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Role of Habituation Exercises in Improvement of Balance and Quality of Life in Cervical Spondylosis Associated Vertigo

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Abstract

Background: Vertigo is one of the common problems presented in OPD of ENT in which there occur swaying or rotational movement, loss of perception of body and or in space. Dizziness due to cervical spine pathology may give rise to poor balance, abnormal space orientation and, neck pain along with restricted movements of cervical spine and also sometimes headache.

Aim and objectives: Purpose of the study was to find out effective exercise regimen for the vertigo associated with cervical spondylosis. Objectives of the study were to compare the effects of habituation exercises on pain, balance and quality of life in subjects of cervical spondylosis associated vertigo.

Method and materials: A total of 38 patients of Cervical Spondylosis with Vertigo were selected as per sample size calculation. Subjects were allocated in control and experimental groups randomly and a conventional exercise protocol was followed by control group whereas habituation exercise regimen was followed by experimental group for 06 months.

Results: At the post-test stage, the mean BBS score was significantly higher for the experimental group (50.79) compared to the control group (47.32), and the mean DHI score was significantly higher for the experimental group (111.05) compared to the control group (101.37).

Discussion: In experimental group improvements are significantly higher than that of control group which could be attributed to the session that in experimental group habituation exercises were added so improvements of experimental group are higher than control group.

Key words: *Vertigo, Habituation exercises, BBS .*

BACKGROUND

Cervical spondylosis is a disease of cervical spine due to degeneration and mostly occur among old age people especially after forty years of age [1].

The principal symptoms encountered in cervical spondylosis may be neck pain, weakness, stiffness, headache, shoulder pain, tingling, numbness loss of balance and dizziness or vertigo [2].

Vertigo is described as uncomfortable spinning experience in space and it causes lack of orientation of body. Despite its unpleasant nature, vertigo is not considered a disease entity in and of itself. Rather, it is a manifestation of a variety of underlying conditions. The sensation of vertigo can be triggered by various stimuli, including motion, changes in position, and visual cues. In some cases, the cause of vertigo may be related to underlying medical conditions such as inner ear disorders, migraines, or neurological disorders [3].

Vertigo is one of the common problems presented in OPD of ENT in which there occur swaying or rotational movement, loss of perception of body and or in space [1, 2]. It may be central or peripheral caused by neurological dysfunctions or dysfunctions of vestibule- cochlear apparatus in association with neuro-auditory vestibular impacts due to diabetes, hypertension, and dyslipidemia etc. peripheral vertigo is associated with cervical spondylosis [2].

Dizziness is often seen as common symptom in day today life with occurrence rate ranging from 15 to 35 percent among the people [4-9]. It may be caused by several factors such as inner ear disease, cardiac or respiratory disorders, nervous system diseases, psychological illness and cervical spondylosis [10].

Dizziness due to cervical spine pathology may give rise to poor balance, abnormal space orientation and, neck pain along with restricted movements of cervical spine and also sometimes headache [11, 12]. It is important to note that not all cases of dizziness are caused by cervical spine pathology generated dizziness. There are other important common causes that should be ruled out before determining that the cervical spine is the culprit specially when there is neck stiffness and pain [13].

In addition to whiplash, cervicogenic dizziness has also been associated with inflammatory, degenerative, or mechanical dysfunctions of the cervical spine. These conditions can cause damage to the nerves that control muscle movement, leading to the involuntary muscle contractions that are characteristic of cervical dizziness [14, 15].

Complaints of dizziness and vertigo are common presentations which cause patients to go to consultant for treatment. The overall occurrence percentage in adults is approximately 20% to 40% [16]. Vertigo is not a single disorder; it is combination of various symptoms caused by different sources. These can be due to problems of inner ear, the brainstem, and the cerebellum, even there can be different sources of problems of internal, vestibular, or psychosomatic system. Cervical vertigo or cervicogenic vertigo is a common clinical presentation seen among the clinicians but due to absence of valid data, it is difficult to provide standard treatment protocol and diagnose well too [17]. The actual incidence of cervical vertigo is yet not clear since there is lack of standard clinical tests for this, and so it is diagnosed through screening of other similar symptoms [18]. Colledge et al., in their study of older age people suffering from dizziness, found that it is mostly caused by cervical spondylosis [19]. In a study of 1000 patients by Takahashi, it is concluded that 90% cases of vertigo presented in outpatient department were suffering due to cervical spondylosis [20]. There is too much confusing data misguiding to clinicians in diagnosing cervical vertigo [21].

