COGNITIVE ASSESSMENT INSTRUMENTS IN INDIVIDUALS WITH PARKINSON'S DISEASE UNDERGOING DEEP BRAIN STIMULATION

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"... existem momentos inesquecíveis, coisas inexplicáveis e pessoas incomparáveis." (Fernando Pessoa)

Dedico este trabalho aos meus pais, Luiz e Noeli, pessoas incomparáveis que me apoiaram nos momentos de muita dificuldade e comemoram nos momentos mais alegre. Saibam que mesmo na saudade da distância, vocês não estão ausentes em minha vida.

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“Por tantas vezes pensamos ter chegado. Tantas vezes é preciso ir mais além.”

(Fernando Pessoa)

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COGNITIVE ASSESSMENT INSTRUMENTS IN INDIVIDUALS WITH PARKINSON'S DISEASE UNDERGOING DEEP BRAIN STIMULATION

INTRUMENTOS DE AVALIAÇÃO COGNITIVA EM INDIVÍDUOS COM DOENÇA DE PARKINSON SUBMETIDOS À ESTIMULAÇÃO CEREBRAL PROFUNDA

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ABSTRACT

INTRODUCTION: The Deep Brain Stimulation (DBS) has been a widely used surgical technique in individuals whit Parkinson's Disease (PD) due to significant reduction in motor symptoms. **OBJECTIVE**: To determine which instruments most commonly used for cognitive evaluation in individuals with PD undergoing DBS. **METHODS**: Was conducted a systematic review in the data base: PubMed, Medline, Scielo e LILACS used the descriptors "Deep Brain Stimulation", "Verbal Fluency", "Parkinson Disease", "Executive Function" e "Cognition" in combination. Were include in this study: original studies published between 1997 and 2010; people with PD undergoing DBS. **CONCLUSION**: Among the cognitive, verbal function is highlighted by the significant decline after implantation of the DBS and the Verbal Fluency Test the most used instrument. The validation of instruments for this population is needed and the used of batteries with more specificity and sensitivity for detection of cognitive impairment .

DESCRIPTORS: Parkinson Disease; Cognitive; Deep Brain Stimulation.

RESUMO

INTRODUÇÃO: A Estimulação Cerebral Profunda (ECP) tem sido uma técnica cirúrgica bastante utilizada em indivíduos com Doença de Parkinson (DP) devido à redução significativa dos sintomas motores. **OBJETIVO**: verificar quais os instrumentos mais utilizados para avaliação cognitiva em pacientes com DP submetidos à ECP. **MÉTODOS**: Foi realizado uma revisão sistemática nas bases de dados PubMed, Medline, Scielo e LILACS utilizando os descritores "Deep Brain Stimulation", "Verbal Fluency", "Parkinson Disease", "Executive Function" e "Cognition" de forma combinada. Foram incluídos nesta revisão sistemática: estudos originais publicados entre 1997 e 2010; população com DP submetidos à ECP. **CONCLUSÃO**: Dentre os aspectos cognitivos, a função verbal se destaca pelo declínio

significativo após o implante do ECP, sendo o teste de Fluência Verbal o instrumento mais utilizado. A validação de instrumentos para esta população se faz necessária bem como a utilização de baterias com mais especificidade e sensibilidade para detecção das alterações cognitivas.

DESCRITORES: Doença de Parkinson; Cognição; Estimulação Cerebral Profunda.

INTRODUCTION

Parkinson's disease (PD) was first described in 1817 by James Parkinson after observing symptoms presented by his patients: tremor, bradykinesia and rigidity. These symptoms remain the main source of discomfort reported by patients. In addition to the motor symptoms that affect activities of daily living (ADL) and the quality of communications and eating, PD has other symptoms. Cognitive changes occur, in most cases, in the more advanced stages of the disease, preceded by psychiatric signs, such as hallucinations and psychosis.[2] Other symptoms, such as depression, may be present since the early stages of PD.[3]

The diagnosis of PD is clinical. Imaging tests, such as PET and SPCT scans, are more sensitive in detecting the disease; the use of magnetic resonance (MRI) as a diagnostic tool is still under discussion.[4] Cognitive symptoms may also be used for diagnoses; therefore, the validation of these instruments is fundamentally important.

Many treatment options have been developed since the discovery of this disease, such as new medications, technology and surgical techniques, as well as rehabilitation. However, drugs do not mitigate nor delay disease symptoms, and the cure of PD is still a challenge to researchers.

Deep Brain Stimulation (DBS) is a stereotactic technique in which two leads with four electrodes are implanted in the region of the basal ganglia. It is offered to patients with PD undergoing treatment with drugs (Levodopa) and who present with greater complications, such as dyskinesia, motor fluctuations and refractory tremor.[5] The motor gains acquired as a result of neuronal inhibition provided by the neurostimulator are significant;[6] in contrast, DBS may have a negative impact on communication skills[7] and cognitive symptoms.[8,9]

The American Academy of Neurology (AAN) listed instruments for the cognitive and neuropsychiatric examination of individuals with PD. To investigate psychiatric symptoms, the AAN suggests the use of the Beck Depression Inventory (BDI), the Hamilton Depression Rating Scale (HDRS-17), the Hamilton Anxiety Rating Scale (HARS), the Brief Psychiatric Rating Scale (BPRS), the Schedule for the Assessment of Positive Symptoms (SAPS), the Apathy Scale (AS) and the

Neuropsychiatric Inventory (NPI); and, for cognitive investigations, the AAN suggests the Cambridge Cognitive Examination (CAMCog), the Alzheimer's Disease Assessment Scale-cognitive (ADAS COG), the Addenbrooke's Cognitive Examination - Revised (ACE-R), the Clinician Global Impression of Change (CGIC), the Montreal Cognitive Assessment (MoCA), the Mattis Dementia Rating Scale (MDRS), the Parkinson Neuropsychometric Dementia Assessment (PANDA), the Parkinson's Disease-Cognitive Rating Scale (PD-CRS), the Scales for Outcomes of Parkinson's Disease – Cognition (SCOPA-COG), the Short Portable Mental Status Questionnaire (SPMSQ) and the Mini Mental Status Examination (MMSE).[10] However, patients that undergo DBS have a wide variety of cognitive symptoms, and researchers tend to use several instruments because the inventories and scales suggested by the AAN are not enough.

This study evaluated which instruments are used for the cognitive evaluation of patients with PD that undergo DBS.

METHODS

A systematic review of the literature was conducted including all publications available in PUBMED, MEDLINE, LILACS, EBECS and SCIELO. To conduct a broad-based literature review, the search included studies since 1997, date of the first publication that evaluated the cognitive aspects of patients with PD in the databases reviewed. The search was conducted using the following key words: Parkinson disease and deep brain stimulation combined with cognitive, executive function and verbal fluency.

The studies, reviewed independently by three examiners, were selected according to the following inclusion criteria:

- Published from 1997 to 2011;
- Original studies with human beings;
- Studies whose objective was the cognitive assessment of patients with PD that received unilateral or bilateral DBS;

- At least one instrument of cognitive assessment;
- Positive or negative cognitive results.

The studies that did not meet these criteria were excluded. To ensure that all examiners had the same criteria to evaluate abstracts, a data collection form (Annex A) with the criteria described above was developed and filled out for each study. Each assessor assigned a grade from 0 to 10 to each study. Studies that received grades below 8 were excluded from this review.

