Original Article

A limitation on the use of Integrated Proprioception Screening Scale: a feasibility cross-sectional survey study

Limitações à utilização da escala integrada de rastreio da propriocepção: estudo de viabilidade de um inquérito transversal

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ABSTRACT | INTRODUCTION: Proprioception is essential during the movement implementation to update the feedforward commands resulting from the visual image and in planning and amendment of internally generated motor commands. The integrated proprioception screening scale (IPSS) assesses proprioception in different domains in people with Parkinson's disease. **OBJECTIVES:** To determine the limitations of IPSS faced by Neuro-physiotherapists and geriatric volunteers in clinical settings. **MATERIALS AND METHODS:** Ten Neuro-physiotherapists and thirty geriatric volunteers under each therapist were recruited for this feasibility cross-sectional survey study. Participants were selected according to the inclusion criteria. Questionnaires were designed and created to evaluate difficulties faced by therapists and geriatric volunteers in terms of time taken for the administration of the scale, level of understanding of the scale and its sublevels, and physical exertion experienced by both therapists and geriatric volunteers. The therapist administered IPSS. Universal Goniometer, measuring tape, and motion tracking device were used during the IPSS administration. After administration, Questionnaires were circulated and filled by Neuro-physiotherapists and geriatric volunteers. Shapiro-Wilk test was used for testing the normality, as data was less than 50. **RESULTS:** As the data follows not a normal distribution, data was expressed in median and range. Skewness and Kurtosis were also measured. Variables were expressed in the form of pie charts. **CONCLUSION:** The study concluded that IPSS has several limitations as subjectively reported by the therapists and volunteers.

KEYWORDS: Geriatric. Proprioception. Survey.

RESUMO | INTRODUÇÃO: A propriocepção é essencial durante a implementação do movimento para atualizar os comandos de alimentação adiante resultantes da imagem visual e no planejamento e alteração de comandos motores gerados internamente. A escala integrada de rastreio da propriocepção (IPSS) avalia a propriocepção em vários domínios diferentes em pessoas com doença de Parkinson. **OBJETIVOS:** Determinar as limitações da IPSS enfrentadas por fisioterapeuta neurológico e voluntários geriátricos em ambientes clínicos. **MATERIAIS E MÉTODOS:** Dez Neuro-fisioterapeutas e trinta voluntários geriátricos de cada terapeuta foram recrutados para este estudo de viabilidade de pesquisa transversal. Os participantes foram selecionados de acordo com os critérios de inclusão. Os questionários foram projetados e criados para avaliar as dificuldades enfrentadas pelos terapeutas e voluntários geriátricos em termos de tempo necessário para a administração da escala, do nível de compreensão da escala e seus subníveis, e o esforço físico experimentado pelo terapeuta e voluntários geriátricos. A IPSS foi administrada pelo terapeuta. Goniômetro Universal, fita métrica e dispositivo de rastreamento de movimento foram usados durante a administração da IPSS. Após a administração, os questionários foram distribuídos e preenchidos por Neuro-fisioterapeutas e voluntários geriátricos. O teste Shapiro-Wilk foi usado para testar a normalidade, pois os dados eram inferiores a 50. **RESULTADOS:** Os dados foram expressos em mediana e intervalo. Skewness e Kurtosis também foram medidos. As variáveis foram expressas na forma de gráficos circulares. **CONCLUSÃO:** O estudo concluiu que o IPSS tem várias limitações como subjetivamente relatado pelos terapeutas e voluntários.

PALAVRAS-CHAVE: Geriátrico. Propriocepção. Inquérito.

