas ($p < 0,01$) entre o escore do *Token Test* e a educação formal e a idade, os quais corresponderam respectivamente a 5% e 21% da variância compartilhada. Tais variáveis foram consideradas nas tabelas normativas. **Conclusão:** Nossos dados indicam que as normas disponibilizadas aqui são suficientemente representativas. Este trabalho abre caminho para estudos futuros de comparação entre o desempenho no *Token Test* de idosos saudáveis e daqueles em processos de declínio cognitivo.

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Palavras-chave: Compreensão verbal, funções cognitivas, avaliação, *Token Test*.

Introduction

According to the Synthesis of Social Indicators of IBGE[1], the Brazilian population aged 60 or older is approximately 19 million [people]. The notable increase in life expectancy at birth, owing to significant improvements in the structure of the health system and the advancement of health sciences, has led to the growth of the proportion of seniors in the population[2-4].

Guerreiro and Caldas reported that aging predisposes various conditions of illness, with direct impact on functional capacity[5]. The number of medical diagnoses and medications used tend to increase sharply after 60 years of age[6-8].

One of the most valuable fields of research concerning the effects of aging on seniors' quality of life and autonomy is the study of the neuropsychological aspects of cognition[9], especially, language and other functions involved in the communication process[10]. Language is the basis of the social and cultural evolution of mankind. It is primarily responsible for the abilities to transfer knowledge and to communicate[11-13]. Some authors consider it as the cognitive function that is most closely linked to the whole complexity of thought, the basic processes of organization and categorization of stimuli, and even creativity[14-16].

Language assessment difficulties in elderly patients are likely due to the fact that the nature of language itself directly affects other

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cognitive functions such as attention and memory. The maintenance of linguistic and communicative abilities in the elderly is correlated with the preservation of cognitive functions[17-19]. In advanced stages of cognitive impairment, patients may have a mean reduction in specific aspects of communication, such as initiative, spontaneity and speech recognition, even though they may still have some ability to communicate and to adapt to their environment[20]. Other studies have reported that aspects such as attention and working memory (phonological loop) would be particularly affected in patients with language impairments, especially oral comprehension, defined as the ability to process and manipulate information received through speech[20-23].

As speech recognition is one of the key features of communication, its evaluation allows the examiner to identify more specific cognitive deficits, facilitating the development of intervention strategies, making them more effective and also contributing to the differential diagnosis in cases of pathological cognitive decline[24].

De Renzi e Vignolo[25] stated that a oral comprehension test should have the following characteristics: a) it should have a fast application; b) it should not require any complex material; c) the tasks should be short in order to avoid defects of memory, and so that any normal adult, regardless of age, would have no difficulty completing them; d) it should not include intellectual difficulties, whereby, until some acceptable limit, any person would be able to answer the questions, independent of their intelligence quotient; and e) difficulties encountered in the test should occur mainly due to linguistic challenges, but progressively ordered with a lexicon of everyday life.

The Token Test is among the instruments most commonly used in the clinical neuropsychological assessment of language comprehension. This instrument has been highly accepted in clinical practice over the last decades, as evidenced by the emergence of multiple versions and various studies. This acceptance is probably linked to its simplicity, objectivity, fast application and high sensitivity[10,26-28].

When the Token Test was originally designed, its developers identified the issues that could affect its level of sensitivity[25,29]: (1) artificiality of the testing environment , it being impossible to reconstruct the command by the examiner in the context; (2) influence of disturbances in concentration, motivation, and either auditory or visual-motor fatigue; (3) lack of redundancy of the transmitted message, requiring the subject to decode each element from command to fulfill it properly; (4) specific language difficulties of late acquisition, like the identification of geometric shapes, with ambiguous distinction between adjective and noun; (5) abstract nature of the tokens, detached from the context of the subject; (6) aspects of verbal memory, especially short-term memory; (7) cognitive aspects such as the ability of the subject to analyze the command as a whole; and (8) difficulties inherent to completing tests which require choices between sequences and the similars.

In a previous study, we published normative data for the Token Test's short form for Brazilian children between 7 and 10 years of age[28]. According to PubMed and other databases (Lilacs and SCIELO), a search for the term "Token Test" revealed that the latest Brazilian normative data for this test for elderly people were provided by Fontanari[26]. Considering the significant changes in the Brazilian senior population over the last 20 years, the need for new normative studies is essential.

