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RESEARCH ARTICLE

EFFECT OF VESTIBULAR REHABILITATION IN IMPROVING DAILY LIFE **FUNCTIONS IN ELDERLY**

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Abstract

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This Study was conducted on 50 subjects (age between 60-75 yrs.) who fulfilled the inclusion criteria of balance confidence based on ABC

Scale between 10-90. The aim of this study was to find out the effectiveness of vestibular rehabilitation in improvement of daily life functions in elderly Under vestibular rehabilitation program Cawthorne Cooksey Exercises, Postural Stability Exercises, and General Conditioning Exercises as home based exercise program was given for 8 weeks, data was collected by using ABC (The Activities-specific Balance Confidence) scale for confidently performing outdoor & indoor activities & Berge Balance Scale for balance. **Result:** ABC Scale shown mean of 1st day was 56.7380, which was constantly increased up to 58.5560 after 8 weeks of vestibular rehabilitation program. Similarly Berg Balance Scale had shown a constant increase in mean from 37.0200 to 39.9200, starting from 1st day to 8th week of vestibular rehabilitation. There was significant improvement in daily life functions in elderly with vestibular rehabilitation.

Conclusion: - Based on results of statistical analysis, this study found that simple home based exercise program of vestibular rehabilitation involving head movement exercises along with postural stability and general conditioning exercises are effective in increasing independence while performing activities of daily living.

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INTRODUCTION

Balance is one of those 'ordinary' body functions we do not think about until its disruption. Sit in a violently spinning roller coaster ride for a few minutes, however, and then try to walk upright. We'll become actually aware that our vestibular system, located in inner ear has been upset1. Balance can be viewed as a motor skill that emerges from the interaction of multiple systems. These systems are organized to meet functional task goals & are constrained by the type of environment. Balance, like any skill, can improve with practice2. Steadiness, Symmetry, dynamic stability is components of balance.

Postural symmetry & dynamic stability have been consistently improved by training. Balance is fundamental to many daily activities such as- Transfers, Walking, Driving, Recreational activities, Sense of stability and well being. Loss of balance can be debilitating, leading to self restrictions in movement and fear of falling. A marked withdrawal from social activities is a social consequence of Fear of fall that has been linked with psychological symptoms resembling depression in the older adult population3.such social withdrawal has a negative impact on the quality of life of the older adult.3 Studies designed to differentiate and identify physical factors associated with Fear of Fall and activity restriction show marked frailty, reduce functional capacity for activity, as well as a higher propensity to future falls.4

The vestibular system, which is a contributor to our balance system and our sense of spatial Orientation, is the sensory system that provides the dominant input about movement and equilibrioception. The human vestibular system has three components: a Peripheral sensory apparatus, a central processor and a mechanism for motor output5.

Disorders of the vestibular system are characterized by vertigo, disequilibrium, disorientation, and blurred vision6. Vestibular rehabilitation is an exercise approach to the remediation of disequilibrium and dizziness symptoms associated with vestibular pathology. An exercise-based approach designed to maximize CNS compensation for Vestibular Pathology. These programs typically involve a three-pronged approach, customized to the needs of the individual patient:

- habituation exercises designed to facilitate central nervous system compensation by extinguishing pathologic responses to head motion,
- Postural control exercises, and
- General conditioning activities⁷.

Vestibular rehabilitation is effective and beneficial for many patients with disequilibrium and balance disorders. Relief of symptoms of vertigo, improved balance and postural control, decreased dizziness, and improvements of quality of life have all been reported after a course of vestibular rehabilitation. A recent Cochrane review reported that there was moderate to strong evidence, based on high quality trials, that vestibular rehabilitation for persons with peripheral vestibular dysfunction is safe and effective.⁸

Aim of Study

To find out the effectiveness of vestibular rehabilitation in improvement of daily life functions in elderly (60-75 yrs. old) by using ABC (The Activities-specific Balance Confidence) scale for confidently performing indoor &outdoor activities & Berge Balance Scale for balance.