Submitted 01/31/2021, Accepted 04/20/21, Published 05/12/2021
J. Physiother. Res., Salvador, 2021 May;11(2):320-327
http://dx.doi.org/10.17267/2238-2704rpf.v11i2.3616 | ISSN: 2238-2704
Designated editors: George Dias, Katia Sá

How to cite this article: Dangi P, Arumugam N, Midha D. A limitation on the use of Integrated Proprioception Screening Scale: a feasibility cross-sectional survey study. J Physiother Res. 2021;11(2):320-327. http://dx.doi.org/10.17267/2238-2704rpf.v11i2.3616

Introduction

Aging leads to the alteration in various body functions such as sensory, motor, psychosocial, and cognitive.[1] Aging causes a decline in proprioceptive functions necessary for normal body functioning during movements and maintaining balance. Alteration and decrease in body and limb position sensitivity during aging cause mobility limitation, leading to increased risk of falls.[2] Proprioception is essential during the movement implementation to update the feedforward commands resulting from the visual image and in planning and amendment of internally generated motor commands.[2] Disturbances of proprioception or position sense may have detrimental functional implications resulting in poorly controlled body posture and movement.[1] Balance system allows humans to identify the position, determine direction and speed of movement and make subconscious postural adjustments to maintain posture and stability.[3] Balance problems and falls are common among the geriatric population. Balance disorder is a multifactorial condition such as weakness in the core stabilizing muscles, altered muscle activation patterns, loss of proprioception, and an inability to control normal postural sway.[3] Age-related proprioceptive deficits had been associated with loss of static postural stability and falling, and further can leads to a decrease in the activity of daily living and functional ability.[1]

Proprioceptive assessment is one of the essential vital elements and must be included in the balance examination among the geriatric population.[4] And common assessment tools available to assess the balance are Tinetti Balance and Gait Test, Berg Balance Scale, Timed Up and Go Test, One-leg stance test, functional reach test used for functional assessment.[3] Common test used for assessing proprioception among the geriatric population is Fugl-Meyer Assessment (FMA), Nottingham Sensory Assessment Revised (NSA-R), Rivermead Assessment of Somatosensory Performance (RASP), The Sensory Integration and Praxis Tests (SIPT), The Thumb Localization Test (TLT) for clinical assessment and the Kincom Dynamometer, the Kinesthesiometer test, the Kinesthetic Acuity test (KAT) and Wrist Position Sense Test (WPST) used for quantitative assessment.[3,5,6]

Integrated Proprioception Screening Scale (IPSS) was designed and developed[7] to cover all the aspects/ domains of proprioception. IPSS is used to assess proprioceptive deficits among normal healthy individuals and as well as in patients with Parkinson's disease.[7] IPSS has 11 domains, and it is a four-point Scale. The existing Integrated Proprioceptive Screening Scale (IPSS) had various limitations, as mentioned in previous studies, limiting the practical application of the scale by the therapist in their clinical settings on patients to a greater extent.[7] As evidenced in previous literature, the applicability of IPSS is associated with many limitations like increased length, more time consuming, and difficulty in carrying instrument used in IPSS, since no work has been done on limitations. Hence, there is a strong need to find out these limitations and difficulties faced by both therapists and geriatric volunteers in applying IPSS.

Methodology

Ethical statement and study settings

This descriptive cross-sectional survey was approved by Institutional Ethical Committee (IEC), Punjabi University, Patiala (Ref. No-62, dated-23/05/2017). Written consent was obtained from both neuro-physiotherapist and geriatric volunteers before the study procedure. The study was conducted at the Department of Physiotherapy, AIIMS, Delhi, BLK hospital, Delhi, CMC, Ludhiana, OPD II- Punjabi University, Gyani Lal Memorial Hospital, and HKM Patiala, Mohali, MMIPR, Mullana. The study followed the principles laid by the Declaration of Helsinki (Revised 2013), Council for International Organizations of Medical Sciences (CIOMS) guidelines, and International Ethical Guidelines for Health-related Research Involving Humans (2016).

Sample and design

A descriptive cross-sectional survey was adopted as a study design for this study. Ten neuro-physiotherapists and a total of 30 geriatric volunteers (3 each) of age ≥60 years were recruited under each neuro-physiotherapist via convenient sampling for the study. The board selected ten physiotherapists for the present study of

external experts, panelists, and supervisors. Therapists having specialization in neurological physiotherapy were included in the study.

Inclusion and exclusion criteria

Geriatric volunteers of Age group ≥ 60 years, both males and females who are willing to participate, were included in the study. Individuals with any musculoskeletal injury history, neurological disease, or systemic illness were excluded from the study.