RESULTS

A total of 519 studies were found in the databases used and 469 were excluded: 224 because they were the same study indexed in different databases, and 245 due to other exclusion criteria. Fifty studies were included in this review,[8,9;11-59] and 90 instruments were found: 71 tests and 19 scales. Because of the large number of instruments, only those that have been used in more than 10 studies included in this review will be described below. All inventories and scales found are presented in Tables 1 and 2. To facilitate comprehension and because the same instrument might evaluate more than one cognitive aspect, the instruments were classified according to their predominant cognitive function: attention, perception, memory, language, dexterity, executive functions, cognitive screening tests, intelligence, and laterality in handedness. The scales were classified according to whether they investigated depression, anxiety, mood, apathy, psychiatric disorders and quality of life. The classification followed the suggestions made by Lezak (2004).[60]

COGNITIVE ASSESSMENT TESTS OF INDIVIDUALS WITH PD THAT UNDERWENT DBS

Attention

The instrument most often used for attention, found in 21 studies, was the Stroop Test (ST). This test, developed by John Ridley Stroop in 1935, aims at evaluating selective attention, inhibitory capacity and concentration. The author based his test on the finding that it is easier to name the color of the ink and/or read the name of the colors when they are printed in a different color from the one that they name.[60] This phenomenon has received different interpretations. Some studies classify it as a deficit in inhibitory response, and others, as a selective attention deficit. This test has some variations, but the full format has the following stages: first, the individual has to recognize the colors used in the test, which is achieved by showing the respondent cards with rectangles in the colors used. After that, the individual should read the words (names of colors) that are printed in a different color from the one that they name; and, in the third stage, which is the test proper, the individual should name the color of the ink in which the words are printed when the words denote names of colors different from the ink.[61] Scores may be defined according to the test performance time, number of errors or both, or, still, according to the number of items read or named in a certain amount of time.

The ST was standardized by Tosi (2004)[62] for use with Brazilian populations, and was tested for Brazilian students aged 12 to 14 years to obtain normative data for this population.[61] However, this test has not been standardized for adult and elderly Brazilians, and has not been validated for individuals with PD.

Cognitive aspects, such as visual attention, processing speed, flexibility and planning, have been evaluated in 20 studies using the Trail Making Test (TMT), which originated from the Army Individual Test Battery (1944) and has two parts, A and B. Part A has 25 circles with numbers, and the respondent should draw a line to connect the numbers in ascending order. In part B, in addition to numbers (1 to 13), there are letters (A to M) among the numbers; the numbers should be connected in ascending order, but alternating with the sequence of letters. The score is defined according to time, that is, the test should be completed as fast as possible.[60]

The TMT was used for a Brazilian population by Hamdan and Hamdan (2009),[63] who found that age and schooling affected individual scores, and that there was a

significant increase in the time necessary to complete the TMT tasks according to the individual's age; also, mean time decreased as the individual's schooling increased.

Memory

The Digit Span (DS) test, part of the Wechsler Adult Intelligence Scale (WAIS), was individually used in 11 studies, and, together with WAIS, in 7 studies. This test includes two different parts: direct DS and inverse DS. Both include the oral presentation of seven pairs of sequences of numbers, which are presented individual in one second in an order that is randomized by the examiner. In the direct DS, the individual should repeat the numbers as presented by the examiner; in the inverse DS, the individual should repeat the numbers in the inverse order. Scores are defined by the number of correct answers. Adults without deficits should repeat at least 5 numbers in the direct order and at least 3 in inverse order. Age tends to affect performance only for individuals > 65 years old, for whom the normal score is 5 right answers.[60]

The DS test alone has not been standardized for Brazilian populations or individuals with PD. However, together with the WAIS, it was standardized for a Brazilian population by Nascimento et al. (1998)[64] and validated for a population with PD by Randolph et al. (1993)[65].

A test used in 14 studies to evaluate immediate, short- and long-term memory is the Rey's Auditory Verbal Learning Test (RAVLT), developed by Rey in 1964. This test has several variations, but the one most often used has the following parts: 15 words are read from a list of words (list A) at an interval of one second between words over five trials, and each time the list is read, the individual is asked to recall the words that were presented. The order of word remains the same at each trial, and the test instructions are repeated every time the words are presented. The RAVLT learning score is the sum of words remember in the five trials. After the fifth reading of the same list of words is complete, another list of 15 new words is introduced (list B), and the individual should also recall the words presented. Immediately after remembering the words in list B, the words in list A should be recalled without being read another time. In this stage, short-term memory after interference is tested. Finally, after 30 minutes,

the individual is asked to recall the words in list A with no presentation of cues. In this last stage, long-term memory is tested; the maximum score is again 15, and the closer the result is to this number, the better the performance.[60]

In Brazil, Malloy-Diniz et al. (2007)[66] developed a version of RAVLT with nouns frequently used in Portuguese, and applied it to groups of elderly individuals aged 60 to 89 years. The authors found that the Brazilian adaptation of the RAVLT was appropriate and evaluated the memory of Brazilian individuals of the same age and schooling. In 2009 Teruya et al.[67] conducted a pilot study to evaluate the performance of normal Brazilian adults using the RAVLT. They found that overall test performance decreased as age increased, and schooling was positively associated with the scores. In 2010, Fichman et al.[69] published a study to validate the RAVLT. The authors found a strong association between episodic memory and social and demographic variables. This finding is relevant in a country like Brazil, where educational levels vary substantially. However, further studies should be conducted to test the effect of age and schooling in the RAVLT.

Language

The Verbal Fluency test, used in 37 studies, was the most frequent test to evaluate executive functions, language and semantic memory. The phonological VF (FAS), developed by Benton and Hamsher (1989), asks the respondent to name words with the letters F, A and S, excluding proper names, numbers, the same word with different suffixes, or different conjugations of the same verb. A time of 1 minute is assigned for each letter.[60] The test was normalized by Tombaugh et al. (1998)[69] but no studies have been found about FAS validation for populations with PD.

The VF test has a variation, semantic restriction, in which the individual has 1 minute to say words limited to one semantic class (animals, fruit, foods, etc.). This instrument variation evaluates the capacity to search and withdraw data stored in the long-term memory within a certain category and to demonstrate the capacities of organization, self-regulation and operational memory. This variation was validated for the Brazilian population by Brucki et. al (1997;2004).[70-71]

The study conducted by Lars Wojtecki et. al (2006)[9] used variations with phonological restriction. Two sequences of words were restricted to one letter and, immediately after that, the sequence was restricted to a semantic category to evaluate, in addition to the aspects mentioned above, flexibility, as there was a change in the strategy suggested in the testing sequence. Scores are the sum of words produced in accordance with phonological or semantic restriction. Results are affected by schooling (the greater schooling, the higher mean number of words said) and age (the greater the age, the smaller the mean number of words said).[69]

The Boston Naming Test (BNT) was used in 12 studies to evaluate language skills and semantic memory by naming figures. Developed by Kaplan, Goodglass and Weintraub in 1978, it consists of the presentation of 60 items drawn in black and white, graded according to difficulty parameters, which the individual has to name spontaneously in 20 seconds. In case the patient cannot name it, or names it incorrectly, the examiner can give a semantic cue; if the error persists, the examiner gives a phonological cue by producing the first syllable of the word that corresponds to the figure.[72]

This test was validated for a Brazilian population by Miotto et al. (2010).[72] In this adapted version, the authors replaced 20 figures to take into consideration cultural familiarity, frequency, ambiguity and similarity with the original figure. They found that the adapted version is less dependent on schooling and age than the original version, and may, thus, by more appropriate for clinical applications. However, it has not been standardized for populations with PD.

