

**ADHERENCE TO KINECT ADVENTURE GAMES IN
INDIVIDUALS WITH PARKINSON'S DISEASE**

By

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09_T046_84304

Dissertation Submitted to the
Rajiv Gandhi University of Health Sciences, Karnataka, Bengaluru

In partial fulfilment
of the requirements for the degree of
MASTER OF PHYSIOTHERAPY

in

NEUROLOGICAL AND PSYCHOSOMATIC DISORDERS

Under the guidance of

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I hereby declare that this dissertation entitled “**Adherence to Kinect Adventure Games in individuals with Parkinson’s disease**” is a bona fide and a genuine research work carried out by me under the guidance of **M. Renukadevi, MPT**, Professor of JSS College of Physiotherapy, Mysuru.

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ACKNOWLEDGEMENT

I would like to begin by thanking the *Almighty God*, for His grace and Blessings without which this project would not have been possible.

It gives me great pleasure to express my thankfulness and gratitude to my guide ***Mrs. M. Renuka Devi***, for her constant source of encouragement and enthusiasm, during the two years of my master's program.

I express my sincere thanks to Principal ***Dr. Kavitha Raja***, Principal, JSS College of Physiotherapy for her valuable suggestions, immense knowledge and thought provoking feedback on my work which made this research endeavor meaningful and enjoyable.

I would like to thank ***Mr. Sandeep PH***, my beloved co-guide and teacher who constantly provided guidance and taught me not to crack under pressure.

I would like to thank, ***Mr. Jakson K Joseph and Dr. Annie Thomas*** for helping me and encouraging me during this study.

I would like to thank my juniors for their constant support to my study.

This thesis would not be complete without the cooperation of my patients to whom I would like to express my sincere appreciate and gratitude.

I would like to thank my parents for supporting me and bringing the best out of me.

I would like to thank ***Ms. Swathi C.M.*** for always being there for me and making sure that I endure this perilous journey.

Last, but not the least, I would like to sincerely thank my classmates, Lecturers, friends and faculty who have supported and encouraged me during this venture.

Thillaivignesh.B

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ABSTRACT

Background: Individuals with PD experience reduced balance ability and are prone to fall. As the disease advances with age the traditional forms of physiotherapy are prone to fail in long-term exercise intervention as patients lose interest in performing the exercises. The use of virtual reality game technology consists of tasks in virtual environments that combine physical and cognitive demands in a fun and motivating manner which leads to adherence in long-term exercise intervention.

Objective: Objective is to know the adherence of Kinect adventure games in individuals with PD by attendance percentage of prescribed sessions. Secondary objective is to analyze the impact of balance after Kinect adventure games in individuals with Parkinson's disease.

Methodology: Experimental study with pre-post design in which 11 individuals were selected, with mean age 67.8 years. Home-based balance exercises were given for three days in a week up to 6 weeks (18 sessions). Kinect adventure games were implemented for another six weeks. Adherence was measured by attendance percentage in terms of frequency of sessions completed. The secondary outcome measure was to assess balance. Participants were evaluated prior to intervention and post-intervention using BESTest. Descriptive statistics were used to compare the BESTest scores of pre and post intervention

Result: Adherence percentage of Kinect adventure game therapy was 38%. The adherence percentage of home based balance exercises was only 9%. The BESTest scores improved in home based balance exercise compared to kinect adventure game therapy.

Conclusion: The participants with Parkinson's disease did not adhere to kinect adventure game therapy. For the attended sessions the balance improved for home based balance exercise compared to kinect game therapy.

LIST OF ABBREVIATIONS

ABC	Activities- Specific Balance Confidence
BBS	Berg Balance Scale
BESTest	Balance Evaluation Systems Test
CASP	Critical Appraisal Skills Programme
CB	Conventional balance training
COP	Centre of pressure
DGI	Dynamic Gait Index
FAB	Fullerton Advanced Balance scale
FOG	Freezing of gait
GPe, GPi	External Globus pallidus, Internal Globus pallidus
HC	Healthy control
IPD	Idiopathic Parkinson's disease
MMSE	Mini-Mental State Examination
PD	Parkinson's disease
PDQ	Parkinson's disease Questionnaire
QoL	Quality of life
SOTs	Sensory organization tests
SRT	Sitting-rising test
STN	Sub-thalamic nucleus
VF	Visual feedback
VR	Virtual reality
VRTs	Verbal reaction times
WHO	World Health Organization
WHODAS	World Health Organization Disability Assessment Schedule
6MWT	Six minute walk test
10MWT	10-meters walk test

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1. INTRODUCTION

1.1 Background

Parkinson's disease (PD) can be defined as a neurodegenerative disorder that causes progressive motor symptoms such as tremor, rigidity, bradykinesia, gait instability, balance dysfunction and cognitive deficits leading to limitations across various domains of the ICF, that is body function, activity limitation, participation restriction.¹ It is estimated that approximately about 60 lakh individuals suffer from PD worldwide. World Health Organisation (WHO) reports that, out of the world's 580 million elderly (over 60 years), 16- 19 per lakh suffer from PD, in which 60% live in developing countries and 22% live in India.

The basal ganglia structures involved in the disease process are neostriatum, external and internal pallidal segments, subthalamic nucleus, and substantia nigra, which are responsible for the smooth and purposeful coordination of body movements.² In PD, there is degeneration of dopaminergic neurons and their extensions to the striatum. Substantia nigra projections to the putamen degenerate earlier and during the course of this degeneration, motor symptoms and signs of PD appear. These symptoms occur only following the substantial degeneration of the nigrostriatal neurons, which affects at least 70%.³

The pathophysiology of balance impairments in PD includes various subsystems which include sensory, motor, and cognition. Sensory issues compromise equilibrium, which leads to impaired proprioception & motor features with cognitive deficiencies further worsen the efficiency of balance control.⁴

The commonly used drugs for managing Parkinson's disease are Levodopa, MAO-B inhibitors, a Dopamine agonist, Ant cholinergic agents, Amantadine⁵ Even though pharmacological interventions were able to alter the natural course of the disease, it cannot reverse the balance dysfunction and the cardinal features of PD³. These symptoms exacerbate over time as the disease advance with a significant deterioration of the patient's exercise capacity and quality of life.⁴

Microsoft Game Studios developed Kinect Adventure games for Xbox 360. It is a sports video game allowing the entire body movement to involve the participant in multiple mini-games along with the goal of attaining the maximum number of points. The adventure points which were earned are represented in medals which influence the game progression. The medals were classified into bronze, silver, gold and platinum, in order from least to maximum pins needed to acquire in each game.⁶

World Health Organization (WHO) defines adherence as the extent to which a person's behaviour following a diet, taking medication and/or executing lifestyle changes—corresponds to the recommendations of a healthcare provider. Exercise adherence can be defined as the degree to which a patient complies with the advised interval and exercise dosing regimen. The unit of measure for adherence is measured as performed exercise doses, per defined period of time reported as a proportion of prescribed exercise doses undergone at the prescribed time interval.

Patients can be separated into 3 groups on the basis of their adherence to exercise protocol that was prescribed. The 1st group is patients who adhere at least 80% to the number of training sessions prescribed and to the duration of the prescribed cycle. The

2nd group consists of patients who are adherent less than 20% to the advised number of training sessions & their duration. The 3rd group consists of partially adherent patients who perform the prescribed exercises, but avoid some of the exercises or they will not perform for the prescribed duration⁷

A cross-sectional study was done by Miller K et al states that 65.3% reported adherence to home exercise programme within the first 6 months post discharge. The adherence rates for exercises have been reported in elderly individuals with arthritis, low back pain (LBP) and a general physical therapy population ranging from 40 to 71%. The reasons for non-adherence documented in that study was doing exercises other than what was prescribed by the physiotherapist, exercise is painful, boring, fear of fall while exercising.⁸

A systematic review done by Yitayeh et al states that there is a short term benefit in enhancing balance and mobility in individuals with PD using physiotherapy interventions like balance training, strength training and aerobic training.⁴ Conventional physiotherapy involved in the management of Parkinson's disease are cognitive movement strategies, cueing strategies, balance training, gait training, aerobic training, relaxation techniques, strengthening exercises and flexibility training.⁶

The use of virtual reality game technology such as (Sony play station, Nintendo Wii, Kinect etc.) are rapidly increasing in neurological rehabilitation.⁷ virtual reality games consist of tasks in virtual environments which combine physical and cognitive demands in a way that is attractive and challenging.⁷ The player is motivated to attain goals and overcome his/ her limits during the games, which provide immediate feedback on his / her performance. In addition, virtual reality games like Kinect adventures engage

patients in executing from simple or complex exercise patterns within a goal-oriented enjoyable context, with visual and auditory feedback.⁷

Regular Physiotherapy has a major role in controlling symptoms in PD. As the disease progresses with age the traditional forms of physiotherapy are prone to fail in long term rehabilitation as patients lose interest in performing the same form of tasks and exercises day after day and get easily bored and eventually drop out of a rehabilitation programme.⁶

1.2. Need for the study

It is well documented that, due to lack of interest, fear of falling and the progressive nature of the disease, there is lack of adherence to exercises which becomes the barrier to short term or long term exercise intervention in chronic conditions that evidently needs the exercise as an intervention. This leads to poor outcomes. Kinect adventure games are a set of games which involves whole body motion that are challenging, stimulates users to exercise as there are rewards and scores which would be fun and motivating, therefore the adherence to the exercise would improve and therefore and improve the balance. Therefore the need of this study is to know the adherence of Kinect adventure games in patients with PD.

1.3. Clinical significance

Kinect games would give pleasure and games used in this task will offer different types of feedback like visual, auditory, proprioception. It stimulates subject to participate and therefore adhere to the therapy and in turn improve the balance which is the core

component in subjects with PD. If it shows a positive effect in terms of balance improvements it can improve the rehabilitation protocol in Parkinson's disease patients.

