Effectiveness Of Swiss Ball Training Exercises and Trunk Training Exercises to Improve Postural Instability in Subjects with Parkinson's Disease

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ABSTRACT

BACKGROUND & OBJECTIVE: Parkinson's disease is a neuro degenerative disorder due to the depletion of dopamine in the basal ganglia with progressive reduction in the speed and amplitude of movements.It leads to significant impairment in activities of daily living (ADL) and motor function as the disease progresses. It is commonly associated with depression, anxiety and reduced quality of life. Lack of balance and Postural Instability will affect the activities of daily living. Swiss Ball Exercises and Trunk Training Exercises has been shown to improve balance and Postural Instability. Hence the study.

METHODS: Quasi experimental study design. In this study, there were 60subjects with an average age of over 50 years, a clinical diagnosis of Parkinson's disease, and who were divided into two groups at randomly. The subjects in Group A (n =30) received, Swiss Ball Training Exercises while the subjects in Group B (n = 30) received Trunk Training Exercises. Intervention was given to participants thrice a week for twelve weeks. The REP (MDS-UPRDS) and the BBS were used to assess the intervention's effectiveness.

RESULTS: Independent 't' test was used to compare the mean significance difference between continuous variables. Paired 't' test was used to assess the statistical significance difference between pre and post test scores. Statistical analysis of this data revealed that, both groups significantly improved in both parameters when compared within groups, but when compared between groups, the Swiss Ball Training Exercise group improved better than the Trunk Training Exercises group.

CONCLUSION: The present study concludes both Swiss Ball Training exercise group and Trunk Training exercise group showed significant improvement in postural instability in subjects with Parkinson's Disease. However Swiss Ball Training exercise group is more effective when compared to Trunk Training exercise group. Hence treatment intervention may be incorporated in management of Parkinson's Disease.

Key words:Parkinson's Disease,Swiss Ball Training Exercises,Trunk Training exs, BBS

INTRODUCTION

Parkinson's disease is a neuro degenerative disorder due to the depletion of dopamine in the basal ganglia with progressive reduction in the speed and amplitude of movements.[1]It leads to significant impairment in activities of daily living (ADL) and motor function as the disease progresses. It is commonly associated with depression, anxiety and reduced quality of life.[2]

A total of 588 newly diagnosed cases of Parkinson's disease were identified, which gave an overall annualized age and gender adjusted incidence rate of 13.4 per 1000,000. Parkinson's disease that effects more than 2% of the population older than 65years of age. Average age of Parkinson's disease inset is approximately 50-60years.[3]

Prospective studies indicate that the incidence of falls are much greater for the people with Parkinson's disease than for age matched controls, with up to 68% of people with Parkinson's disease falling at least once each year and upto 50% of these individual experiencing recurrent falls. The increased fall risk in this population is compounded by an increased risk of injury, as differences in the postural response of the people with Parkinson's disease place them at a greater risk of sustaining a significant fall-related injuries often lead to a fear of falling, reduced mobility, poorer muscle strength and loss of independence, all of which ultimately influence an individual's mortality, morbidity and quality of life.[4]

Risk factors includes in advancing Age- the risk continues to increase the older one gets. Some researchers assume that people with Parkinson's have neural damage from genetic or environmental factors that get worse as they age, in sex- Males are more likely to get Parkinson's than females, it has been theorised that oestrogen may have neuro-protective effects, in the case of genetic predisposition, a gene predisposing someone to Parkinson's may be linked to the X chromosome, declining oestrogen levels- in Post menopausal who do not use hormone replacement therapy are at greater risk, as are those who have had hysterectomies, Agricultural work- exposure to an environmental toxin such as a pesticide or herbicide puts you at greater risk Some of these toxins inhibit dopamine production and promote free radical damage. Those involved in farming and are therefore exposed to such toxins

have a greater prevalence of Parkinson's symptoms, Genetic factors- A Mayo Clinic led international study revealed that the gene alpha-synuclein may play a role in the likelihood of developing the disease. Studies showed that individuals with a more active gene had a 1.5 times greater risk of developing Parkinson's symptoms, low levels of vitamin B-folate, head traumas.[5]

Pathologically, PD is defined by loss of dopaminergic neurons in the substantia nigra pars compacta (SN) located in the midbrain and associated with Lewy bodies, which are cytoplasmic inclusions that include insoluble alpha-synuclein aggregates.[6]

