International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Study to Compare the Effect of Balance Training Exercises on Presbystasis: A Cross-Sectional Study

Snehil Verma[1], Ashutosh Sharma[2], Anita Bhandari[3], Atul Singh[4], Punam Chandra[5]

[1]MPT, Neurology and Psychosomatic disorders, Jaipur National University, Jaipur, Rajasthan, India.
[2]Associate Professor, Department of Physiotherapy, Jaipur National University, India.
[3]Clinical Neurotologist, Vertigo and Ear Clinic, Jaipur.
[4]Associate Professor and HOD, Department of Physiotherapy, Jaipur National University, India.
[5]Assistant Professor, Department of Physiotherapy, Jaipur National University, India.

ABSTRACT

BACKGROUND OF THE STUDY

Presbyastasis is a medical term for age related balance problems. Presby means elders and stasis means balance problem. Presbystasis can be defined as an aging disequilibrium. Elderly people often complain of dizziness and loss of balance. The main sign and symptoms of presbystasis are dizziness, loss of balance, increased fall risk, vertigo, postural instability which progressively increases loss of quality of life. An estimated 13 percent of adults report imbalance between the ages of 65 and 69. For people 85 and older, it increases to 46%. In addition, balance, and gait disorders are associated with an increased risk of falls13. The estimated annual fall ratefor adults over age 65 is 28%. Balance is important for maintaining postural balanceand thus preventing falls.

PURPOSE OF THE STUDY

The purpose of this study is to observe the comparison of the effect of the rhythmic weight shift exercises and limit of stability exercises on balance and fall risk in patients with presbystasis.

STUDY DESIGN

A Cross-sectional study.

METHODOLOGY

Individuals suffering with presbystasis, between the age group 65 to 85 were included in this study. Presbystasis should be confirmed diagnosed by ENT physician with posturography and Craniocorpography done of the patients, showing abnormal sway were considered in this study. Intervention done are Rhythmic weigh shift exercises and Limit of stability exercise protocol. Outcome measures used were FHI scale and TUG test to measure pre-test and post-test scores. Intervention was givenfor 4 weeks, with 4 sessions per week.

RESULT

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurement are presented on mean and standard deviation. Paired t-test was used to compare the changes in the balance & risk of fall within the groups and independent t-test was used to compare baseline values between the group measures of balance & risk of fall & handicap among the participants of Group A and B. Both the groups showed significant improvement in balance and fall risk, but groupB shows better improvement than group A, suggesting better clinical outcomes in thosetreated with Limit of stability exercise protocol.

CONCLUSION

The study concluded that Rhythmic weight shift and Limit of stability exercises are both effective in reducing falls and improving balance in patients with presbystasis. But the participants of group B, who have received Limit of stability exercise protocol have better clinical outcomes when compares the FHI and TUG scoreof both groups.

KEYWORDS: Presbystasis, Balance training, Rhythmic weight shift, Limit of stability, Dizziness, Disequilibrium.

1. INTRODUCTION

Life expectancy is increasing worldwide, especially in the Indian subcontinents. The problems associated with ageing are now understood as the proportion of the population in this category is increasing[1]. The number of people aged 65 and over continues to grow at an unprecedented rate. India's current population is 1414940553 as of Tuesday, January 31, 2023 based on the latest UN data Worldometer revision. India's elderly population is now the world's first largest. With the rapid aging population, it is important to emphasize the need to maintain function and maintain quality of life into old age. There are an estimated 962 million people over the age 60 in the world, representing over 13% of the total population.

Age related changes in vestibular function include a decline in vestibulo-ocular reflex, which is responsible for stabilizing vision during head movements, as well as the vestibulospinal reflexes, which is used to maintain upright posture[3]

Balance and gait are important considerations in the health of the elderly. Maintainingbalance depends on the information the brain receives from the three organs: eye, muscles and joints, and vestibular system. All three of these sources send signals to the brain in the form of nerve impulses from certain nerve terminals called sensoryreceptors. An estimated 13 percent of adults report imbalance between the ages of 65 and 69. For people 85 and older, it increases to 46%.[4]The prevalence of walking disorder among community-dwelling adults 70 years and older has been estimated 35%in elderly.