Executive functions

The objective of the Wisconsin Card Sorting Test (WCST) is to evaluate components of the executive functions of categorizing, conceptualizing, planning, learning, perseveration of rules and successful strategies and cognitive flexibility. This test was used in 17 studies to evaluate the main cognitive impairments in PD. It consists of four key cards: a red triangle, two green stars, three yellow crosses and four blue circles. They are always presented in this order, from left to right, and 128 response

cards with geometric shapes that change according to the same dimensions of the key cards: color, shape and number. At each trial, one stimulus card is presented to the individual, who should combine it with one of the four key cards based on color, shape or number. No rule is defined for combinations. At each 10 correct answers for each category (color, shape and number), the examiner changes the combination, and the participant should change the strategy.[60] The WCST has not been validated for Brazilian adults and elderly populations or for use with individuals with PD.

The Raven's Progressive Matrices (RPM) consists of a set of nonverbal tests of problem resolution involving the elaboration of reasoning and efficacious strategies, discovery of rules and applications of mental operations. This test, used in 10 studies, has three versions: the Standard Progressive Matrices (SPM), for use with individuals of all levels of intellectual development; the Colored Progressive Matrices (CPM), for small children, elderly individuals and people with mental deficiencies; the Advanced Progressive Matrices (APM), developed for people with above average intellectual capacity, usually indicated for university students.[60] The SPM consists of 60 geometric shapes in which a part of the test is removed and added to other 5 incorrect alternatives. The individual should choose the correct complement to the figure based on rules that apply to horizontal and vertical dimensions. The level of difficulty increases as the individual completes the tasks. The time to do the test ranges from 40 to 60 minutes.

In Brazil, the RPM was validated only for children by Pasquali et al, (2002),[74] who defined normative data for a population of children in the city of Porto Alegre. However, it has not been validated for Brazilian adults, elderly adults, or individuals with PD.

Cognitive Screening Batteries

The most frequently used cognitive screening battery was the Mini Mental State Examination (MMSE), applied in 18 studies. The MMSE tests the integrity of mental functions in a rapid and simple way. It evaluates the following functions: orientation to time and place, memory, attention, calculation, language and construct ability. Scores are defined according to points, which may vary from 0 to 30. The variables that affect

total MMSE score are intensively discussed among researchers. Studies suggest that age and schooling of the Brazilian population have a strong influence on the performance of the tasks in the MMSE. This discussion led to the validation of the MMSE[75-76] scale for the Brazilian population and the definition of new scores according to age and schooling. At the same time, a recent study[77] evaluated the impact of education on the MMSE subscales and items. Results revealed that schooling has no effect on naming tasks, three-stage commands, memory recall and delayed memory. Memory is a key factor in diagnosing dementia; therefore, those items may be included in the evaluation despite the level of education.

The Mattis dementia rating scale (MDRS), a cognitive screening battery that also evaluates general cognitive status, was used in 15 studies. This scale consists of 36 individual tasks divided into 5 subscales: attention (8 items, 37 points); initiation and perseveration (11items, 37 points), construct (6 items, 6 points), conceptualization (6 items, 39 points) and memory (5 items, 25 points), at a total of 144 points. The cut-off score for absence of dementia in the Brazilian population is 122 points; scores below that indicate a demential process.

In 2003, Porto et al.[78] developed a Portuguese version of the MDRS and applied it to a group of individuals with Alzheimer's disease (AD) and compared them with a group of healthy elderly individuals. The authors concluded that the MDRS had good diagnostic accuracy to discriminate between patients with mild AD and control individuals. In the study population, the effects of schooling were more marked than those of age. This result was confirmed by Foss et al. (2005),[79] who investigated the influence of little schooling and illiteracy on the evaluation of dementia by applying the MDRS. They found that schooling affects performance and concluded that illiteracy is a determinant factor to lower MDRS scores, which may generate diagnostic errors.

SCALES TO EVALUATE INDIVIDUALS WITH PD

The Beck Depression Inventory (BDI), in the form of a self-administered questionnaire, was used in 20 studies to evaluate the intensity of depression. This instrument has 21 items for symptoms and attitudes, and they describe behavioral,

affective, cognitive and somatic signs of depression. Each item has four response alternatives in the form of statements, organized according to severity and with scores that range from 0 to 3. The respondents select the option that best describes the way that they feel at the time. The overall evaluation of depression is defined according to the sum of numbers that correspond to the answers. Therefore, a sum of 0 to 9 is within the limits of normality; from 10 to 15, the result suggests mild depression; from 16 to 23, moderate depression, and 24 or more, severe depression.

The BDI was validated for the Brazilian population by Gorenstein and Andrade[80] in 1986. The Hamilton Depression Rating Scale and the State-Trait Anxiety Inventory were used for comparisons: the BDI was more efficacious, and its reliability ranged from moderate to good.

Of the 89 instruments used, 20 have been validated for the Brazilian population[66;68;72;74-76;78;81-84;86-91;94;96;100-102] and 12 have been standardized for populations with PD.[71;92-93;95;97-99;103] The instruments tested for the Brazilian population and for individuals with PD are listed in Table 3.

DISCUSSION

The purpose of the studies included in this systematic review was to evaluate the cognition of patients with PD that underwent DBS and to investigate the impact of the neurostimulator in cognitive performance. The results showed the diversity of instruments used. There is no agreement about the use of a single test or scale, or about the cognitive functions evaluated.

The application of only one test is insufficient to evaluate cognition, and a group of instruments is usually applied to obtain more reliable data, particularly because of the insufficient number of standardized instruments for the population with PD and the divergent understandings about the predominant cognitive functions in decline. According to instrument classifications, the functions more frequently evaluated were language (74.5%), memory (72.2%), attention (66.7%) and executive functions (47.7%). These functions may be impaired because of the disease, but studies in the

literature draw attention to the decline of executive skills, which may be present in the initial stages of the disease.[97] However, as demonstrated above, the use of tests directed to the evaluation of this function was less frequent.

Of the instruments recommended by the AAN for cognitive screening, the most frequently used were the MMSE and the MDRS. The MMSE is one of the most frequently used instruments of cognitive screening to investigate cognitive decline in the elderly. However, because of the cognitive impairments in PD, studies have shown that this is not the best instrument of cognitive screening for this population. Hoops et al. (2009)[85] evaluated the discriminating validity of the MoCA and the MEEM to detect mild cognitive impairment (MCI) and dementia in PD. They found that the MoCA had appropriate psychometric properties as a screening instrument to detect MCI and dementia in PD, and that it is, therefore, more sensitive than the MMSE in this population. In the same way, Hanna-Pladdy et al. (2010)[98] conducted a comparative study of the MoCA, the MEED and the NeuroTrax battery. Results suggest that the MoCA is more sensitive to investigate MCI in PD.

The MDRS also has good diagnostic accuracy to investigate the cognitive functioning of individuals with PD. It was validated as a screening instrument for cognitive dysfunction in this population by Brown et al. (1999),[88] and is more sensitive to variations in the level of cognitive impairment than the MMSE. Llebaria et al. (2008)[86] conducted a study to validate the MDRS for dementia screening in PD. Their results revealed that the MDRS has an excellent discriminating ability to diagnose dementia in PD, as well as to provide objective measurements.

Of the main scales used to evaluate depression, mood and anxiety among individuals with PD, the BDI and the MDRS were evaluated to check their accuracy and correlation with clinical diagnoses by Silberman et al. (2006).[99] The authors found positive results and suggested the use of a cut-off point of 10 for the MDRS and 18 for the BDI to help clinicians to detect depression in mild and moderate PD. The use of these scales to investigate depressive symptoms was also recommended by Schrag et al. (2007),[100] who also suggested that the BDI might be used to monitor depressive symptoms in relation to clinical or surgical treatment of PD. However, the clinical aspects of depression were not evaluated, and depression was only monitored using the BDI.