The causes of central and peripheral vertigo are too many and the exact cause is yet not known but one of the important causes of peripheral vertigo is disturbance of cervical somatic sensory nerve afferents due to dysfunction upper cervical musculature section [22].

The proximal part of cervical spine is very unstable as there is great mobility. The excess movement of cervical spine permitsenough use of all components of head under the control of highly developed neuromuscular proprioception system [23, 24].

There are several studies which have documented efficacy of exercises in relieving symptoms of cervical spondylosis associated vertigo and functional impairments due to vestibular dysfunction. The particular exercises which followed are habituation exercises or adaptation exercises [25, 26 & 27]

This study was focused to get effective exercise regimen for the cervical spondylosisassociated vertigo. In King George's Medical University, Physiotherapy units follow conventional therapy for such patients and its need of time to update therapy protocol which can effectively alleviate vertigo.

MATERIALS AND METHOD

Study type: Non randomized control trail.

Study design: Interventional (Clinical).

Target Population- Case of cervical spondylosis with vertigo aged more than 40 years presented to OPD of PMR and ENT departments of KGMU, Lucknow, U.P, India.
Study Population: A total of 38 patients of Cervical Spondylosis with Vertigo were recruited by calculating thesample.
n=7.84 X $[\sigma_0^2+\sigma_1^2)/(\mu_0-\mu_1)^2$ n=sample size per group is 19
Study duration: From October 2022 to September 2022

Inclusion criteria:

Male and Female subjects diagnosed as cervical spondylosis associated with vertigo with age group between 20 to 70 years.

Exclusion criteria:

1) People of age group from 20 years and up to 70 years.
2) Patients suffering from central vertigo.
3) Patients of vertigo with cervical spondylosis suffering from cervical myelopathy and CNS disorders.
4) Patients of cervical spondylosis and vertigo continuing any other treatment or therapy protocol.

Setting

All the included participants in study subject to written informed consent were blindly assigned in control and experimental groups and assessed by another therapist who was not aware of group of participants for the outcome measures: At the start up and after 06 months of treatment -

1) Neck pain scoring through visual analogue scale.
2) Balance score through Berg's balance scale.
3) Quality of life Index by DHI

Exercise protocol:

Both group participants followed exercise regimen after hot pack application for 10 minutes.
Control Group: Isometric neck exercise, 10 repetitions twice in a day. Shoulder girdle muscle strengthening exercises 10 repetitions twice in a day.

Experimental group: In addition to exercises for control group Habituation exercise performed 10 repetitions twice in a day, Subjects were asked to follow exercises as mentioned below -

1) To sit on bed/couch
2) Head to be turned toward right side up to 45^0
3) Lie down rapidly on left side and stay until the dizziness resolves to be followed by lying down on right side for 30 seconds.
4) Sit up fast and stay for 30 seconds.
5) Head to be turned toward left side up to 45^0
6) Lie down rapidly on right side and stay until the dizziness resolves to be followed by lying down on left side for 30 seconds.
7) Sit up fast and stay for 30 seconds.

This completes 1 repetition. Do 5 repetitions, 2 times each day for 2 weeks

Statistical Analysis

The Mann Whitney Test and the Wilcoxon Signed Rank Test are both nonparametric statistical tests commonly used in research to compare two sets of data. These tests are particularly useful when the data are not normally distributed or when the sample size is small. If the two groups are independent, the Mann Whitney test is used; if they are dependent, the Wilcoxon signed rank test is used. Both tests compare the medians of the two groups and yield a p-value, which indicates the probability that the observed difference between the groups is due to chance. A p-value of less than 0.05 is usually considered statistically significant. This means that the probability that the results are due to chance or random error is less than 5%.chance that the results were due to chance or random error.

Multivariate regression analysis is used to determine how much each independent variable affects the dependent variable, taking into account the effects of the other independent variables. It is often used to predict outcomes based on a set of predictor variables. The analysis yields coefficients for each independent variable that indicate the direction and strength of its relationship with the dependent variable. The p-value determines the significance of the coefficient. A p-value <of 0.05 means that the variable is statistically significant and has an effect on the dependent variable.

