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Brazilian version of the Nottingham Sensory Assessment: validity, agreement and reliability

Versão brasileira da Avaliação Sensorial de Nottingham: validade, concordância e confiabilidade

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Abstract

Objectives: To investigate the inter-rater and intra-rater reliability, construct validity and internal consistency of the Brazilian version of the Nottingham Sensory Assessment for Stroke Patients (NSA). **Methods:** The instrument was translated into Portuguese from its original in English by a bilingual translator and was then back-translated into English. Twenty-one hemiparetics were evaluated by two examiners using the NSA and the Fugl-Meyer Assessment (FMA) of physical performance. **Results:** Significant correlation were found between the FMA and the NSA (r=0.752). The NSA showed excellent internal consistency (0.86), and there were acceptable inter- and intra-rater reliability for all items of the NSA, except temperature. Significant ceiling effects were found for the NSA and the FMA. **Conclusions:** The Brazilian version of the NSA met the criteria for agreement, internal consistency and concurrent validity. It was quick and easy to apply, and it could be used within clinical practice in neuro-rehabilitation outpatient clinics to assess sensory functions following stroke. The significant ceiling effect for the NSA did not limit its use, given that for the same patients, the FMA also showed ceiling effects.

Key words: stroke; disability evaluation; validity tests; sensation; rehabilitation.

Resumo

Objetivo: Verificar a concordância inter e intraexaminador, validade construtiva e consistência interna da versão brasileira do instrumento *Nottingham Sensory Assessment* para hemiparéticos após acidente vascular encefálico (AVE). **Métodos:** O instrumento foi traduzido para língua portuguesa com base na sua versão original em Inglês por um tradutor bilíngue e, posteriormente, revertido para a língua inglesa. Vinte e um hemiparéticos foram avaliados por dois examinadores pela Avaliação Sensorial de Nottingham para pacientes pós-AVE (ASN) e pelo Protocolo de Desempenho Físico de Fugl-Meyer (FM). **Resultados:** Foi encontrada correlação entre os instrumentos FM e ASN (0,752); excelente consistência interna da ASN (0,86); excelentes coeficientes de concordância interexaminador e intraexaminador para todos os itens da ASN, exceto temperatura e efeito teto significativo para ASN e FM. **Conclusão:** A versão brasileira da *Nottingham Sensory Assessment* cumpriu os critérios de concordância, consistência interna e validade concorrente, sendo um instrumento de rápida e fácil aplicação, podendo ser utilizada nos ambulatórios de neuroreabilitação para avaliar a função sensorial pós-AVE. O efeito teto significativo da ASN não limita seu uso, tendo em vista que, para os mesmos pacientes, o Protocolo de Fugl-Meyer também revelou efeito teto.

Palavras-chave: acidente cerebral vascular; avaliação da deficiência; testes de validade; sensação; reabilitação.

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Introduction

Sensory impairments affect about 60% of patients who have suffered a cerebrovascular disease (CVD)[1]. According to Sterzi et al.[2], the somatic sensations are affected in 37% of patients with a injury in the right hemisphere and in 25% of patients with a injury in the left hemisphere. The most evident consequences of the somato-sensory impairments are alterations in tactile recognition and in the manipulation of objects, the threat of burns or other injuries in the limb with loss of sensory perception, motor changes of the affected limb, deficits to control the level of strength during hand grip and gait impairments[2-7].

The motor cortex is related to sensory processing during the performance of motor tasks[1]. Two of the main functions of the cutaneous sensations of the hand are to obtain information regarding the environment during exploratory tasks and to provide the feedback for the precision abilities during the tasks of grip and object manipulation[1,6,8-10]. Sensory impairments in the lower limb can cause losses in gait, since it leads to a reduction of the swing phase, gait velocity and step symmetry[11]. The sensory functions are recognized as a precursor of the recovery of movement and functional activity[3,12].

It is known that somato-sensory impairments have a significant influence on daily activities. Patients with sensory and motor losses have poorer prognostics than patients with exclusive motor impairment, since the somato-sensory impairments have a negative effect on functional performance of hemiplegic patients and prolongs the rehabilitation treatment[3,10]. Sommerfield and Von Arbin[13] evaluated the pain and tactile sensitivity of hemiparetic subjects in the acute phase and observed 40% of them had sensory dysfunctions, concluding that normal sensory functions were related to high functional performance and to a lower length of permanence in the hospital.