Need or purpose of study

Purpose of study is to find out the effectiveness of vestibular rehabilitation in improvement of daily life functions in elderly (age between 60-75 yrs.) so that their quality of life can be improved.

Hypothesis

There is significant effect of vestibular rehabilitation in improvement of daily life functions in elderly **Null Hypothesis**

There is no significant effect of vestibular rehabilitation in improvement of daily life functions in elderly.

Methodology

Sample size:

50 subjects are included, male and females age group between 60 to 75 yrs.

Sample technique:

Randomized control trial

Design of study:

Experimental study

Inclusion criteria:

- Both gender with age group between 60 to 75 yrs.
- Subjects who can understand instructions (Cooperative subjects)
- ABC scale between 10-90

Exclusion criteria:

- Subjects below 60 and above 75
- Subjects with systemic illness
- Subjects with neurological condition, ENT, vascular, metabolic, degenerative disorders.
- ABC scale below 10 and above 90

Outcome measure:

1. ABC (The Activities-specific Balance Confidence) scale for Balance

2. Berg-Balance Scale

Instruments used:

1. ABC (The Activities-specific Balance Confidence) scale for Balance

2. Berg-Balance Scale

Procedure:

50 subjects including both sexes were taken from Orbit hospital, Gurgaon & MG hospital, Jaipur who could understand instructions and were not suffering from neurological disorders such as stroke, parkinsonism etc. **Vestibular Rehabilitation:** - Vestibular rehabilitation therapy (VRT) is an exercise-based program for reducing the symptoms of disequilibrium and dizziness associated with vestibularpathology (disease or disorder)⁹. The aims of vestibular rehabilitation are to decrease dizziness, increase balance function and increase general activities level. These exercises are designed dependent on the impairments identified through evaluation, to promote CNS compensation for the deficits of the vestibular system¹⁰.

The vestibular exercises included in this study were Cawthorne- Cooksey Vestibular Exercises, Postural Stability Exercises & General Conditioning Exercises.

I. Cawthorne-Cooksey Vestibular Exercise^{11,12} – devised in 1940 are till today commonly used to decrease dizziness. They found that exercises designed to encourage head and eye movements hastened the patient recovery.

AIMS OF EXERCISE:

- 1. To loosen up the muscles of the neck and shoulders,
- 2. To overcome the protective muscular spasm and tendency to move "in one piece".
- 3. To train movement of the eyes, independent of the head.
- 4. To practice balancing in everyday situations with special attention to developing the use of the eyes and the muscle senses.
- 5. To practice head movements that cause dizziness, and thus gradually overcome the disability.
- 6. To become accustomed to moving about naturally in daylight and in the dark.
- 7. To encourage the restoration of self-confidence and easy spontaneous movement¹³.

NOTE THAT EXERCISE OFTEN MAKES DIZZINESS WORSE IN THE BEGINNING BEFORE THE DIZZINESS GETS BETTER.

- All exercises are started in exaggerated slow time and gradually progress to more rapid time. The rate of progression from sitting to standing exercises depends upon the dizziness in each individual case. Perform these exercises at least twice daily.
- Make sure that you are in a safe environment before you start any of the exercises to reduce the risk of injury.
- A) SITTING POSITION with arm rests:
 - 1. Eye exercises at first slow, then quick 20 times
 - (a) Up and down
 - (b) Side to side
 - (c) Repeat a) and b) focusing on finger at arm's length.
 - 2. Head exercises at first slow then quick, 20times (See a and b above)
 - 3. Shrug shoulders and rotate 20 times.
 - 4. Bend forward and pick up objects from the ground, 20 times.
 - 5. Rotate head and shoulders slowly, then fast, 20 times.
 - 6. Rotate head, shoulders and trunk with eyes open, then closed, 20 times^{13} .