In statistical hypothesis testing, the p-value is an important statistical measure that can be used to determine the significance of results. A p-value <of 0.05 is usually considered statistically significant and indicates strong evidence against the null hypothesis, meaning that the probability of obtaining the observed result by chance is < 5%. The p-value is an important tool in determining whether or not a hypothesis should be rejected and should be interpreted in conjunction with other measures of effect size and statistical power.

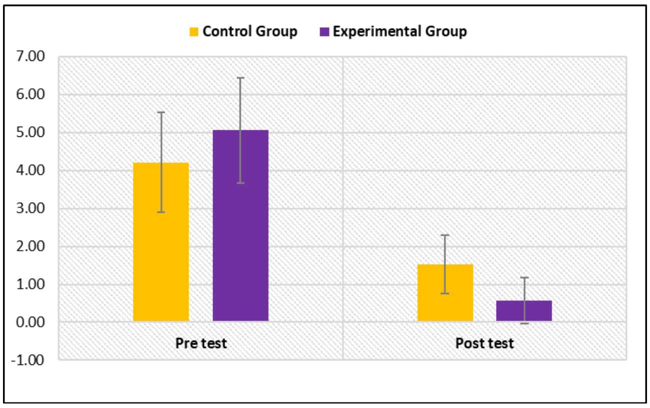
OBSERVATION AND RESULTS

Table 1: Intergroup and Intragroup Comparison of VAS Score

VAS score	Control Group		Experimental Group		Mann Whitney Test	
	Mean	SD	Mean	SD	U-value	p-value
Pre test	4.21	1.32	5.05	1.39	121.0	0.085
Post test	1.53	0.77	0.58	0.61	67.5	**0.001**
Intragroup (Wilcoxon signed rank test)	z = 3.90, **p<0.001**		z = 3.85, **p<0.001**			

The Mann-Whitney test was used to compare the differences in VAS scores between the two groups, while the Wilcoxon signed-rank test was used to analyse the change in VAS scores within each group over time.

In the pre-test phase, the average VAS score was higher in the experimental group (5.05) than in the control group (4.21), but the difference was not statistically significant (U-value = 121.0, p-value = 0.085).



In the post-test phase, the average VAS score was significantly lower in the experimental group (0.58) than in the control group (1.53) (U-value = 67.5, p-value = 0.001). Both the control and experimental groups showed a significant decrease in VAS scores from the pre-test phase to the post-test phase, as indicated by the Wilcoxon signed-rank test (z = 3.90, p < 0.001 for the control group; z = 3.85, p < 0.001 for the experimental group).

Overall, the study suggests that the intervention resulted in effective pain relief in both the control and experimental groups, with the experimental group experiencing greater pain relief compared with the control group.

Table 2: Intergroup and Intragroup Comparison of DHI Score

DHI score	Control Group		Experimental Group		Mann Whitney Test	
	Mean	SD	Mean	SD	U-value	p-value
Pre test	65.16	18.66	57.37	14.53	128.0	0.130
Post test	101.37	16.16	111.05	4.45	99.0	**0.017**
Intragroup (Wilcoxon signed rank test)	z = 3.82, **p<0.001**		z = 3.83, **p<0.001**			

The table shows the mean and standard deviation of the DHI values for both the control and experimental groups before and after the test. The Mann-Whitney test was used to compare the difference in DHI values between the two groups, while the Wilcoxon signed-rank test was used to analyze the change in DHI values within each group over time.

In the pretest phase, the mean DHI value was lower in the experimental group (57.37) than in the control group (65.16), but the difference was not statistically significant (U value = 128.0, p value = 0.130).

In the posttest phase, the mean DHI value was significantly higher in the experimental group (111.05) than in the control group (101.37) (U value = 99.0, p value = 0.017). Both the control and experimental groups showed a significant increase in DHI scores from pretest to posttest, as indicated by the Wilcoxon signed-rank test (z = 3.82, p < 0.001 for the control group; z = 3.83, p < 0.001 for the experimental group).

Overall, the study suggests that the intervention was effective in improving participants' functional independence in both the control and experimental groups, with the experimental group experiencing more improvement in functional independence compared with the control group.