Sensory assessments are done by 80% of health professionals[3], however, much research consider it difficult to be developed and tiring, especially because it is commonly performed after all of the motor tests. Sensory assessments in hemiparetic have been performed through somato-sensory evoked potentials[14] or functional scales. Considering the last ones, therapists should consider the validity and reliability of the instruments used in their clinical exams, since there are non-standardized forms of assessing sensitivity, but many of them do not provide and adequate information to assess diagnostics or to monitor the gains resulting from sensory rehabilitation [1,10,11,15].

According Lyden and Hantson[16], the characteristics of an ideal instrument for the evaluation after CVD consist of easy and quick application; simplicity and a lack of ambiguity; concurrent validity; reliability; to demonstrate and appropriate internal consistency and reproducibility inter- and intra-raters; to be independent of the influences of age, sex, language, social class, profession or educational levels of the patient and to demonstrate ranges of scores which avoid difficulties to indicate minimal clinical changes.

In the literature, the use of clinical instruments for sensory assessment is poorly documented, and there were not found, in the literature, research, nor validated instruments exclusive for the sensory assessment of this population in Brazil. Carey, Oke e Matyas[5] created the test of limb position sense. They confirmed its reliability and clinical usefulness in the proprioceptive assessment of hemiparetic wrists. Later, Dannenbaum et al.[10] created two evaluations of the sensory functions of the hand for this population. In 2002, the instrument *Rivermead Assessment of Somato-sensory Performance* was created to measure the sensory functions of hemiparetic patients and it demonstrated good intra- and inter-rater reliability coefficients, however, it required commercially registered equipment for its administration[1].

In 2006, the instrument Hand Active Sensation Test was elaborated. It evaluates the identification of weights and textures by hemiparetic subjects, however it is limited to the hand evaluation and does not involve thermal sensations and stereognosis[17]. The subscale of sensitivity of the Fugl-Meyer Assessment (FMA) of physical performance involves extereoception and proproception of the upper and lower limbs and has high inter-rater reliability and internal consistency, nevertheless it has shown a high ceiling effect and a poor to moderate reliability for the item extereoception[18].

The *Nottingham Sensory Assessment* (NSA) was created in England, in 1991, by Lincoln et al.[19], and aimed to identify the sensory deficits present after CVD and to monitor their recovery. It is related to the evaluation of the protophatic and epicritic sensory modalities, and has shown good intra-rater reliability, but had poor inter-rater reliability after the assessment of hemiparetic subjects. Considering this, in 1998, the instrument were items reduced and went through a new evaluation of its reliability, in its country of origin, and there was found acceptable levels of inter-rater reliability[20]. The NSA differs from the other types of sensory assessments since it tests all body segments and does not require high cost equipment for its administration.

This present study has the purpose of translating the *Nottingham Sensory Assessment* (NSA) scale, and to verify its reliability, concordance, internal consistency and concurrent validity in hemiparetic patients after CVD occurrence.

Methods

A prospective study was developed in the Outpatient Clinic of Physical Therapy and Occupational Therapy of the Clinical

Hospital of the Universidade Estadual de Campinas (UNICAMP). This research was approved by the Ethics Committee of Research of the Medical Sciences Scholl of the UNICAMP (number 996/2007). The study of validation of the NSA had been permitted by the authors of the instrument[20], through its concession and of its manual, while maintaining the authors rights.

Participants

Patients were invited with hemiparesis secondary to CVD from a list of patients treated at the Outpatients Clinic of Physical Therapy and Occupational Therapy. The inclusion criteria adopted were ages up to 18 years-old; of both sexes; and unilateral CVD ischemic or hemorrhagic CVD with an onset of up to six months. There were included literate patients. Patients excluded from this study included subjects with sensitive impairments secondary to other diseases; those with speech impairments and/or unable to understand simple instructions; with severe cognitive disturbances; with cerebellar CVD and those with Diabetes Mellitus and/or peripheral neuropathies. The patients or their relatives signed a free informed consent form.