B) STANDING:

- 7. Repeat number 1
- 8. Repeat number, 2.
- 9. Repeat number 3.
- 10. Change from a sitting to standing position, with eyes open, then shut, 10 times.
- 11. Throw ball from hand to hand (above eye level), 10 times.
- 12. Throw ball from hand to hand (under knees), 10 times.
- 13. Change from sitting to standing and turn around in between, 10 times.
- 14. Repeat number 6.

C) WALKING:

- 15. Walk across room with eyes open, then close, 10 times.
- 16. Walk up and down slope with eyes open, then close, 10 times.
- 17. Do any games involving stooping, or stretching and aiming, such as bowling, shuffleboard etc.
- 18. Stand on one foot with eyes open, then closed.
- 19. Walk with one foot in front of the other with eyes open, then closed



Fig¹⁰. - Cawthorne-Cooksey exercises

II. Postural Stability Exercises¹⁰

1. Patients stands with feet close together as possible with one or both hands touching the wall to maintain balance if needed. Turn the head to the right and to the left for 1 minute without stopping. Repeat the exercise with feet close together.

2. Practice turning the head while walking. Initially practice near a wall to prevent fall

3. Stand with feet close together. Outstretch the hands in front then bring arms close to the body and lastly keep the arms folded across the chest. Maintain each position for 15 seconds. Repeat by standing in tandem stance position, i.e by placing one feet in front of the other.

4. Repeat the above exercise with eyes closed.

5. In standing, shift weight from one leg to the other.

6. Stand on a cushioned surface.

7. Walk backward. Difficulty increased by asking the patient to count backward while walking.

8. Walk in a large circle then walk in smaller circles and finally in figure of eight.

9. Walk on ramps and uneven surfaces.

10. Balance training on dynamic surface like vestibular ball.

11. In the community, walk in a mall it is least crowded. Practice walking in the same direction as the flow of traffic or against the flow of traffic.

III. General Conditioning Exercises¹⁰

Patients with vestibular dysfunction may be significantly deconditioned due to inactivity. Such patients are mostly advised to begin a regular walking program to not only prevent deconditioning but also to provide realistic balance challenges to the CNS, e.g. walking on uneven terrain, crossing a road, etc. Initially, they are advised to walk for 15 to 20 minutes daily gradually increasing to 30 minutes daily and later encouraged to walk in a park and shopping mall. Patients can be encouraged to return to recreational activities like golf, tennis, badminton, that will help to improves their fitness.

Description of Instrument:-

Activities-Specific Balance Confidence Scale (ABC): - The Activities-specific Balance Confidence (ABC) scale has been used to quantify balance confidence in older adults and persons with vestibular disorders.^{14,15} The ABC scale is from 0%-100%, with 0% indicating no confidence & 100% indicating optimal balance confidence. Persons are asked to rate their confidence while performing 16 different balance tasks (Higher functioning- Indoor & outdoor activities) and a total score is generated. Scores of 67% or less have been related to increased fall risk in older people¹⁶.

The Activities-specific Balance Confidence (ABC) Scale*

Instructions to Participants:

For each of the following, please indicate your level of confidence in doing the activity without losing your balance or becoming unsteady from choosing one of the percentage points on the scale form 0% to 100%. If you do not currently do the activity in question, try and imagine how confident you would be if you had to do the activity. If you normally use a walking aid to do the activity or hold onto someone, rate your confidence as it you were using these supports. If you have any questions about answering any of these items, please ask the administrator.

The Activities-specific Balance Confidence (ABC) Scale*

For each of the following activities, please indicate your level of selfconfidence by choosing a corresponding number from the following rating scale:

0%	10	20	30	40	50	60	70	80	90	100%
no co	onfide	ence					com	pletel	ly con	fident

"How confident are you that you will not lose your balance or become unsteady when you...