Falls are associated with significant morbidity and mortality in the elderly: they are the most common cause of accidental death and nonfatal accidental injury in those 65 andolder, accounting for 55.8% of accidental deaths[4,5,6,7,8]. One study reported that more than 10,000 seniors died from accidental falls 65 and older every year, and the risk increases with age[9]. Impaired postural stability is recognized as a major risk factor for falls in the elderly[10]. Some fall risk factors are irreversible, while others are potentially modifiable with appropriate interventions[11]. Balance is important for maintaining postural balance and thus preventing falls.

According to WHO fall is defined as an event which results in a person coming to restinadvertently on the ground or floor or other lower level[12]. Many people who experience falls are immobilized by fear

of falling, which in turn increases the risk of pressure ulcers, pneumonia, weakness, and falls[13]
The presence of dizziness in elderly is a strong augury of fall. Dizziness is a frequent occurrence in the elderly and it carries substantial health and quality of life consequences for elders[14]. Multifactorial balance dysfunction and dizziness that occur in an individual age is also called Presbyastasis.[15]

Presbyastasis is a medical term for age related balance problems. Presby means elders and stasis means balance problem[16]. Presbystasis can be defined as an aging disequilibrium. It is dizziness and imbalance caused by the aging of the sensory systems, the aging of the central nervous system and motor system[15]. Elderly people often complain of dizziness and loss of balance. Elderly people with dizziness are found to have significant disabilities that require assistance. According to Agrawal et al., the likelihood of falling increases 12-fold in people affected by vestibular dysfunction[17]. Age-related vestibular degeneration is a condition that leads to unsteady gait, dizziness, and an increased risk of falling in the elderly which interferes with daily activities and life.

Presbyastasis summarizes these terms and can be defined as an age-related imbalance of peripheral and central balance systems (vestibular, visual, somatosensory) involved in striking the right balance[18]. The main sign and symptoms of presbystasis are dizziness, loss of balance, increased fall risk, vertigo, postural instability which progressively increases loss of quality of life[2,16]. People who suffer with other vestibular conditions are more prone to Presbyastasis. Age related conditions of reduced vestibular functions that can manifest in the elderly increases the chances of presbystasis[19].

Vestibular rehabilitation therapy (VRT) is a specialized treatment primarily aimed at reducing problems caused by vestibular disorders such as dizziness and vertigo, gaze instability and/or loss of balance and falls[20]. People with vestibular disorders often experience problems such as dizziness, vertigo, visual disturbances, and/or imbalance[21]. VR aims to use a problem-oriented approach to facilitate compensation[22]. This is done by customizing exercises to address each individual's specific problems. Depending on the identified vestibular problem, three main exercise strategies can be prescribed: 1) habituation, 2) gaze fixation, and/or 3) balance training[24].

2. METHOD and METHODOLOGY

This study is a prospective cross-sectional study, and the subject were recruited from a tertiary Neuro-otology Clinic. Participants who fulfil the inclusion criteria were included in the study. The purpose of the study was explained to the subjects. And the participants were instructed regarding treatment protocol in detail. The written consent was taken from the subjects before starting the treatment protocol. Patients with presbyastasis randomly assigned into 2 groups; Group A and Group B. Subjects fill the FHI questionnaire and TUG test was done.
The following protocol was followed: -

1. Individuals with confirmed diagnosis of Presbyastasis by ENT physician.
2. Craniocorpography (CCG) showing abnormal sway in any 2 components of CCG i.e., Unterberger test, Romberg test and tendem walking.
3. Posturography showing abnormal sway.

- After getting the results of these test the patients will be randomly allocated to one of the 2 experimental groups, with 25 patients in each group.
  GROUP A: - Rhythmic Weight shift exercises
  This group consist of 25 participants. They were treated with the Rhythmic Weight shift exercise protocol.
  GROUP B: - Limit of Stability exercises.
  This group consist of 25 participants. They were treated with the Limit of Stability exercise protocol.
- For both the groups, interventions are given for 4 sessions per week, for 4weeks, and the data was collected on day 0 and day 28 [23].