Measurement Instruments

The NSA has four subscales and 20 items (in annex). The subscales were tactile sensation, proprioception, stereognosis and two-point discrimination. The NSA identified the sensory impairments in the face, trunk, shoulder, elbow, wrist, hand, knee, ankle and foot. Each item of the subscale tactile sensation (light touch, pressure, pinprick, temperature, tactile location on both sides of the body and bilateral simultaneous touch) may be scored from 0 to 2, which represented tactile anesthesia and normal tactile sensation, respectively. The total scoring for the non-affected side of the body ranged from 0 to 90 and for the affected one ranged from 0 to 108.

The subscale for proprioception of the NSA evaluated the movement performance, its direction and the joint position of segments only on the affected side of the body. Each item was scored from 0 (absence of proprioception) and 3 (normal proprioception), with a total score that ranged from 0 to 21. The segments of the face, trunk and foot were not assessed through this subscale according to the original version.

The subscale stereognosis of the NSA observes the recognition of 11 objects by the affected side of the body, being scored from 0 (astereognosis) to 2 (normal stereognosis) and with a total score ranging from 0 to 22. The objects required by this subscale are used in the activities of daily living.

The subscale two-point discrimination was tested in the index finger and thenar region, and each part received a score from 0 (absence of discriminative touch) to 2 (normal function), with a total score ranging from 0 to 4.

In the cases in which were impossible to test any segment, it was given a punctuation from 4 to 10 for the subscales: (4) unable to detect pressure, (5) physical reasons, for example, motor disability which impairs tactile location, (6) unable to assess due to the vestment, (7) communication impairments, (8) cognitive problems, (9) pain or increased tone, (10) drowsiness or impaired concentration [7].

The Fulg-Meyer[21] measures the sensory motor recovery in hemiparesis through the subscales: motor function on upper extremity, lower extremity, passive mobility, pain, sensitivity and balance. Each item is pointed from 0 to 2, and, the lower the punctuation, the higher the sensory motor impairment of the patient. This is an instrument validated internationally, translated for the Portuguese language and it has shown high reliability coefficients in Brazilian hemiparetic[21]. The subscale sensitivity of the FMA protocol involves extereoception (light touch in forearm, hand palm, thigh and foot sole) and proprioception (joints from the upper and lower limbs) and its score ranges from 0 to 8 for extereoception and from 0 to 16 for proprioception. The patients were evaluated through the motor and sensitivity subscales of the FMA in order to categorize their sensory motor impairment.

Instrument translation

The NSA and its manual were translated for the Portuguese language based in its original version in English by a bilingual translator and posteriorly reversed for the English by a second translator. This last translator compared the original version to the English version resultant from the back translation, corrected the conflicting interpretations and performed the cultural adaptation with the assistance of a physical therapist experienced in neurological rehabilitation[22].

Material

According to the exigencies from the NSA, there shall be used for the assessment of the tactile sensation: cotton ball, monofilament (green color), two test tubes containing hot or cold water and talcum. To measure stereognosis it shall be used: coins of R$ 0,01, 0,10 and 1,00, ballpoint pen, pencil, comb, scissors, sponge, cloth, a tea-cup and a cup, and, for the test of two-point discrimination, a compass is used.

Procedure

The examiners were professionals of physical therapy whom have done, separately, the theoretic-practical training with the

purpose of standardization of the criteria from NSA using the proper manual and listening to seminars developed by an experienced physical therapist whom kept contact with the researcher creator of the instrument. Posteriorly, the NSA was administered to three hemiparetic who did not take place of this research's sample. The patients from the sample were assessed by two examiners, simultaneously, and one did not have asses to the other's evaluation. A re-test was performed by the examiner 2 after a period of 3 to 7 days. Figure 1 exhibits the procedure of the study.

The order of application of the NSA was: tactile sensation, stereognosis, proprioception and two-point discrimination. During the evaluation, the patients were asked to use a blindfold and they could take it out between the tests in case of discomfort. The tactile sensation was examined in both sides of the body, in a variable order. Patients were evaluated with the minimum vestment, preferably wearing a short, when allowed by them. Orthosis and elastic stokings were removed during the evaluation. A third examiner administered the FMA protocol in the first day of evaluation. Patients were evaluated in the Outpatient Clinic of Physical Therapy and Occupational Therapy in the evening.