Objective

The purpose of this study is to provide contemporary normative data for the use of the Token Test with a healthy senior population.

Ethical committee

All participants signed the terms of consent. This study was approved by the Ethics Committee of Hospital Felício Rocho under the protocol CAAE – 006.0.240.000-07.

Method

Sample

The sample was comprised of 120 elderly subjects, selected from the authors' social network. The mean age was 71.1 years and average education was 6.9 years. The group included 76 women, which represented 63.3% of the total. The sample description is shown in table 1.

The Exclusion Criteria employed in this study were: presence of pathological cognitive decline assessed by the Mini-Mental State Examination (MMSE)[30], complaints of depression, neurological or psychiatric diagnoses (prior or current), sensorial impairment related to anamnesis. No subjects were receiving psychopharmacological therapy.

Instruments

The sample was subjected to the MMSE[30] and to the Token Test short version[29]. The MMSE, associated with anamnesis, score was one of the factors used as exclusion criteria to select the sample. Different cut-off scores were used based on education: 13 for illiterate, 18 for elementary and high school and 26 for post-secondary education. MMSE was also used for cognitive screening in the sample. This neuropsychological test is widely used as it can be adapted to many different cultures, it provides good psychometrics characteristics and it is sensitive to Alzheimer diagnosis[31]. In the current study, the MMSE provides an overview of cognitive functions, establishing a baseline for the language examination done by the Token Test short version.

The Token Test was first developed by De Renzi and Vignolo[25] in order to evaluate mild disorders of language comprehension. The first version of the test had 62 commands. Since then, it has undergone various changes, resulting in several versions. The short version used in this study[29] contains 36 commands (scored 1 if correct and 0 if incorrect) and it is simpler and faster to apply when compared with the original version, which explains its inclusion in any neuropsychological assessment protocol[32].

The Token Test short version is divided into six parts (Figure 1): part 1 consists of seven items, parts 2, 3, 4 and 5 have four items each and part 6 has 13 items. In parts 1, 3 and 5, all items are used, in parts 2, 4 and 6, only the big pieces (the small pieces are covered).

The items within a section have the same level of complexity. The score is calculated by assigning 1 point for each item answered completely correct, ranging from 0 to 36 points. The cut-off score was 29 in the original study, representing less than 5% of the population.

The pieces are arranged in a specific order and the subject must answer exactly as the item requests[33].

Procedure

The tests were conducted in the subjects' homes, in the absence of auditory and/or visual distraction. The MMSE was conducted first, followed by the Token Test.

Statistical analysis

The statistical methods used in large-scale studies of standardization of neuropsychological instruments were followed[34-36]. The procedures were:

1. Overlapping cell strategy[37] was adopted to maximize the sample size for each age group. Thus, the standards for each age group (mean age plus or minus 2 years) were built on a broader age group (mean age plus or minus 5 years).

2. In order to verify age and education influences on the overall results of the Token Test, a bivariate correlation was conducted between the Token Test raw scores and measures of schooling. The point-biserial correlation was used to verify the effect of gender on

TOKEN TEST – Short Version

Name: _____
Birth:_____ **Age:** ____ **yars and** _____ **months.**
Schooling: _____ **Date:** _____
Examiner: _____

Part 1 (All tokens)
- ☐ 1- Touch a circle.
- ☐ 2- Touch a square.
- ☐ 3- Touch a yellow token
- ☐ 4- Touch a red one.
- ☐ 5- Touch a black one.
- ☐ 6- Touch a green one.
- ☐ 7- Touch a white onde.

Part 2 (Only large tokens)
- ☐ 8- Touch the yellow square.
- ☐ 9- Touch the black circle.
- ☐ 10- Touch the green circle.
- ☐ 11- Touch the white square.

Part 3 (All tokens)
- ☐ 12- Touch the small white circle.
- ☐ 13- Touch the large yellow square.
- ☐ 14- Touch the large green square green.
- ☐ 15- Touch the small black circle.

Part 4 (Only large tokens)
- ☐ 16- Touch the red circle red and the green square.
- ☐ 17- Touch the yellow square and the black square.
- ☐ 18- Touch the white square and the green circle.
- ☐ 19- Touch the white circle and red circle.

Part 5 (All tokens)
- ☐ 20- Touch the large white circle and the small green square.
- ☐ 21- Touch the small black circle and the large yellow square.
- ☐ 22- Touch the large green square and the large red square.
- ☐ 23- Touch the large white square and the small green circle.

