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A COMPARATIVE STUDY AMONG VISUAL, AUDITORY, AND TACTILE CUEING STRATEGIES AND ITS EFFECTIVENESS IN IMPROVING BALANCE AMONG HEMIPLEGIC STROKE PATIENTS

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ABSTRACT

This study describes the comparison about the most effective cueing strategy (Visual, Auditory and Tactile) in improving balance among stroke patients following a pre and post test performance of the individual patients.The Berg Balance Scale (BBS) was used as a tool for measurement and 27 Stroke Patients from Pain and stroke rehabilitation center and SRMCOT department in Chennai, India participated in the session. The outcome of this study shows minimal differences in all the cueing with tactile having the highest score. This follows researches which affirm that there is a need for individual cueing analysis in order to stand out the best among all cueing strategies (by Paulette M. Van Vliet Et-Allin July 2006, research group). Any of the cueing strategies can facilitate balance control in hemiplegic stroke patient and help the patient maintains a proper center of gravity and therapeutic implementation of task with relevance to balance and control.

KEYWORDS: **Stroke, Balance, BBS, Cueing (Visual, Auditory and Tactile cueing)**

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INTRODUCTION

To maintain balance in activities of daily living (ADL), posture control is essential, while motor, Sensory and higher cognitive function all contribute to postural control. [2]Following stroke, patients loses the functions of the motor, sensory and higher brain cognitive faculties to various degrees which lead to diminished balance. It has been documented that hemiplegic or hemiparetic stroke patients present with more posture sway, asymmetric weight distribution, impaired weight-shifting ability and decreased stability capability. [3]In addition, about 80% of all stroke survivors have an upper limb paresis and postural instabilities immediately after stroke affecting gross motor, fine motor and balancing functions. [4]Balance changes over time after stroke, many studies have been done on the assessment and treatment of balance in stroke patient.[5]Individual external cueing strategies have shown significant impact in improving balance and gait among Parkinson patients. (SelvakumarSomasundaram et al, 2008) but there was no such study found in stroke patients and the most preferred cueing strategies.[6]To assess balance in stroke patients, it's also important to have quantifiable measures that clinicians can use to monitor these changes and adjust treatment accordingly.[8]Several studies were reviewed and conducted using external cueing strategies with stroke patients to improve balance and postural control.[9]Results across studies indicate significant improvements in dynamic balance function (Walker and colleagues, Chang Gung Med J Vol. 25 No. 9, September 2002). Also, investigators in some studies used visual, auditory and tactile cueing to improve gross motor, fine motor, and gait imbalance in acute hemiparetic stroke (Chouhan, Swati; Kumar, Sanjiv, International Journal of Therapy & Rehabilitation; Jun2012, Vol. 19 Issue 6, p344).This present research is to investigate which cueing strategy (visual, auditory or tactile) is more effective in the development of balance among stroke patients. Berg Balance Scale (BBS), and Timed Get Up and Go Test which was designed to quantitatively assess balance in older adult as recommended by previous researchers on external cueing strategies in improving balance have been selected for this study.

MATERIALS AND METHODS

The researcher conducted a quantitative quasi experimental design intervention study, which compares the means between independent groups of variable through a convenient sampling method within 40 to 80 yrs individuals affected by stroke at brunstrom stage 4-6 with sample size (n=27). Data collection focuses on patients with stroke within the (age 40 to 80 years) based upon the inclusion and exclusion criteria. The purpose of the study was explained to the subjects and written consent form was obtained from each subject. All participants were assessed individually with Berg Balance Scale and Timed Get Up and Go Test along with a concerned therapist or authorities regarding the goal setting for each patient. Following completion of 32 sessions, Berg Balance Scale and Timed Get Up and Go Test were administered to all participants to determine the post test performance which enables comparison between visual, auditory and tactile cueing strategies and its effectiveness in improving balance among stroke patients.