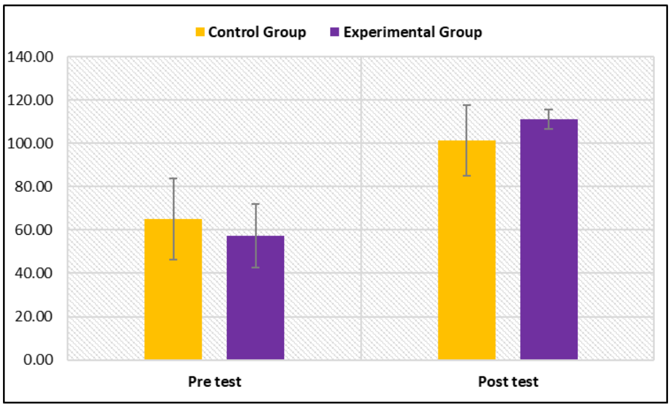


Table 3: Intergroup and Intragroup Comparison of BBS Score

BBS score	Control Group		Experimental Group		Mann Whitney Test	
	Mean	SD	Mean	SD	U-value	p-value
Pre test	33.05	7.91	29.68	6.31	130.5	0.146
Post test	47.32	4.28	50.79	1.96	85.0	**0.005**
Intragroup (Wilcoxon signed rank test)	z = 3.73, **p<0.001**		z = 3.83, **p<0.001**			

The table shows the mean and standard deviation of the BBS results for both the control and experimental groups in the pretest and posttest phases. The Mann-Whitney test was used to compare the differences in BBS scores between the two groups, while the Wilcoxon signed-rank test was used to analyze the change in BBS scores within each group over time.

In the pre-test phase, the average BBS score was lower in the experimental group (29.68) than in the control group (33.05), but the difference was not statistically significant (U value = 130.5, p value = 0.146).

In the post-test phase, the average BBS score was significantly higher in the experimental group (50.79) than in the control group (47.32) (U-value = 85.0, p-value = 0.005). There was a significant increase in BBS scores from pretest to posttest in both the control and experimental groups, as indicated by the Wilcoxon signed-rank test (z = 3.73, $p < 0.001$ for the control group; z = 3.83, $p < 0.001$ for the experimental group).

Overall, the study suggests that the intervention was effective in improving participants' balance ability in both the control and experimental groups, with the experimental group experiencing greater improvement in balance ability compared to the control group.

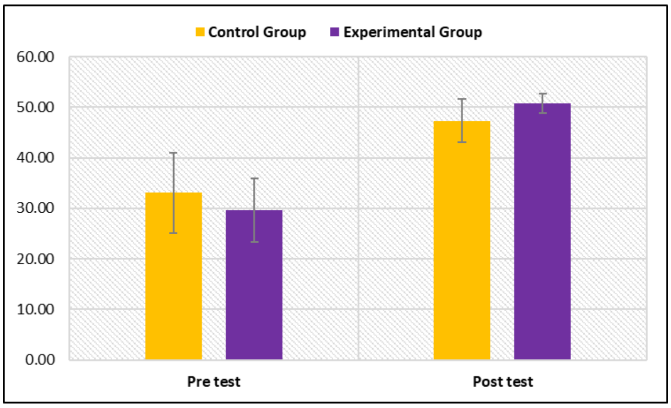


Table 4: Multivariate Regression Analysis Showing Effect of Intervention over Study Variable

Dependent Variable	Independent Variable	B	SE	t - value	p-value	Effect Size
VAS	Intercept	0.58	0.16	3.63	**0.001**	0.268
	intervention	-0.95	0.23	4.20	**<0.001**	0.329
DHI	Intercept	111.05	2.72	40.84	**<0.001**	0.979
	intervention	9.68	3.85	-2.52	**0.016**	0.150
BBS	Intercept	50.79	0.76	66.48	**<0.001**	0.992

	intervention	3.47	1.08	-3.21	**0.003**	0.223

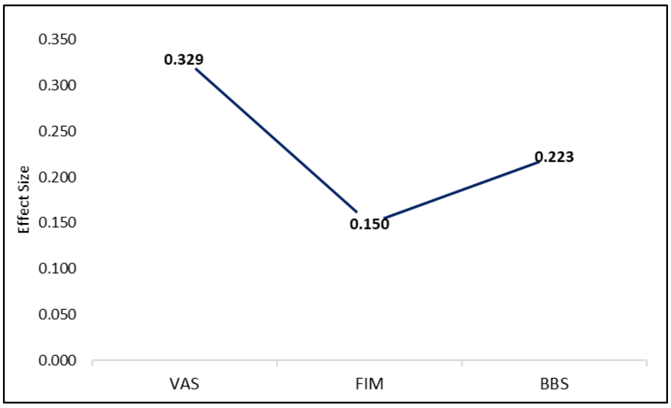
The paragraph provides a quantitative description of a multivariate regression analysis examining the relationship between the dependent and independent variables. The study examined three different dependent variables: VAS BBS the paragraph contains a quantitative description of a multivariate regression analysis that examines the relationship between the dependent variable and the independent variable. Three different dependent variables were examined in the study: VAS, DHI, and BBS, and the independent variable was the intervention.

