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A COMPARATIVE STUDY BETWEEN OTAGO EXERCISE PROGRAM AND MULTISENSORY BALANCE EXERCISE IN BALANCING DISORDER

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ABSTRACT

Background: Balance disorder significantly impacts functional mobility and increases the risk of reducing balance, particularly in middle age and older adults. Rehabilitation strategies targeting functional mobility and postural control are essential in decreasing the risks. It's one of the neurological conditions. Objective of the study is to compare the effectiveness of OTAGO exercise program and Multisensory balance exercise in balancing disorder. **Method**: The patient was informed about the treatment. A written consent was obtained from the voluntary participation in this study. There were 30 patients with balancing disorder were selected based on the inclusion and exclusion criteria and they were divided into 2 groups, Group A and Group B. Group A was treated with OTAGO exercise program and Group B was treated with Multisensory balance. Exercise on balancing disorder. Fullerton Advanced Balance (FAB) scale and Tinetti Gait-Balance scale were used as outcomes measures. Each patient was given a physiotherapy program for 12 weeks duration. The measurements taken prior to treatment were compared with those recorded after 12 weeks of therapy. The study's findings indicated that both groups experienced significant improvement. **Result:** The findings of this study indicated that both groups experienced considerable improvement. The subject who participated in experimental Group A had shown good improvement on balance and functional mobility than the Group B. **Conclusion:** The study which was conducted for 12 weeks period of intervention showed that Group A of those who received OTAGO exercise program resulted in improvement on balance and enhance the functional mobility than the Group B who received Multisensory balance exercise.

Keywords: OTAGO exercise program, Multisensory balance exercise, Fullerton Advanced Balance scale, Tinetti Gait-Balance scale.

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INTRODUCTION

Balance states an individual ability to maintain their line of gravity (LOG) within their base of support (BOS). It can also be described as the ability to maintain equilibrium. The static and dynamic balance control ability can be negatively impacted by ageing, neurovascular issues, insufficient muscle strength, restricted range of motion and cognitive loss, which raises the fall risks and affected their ADL activities. Balance is one of the intricate functions of the human body that requires a variety of neuromuscular activities. Numerous sensory inputs from the vestibular, ocular and somato- sensory systems influence balance. The balancing disorder is the most common causes of falls in older adults and is often lead to injury, disability, loss of independence, and limitations in quality of life. Balancing disorder can stem from various causes, including inner ear problems, neurological conditions, and visual or skeletal issues. This disorder can lead to dizziness, vertigo, and general feeling of unsteadiness, impacting daily life and potentially increasing risk of falls; while others involve the brain or other systems that contribute to balance.

Common Causes of Balancing Disorder: **Labyrinthitis**: Inflammation of the inner ear, affecting both hearing balance. Vestibular neuritis: Inflammation of the vestibule-cochlear nerve, which transmits signals about balance. Benign paroxysmal positional vertigo: Vertigo triggered by changes in head position. Neurological conditions like Multiple sclerosis, stroke, Parkinson disease, Traumatic brain injury. Arthritis, acoustic neuroma, orthostatic hypotension, certain medications can contribute to balance disorder.

Balancing Disorder: it includes Dizziness, which is spinning sensation, lightheadedness, faintness, blurred vision, disorientation staggering while walking.

OTAGO Exercise Program: The Otago exercise program developed in New Zealand, this evidence- based program calls for PTs to assess the progress patients over the six months to one year. The Otago exercise consists of 17 strength and balance exercise and walking program, performed three times a week by the older adult in the home or outpatient or community setting. The rationale behind the exercise program is that while muscle strength, flexibility, balance reaction time are risk factors for balancing problems, they can easily be modified. The OEP has been validated and proven effective when delivered in both an individual or group format. Exercise can be done individually or in a group setting[3].

The program is most effective for middle and older adults. The physiotherapist assessed and prescribes the initial exercise three times per week over on 12 weeks of period. These exercises are completed over the time of 45 minutes. Every individual exercise has 10-repetition per session with 10 seconds of interval. Its participants may include the walking program. The benefits of OTAGO exercise are plentiful and improve balance, muscle strength, general fitness and general wellbeing. The OTAGO exercise program is a simple, effective, and fun way to improve balance and hopefully prevent falls[2,3].

Flexibility Exercise: Head movements, neck rotations, chin tuck, trunk movements, trunk rotations.

