

Reliability of Short Gravitational Insecurity (SGI) Assessment among Indian children

Dr. U. Ganapathy Sankar¹, Dr. A. Prema²

¹Assistant Professor, SRM College of Occupational Therapy, SRM University, Kattankulathur, Tamilnadu, INDIA.

²Professor & Head of the Department, Department of Paediatrics, SRM Medical College Hospital & Research Center, SRM University, Kattankulathur, Tamilnadu, INDIA.

Abstract: The purpose of this study was to examine reliability of Short Gravitational Insecurity (SGI) assessment among Indian Children. Short Gravitational Insecurity assessment consists of 5 items with two behavioural categories. Interrater reliability and test-retest reliability of SGI was examined. Fifty Gravitational Insecurity children participated in the study. Two raters were trained to administer the SGI Assessment by the first author, using demonstration and verbal instruction. Fifty gravitational insecurity children were tested by two raters for interrater reliability. The primary rater re-administered the SGI Assessment to the same 50 gravitationally insecure children after 2 weeks interval to establish test-retest reliability. ICC was used to analyze the interrater reliability and test-retest reliability. The results were 0.90, $p < 0.001$ for Emotional Response; 0.93, $p < 0.001$ for Postural Response; 0.96, $p < 0.001$ for Total Score indicating acceptable level of reliability for emotional response, postural response and total score of the SGI assessment. The results were 0.95 for Emotional Response, 0.90 for Postural Response and 0.97 for Total Score indicating good test-retest reliability. Hence, it provides supportive evidence to the stability of SGI assessment over different period of intervals. The result of this study was concluded that SGI assessment has excellent interrater and test-retest reliability. It can be used as assessment tool as well as outcome measure to evaluate effectiveness of occupational therapy intervention program.

Key words: Gravitational Insecurity, SGI assessment, reliability, interrater reliability, test-retest reliability

I. Introduction

Children typically spend much of their time developing their relationship to gravity. First infants lift up their head and find out that gravity makes it heavy. With each new movement, they learn what gravity can do and what they can do. They learn that the pull of gravity, never, ever changes its direction or strength. They discover that there is nothing on this planet that can avoid gravity but that by adapting to gravity they can stand up, climb a tree, or throw a ball in the air. Gravitational security is so vital to emotional health that nature has given us a strong inner drive to explore gravity and master it. Because this inner drive is so strong, a child will intuitively do whatever is necessary to develop his/her vestibular system [1]. Mothers have always used rocking to calm a distressed baby. The cradle is our symbol for the peace and serenity of infancy. Both young and old find that rocking chairs and swings reduce anxiety and emotional upset [2]. Children have playground equipment and amusement park rides, because swinging, sliding, climbing and riding a see-saw or merry-ground or roller coaster provide so much vestibular stimulation.

Skiing, flying, high diving, and fast driving are emotionally gratifying for quite a few adolescents and adults, and just about everyone enjoys some type of body movements. Long periods of rocking are common among children who have been institutionalized, such as those in orphanages, and also in monkeys who have been deprived of their mothers. Many children in therapy using a sensory integrative approach ride on a piece of equipment for long periods of time, indicating that they have a great need for vestibular input. Because gravitational security is so essential to our nature, we take it for granted. Therefore, when something goes wrong in the neural functions that relate us to gravity, most people attribute the resulting problem to some other cause. A psychologist traces an emotional problem back to conflicts in childhood, but sometimes the problem can be traced even further back to poor processing of vestibular sensation during fetal life and infancy.

If the child's relationship to the earth is not secure, then all other relationships fail to develop optimally. Even the most loving mother cannot "reach" her child if the earth is not a safe place for him to be. Children with vestibular disorder seem to be missing something vital, as though they were "lost in space". Sometimes they cannot follow their inner drive because they are so afraid of what might happen to them. Therefore the child misses many of the sensorimotor experiences [3] that are needed as building blocks for mature emotions and behavior. Gravitational insecurity has been hypothesized to be due to poor modulation of otolithic input. It's a distinct disorder that may occur in individuals with normal postural ocular responses. Fisher & Bundy [4] conceptualized that GI is characterized by decreased vestibulocerebellar functioning (primarily difficulty in processing information from the utricles and saccules of the vestibular system). This

possibly decreases vestibularocular integration, resulting in high arousal and apparently irrational limbic system based fear responses to sudden or disorienting movement experiences.

