

# Comparative Study of Vestibular Rehabilitation vs Sensorimotor Training on Balance and Quality of Life among Geriatric Population

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## Abstract

**Aim:** The aim of the study is to Compare the Effectiveness of Vestibular Rehabilitation VS Sensorimotor Training on Balance and Quality of life among geriatric population with history of fall. **Need for the study:** There has been no research that compare Vestibular Rehabilitation and Sensorimotor training among Geriatric population. As a result, the purpose of this research is to compare the effects of Vestibular Rehabilitation and Sensorimotor training among Geriatric population. **Methodology:** 30 subjects of both sexes aged between 60-70 years with previous history of fall are selected. They were divided into two groups. Group A is given vestibular rehabilitation and Group B is given Sensorimotor training for 4 weeks. All the subjects are measured for the level of balance and the quality of life by Berg Balance Scale and Older People's Quality of Life-Brief Questionnaire respectively before administering the intervention and at the end of 4 weeks **Results:** Statistical analysis is done using paired t test and independent t test. The outcome measures are balance and quality of life. The statistical analysis showed significant difference after the consecutive 4 weeks. **Conclusion:** Both Vestibular Rehabilitation and Sensorimotor Training improved Balance and Quality of life among elderly. On comparing both the interventions ,Vestibular Rehabilitation shows more significant difference.

**Key Words:** Sensori motor training, Vestibular Rehabilitation, Balance, Geriatrics, Quality of Life, Cawthorne Cooksey Exercise

## I. INTRODUCTION

Ageing is the basic process that occurs in all the systems of human body at cellular level.<sup>(6)</sup> Falls are a major problem pertaining to the geriatric population. Falls lead to decrease in the level of independence among them. It can result in serious trauma and accounts for increase in mortality rate among the elderly.<sup>(11)</sup> Thus falls becomes a major community health issue. Incidence of fall among elderly is 28-34%. On an average 30% of falls need medical care and 10% end up in fracture.<sup>(13)</sup>

Falls are great source of injury.<sup>(12)</sup> Age associated advances in elderly are decrease in the level of functioning in sensory, vestibular, auditory and visual systems. Risk factors leading to falls can be categorized in to internal and external elements.<sup>(4)</sup> The internal elements are gait impairment; age related joint disease, imbalance, visual deterrent, generalized weakness, memory impairment that is pertaining to the advancement of ageing.<sup>(3)</sup> The external factor is insecure. Due to balance impairment activities of daily living and quality of life of the elderly are affected to a greater extent.<sup>(5)</sup>

Dr. Vladimír Janda, a physiatrist identified that both sensory and motor system works synchronizely in order to control the human movement. Hence he coined the term "sensorimotor system" which functions as a single unit and alterations in one will accompany with the changes in the other.<sup>(15)</sup> The aim of sensorimotor training is to rise the afferent proprioceptive inputs to this system in order to facilitate the pathways that are involved in balance.<sup>(14)</sup>

Vestibular system is a part of our sensory system that is responsible for our balance, equilibrium, orientation of the body to its surroundings.<sup>(7)</sup> Age related changes in this system causes impairment in balance and equilibrium which could lead to falls. Thus, rehabilitation of the vestibular system is very much important.<sup>(9)</sup>

Berg Balance Scale is a gold standard clinical test to determine the level of balance of a person under static and dynamic conditions. The validity and reliability of Berg Balance Scale is 95%.<sup>(1)</sup> Older People's Quality Of Life (OPQOL) questionnaire is used to determine the quality of life in older individuals in a wide range of peculiar areas. It consists of 35 items that has to be filled by the individual. The validity and reliability of OPQOL questionnaire is 95%.<sup>(2)</sup>

## BACKGROUND OF THE STUDY:

B N Patel in 2020, concluded that the results of his systematic review revealed the positive effect of vestibular rehabilitation in quality of life and overall well being of the elderly patients, thus reducing the incidence of falls among them.

Irshad Ahmad in 2019 concluded that sensorimotor training improved balance and proprioception under static and dynamic conditions.

## 2. MATERIALS AND METHODOLOGY:

### 2.1. Statement of the study:

Comparative study of vestibular rehabilitation vs sensorimotor training on balance and quality of life among geriatric population.

