ORIGINAL RESEARCH

Effects of Biofeedback and Task-Oriented Intervention on Balance Confidence and its Relationship with Social Participation among Stroke Survivors

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ABSTRACT

Purpose: *The study aimed to compare the effects of balance training on balance confidence and its relationship with social participation among clients with stroke.*

Method: *A pre- and post- experimental group design was used. Stroke survivors who met the inclusion criteria were consecutively assigned to two groups (task-oriented and biofeedback). Participants in the task-oriented group received task-oriented activities for 20 minutes and the biofeedback group received intervention in correckta (equipment used for balance training) for 20 minutes, along with conventional occupational therapy - 5 sessions per week, for 12 weeks. Balance Confidence Scale was used for measuring balance confidence, and Frenchay Activities Index (FAI) was used to measure social participation. Statistical calculations were performed with SPSS version 16.0 package. Statistical tests were carried out with the level of significance set at $p \leq 0.05$.*

Results: *The findings suggest that both the biofeedback and task-oriented groups showed significant improvement in balance confidence and there was no statistically significant difference between the groups. There was a moderate to good relationship between balance confidence and social participation.*

Conclusions and Implications: *There is evidence that many stroke survivors have low balance confidence. Therapists should assess the balance confidence of their clients and encourage them to participate in these beneficial interventions.*

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Key words: *stroke, balance confidence, confidence, social participation, biofeedback, task- oriented, correckta*

INTRODUCTION

Stroke is the third leading cause of death and the leading cause of adult disability around the world (Strong et al, 2007; Feigin et al, 2009). The WHO defines stroke as an "acute neurological dysfunction of vascular origin with sudden or at least rapid occurrence of symptoms and signs corresponding to involvement of focal areas in the brain; further, the symptoms should last 24 hours or longer" (Aho et al, 1980). In India the incidence of stroke during the past decade was between 136 and 220 per 100000 (Banerjee et al, 2001; Saha et al, 2003; Gourie-Devi et al, 2004).

Balance impairment is a significant challenge after stroke because the number of falls can be as high as five per year in the first year post-lesion (Nyberg and Gustafson, 1995). These falls can further lead to pathological events (e.g., hip fractures), and additional declines in function and disability status (Grisso et al, 1991). Balance problems have been implicated in the poor recovery of activities of daily living (ADL) and mobility (Loewen & Anderson, 1990; Kwakkel et al, 1996; Lofgren et al, 1998). Diverse mechanisms are involved in determining individual causes of balance impairment. Decreased muscle strength, range of motion, abnormal muscle tone, motor coordination, sensory organisation, cognition, and multisensory integration can contribute to balance disturbances at different levels (Wing et al, 1993; Chen et al,2002; Bonan et al, 2004).

In addition to physical parameters, psychological measures such as balance confidence (i.e., the level of confidence that a person has in performing mobility tasks without losing balance or becoming unsteady) may also influence walking capacity among individuals with chronic stroke (Salbach et al, 2006). Many stroke survivors do not go out of the house as much as they would like to, and this has deleterious effects on their quality of life. Some reasons for poor outdoor mobility are potentially remediable, including the lack of confidence and inadequate information on transport options, aids, appliances or adaptations to the home (Logan et al, 2004). The belief in one's capabilities to organise and execute the skills required to produce given attainments is referred to as perceived self-efficacy (Bandura, 1977). Therefore balance confidence can be viewed as self-efficacious belief in one's capabilities to maintain balance while performing selected specific activities that commonly challenge balance.

Objective

The objective of this study is to compare the effects of biofeedback and task-oriented interventions on balance confidence and to find their relationship with social participation among persons affected by stroke.

METHOD

Participants

A total of 30 clients affected by were selected from Swami Vivekanand National Institute of Rehabilitation Training and Research Bhuvaneshwar (SVNIRTAR) and consecutively assigned to the task-oriented and biofeedback groups (15 participants each).