Part 6 (Only large tokens)
- ☐ 24- Put the red circle on the green square.
- ☐ 25- Touch the black circle with the red square.
- ☐ 26- Touch the black circle and the red square.
- ☐ 27- Touch the black circle or the red square.
- ☐ 28- Put the green square away from the yellow square.
- ☐ 29- If there is blue circle, Touch the red square.
- ☐ 30- Put the green square next to the red circle.
- ☐ 31- Touch the squares slowly and the circles quickly.
- ☐ 32- Put the red circle between the yellow square and de green square.
- ☐ 33- Touch all the circles, except the green one.
- ☐ 34- Touch the red circle red. No! The white square.
- ☐ 35- Instead of the white square, Touch the yellow circle.
- ☐ 36- In addition to touching the yellow circle, Touch black circle.

Score:_____

Figure 1. Token Test commands.

the Token Test score. Correlation coefficients (r), determination (r^2) and significance (p) were then determined.

3. In order to create an age-adjusted table for each age group, the raw scores were transformed into a cumulative distribution frequency. Therefore, these values were transformed into standard scores (z). These scores were then weighted using two different measures: the first was a Standardized Score by Age (SSA) with a mean of 10 and standard deviation of 3. The second (additionally), was a T-scores column inserted as a base reference (mean 50 and SD 10)

4. In order to generate the correction values for education, the following equation was used: SSA = k + (β * Educ). The coefficient β was the basis for adjusting for education. The weighted Standardized Score by Age and Education (SSAE) was obtained using the equation[31,36]: SSAE = SSA - (β * [Educ-12]). The values were truncated to the lowest one in order to obtain an integer.

Results

Table 1 shows the sociodemographic characterization of participants and their performance (mean and standard-deviation) in Token Test and MMSE.

The correlations (r), shared variance (r^2) and significance between the Token Test score and the variables: age, gender and education were: 0.23/0.05 ($p < 0.01$), 0.13/0.02 ($p < 0.15$) e 0.46/0.21 ($p < 0.001$), respectively Test scores showed significant correlations between education and age, which accounted for 5% and 21% of shared variance, respectively.

The standardized scores by age (SSA) are shown in table 2, which also includes the percentile scores, T scores and raw scores for each age group. To use the table just find the corresponding age group in the columns and the score got by the subject, then the line obtained will correspond to the classification of this subject compared to the rest of the sample (SSA).

To construct the table with scores adjusted by schooling (Table 3), the regression coefficient β = 0.194 was used. To use the table, find the row that corresponds to the SSA obtained in Table 2, and then find the column for the subject's years of schooling. The cell that is the intersection between the row and column corresponds to the obtained standard score corrected for age and education (SSAE).

However, despite the greater influence of education, the normative table was first adjusted by age, and in continuity to another lined up by schooling. This decision was made in order to facilitate the comparison of these results with those of other studies[34-36].

Table 1. Sociodemographic and cognitive characterization of the subjects

	N	%	Mean	SD	Minimum	Maximum
Sex						
Female	76	63.3%				
Male	44	36.7%				
Age (years)			71.14	7.32	60	89
Education (years)			6.89	3.89	4	18
MMSE			26.63	2.60	19	30
Token Test			28.92	3.94	15	35

Table 2. Standardized Scores by Age (SSA)

SSA	p%	Age (years)					T-*score*
		63-67	68-72	73-77	78-82	83+	
2	< 1	≤ 14	≤ 14	≤ 18	≤ 18	≤ 15	< 25
3	1	15	15	19	-	-	25-28
4	2	19	19	-	19	-	28-31
5	3–5	23	23	23	22	16	32-35
6	6–10	24	-	24	23	22	35-38
7	11–18	25-26	24-25	25	24	23	39-42
8	19–28	27	26-28	26	25-26	24	42-45
9	29–40	29	29	27-28	27	26	45-48
10	41–59	30	30	29-30	28-29	28	49-51
11	60–71	31	31	31	30	29-30	52-55
12	72–81	32-33	32	32	31	31	55-58
13	82–89	-	33	-	-	-	58-61
14	90–94	34	34	33	32	-	62-65
15	95–97	35	-	-	-	32	65-68
16	98	-	35	34	33	-	69-72
17	99	-	-	-	-	-	72-75
18	> 99	36	36	35	34	33	> 75
Normative age		60-70	65-75	70-80	75-85	80+ (80-89)	
MMSE > Mean (SD		27.24 (2.41)	26.7 (2.73)	26.37 (2.9)	25.85 (2.33)	25.18 (1.84)	
Sample size		55	52	48	40	17	