Survey development

Questionnaires were developed using Google forms for both therapists and volunteers for assessing time taken for scale administration, understanding level, and physical exertion experienced by both therapists and geriatric volunteers. Domains considered for the questionnaire development were time, physical exertion, instruments, and understanding level of both therapist & geriatric volunteers.

Study procedure

Subjects were selected based on selection criteria. Each neuro-physiotherapist was directed to collect the data from three volunteers. IPSS was explained to the therapist by the researcher in a research lab, and training was also provided before administering the scale in geriatric volunteers. Based on this, questionnaires were filled by both therapists and volunteers right after the application of the IPSS. Each neuro-physiotherapist was directed to rate the performance of the tasks from 0-10, where a score <5 indicates: maximum level of difficulty or poor performance, and a score >5 indicate: no difficulty in performing the tasks or good performance. Materials used for the application of IPSS were a Universal goniometer, motion tracking device, measuring tape, and stationery. The neuro-physiotherapists applied IPSS on three volunteers each. Difficulties faced during the application of IPSS were pointed out through questionnaires by the therapists and volunteers also.

Statistical analysis

Statistics were performed by using the SPSS version 16. The normality of collected data was analyzed using Shapiro- Wilk test. The result was calculated by mean with 95% confidence interval and median/ range. Using statistical formula for the mean, for the given number of tasks, mean of different variables were calculated by: Mean ($\overline{X}$).

Using the statistical formula for the Mean, for a given number of subjects, the Mean of different variables was calculated by:

$$\overline{X} = \frac{\sum X}{N}$$

Results

A total of 10 neuro-physiotherapists and 30 geriatric volunteers (3) under each neuro-physiotherapist were recruited for the study. As the study is a feasibility study, the sample size is appropriate for the study. As the data does not follow a normal distribution, descriptive statistics were expressed in Median & Range/ Mean with a 95% confidence interval. Skewness and Kurtosis values were also added to them. Table 1 represents the mean difference and 95% Confidence interval of the responses collected from the therapists on the given parameters. Table 2 represents the median and range of the responses gathered from the therapists on the given parameters. Table 3 represents the median and range of the responses gathered from the geriatric volunteers on the given parameters. Table 4 represents the mean difference and 95% Confidence interval of the responses collected from the geriatric volunteers on the given parameters. Figure 1 depicts the total time duration required by the therapists for the administration of the scale. Figure 2 depicts the difficulty levels faced on each sublevel of IPSS by the therapists. Figure 3 depicts the difficulty level faced on each sublevel of IPSS by the geriatric volunteers. As required by the therapists, 70% gave the score <5. IPSS involved more tasks which should be performed at multiple joint in multiple planes, and this requires more than 45 minutes in Completion of IPSS.

95% of therapists completed IPSS in more than 45 minutes, and only 3% of the therapists completed IPSS within 30-45 minutes.

Table 1. Mean value with 95% confidence interval

	Mean difference	95% confidence interval	
		Lower limit	Upper limit
Time calculation for task	2.86667	2.4202	3.3132
Physical exertion	1.86667	1.5607	2.1726
Understanding the words	2.10000	1.8732	2.3268
Level of performance	2.06667	1.7736	2.3598
Understanding to instruction give	2.26667	2.0278	2.5055
Volunteer Behavior	2.13333	1.8789	2.3878
Transportation Motion tracking system	2.86667	1.7155	2.1511
Application of MTS	2.36667	2.1370	2.5963
Space utilization by MTS	1.80000	1.5943	2.0057

Abbreviations: Motion tracking system (MTS); Integrated Proprioceptive Screening Scale (IPSS)

Table 2. Median and Range value for the therapist

	Median (Range)	Skewness	Kurtosis
Time calculation for Task	2.0 (1-6)	0.53	-0.29
Physical exertion	2.0 (1-3)	0.26	-1.46
Understanding the words used	2.0 (1-3)	-0.04	-0.08
Level of Performing Task	2.0 (1-4)	-0.12	1.35
Understanding the instructions given	2.0 (1-3)	-0.29	-0.55
Volunteer behavior	2.0 (1-4)	-0.53	1.02
Transportation of MTS	2.0 (1-3)	-0.003	0.23
Use and Application of MTS	2.0 (1-3)	-0.40	-0.57
Space Utilization	2.0 (1-3)	-0.11	0.09