DATA ANALYSIS

Data analysis was accomplished with following software: Microsoft EXCEL (Professional Edition 2007; Microsoft Corp, Redmond, WA) and Statistical Package ofSocial Sciences (SPSS version 20). Paired t-test (parametric test) was used to comparethe changes in the balance & risk of fall within the groups and independent t-test was used to compare baseline values of age, balance & risk of fall & handicap and also thefinal between the group measures of balance & risk of fall & handicap among the participants of Group A and B. A statistically significant difference was defined as 'p'value was less than 0.005.

RESULT

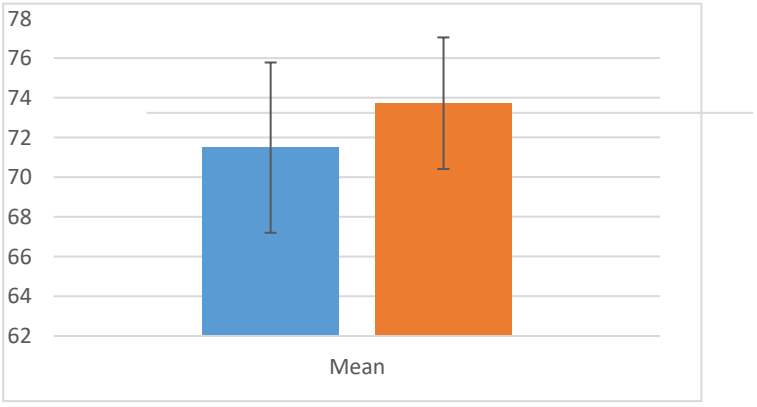
DESCRIPTIVE ANALYSIS

1. Demographic Data:

A total of 50 participants volunteered for this study. 26 males and 24 females participated in the study (Group A: 13 males and 12 females; Group B: 13 malesand 12 females). The mean age in the Group A and Group B were 71.48±3.917 and 73.72±3.422 respectively. Table gives the details of mean and standard deviation of this data.

Table 1: Mean and standard deviation of Age of Group A and Group B

	Mean	S.D.	P value
Group A	71.48	3.917	0.03
Group B	73.72	3.422	



Graph 1: Bar graph representing mean and standard deviation of age of theparticipants of Group A and

Group B

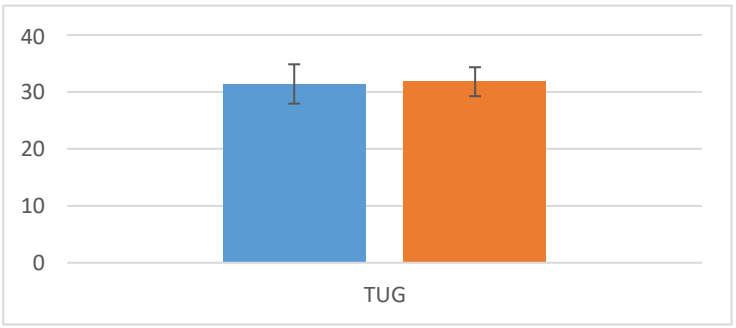
2. Baseline Parameters:

The Timed Up & Go (TUG) is the measure of extent of Balance & Risk of fall, Fall Handicap Inventory (FHI) is the measure of handicap associated falls. The pre-test means values for TUG for participants in the Group A & B came out to be 31.4±3.367and 31.80±2.466 respectively; that of FHI came out to be 52.80±4.143 & 52.60±3.797.