However, PD is characterized by more widespread pathology in other brain regions and involves non-dopaminergic neurons as well. The clinical diagnosis of PD is based primarily on motor features, such as a slowly progressive asymmetric resting tremor, cogwheel rigidity and bradykinesia, although non-motor features, which include anosmia, constipation, depression and REM sleep behaviour disorder, can develop years before motor deficits. During later stages of the disease, additional non-motor features, such as autonomic dysfunction, pain and cognitive decline, can appear.[7]

With progression of the disease patients may demonstrate postural instability, gait dysfunction, difficulty managing functional tasks, such as obstacle crossing, participants with PD usually step their leading foot closer to the obstacle and subsequent falls. These individuals also adopt a conservative strategy during obstacle crossing and maintain their Center of mass (COM) more medially to their stance leg. This alteration reduces the distance between the Center of pressure (COP) and COM throughout the obstacle crossing task compared with normal older adults.[8]

The rehabilitation of body balance, gait and consequently the functional mobility of patients with PD is fundamental, and interventions using conventional exercises are considered important tools to achieve these goals.[9] So evidence based Swiss ball Training Exercises and Trunk Training Exercises have the potential to improve Postural instability and also to maintain equillibrium under dynamic and static conditions such as preparation of movements, perturbations and quiet stance.[9]

Swiss Ball is widely used for recreational & rehabilitation training programmes. As the liable surface of the Swiss ball provides greater challenge for the dynamic balance, co-ordination & trunk control. Upper body strength exercises on a Swiss ball, stress the spinal stabilizing musculature to achieve beneficial endurance training effects.[10] Stability is brought by the co-activation of trunk muscles therefore, endurance training. Swiss ball exercises facilitate postural control, trunk control, sitting & dynamic balance control by reducing impaired balance & co-ordination by maintaining interaction between nervous system, musculoskeletal system & contextual effects.[11]

Trunk Training Exercises mainly focus on improving trunk muscle strength and endurance. Specifically these exercises focusing on improving trunk mobility, exercises that target muscular strength and endurance, tasks that aim to develop balance under challenging situations and ambulating over different terrians.[12]

Many researchers have conducted study on Swiss Ball Training exercises and Trunk Training Exercises to improve balance and postural instability in other neurological conditions, but less work done on the effects of Swiss Ball Training exercises and Trunk Training Exercises on treating Postural Instability in Parkinson's subjects.so the aim of this study was to compare the effects of Swiss Ball Training Exercises and Trunk Training Exercises on Postural Instability.

Thus the aim of the study was to evaluate the effects of Swiss Ball Training Exercises and Trunk Training Exercises to improve Postural Instability in subjects with Parkinson's Disease.

MATERIALS AND METHODS

Study Design: Quasi-experimental study design.

Ethical Clearance And Informed Consent: The study protocol was approved by the Ethical Committee of GSL Medical College & General Hospital, the investigator explained the purpose of the study and given the patient information sheet. The participants were requested to provide their consent to participate in the study. All the participants signed the informed consent and the rights of the included participants have been secured.

Study Population: Subjects clinically diagnosed as Parkinson's disease by a Neuro Physician.

Study Setting: The study was conducted at Department of Physiotherapy, GSL general hospital, Rajamahendravaram, Andhra Pradesh, India.

Study Duration: The study was conducted for a period of one year

Intervention Duration: 12 weeks

Treatment Duration: 1 hour per session, 3 sessions per week for 12 weeks.

Study Sampling Method: Systematic random sampling method

Sample Size: A total of 67 subjects were screened in that 60 subjects, both men and women with Parkinson's disease who are willing to participate in the study were included in this study, all the recruited participants were explained about the study. After obtaining informed consent form and meeting the criteria, total 60 subjects were allocated into two groups equally by systematic random sampling method.

Group A – Swiss Ball Training Exercises (30 subjects)

GROUPS	NO. OF SUBJECTS	TREATMENT
GROUP A	30	SWISS BALL TRAINING PROTOCOL

GROUP B	30	TRUNK TRAINING PROTOCOL

Group B - Trunk Training Exercises (30 subjects)

MATERIALS USED

- Swiss ball
- Slope
- Stool
- Mat
- Objects to do reach activities
- Examination couch
- Data collection forms**.**

CRITERIA FOR SAMPLE SELECTION

INCLUSION CRITERIA

- Subjects with age groups of 55 years-65 years who are in acute stage of PD.
- Subjects who have difficulty with bodily movements.
- Subjects who have problem with gait (slow shuffling gait).
- Subjects having problem with their postural instability.