FINAL CONSIDERATIONS

Results of this review showed that there is no consensus about the instruments used in the evaluations of individuals with PD that underwent DBS. The AAN recommended some instruments that are more appropriate to evaluate cognitive decline in populations with PD, but they have not been used frequently. Moreover, instruments should be standardized for use with this population.

The analysis of cognitive functions revealed that the evaluations in this population with PD are concentrated in language and memory. Studies in the literature showed that PD leads to a decline predominantly in executive functions, which may indicate that individuals that underwent DBS may suffer different impacts and that it is necessary to use instruments to asses both cognitive functions to obtain more reliable results.

Cognitive function	Tests	Number of studies
Attention	Stroop Test	21
	Trail Making Test	20
	Corsi's Block Tapping Test	8
	Go–No–Go Task	3
	Symbol Digital Modalities Test	1
	N-Back Task	1
	Oral Trail Making Test	1
	Spinler Matrices Test	1
	Color Word Interference Test (D-KEFS)	1
	Visual Reaction Time (Vrt)	1
	Money's Standardised Road Map Test For Direction Sense (Mrmt)	1
	Test For Attentional Performance (Tap)	1
Perception	Hooper Visual Organizational Test	2
	The Visual Object And Space Perception Battery (Vosp)	1
Memory	Rey's Auditory Verbal Learning Test	14
	Digit Span	11
	Weschler Memory Scale	6
	Paired Associate Learning	4
	Benton Visual Retention Test	4
	Grober And Buschke Verbal Learning Test	3
	Benton Line Orientation Test	3
	Random Number Generation Task (Rngt)	2
	California Verbal Learning Test	2
	Hopkins Verbal Learning Test	2
	Logical Memory Task	2
	Rey Eosterrieth Complex Figure Test	2

	Brief Visuospatial Memory Test	1
	Visual Conditional Learning Test	1
	Benton Judgment Of Line Orientation Test	1
	Rey Figure/Taylor Figure	1
	Memory Assessment Clinic Ratings (Mac)	1
	Rivermead Behavioural Memory Test	1
	Rey–Kim Memory Battery	1
	Brief Visual Memory Test	1
	Conditional Associative Learning Test (CALT)	1
	Externally Ordered Working Memory Test	1
Language	Verbal Fluency	37
	Boston Naming Test	12
	Controlled Oral Word Association Test	6
	Bi-Syllabic words Repetition Test	6
	Boston Diagnostic Aphasia Examination	1
	Regensburg Word Fluency Test (RWT)	1
	Syntactic Comprehension Test And Morphological Test	1
	Agnosia Screening Task Of Schnider	1
	ABBA	1
	North American Adult Reading Test	1
Construct	Clock Drawing	1
	Grooved Pegboard Test	1
	Purdue Pegboard Test	1
Executive functions	Wisconsin Card Sorting Test	17
	Raven’s Progressive Matrices	10
	Modified Wisconsin Card Sorting Test	4
	Frontal Assessment Battery	3
	Tower of London	2

	Dex Questionnaire of the Behavioural Assessment of the Dysexecutive Syndrome	1
	Paced Auditory Serial Addition Task	1
	Paced Visual Serial Addition Test	1
	frontal systems behavior scale	1
	Odd Man Out Test	1
	Vocabulary And Reasoning Of The ‘‘Leistungsprufsystem’’ (LPS)	1
	Homophone Meaning Generation Test	1
Cognitive Screening Batteries	Mini Mental State Examination	18
	Mattis Dementia Rating Scale	15
	Dementia Rating Scale	7
	Dutch Adult Reading Test	1
	National Adult Reading Test	1
	Cerad Neuropsychological Battery	1
Intelligence	Wechsler Adult Intelligence Scale	7
	Groningen Intelligence Test	1
	Verbal Intelligence Quotient	1
Laterality of Handedness	Edinburgh Handedness Inventory	1

Table 1. Tests and Cognitive Screening Batteries used in the studies, classified according to the predominant cognitive function

	Scales	Number of studies
Depression	Beck Depression Inventory	20
	Montgomery-Asberg Depression Rating Scale	6
	Hamilton Depression Rating Scale	2
	Geriatric Depression Scale	1
	Hospital Anxiety And Depression Scale	1
	Brief Symptom Inventory	1
Anxiety	State-Trait Anxiety Inventory	4
	Beck Anxiety Inventory	2
	Hamilton Anxiety Rating Scales	1
	Snaith-Hamilton pleasure Scale	1
	Maudsley Obsessional Compulsive Inventory	1
Mood	Visual Analogue Mood Scale	1
	Positive And Negative Affect Scale	1
	Profile Of Mood States	1
Apathy	Apathy Scale	1
	Apathy Evaluation Scale	1
Psychiatric	Neuropsychiatric Inventory	2
	Bech-Rafaelsen Mania Scale	1
Quality of life	Parkinson's Disease Questionnaire (PDQ-39)	3

Table 2. Scales used in the studies

Author and year	**Instrument tested for Brazilian population**	**Instrument tested for population with PD**
Tosi (2004)[62]	Stroop Test	
Hamdan AC et. al (2009)[63]	Trail Making Test	
Malloy-Diniz LF et. al (2007)[66] Fichman HC et. al (2010)[68]	Rey's Auditory Verbal Learning Test	
Yassuda MS et. al (2010)[81]	Rivermead Behavioural Memory Test	
Brucki SM et. al (1997)[70] Brucki SM et. al (2004)[71]	Verbal Fluency	
Miotto EC et. al (2010)[72]	Boston Naming Test	
Mansur LL et. al (2005)[82]	Boston Diagnostic Aphasia Examination	
Canali F et. al (2011)[83]	Dex Questionnaire of the Behavioural Assessment of the Dysexecutive Syndrome	
73	Wisconsin Card Sorting Test	
Beato RG et. al (2007)[84]	Frontal Assessment Battery	
Brucki S et. al (2003)[76] Castro-Costa E et. al (2008)[75] Laks J et. al (2010)[77]	Mini Mental State Examination	
Hoops S et. al (2009)[85]		Mini Mental State Examination
Porto CS et. al (2003)[78]	Mattis Dementia Rating Scale	
Llebaria G et. al (2008)[86]		Mattis Dementia Rating Scale
Montaño M et. al (2005)[87]	Dementia Rating Scale	
Brown GG et. al (1999)[88]		Dementia Rating Scale
Nascimento E (1998)[64]	Wechsler Adult Intelligence Scale	

Randolph C et. al (1993)[65]		Wechsler Adult Intelligence Scale
Brito GN et. al (1989)[89]	Edinburgh Handedness Inventory	
Gorenstein C et. al (1996)[80]	Beck Depression Inventory	
Visser M et. al (2006)[90]		Beck Depression Inventory
Leentjens AF et. al (2000)[91]		Montgomery-Asberg Depression Rating Scale
Leentjens AF et. al (2000)[91]		Hamilton Depression Rating Scale
Gorenstein C et. al (1996)[80]	State-Trait Anxiety Inventory	
Leentjens AF et. al (2011)[92]		Hamilton Anxiety Rating Scales
Castro MMC et. al (2006)[93]	Hospital Anxiety And Depression Scale	
Leentjens AF et. al (2011)[92]		Hospital Anxiety And Depression Scale
Leentjens AF et. al (2011)[92]		Beck Anxiety Inventory
Shansis F et. al (2004)[94]	Bech-Rafaelsen Mania Rating Scale	
Souza RG et. al (2007)[95]	Parkinson's Disease Questionnaire (PDQ-39)	
Jenkinson C et. al (1997)[96]		Parkinson's Disease Questionnaire (PDQ-39)

Table 3. Instruments tested for the Brazilian population and for populations with PD

REFERENCES

1. McKeith IG. Consensus guidelines for the clinical and pathological diagnosis of dementia with Lewy bodies (DLB): report of the consortium on DLB International Workshop. J Alzheimers Dis 2006; 9(Suppl): 1–29.