Instrumentation

The Berg Balance Scale (BBS) is a performance based measure of balance consisting of 14 observable tasks (Berg et al. 1989). The tasks are of progressing difficulty and include functional activities related to balance while reaching, bending, transferring and standing. Originally developed for use with the elderly, the scale has been used in variety of populations including stroke, Parkinson's, multiple sclerosis and recently spinal cord injury. The scale consists of 14 tasks common in everyday life. The items test the subject's stability to maintain position or movement of increasing difficulty by diminishing the base of support from sitting, standing, and two single leg stances. Scoring is based on a 5 point ordinal scale.Psychometric properties:Test-retest: ICC's = 0.91 (general elderly) & 0.99 (stroke survivors) (Berg et al. 1995); ICC=0.88 (Bogle-Thorbahn et al. 1996); ICC = 0.98 (Liston &Brouwer, 1996). Also, Timed Get Up and Go Test This measures mobility in people who are able to walk on their own (assistive device permitted).The patient sits in the chair with his/her back against the chair back On the command "go", the patient rises from the chair, walks 3 meters at comfortable and safe pace, turns, walks back to the chair and sits down,Timing begins at the instruction "go" and stops when the patient is seated. Scoring range from 1 to 5 based on the observer's perception of the patient's risk of falling (Mathias et al, 1986). Podsiadlo& Richardson, 1991, quantified the test by recommending timing (sec) the time between the commands to start, till the buttocks touch the chair.The patient should have one practice trial that is not included in the score (Podsiadlo& Richardson, 1991) and must use the same assistive device each time he/she is tested to be able to compare scores.Psychometric properties: according to Flansbjer, Holmback, Downham, Patten, and Lexell (2005) who assessed the test-retest reliability of the TUG in 50 patients with chronic mild to moderate post-stroke hemiparesis. The patients performed the TUG twice, with 7 days between each evaluation. The test-retest reliability of the TUG was found to be excellent (ICC = 0.96).In another study, the results showed excellent test-retest reliability for both healthy elderly subjects (ICC = 0.97) and patients with stroke (ICC = 0.95). The results of this study and the previous study by Flansbjer et al. (2005) suggest that the TUG is a reliable measure in patients with stroke.

Table 1
Demographic characteristics of tools used

VISUAL CUEING	AUDITORY CUEING	TACTILE CUEING
Sanding Board	Wooden Peg Board	Hand Vibrator
Mirror	Audio set	Inclined standing
Tube light	Riostart	Overhead transfer
Fan		
Rope or Floor line		

Procedures

The study was based on 29 ambulatory patients with stroke, duly assess with Berg Balance Scale and Timed Get Up and Go Test. The sample was collected from different setups like hospitals, rehabilitation clinics and home visits. Intervention was explained to the patient and writing consent was served prior to assessment.Inclusion Criteria focus on (Both Gender, Aged, 40 to 80 years, Ambulate with/without ambulatory aid, Medically stable patient, Patients with good cognitive functioning, Both right and left hemiplegia) while the exclusion Criteria is based on (Wheelchair bound patients, Visual, hearing and sensory impaired patients, Patients with disorders such as Musculoskeletal and Cardiovascular illness).

Data Analysis

To compare the data for analysis, each group identified following assessment with BBS and was coded under a category that best represented the cueing strategies (Visual, Auditory, and Tactile) from the analysis of different variables of the research. Comparative and inferential statistical analysis has been carried out in the present study and results on continuous measurements are presented on Mean ± SD (Min-Max), also, results on categorical measurements are presented in Number (%). Significance is assessed at P value <0.05 level of significance.Student T- test (three tailed, independent) has been used to find the significance of study parameters on continuous scale between three groups (Inter group analysis) on metric parameters. Student t test (three tailed, dependent) has been used to find the significance of study parameters on a continuous scale within each group. Kruskalwallis test was used to find the difference between the three cueing types. P value <0.05 is considered to be significance of study parameters on a categorical scale between three or more groups. The Statistical software, namely SPSS 19.0, Wilcoxan Signed Rank, test and Kruskalwallis test were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables, etc**.** Significant figures: + Suggestive significance (P value: 0.05<P<0.10),*Moderately significant (P value: 0.01<P ≤ 0.05),** Strongly significant (P value: P≤0.01).