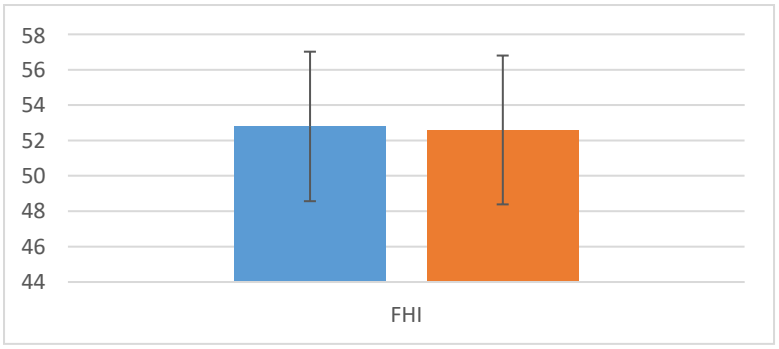
Between the group comparison of baseline parameters was conducted using independent t-test test, with level of significance, p set at 0.05. The comparison of the readings for Group A and B was not found to be statistically significant (0.0001). Thisvalidates the normalization of the baseline variables.

Table 2: Mean and standard deviation of Timed Up & Go & FHI of Group Aand Group B

	TUG	FHI
Group A	31.4±3.367	52.80±4.143
Group B	31.80±2.466	52.60±3.797
P value	0.634	0.860



h 2: Bar graph representing mean and standard deviation of TUG of theparticipants of Group A and Group B.



Graph 3: Bar graph representing mean and standard deviation of FHI of theparticipants of Group A and Group B.

Within The Group Comparison

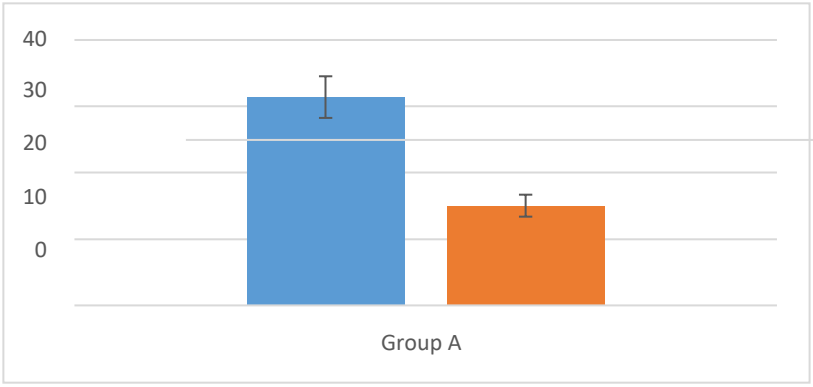
1. Balance & Risk of Fall:

The Timed Up & Go (TUG) is the measure of extent of Balance & Risk of fall. The pre-test and post-test mean values for Timed Up & Go for participants in the Group A came out to be 31.4±3.367 and 15.04±1.989 and that for Group B came out to be 31.8±2.466 and 11.76±1.332.

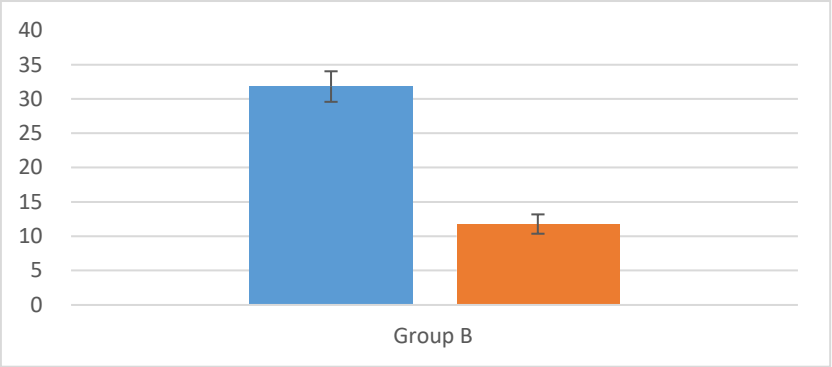
Within the group analysis of TUG was conducted using Paired t-test test, with level ofsignificance, p set at 0.05. The comparison of the readings for TUG of the two groups namely, Group A and B was found to be statistically significant (0.0001).

Table 3: Mean and standard deviation of Timed Up & Go of Group A and Group B.