Occupational therapy treatment of gravitational insecurity centers on activities that provide opportunities for children to take in controlled linear vestibular and proprioceptive information [5]. The child's active participation in occupational therapy treatment activities is important for the development of body scheme; when the activity also provides resistance to the child's movements, the resulting proprioceptive intake is heightened. Occupational therapist controls the amount of vestibular-proprioreceptive information taken in by children. Children who are afraid of moving, of having their heads out of the upright position, often perceive very small movements to be much larger than they actually are. Further, although we may think that a swing is moving in a straight line, children who are gravitationally insecure may perceive even an almost imperceptible arc as "going around in circles". Children who are gravitationally insecure need a lot of support and encouragement from occupational therapist. Occupational therapists have found two strategies that have been particularly helpful for developing the trust of clients who are gravitationally insecure. First, the children should always be in control of the amount and type of movement that occurs during an activity. Initially, activities should allow the children to keep his or her feet near the ground so as to be able to stop the activity immediately if he or she so desires. Secondly, children who are gravitational insecure seem especially to fear movements into backward because they cannot see where they are going. Initially, stacking cardboard is used to reduce backward movement and the backward movement distance can be increased gradually as he or she becomes less fearful[6]

Need for the study:

Gravitational insecurity was commonly seen in children with Autism, Attention Deficit Disorder, Learning disability. Gravitational insecurity was identified by informal assessment, clinical observation and parent or caregiver questionnaire. Lee [7] developed first attitude scale to measure Gravitational Insecurity in children. May-benson & Koomar [8] developed objective measurement tool to identify children with Gravitational Insecurity. This Gravitational Insecurity assessment was standardised [9] among Indian children in 2013. The results of this study concluded that 5 items with two behavioural categories was sufficient to discriminate GI children from typically developing children. This GI assessment is called Short Gravitational Assessment (SGI). Reliability and validity is important for assessment tool, research tool and outcome measure. But reliability and validity was not examined for SGI assessment. Hence the present study was carried out to examine reliability of Short Gravitational insecurity assessment among Indian children.

II. Methodology

Ethical clearance was obtained from SRM University Research Ethical committee to carry out this research work.

Research design: quantitative research-cross sectional study.

Participants:

Gravitational Insecurity children was selected randomly from various therapy centre and special schools in Chennai, Tamil nadu, India based on screening criteria.

Screening criteria:

Inclusion Criteria:

(i) Gravitational Insecurity children : Children were identified by investigator in selected special school and therapy centre based on their behaviour during the occupational therapy intervention sessions mainly demonstrating fearful response in any two of the following behavioural characteristics of Gravitational Insecurity:(1)Movement on an unstable surface;(2)Unexpected of quick movement by another person;(3)Change of head position;(4)Change of head position with feet moved off a stable surface;(5)Static position or movement on a high surface;(6)Disorienting to lack of visual input.In addition, the following criteria were included, Age group of 5- 10 yrs;Both genders. Children with physical handicap and children with comprehension problem were excluded from the study.

Instruments used:

Short Gravitational Insecurity (SGI) assessment

Short Gravitational Insecurity Assessment(SGI):

Short Gravitational Insecurity Assessment (SGI) was developed from original version of GI assessment in 2013. It is an individually administering test [9]. It consists of 5 items with two behavioural categories. The administration time is about 10-15 minutes. Intra-class correlation coefficient for GI assessment (revised

version) was 0.959[7] and it has acceptable level of interrater reliability (ICC=0.89, 0.92, 0.94 for ER, PR and total test score) and test-retest reliability (ICC=0.93, 0.86, 0.94 for ER, PR and total test score). Internal consistency ($\alpha=0.96$) and split - half reliability ($r=0.68$) of GI assessment items were good. Convergent validity, development trends for GI assessment –revised version[10] has been reported. Reliability and validity was not established for SGI.

Equipment’s Used:

SGI assessment, Scoring sheets, Pencil, Floor mat, Meter / yard stick, Standard therapy ball, Standard adult chair, Tilt board, Masking tape.