EXCLUSION CRITERIA

- Subjects with previous histories of uncontrolled hypertension.
- Subjects using Psychotropic medication.
- Subjects with any serious neck, shoulder, or back injuries including spinal fusion.
- Subjects who received deep brain stimulation surgery to manage their symptoms within one year.
- Subjects having any significant limitations due to osteoporosis.
- Subjects with any orthopedic surgery in previous year

STUDY TOOLS AND OUTCOME MEASURES

- **Retropulsion Test (REP) (MDS-UPRDS):** This tool was used to measure the postural instability.
- **Berg Balance Scale (BBS) :** This tool was used to measure the balance.

THE RETROPULSION TEST [13] : The Retropulsion test is widely regarded as the gold standard to evaluate postural instability and therefore a key component of the neurological examination in PD. Here we evaluate the merits of this test by discussing three common variants : [1] the pull test as described in the MDS-UPDRS scale, [2] using an unexpected shoulder pull, without prior warning,[3] the push-and-release test. All variants are a quick method to index the degree of postural instability, but the outcome can vary considerably due to the variability in test execution and interpretation. This partially explains why the retropulsion test fails to predict future falls.

0-Normal.
1-retropulsion, but recovers unaided.
2-absence of postural response, would fall if not caught by the examiner.
3-very unstable, tends to lose spontaneously.
4-unable to stand without assistance.

BERG BALANCE SCALE (BBS)[14] : This tool is used to objectively determine a patient's ability (or inability) to safely balance during a series of predetermined tasks. It is a 14 item list with each item consisting of a five-point ordinal scale ranging from 0 to 4, with 0 indicating the lowest level of function and 4 the highest level of function and takes approximately 20 minutes to complete. It does not include the assessment of gait.

General instructions for completing the scale:

Please document each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item. In most items, the subject is asked to maintain a given position for a specific time. Progressively more points are deducted if:

- The time or distance requirements are not met.
- The subject's performance warrants supervision.
- The subject touches an external support or receives assistance from the examiner.

The subject should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring. Equipment required for testing is a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5, and 10 inches. Chairs used during testing should be a reasonable height. Either a step or a stool of average step height may be used for item # 12.

- A score of 56 indicates functional balance.
- A score of < 45 indicates individuals may be at greater risk of falling.

INTERVENTIONS

This is a 12week study which includes Swiss Ball Training Exercises for Group-A and Trunk Training Exercises for Group-B. The outcomes were measured by the Retropulsion Test (REP)(MDS-UPRDS) and the Berg Balance Scale (BBS) for Postural Instability.

All the subjects who were eligible for the criteria were randomly allocated into Group A and Group B.

GROUP A

SWISS BALL TRAINING EXERCISES[15]

Swiss Ball training protocols included: Swiss ball training includes supine exercises, sitting exercises, standing exercises, Prone exercises, Trunk rotations, Swiss ball core stability enhancing exercises, Swiss ball balance and co-ordination exercises. Conventional physiotherapy interventions included Stretching & strengthening exercises, PNF techniques, icing, passive movements & gait training.

Supine exercises: Bridging (hamstring curl) · Lower trunk rotation Bridging: Patient is asked to lie down on mat in supine position. With hip flexed and knee extended, patient's legs are kept on Swiss ball. Patient is asked to lift off the pelvis with the Swiss ball placed under knees, then slowly and progressively the ball is placed under the foot, in order to increase the ability to maintain balance. The position is maintained for 10sec.

Lower trunk rotations: In supine lying, with both the lower limbs supported on the Swiss Ball. Then in crook lying position patient is asked to move the knees and rotate the pelvis on either sides. Slowly the position of Swiss ball is shifted from knees to foot end in order to gain more control

Prone exercises:

- Swiss Ball opposite arm and leg lift ·
- Back extension (abdomen supported on ball) or T-raise

Swiss Ball opposite arm and leg lift: In prone position, patient lies down on belly-side, so that the navel is over the center of Swiss ball and trunk is supported. Initially both hands and feet are supported on floor. Then slowly patient lifts his alternate one arm and one leg (right arm and left leg) and maintains the position for 10 sec.