2.2. Sample size: sample size of the study is 30 subjects.

2.3. Sampling technique: sampling technique of the study is simple random sampling method.

2.4. Study design: pretest posttest experimental study design.

2.5. Study population: Geriatric population with history of falls.

### 2.6. Measurement tool:

1. Berg balance scale
2. Older people's quality of life questionnaire

### 2.7. Inclusion criteria:

- Subjects with history of previous fall.
- Age group ranging between 60-70 years.
- Subjects of both sexes.
- Subjects with history of diabetes.

### 2.8. Exclusion criteria:

- Subjects aged above 70 years.
- Subjects with systemic illness such as renal diseases, asthma, hypertension and tuberculosis.
- Subjects with neurological disorders such as bell's palsy and epilepsy.
- Subjects with vascular diseases such as coronary heart diseases.

2.9. Duration of the study: 4 weeks.

2.10. Statistical tool: Paired t test and Independent t test.

2.11. Hypothesis:

□ Null hypothesis:

The study shows no significant difference exists within Group A (vestibular rehabilitation Group) and Group B (Sensorimotor training Group) and between the Groups in improving balance and quality of life among geriatric population.

□ Alternate hypothesis:

The study shows significant difference exists within Group A (vestibular rehabilitation Group) and Group B (Sensorimotor training Group) and between the Group in improving balance and quality of life among geriatric population.

2.12. Procedure:

□ 30 samples were selected based on inclusion and exclusion criteria.

□ They will be categorized into Group A and Group B by simple random sampling method.

□ Group A (N=15) will receive Vestibular rehabilitation. Group B (N=15) will receive Sensorimotor training.

□ The vestibular exercises included in this study are Cawthorne- Cooksey Vestibular Exercises and Postural stability exercise.

Cawthorne Cooksey vestibular exercises:

Cawthorne Cooksey vestibular exercises formed in 1940 is used till today to improve balance. This exercise focuses on the movements of head and eye. All these exercises focus on the movements of head and eye. They are started at slow rate and progressed to a faster rate.<sup>(10)</sup> The advancement from performing the exercises from sitting to standing differs from person to person.<sup>(3)</sup>

Exercise protocol:

I. Position of the subject: sitting with arm rest.

1. Eye exercises:

Initially started at a slow movement and progressed to faster for 10 times.

They include moving the eye ball:

a) Up and down

b) Sideways

c) Repetition of a and b

d) Focus of eyesight at an object at one arm's length.

2. Bend down and pick up small objects on the floor for 5 times.

3. Neck exercises:

- Bending and extending the neck for 5 times.

- Rotating the head to right and left side for 5 times.<sup>(4,10)</sup>

II. Position of the subject:

4. Subject is made to perform sit to stand with eyes open for 5 times. Then, the subject is asked to perform the same with eyes closed.

5. Throwing a ball from one hand to other for 5 times.<sup>(16)</sup>

6. Changing the position from sitting to standing and turn around in between for 5 times.

III. In walking:

7. Walking across the room for 5 times.

8. Standing on one foot with eyes open. (30 seconds/ 3 times)<sup>(8)</sup>

9. Tandom walking: walking with one foot in front of the other with eyes open for 3 meters.

Trunk stability exercises:

1. Patient is asked to stand with feet apart initially. Support may or may not be taken by placing his/her hands on the wall. Then the subject is asked to turn the head to the right and left side simultaneously for one minute without rest. Repetition of same exercise with feet placed together.

2. Subject is asked to turn the head while walking. Advised initially to practice near a wall to avoid fall.

3. Shifting the weight of the whole body from one leg to another.

4. Standing on a soft surface for 10 seconds for 3 times.

5. Walking in a circular fashion, initially at a larger circle. Progression in walking in smaller circles. Further progression can be walking in figure of eight.

6. Walking on elevated and uneven surfaces.

Exercise protocol:

The exercises mentioned above will be done twice a day for three days (alternate days) per week for 8 weeks.

GROUP B (sensorimotor training)

It consists of five phases. They are warm-up, static, dynamic, functional and cooldown. Rest periods can be given in-between the phases. Subjects are mentioned to ensure the safety during each phase. The three major components are static, dynamic and functional.<sup>(1)</sup>

1. Warm-up:

It consists of 5 minutes of slow walking and moderate stretching of hamstring, quadriceps, and calf muscles.