Scoring Procedure:

The scoring system is a 3 point scoring system with 2 behavioral categories. The behavioral categories are Emotional response and Postural response. The point scoring is 3 - Typical response; 2 - Moderate / Mild GI; 1 - Definite GI

Data collection procedure:

The purpose of the study was explained to the appropriate authorities of the special schools and therapy centres involved and informed consent form was obtained from parents. Pediatric occupational therapist with 5 years’ experience was requested to identify GI children in their centre based on behavioural characteristic of GI children. Further it was confirmed by investigator. Testing was conducted at seven therapy centres and three special schools in Chennai by investigator. The SGI assessment was conducted in the standardized format according to the protocol developed for the SGI Assessment in distraction free environment with good ventilation. The directions were given for each task and children were requested to complete the tasks two times. Average score was taken for final computation. The room was covered by “plinth” in order to avoid injury during GI assessment task like supine on therapy ball-active, Supine ball-passive and forward roll etc.

Two raters were trained to administer the SGI Assessment by the first author using demonstration and verbal instruction. Fifty gravitational insecurity children were tested by two raters for interrater reliability. The primary rater re-administered the SGI Assessment to the same 50 gravitationally insecure children after 2 weeks interval to establish test- retest reliability.

III. Results

Table 1. Interrater Reliability of the SGI Assessment

Components	Intraclass Correlation Coefficient (ICC)
Emotional response	0.90
Postural response	0.93
Total score	0.96

The results showed that there is high correlation in Emotional response, Postural response, and Total score of SGI assessment indicating a good interrater reliability.

Table 2. Test - Retest reliability of the SGI Assessment

Components	Intraclass Correlation Coefficient (ICC)
Emotional response	0.95
Postural response	0.90
Total score	0.97

The results showed that there is high correlation in Emotional response, Postural response, and Total score of SGI assessment (ICC=0.95, $p<0.001$; ICC=0.90, $p<0.001$; ICC= 0.97, $p<0.001$ respectively) indicating a good test- retest reliability.

IV. Discussion

Reliability encompasses the components of precision, stability and consistency. Interrater reliability and test-retest reliability was done to strengthen the psychometric properties of the Short Gravitational Insecurity assessment (SGI).

Interrater Reliability

Interrater reliability assessed the degree to which different raters gave consistent scores on the SGI Assessment. ICC was used to analyze the interrater reliability. The results (table 1) were 0.90, $p<0.001$ for Emotional Response; 0.93, $p<0.001$ for Postural Response; 0.96, $p<0.001$ for Total Score indicating acceptable

level of reliability for emotional response, postural response and total score of the SGI assessment. This is due to objective measurement tool and prior training of administration of the SGI Assessment. Finally, results revealed that SGI Assessment score is not influenced by different raters.

Table 3. Comparison of interrater reliability of SGI assessment with previous studies

Authors	Samples	GI assessment version	Results
May-Benson & Koomar, 2008	12 GI children	Original version	ICC=0.79 for the TS, ICC=0.91 for the PR, ICC=0.71 for the ER, and ICC=0.23 for the Avoidance subscore
	48 TDC	Revised	Interater reliability was ICC=0.959
Anupama & Ganapathy, 2008	28 GI children	Revised	ICC=0.91 for the ER, ICC=0.91 for PR and ICC= 0.96 for TS
Present study	50 GI children	SGI assessment	ICC = 0.90 for ER; ICC = 0.93, for PR; ICC = 0.96 for TS

May-Benson & Koomar [8] established Interrater reliability for gravitational insecurity original version and revised version. They recruited 12 gravitational insecurity children to identify interrater reliability for GI assessment –original version. The results reported that ICC=0.79 for the total test score, ICC=0.91 for the Postural subscore, ICC=0.71 for the Emotional subscore, and ICC=0.23 for the Avoidance subscore. Fourty eight typically developing children were participated to establish interrater reliability for GI assessment-revised version. The results showed that Interrater reliability was ICC=0.959.

Anupama & Ganapathy [10] examined interrater reliability of revised version of Gravitational Insecurity assessment with 28 gravitational insecurity children. The results showed that there is acceptable level of interrater reliability in Emotional response, Postural response, and Total score of GI assessment (ICC=0.91, $p < 0.001$; ICC=0.91, $p < 0.001$; ICC= 0.96, $p < 0.001$ respectively) indicating a good interrater reliability. The present study found that interrater reliability of Short Gravitational Insecurity assessment was good. These findings are consistent with previous studies results. Because gravitational insecurity assessment was objective measurement tool and prior training of different raters to administer the GI assessment.