Back extension: In prone position, patient lies on the ball with umbilicus over the center of Swiss ball. Initially the upper body was relaxed and both feet were in contact with the floor. Then, both hands were kept behind the head with both feet on ground and patient was asked to lift the upper body up and extend his back. The position was maintained progressively for 5-10 sec

Sitting exercises: ·

- Trunk flexion and extension ·
- Static sitting balance ·
- Swiss ball rocking ·
- Trunk lateral flexion ·
- Front and back bending ·
- Forward reach ·
- Lateral reach

Trunk flexion & extension: In sitting position on Swiss Ball, initially patient is asked to flex and extend the trunk without moving the forwards or backwards. Then patient is asked to flex and extend his lumbar spine. slight rotations of the trunk also occur with flexion and extension

Static sitting balance: The patient is told to sit firm on the Swiss Ball and asked to maintain a correct back posture and balance with both the feet on the ground. Position is maintained for 10 sec.

Swiss Ball rocking: Patient is made to sit on the Swiss Ball and asked to rock (bounce) the pelvis and hips from side to side, front to back, up & down or in circular direction.

Trunk flexion: In sitting position on Swiss ball, patient is asked to laterally flex his trunk. Upper and lower trunk lateral flexion initiates with the movement of shoulder and pelvis girdle.

Front and back bending: In sitting position on Swiss Ball, with clasped hands position the patient is asked to bend the trunk forward and backward.

Forward reach: In sitting position on Swiss Ball, patient is asked to reach the object in forward direction. So when the patient reaches forward towards the object, rotations also occur with the trunk flexion. Lateral reach: In sitting position on Swiss ball, patient is asked to reach the object by flexing his trunk laterally

Standing exercises: Wall squatting exercises (Swiss Ball squats) with knees in extension

Wall squat with knees bending

Swiss Ball wall squats with knee extension: patient is asked to Stand and hold the Swiss Ball behind the back, so that the Swiss Ball should get pressed between the wall and patient's back. Keep the little distance between both the feets so that body can maintain balance. Maintain the position for 10sec. Swiss ball wall squats with knee bending: Initially, Patient is asked to stand and hold the swiss ball behind his back. Then patient is asked to slowly bend his knees with the ball supported where the ball is pinned between wall and patient's back. Maintain the position with bent knees for 10 sec.

Cool down: 5 Minutes walking, Light stretching - hip extensor and hip flexor stretch, Gastrocnemius and soleus stretch, core muscle stretch, Paraspinal stretch (5 repetitions and 10 seconds hold). The Swiss Ball training were performed with 10 repetitions, 3 sets of each segment, for 45 min. session.

Fig no :1 Subject performing bridging on Swiss Ball in supine position

Fig no :2 Subject performing lower trunk rotation to left on Swiss Ball

Fig no:3 Subject performing opposite arm and leg lift in prone position on Swiss Ball

Fig no 4: Subject performing back extension in prone position on Swiss Ball

Fig no:5 Subject performing trunk flexion in sitting position on Swiss Ball

Fig no:6 Subject performing Swiss Ball rocking to right side

Fig no:7 Therapist offering assistance to subject to perform trunk lateral flexion to left on Swiss Ball.

Fig no:8 Subject performing forward bending on Swiss Ball

Fig no:9 Subject performing forward reach by sitting on Swiss Ball

Fig no: 10 Subject performing lateral reach by sitting on Swiss Ball

Fig no:11 Subject performing wall squats with knee extension by using a Swiss Ball

Fig no:12 Subject performing wall squats with knee bending by using Swiss Ball

GROUP B

TRUNK TRAINING EXERCISES[16]

The exercise programme primarily consists of exercises that have previously been used in two different exercise-based interventions involving older adults and people with PD, that focused on improving trunk muscle strength and endurance. Importantly, the programme was designed to conform to the current recommendations for best clinical practice with respect to the implementation of exercise-based interventions for improving postural stability. Specifically, the programme includes movements focusing on improving trunk mobility, exercises that target muscular strength and endurance, tasks that aim to develop balance under challenging situations and ambulating over different terrains in a real-world environment.