1. Levy G, Tang MX, Cote LJ, Louis ED, Alfaro B, Mejia H, et al. Motor impairment in PD: relationship to incident dementia and age. Neurology 2000;55(4):539–44

2. Schuurmann AG, Akker M, Ensinck KTJL, Metsemakers JFM, Knottnerus JA, Leentjens AFG, et al. Increased risk of Parkinson's disease after depression. A retrospective cohort study. Neurology 2002; 58:1501-4.

3. Vedolini L, Marchiro E, Rieder C. Avaliação da doença de parkinson pela ressonância magnética. Radiol Bras 2004; 37(2):83-90

5. M.-P. Perriol, P. Krystkowiak, L. Defebvre, S. Blond, A. Deste´e, K. Dujardin. Stimulation of the subthalamic nucleus in Parkinson's disease: Cognitive and affective changes are not linked to the motor outcome. Parkinsonism and Related Disorders 12 (2006) 205–210

6. Frances M. Weaver, Kenneth Follett, Matthew Stern, Kwan Hur, Crystal Harris, William J. Marks Jr et. al. Bilateral Deep Brain Stimulation vs Best Medical Therapy for Patients With Advanced Parkinson Disease A Randomized Controlled Trial. JAMA. 2009;301(1):63-73

7. Anna Lena To¨rnqvist, Lucyna Schale´n and Stig Rehncrona. Effects of Different Electrical Parameter Settings on the Intelligibility of Speech in Patients With Parkinson's Disease Treated With Subthalamic Deep Brain Stimulation. Movement Disorders Vol. 20, No. 4, 2005, pp. 416–423

8. M F Contarino, A Daniele, A H Sibilia, L M A Romito, A R Bentivoglio, G Gainotti, A Albanese. Cognitive outcome 5 years after bilateral chronic stimulation of subthalamic nucleus in patients with Parkinson's disease. J Neurol Neurosurg Psychiatry 2007;78:248–252

9. Lars Wojtecki, Lars Timmermann, Silke Jo¨rgens, Martin Su¨dmeyer, Mohammad Maarouf, Harald Treuer et. al. Frequency-Dependent Reciprocal Modulation of Verbal Fluency and Motor Functions in Subthalamic Deep Brain Stimulation. Arch Neurol. 2006;63:1273-1276

10. J. M. Miyasaki; K. Shannon; V. Voon; B. Ravina; G. Kleiner-Fisman; K. Anderson; L.M. Shulman; G. Gronseth; W. J. Weiner. Practice Parameter: Evaluation and Treatment of Depression, Psychosis and Dementia in Parkinson Disease (An Evidence-Based Review). April 11, 2006 in Neurology

11. Vingerhoets G, van der Linden C, Lannoo E, Vandewalle V, Caemaert J, Wolters M et al. Cognitive outcome after unilateral pallidal stimulation in Parkinson's disease.J Neurol Neurosurg Psychiatry. 1999 Mar;66(3):297-304.

12. Ann Neurol. 1999 Aug;46(2):217-23. Bilateral subthalamic or pallidal stimulation for Parkinson's disease affects neither memory nor executive functions: a consecutive series of 62 patients. Ardouin C, Pillon B, Peiffer E, Bejjani P, Limousin P, Damier P, Arnulf I, Benabid AL, Agid Y, Pollak P

13. Arch Neurol. 2001 Aug;58(8):1223-7. Effects of bilateral subthalamic stimulation on cognitive function in Parkinson disease. Alegret M, Junqué C, Valldeoriola F, Vendrell P, Pilleri M, Rumià J, Tolosa E

14. J Neurol Sci. 2001 Nov 15;192(1-2):9-15. Deep brain stimulation of the subthalamic nucleus in Parkinson's disease: comparison of pre- and postoperative neuropsychological evaluation. Perozzo P, Rizzone M, Bergamasco B, Castelli L, Lanotte M, Tavella A, Torre E, Lopiano L

15. Long term effects of bilateral subthalamic nucleus stimulation on cognitive function, mood, and behaviour in Parkinson's disease. Autor(es): Funkiewiez A; Ardouin C; Caputo E; Krack P; Fraix V; Klinger H; Chabardes S; Foote K; Benabid AL; Pollak P Fonte: J Neurol Neurosurg Psychiatry; 75(6): 834-9, 2004 Jun

16. J Neurol. 2003 Jun;250(6):707-13. Thalamic stimulation for tremor. Subtle changes in episodic memory are related to stimulation per se and not to a microthalamotomy effect. Loher TJ, Gutbrod K, Fravi NL, Pohle T, Burgunder JM, Krauss JK

17. Parkinsonism Relat Disord. 2003 Dec;10(2):73-9. Neuropsychological changes after subthalamic nucleus stimulation: a 12 month follow-up in nine patients with Parkinson's disease. Moretti R, Torre P, Antonello RM, Capus L, Marsala SZ, Cattaruzza T, Cazzato G, Bava A

18. Brain. 2010 Sep;133(9):2664-76. Motor and cognitive outcome in patients with Parkinson's disease 8 years after subthalamic implants. Fasano A, Romito LM, Daniele A, Piano C, Zinno M, Bentivoglio AR, Albanese A.

19. Parkinsonism Relat Disord. 2010 Sep;16(8):535-9. Cognitive and neuropsychiatric effects of subthalamotomy for Parkinson's disease. Bickel S, Alvarez L, Macias R, Pavon N, Leon M, Fernandez C, Houghton DJ, Salazar S, Rodríguez-Oroz MC, Juncos J, Guridi J, Delong M, Obeso JA, Litvan I.

20. Parkinsonism Relat Disord. 2010 Feb;16(2):115-8. Neuropsychological changes 1-year after subthalamic DBS in PD patients: A prospective controlled study. Castelli L, Rizzi L, Zibetti M, Angrisano S, Lanotte M, Lopiano L.

21. J Neurol Sci. 2009 Dec 15;287(1-2):159-71. Relationship between neuropsychological outcome and DBS surgical trajectory and electrode location. York MK, Wilde EA, Simpson R, Jankovic J.

22. Mov Disord. 2009 Aug 15;24(11):1621-8. Deep brain stimulation and cognitive functions in Parkinson's disease: A three-year controlled study. Zangaglia R, Pacchetti C, Pasotti C, Mancini F, Servello D, Sinforiani E, Cristina S, Sassi M, Nappi G.

23. J Neurol. 2009 Aug;256(8):1321-9. Greater improvement in quality of life following unilateral deep brain stimulation surgery in the globus pallidus as compared to the subthalamic nucleus. Zahodne LB, Okun MS, Foote KD, Fernandez HH, Rodriguez RL, Wu SS, Kirsch-Darrow L, Jacobson CE 4th, Rosado C, Bowers D.

24. Ann Neurol. 2009 May;65(5):586-95. Cognition and mood in Parkinson's disease in subthalamic nucleus versus globus pallidus interna deep brain stimulation: the COMPARE trial. Okun MS, Fernandez HH, Wu SS, Kirsch-Darrow L, Bowers D, Bova F, Suelter M, Jacobson CE 4th, Wang X, Gordon CW Jr, Zeilman P, Romrell J, Martin P, Ward H, Rodriguez RL, Foote KD.