2. Static component:

- Standing in upright position:

Subject is asked to stand with feet together in hard surface for 30 seconds. Progression is standing on foam surface for 30 seconds.

- Half step position for 10 seconds:

Subject is asked to stand in half step position for 10 seconds. This position is done initially by placing the right leg in front followed by performing the same with the other.

- Single leg balance for 10 seconds:

The subject is asked to stand on one leg.

Progression is made from right leg to left leg, eyes open to eyes closed, hard surface to foam surface.

### 3. Dynamic:

- Forward steeping lounge position:

The subject is asked to stand erect initially and asked to lean forward from the heels. When the weight of the body is shifted forward, the heel will be automatically lifted up resulting in one leg steeping forward. Stabilization of the body must be done during the heel strike.

The above mentioned position is maintained for 10 seconds which is repeated for 3 times per session.

### 4. Functional:

- Foot placement on target.
- Fast walking for short distance (70-80 steps/minute).
- Step up and step down.<sup>(6)</sup>

### 5. Cool down:

This phase consists of slow walking for 5 minutes.

Exercise protocol: The exercises mentioned above will be done three days (alternate days) per week for 8 weeks.

2.13. Study setting: Little sisters of the poor, Chetpet, Chennai.

2.14. Tools used: Berg Balance Scale to measure balance and Older People's Quality of Life Questionnaire for Quality of life.

2.15. Outcome measure:

- Balance and quality of life.

Statistical analysis

COMPARISON OF PRE AND POST TEST VALUES OF EXPERIMENTAL

GROUP I

S.NO	VARIABLES	DAY	MEAN	t VALUE	LEVEL OF SIGNIFICANCE
1.	Balance	Day 1	35.2	18.152	P<0.05
		Day 28	44.1		
2.	Quality of life	Day 1	43.2	17.675	P<0.05
		Day 28	34.6		

COMPARISON OF PRE AND POST TEST VALUES OF EXPERIMENTAL

GROUP II

S.NO	VARIABLES	DAY	MEAN	t VALUE	LEVEL OF SIGNIFICANCE
1.	Balance	Day 1	34.4	18.659	P<0.05
		Day 28	38.6		
2.	Quality of life	Day 1	41.83	7.193	P<0.05
		Day 28	40.0		