Strengthening Exercises: Front knee strengthening exercise, side hip strengthening exercise, back knee strengthening exercise, calf raises with and without support, toe raises with and without support, knee bends with and without support, sit to stand from chair (two hand assist, one hand assist, no hand assist).

Balance Exercise: Heel-toe stand with and without support, one leg- stand with and without support, side-way walking, backward walking with and without support, tandem walking with and without support, walking and turning (figure of 8 walking), tandem walking backwards, heel walking with and without support, toe walking with and without support, stair climbing [4].

Multisensory Balance Exercise: Multisensory exercises could lower the risk of fall and improve balance, enhance confidence level to improve the quality of life. Multisensory balance training involves using sensory inputs (visual, vestibular, somatosensory) to improve balance and postural control. This type of training can enhance balance, gait, and quality of life, especially for individuals with balance disorders. These exercises finished up to 30 minutes. Each exercise has 3- repetition with interval. The multisensory balance exercise mainly consists of balance exercise[5].

Multisensory Balance Exercise: Weight lifts on standing, forward reach, lateral reach, diagonal reach, perturbation in standing by therapist, weight shift in standing on foam roller & trampoline, single leg deadlift, tandem stance, walking in between obstacles, standing with eyes open and closed in firm & soft surfaces, sport marching, spin around, jump side to side, jump onto targets[6].

METHODOLOGY

The study was conducted at JKKMMRF College of Physiotherapy- Outpatient Department. The patient was informed about the whole procedure and treatment method. A written consent was obtained from their voluntary participation in this study. There were 30 patients with balancing disorder were selected based on the inclusion and exclusion criteria and they were divided into 2 Groups, Group A and Group B. Group A was treated with Otago exercise program and Group B was treated with Multisensory balance exercise on Balancing disorder measures. Fullerton advanced balance (FAB) scale and Tinetti Gait - Balance scale was used as outcome. Each patient was given a Physiotherapy program for 12-weeks duration. The pre and post treatment values were measured before and after 12 weeks for comparison.

Inclusion Criteria: Age group 50-70 years, Both gender (Male & Female), Neuromuscular conditions (Head injury, Parkinson's disease, Stroke, Multiple sclerosis) People who can willing to walk Decreased cognitive function

Exclusion Criteria: Comorbidities that affect walking or balance, Congenital abnormality Participants with psychological or psychosomatic disorder, History of knee surgery, Abnormally high blood pressure (systolic BP>140mm hg (or) diastolic, BP>90 mm hg), Participants who had recently surgery within the month, Spinal deformity, Knee instability Severe arthritis, Procedure and Protocols.

Group A: Group A was treated with Otago exercise program in balancing disorder

Procedure

Flexibility Exercise: Head movements, neck rotations, chin tuck, trunk movements, trunk rotations.

Strengthening Exercises: Front knee strengthening exercise, side hip strengthening exercise, back knee strengthening exercise, calf raises with and without support, toe raises with and without support, knee bends with and without support, sit to stand from chair (two hand assist, one hand assist,
no hand assist).

Balance Exercise: Heel-toe stand with and without support, one leg- stand with and without support, sideway walking, backward walking with and without support, tandem walking with and without support, walking and turning (figure of 8 walking), tandem walking backwards, heel walking with and without support, toe walking with and without support, stair climbing.

Duration: Three sessions per week over on 12 weeks on period. These exercises are completed over on 45 minutes. Each exercise is repeated at 10 times per session.

GROUP B

Group B was treated with Multisensory balance exercise in balancing disorder.

Procedure

Multisensory Balance Exercise: Weight lifts on standing, forward reach, lateral reach, diagonal reach, perturbation in standing by Descriptive statistics for Fullerton Advanced Balance Scale-Group A and Group B therapist, weight shift in standing on foam roller & trampoline, single leg deadlift, tandem stance, walking in between obstacles, standing with eyes open and closed in firm & soft surfaces, sport marching, spin around, jump side to side, jump onto targets, single-leg stand with eyes closed, walking lunges with eye focus shift, balance board squats, balance on foam with object tracking, tandem walk with head turns.

Duration: These exercises are completed over on 30 minutes. These exercises are repeated at 10 times per session.