	Pre-Test	Post-Test	P value
Group A	31.4±3.367	15.04±1.989	0.000*
Group B	31.8±2.466	11.76±1.332	0.000*



Graph 4: Bar graph representing mean and standard deviation of Timed Up& Go of the participants of Group A



Graph 5: Bar graph representing mean and standard deviation of Timed Up& Go of the participants of Group B

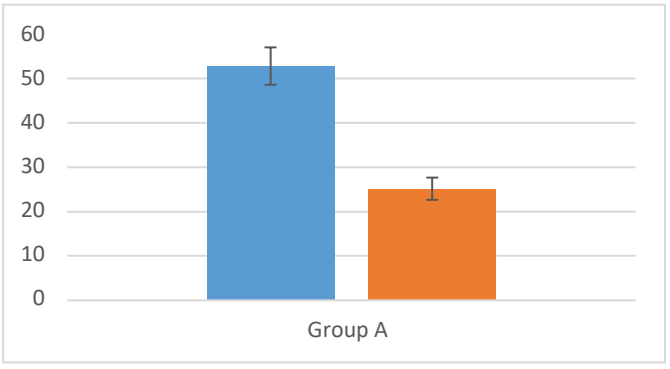
2. Fall Handicap Inventory (FHI):

The Fall Handicap Inventory (FHI) is the measure of extent of handicap associated withrepeated falls. The pre-test and post-test mean values for FHI for participants in the Group A came out to be 52.8±4.143 and 25.12±2.386 and that for Group B came out to be 52.6±3.797 and 16.16±3.508.

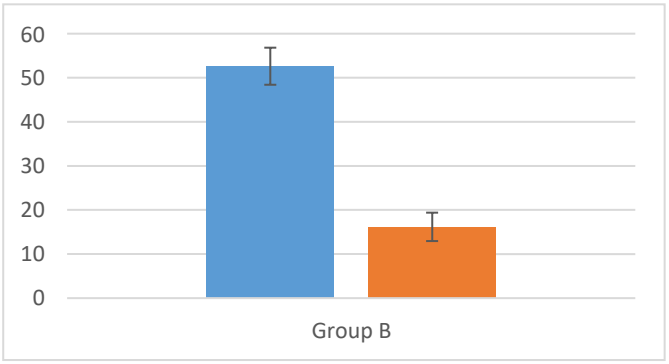
Within the group analysis of FHI was conducted using Paired t-test test, with level of significance, p set at 0.05. The comparison of the readings for FHI of the two groups namely, Group A and B was found to be statistically significant (0.0001).

Table 4: Mean and standard deviation of FHI for Group A and Group B

	Pre-Test	Post-Test	P value
Grou-A	52.8±4.143	25.12±2.386	0.000*
Group B	52.6±3.797	16.16±3.508	0.000*



Graph 6: Bar graph representing mean and standard deviation of FHI of theparticipants of Group A.



Graph 7: Bar graph representing mean and standard deviation of FHI of theparticipants of Group A.

BETWEEN THE GROUP COMPARISON OF TIMED UP & GO & FALLHANDICAP INVENTORY

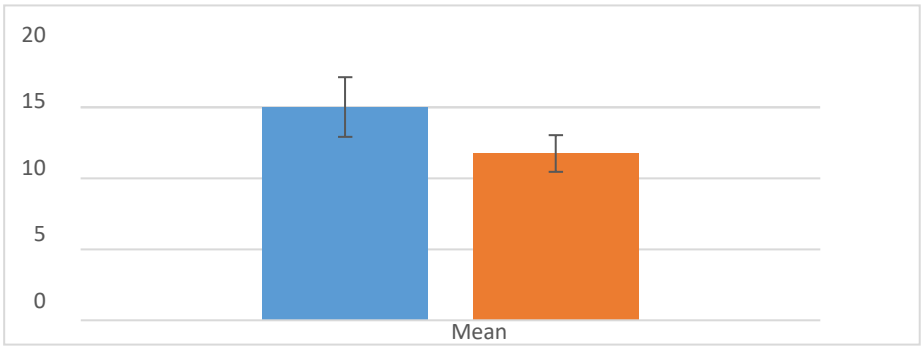
1. Balance & Risk of Fall

The Timed Up & Go (TUG) is the measure of extent of Balance & Risk of Fall. The post-test mean values for TUG for participants in the Group A came out to be15.04±1.989 and that for Group B came out to be 11.76±1.332.