COMPARISON OF PRETEST VALUES IN BBS AND OPQOL IN BOTH GROUPS

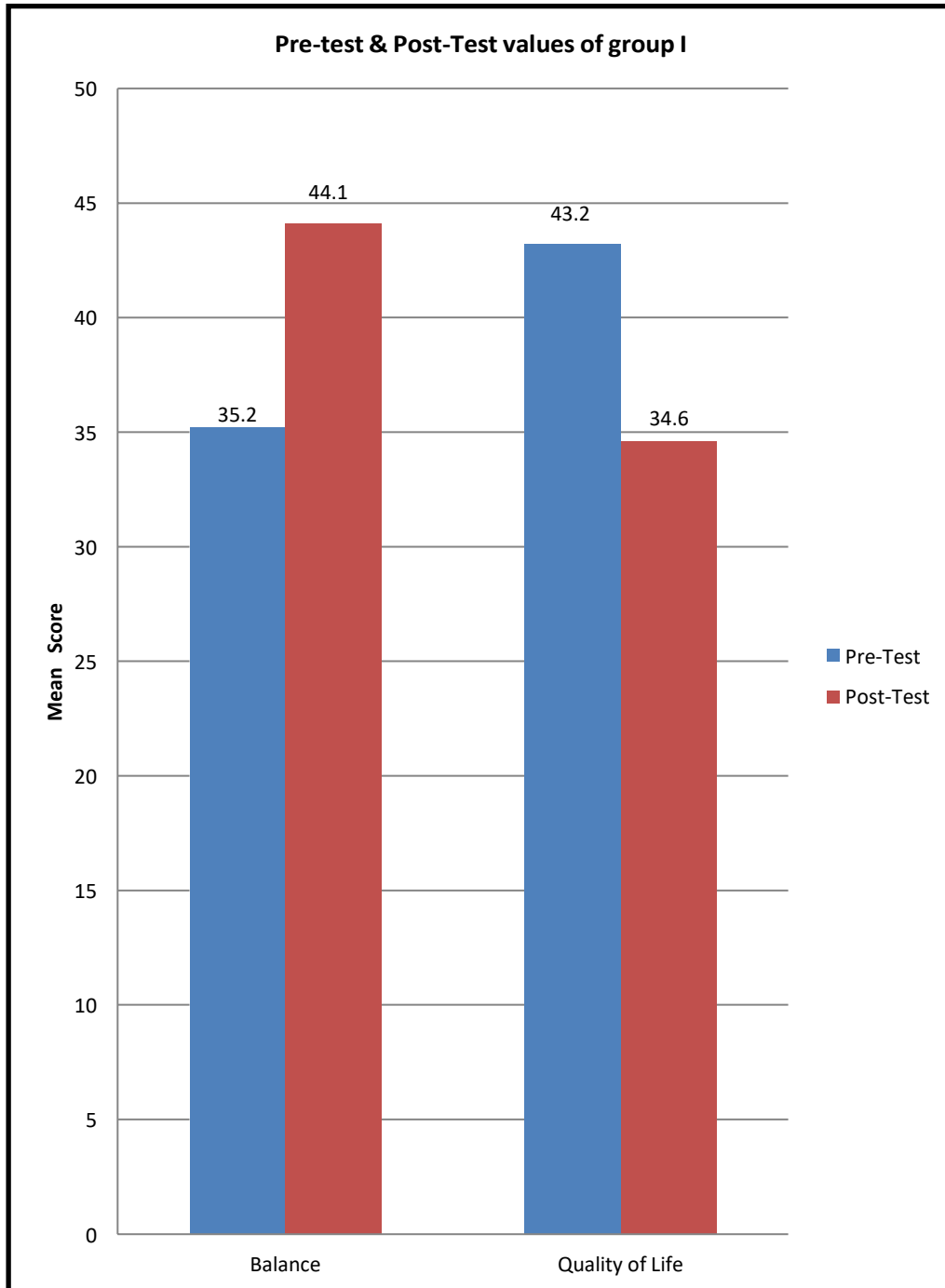
GROUPS	EXPERIMENTAL I (mean)	EXPERIMENTAL II (mean)	t VALUE	LEVEL OF SIGNIFICANCE
BBS	35.2	34.4	0.242	P<0.05
OPQOL	43.2	41.83	0.472	P<0.05

COMPARISON OF POST TEST VALUES IN BBS AND OPQOL IN BOTH GROUPS

GROUPS	EXPERIMENTAL I (mean)	EXPERIMENTAL II (mean)	t VALUE	LEVEL OF SIGNIFICANCE
BBS	44.1	38.6	2.16	P<0.05
OPQOL	34.6	40.8	2.26	P<0.05