1.4 Assumption

The assumption is that the participants will be adherent to Kinect adventure games in individuals with PD.

1.5 Objectives of the study

Primary objective

To know the adherence of Kinect adventure games in patients with PD by attendance percentage of sessions completed.

To know the adherence of home-based balance exercises in patients with PD by attendance percentage of sessions completed.

To compare the adherence of home based-balance exercises and Kinect adventure games in patients with PD

Secondary objective

To analyze the impact of home-based balance exercises on balance in patients with PD using BESTest as an outcome measure

To analyze the impact of Kinect adventure games on balance in patients with PD using BESTest as an outcome measure

2. REVIEW OF LITERATURE

2.1. Methodology of literature review

Literature search was conducted from electronic database viz PubMed, and Cochrane. The databases searched were searched for articles with a time limit of recent 5 years. Mesh terms and keywords included were selected for the individual section with and without Booleans Operator – AND, IN, NOT etc.

2.2 Search Strategy:

The search was narrowed by specifying English language; species human, inclusion criteria for this review were all types of study related to balance and PD, barriers, adherence to exercise, VR in PD and outcome measures used in balance. Exclusion criteria for this review are articles not relevant to this study (study of motor function, gait training, drug therapy management and surgical management to PD etc.), duplicate articles, languages other than English, and articles with CASP score less than 75%. A quality search of keywords was selected for each section.

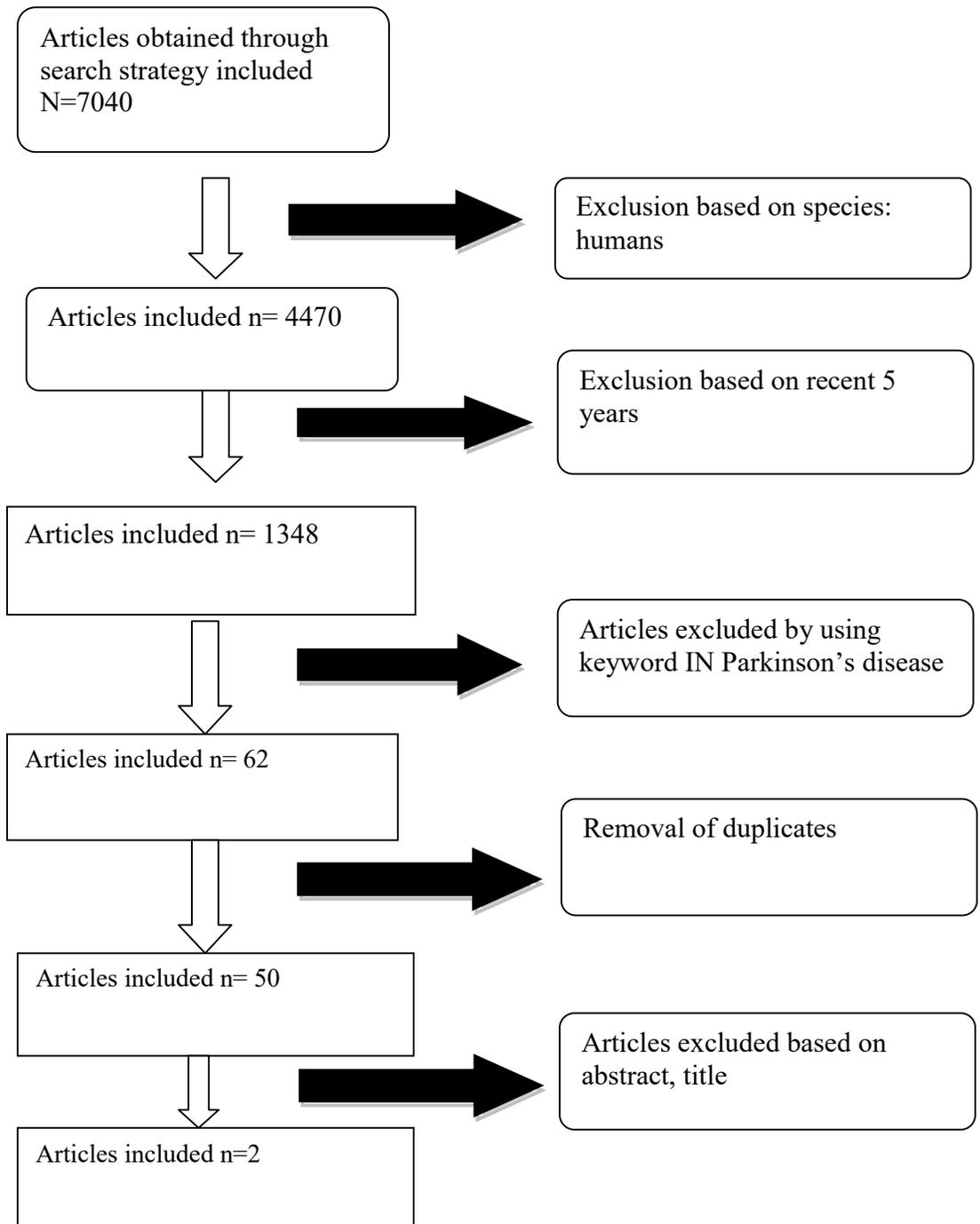
The results of the review of the review section are described in the following pages under relevant sections.

2.3 Section: 1 Impact of Balance in PD

Objective: To find the impact of balance in PD.

Keywords: Impairment, Balance, Parkinson's disease.

Figure 1: Search strategy adopted for section 1 of the literature review



Literature reports that there is a reduced postural control due to rigidity affecting biomechanics, bradykinesia of postural responses and PD + Freezing of gait compared to PD-Freezing of gait, healthy control and they concluded that relationship between the anterior-posterior centre of pressure position during quiet stance and Freezing of gait. The Centre of pressure shift towards posterior in PD + Freezing of gait lead to a restricted prerequisite to generate forward progression during gait.^{9,10}

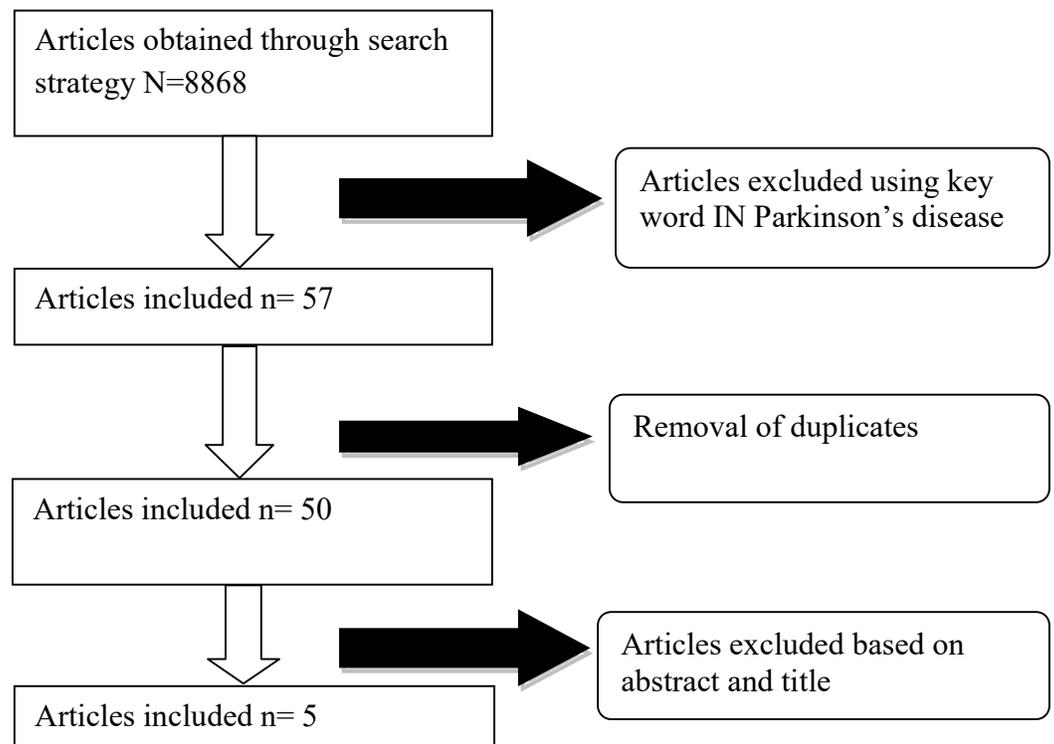
Level of evidence-III

2.4. Section: 2 barriers and adherence to exercise in PD

Objective: To find the barriers involved in exercises, adherence to exercises.

Keywords: Exercise barrier, exercise adherence, Parkinson's disease with Boolean operators IN.

Figure 2: Search strategy adopted for section 2 of the literature review



All the articles showed that barriers for exercise are fear of fall, lack of interest and motivation on exercise. They found that constant reassurance and incitement from instructor may help people to indulge in exercises¹¹⁻¹⁵.