- 1. ...walk around the house? %
- 2. ...walk up or down stairs? %
- 3. ... bend over and pick up a slipper from the front of a closet floor
- 4. ...reach for a small can off a shelf at eye level? ____%
- 5. ...stand on your tiptoes and reach for something above your head?
- 6. ...stand on a chair and reach for something? ____%
- 7. ...sweep the floor? ____%
- 8. ...walk outside the house to a car parked in the driveway? ____%
- 9. ... get into or out of a car? %
- 10. ...walk across a parking lot to the mall? %
- 11. ...walk up or down a ramp? %
- ...walk in a crowded mall where people rapidly walk past you?
- 13. ... are bumped into by people as you walk through the mall? 0/
- 14. ... step onto or off an escalator while you are holding onto a railing? _%

15. ... step onto or off an escalator while holding onto parcels such that you cannot hold onto the railing? %

16. ...walk outside on icy sidewalks? %

*Powell, LE & Myers AM. The Activities-specific Balance Confidence (ABC) Scale. J Gerontol Med Sci 1995; 50(1): M28-34

Berge Balance Scale (BBS):- BBS was developed in the early 1990s as a tool for measuring balance in the elderly. The scale consists in 14 tasks which assess representative aspects of daily activities that require balance, such as sitting, standing, standing on a leg, changing position, transfer, leaning over, reaching forward, stepping, turning around 360 degree or turning with fixed feet. Each task is scored on a scale of 0 to 4: 0 meaning the patient is unable to do the task, and 4 meaning the patient is able to complete the task based entirely. The maximum total score of 56 is associated with excellent balance, while a lower than 45 score Signifies a high risk of falling ¹⁷.

Exercise protocol:-

Days	Types of exercises	Frequency	Intensity	Time
0-15 days	Cawthorne Cooksey	Five days/week	Three repetitions daily	10-15 min
	exercises			
	Postural stability		Three repetitions daily	
	exercises			
	General conditioning		Single time a day	
	exercises			

15-30days	Cawthorne Cooksey exercises	Five days/week	Five repetitions daily	15-20min
	Postural stability		Five repetitions daily	
	exercises			
	General conditioning exercises		Twice a day	
30-45days	Cawthorne Cooksey exercises	Five days/week	Five repetitions daily	15-20min
	Postural stability exercises		Five repetitions daily	
	General conditioning exercises		Twice a day	
45-60days	Cawthorne Cooksey exercises	Five days/week	Five repetitions daily	20-30min
	Postural stability exercises		Five repetitions daily	
	General conditioning exercises		Twice a day	

DATA ANALYSIS

Statistical Test:

An appropriate statistical test was applied for data analysis. Independent t-test was used.

 $\Box x =$ sum of data, N= no. Of data

x-x = deviation of each data with their mean, n = total no. Of data

 m_1 - m_2 = difference of mean S.E.D.= standard error of mean

RESULTS:

There was significant improvement in daily life functions in elderly with vestibular rehabilitation.

ABC scale: 1^{st} day ABC Scale mean as compare to 2^{nd} wk mean is 56.73± 56.91 and S.D. is 21.1064± 21.1813 and t test is 4.059 and P value is .000

Table no.5.1: Comparison of ABC Scale between 1st day and 2ndWk

					r	Mean	t	p value
			Std.	Std. Error		Difference		-
	Mean	Ν	Deviation	Mean				
1stday	56.7380	50	21.10649	2.98491	1.000	.18140	4.059	.000
2ndwk	56.9194	50	21.18134	2.99549				

Graph -5.1: Comparison of ABC Scale between 1st day and 2ndWk



ABC scale: 1^{st} day ABC Scale mean as compare to 4th wk mean is 56.73 ± 57.50 and S.D. is 21.1064 ± 21.0794 and t test is 9.550 and P value is .000