Abbreviations: Motion tracking system (MTS); Integrated Proprioceptive Screening Scale (IPSS)

Table 3. Median and Range values for the volunteer

	Median (Range)	Skewness	Kurtosis
Comprehension	2.5 (1-4)	0.12	-0.23
Level of Difficulty	2.0 (1-3)	-0.17	-0.71
Importance of IPSS	2.0 (1-3)	0.29	-0.55
Performance	2.0 (1-4)	0.14	0.06
Understanding of Instrument	2.0 (1-4)	0.53	0.14
Description of Item	2.0 (1-3)	0.38	-0.61
Cooperation with therapist	3.0 (1-4)	-0.16	-0.43
Accomplishing the Task	2.0 (1-4)	0.24	-0.21
Level of Difficulty in Task	2.0 (1-2)	-0.92	-1.24
Confidence level	3.0 (1-4)	-0.56	0.86

Abbreviations: Integrated Proprioceptive Screening Scale (IPSS)

Table 4. Mean values with 95% confidence interval for volunteer

	Mean difference	95% confidence interval	
		Lower limit	Upper limit
Comprehension	2.53333	2.2435	2.8231
Level of difficulty	2.13333	1.8789	2.3878
Importance of IPSS	1.73333	1.4945	1.9722
Performance	2.30000	2.0378	2.5622
Understanding the instrument	2.10000	1.7845	2.4155
Description	1.70000	1.4568	1.9432
Cooperation with therapist	2.60000	2.2807	2.9193
Accomplishing the task	2.50000	2.2099	2.7901
Level of Difficulty in Task	1.70000	1.5260	1.8740
Confidence level	2.73333	2.4945	2.9722

Abbreviations: Integrated Proprioceptive Screening Scale (IPSS)

Categorical variables were described in the form of Pie chart. The quantitative variables measured on a 0-10 scale have been displayed using Pie chart.

Figure 1. Total time taken by the therapists in completion of IPSS

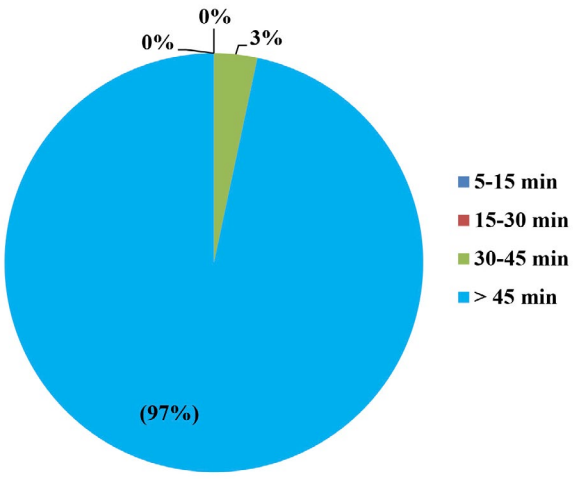


Figure 2. Difficulty level of subscales of IPSS on the parameters of Physical exertion/ consumption of time to accomplish the tasks faced by therapists