Statistical analysis

The descriptive analysis of the numerical and categorical variables of the sample was done. There were calculated the ceiling and floor effects of the subscales of the NSA and of the subscale sensitivity of the FMA protocol – the percentage of the scores which are grouped around the higher and lower punctuations, respectively. Values higher than 20% are considered significant. The existence of high ceiling effect indicates a limited capacity of an instrument to discriminate between individuals[23].

The level of reliability of an instrument can be obtained measuring the concordance between the results originated from different examiners in their applications to the same patients[24]. The concordance inter and intra-raters (retest) was verified for the domains of the NSA and in its score in the affected side of the body by the Intraclass Correlation Coefficient (ICC): ICC<0,40 – weak concordance, ICC or 0,4-0,75- moderate concordance and ICC>0,75 – strong concordance[25]. The Bland-Altman analysis was performed through graphics of the sum of the four subscales of the NSA, whose objective is to evaluate the level of concordance inter and intra-rater, considering the differences from the scores and their means[26].

The internal consistency was assessed through the Cronbach's Alpha, and values above 0,70 indicate high internal consistency[27]. The correlation item-total of the NSA was executed, being the score above 0,4 considered satisfactory[28]. The correlation between the measuring instruments was performed by the Pearson's Correlation Coefficient (r). The level of significance adopted for the analysis was of 5%. It was used the statistical program SPSS 15.0 for Windows.

Results

Demographic data and the categorization of the sensory and motor impairments are summarized on Table 1. Participated in this study 21 hemiparetic patients whose mean age

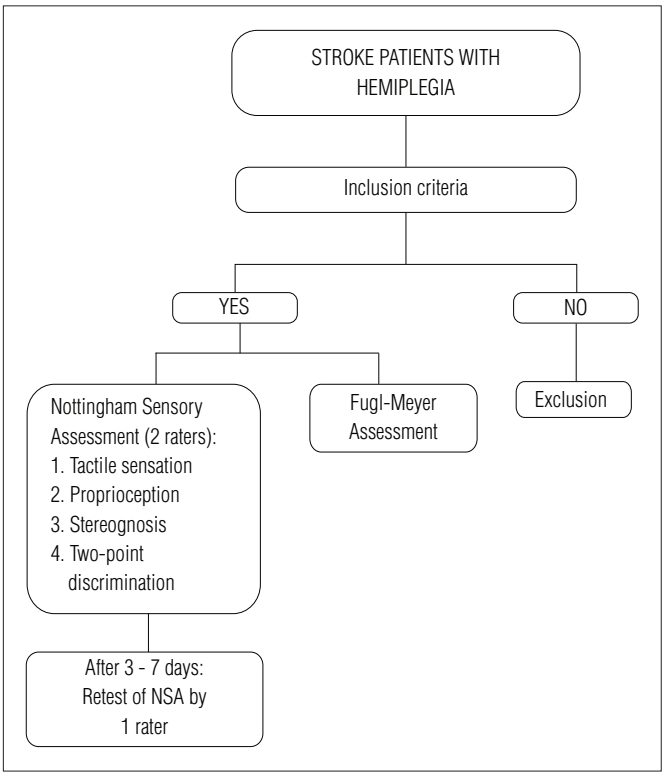

Figure 1. Flow chart of the study.

Table 1. Demographic data and impairment levels (n=21).

sensory-motor (n=21).	
Variables	Mean±SD [min; max]
Age (years)	49.47±13.64 [21;78]
Gender (F/M)	8 (38.1%) / 13 (61.9%)
Type of stroke (H/I)	4 (19%) / 17 (81%)
Time since lesion (months)	40.23±32.35 [6;116]
FMA – motor scale	54.09±19.21 [24;88]
FMA – sensory scale	16.23±5.43 [8;24]
Exteroception	5.14±1.68 [3;8]
Proprioception	11.28±3.82 [4;16]
Nottingham Sensory Assessment	
Tactile sensation (non-affected side)	90
Tactile sensation (affected side)	98.61±12.5 [59;108]
Proprioception	14.95±3.89 [8;21]
Stereognosis	10.85±10.27 [0;22]
Two-point discrimination	1.28±1.45 [0;4]

F=female; M=male; H=hemorrhagic; I=ischemic; FMA=Fulg-Meyer Assessment.