Inclusion criteria:

- Those who had a first attack of stroke,
- Age range below 65 years,
- Able to walk unaided or with minimal support, and
- No cognitive deficits.

MMSE was used to rule out cognitive deficit (more than 25 in MMSE).

Exclusion criteria:

- Hemiplegia due to other conditions,
- Those with previous injury to lower extremity, and
- Those with associated neurological problems.

Informed consent was obtained from the clients after explaining the treatment programme to them.

Outcome Measures

Balance Confidence Scale (BCS)

The Balance Confidence Scale (BCS) is a 22-item scale; each item is rated from 0% (no confidence) to 100% (complete confidence). Elderly respondents are asked to rate their confidence on whether they will lose their balance or become unsteady in the course of daily activities. Experts validated the content of BCS. Construct

Validity of BCS is established (P<0.001). BCS has high test – retest reliability (R=0.93, P<0.001), high internal consistency

(a=0.97) and reliability on phone ((R=0.96.<0.001).

The Frenchay Activities Index (FAI)

The Frenchay Activities Index (FAI) has been used in many studies. It has had its factor structure analysed on several occasions (Bond et al, 1992). The FAI contains 15 items or activities that can be separated into 3 subscales: domestic chores, leisure/work, and outdoor activities. The frequency with which each item or activity is undertaken over the past 3 - 6 months (depending on the nature of the activity) is assigned a score of 1 – 4, where a score of 1 = lowest level of activity. The Scale provides a summed score from 15 - 54.

Procedure

Balance Confidence Scale (BCS) was used to assess the balance confidence levels, along with FAI to assess social participation. After the pre-test, the therapy was begun**.** Participants in the task-oriented group received task-oriented activities and those in the biofeedback group received intervention in correckta (equipment used for balance training) for 20 minutes, along with conventional occupational therapy over 5 sessions a week for 12 weeks.

For the task-oriented group, intervention consisted of the following activities:

Warm-ups, step-ups, kicking ball, floor ladder and obstacle course, stand up and walk, walk and carry, and climbing stairs.

For the biofeedback group, intervention consisted of the following activities:

Exercises for balance, for posture, for asymmetries, distribution of loads, and guided or random objectives.

Before starting exercise in correckta the participants were asked to follow the guidelines and given an explanation about the activities. The exercises were carried out in a calm environment, without bright lights and disturbing noises.

RESULTS

The Test parameters were compared before and after therapy. Statistical calculations were performed with SPSS version 16.0 package, with the level of

significance set at $p \leq 0.05$. The raw scores of pre- intervention and post- intervention of both outcome measures were added and summed up for final scores. As this was a 2-tailed non- parametric study, the changes in the two outcome measures within the biofeedback and task- oriented groups were analysed using Wilcoxon Signed Rank Test. Mann–Whitney U Test was performed to find the significance between the groups. Spearman Rank Correlation test was used for analysis of the relationship between balance confidence and social participation.

Table 1: Descriptive Statistics of Outcome Measures

Outcome Measure	Mean test score(Group) Biofeedback (N = 15)		Mean test score(Group) Task-oriented (N = 15)	
	Pre-test	Post-test	Pre-test	Post-test
Balance Confidence Scale	21.6	53.2	22.33	55
Frenchay Activity Index	5.46	20.6	5.6	21.6

Table 2: Results of Wilcoxon Signed Rank Test for Balance Confidence Scale within the Groups

Groups	Mean diff.	z	P (2-tailed)
BIOFEEDBACK	31.600	-3.408	0.001
TASK-ORIENTED	32.667	-3.412	0.001

The results of Balance Confidence Scale in Table 2 show there was significant improvement in both the biofeedback group and task-oriented group, with P values of 0.001 and 0.001 respectively.