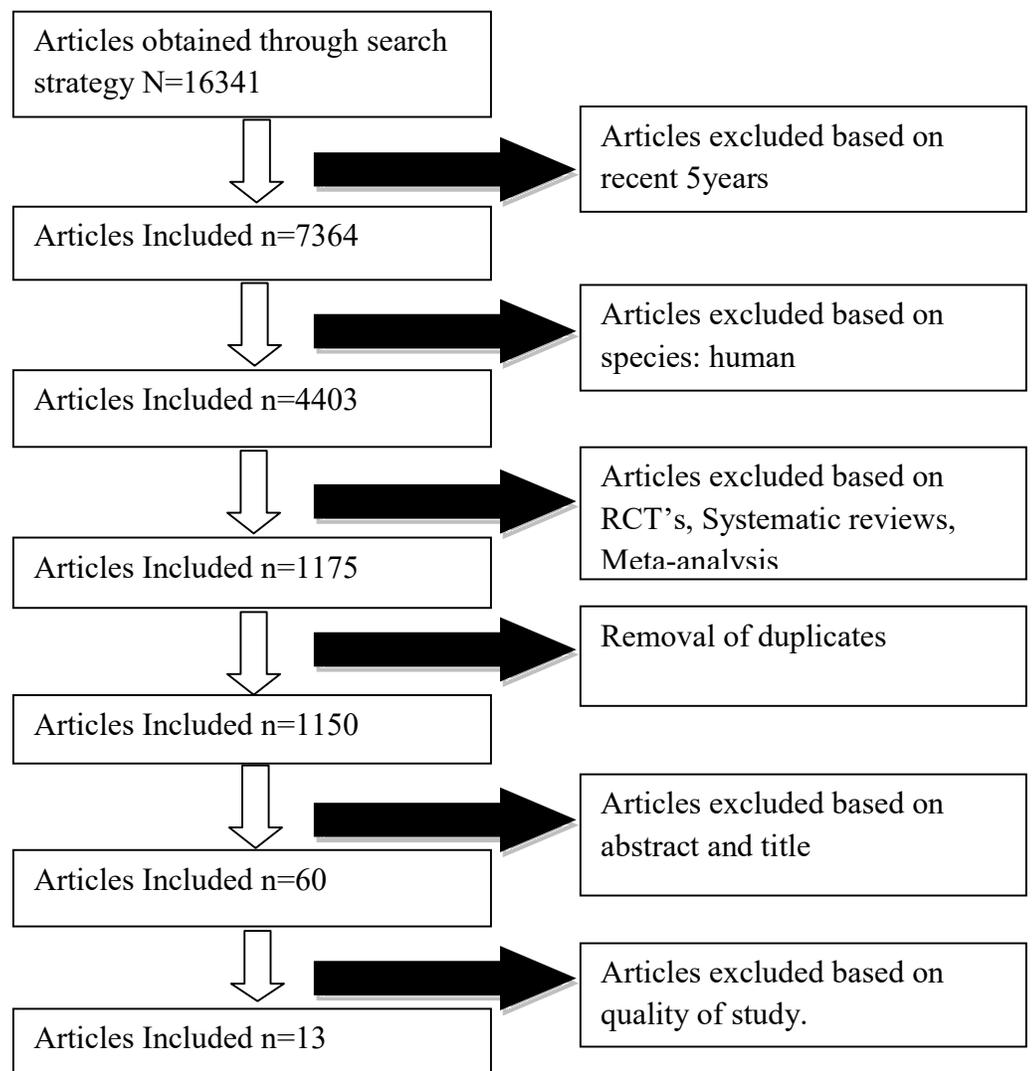
Level of evidence – III

2.5. Section 3: Home-based balance exercises in PD.

Objective: To find a protocol for home-based balance exercises in PD

Keywords - Balance training, Conventional balance training IN PD

Figure 3. Search strategy adopted for section 3 of the literature review



Literature reports highly challenging balance exercises to have effect in enhancing balance, and reducing the fear of fall in persons with mild to moderate PD in short-term and suggest that training effects diminish within 6 months of balance training. This implies that exercises need to be performed regularly.^{16-18, 44} From a systematic review, it showed that physiotherapy interventions like balance training, muscle strengthening, range of motion exercises, gait training are efficacious in enhancing postural control in patients with PD¹⁸⁻¹⁹. Balance exercises with feedback may improve balance and gait performance in patients with PD.²⁰⁻²¹ A program of balance training with dual-task gait performance improve postural instability in patients with PD²²⁻²⁵. Home-based VR may be a feasible and alternative option for PD patients staying in areas with minimal access to physiotherapy services²⁶.

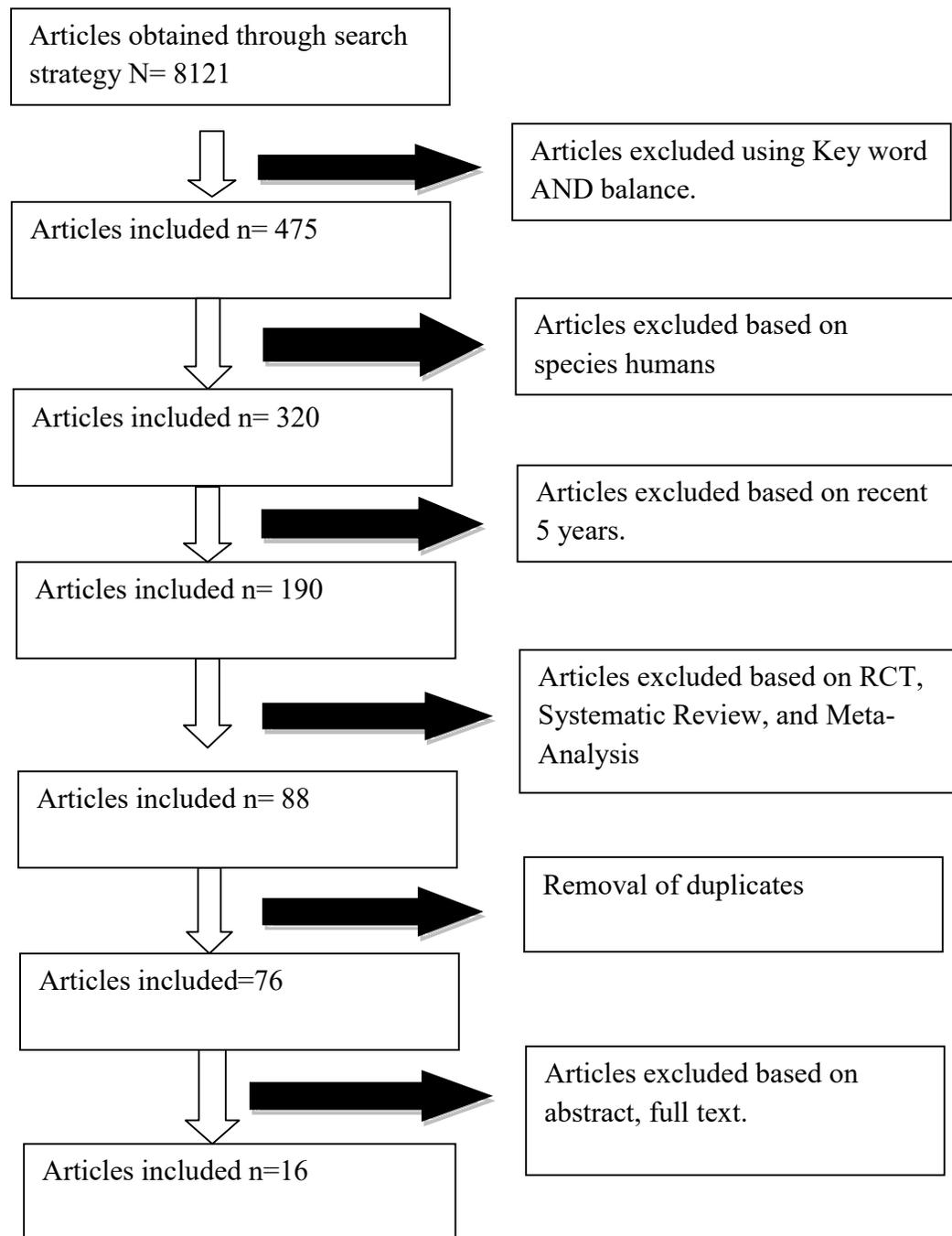
Level of evidence-II

2.6. Section 4: Virtual reality in PD

Objective: To find the efficacy of virtual reality in PD

Keywords- Virtual reality, Balance, Parkinson's disease with Boolean operators AND, IN

Figure 4: Search strategy adopted for section 4 of the literature review



Literature reports that VR was found to be the promising tool to enhance motor control of movement in unusual environments, cognitive demands of the games improved cognition, virtual reality with visual, audio cues of balance training improves the sensory integration of postural control²⁷⁻³⁰. A systematic review states that virtual reality has an effect in gait, balance and quality of life³¹. Virtual reality-based exercise helps in dynamic balance by obstacle crossing activities and patients safely use a head mounted displays for walking without adverse effects^{32,33}. Virtual reality dance reported the effect on functional activities, depressive patients, balance but there were no notable differences found in both home-based VR training and conventional balance training. Kinect adventure games will be feasible enough to improve postural control and also the improvement maintains for four weeks, gait, cognition when compared with European physiotherapy guidelines^{34-37, 45, 46}. From a Meta-analysis exergaming was found to be a feasible option for enhancing balance in elderly patients³⁸.