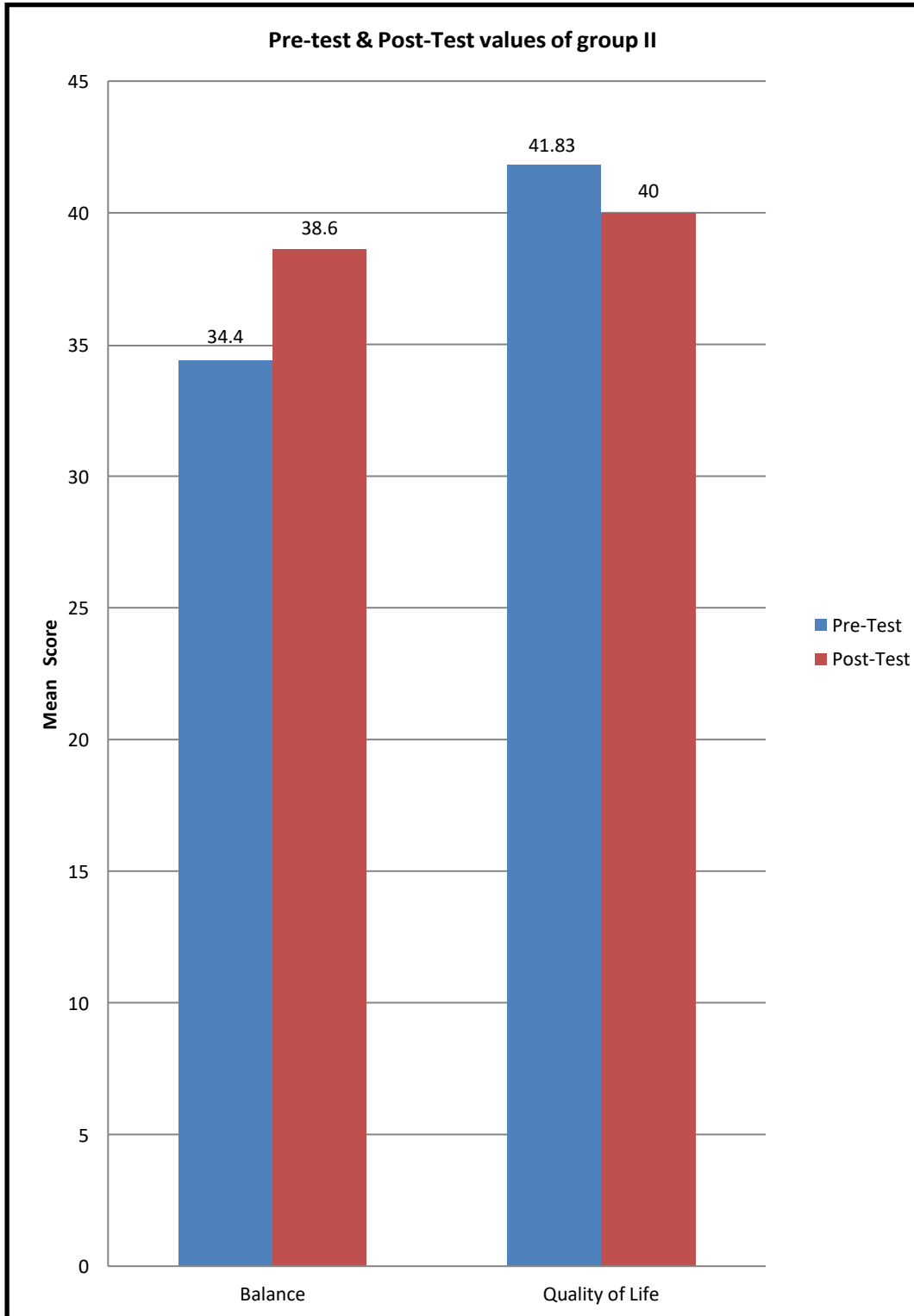
GRAPHICAL REPRESENTATION

GROUP I



Graph 1: Comparison of pre-test & post-test values of Group I

GROUP II



Graph 2: Comparison of pre-test & post-test values of Group II

- From the table I, the descriptive statistics mean, standard deviation, t-value has been obtained using t-test of pretest BBS and post BBS. The statistical results support the application of Vestibular rehabilitation is effective.
- From the table I, the descriptive statistics mean, standard deviation, t-value has been obtained using t-test of pretest QOL and post QOL. The statistical results support the application of Vestibular rehabilitation is effective.
- From the table II, the descriptive statistics mean, standard deviation t-value has been obtained using t-test of pretest BBS and post BBS. The statistical results support the application of Sensorimotor training is effective.
- From the table II, the descriptive statistics mean, standard deviation, t-value has been obtained using t-test of pretest QOL and post QOL. The statistical results support the application of Sensorimotor training is effective.
- From the table III, the descriptive statistics of pretest values of both BBS and QOL scales and both Groups in this t-test values BBS 0.242 and QOL 0.472 P value BBS <0.05 and QOL <0.05 with the mean value and standard deviation value.
- From the table IV the descriptive statistics of posttest values of both BBS and QOL scales and both Groups in this t-test values BBS 2.16 and QOL 2.26 P value BBS <0.05 and QOL <0.05 with the mean value and standard deviation value.

### 3. DISCUSSION:

Ageing is a natural basic process which affects the elderly population. It results in impaired balance which ultimately affects the overall quality of life of the elderly. Therefore, measuring balance and quality of life becomes important.

There are several possible studies that could explain why vestibular rehabilitation improves balance and quality of life among aged. B N Patel (2020) concluded that results of his study showed the importance of vestibular rehabilitation in improving the overall quality of life thus reducing the frequency of falls among the geriatric population. Suraj kumar (2015) concluded that vestibular rehabilitation along with postural stability exercises are effective in improving balance among elderly.