Graph 1: Mean Score changes in the Balance Confidence Scale of both the Biofeedback and Task-oriented Groups

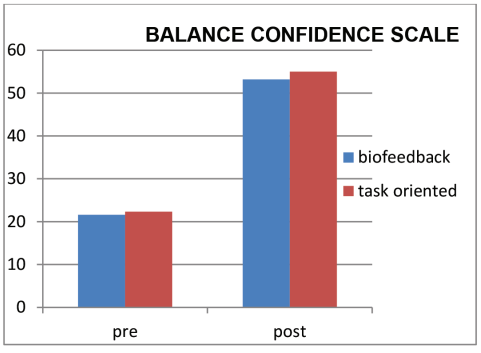


Table 3: Results of Wilcoxon Signed Rank Test for Frenchay Activity Index within the Groups

Groups	Mean Diff.	z	P (2-tailed)
BIOFEEDBACK	15.133	-3.410	0.001
TASK-ORIENTED	16.000	-3.419	0.001

The results of Frenchay Activity Index in Table 3 show there was significant improvement in both the biofeedback group and task-oriented group, with P values of 0.001 and 0.001 respectively.

Graph 2: Mean Score changes in the Frenchay Activity Index of both the Biofeedback and Task-oriented Groups

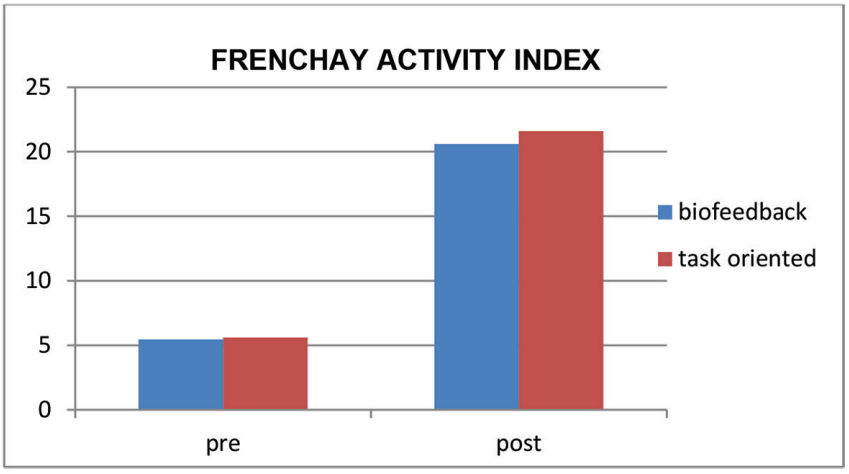


Table 4: Mann-Whitney U tests - Results between the Groups

Outcome Measures	Mean Diff.	z	P(2-tailed)
Balance Confidence Scale	1.800	- 0 .457	0.653
Frenchay Activity Index	1.000	-0.437	0.683

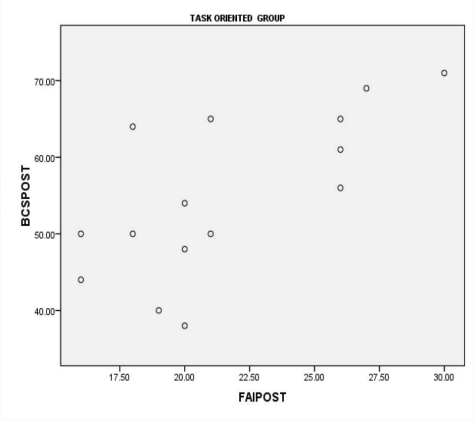
The task-oriented group showed slightly higher scores than the biofeedback group in both the outcome measures but it was not statistically significant, as shown by the results of Mann- Whitney U test at P values of 0.653 and 0.683 respectively.