TRUNK MOBILITY WARM UP EXERCISES

TASK	MOVEMENT	SETS	REPETITIONS
WARM UP	Small arm circles	1	10 forward and backward
	Large arm circles	1	10 forward and backward
	Lateral bends	1	10 to the left and right
	Torso rotations	1	10 to the left and right
	Torso rotations with high reaching	1	10 reaching up to the left down to the right
	Torso rotation with low reaching	1	10 reaching up to the right, down to the left

During dynamic tasks, the coordination of pelvic and trunk movements is vital to maintaining stability. However, the symptoms of axial rigidity that are often present in people with PD lead to an increase in trunk stiffness and a tendency for en-bloc movements of the upper body segment.10 The warm-up exercises seek to prepare the patients for the more physically challenging aspects of the session, while also promoting increased pelvic and trunk mobility.

Task	**Movement**	**Sets**	**Time progression**	**Difficulty progression**
Exercise	Back bridging	3	Increased from a 5 to 20s hold time in 5s increment	Seated – double leg pelvic bridge
	Pelvic rotations	3	Increased from a 5 to 20s hold time in 5s increment	Pelvic rotations to right and to the left
	Front bridging	3	Increased from a 5 to 20s hold time in 5s increment	On floor with knees on ground On floor with knees off ground
	Bird dog	3	Increased from a 5 to	Single arm

			20s hold time in 5s increment	Single leg alternate arm and leg

dysfunction of the trunk muscles has been shown to be predictive of the excessive head, trunk, and pelvis motion linked to falls in people with PD, the exercises were chosen to improve the strength and endurance of deeper trunk muscles. Specifically, these exercises targeted the transversus abdominus, the internal obliques, and the multifidus, which are collectively known to be important for stabilizing the spine during static and dynamic activities.

Active cool down	Hamstring stretch	2	20s hold per side
	Quadriceps stretch	2	20s hold per side
	Gastrocnemius stretch	2	20s hold per side
	Triceps stretch	2	20s hold per side
	Pectoral stretch	2	20s hold per side
	Walking	1	8-10 min involving stair ascent/descent and walking over surfaces of varying incline/decline and density in an outdoor environment

The active cooldown was incorporated to allow participants to actively recover from the more physically exerting component of the program. The short walking component incorporated into this phase sought to improve the patients' mobility and their capacity to safely navigate real-world environments. Although systematic evidence suggests that walking programs may not be effective at reducing falls risk, they are known to have important benefits for general health and physical function.[15]