RESULT ANDTABLES

GROUP	FAB	Mean	Standard Deviation	Paired 't' value
Group A	Pretest	22.65	0.82	16.32
	Posttest	32.06	0.82	
Group B	Pretest	23.47	0.0212	27.63
	Posttest	26.73	0.0212	

Table 1: Descriptive statistics for Fullerton Advanced Balance Scale-Group A and Group B

Descriptive statistic for Fullerton Advanced Balance scale in Group A shows that paired't' test values of pre vs post-test values of GroupAwas16.32at 0.05% level which was greater than tabulated 't' values 2.14. Group B shows that paired't' test values of pre vs post-test values of Group B was 27.63

At 0.05% level which was greater than tabulated 't' values 2.14. This showed like there in significant difference between pre vs post-test results of Group A and Group B for FAB. This exposed that there was significant reduction in post-test mean values in response to FAB in Group A and Group B.

FAB	Mean	Mean Difference	Standard Deviation	Un-Paired 't' value
Group A	5.59	0.18	0.8273	0.84
Group B	5.77		0.0212	

Table 2: FAB (Post test analysis)

The Unpaired 't'-value of 0.84 was greater than the tabulated Unpaired't'- value of 2.4 which showed that there was statistically significant differenceat 0.0001 level between Group A and Group B. The pre vs post-test mean of Group A was 5.59 and the pre vs post-test mean of Group B was 2.00 and the mean difference of Group A and Group B was 5.77 which showed that there was significant reduction in FAB score for Group A than Group B

GROUPS	Tinetti (G-B)	Mean	Standard Deviation	Paired 't value
Group A	Pretest	13.00	0.34	24.01
	Posttest	20.93	3.54	
Group B	Pretest	14.53	0.070	18.33
	Posttest	17.73	0.070	

Table 3: Descriptive statistics for TINETTIGAIT-Balances scale- Group A and B

Descriptive statistic for Tinetti Gait- Balance scale in Group A shows that paired 't' test values of pre vs post-test values of Group A was 24.01 at 0.05%level which was greater than tabulated 't' values 2.14. Group B shows that paired 't' test values of pre vs post-test values of Group B was 18.33 at 0.05% level which was greater than tabulated 't'values2.14.Thisshowedlikethereinsignificant difference between pre vs post test results of Group A and Group B for Tinetti G-B. This exposed that there was significant reduction in post –test mean values in response to TinettiG-B in Group A and Group B.

Tinetti (G- B)	Mean	Mean Difference	Standard Deviation	Unpaired 't' value
Group A	4.35	0.49	0.3465	5.42
Group B	3.86		0.4950	

Table 4: Tinetti Gait- Balance scale (Post test analysis)

The Unpaired 't'-value of 5.42 was greater than the tabulated paired 't'-value of 2.14 which showed that there was statistically significant difference at0.0001 level between Group A and Group B. The pre vs post -test mean of Group A was 4.35 and the pre vs post-test mean of Group B was 3.86 and the mean difference of Group A and Group B was 0.27 which showed that there was significant reduction in Tinetti G-B for Group A than Group B.

DISCUSSION

Theaimofthestudywastocomparetheeffectivenessof Otagoexerciseprogramand Multisensorybalanceexerciseinbalancingdisorder.The Fullerton Advanced Balance scale and Tinetti Gait-Balance scale score was taken as the parameter of quality the effectiveness of the treatment Otago exercise program and Multisensory balance exercise.

The study sample comprised of 30 patients of which 15 group A and B. The mean age of subjects was 50 to 70 years. Among 30 subjects, 15 were treatment with OTAGO exercise program and 15 were treated with Multi sensory balance exercise.

The pre and posttest values were assessed by FAB and Tinetti G-B scale in Group A and Group B. The paired t-test value of FAB 16.32 and 27.63 and Tinetti Gait G-B score is 24.01 and 18.33 respectively. The unpaired t test values for FAB 0.84 and Tinetti G-B is 5.42respectively.

By analyzing the values of paired and unpaired t test the result showed statically significant results are comparing with the table value with 0.05 level of significance of both groups between pretest and posttest results. The result obtained from statically significant difference between two groups in showing improvement in balance disorder. The improving balance and functional activity were seen in all subjects received irrespective of the technique OTAGO exercise program and Multisensory balance exercise[7].

By the result alternate hypothesis accepted and also there is significant difference between OTAGO exercise program and Multisensory balance exercise for the improvement in balance and functional activity. By analyzing the mean and standard deviation values the result showed the subjects who received OTAGO exercise program is found to be more effective in improving balance and functional activity then Multisensory balance exercise.