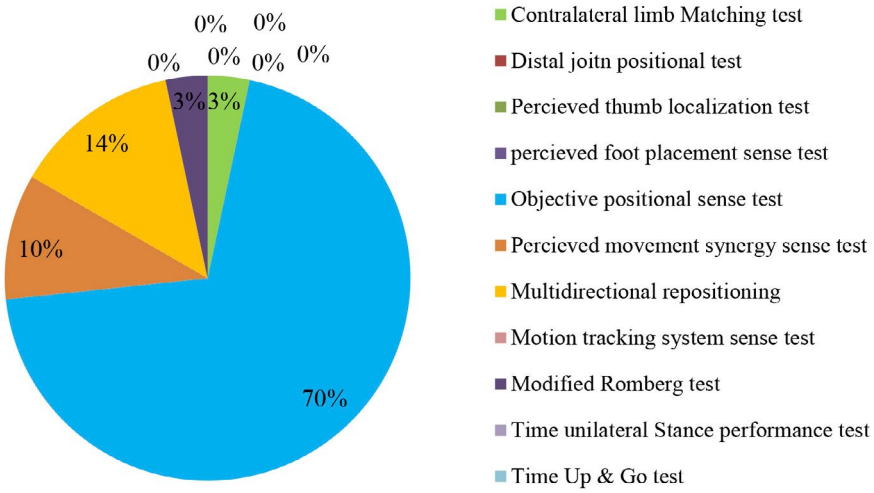
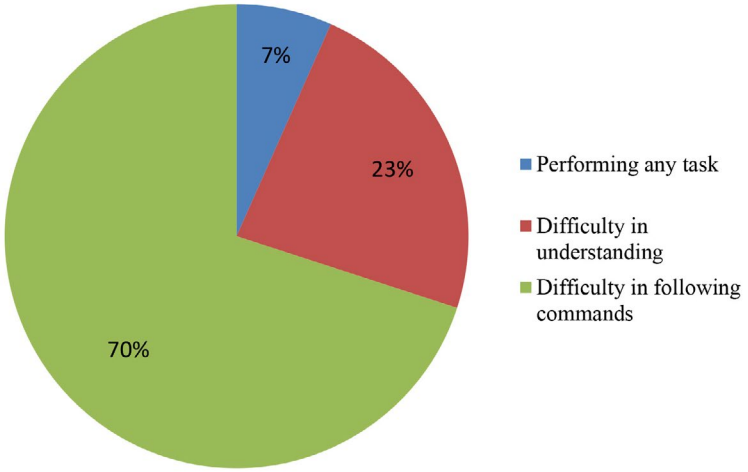


Figure 3. Level of Difficulty in performing IPSS by volunteers



Discussion

Proprioception is the awareness of the body position, orientation, movement, and sensation of force.[8] Loss of proprioception leads to a decrease in balance which increases the risk of fall. It has a major influence on daily activities and rehabilitation outcome.[8] People with both sensory and motor loss show a worse prognosis than a person with motor loss only.[9] Present study focused on finding out the various clinical limitations associated with the implication of IPSS by various neuro-physiotherapists on the elderly population. In the present study, ten neuro-physiotherapists were targeted. Each neuro-physiotherapist, in turn, performed IPSS in 3 volunteers. Then, the data from each neuro-physiotherapist was subjectively collected and analyzed by the researcher, thus justifying the descriptive nature of the study. The data were compiled by the researchers and described in the form of pie charts.

Difficulties faced by the therapists in the application of IPSS

The present study was conducted in North India, specifically in the region of Punjab. Despite the use of the preferred mode of communication, a significant number of therapists reported difficulty in understanding the language and instruction of IPSS. Analysis of data also revealed unfavorable behavior of patients towards the therapists. Increased time consumption with more physical exertion was the prominent factor associated with the application of IPSS as described by the therapist in shown figure 2. Out of all subscales, 70% of therapists reported that the objective positional sense test was most difficult out of all 11 subscales, followed by 14%, 10%, 3% of therapists that reported to be the multidirectional repositioning task, perceived movement synergy sense test, contra-lateral limb matching test and perceived foot placement sense test. These tasks are lengthy and require a frequent change in the position for activities since these tasks require repetitive instructions and persistent attention of both therapists and patients.

Motion Tracking System is used in Motion Tracking system sense test to measure the subject's hand in space. The size of the instrument is a 60x60cm wooden miniature table of height 20cm, which is difficult to carry anywhere. Regarding the usage and application of IPSS, the therapist reported a score of 3, indicating moderate difficulty faced by the therapists. Statistically, the analysis also revealed that more physical exertion was a prominent factor in all the subscales responsible for the consumption of more time in completion of the scale. The present study results are also supported by the study conducted by Debnath et al.[7], Stating that IPSS requires more time to administer.