Table 2. Inter-rater reliability and intra-class correlation coefficients.

Item	ICC	Confidence interval (CI) 95%	p-values	Item-total correlations
Light touch	0.998	0.995;0.999	<0.01	0.79
Pressure	1.000	1.000;1.000	<0.01	0.82
Pinprick	1.000	1.000;1.000	<0.01	0.88
Temperature	0.804	0.578;0.916	<0.01	0.199
Tactile localization	0.890	0.750;0.954	<0.01	0.362
Bilateral touch	1.000	1.000;1.000	<0.01	0.341
Proprioception	0.997	0.994;0.999	<0.01	0.334
One cent coin	1.000	1.000;1.000	<0.01	0.64
Ten cent coin	1.000	1.000;1.000	<0.01	0.64
One real coin	1.000	1.000;1.000	<0.01	0.64
Ballpoint pen	1.000	1.000;1.000	<0.01	0.509
Pencil	1.000	1.000;1.000	<0.01	0.575
Comb	1.000	1.000;1.000	<0.01	0.515
Scissors	0.976	0.941;0.990	<0.01	0.582
Sponge	1.000	1.000;1.000	<0.01	0.64
Face cloth	1.000	1.000;1.000	<0.01	0.599
Cup	1.000	1.000;1.000	<0.01	0.692
Glass	0.974	0.937;0.989	<0.01	0.638
Two-point disc. palm	0.953	0.889;0.981	<0.01	0.431
Two-point disc. fingertips	1.000	1.000;1.000	<0.01	0.616

n=21; ICC= intraclass correlation coefficient; disc=discrimination.

Table 3. Intra-rater reliability and intra-class correlation coefficients.

Item	ICC	Confidence interval (CI) 95%	p-values
Light touch	0.901	0.776;0.959	<0.01
Pressure	0.988	0.971;0.995	<0.01
Pinprick	0.907	0.786;0.961	<0.01
Temperature	-0.070	-0.479;0.363	<0.622
Tactile localization	0.863	0.693;0.942	<0.01
Bilateral touch	0.976	0.943;0.990	<0.01
Proprioception	0.933	0.843;0.972	<0.01
One cent coin	1.000	1.000;1.000	<0.01
Ten cent coin	0.977	0.943;0.990	<0.01
One real coin	1.000	1.000;1.000	<0.01
Ballpoint pen	0.909	0.790;0.962	<0.01
Pencil	0.974	0.937;0.989	<0.01
Comb	0.977	0.944;0.990	<0.01
Scissors	1.000	1.000;1.000	<0.01
Sponge	0.888	0.745;0.953	<0.01
Face cloth	1.000	1.000;1.000	<0.01
Cup	0.975	0.941;0.990	<0.01
Glass	0.949	0.874;0.979	<0.01
Two-point disc. palm	0.855	0.677;0.939	<0.01
Two-point disc. fingertips	1.000	1.000;1.000	<0.01

n=21; ICC= intraclass correlation coefficient; disc=discrimination.

was of 49.47 (±13.64), being one of them older than 60 years. The level of motor and sensory recovery corresponds to 54% and 67% of the maximal function, respectively, by the FMA protocol. Considering the scores from the nine body points form the NSA, the patients reached 91.3% of the score for tactile sensation, 71% of proprioception, 49.3% of stereognosis and 32% of two-point discrimination. There were not found tactile sensory disturbances in the body side contralateral to the hemiparesis.

None patient obtained maximal score in all the subscales from the NSA.

A ceiling effect of 66% was found for the subscale tactile sensation of the NSA, of 38% for the stereognosis of the NSA and of 28% for the subscale sensitivity of the FMA protocol; a floor effect of 42% for the subscale two-point discrimination of the NSA and absence of ceiling/floor effects for the subscale proprioception of the NSA.