While consideration of improving quality of life patients with balancing disorder patients the study shows there was effective and improvement. A study conducted by Yang Y, on response to OTAGO exercise program in risk of falls patients to improve balance· The result of the study supports the present study where the participants were improved in terms of BBS. A study conducted by Anabela Correia Martins, validate the reflect the Extent of balancing disorder is allowing better assessment of individual variations and enhancing research outcomes[8].

Physiological effects of OTAGO exercise program

Improved Balance: Multiple meta-analyses confirm that OEP participants show significant improvements in static and dynamic balance relative to controls. Improving balance is essential for lowering the risk of falls, particularly in frail elderly individuals, OEP. Increased lower limb strength is consistently associated with substantial gains in lower body strength. The strength gains are most marked in the lower extremities (e.g., quadriceps, hip abductors), as measured by tests like the 10-repetition maximum (10RM) and chair stand tests. These improvements substantially contribute to participants' ability to perform activities of daily living and falls risk, Enhanced mobility and gait: The program produces moderate, statistically significant enhancements in functional mobility (e.g., faster timed up-and-go tests, improved walking speed and step quality). Greater independence and confidence during daily activities are supported by enhanced mobility.

Physiological effects of Multi sensory balance exercise:

Balance Performance and Confidence**:** Eight to twelve weeks of multi sensory exercises (such as standing on unstable surfaces with eyes open / closed, or movement tasks with altered visual /vestibular input) produce significant gains in both static and dynamic balance. Clinical Measures such as the Berg Balance Scale and Activity-Specific Balance Confidence Scale consistently show improved scores after intervention, reflecting better physical performance and increased confidence in balance abilities. Reduction in Fall Improved MSI and strength lead to a measurable decrease in fall incidence and fear of falling, which is particularly pronounced in older adults and clinical populations such as those with diabetic neuropathy[9].

Lower Extremity strength and functional Improvement:

Multisensory training often results in increased muscle strength (especially in the lower limbs), improved joint mobility, and better body awareness (proprioception) due to more efficient sensory-motor integration[10].

CONCLUSION

The study which was conducted for 12 weeks period of intervention, based on statistical analysis the results of this study showed that there was significant improvement in both Groups. The result also showed that the subject who participated in experimental Otago exercise program had shown good improvement balance and functional ability than in Multi sensory balance exercise.

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REFERENCES

1. Riley PO, Mann RW, Hodge WA. Modelling of the biomechanics ofposture and balance.*J Biomech*. 1990.
2. SuterF, AvaiA, Fusco U, Gerund ini M, CaprioliS,MaggioloF.Teicoplaninversuscefa mandoleinthepreventionofinfectionintotalhi preplacement.Eur *J ClinMicrobiol Infect Dis*.1994.
3. SalzmanB.Gaitandbalancedisordersinoldera dults.*AmFamPhysician*.2010; 82(1):61-68.
4. Yuxiao Li, Rebecca M Smith, Susan L Whitney, Barry M Seemungal, Toby J Ellmers, Association between dizziness and future falls and fall-relatedinjuriesinolderadults:asystematicrevi ewandmeta-analysis, *Ageand Ageing*,Volume53,Issue9,September2024.
5. Han J, Wang H, Ding Y, Li Q, Zhai H, He S. Effect of Otago exercise onfear of falling in older adults: a systematic review and meta-analysis.BMCSports Sci MedRehabil.2024Jun 14.
6. MgbeojedoUG,AkosileCO,OkoyeEC,AniKU,E kechukwuEN,Okezue OC, John JN, Nwobodo N. Effects of Otago Exercise Programon Physical and Psychosocial Functions Among Community-DwellingandInstitutionalizedOlderAdults:AS copingReview.Inquiry.2023Jan.
7. Zhang SL, Liu D, Yu DZ, et al. Multisensory Exercise Improves Balancein People with Balance Disorders: A Systematic Review. *Curr Med Sci*.2021.
8. Yang Y, Wang K, iu H, etal. The impact o f Otago exercise programme on the

prevention off all sin older adult: A systematic review. Front Public Health.2022; Published 2022Oct 20.

9. Kong, Lingyu PhDa; Zhang, Xinwen BMb; Zh Xinrui . Dc; Meng, Lingyue PhDa; Zhang, Qiuxia PhD a, Effects of Otago Exercise Program on postural control ability in elders living in the nursing home: A systematic review and meta-analysis. Medicine 102(11): p e33300, March17, 2023.
10. Zhang SL, Liu D, Yu DZ, et al. Multisensory Exercise Improves Balancein People with Balance Disorders: A Systematic Review. *Curr Med Sci*.2021.

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