Table 5: Spearman Rank Correlation tests - Results for the Relationship between Balance Confidence and Social Participation for Biofeedback and Task-oriented Groups

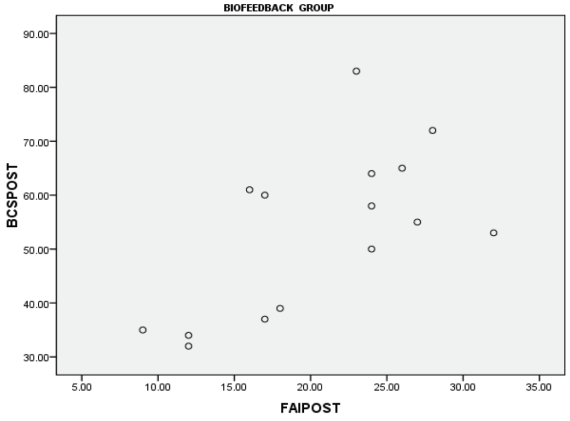
Group	Spearman Rank Correlation (r)	Level of significance (2- tailed)
BIOFEEDBACK	0.566	0.002
TASK-ORIENTED	0.684	0.005

Both the groups showed a moderate to good relationship between balance confidence and social participation.

Graph 3: Scatter Diagram showing the Relationship between Balance Confidence and Social Participation in the Task-oriented Group



Graph 4: Scatter Diagram showing the Relationship between Balance Confidence and Social Participation in the Biofeedback Group



DISCUSSION

The findings of the study suggest that both the biofeedback and task-oriented groups showed significant improvement in balance confidence, and there was no statistically significant difference between the groups as shown by scores. Before the intervention, the pre-scores on the Balance Confidence Scale showed that all the clients had lower balance confidence. The pre-test mean balance confidence level was 21.6% for the biofeedback group and 22.33% for the task-oriented group. However, post-intervention, both the groups showed significant improvements in the outcome measure. The task-oriented group showed a higher score in the outcome measure but it was not statistically significant when compared to the biofeedback group. The mean balance confidence level was 53.2% for the biofeedback group and 55% for the task-oriented group.

The task-oriented group showed significant improvement in balance confidence. The finding of the study is consistent with previous studies on rehabilitation (Marigold et al, 2005; Salbach et al, 2005). Task-oriented walking retraining enhances balance self-efficacy in community-dwelling individuals with chronic stroke (Salbach et al, 2005). The task-oriented progressive resistance strength training programme could improve lower extremity muscle strength in individuals with chronic stroke and could carry over into improvement in functional abilities (Yang et al, 2006).

The study found positive effects of visual feedback-based balance training on clients with stroke. They were able to benefit from the visual feedback exercise programme focused on balance control. The motor learning theory has emphasised the role of feedback in learning motor tasks, and earlier studies have shown the importance of vision in learning to produce effective postural responses (Clark & Rose, 2001; Hu & Woollacott 1994; Nichols, 1997). This study supports the notion that enhanced use of visual feedback for balance training can facilitate the learning of balance skills. Visual feedback training improves dynamic balance in stroke clients and there is also significant improvement in self-care abilities (Chen et al, 2002).

There is a moderate to good relationship between balance confidence and social participation, as shown in Table 6. Spearman Rank Correlation r value is 0.566 for the biofeedback group and 0.684 for the task-oriented group. Balance self-efficacy is an independent predictor of satisfaction with community reintegration in older adults with chronic stroke. Improving balance self-efficacy may be instrumental in enhancing community reintegration in this population (Pang et al, 2007).

Enhancing balance self-efficacy in addition to functional walking capacity may lead to greater improvement, primarily in perceived health status and physical function (Salbach et al, 2006).

CONCLUSION

This study provides evidence that many stroke clients have low balance confidence. However, the results of the study suggest that participants in both the groups (biofeedback and task-oriented interventions) showed significant improvement in balance confidence. There is a moderate to good relationship between balance confidence and social participation. Occupational therapists are encouraged to assess the balance confidence of their clients and those with low confidence should be advised to participate in these beneficial interventions. In addition, occupational therapists should consider incorporating activities and exercises that physically challenge the balance of their clients, in order to maximise their occupational performance.

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