For the VAS model, the coefficient on the intervention variable was -0.95, meaning that the intervention was associated with a 0.95 decrease in score VAS. The coefficient was statistically significant ($p < 0.001$), indicating that the intervention had a significant effect on the VAS score.

For the DHI model, the coefficient for the intervention variable was 9.68, meaning that the intervention was associated with a 9.68 increase in DHI score. The coefficient was statistically significant ($p = 0.016$), indicating that the intervention had a significant effect on the DHI score.

For the model BBS, the coefficient for the intervention variable was 3.47, meaning that the intervention was associated with a 3.47 increase in the BBS score. The coefficient was statistically significant ($p = 0.003$), indicating that the intervention had a significant effect on the BBS score.

This section also reports the standard error, t-value, and effect size for each coefficient. The effect size is reported as the proportion of the variance in the dependent variable that is explained by the independent variable. Overall, the multivariate regression analysis indicates that the intervention led to an improvement in VAS, DHI, and BBS scores among study participants.



DISCUSSION

Preeti S Gazbare et al. concluded in their study that both gaze stabilization and habituation exercises, as well as yogasanas, have shown effectiveness in improving symptoms of dizziness in patients with peripheral vestibular dysfunction. While yogasanas have demonstrated a superior impact on the MSQ score, indicating better quality of life, gaze stabilization and habituation exercises have shown a superior impact on the DHI scale, reflecting improved daily functioning and emotional well-being. It is crucial for healthcare professionals to consider these findings when designing a physical therapy exercise program for patients with peripheral vestibular dysfunction, ensuring a comprehensive approach that addresses both the physical and psychological aspects of their condition [28].

Gitanjali Sikka et al. stated in their study that physical therapy exercise intervention encompasses a wide range of strategies to address musculoskeletal issues and improve overall function. This includes stability exercises, postural reeducation, stretching of shortened muscles, strengthening of weak muscles, and improvement of cervical spine joint play. Additionally, balance exercises and vestibular rehabilitation are crucial components of physical therapy intervention for individuals experiencing symptoms of disequilibrium and dizziness associated with vestibular pathology. Through these interventions, physical therapists aim to enhance mobility, alleviate pain, and improve quality of life [29].

Badke MB et al. in their study found thatbalance and vestibular physical therapy have proven to be valuable interventions for patients seeking functional improvements. The therapy has shown significant enhancements in balance, visual acuity, and gait stability, ultimately leading to improved quality of life and independence for individuals undergoing the treatment. age and pretherapy vertical dynamic visual acuity score are influential factors in the dynamic gait outcome after a balance rehabilitation program. The DGI showed significant improvement in both patients with peripheral vestibular dysfunction and patients with central balance disorders. Additionally, the BBS score significantly improved for individuals with central balance disorders. These findings emphasize the value of personalized rehabilitation approaches to effectively address the needs of patients with vestibular dysfunction [30].

In the current study participants of experimental group showed improvement in VAS score with mean difference of 4.47, in score with difference 53.68 and BBS score with mean difference of 21.11. The participants of control group also showed improvements in VAS score with a mean difference of 2.68, in score with difference of 36.21 and BBS score with a mean difference of 14.27. Also, At the post-test stage, the mean DHI score was significantly higher for the experimental group (111.05) compared to the control group (101.37) (U-value = 99.0, p-value = 0.017).

In experimental group improvements are significantly higher than that of control group which could be attributed to the session that in experimental group habituation exercises were added so improvements of experimental group are higher than control group.

Therefore, it is evident from the study which suggests that the intervention was effective in improving the balance ability of participants for both the control and experimental groups, whereas the experimental group experiencing a greater improvement in balance ability and pain relief in comparison to the control group.

CONCLUSION

It is concluded from this study that in cervical spondylosis associated vertigo, habituation exercises in conjunction with isometric neck exercise and shoulder girdle exercises are more effective in gaining balance control, relieving pain and improving quality of life.

Limitations of study: A larger sample size could reveal more evident results.
Conflict of Interest: None.

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