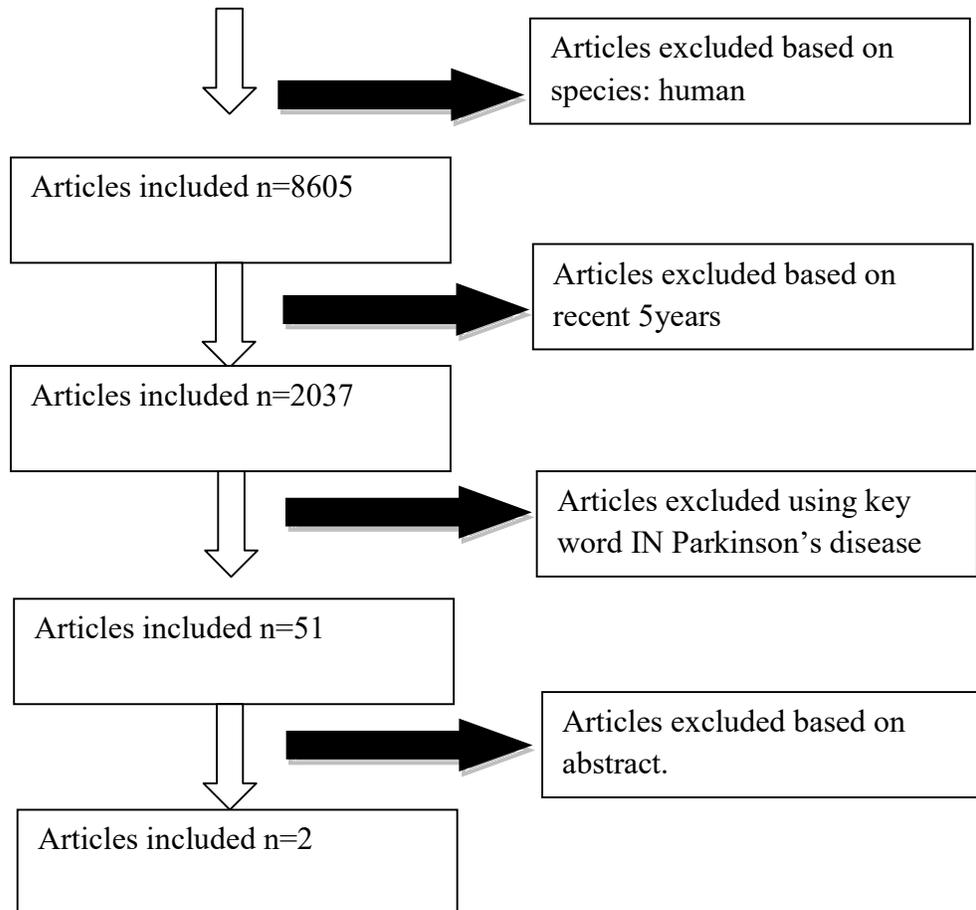
Level of evidence- I, II

2.7. Section: 5 Outcome measures used for balance in PD.

Objective: To find the best outcome measure used in balance

Key words: Balance measurements, PD with Boolean IN.

Figure 5: Search strategy adopted for section 5 of the literature review



Literature reports that overall accuracy of BESTest was concluded by comparing with FGA and BBS cut-off score (85, 80, 79) The most sensitive tool for identifying fallers was BESTest^{39, 40}.

2.8. Table I: Summary of literature review

1	
Sl. No	1
Author	Schlenst C et al
Journal	Journal of Parkinsonism and Related Disorders (2016)
Study design	Cross-sectional observational study.
No. of Subject	80
Result	PD+FOG performed significantly worse in the FAB scale compared to PD-FOG and HC.
Conclusion & Limitation	The study concludes that patients with FOG have reduced postural control in comparison to patients without FOG and HC. Limitations When interpreting, findings were taken during ON state of medication. The execution in the OFF state will provide more information about underlying mechanisms leading to FOG.
Quality of article	CASP- 8/10.
2	
Sl. No	2
Author	Park HJ et al
Journal	Journal of movement disorder (2015)
Study design	Review article
No. of Subject	-
Result	Major factors that determine the quality of life are Postural instability and resulting falls
Conclusion & Limitation	Patients with PD show impairments in many aspects of postural control including 1) rigidity affecting biomechanics, 2) bradykinesia of postural responses and anticipatory postural adjustments, 3) impaired kinesthesia for sensory integration, 4) bradykinetic gait with freezing, and 5) less automaticity of gait and balance.
3	
Sl. No	3
Author	Ellis T et al
Journal	Journal of the American physical therapy association (2013)
Study design	Cross-sectional design.
No. of Subject	260
Result	3 barriers were found from more than one variable.
Conclusion & Limitation	Lack of time to perform the exercise, low outcome expectation from exercise protocol and fear of fall are the barriers found to be involved in patients with PD.
Quality of Article	AXIS-17/20

4	
Sl. No	4
Author	Ene H et al
Journal	Journal of neurologic physical therapy (2011)
Study design	Qualitative study
No. of Subject	18
Result	Exercise can slow down the disease/ prevent a decline in the function of individuals, 39% feeling better with exercise, 3 individuals [17%] believe that exercise is beneficial.
Conclusion & Limitation	Physiotherapists should work along with patients to modify the treatment protocol with patient-specific which can be acceptable and feasible for the patient. Limitations Findings could have been different if the sample was taken from another area of the country/ community which have a lack of enthusiasm for doing exercise.
Quality of article	CASP- 7/10
5	
Sl. No	5
Author	Crizzle A et al
Journal	Journal of occupational therapy in health care (2012)
Study design	Qualitative Study
No. of Subject	4
Result	Exercising in a group environment and social interaction with other persons with PD were the themes. Perceived changes in physical ability improved participant confidence & motivation to continue exercising.
Conclusion& Limitation	Constant encouragement and reassurance from the instructor in the early stages of the program motivates PD participants Limitations Exercise opinions will differ from person to person and they did not screened for cognition.
Quality of Article	CASP 8/10
6	
Sl. No	6
Author	Afshari M et al
Journal	Journal of Parkinson's Disease (2017)
Study design	Cross-sectional study
No. of Subject	215 participants
Result	49.3% reported 'low'-exercise and 50.7% reported 'high'-exercise. Low-exercisers reported twice as many barriers as high-exercisers and Barriers that were significantly more common in low-exercisers were lacking someone to motivate them.
Conclusion &	There are significant differences between people with PD who exercise

Limitation	regularly and those who do not in terms of motivators and barriers. Limitations The study includes the use of data that are self-reported and lack of objective measures such as UPDRS and Hoehn and Yahr staging, it should include a validated survey such as the “Self-Efficacy for Exercise Scale”
Quality of article	AXIS 16/20
7	
Sl. No	7
Author	Quinn L et al
Journal	Journal of Disability and Rehabilitation (2010)
Study design	Qualitative design
No. of Subject	18
Result	There were various barriers found to be committed in exercise programmes, which incorporate disease-relevant impairments, the safety of an individual and the area where exercise has been performed. Participant’s cognition will affect their ability to participate in an exercise programme
Conclusion & Limitation	Health professionals should work along with clients to assess their individual opinion, identify barriers to exercise and make a participant-specific programme that is bearable and viable for the client. Limitations Limited geographical area, and with a relatively small number of participant.
Quality of Article	CASP 8/10
8	
Sl. No	8
Author	Yang W et al
Journal	Journal of the Formosan Medical Association 2016
Study design	Randomized controlled trial
No. of Subject	23
Result	Post training, both groups performed better in the BBS, Dynamic Gait Index, Timed Up-and-Go test, & PDQ at post-test & follow-up than at pre-test.
Conclusion& Limitation	No significant differences found between these two groups at post-test and follow-up Limitations The 2- week follow-up might be too short to conclude the training effects
Quality of Article	CASP 9/11
9	
Sl. No	9
Author	Laio Y et al
Journal	Journal of Neuro rehabilitation and Neural repair (2014)
Study design	Randomized controlled trial.
No. of Subject	36
Result	The VR group reported better improvement in stride length, dynamic

	balance and obstacle crossing when compared with the control group.
Conclusion & Limitation	VR training can be implemented in patients with PD to improve their gait and dynamic balance. Limitations Small sample size, There was no blinding
Quality of Article	CASP 09/11
10	
Sl. No	10
Author	Kim A et al - 2017
Journal	Journal of Neuro-Engineering and Rehabilitation
Study design	Experimental study
No. of Subject	33
Result	There were no significant differences found in the static and dynamic balance after VR intervention.
Conclusion & Limitation	VR can be used safely during walking without adverse effects. Limitations Small sample size, The validation of the questionnaire was done only in healthy adults
Quality of article	CASP 8/11
11	
Sl. No	11
Author	Yong Lee N et al
Journal	Journal of physical therapy sciences (2015)
Study design	Randomized controlled trial
No. of Subject	20
Result	Balance and ADL have significantly improved after 6 weeks of VR dance therapy.
Conclusion& Limitation	VR dance therapy has proven to be effective in improving balance, ADL and depressive disorder status in patients with PD. Limitations Small sample size.
Quality of Article	CASP 10/11
12	
Sl. No	12
Author	Heuvel M et al
Journal	Journal of Biomed central neurology (2013)
Study design	Randomized controlled trial
No. of Subject	36
Result	Balance training with visual feedback shows better improvement in standing balance when compared to control group.
Conclusion&	Balance training with Visual feedback may be an alternative feasible option

Limitation	to supervised therapy.
Quality of Article	CASP 9/11
13	
Sl. No	13
Author	Silva K et al
Journal	Journal of Pilot and feasibility studies. (2017)
Study design	Randomized controlled trial.
No. of Subject	36
Result	Conventional physiotherapy and Kinect game therapy was found to be feasible, safely acceptable for PD patients.
Conclusion& Limitation	Kinect games will promote positive clinical effects on balance. Limitations Furthermore studies are needed on safety, adverse effects.
Quality of Article	CASP 9/11
14	
Sl. No	14
Author	Harris D et al
Journal	Journal of the frontiers in neuroscience (2015)
Study design	Systematic review
No. of Subject	225
Result	Exergaming improved static balance, postural control, and dynamic balance in elderly. 2 Studies on Idiopathic PD reported better improvement in static and dynamic balance.
Conclusion& Limitation	Exergaming was found to be a best therapeutic tool for enhancing postural control in the elderly. Limitations Use of simplest form of assessment to check the static and dynamic balance.
Quality of Article	CASP 7/10
15	
Sl. No	15
Author	Ferraz D et al
Journal	Archives of Physical Medicine and (2017)
Study design	A randomized controlled single blinded trial
No. of Subject	62
Result	The Kinect group showed a greater improvement in gait speed in 10MWT and quality of life in PDQ39.
Conclusion & Limitation	Kinect Exergames was found to be safe and enhances the walking capacity of older adults with PD.
Quality of Article	CASP 9/11
16	
Sl. No	16