D

Fig:13 Subject performing small arm circles forward

Fig no: 14 subject performing large arm circles forward

Fig no:15 subjects performing lateral bends to right

Fig no:16 subject performing torso rotation to right

Fig no:17 subject performing back bridging

Fig no:18 subject performing pelvic rotations to left

Fig no: 19 therapist offering assistance to subject to perform front bridging

Fig no:20 subject performing bird dog with single arm

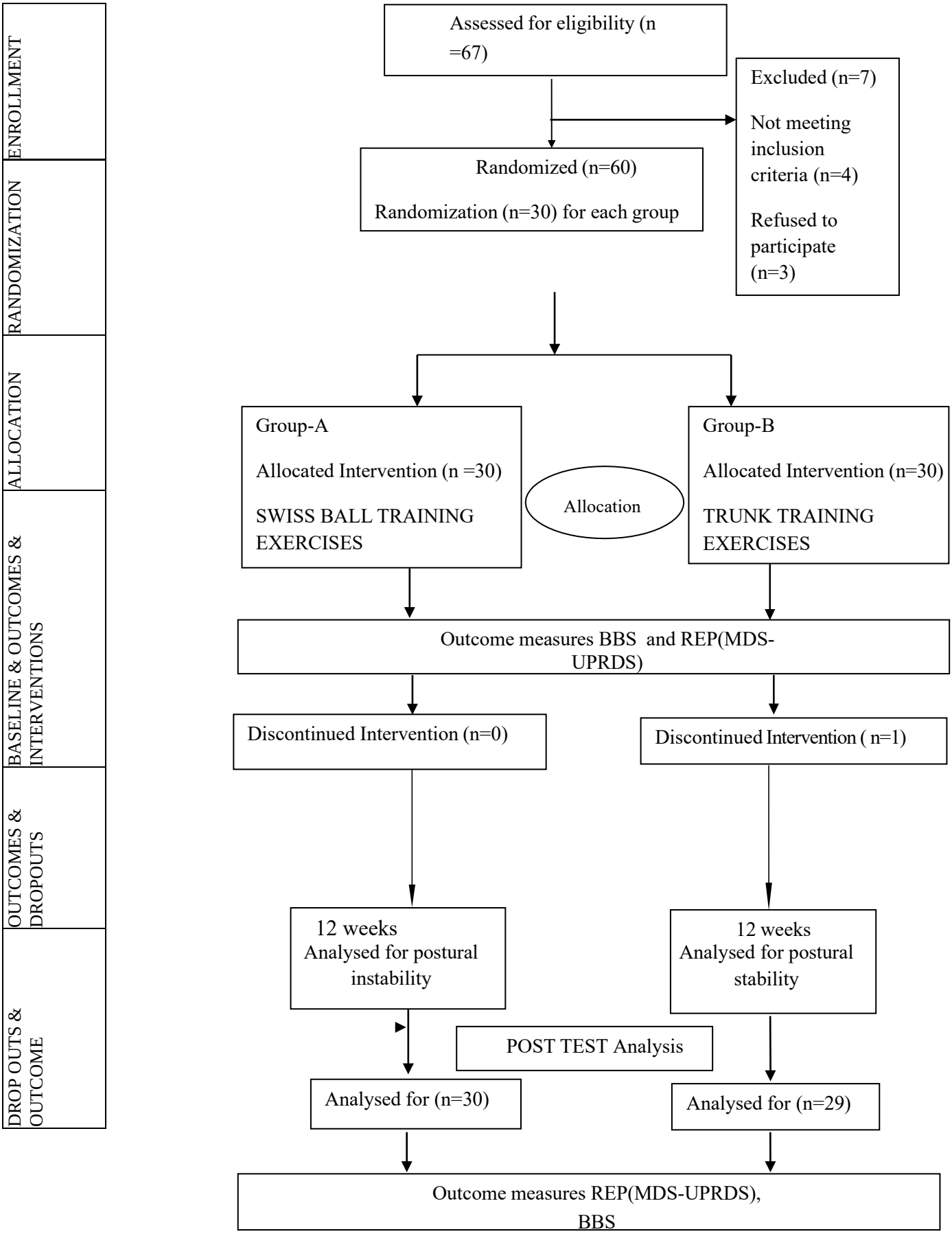
Fig no:21 therapist offering assistance to subject performing bird dog with single leg

Fig no: 22 therapist offering assistance to subject to perform bird dog with alternate leg and arm

Fig no: 23 subject walking on incline surface

Fig no:24 subject walking on decline surface

FLOW CHART


ENROLLMENT
RANDOMIZATION
ALLOCATION
BASELINE & OUTCOMES & INTERVENTIONS
OUTCOMES & DROPOUTS
DROP OUTS & OUTCOME
Assessed for eligibility (n =67)
Excluded (n=7)
Not meeting inclusion criteria (n=4)
Refused to participate (n=3)
Randomized (n=60)
Randomization (n=30) for each group
Group-A
Allocated Intervention (n =30)
SWISS BALL TRAINING EXERCISES
Allocation
Group-B
Allocated Intervention (n=30)
TRUNK TRAINING EXERCISES
Outcome measures BBS and REP(MDS-UPRDS)
Discontinued Intervention (n=0)
Discontinued Intervention (n=1)
12 weeks
Analysed for postural instability
12 weeks
Analysed for postural stability
POST TEST Analysis
Analysed for (n=30)
Analysed for (n=29)
Outcome measures REP(MDS-UPRDS), BBS

STATISTICAL ANALYSIS

All Statistical analysis was done by using SPSS software version 21.0 and Microsoft excel-2007. Descriptive data was presented in the form of mean +/- standard deviation and mean difference percentages were calculated and presented.

Within the groups: Paired student "t" test was performed to assess the statistical difference within the groups for postural instability (BBS and REP) from pre-test and post-test values.

Between the groups: Independent student "t" test was performed to assess the statistically significant difference in mean value between the groups for Berg Balance Scale and Retropulsion test (MDS-UPRDS) for postural instability.

For all statistical analysis, $p \leq 0.05$ will be considered as statistically significant.

RESULTS

The results of this study were analysed in terms of postural instability on Berg Balance Scale and Retropulsion Test (MDS-UPRDS SCALE) The consort flow chart of the study showed the study organization in terms of subjects screening, random allocation and analysis following the intervention.