25. Clin Neuropsychol. 2009 Apr;23(3):385-405. Cognitive declines one year after unilateral deep brain stimulation surgery in Parkinson's disease: a controlled study using reliable change. Zahodne LB, Okun MS, Foote KD, Fernandez HH, Rodriguez RL, Kirsch-Darrow L, Bowers D.

26. J Int Neuropsychol Soc. 2008 Sep;14(5):890-4. Subthalamic stimulation affects homophone meaning generation in Parkinson's disease. Castner JE, Copland DA, Silburn PA, Coyne TJ, Sinclair F, Chenery HJ.

27. J Neurol Sci. 2008 Oct 15;273(1-2):19-24. The effects of bilateral subthalamic nucleus deep brain stimulation (STN DBS) on cognition in Parkinson disease. Heo JH, Lee KM, Paek SH, Kim MJ, Lee JY, Kim JY, Cho SY, Lim YH, Kim MR, Jeong SY, Jeon BS.

28. J Clin Exp Neuropsychol. 2009 Jan;31(1):65-72. The clinical significance of neuropsychological changes following bilateral subthalamic nucleus deep brain stimulation for Parkinson's disease. Higginson CI, Wheelock VL, Levine D, King DS, Pappas CT, Sigvardt KA.

29. Lancet Neurol. 2008 Jul;7(7):605-14. Neuropsychological and psychiatric changes after deep brain stimulation for Parkinson's disease: a randomised, multicentre study. Witt K, Daniels C, Reiff J, Krack P, Volkmann J, Pinsker MO, Krause M, Tronnier V, Kloss M, Schnitzler A, Wojtecki L, Bötzel K, Danek A, Hilker R, Sturm V, Kupsch A, Karner E, Deuschl G.

30. J Neurol Neurosurg Psychiatry. 2008 Jul;79(7):789-95. Cognitive declines following bilateral subthalamic nucleus deep brain stimulation for the treatment of Parkinson's disease. York MK, Dulay M, Macias A, Levin HS, Grossman R, Simpson R, Jankovic J.

31. J Neurol. 2007 Sep;254(9):1238-43. Apathy and verbal fluency in STN-stimulated PD patients. An observational follow-up study. Castelli L, Lanotte M, Zibetti M, Caglio M, Rizzi L, Ducati A, Bergamasco B, Lopiano L.

32. Parkinsonism Relat Disord. 2007 Jul;13(5):290-4. Brain networks underlining verbal fluency decline during STN-DBS in Parkinson's disease: an ECD-SPECT study. Cilia R, Siri C, Marotta G, De Gaspari D, Landi A, Mariani CB, Benti R, Isaias IU, Vergani F, Pezzoli G, Antonini A.

33. J Int Neuropsychol Soc. 2007 Jan;13(1):68-79. Neuropsychological performance following staged bilateral pallidal or subthalamic nucleus deep brain stimulation for Parkinson's disease. Rothlind JC, Cockshott RW, Starr PA, Marks WJ Jr.

34. Parkinsonism Relat Disord. 2006 Jun;12(5):289-95. Clinical correlates and cognitive underpinnings of verbal fluency impairment after chronic subthalamic stimulation in Parkinson's disease. De Gaspari D, Siri C, Di Gioia M, Antonini A, Isella V, Pizzolato A, Landi A, Vergani F, Gaini SM, Appollonio IM, Pezzoli G

35. Acta Neurochir (Wien). 2006 Apr;148(4):389-94. Efficacy of bilateral subthalamic nucleus (STN) stimulation in Parkinson's disease. Erola T, Heikkinen ER, Haapaniemi T, Tuominen J, Juolasmaa A, Myllylä VV

36. Arch Neurol. 2004 May;61(5):697-700. Deep brain stimulation of the subthalamic nucleus improves cognitive flexibility but impairs response inhibition in Parkinson disease. Witt K, Pulkowski U, Herzog J, Lorenz D, Hamel W, Deuschl G, Krack P

37. J Neural Transm. 2001;108(8-9):1021-7. Deep brain stimulation (DBS) attentional effects parallel those of l-dopa treatment. Brusa L, Pierantozzi M, Peppe A, Altibrandi MG, Giacomini P, Mazzone P, Stanzione P

38. Mov Disord. 2010 Aug 15;25(11):1583-9. Risk factors for executive dysfunction after subthalamic nucleus stimulation in Parkinson's disease. Daniels C, Krack P, Volkmann J, Pinsker MO, Krause M, Tronnier V, Kloss M, Schnitzler A, Wojtecki L, Bötzel K, Danek A, Hilker R, Sturm V, Kupsch A, Karner E, Deuschl G, Witt K

39. Clin Neuropsychol. 2010 Feb;24(2):235-45. Cognitive declines after unilateral deep brain stimulation surgery in Parkinson's disease: a controlled study using Reliable Change, part II. Mikos A, Zahodne L, Okun MS, Foote K, Bowers D

40. Arch Clin Neuropsychol. 2008 Jul;23(4):399-408. Absence of cognitive deficits following deep brain stimulation of the subthalamic nucleus for the treatment of Parkinson's disease. Fraraccio M, Ptito A, Sadikot A, Panisset M, Dagher A

41. J Neurol. 2001 Jul;248(7):603-11. Influence of chronic bilateral stimulation of the subthalamic nucleus on cognitive function in Parkinson's disease. Dujardin K, Defebvre L, Krystkowiak P, Blond S, Destée A

42. Brain. 2000 Jun;123 (Pt 6):1142-54.The impact of deep brain stimulation on executive function in Parkinson's disease. Jahanshahi M, Ardouin CM, Brown RG, Rothwell JC, Obeso J, Albanese A, Rodriguez-Oroz MC, Moro E, Benabid AL, Pollak P, Limousin-Dowsey P

43. Clin Neurol Neurosurg. 1999 Sep;101(3):182-8. Cognitive outcome following staged bilateral pallidal stimulation for the treatment of Parkinson's disease. Fields JA, Tröster AI, Wilkinson SB, Pahwa R, Koller WC

44. Brain. 2010 Dec;133(Pt 12):3625-34. Mapping Go-No-Go performance within the subthalamic nucleus region. Hershey T, Campbell MC, Videen TO, Lugar HM, Weaver PM, Hartlein J, Karimi M, Tabbal SD, Perlmutter JS

45. Mov Disord. 2010 Sep 15;25(12):1839-46. Pallidal stimulation in advanced Parkinson's patients with contraindications for subthalamic stimulation. Rouaud T, Dondaine T, Drapier S, Haegelen C, Lallement F, Péron J, Raoul S, Sauleau P, Vérin M

46. Parkinsonism Relat Disord. 2010 Jun;16(5):324-8.Factors related to extended hospital stays following deep brain stimulation for Parkinson's disease. Mikos A, Pavon J, Bowers D, Foote KD, Resnick AS, Fernandez HH, Thomas P, Garvan C, Roy A, Okun MS

47. Neuropsychologia. 2009 Dec;47(14):3203-9. Behavioral effects of subthalamic deep brain stimulation in Parkinson's disease. Denheyer M, Kiss ZH, Haffenden AM

48. Mov Disord. 2009 Aug 15;24(11):1613-20. Deep brain stimulation of the subthalamic nucleus improves intrinsic alertness in Parkinson's disease. Fimm B, Heber IA, Coenen VA, Fromm C, Noth J, Kronenbuerger M

49. J Neurol. 2008 Dec;255(12):1940-8. Impaired performance on the Wisconsin Card Sorting Test under left- when compared to right-sided deep brain stimulation of the subthalamic nucleus in patients with Parkinson's disease. Lueken U, Schwarz M, Hertel F, Schweiger E, Wittling W