Ethical Consideration

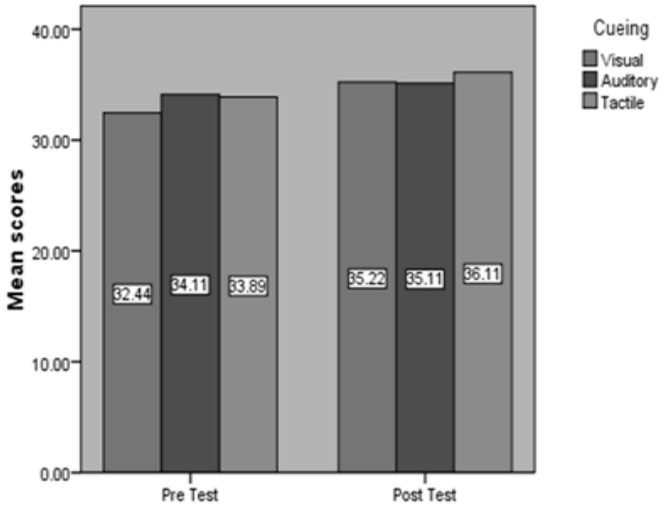
This research was approved by the Research team of SRM University College of Occupational Therapy, Chennai following thorough scrutinization of the relevant papers and consent letter approval from all participants.

RESULTS

Table 2
Demographic characteristics of results Comparing Visual, auditory and tactile cueing in pre test and post test

	Cueing	Mean	S.D	95% Confidence Interval for Mean		P value
				Lower Bound	Upper Bound	
Pre test	Visual	32.44	5.64	28.11	36.78	0.713
	Auditory	34.11	4.20	30.89	37.34	
	Tactile	33.89	5.23	29.87	37.91	
Post test	Visual	35.22	5.17	31.25	39.19	0.915
	Auditory	35.11	5.04	31.24	38.98	
	Tactile	36.11	4.20	32.89	39.34	

Graph 1
Comparing Visual, auditory and tactile cueing in pre test and post test



Pre-test, Shows minimal difference between the mean values of the three cueing types while Post-test, also shows minimal difference between the mean values of the three cueing types.Therefore,Alternate hypothesis was considered due to differencesseen between the mean values of the three cueing types.Kruskalwallis test was used to find the difference between the three cueing types and P value <0.05 is considered to be significant.

DISCUSSION

This study was undertaken with an overall sample size of 27 hemiplegic stroke patients after duly assessed with TGGT and BBS. Among the 27 patients, all the patients were divided into 3 groups of 9 patients each, (Visual, auditory and tactile cueing groups). The following outcome variables of scale BBS-(P value <0.05 +) is considered to be significant between the groups at 10 weeks. Thus all the selected hemiplegic stroke patients in all the groups were assessed on TGGT and BBS-14 (5 grading) in areas of siting to standing, standing and sitting unsupported ,standing with eye closed , standing with feet together ,tandem standing, transfers etc. Minimal significant differences are seen in between all groups which are not statistically significant based on the hypothesis of these study so therefore null hypothesis was be considered. Studies from other literature show that individually all the cueing technique are effective in improving balance in stroke patient depending on procedure and intervention strategy according to study conducted by PAULETTE M. VAN VLIET et-alin July 2006 on Extrinsic feedback for motor learning and balance training in post stroke patients. Cueing strategies used in these study consisted of Visual (standing board, mirror, tube light, fan and rope), Auditory (wooden peg board, audio set and Riostart), Tactile (hand vibrator, inclined standing and overhead transfer), positioning and assistive equipment. The findings suggest the importance of maintaining continual holistic treatment protocol and skepticism about the objectives of interventions. As much as one might want to believe that cueing strategies are outstanding for the positivity of intervention, and the reality may be that there are no difference in this regards to one another in terms of occupational therapy mode of intervention. Following review of literature concerning hemiplegic stroke patients and the effectiveness of cueing strategies in improving balance, with the use of:

- ✓ Mat Activities (pillows, bolster, floor table, soupy ball) as a starting activity
- ✓ Co-ordinated Activities (using tube light, beam balance, overhead ball throwing, and wall bar stringing)
- ✓ Standing Activities (using wall bar, overhead pulley, pegs, ball targeting, throwing and catching)
- ✓ Walking (Tandem walking, maintaining a straight line, flash light and circular motion).