There was found a correlation between the subscale sensitivity of the FMA and the total score of the NSA ($r=0.708$, $p<0.001$). There was not found a correlation between the subscales from the NSA and the motor subscale of the FMA protocol, as well as there was not found a correlation between the motor and sensory sections of the FMA protocol in this sample ($r=-0.035$, $p=0.882$). There was found a high internal consistency for the NSA (0.86). The correlation item-total was satisfactory in 16 items from the NSA (Table 2).

It was observed an excellent inter-rater coefficient of concordance for all the items of the NSA (Tables 2 and 3). There

was found a high intra-rater concordance (re-test) in the items of the NSA, except for the item temperature. Figure 2 shows the analysis Bland-Altman for inter-rater concordance and reveals a deviation of -0.33 and a confidence interval of [-1.89; 1.22]. Figure 3 shows the same analysis for concordance between the scores of the examiner 2 (intra-rater or re-test) and there was a deviation of -1.33 and a confidence interval of [-6.64; 3.97]. There was found a good inter and intra-rater concordance, since the majority of the measures pairs was inside the expected limit of concordance.

Discussion

In the present study, the Brazilian version of the NSA has shown a high internal consistence, concurrent validity and high inter and intra-raters concordance levels in all the scale's items, except for temperature in the intra-rater concordance. Lincoln, Jackson e Adams[20] developed the study of concordance of this instrument in 27 hemiparetic and found that the items light touch, pressure and the subscale proprioception have shown the best coefficients of concordance, whereas pinprick and temperature were the less reliable.

The assessment of the thermal sensation through the NSA was reported as unreliable by Lincoln, Jackson e Adams[20]. Thermal sensitivity is poorly explored by the instruments used to assess sensitivity in outpatient settings, possibly due to its lack of standardized resources to provoke hypothermia or hyperthermia. The temperature of the water was not defined by the authors of the NSA, which may affect the results from the examination. Besides this, the changes on environmental temperature may interfere on the thermal sensation of the patient; nevertheless, our patients were assessed in the same period of the day and in the same environment.

In 2006, Stolk-Hornsveld et al.[29] performed the second revision of the SNA – eliminating the item temperature, modifying the test of pain sensitivity and standardizing the tests of proprioception and discriminative touch – and submitted the new version to the test for reliability in 18 patients. The authors found high inter and intra-raters reliability coefficients and took away the subscale discriminative touch of the instrument due to its difficult reproduction. This difficulty was not observed in the present study.

The only measuring instrument available and validated to Brazil which measures the sensitivity of hemiparetic is the FMA protocol[21]. This instrument contains two subscales – extereoceptive and proprioceptive sensitivity. On the other hand, the NSA involves tactile sensations, proprioception, stereognosis. two-point discrimination, identification of the sensory deficits in the face, trunk, shoulders, elbows, hand, knees, ankles and the feet on both sides of the body which is a more complete instrument for the investigation of sensory deficits. The subscale of proprioception of the NSA evaluates movement performance, its direction and the joint positions (kinesthetic and joint aesthesis), and the FMA protocol, but on the other hand, evaluates only the number of locations of the final joint positions, in other words, the joint aesthesis.

Knowing that stereognosis is a key component in the recovery of the upper limb functions, Gaubert and Mockett[30] verified