Table no.5.2: Comparison of ABC Scale between 1st day and 4thWk

	Mean	Ν	Std. Deviation	Std. Error Mean	R	Mean Difference	t	p value
1 st day	56.7380	50	21.10649	2.98491	1.000	.76800	9.550	.000
4 th wk	57.5060	50	21.07942	2.98108				

Graph -5.2: Comparison of ABC Scale between 1st day and 4thWk



ABC scale: 1^{st} day ABC Scale mean as compare to 6^{th} wk mean is 56.73 ± 58.09 and S.D. is 21.1064 ± 21.0152 and t test is 10.660 and P value is .000

Table no.5.3: Comparison of ABC Scale between 1st day and 6thwk

	Mean	N	Std. Deviation	Std. Error Mean	r	Mean Difference	Т	p value
1stday	56.7380	50	21.10649	2.98491	.999	1.35600	10.660	.000
6thwk	58.0940	50	21.01529	2.97201				

Graph -5.3: Comparison of ABC Scale between 1st day and 6thwk



ABC scale: 1^{st} day ABC Scale mean as compare to 8^{th} wk mean is 56.73 ± 58.55 and S.D. is 21.1064 ± 20.981 and t test is 10.828 and P value is .000

Table no.5.4: Comparison of ABC Scale between 1st day and 8thwk

	Mean	Ν	Std. Deviation	Std. Error Mean	r	Mean Difference	Т	p value
1stday	56.7380	50	21.10649	2.98491	.998	1.81800	10.828	.000
8thwk	58.5560	50	20.98159	2.96724				

Graph -5.4: Comparison of ABC Scale between 1st day and 8thwk



Graph-5.11: Comparison of Mean of ABC scale among 1st day, 2nd wk, 4th wk, 6th wk and 8th wk.



BERG BALANCE SCALE : 1^{st} day berg balance mean as compare to 2^{nd} wk mean is 37.02 ± 37.32 and S.D. is 12.3973 ± 12.3609 and t test is 3.280 and P value is .002

Table no.5.11: Comparison of BERG BALANCE Scale between 1st day and 2nd wk

	Mean	N	Std. Deviation	Std. Error Mean	r	Mean Difference	t	p value
1stday	37.0200	50	12.39732	1.75325	.999	.30000	3.280	.002
2ndwk	37.3200	50	12.36097	1.74810	1		1	

Graph -5.12: Comparison of berg balance Scale between 1st day and 2nd wk



BERG BALANCE scale: 1st day berg balance Scale mean as compare to 4th wk mean is 37.02± 38.22 and S.D. is 12.3973±12.2379 and t test is 9.165 and P value is .000

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	Mean	Ν	Std. Deviation	Std. Error Mean	r	Mean Difference	t	p value					
1stday	37.0200	50	12.39732	1.75325	.997	1.20000	9.165	.000					
4thwk	38.2200	50	12.23793	1.73070									

Table no.5.12: Comparison of BERG BALANCE Scale between 1st day and 4th wk





BERG BALANCE scale: 1st day BERG BALANCE Scale mean as compare to 6th wk mean is 37.02± 38.96 and S.D. is 12.3973±12.0897 and t test is 10.956 and P value is .000 **Table no.5.13: Comparison of BERG BALANCE Scale between 1st day and 6th wk**

	Mean	Ν	Std. Deviation	Std. Error Mean	r	Mean Difference	t	p value
1stday	37.0200	50	12.39732	1.75325	.995	1.94000	10.956	.000
6thwk	38.9600	50	12.08973	1.70975				

Graph -5.14: Comparison of berg balance Scale between 1st day and 6th week



BERG BALANCE scale: 1st day BERG BALANCE Scale mean as compare to 8th wk mean is 37.02± 39.92 and S.D. is 12.3973±11.8232 and t test is 10.929 and P value is .000

	Mean	Ν	Std. Deviation	Std. Error Mean	r	Mean Difference	t	p value
1stday	37.0200	50	12.39732	1.75325	.989	2.90000	10.929	.000
8thwk	39.9200	50	11.82326	1.67206				

Table no.5.14: Comparison of BERG BALANCE Scale between 1st day and 8th wk

Graph -5.15: Comparison of berg balance Scale between 1st day and 8th week.