Between the group analysis of TUG was conducted using Independent t-test test, with level of significance, p set at 0.05. The comparison of the readings for TUG of the twogroups namely, Group A and B was not found to be statistically significant (0.0001).

Table 5: Mean and standard deviation of Timed Up & Go of Group A and Group B

	Mean±SD	P value
Group A	15.04±1.989	0.000
Group B	11.76±1.332	



Graph 8: Bar graph representing mean and standard deviation of TUG of theparticipants of Group A and Group B.

2. Fall Handicap Inventory (FHI)

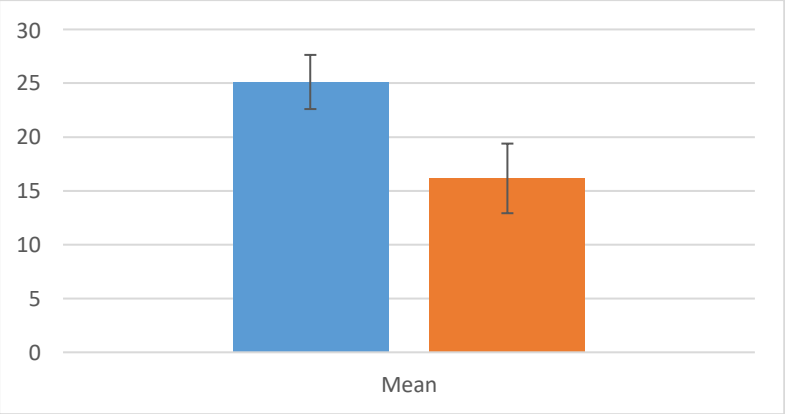
The Fall Handicap Inventory (FHI)is the measure of handicapped associated with repeated falls. It is measured using a self-administered 18 item scale. The post-test meanvalues for FHI for participants in the Group A came out to be 25.12±2.386 and that forGroup B came out to be 16.16±3.508.

Between the group analysis of FHI was conducted using Paired t-test test, with level ofsignificance, p set at 0.05. The comparison of the readings for FHI of the two groups namely, Group A and B was not found to be statistically significant (0.0001).

Table 6: Mean and standard deviation of FHI for Group A and Group B

	Mean±SD	P value
Group A	25.12±2.386	0.000
Group B	16.16±3.508	

Graph 9: Bar graph representing mean and standard deviation of FHI of theparticipants of Group A and Group B.



DISCUSSION

In this prospective study we tried to evaluate presbystasis patients and assess the effect of balance training exercises on fall efficacy and dizziness. This study also compares the two balance training approaches that is Rhythmic weight shift and limit of stability. The study was carried out at a tertiary Neuro-Otology clinic. 50 patients between the age group of 65 to 80 years of age were included in this study. Our overall result agreeswith those reported in the literature that the balance training exercises are helpful in decreasing the falls in older adults and improves the ADL and confidence.

Both the groups showed significant improvement in balance and fall risk, but group B shows better improvement than group A, suggesting better clinical outcomes in those treated with Limit of stability exercise protocol.

CONCLUSION

The study concluded that Rhythmic weight shift and Limit of stability exercises are both effective in reducing falls and improving balance in patients with presbystasis. Butthe participants of group B, who have received Limit of stability exercise protocol havebetter clinical outcomes when compares the FHI and TUG score of both groups. Hence,we concluded and accepted the experimental hypothesis which stated that Limit of stability exercises have a significant effect in balance and fall in individuals having presbystasis.

CONFLICT OF INTEREST

Author declares no conflict of interest.

ACKNOWLEDGEMENT

Dedicated to my beloved Parents Mrs. Ranno Devi and Mr. Kamlesh Kumar Verma.