Author	Yi Wang C et al
Journal	Journal of Clinical Rehabilitation (2011)
Study design	Randomized controlled pilot trial
No. of Subject	33
Result	The VR training shows a faster time when compared control group in reaching stationary balls.
Conclusion & Limitation	In Short term, VR training the movement velocity of aiming task was faster when compared to the control group. Limitations The practice sessions were short in this pilot study.
Quality of article	CASP 9/11
17	
Sl. No	17
Author	Yi Yen C et al
Journal	Journal of American physical therapy association. (2011)
Study design	A longitudinal RCT
No. of Subject	42
Result	VR group was significantly improved in equilibrium scores when compared to control group.
Conclusion & Limitation	VR and control group showed a significant improvement in sensory integration in patients with PD. Limitations Smaller sample size
Quality of article	CASP 9/11.
18	
Sl. No	18
Author	Santos Mendes F et al
Journal	(2012) Journal of physiotherapy
Study design	Longitudinal, controlled clinical study.
No. of Subject	16
Result	PD patients have performed demands from the motor ability of the games.
Conclusion& Limitation	After training in Wii fitt games PD patents gained the ability to learn and retain cognitive aspects of games involved. The games were used in rehabilitation has minimal learning deficit.
Quality of Article	CASP 9/12
19	
Sl. No	19
Author	Arias P et al
Journal	(2012) The public library of science
Study design	Randomized controlled trial
No. of Subject	32
Result	VR is reliable in assessing finger movement of persons with healthy and

	neurological deficits.
Conclusion & Limitation	VR was found to be the best tool to check the control of movements.
Quality of Article	CASP 8/11
20	
Sl. No	20
Author	Dockx K et al
Journal	Cochrane database (2013)
Study design	Systematic review
No. of Subject	263
Result	VR therapy increased benefits in gait parameters (step and stride length) and also it showed improvement in postural control, gait, cognitive and ADL function.
Conclusion & Limitation	In conclusion, we found that VR enhanced exercise provides a useful alternative to conventional physiotherapy for improving Walking speed and quality of life Limitations Small sample size. Only a small number of trials were included
Quality of Article	CASP 7/10
21	
Sl. No	21
Author	Leddy A et al
Journal	Journal of the American physical therapy association (2010)
Study design	Observational study
No. of Subject	80
Result	Both FGA and BESTest were compared with the BBS Cut off scores to identify fallers and concluded that the overall accuracy for the BESTest, FGA, BBS was 85, .80,.79.
Conclusion & Limitation	The most sensitive tool for identifying fallers was BESTest Limitations Retrospective fall report, the balance tests were not randomized.
Quality of Article	Critical Review – form McMaster University12/15
22	
Sl. No	22
Author	Horak F et al
Journal	Journal of the American physical therapy association(2009)
Study design	Observational study
No. of Subject	22
Result	The intra-class correlation coefficient (ICC) for interrater reliability for the BESTest as a whole was .91, with the 6 Section.

Conclusion & Limitation	BESTest was easy to administer and it helps to find a balance deficit of 6 sections.
Quality of article	Critical Review – form McMaster University 10/15
23	
Sl. No	23
Author	Tornai J et al (2015)
Journal	Journal of BMC Neurology
Study design	Randomized controlled trial
No. of Subject	150
Result	Balance exercises were found to facilitate balance reactions at the proper time.
Conclusion& Limitation	The balance exercises are cost effective and it is easy to administer in PD patients.
Quality of article	CASP 8/11
24	
Sl. No	24
Author	Schlenstedt C et al
Journal	Journal of PLOS ONE (2015)
Study design	Randomized controlled trial
No. of Subject	40
Result	There was no significant difference in FAB scores in comparison with two treatment group.
Conclusion& Limitation	There was no difference between the two interventions. Limitations Attendance percentage of sessions should be included.
Quality of Article	7/11
25	
Sl. No	25
Author	Sparrow D et al
Journal	Journal of neural physiotherapy(2016)
Study design	Randomized cross-over trial.
No. of Subject	23
Result	The experimental group showed better improvement in balance in comparison with the control group.
Conclusion& Limitation	Highly challenging and progressive exercise protocol was found to be effective in reducing the fear of fall and enhancing balance in PD. Limitation Small sample size.
Quality of Article	8/11 CASP
26	
Sl. No	26
Author	Wong-Yu S I et al

Journal	Journal of Parkinson's and related disorders
Study design	Randomized controlled trial
No. of Subject	84
Result	Total BESTest score and its subsections showed improvement in the experimental group ($p < 0.05$).
Conclusion & Limitation	The various dimensions of balance training improve postural control and gait with the dual task in PD. Limitations It cannot be hypothesized to recurrent fallers or patients with end stages of PD. Some of the treatments involved in this study were found to be not feasible.
Quality of article	8/11 CASP
27	
Sl. No	27
Author	Smania N et al
Journal	Journal of Neuro rehabilitation and neural repair(2010)
Study design	Randomized controlled trial
No. of Subject	64
Result	The experimental group showed better improvement in scores of balance, gait outcome measures and these improvements were maintained for one month.
Conclusion & Limitation	Balance training was found to improve balance in patients with PD. Limitations: Lack of followup
Quality of Article	CASP- 8/11
28	
Sl. No	28
Author	Conradsson D et al
Journal	Journal of Neuro rehabilitation and neural repair(2015)
Study design	Randomized controlled trial
No. of Subject	100
Result	A highly significant effect was found in step length in normal walking with a difference of 3 points in the intervention group.
Conclusion & Limitation	Highly challenging balance protocol was proven to be effective in improving balance and gait distance in patients with PD. Limitations Applies only in mild to moderate stages of older patients with PD.
Quality of article.	9/11

29	
Sl. No	29
Author	Shen x et al
Journal	Journal of Neuro Rehabilitation and Neural Repair(2014)
Study design	Randomized controlled trial
No. of Subject	51
Result	The Activities-Specific Balance Confidence Score showed improvement in the post, 3 months and 12 months follow-up in the balance training group.
Conclusion & Limitation	Balance training with feedback provided a better improvement in balance in post-intervention and follow-up. Limitations Dropouts were found high in follow-up
Quality of Article	8/11
30	
Sl. No	30
Author	Stozek J et al
Journal	Ageing clinical and Experimental research
Study design	Randomized controlled trial
No. of Subject	64
Result	Comparing to the control group, the rehabilitation group showed a significant effect in balance, gait and trunk rotations. (p=<0.005)
Conclusion & Limitation	Four weeks treatment protocol showed greater improvement in mobility, balance and gait in patients with PD.
Quality of Article	7/11
31	
Sl. No	31
Author	Hirsch M et al
Journal	Journal of Physical Medicine and Rehabilitation
Study design	Randomized controlled trial
No. of Subject	15
Result	Both Strength and balance training group improved in sensory organization test.
Conclusion & Limitation	High-intensity balance and resistance training improves balance and strength in patients with IPD. Limitations Four weeks training was found to be short term and it is difficult to explore the effect.
Quality of Article	7/11 CASP
32	
Sl. No	32
Author	Yang W et al
Journal	Journal of the Formosan medical association

Study design	Randomized controlled trial
No. of Subject	23
Result	Both the group showed greater improvement in BBS, DGI, TUG, and PDQ39 after intervention and follow-up.
Conclusion & Limitation	Home-based VR is a viable option for patients with PD. Limitations Two weeks training was found to be short term and it is difficult to explore the effect.
Quality of Article	CASP 8/11
33	
Sl. No	33
Author	Yitayeh A et al
Journal	BMC Sports science, Medicine and Rehabilitation
Study design	A systematic review
No. of Subject	483
Result	Exercise intervention was having a moderate effect size in treating balance disorders.
Conclusion& Limitation	Multiple interventions like strength, balance training was proven to be effective in enhancing balance in PD patients.
Quality of Article	8/10
34	
Sl. No	34
Author	Zhang H et al
Journal	American Journal of Physical Medicine and Rehabilitation.
Study design	Randomized clinical trial
No. of Subject	
Result	The multimodal exercise protocol showed better in reducing balance impairment and questionnaire reported that multimodal exercise protocol is easy to administer and adhere.
Conclusion& Limitation	The multimodal exercise protocol showed improvement in motor function and balance.
Quality of Article	8/11
35.	
Author	Wallen BM et al
Journal	Journal of Clinical Rehabilitation
Study design	Randomized controlled trial
No. of Subject	(100)Balance training group (n=51) control group (n=49)
Result	No significant difference was shown in six and twelve months follow-up.
Conclusion& Limitation	From the results, the treatment effect diminishes within six months after post-intervention.
Quality of Article	8/11

36.	
Author	Bacha J et al
Journal	GAMES FOR HEALTH JOURNAL
Study design	Randomized Controlled Trial
No. of Subject	46 kinect group (n=23) and control group (n=23)
Result	Both the training groups showed improvement in Mini BESTest, FGA and cognition. The effect was maintained at 4 th week after interventions and there was 91% adherence in both the group.
Conclusion & Limitation	The effect was the same in both the groups.
Quality of Article	09/11
37.	
Author	Gandolfi M et al
Journal	Journal of Bio Med Research International
Study design	Randomized Controlled Trial
No. of Subject	76, VR tele-rehabilitation (<i>n</i> = 38) in-clinic SIBT (<i>n</i> = 38)
Result	In VR telerehabilitation group showed improvement in BBS, DGI except for frequency of fall.
Conclusion& Limitation	VR is an emerging and feasible option than conventional treatments in reducing postural instability in PD patients
Quality of Article	8/11

2.9. Summary

The studies documented that physiotherapy has benefits after short term exercise training on balance in PD patients. The adherence is low due to lack of interest, lack of motivation, disease progression, fear of fall and finite access to exercise facilities. So the need of the study arises that fulfils the gap by therapy strategy which is a fun, motivating and rewarding and may be effective in improving balance and increasing adherence and it will state the benefit of long term exercise training.