Total 67 subjects with Parkinson's disease were screened for eligibility were included in the study trail. Out of which 60 subjects who met inclusion criteria have undergone baseline assessment and included subjects were randomized into two equal groups consisting 30 in each group. By the end of the treatment 59 subjects completed 12 weeks treatment session while one subject dropped out of the study without completing treatment duration.

Comparison was done both within the group as well as in between the two groups. So as to evaluate the intra group and inter group effectiveness of Swiss Ball Training Exercises and Trunk Training Exercises which are under considerations in the present study.

ANALYSIS OF MEAN SCORE OF REP(MDS-UPRDS) WITHIN GROUP A

GROUP A		MEAN	Std. Deviation	P VALUE	INFERENCE
REP	PRE TEST	2.533	.5074	0.000*	Highly Significant
	POST TEST	1.400	.4983		

TABLE -1

ANALYSIS OF MEAN SCORE OF REP(MDS-UPRDS) WITHIN GROUP B

GROUP B		MEAN	Std. Deviation	P VALUE	INFERENCE
REP	PRE TEST	2.500	.5085	0.000*	Highly Significant
	POST TEST	1.700	.4661		

TABLE-2

COMPARISON OF MEAN SCORE OF REP(MDS-UPRDS) IN BETWEEN THE GROUPS AT BASELINE (PRE-TEST)

REP		MEAN	Std. Deviation	P VALUE	INFERENCE
PRE TEST	GROUP A	2.533	.5074	0.8002	Insignificant
	GROUP B	2.500	.5085		

TABLE -3

REP		MEAN	Std. Deviation	P VALUE	INFERENCE
POST TEST	GROUP A	1.400	.4983	.0192	Significant
	GROUP B	1.700	.4661		

COMPARISON OF MEAN SCORE OF REP(MDS-UPRDS) IN BETWEEN THE GROUPS (POST-TEST)

TABLE-4
ANALYSIS OF MEAN SCORE OF BBS WITHIN GROUP A

GROUP A		Mean	Std. Deviation	PVALUE	INFERENCE
BBS	PRE TEST	39.100	2.2183	0.000*	Highly significant
	POST TEST	49.300	1.9853		

TABLE-5
ANALYSIS OF MEAN SCORE OF BBS WITHIN GROUP B

GROUP B		Mean	Std. Deviation	P VALUE	INFERENCE
BBS	PRE TEST	38.233	2.3589	0.0001	Significant
	POST TEST	44.300	2.0869		

TABLE-6
COMPARISION OF MEAN SCORE OF BBS (PRE-TEST) IN BETWEEN THE GROUPS AT BASELINE

BBS		MEAN	Std. Deviation	P VALUE	INFERENCE
PRE TEST	GROUP A	39.100	2.2183	0.148	Insignificant
	GROUP B	38.233	2.3589		

TABLE-7
COMPARISON OF MEAN SCORE OF BBS (POST-TEST) IN BETWEEN THE GROUPS

BBS		Mean	Std. Deviation	P VALUE	INFERENCE
POST-TEST	GROUP A	49.300	1.9853	0.0001	Significant
	GROUP B	44.300	2.0869		

TABLE-8

DISCUSSION

The aim of our present study was to evaluate the effectiveness of Swiss Ball Training Exercises and Trunk Training Exercises to improve Postural Instability in subjects with Parkinson's Disease. In this study the subjects were assessed for Postural Instability. The following outcome measures Retropulsion Test and Berg Balance Balance Scale was used to assess the Postural Instability. The results showed significant improvement in both outcome measures, retropulsion test and Berg Balance Scale in both interventions. The two interventions were similarly effective in improving balance and Postural Instability

This study supports the previous study of Carla Silva-Batista, Daniel M.Corcos, Helcio Kanegusuku et al[17] "balance and fear of falling in subjects with Parkinson's disease is improved after exercises with motor complexity.

Several studies have reported positive effects on Swiss Ball Training, but there were limited studies on exploring the effect of Swiss Ball on Postural Instability and fear of falls in Parkinson's patients. Subjects were assessed for Postural Instability at baseline and the end of intervention using Retropulsion Test (MDS-UPRDS SCALE) and Berg Balance Scale. There are no drop outs in group A(Swiss Ball Training Exercises) in group B(Trunk Training Exercises) there is one drop out of a women due to post-menopausal irritation she discontinued in Trunk Training Protocol.