Graph -5.22: Comparison of Mean of BERG BALANCE SCALE among 1st day, 2nd wk, 4th wk, 6th wk and 8th wk.



Discussion:-

The present study has shown that customized vestibular rehabilitation programs decreased symptoms, increased postural stability, and improved other vestibular dysfunctions.

ABC Scale shown mean of 1^{st} day was 56.7380, which was constantly increased upto 58.5560 after 8 weeks of vestibular rehabilitation program. Similarly Berg Balance Scale had shown a constant increase in mean from 37.0200 to 39.9200 from 1^{st} day to 8^{th} week of vestibular rehabilitation.

Shumway-Cook et al.¹⁸ reported that 25% to 35% of the population aged over 65 years tends to suffer falls. No elderly subject presented no possibility of fall equal to 100%, which would be expectable in a survey with healthy elderly, but few of them presented possibility of fall between 28% and 73%, which demonstrates that subjects without diseases present likelihood of suffering falls that is high enough to restrict their daily life activities. The process of aging, per se, determines gradual system failure, regardless of the presence of disorders; Vestibular system is the absolute referential for the maintenance of balance. Functional deficit with aging can result in balance

disturbance and in increase of likelihood of falls. Vestibular impairments cause vertigo, blurred vision, disequilibrium and disorientation. These Symptoms can be extremely disabling and cause dependence in ADLs including self-care skills, home management tasks, community mobility, job tasks, and vocational activities.

Cawthorne and Cooksey exercises applied as described in the procedures were capable of improving balance in our sample, consequently reducing the likelihood of fall. Age was not considered as a limiting factor on the response to therapy. Vertigo decreased and independence in activities of daily living improved significantly. For many patients, a simple home program of vestibular habituation head movement exercises is related to reduce symptoms of imbalance during stance and gait¹⁹.

One study done by *Erika Barioni Mantello et.all (2008) on elder population in Brazil* concluded that Vestibular Rehabilitation (based on Cawthorne and Cooksey's protocol) in elderly patients with vascular or metabolic labyrinthic disease was effective in improving the quality of life of these patients²⁰. It is important that this physiological form of therapy be disseminated among healthcare professionals working in gerontology teams.

Vestibular rehabilitation is inexpensive and useful in primary care settings²¹ and has recently been introduced into some emergency departments.⁸

Considering that falls are aspects that substantially change the quality of life of the elderly and that life expectancy of the population in general has increased significantly, leading to increasingly higher elderly population every year, general therapeutic interventions directed to the elderly and especially those that provide prevention of falls owing to improvement of posture stability, will eventually lead to improvement in quality of life, which is currently the priority of any and all health policies. The results found in this study confirmed that according to berg balance scale, healthy elderly subjects have balance disorders and run the risk of falling. The clinical importance of this result lies in the fact that falls are one of the main factors that contribute to morbidity and mortality of the elderly. Thus, preventing falls by improving balance provides basic conditions for the maintenance of physical independence.

LIMITATION OF STUDY:

- Sample size limited to 50
- Age group is between 60-75 yrs.
- A control group must be taken to see the effect

FUTURE SCOPE:

- Further study can be done on age group other than 60-75 yrs.
- Further study can be done on comparison of two scales.
- Further study can be done on Comparison of both genders.

CONCLUSION

In this study the aim was to evaluate the effectiveness of vestibular rehabilitation exercises in reduction of symptoms of imbalance and increasing independence in activities of daily living in elderly people. Based on results of statistical analysis, this study found that simple home based exercise program of vestibular rehabilitation involving head movement exercises along with postural stability and general conditioning exercises are effective in increasing independence while performing activities of daily living.

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