Group A (vestibular rehabilitation) is effective because of the following reasons:

- Improves balance.
- Improves the strength of the muscles.
- Improved postural stability.
- Improvement in overall quality of life of subjects.

Shrikant Bhimroa Darade (2017) proved the positive effect of sensorimotor training in improving balance and quality of life and prevention of falls in geriatric population. Bellemo R.G. Iodice (2009), concluded that sensorimotor training is the most effective intervention in treating the age related weakness among the elderly.

Group B (sensorimotor training) is effective because of the following reasons:

- Improved postural stability
- Improved proprioception.
- Restores normal physiological properties of the muscle.
- Improves overall quality of life of the subjects.

Group A which underwent Vestibular rehabilitation had shown significant improvement in improving balance and quality of life among Geriatric population. Group B which underwent Sensorimotor training shown significant improvement in improving balance and quality of life among Geriatric population. But Group A is more significant improvement than Group B in improving balance and quality of life among Geriatric population. Because Vestibular rehabilitation has additional effects among Geriatric population. They are

- It restores normal postural strategies
- Improves overall efficiency in carrying out ADL activities
- Improved ability to stabilize vision/ gaze
- Reduced risk of fall.

#### 4. CONCLUSION:

Falls are major cause of injury and death in elderly population. Impairment in balance and poor quality of life could lead of falls. This study shows evidence in improving balance and QOL among Geriatric population with history of fall. This study uses Vestibular rehabilitation and Sensorimotor training in improving balance and QOL among Geriatric population with history of fall. Pretest and posttest values are taken using independent t test. From this study it is concluded that Vestibular rehabilitation is effective in improving balance and QOL among Geriatric population with history of fall.

#### REFERENCES

1. Amal F Ahmed (2011) Effect of Sensorimotor training on balance in elderly patients with knee osteoarthritis, Vol- 2, Issue-4, 305-311.
2. Aigner M (2006) What does the WHO QOL- brief measure? Measurement overlaps between quality of life and depressive symptomatology in chronic somatoform disorder. *SOC Psych Epid* 41: 81-86.
3. Byung In Han (2011) Vestibular rehabilitation therapy: Review of indication, Mechanisms, and Key Exercises 7-184-196
4. Cawthorne T. (1994) *The Physiological basis for Head Exercises* 29:106-7.
5. Gillespie LD (2009) Interventions for Preventing Falls in Older People Living in the Community. *Cochrane Database Syst Rev*: CD007146, Pub 3, issue 9, page 4-7.
6. Guccione A A (2000) *Geriatric physical therapy* 2nd edition chapter 24, 183.
7. Hatice Caliskan et al (2019) Turkish validation of a new scale from older people's perspectives: Older peoples quality of life- brief (OPQOL-brief) Vol 83, 91-95
8. Heloisa Freiria Tsukamoto (2015) Effectiveness of a Vestibular rehabilitation Protocol to Improve the Health-Related Quality of Life in Patients with Vertigo 19:238-47.
9. Hiller (2011) Vestibular rehabilitation for unilateral peripheral vestibular dysfunction. *Clin otolaryngol* 36:248-9.
10. HS Writer (2012) Vestibular rehabilitation: An Overview. *Int J Otorhinolaringol clin* 4(1): 54-69.
11. James K, Eldemix shearer D, Gouldbourne J Mories (2007) Falls and fall prevention in the elderly. *The Jamacian perceptive*. 56:534-539
12. Kumar A (2013) The problems of Fall, Risk Factors and their Management among Geriatric Population in India. *Ind J Comm Health* 25: 89-94.
13. Kuptniratsaikul V, praditsuwan R, Assanchai (2011) Effectiveness of simple balancing training program in elderly patients with history of falls. *Clinic inter aging* 6: 111-117.
14. Liebenson C (2005) Sensory motor training- an update. 9: 142-147.
15. Mahmoud Shaykh (2019) Investigating the Effect of Cognitive and Sensorimotor Exercises on the Functional Balance in the Elderly 6(4): 171-176.
16. McDonnell MN (2015) Vestibular rehabilitation for unilateral peripheral vestibular dysfunction. Issue 1, pub 4, 33-36