In group-A there is a statistically more significant improvement in Retropulsion Test (MDS-UPRDS SCALE) ($p<0.0001$) and in BBS scale($p<0.0001$). According to Riddhi H. et al[18], Jayshree M. Sutaria[19] Swiss Ball Training improves Postural Stability. The mechanism by Swiss Ball increases kinaesthetic awareness because of the unstable nature of the ball, the user is forced to be intrinsically aware of the positioning of their body in space. The unstable nature of the ball forces the user to make constant weight shifts while on the ball, to find their balance points, various stabiliser muscle groups are also challenged while exercising.[20]

The potential activation of trunk musculature is better when the exercises are performed on a physio ball rather than when they are performed on a plinth, since the movement of a ball beneath the participants provides a postural perturbation to which the muscles

respond in order to maintain the desired posture[21]

Balance is controlled by three systems: Sensory, motor, and central processing. The central nervous system integrates sensory inputs and generates the motor commands which control the position of the body both at the station and as it moves within its environment. An impairment in any of these systems can result in a deficit in balance control. Sensory inputs related to balance will reach the central nervous system by the visual, vestibular, and proprioceptive apparatus. The vestibular apparatus plays a vital role in providing information about the position and movements of the head. Like a vision, vestibular function also deteriorates with normal aging. Proprioceptive acuity declines with normal aging. Muscle spindles, Golgi tendon organs, and joint capsule mechanoreceptors provide information about joint position and movement. Specific pathologies interfere with proprioception, which include peripheral neuropathy and degenerative joint disease[22]

In group-B there is statistical reduction in REP(MDS-UPRDS) ($P<0.0003$) Scores and BBS($P<0.0003$) scores, but within group there is statistical significance in group B. Trunk Training Exercises in the management of postural Instability was effective in previous studies by ryan p hubble et.al[23]geraldine A Naughton et.al[24] peter A silburn et.al[25.] In this programme During dynamic tasks, the coordination of pelvic and trunk movements is vital to maintaining stability. However, the symptoms of axial rigidity that are often present in people with PD lead to an increase in trunk stiffness and a tendency for en-bloc movements of the upper body segment. The warm-up exercises seek to prepare the patients for the more physically challenging aspects of the session, while also promoting increased pelvic and trunk mobility. The dysfunction of the trunk muscles has been shown to be predictive of the excessive head, trunk, and pelvis motion linked to falls in people with PD, the exercises were chosen to improve the strength and endurance of deeper trunk muscles.[26]

Specifically, these exercises targeted the transversus abdominus, the internal obliques, and the multifidus, which are collectively known to be important for stabilizing the spine during static and dynamic activities.[27] The active cooldown was incorporated to allow participants to actively recover from the more physically exerting component of the program. The short walking component incorporated into this phase sought to improve the patients' mobility and their capacity to safely navigate real-world environments. Although systematic evidence suggests that walking programs may not be effective at reducing falls risk, they are known to have important benefits for general health and physical function.[28] Flexed truncal postures have been shown to be associated with poorer balance and mobility in people with PD.[29] As such, it seems reasonable to suggest that by targeting an improvement in trunk mobility and trunk muscle strength and endurance via the exercise-based intervention, it was possible to reduce this impairment and improve medial-lateral balance control. However, given that these improvements were evident only during the most challenging balance task, it seems that subtle changes in balance may not be easily detected when assessments are performed under less-challenging conditions[30]

The study findings indicating that after 12 weeks of interventions Swiss Ball Training Exercise group was more effective than Trunk Training Exercise group on improving Postural Instability. Thus this study concludes that Swiss Ball Training Exercise is a useful adjunct in Parkinson's patients.

LIMITATIONS

- Due to small size in this study results couldn't be generalized to large group of population
- Less treatment sessions per week.
- No blinding of evaluators.
- No follow up.
- No control group.

RECOMMENDATIONS FOR FURTHER RESEARCH

- The study only concentrates on postural instability but a protocol for overall rehabilitation can be beneficial.
- Further studies can be done by increasing sample size.
- Length of the study can be extended for few more months for good rehabilitation.
- Further studies can be recommended by adding Swiss Ball with conventional physiotherapy.

CONCLUSION

The present study concludes both Swiss Ball Training Exercise group and Trunk Training Exercise group showed significant improvement in Postural Instability in subjects with Parkinson's Disease. However Swiss Ball Training Exercise group is more effective when compared to Trunk Training Exercise group. Hence treatment intervention may be incorporated in management of Parkinson's Disease.

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