Table 3. Standardized Scores by Age and Education (SSAE)

		Education (years)																				
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
SSA	2	4	4	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	0	0	0
	3	5	5	4	4	4	4	4	3	3	3	3	3	3	2	2	2	2	2	1	1	1
	4	6	6	5	5	5	5	5	4	4	4	4	4	4	3	3	3	3	3	2	2	2
	5	7	7	6	6	6	6	6	5	5	5	5	5	5	4	4	4	4	4	3	3	3
	6	8	8	7	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	4	4	4
	7	9	9	8	8	8	8	8	7	7	7	7	7	7	6	6	6	6	6	5	5	5
	8	10	10	9	9	9	9	9	8	8	8	8	8	8	7	7	7	7	7	6	6	6
	9	11	11	10	10	10	10	10	9	9	9	9	9	9	8	8	8	8	8	7	7	7
	10	12	12	11	11	11	11	11	10	10	10	10	10	10	9	9	9	9	9	8	8	8
	11	13	13	12	12	12	12	12	11	11	11	11	11	11	10	10	10	10	10	9	9	9
	12	14	14	13	13	13	13	13	12	12	12	12	12	12	11	11	11	11	11	10	10	10
	13	15	15	14	14	14	14	14	13	13	13	13	13	13	12	12	12	12	12	11	11	11
	14	16	16	15	15	15	15	15	14	14	14	14	14	14	13	13	13	13	13	12	12	12
	15	17	17	16	16	16	16	16	15	15	15	15	15	15	14	14	14	14	14	13	13	13
	16	18	18	17	17	17	17	17	16	16	16	16	16	16	15	15	15	15	15	14	14	14
	17	19	19	18	18	18	18	18	17	17	17	17	17	17	16	16	16	16	16	15	15	15
	18	20	20	19	19	19	19	19	18	18	18	18	18	18	17	17	17	17	17	16	16	16

Discussion

We calculated for normative samples, T-score, percentile and SSA, which seek to facilitate the conversion and interpretation of the test to several other instruments that, in general, tend to use at least one of these three scales.

With a weighted score of 10, the difference between age groups varied by two points. This result was also obtained in other studies[34-36], suggesting that, on average, oral comprehension among healthy seniors does not decrease dramatically with the aging process.

The largest association of education than age with performance on the Token test suggests that, although decline in oral comprehension is related to the process of normal individual development, formal schooling plays a more significant role. This finding corroborates the concept of cognitive reserve, in which one of the most important contributors to its increase is formal schooling[38]. Individuals with greater cognitive activity throughout life have a tendency to be less cognitively impaired in their senior years. In this study, schooling seems to play an important protective role, reducing the probability of decline in oral comprehension.

Classic studies using the Token Test consider it to be like a differential diagnosis for certain diseases such as, aphasia[25,26]. However, this study is based on research with subjects who have no neurological damage, which implies that the results also provide a clue to development of oral comprehension in the senior years.

A recent study[10] tested the oral comprehension of a group of seniors, using the Token Test, with several controlled variables in four domains: socio-demographic, health, lifestyle, and psychosocial. This model accounted for 62% of the variance in test scores. These findings highlight the importance of considering environmental factors when looking at linguistic aspects.

This study only considered education, gender and age as factors that can influence Token Test performance. Although these variables were significant enough for the construction of normative tables, future studies are required to examine other variables (like anxiety or depression)[39], such as those expressed above.

Conclusion

The data from this study indicate that, even though the sample group was small, the standards provided might be sufficiently representative. This aspect contributes significantly to the field of clinical neuropsychology in Brazil for several reasons including: providing the possibility of beginning to address the lack of standardized neuropsychological tests in our context; the expansion of Token Test versions to provide standards for the elderly; and the application of the results of the current study to future studies due to the use of a non-clinical population.

Future studies comparing Token Test performance between healthy seniors and those with dementia may reveal how the role of cognitive impairment in the neurodegenerative process. Specific profiles for each type of dementia can be developed using the standards identified in this study as a reference.

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