Test - Retest Reliability

Test – Retest reliability was done to assess the consistency of the SGI assessment from one time to another. ICC was used to analyze the test- retest reliability. The results (table 2) were 0.95 for Emotional Response, 0.90 for Postural Response and 0.97 for Total Score indicating good test – retest reliability. Hence, it provides supportive evidence to the stability of SGI assessment over different period of intervals. This result is supported by previous findings.

Table 4. Comparison of test-retest reliability of SGI assessment with previous studies

Authors	Samples	GI assessment version	Results
Anupama & Ganapathy, 2008	28 GI children	Revised	ICC=0.96 for ER, ICC=0.85 for PR and ICC= 0.97 for TS
Present study	50 GI children	SGI assessment	ICC=0.95 for ER; ICC = 0.90, for PR; ICC = 0.97 for TS

Test-retest reliability of gravitational insecurity assessment-revised version [10] was examined. They recruited 28 children with gravitational insecurity and matched typically developing children for this study. The results showed that test-retest reliability were ICC=0.96 for ER, ICC=0.85 for PR and ICC=0.97 for TS indicating good test – retest reliability.

V. Conclusion

Psychometric properties of Short Gravitational Insecurity assessment were examined. The results revealed that interrater reliability and test-retest reliability was good. The results of this study concluded that SGI assessment is a reliable measure to identifying children with gravitational insecurity. This is the first objective measurement tool in India to measure gravitational insecurity in children and it can be used as an assessment tool, research tool and also as an outcome measurement.

VI. Recommendations

Validity study should be done for Short Gravitational Insecurity assessment. Normative study is recommended to establish cutoff score for Short Gravitational Insecurity assessment.

Acknowledgement

The authors would like to thank Management of SRM University, Director, Health Sciences, SRM University, Dean, SRM College of Occupational Therapy, Authors would like to extend thank to all the children who have participated in the study and their parents for their timely response. Authors also would like to express their gratitude to Mr.Christopher Amalraj, Biostatistician, Department of Community Medicine, SRM University for their support in statistical analysis.

References

- [1]. Baloh, R.W et.al., (1979), "Clinical neurophysiology of the vestibular system", Philadelphia: F. A Davis.
- [2]. Shaffer, M., (1979), "Primal terror: A perspective of vestibular dysfunction", *Journal of Learning Disabilities*, 12(4),pp. 30-33.
- [3]. Bloomberg, J.,Mulavara.,& Cohen.,(2001), "Developing sensorimotor countermeasures to mitigate postflight locomotor dysfunction", American Institute of Aeronautics and Astronautics, Cape Canaveral, FL.
- [4]. Fisher, A., and Bundy,A.C., (1989), "Vestibular stimulation in the treatment of postural and related disorders", In O.D.Payton, R.P.Difabio, S.V.Paris, E.J.Protas, & A.F.VanSant (Eds.) *Manual of physical therapy techniques* (pp.239-258.),New York:Churchill Livingstone.
- [5]. Ayres.,(1979), "Sensory integration and the child", Los Angeles: Western Psychological Services,infant, toddler, and preschool mental health assessment- pp.268-73.
- [6]. Ayres, A. J., (1963), "Eleanor Clarke Slagle Lecture – the development perceptual motor abilities: A theoretical basis for treatment of dysfunction", *American Journal of Occupational Therapy*, 27(3),pp.221-225.
- [7]. Lee, L., (1987), "Domain specification of gravitational insecurity for school aged children", Unpublished masters' thesis.
- [8]. May-Benson, T. A., & Koomar, J. A., (2007), "Identifying gravitational insecurity in children: A pilot study", *American Journal of Occupational Therapy*, 61(2), pp.142–147.
- [9]. Ganapathy Sankar,U & Dr.Prema,A.,(2014), "Standardisation of Gravitational Insecurity assessment among Indian Children", *International Journal of Scientific and Research Publication*,Vol.4 (8),PP 1-8.
- [10]. Anupama, V., & Ganapathy, U., (2008), Reliability and validity of GI assessment-revised version, Unpublished master dissertation, SRM University, Chennai.