REFERENCES

1. Narinder Kaur Multani, Satish Kumar Verma. Principles of Geriatric Physiotherapy.
2. C Rogers (2010) Presbyastasis: a multifactorial cause of balance problems in the elderly, South African Family Practice, 52:5, 431-434.
3. Matsumura, B. A. & Ambrose, A. F. Balance in the Elderly. *Clin. Geriatr. Med.* **22**,395–412 (2006).
4. Osoba, M. Y., Rao, A. K., Agrawal, S. K. & Lalwani, A. K. Balance and gait in the elderly: A contemporary review. *Laryngoscope Investig. Otolaryngol.* **4**, 143–153 (2019).
5. Centers for Disease Control and Prevention. National Center for Injury Prevention and Control. 2016. Available at: http://www.cdc. gov/injury/wisqars/. Accessed May 20, 2018.
6. Kannus, P., Parkkari, J., Niemi, S. & Palvanen, M. Fall-induced deaths among elderly people. *Am. J. Public Health* **95**, 422–424 (2005).
7. Luisa pizzigalli et al; prevention of falling risk in elderly people:the relevance of muscular strength and symmetry of lower limbs in postural stability. Journal of Strength and Conditioning Research. 2011
8. Wang, Q. & Fu, H. Relationship between proprioception and balance control amongChinese senior older adults. *Front. Physiol.* **13**, 1–8 (2022).
9. Shankar, K. N., Liu, S. W. & Ganz, D. A. Trends and characteristics of)
10. Wang, Q. *et al.* The relationships of postural stability with muscle strength and proprioception are different among older adults over and under 75 years of age. *J. Exerc. Sci. Fit.* **20**, 328–334 (2022).
11. Yves J Gschwind et al; A best practice fall prevention exercise program to improvebalance, strength / power, and psychosocial health in older adults: study protocol for arandomized controlled trial. BMC Geriatrics. 2013
12. Falls. World Health Organization; 16 January, 2018. p. 1-2. Available from: http://www.who.int/news-room/fact-sheets/detail/falls. [Last accessed on 2018 Jun 22].
13. Salari, N., Darvishi, N., Ahmadipanah, M., Shohaimi, S. & Mohammadi, M. Globalprevalence of falls in the older adults: a comprehensive systematic review and meta- analysis. *J. Orthop. Surg. Res.* (2022).
14. Fernández, L., Breinbauer, H. A. & Delano, P. H. Vertigo and dizziness in the elderly. *Front. Neurol.* **6**, 1–6 (2015).

15. Christina Cooper PT, Encyclopedia of otolaryngology, head and neck surgery.

16. university of Washington, medical center UW medicine, Rev. 03/2010, available in Online: http//healthonline.washington.edu
17. Agrawal Y, Carey JP, Della Santina CC, Schubert MC, Minor LB (2009) Disorders of balance and vestibular function in US adults: data from the national health and nutrition examination survey, 2001–2004. Arch Intern Med 169(10):938–944
18. Politi, L. *et al.* Risk of falls, vestibular multimodal processing, and multisensory integration decline in the elderly–Predictive role of the functional head impulse test. *Front. Neurol.* **13**, (2022).
19. A Ciorba et al; Genetics of presbycusis and presbystasis. International Journal of Immuno-pathology and Pharmacology. 2015.
20. Lisa Farrell, PT, PhD, AT,C; Clinical Faculty, Department of Physical Therapy, Nova Southeastern University, Fort Lauderdale, FL, available investibular.org/healthcare-directory.
21. Timothy C. Hain, MD; April 14, 2022
22. Cowand JL and others. Efficacy of vestibular rehabilitation. Otolaryngology Head&Neck surgery, 2007 118(1)49-54, 1998
23. Panagiotis V. Tsaklis et al; evaluate the effect of weight-shift training on functional balance, weight distribution, and postural control measures during standing and forward reach tasks in subjects with chronic stroke. Top Stroke Rehabilitation. 2012.
24. Tee LH, Chee NWC. Vestibular rehabilitation for the Dizzy Patient. Ann Acad Med Singapore 2005:34:289-94