3. METHODOLOGY

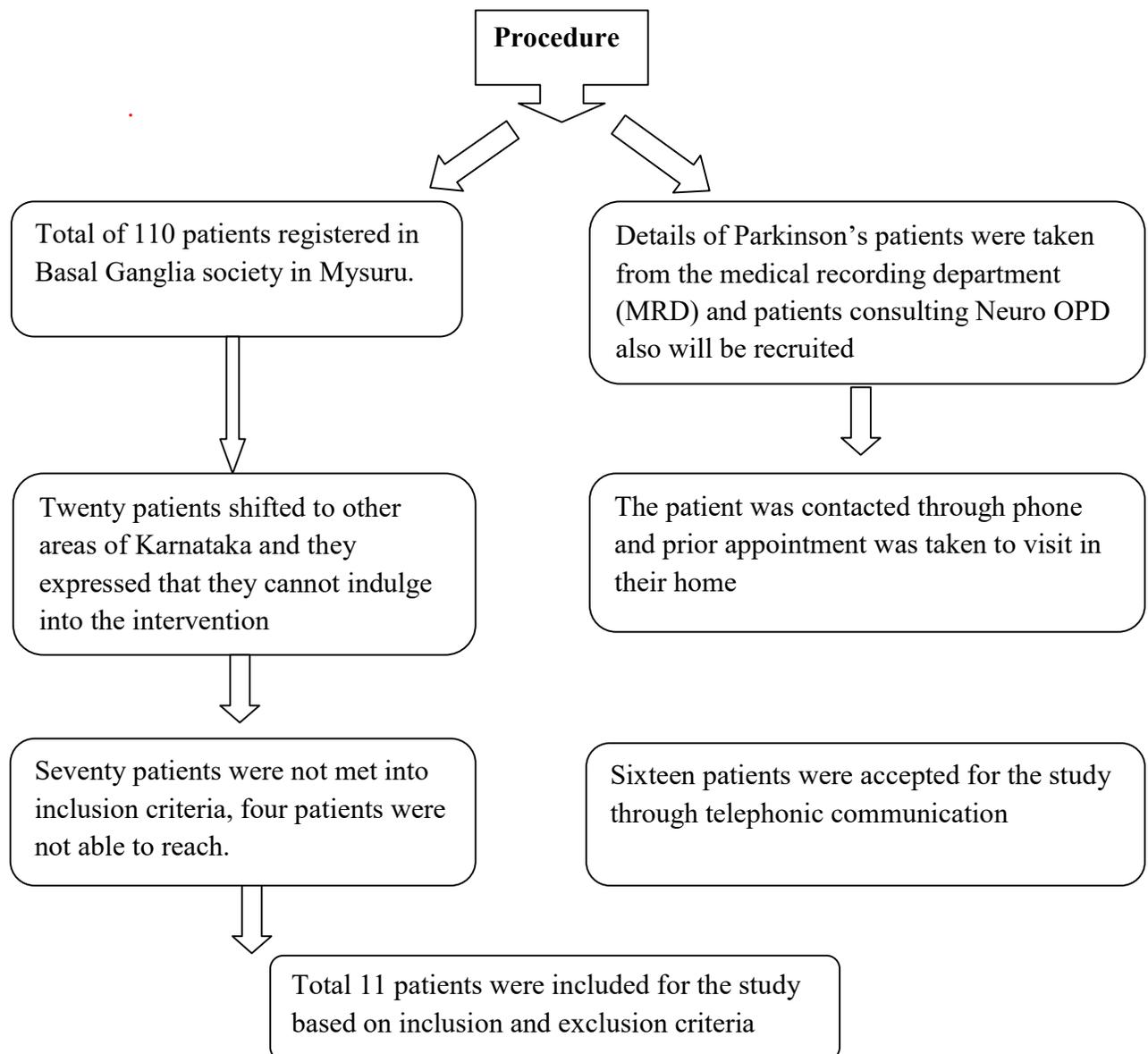
The methodology employed in this study is described below

3.1. Study design: Experimental study (Pre & Post design) ⁴²

3.2. Sampling source: Basal ganglia society, JSS Hospital Neuro Department, Mysuru

3.3. Sampling Strategy: Convenience sampling⁴²- Complete enumeration of participants willing to participate from Basal ganglia society, Mysuru, JSS Hospital Neuro Department will be included (within 3 months of the period- time-bound)

Figure 6: Sampling strategy



3.4. Participants characteristics

Inclusion criteria

- ❖ Patient diagnosed as Parkinson's disease.
- ❖ Patients of Stage 1,2 & 3 of Hoehn & Yahr scale
- ❖ Patient with Mini-mental state examination score ≥ 20
- ❖ Patient with Berg Balance Scale score ≥ 46

Exclusion criteria

- ❖ Patients hemodynamically unstable
- ❖ Patients with unstable angina
- ❖ Patients with recent myocardial infarction
- ❖ Patients with any history of seizure
- ❖ Patients involved in other clinical trials
- ❖ Patients involved in trial of the investigational drug.
- ❖ Patients with orthopedic or neurological-associated diseases.
- ❖ Patients with visual impairment
- ❖ Patients with auditory impairment

3.5 Outcome measures:

1. Adherence will be checked through attendance percentage in terms of frequency of the exercise done on basis of daily logbook.
2. The outcome measure used to measure balance is Balance Evaluation-Systems Test (BESTest). (**Appendix F**)

3.6 Materials Required

- ❖ Daily logbook to note the attendance.
- ❖ LED TV “32” of Philips
- ❖ Xbox 360 console, Microsoft corporation, Model-1538, REDMOND
- ❖ Kinect sensor-Model: 1414 one Microsoft way, made in china.
- ❖ Kinect Xbox 360 wireless controller-Model: 1403, made in china.
- ❖ Xbox 360 Power adapter-Model: PE-2121-03M1, made in china.
- ❖ Kinect Adventures game CD
- ❖ Mobile Stopwatch (Redmi Y2)
- ❖ The materials used in BESTest were attached in **Appendix- F**
- ❖ The materials used in Kinect Adventure games were attached in **Appendix- G**

3.7 PROCEDURE

Phase 1. Permission was taken from Institutional Research Committee (IRC), JSS College of physiotherapy. Ethical clearance was taken from Ethical Committee of JSS Medical College (**Appendix-B**). Following this, permission was obtained from medical superintendent (**Appendix-C**) and head of the department of the neurology (**Appendix-D**). There was a total of 110 patients registered in Basal Ganglia society in Mysuru with permission the complete list of contact information was obtained and the participants were recruited.

The participants were approached through phone and a prior appointment was taken to visit in their home. Explanation about the needs, procedure and benefits of the exercise programme was explained to participants. Informed consent was taken from the participants who were willing to participate in the study. Then the participants were enrolled in the study based on the inclusion and exclusion criteria. A pilot study was done in JSS PMRC, Mysuru. Three PD patients were implemented in a pilot study. To standardize the procedure of the study and the pilot study objectives was to examine the safety of the participants, the feasibility of the games, interest and standardization of the procedure before a large trial was attempted. The participants were asked to play the games by standing in front of a “32” TV at a minimum distance of 3m. The xbox360 videogame console and Kinect sensor were fixed in a manner so that participants will be viewed properly and Kinect setup had infrared sensors which capture the player’s movements through a camera. An avatar was reproduced in the virtual environment from

the movement of the player captured by the camera. Then the participants were asked to play Kinect adventure game which consists of Space Pop, 20,000 Leaks, Reflex Ridge and River Rush for three repetitions where each game consists of 2 minutes followed by a rest period of 4 minutes where a chair was given for the patient to sit. Totally the session lasts for about 60 minutes. The results of the pilot study indicate that river rush one of the four-game was found to be highly challenging and requires more repetitive fast movement with multiple jumps, so participant feels difficult to explore the game and another important factor found after the game was fatigue. From the pilot study results on the basis of feasibility and safety, the River Rush game was removed and a set of four games were reduced to three games.

The main study was initiated with a baseline score of BESTest which was taken prior to intervention. All recruited participants were given handouts which consist of home-based Balance exercise with pictures and description in English and Kannada for 3 days per week up to six weeks (18session) and each session last for 60 minutes 16. Adherence to the exercise was assessed from the log book which comprises date, number of sessions, number of repetition and duration of the exercise. Documentation of frequency of exercises in daily logbook was explained to the participants and the caregivers. The participants home were visited at the end of each week and their logbooks were checked. Doubts and clarification about the exercises presented by participants were re-educated. At the end of the sixth week, the percentage of the attendance for the home-based balance exercise was calculated from the log book in terms of frequency of the exercise performed. The baseline value to check adherence was kept at 75%. The participants who had $\geq 75\%$ of attendance was considered that the

participants adhere to the intervention. The reason for non – adherence, was documented by the researcher.

Home-based balance training consists of exercises:1) Standing equal to shoulder-width, feet together,2) Tandem standing, Partial Tandem standing,3) Standing in one leg,4) Weight-shift (Forward, backward, both the sides),5) Sternal Perturbations from front, Dorsal Perturbations from back,6)Standing on toes, Standing on heels,7) Catching the ball from front, back , both sides , half-squat). All the exercises should be performed in eyes open for 1-3weeks and eyes closed for 4-6weeks.¹⁷⁻²² (Handouts for home-based balance exercise attached in Appendix-I)

After 6 weeks of home-based balance exercises, BESTest was evaluated to know the improvement in balance which was considered as baseline BESTest score for Kinect game therapy.

Phase 2 Then the participants were called back to JSS Physical Medicine and Rehabilitation Centre (PMR), Mysuru for the intervention.

Demonstration and trial of Kinect adventure games were given to get familiarized by the participant and the procedure of gaming was explained to the participants and caregivers by the researcher.