Difficulties faced by volunteers in performing IPSS

Along with the therapists, the volunteers also reported many difficulties during the performance of various subtests of the IPSS. The therapists were not able to give their commands properly, so the patient could not understand the instructions given, which further led to a decrease in the patient's level of trust in the therapist. When the IPSS was explained, the patients were not interested in participating because they would have more tasks that required more time to perform. The subjective analysis also revealed difficulty in comprehensibility regarding use, application, and performing activities with the Motion Tracking System. The volunteer was not familiar with the instrument and its use and application was new for the patient.

Volunteers out of 30 each reported a score of 2, which indicates a very poor involvement. Volunteers reported a score of 3 indicating poor participation, and the remaining scored 1, indicating that volunteers did not cooperate with therapists due to more time needed to perform and the loss of volunteers' interest during the process, because he/she could not understand the commands. Despite the use of common language for commands, volunteers could not perform the IPSS tasks, due to which they withdrew in the middle of the process. 70% of volunteers faced difficulty following commands, and the remaining had difficulty understanding and performing the task; despite this, 80% of volunteers did not refuse, and 17% of volunteers refuse to continue due to more time consumption and physical exertion.

Limitations and future recommendations

The small sample size is the limitation of the study. Conducting the study involving a large sample size and recruiting other volunteers with neurological disorders can be further recommended.

Conclusion

The present study concluded that IPSS is very time-consuming, difficult to administer, and causes more physical exertion to both therapists and geriatric volunteers during the administration.

Author contributions

Dangi P contributed to the manuscript preparation and review. Arumugam A structured the concepts, design, and manuscript review. Midha D participated in the conception, design, statistical analysis of the research data, and interpretation of results.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

References

1. Ribeiro F, Oliveira J. Aging effects on joint proprioception : the role of physical activity in proprioception preservation. Eur Rev Aging Phys Act. 2007;4:71–6. https://doi.org/10.1007/s11556-007-0026-x

2. Nnodim JO, Yung RL. Balance and its Clinical Assessment in Older Adults - A Review. J Geriatr Med Gerontol. 2015;1(1):003. https://doi.org/10.23937/2469-5858/1510003

3. Drummond A, Paz CCS, Menezes RL. Proprioceptive activities to postural balance of the elderly - systematic review. Fisioter. mov. 2018;31:e003135. https://doi.org/10.1590/1980-5918.031.ao35

4. Han J, Waddington G, Adams R, Anson J, Liu Y. Assessing proprioception: A critical review of methods. J Sport Health Sci. 2016;5(1):80-90. http://dx.doi.org/10.1016/j.jshs.2014.10.004

5. Wiesmeier IK, Dalin D, Maurer C. Elderly Use Proprioception Rather than Visual and Vestibular Cues for Postural Motor Control. Front Aging Neurosci. 2015;7:97. https://doi.org/10.3389/fnagi.2015.00097

6. Ferlinc A, Fabiani E, Velnar T, Gradisnik L. The Importance and Role of Proprioception in the Elderly: a Short Review. Mater Sociomed. 2019;31(3):219-21. https://doi.org/10.5455/msm.2019.31.219-221

7. Debnath U, Narkeesh A, Raghumahanti R. Formulation of Integrated Proprioceptive Screening Scale and Testing of its Sensitivity, Reliability and Validity. JESP [Internet]. 2010;6(2):78-87. Available from: https://www.researchgate.net/profile/Raghumahanti-Raghuveer/publication/326827102_integrated_proprioceptive_screening_scale_and_testing_its_reliability_and_validity/links/5e6b5e72458515e55576655e/integrated-proprioceptive-screening-scale-and-testing-its-reliability-and-validity.pdf

8. Squeri V, Zenzeri J, Morasso P, Basteris A. Integrating proprioceptive assessment with proprioceptive training of stroke patients. IEEE Int Conf Rehabil Robot. 2011;2011:5975500. https://doi.org/10.1109/icorr.2011.5975500

9. Aman JE, Elangovan N, Yeh IL, Konczak J. The effectiveness of proprioceptive training for improving motor function: a systematic review. Front Hum Neurosci. 2015;8:1075. https://dx.doi.org/10.3389%2Ffnhum.2014.01075