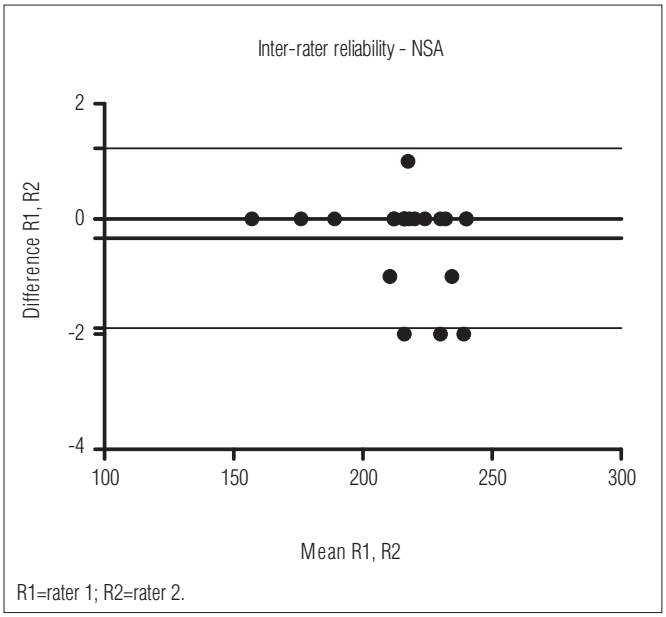

Figure 2. Bland-Altman analysis for inter-rater reliability (total score NSA).

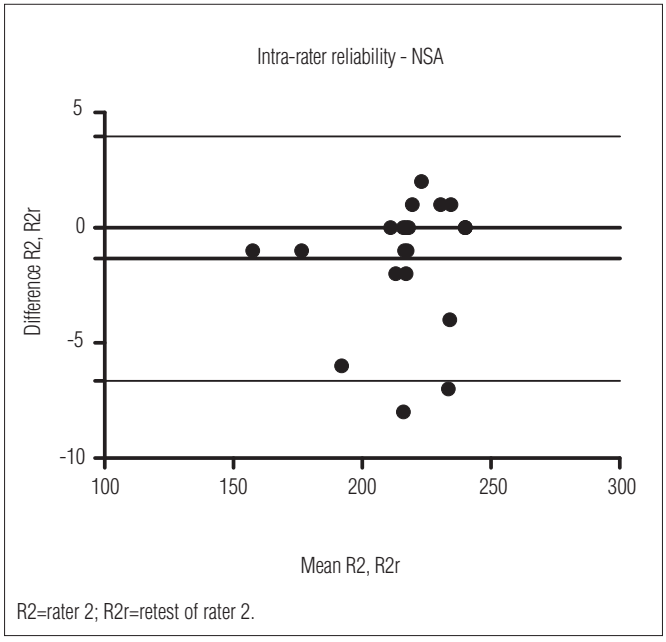

Figure 3. Bland-Altman analysis for intra-rater reliability (total score NSA).

the inter-rater reliability of the subscale of stereognosis of the NSA in 20 patients after CVD in the acute phase, and verified that the subscale had a moderate to high reliability and could be used as a measure for monitoring the evolution of the patients who suffered CVD,, thus reinforcing the present findings. However, there was found a difficulty to assess stereognosis in patients with distal spasticity and impaired hand grip, and it was necessary to position and to move the object in the paretic hand. Some patients confounded the coins' sizes, especially between the R$ 0,01 e 0,10, as well as named the cloth of the towel.

Although the stereognosis subscale allowed the reference of items similar to those tested, for example, a cloth may be identified as a silk or a face towel, Gaubert and Mockett[30] reported that this confusion should be assessed by the inclusion of an intermediate score on this subscale with a level of score two,. This should be chosen when the patient indicated the names of objects with the characteristics similar to the object being evaluated and the score of three would be designated to its normal function.

The light touch and proprioception are the sensory modalities most commonly tested by therapists[31]. Connell, Lincoln and Radford[32] reported that stereognosis and the proprioception are mostly impaired than the tactile sensations in the hemiparetic patients evaluated through the SNA. Their data was confirmed by the present findings, however, the most important deficits occurred in the two-point discrimination. The authors found that 17% of patients with sensory disturbances were on the side of the body corresponding to the side of the brain injury, however, there were not found sensitive alterations on this side of the body in the present study.

For the assessment of tactile locations, it is necessary to use the contralateral limb to indicate the points of stimuli of the sensory test. In case of patients with significant spasticity or paresis of upper limb, they were evaluated with the score of five and, when the patient had aphasia or disarticulate speech, the score of seven was given. The NSA does not offer alternative strategies, such as verbal indications of the examined segments, in the case of motor impairments, which affect the tactile locations.