50. Brain. 2008 Dec;131(Pt 12):3348-60. Bilateral subthalamic stimulation impairs cognitive-motor performance in Parkinson's disease patients. Alberts JL, Voelcker-Rehage C, Hallahan K, Vitek M, Bamzai R, Vitek JL

51. Neuropsychologia. 2008 Nov;46(13):3162-9. Neural correlates of STN DBS-induced cognitive variability in Parkinson disease. Campbell MC, Karimi M, Weaver PM, Wu J, Perantie DC, Golchin NA, Tabbal SD, Perlmutter JS, Hershey T

52. IEEE Trans Neural Syst Rehabil Eng. 2007 Jun;15(2):198-206. Deep brain stimulation of the subthalamic nucleus improves set shifting but does not affect dual task performance in Parkinson's disease. Page D, Jahanshahi M

53. Mov Disord. 2007 Sep 15;22(12):1729-34. Effects of chronic subthalamic stimulation on nonmotor fluctuations in Parkinson's disease. Witjas T, Kaphan E, Régis J, Jouve E, Chérif AA, Péragut JC, Azulay JP

54. Mov Disord. 2007 Jul 30;22(10):1457-63. Does ageing influence deep brain stimulation outcomes in Parkinson's disease? Ory-Magne F, Brefel-Courbon C, Simonetta-Moreau M, Fabre N, Lotterie JA, Chaynes P, Berry I, Lazorthes Y, Rascol O

55. Exhaustive, one-year follow-up of subthalamic nucleus deep brain stimulation in a large, single-center cohort of parkinsonian patients. Tir M, Devos D, Blond S, Touzet G, Reyns N, Duhamel A, Cottencin O, Dujardin K, Cassim F, Destée A, Defebvre L, Krystkowiak P

56. Mov Disord. 2007 May 15;22(7):974-81.Long-term cognitive profile and incidence of dementia after STN-DBS in Parkinson's disease. Aybek S, Gronchi-Perrin A, Berney A, Chiuvé SC, Villemure JG, Burkhard PR, Vingerhoets FJ

57. Parkinsonism Relat Disord. 2006 May;12(4):205-10. Stimulation of the subthalamic nucleus in Parkinson's disease: cognitive and affective changes are not linked to the motor outcome. Perriol MP, Krystkowiak P, Defebvre L, Blond S, Destée A, Dujardin K

58. J Neurol Neurosurg Psychiatry. 2005 Dec;76(12):1640-4. Stimulation of the subthalamic nucleus in Parkinson's disease: a 5 year follow up. Schüpbach WM, Chastan N, Welter ML, Houeto JL, Mesnage V, Bonnet AM, Czernecki V, Maltête D, Hartmann A, Mallet L, Pidoux B, Dormont D, Navarro S, Cornu P, Mallet A, Agid Y

59. J Neurol. 2005 Feb;252(2):176-82. Unilateral pallidotomy versus bilateral subthalamic nucleus stimulation in PD--a comparison of neuropsychological effects. Smeding HM, Esselink RA, Schmand B, Koning-Haanstra M, Nijhuis I, Wijnalda EM, Speelman JD

60. Lezak, M.D., Howieson, D.B., Loring, D.W., Hannay, J.H. & Fischer, J.S. (2004). Neuropsychological Assessment. Oxford University Press, New York.

61. Duncan MT. Obtenção de dados normativos para desempenho no teste de Stroop num grupo de estudantes do ensino fundamental em Niterói. J Bras Psiquiatr, 55(1): 42-48, 2006

62. *Tosi, S.M.V.D., Rossetti, M.O. & Rabelo, I.S. (2007) STRooP – Adaptação Brasileira do Teste das Cores e Palavras*

63. Hamdan AC, Hamdan EMLR. Effects of age and education level on the Trail Making Test in A healthy Brazilian sample. Psychology & Neuroscience, 2009, 2, 2, 199 – 203

64. Nascimento E. Adaptação da terceira edição da escala Wechsler de inteligência para adultos (WAIS-III) para uso no contexto brasileiro. Temas psicol. vol.6 no.3 Ribeirão Preto dic. 1998

65. Randolph C, Mohr E, Chase TN. Assessment of intellectual function in dementing disorders: validity of WAIS-R short forms for patients with Alzheimer's, Huntington's, and Parkinson's disease. J Clin Exp Neuropsychol. 1993 Sep;15(5):743-53.

66. Malloy-Diniz LF, Lasmar VAP, Gazinelli LSR, Fuentes S, Salgado JV. The Rey Auditory-Verbal Learning Test: applicability for the Brazilian elderly population. Rev Bras Psiquiatr. 2007;29(4):324-9

67. Teruya LC, Ortiz KZ, Minett TSC. Performance of normal adults on Rrey auditory Llearning Ttest: A pilot study. Arq Neuropsiquiatr 2009;67(2-A):224-228

68. Fichman HC, Dias LBT, Fernandes CS, Lourenço R, Carmelli P, Nitrini R. Normative data and construct validity of the Rey Auditory Verbal Leraning Test in a Brazilian elderly population. Psychology & Neuroscience, 2010, 3, 1, 79-84

69. Tombaugh TN, Kozak J, Rees L. Normative data stratified by age and education for two measures of verbal fluency: FAS and animal naming. Arch Clin Neruopsychol. 14 (2), p. 167-77, 1996

70. Arq Neuropsiquiatr. 1997 Mar;55(1):56-61.[Normative data on the verbal fluency test in the animal category in our milieu].[Article in Portuguese]Brucki SM, Malheiros SM, Okamoto IH, Bertolucci PH.

71. Braz J Med Biol Res. 2004 Dec;37(12):1771-7. Epub 2004 Nov 17.Category fluency test: effects of age, gender and education on total scores, clustering and switching in Brazilian Portuguese-speaking subjects.Brucki SM, Rocha MS.

72. Miotto EC, Sato J, Lucia MCS, Camargo CHP, Scaff M. Development of an adapted version of the Boston Naming Test for Portuguese speakers. Revista Brasileira de Psiquiatria, vol 32, nº 3, set 2010

73. VALIDAÇÃO WISCONSIN PARA PORTUGUÊS

74. Pasquali L, Wechsler S, Bensusan E. Matrizes Progressivas do Raven Infantil: Um Estudo de Validação para o Brasil. Avaliação Psicológica, 2002,2, pp. 95-110

75. Castro-Costa E, Fuzikawa C, Uchoa E, Firmo JOA, Lima-Costa MF. NORMS FOR THE MINI-MENTAL STATE EXAMINATION. Arq Neuropsiquiatr 2008;66(3-A):524-528

76. Sugestões para o uso do mini-exame do estado mental no Brasil/ Suggestions for utilization of the mini-mental state examination in Brazil Brucki, Sonia M.D.; Nitrini, Ricardo; Caramelli, Paulo; Bertolucci, Paulo H.F.; Okamoto, Ivan H. Arq. Neuro-Psiquiatr. 61(3B): 777-781, TAB. 2003 Sep

77. Laks J, Coutinho ESF, Junger W, Silveira H, Mouta R, Baptista EMR et al. Education does not equally influence all the Mini Mental State Examination subscales

and items: inferences from a Brazilian community sample. Revista Brasileira de Psiquiatria, vol 32; nº 3. set2010

78. Porto CS, Fichman EC, Caramelli P, Bahia VS, Nitrini R. BRAZILIAN VERSION OF THE MATTIS DEMENTIA RATING SCALE. Arq Neuropsiquiatr 2003;61(2-B):339-345

79. Foss MP, Vale FAC, Speciali JG. INFLUÊNCIA DA ESCOLARIDADE NA AVALIAÇÃO NEUROPSICOLÓGICA DE IDOSOS: Aplicação e análise dos resultados da Escala de Mattis para Avaliação de Demência (Mattis Dementia Rating Scale - MDRS). Arq Neuropsiquiatr 2005;63(1):119-126

80. Gorestein C, Andrade L - Validation of a portuguese version on the beck depression inventory and the state-trait anxiety inventory in brasilier. Braz. J. Med Biol Res, 29: 453-457, 1996

81. Int Psychogeriatr. 2010 Sep;22(6):1003-11. Epub 2010 Jul 2. Psychometric characteristics of the Rivermead Behavioural Memory Test (RBMT) as an early detection instrument for dementia and mild cognitive impairment in Brazil. Yassuda MS, Flaks MK, Viola LF, Pereira FS, Memória CM, Nunes PV, Forlenza OV.