After familiarization participants were asked to play the games by standing in front of a “32” TV at a distance of 3m from the xbox360 videogame console and Kinect sensor was placed in such a way that participants can be viewed properly. The Kinect consists of in-built infrared sensors which capture the player’s movements through cameras. An avatar was reproduced in the virtual environment from the movement of the

player captured by the camera. The game therapy session was conducted for 3 days per week up to six weeks of 18session. Each session last for 60 minutes, there were totally 3 series of games such as 20,000 Leaks, Space Pop and Reflex Ridge. They underwent 3 rounds of all three games which last for an hour with a rest period of 4 min between each round. During the rest period, the subjects were informed to sit in the chair.⁴³ Throughout the first two sessions, verbal comments were given to participants to perform actions that are needed to explore the game and to encourage the right posture. Harness or gait belt was given for the participants based on their balance status. Participants were asked to inform the researcher if any problem or discomfort occurs during their session (Description of the games attached in Appendix L)

Plate 1:

**Kinect
(20,000**



**Participants
participating in
adventure games
leaks)**

Plate 2:



Participants participating in Kinect adventure games (Space pop)



**Plate 3: Participants participating in Kinect adventure games
(Reflex ridge)**



After each game, the scores obtained were displayed in the monitor and medals were given as a reward so to perform better for the next session. Adherence to the game was calculated on the basis of session documented in Rehabilitation centre using logbook BESTest and after the intervention of 12 weeks, post-intervention was evaluated.

Figure 7: Procedure Flow chart Phase I (Home based balance exercise)

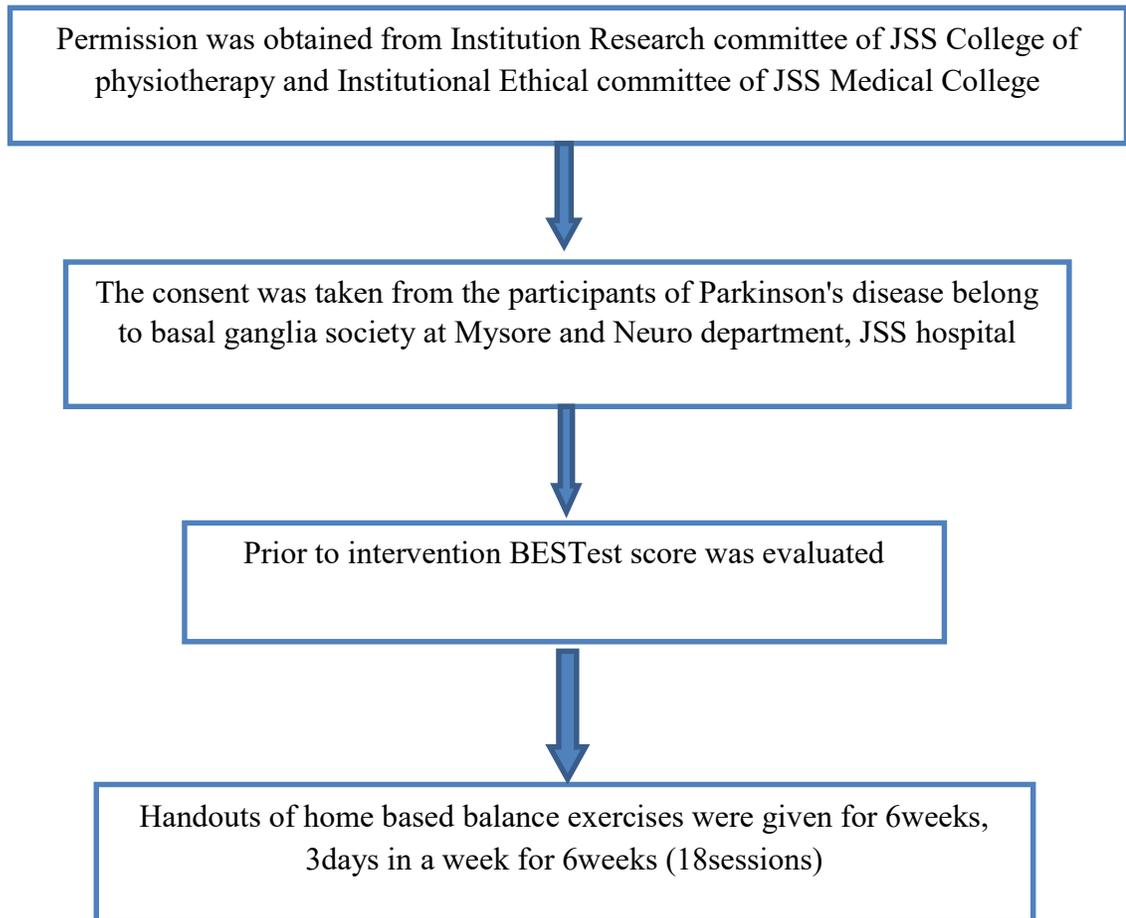
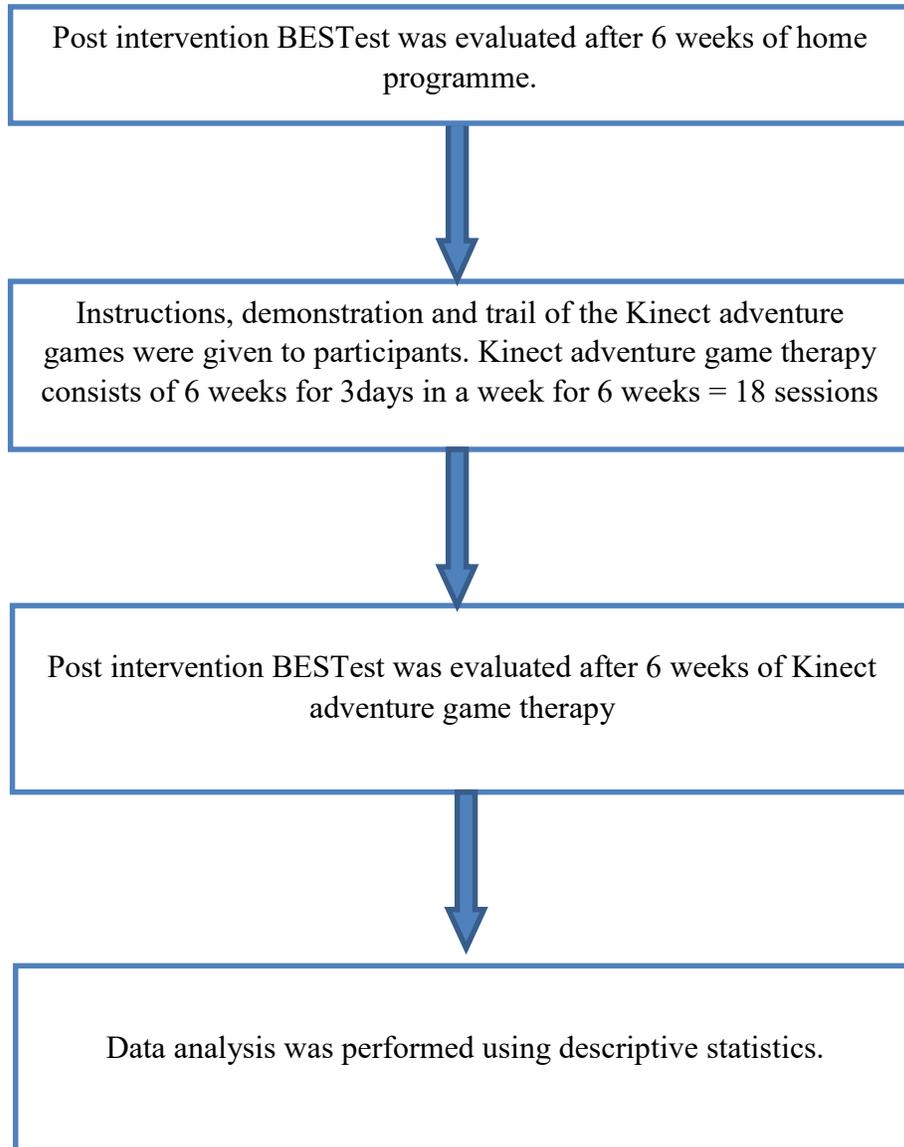


Figure 8: Procedure Flow chart Phase II (Kinect adventure game therapy for 6weeks)



3.8. DATA ANALYSIS

- ❖ Data analysis of Kinect game therapy and home-based balance exercise adherence was calculated by descriptive statistics ⁴²
- ❖ Data analysis of pre and post-test BESTest was calculated by descriptive statistics.⁴²

4. RESULT

A total of 11 Parkinson's disease patients were enrolled for the study with (8men, 3 women) with a mean age of 67.8 years (SD of 7.54). Demographic characteristics of the participant were presented in table1 All participants data entered initially through excel sheet and using descriptive statistics, analysis for adherence and the pre-test and post-test balance scores were calculated in terms of percentage. All the participants recruited for the study was included for analysis. BESTest was evaluated in the baseline, 6weeks after home-based balance exercises and 12 weeks after Kinect adventure game therapy.

Table 2: Participants demographic characteristics

Demographics	Group
Age(years)	67.81±7.54
Weight(kg)	66.63±3.07
Chronicity (years)	6.18±2.44
BBS	48.36±2.65
MMSE	28.45±1.29

1) Primary outcome measure: Adherence to home-based balance exercises

Adherence to home-based balance exercises was calculated by attendance in terms of frequency of the exercise performed by the participants.

Frequency of the exercise

All Participants recruited for the study were analysed for the adherence. The frequency of the exercise was calculated in terms of the repetition of the exercises that the participants performed and values were entered in terms of percentage. Descriptive statistics were used to find the mean percentage frequency of exercise for each participant. Attendance was categorized based on the percentage obtained. Attendance of seventy-five per cent and above was considered as adherence. From the analysis, it shows only one patient was adherent to home-based balance training which was 9%, which indicates that participants were non-adherent to the home-based balance exercises.