The ceiling effects found on the subscales of tactile sensitivity and stereognosis and the floor effect of the subscale of the two-point discriminations, seem to be limiting factors for the use of the instrument. However, there was also found a ceiling effect for the subscale sensitivity of the FMA protocol, as already documented in a previous study[18]. The significant ceiling effect of the NSA subscales may have happened due to the fact that the sample was composed by chronic hemiparetics with mainly motor deficits, which did not allow the confirmation of the NSA limitations in discriminating deficits of these patients.

Among the limitations of this study, it was also observed the absence of assessment of vibratory sensitivity, the small amount of patients and the difficulty to measure the sensory deficits in patients with severe disturbances of speech, language or cognitions. This sample, with only one patient over 60 years old, reduced the possibility of the interference of the signs aging, such as the deterioration of the vibratory, tactile and pain sensitivity and the reduction of the velocity of conduction from the peripheral nerves[33], which could interfere in the results from the instrument.

The NSA were affected by adaptations concerning the material used, since only Real coins were used and a single test tube with cold water to assess their thermal sensitivity. The NSA was administered by the examiners in approximately 20 mins., which showed its efficiency for the assessment of sensory disturbances of hemiparetic subjects. The length of application of the FMA protocol was of 20 mins. In addition to the provision of a determined pattern to identify their deficits, the SNA was an inexpensive and easy application procedure. The low cost of the material requested by the SNA favored its use in outpatient clinics for neurological rehabilitation. It is suggested to perform the reliability examination with a greater sample of hemiparetic subjects in the acute and sub-acute phases after the CVD, to establish the validity and temporal stability of its subscales.

The use of validated and reliable measurement instruments is extremely relevant for clinical practice, since it allows the definition of the sensory profiles and the creation of protocols of sensory rehabilitation during different stages of recovery after the CVD.

Conclusions

The Brazilian version of the *Nottingham Sensory Assessment* has shown excellent intra- and inter-rater coefficients of concordance for all the items, except for the item of temperature. There was also found a high level of internal consistency and confirmed the concurrent validity of the instrument. The NSA is an instrument that is rapid and easy to administer, and it can be used in clinical practice for services of neurological rehabilitation, to assess the tactile sensations, proprioception, stereognosis and two-point discrimination in hemiparetic subjects after CVD. The significant ceiling effects of the NSA does not limit its use, considering that, for the same patients, the FMA protocol has also revealed ceiling effects. The SNA and its application manual are available by e-mail: nubia@fcm.unicamp.br.

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Appendix 1

Avaliação sensorial de Nottingham (Lincoln et al.[19])

Nome: _____ Data do AVE: _____/_____/_____

Idade:_____ Tel(s): (____) _____ Tipo do AVE (H/I): _____

Examinador: _____ Data da avaliação: ____/____/____

Lado do corpo afetado: ( ) Direito ( ) Esquerdo ( ) Nenhum ( ) Ambos — Se AMBOS, lado avaliado: _____

Presença de edema: ( ) Sim ( ) Não — Se sim, onde? _____

Sensação Tátil												
Regiões do corpo	Toque leve		Pressão		Picada		Temperatura		Localização tátil		Toque bilateral simultâneo	Propriocepção
	D	E	D	E	D	E	D	E	D	E		
Face												
Tronco												
Ombro												
Cotovelo												
Punho												
Mão												
Quadril												
Joelho												
Tornozelo												
Pé												

Estereognosia

	Moeda de R$ 0,01		Caneta esferográfica			Pente		Esponja		Xícara
	Moeda de R$ 0,10		Lápis			Tesoura		Flanela		Copo
	Moeda de R$ 1									

Discriminação entre dois pontos

	mm	Pontuação
Palma da mão		

	mm	Pontuação
Pontas dos dedos		

Pontuação

Sensação Tátil e Estereognosia	Propriocepção	Discriminação entre 2 pontos
0: Ausente	0: Ausente	0: Ausente
1: Alterado	1: Execução do movimento (direção errada)	1: >3mm dedos e >8 mm mão
2: Normal	2: Direção do movimento (>10°)	2: <3mm dedos e <8 mm mão
4 a 9: Não testável	3: Normal ou posição articular <10°	4 a 9: Não testável
	4 a 9: Não testável	

Comentários: (por exemplo: edema ou palidez presente, meias de compressão, presença de reflexos).