82. A study of the abilities in oral language comprehension of the Boston Diagnostic Aphasia Examination - Portuguese version: a reference guide for the Brazilian population Mansur, L.L.; Radanovic, M.; Taquemori, L.; Greco, L.; Araújo, G.C. Braz J Med Biol Res 38(2): 277-292, TAB. 2005 Feb.

83. Reliability study of the Behavioral Assessment of the Dysexecutive Syndrome adapted for a Brazilian sample of older-adult controls and probable early Alzheimer's disease patients/ Um estudo de confiabilidade da Bateria de Avaliação da Síndrome Disexecutiva adaptada para uma amostra brasileira de idosos controles e pacientes com doença de Alzheimer provável em fase inicial Canali, Fabíola; Brucki, Sonia M. D.; Bertolucci, Paulo H. F.; Bueno, Orlando F. A. Rev. Bras. Psiquiatr. (ahead): 0-0, TAB. 2011

84. Beato RG, Nitrini R, Formigoni AP, Caramelli P. Brazilian version of the Frontal Assessment Battery (FAB): Preliminary data on administration to healthy elderly. Dementia & Neuropsychologia 2007;1:59-65

85. Validity of the MoCA and MMSE in the detection of MCI and dementia in Parkinson disease. Hoops S, Nazem S, Siderowf AD, Duda JE, Xie SX, Stern MB, Weintraub D. Neurology. 2009 Nov 24;73(21):1738-45.

86. Cut-off score of the Mattis Dementia Rating Scale for screening dementia in Parkinson's disease. Llebaria G, Pagonabarraga J, Kulisevsky J, García-Sánchez C, Pascual-Sedano B, Gironell A, Martínez-Corral M. Mov Disord. 2008 Aug 15;23(11):1546-50.

87. Validade da versão em português da Clinical Dementia Rating/ Validity of the Portuguese version of Clinical Dementia Rating Macedo Montaño, Maria Beatriz M; Ramos, Luiz Roberto Rev. Saúde Pública 39(6): 912-917, ILUS, TAB. 2005 Dec.

88. Validity of the Dementia Rating Scale in assessing cognitive function in Parkinson's disease. Brown GG, Rahill AA, Gorell JM, McDonald C, Brown SJ, Sillanpaa M, Shults C.J Geriatr Psychiatry Neurol. 1999 Winter;12(4):180-8.

89. Brito GN, Brito LS, Paumgartten FJ, Lins MF. Lateral preferences in Brazilian adults: an analysis with the Edinburgh Inventory. Cortex. 1989;25:403-15.

90. Reliability and validity of the Beck depression inventory in patients with Parkinson's disease. Visser M, Leentjens AF, Marinus J, Stiggelbout AM, van Hilten JJ. Mov Disord. 2006 May;21(5):668-72.

91. The validity of the Hamilton and Montgomery-Asberg depression rating scales as screening and diagnostic tools for depression in Parkinson's disease. Leentjens AF, Verhey FR, Lousberg R, Spitsbergen H, Wilmink FW.Int J Geriatr Psychiatry. 2000 Jul;15(7):644-9.

92. Leentjens AFG, Dujardin k, Marsh L, Richard IH, Starkstein SE, Martinez-Martin P. Anxiety rating scales in Parkinson's disease: A validation study of the Hamilton anxiety rating scale, the Beck anxiety inventory, and the hospital anxiety and depression scale. Movement Disorders Volume 26, Issue 3, pages 407–415, 15 February 2011

93. Validade da escala hospitalar de ansiedade e depressão em pacientes com dor crônica/ Validity of the hospital anxiety and depression scale in patients with chronic pain/ Validez de la escala hospitalaria de ansiedad y depresión en pacientes con dolor crónico Castro, Martha Moreira Cavalcante; Quarantini, Lucas; Batista-Neves, Susana;

Kraychete, Durval Campos; Daltro, Carla; Miranda-Scippa, Ângela. Rev. Bras. Anestesiol. 56(5): 470-477, TAB. 2006 Oct.

94. Desenvolvimento da versão em português da Escala de Avaliação de Mania de Bech-Rafaelsen (EAM-BR)/ Development of the Portuguese version of the Bech-Rafaelsen Mania Rating Scale (BRMaS)/ Desarrollo de la versión en portugués de la Escala de Evaluación de la Manía de Bech-Rafaelsen (EAM-BR) Shansis, Flávio; Berlim, Marcelo T.; Mattevi, Betina; Maldonado, Gabriela; Izquierdo, Ivan; Fleck, Marcelo. Rev. psiquiatr. Rio Gd. Sul 26(1): 30-38, TAB. 2004 Apr.

95. 41. Souza RG, Borges V, Silva SMCA, Ferraz HB. QUALITY OF LIFE SCALE IN PARKINSON'S DISEASE PDQ-39 - (Brazilian Portuguese version) to assess patients with and without levodopa motor fluctuation. Arq Neuropsiquiatr 2007;65(3-B):787-791

96. The Parkinson's Disease Questionnaire (PDQ-39): development and validation of a Parkinson's disease summary index score. Jenkinson C, Fitzpatrick R, Peto V, Greenhall R, Hyman N. Age Ageing. 1997 Sep;26(5):353-7.

97. Campos-Sousa IS, Campos-Sousa RN, Ataíde Jr L, Soares MMB, Almeida KJ. Executive dysfunction and motor symptoms in Parkinson's disease. Arq Neuropsiquiatr 2010;68(2):246-251

98. Hanna-Pladdy B, Enslein A, Fray M, Gajewski BJ, Pahwa R, Lyons KE. Utility of the NeuroTrax Computerized Battery for Cognitive Screening in Parkinson's Disease: Comparison with the MMSE and the MoCA. Int J Neurosci. 2010 Aug;120(8):538-43

99. Silberman CD, Laks J, Capitão CF, Rodrigues CS, Moreira I, Engelhardt E. Recognizing depression in patients with parkinson's disease: Accuracy and specificity of two depression rating scale. Arq Neuropsiquiatr 2006;64(2-B):407-411

100. Schrag A, Barone P, Brown RG, Leentjens AFG, McDonald WM, Starkstein S et al. Depression Rating Scales in Parkinson's Disease: Critique and Recommendations. Movement Disorders Vol. 22, No. 8, 2007, pp. 1077–1092

ANEXO B

Dementia & Neuropsychologia is a quarterly journal dedicated to publishing research in cognitive and behavioral sciences, focusing on clinical epidemiology, basic and applied neurosciences, and cognitive tests devised or adapted for populations with heterogeneous cultural, educational and socioeconomic backgrounds. **Dementia & Neuropsychologia** is particularly involved in publishing research relevant to developing countries, and also seeks to disseminate reviews and case reports that are important contributions to neurological, psychiatric, geriatric, neuropsychological, speech therapy, occupational therapy and related fields.

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