The outcome of this study shows minimal differences in all the cueing with tactile having the higher score, followed by auditory and visual all of which are non-significant but pointing to the fact that individually all the cues have their potentials in improving balance among stroke patient with variability in age differences. This study can be supported by the assumption that patient with hemiplegic stroke and other gait abnormalities (e.g., Parkinsonism or ataxic gait due to cerebellar lesion) respond better when treatment are predictable and presented sequentially in a step-by-step manner(e.g., Selvakumar Somasundaram,(2008). Also stated that auditory and visual cues have a significant impact in improving balance among patients with Parkinson disease. Furthermore, each material used during the activities may have serve as a discriminative stimulus or cue for initiating the activity differently. Also, it is highly probable that the activities guidance serve as visual, auditory, tactile, proprioception and physical prompts for the participants leading to completion of the targeted activities. In general, any of the cueing strategies is required to facilitate balance control in hemiplegic stroke patient and help the patient maintain a proper center of gravity and therapeutic implementation of task with relevance to balance and control. Abbreviations: Berg Balance Scale (BBS), Activities of daily living (ADL), Timed Get Up and Go Test (TGGT).

Implications

Clinical

The external visual, auditory and tactile cueing strategies can be used as a part of intervention for improving

balance in patient with hemiplegic stroke. This is owing to the fact that it's highly flexible to choose out of the variety of activities available in practice to engage patient while using cueing strategies. Furthermore, external cueing activities have shown greater impact and influence on development of balance as well as strengthening internal cueing devices.

Administrative
The outcome of this study can be documented for administrative use in various establishments to guide therapist during intervention and to stream line choice of cueing activities during assessment and balance management in hemiplegic stroke patients.

Research
Furthermore, this study serve as guideline for further researchers interested in external cueing strategies study as well as balance management in hemiplegic stroke patients.

CONCLUSION

This study reveals that all the three cueing strategies used in this study through occupational therapy intervention has beneficial effect in improving balance and control in hemiplegic stroke under the maximum guidance of the therapist. All the treatment cueing regimes can be considered significant for treatment intervention, combination of all the cueing will be superior doing intervention owing to its theoretical basis and due to the fact that individually all the cueing have their distinct functions.

Limitation
Because this study used a quantitative experimental design methodology and consisted of patients from a specific geographical location who had diverse ethnic and cultural backgrounds, the ability to generalize the results or assign causality to the outcomes is limited. The sample size is limited, another important factor is age limit which can be altered as it was strenuous to work on balance in patients above 70, retrospective analysis of the study will give a wider range of improvement rather than the short duration of study and intervention, Also the outcome of this study is subjected to variability in different set-up use for the study. In addition, Language and communication barrier account for error at the initial stage of the study.

Suggestions for future research
Future studies should examine the present study and consider it in a larger population for more accurate result, other types of stroke can be considered in further studies, gender wise distribution of patient selection, duration of intervention can be increased in future research to elicit progress, One type of hemiplegia, either right or left can be taken in future study so as to understand the significance of cueing strategy based on area affected, single type of set-up, either hospital, home or community, can be used. In addition continued research is needed to examine the cueing strategies and balancing function in hemiplegic stroke patient. In further studies it is recommended that at least one year retrospective follow up should be done to see the overall improvement of cueing strategies in balance ability of a hemiplegic stroke patient and to find out the long term effect of Occupational therapy services.

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CONFLICT OF INTEREST

Conflicts of interest declared none.

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