Table 3: Mean percentage of frequency of home balance exercises (n=11)

S.no	% Frequency of the exercise for 6weeks (Mean)
1.	51.17
2.	58.83
3.	17.33
4.	0.00
5.	34.17
6.	80.00
7.	15.17
8.	44.17
9.	0.00
10.	13.16
11.	58.33

Figure 9: The adherence percentage to home-based balance exercises (n=11)

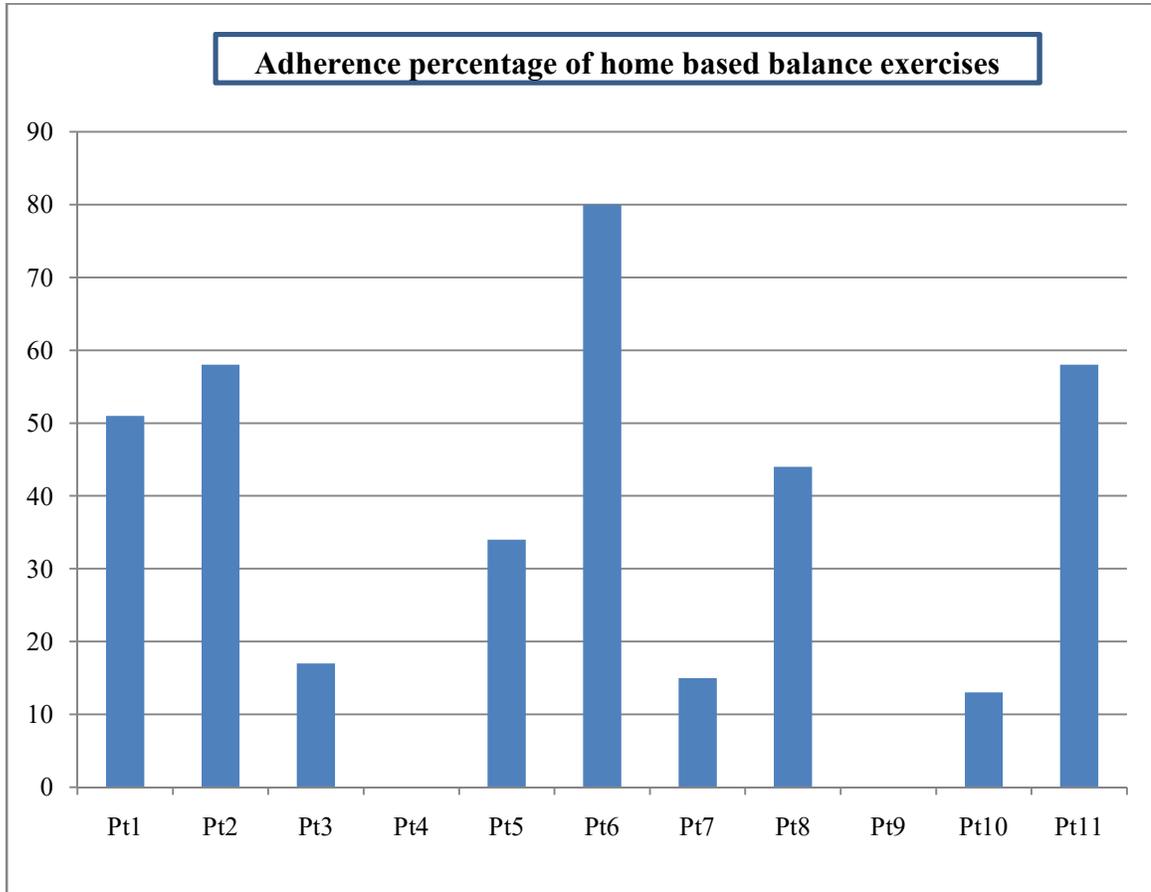


Table 4: The adherence percentage, no of participants and range of BESTest scores in pre and post intervention of home-based balance exercises (n=11)

Adherent Percentage	Number of participants	Range of BESTest in baseline	Range of BESTest in Post-test
<25%	5/11	67-78	77-79
26-50%	2/11	80-86	85-90
51-75%	3/11	65-74	63-80
76-100%	1/11	82	92

From table 4, it shows that out of 11 participants five participants adherence was less than 25%, two participants adherence was between 26-50%, three participants adherence was between 51-75% which indicates these participants were non-adherent to the home-based balance exercise and only one patient adherence was more than 75% which indicates that participant is adherent to home-based balance exercises. The overall percentage of the adherent to home-based balance exercise was only 9%.

Table 5: Participants week wise analysis of adherence to home-based balance exercises (n=11)

S.no	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
1.	81%	79%	60%	49%	38%	0%
2.	58%	58%	59%	63%	63%	52%
3.	44%	43%	17%	0%	0%	0%
4.	0%	0%	0%	0%	0%	0%
5.	72%	65%	0%	0%	0%	68%
6.	63%	83%	88%	82%	82%	82%
7.	45%	46%	0%	0%	0%	0%
8.	64%	46%	22%	23%	46%	64%
9.	0%	0%	0%	0%	0%	0%
10.	79%	0%	.00	0%	0%	0%
11.	81%	79%	60%	50%	40%	40%
≥to 75%	3	3	1	1	1	1

From table 5, it shows for 1st and 2nd week only 3 participants were adhered to home-based balance exercises, from the third week only one participant adhered to home-based balance exercise. The percentage of adherent was reduced from 27% to 9%.

ii) Secondary outcome measure: BESTest.

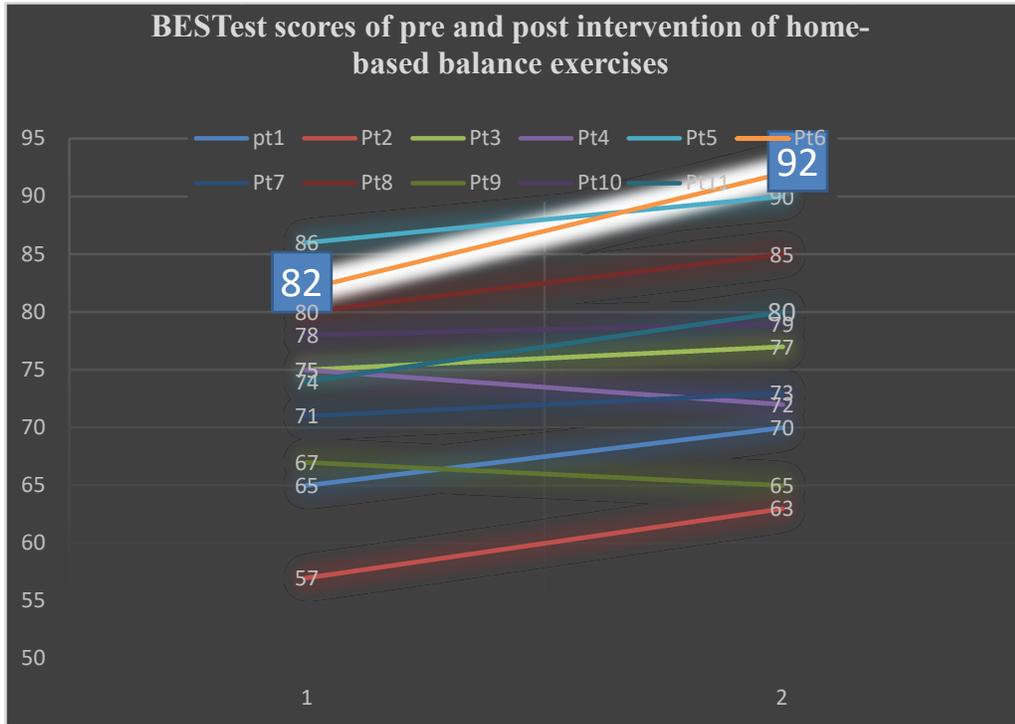
The difference between pre-test and post-test balance score with adherent percentage was analysed for all the participants recruited in the study using descriptive statistics.

Table 6: Pretest, posttest BESTest scores, difference and adherent percentage of home-based balance exercises with (n=11)

S.no	Pre-test (BESTest %)	Post-test (BESTest %)	Difference	Adherent%
1.	65	70	5	51
2.	57	63	6	58
3.	75	77	2	17
4.	75	72	-3	0
5.	86	90	4	34
6.	82	92	10	80
7.	71	73	2	15
8.	80	85	5	44
9.	67	65	-2	0
10.	78	79	1	13
11.	74	80	6	58

From table 6, it shows out of 11 participants, only one participant showed a maximum difference of 10% which is clinically significant as the MCID of BESTest score is 6.5

Fig 10: BESTest scores of pre and post intervention of home-based balance exercises (n=11)



Adherence to Kinect adventures game therapy

Adherence to Kinect adventure game therapy was calculated by attendance in terms of frequency of the game performed by the participants.

Frequency of the game

In a total of 11 participants, three dropped out. Remaining eight participants considered for analysis. The frequency of the game was calculated in terms of the repetition of the games that the participants performed and values were entered in terms of percentage. Descriptive statistics were used to find the mean percentage frequency of games for each participant. Attendance was categorized based on the percentage obtained. Attendance of seventy-five per cent and above was considered as adherence.

From the analysis, it shows only three patient was adherent to Kinect adventure game therapy which was only 38% which indicates that participants were non-adherent to the home-based balance exercises.

Table 7: Mean percentage of frequency of Kinect game therapy for 6 weeks (n=8)

S.no	Mean percentage of frequency of the game for 6weeks
1.	00
2.	33
3.	89
4.	00
5.	100
6.	100
7.	61
8.	11

Figure 11: Participant's adherent percentage of Kinect game therapy (n=8)

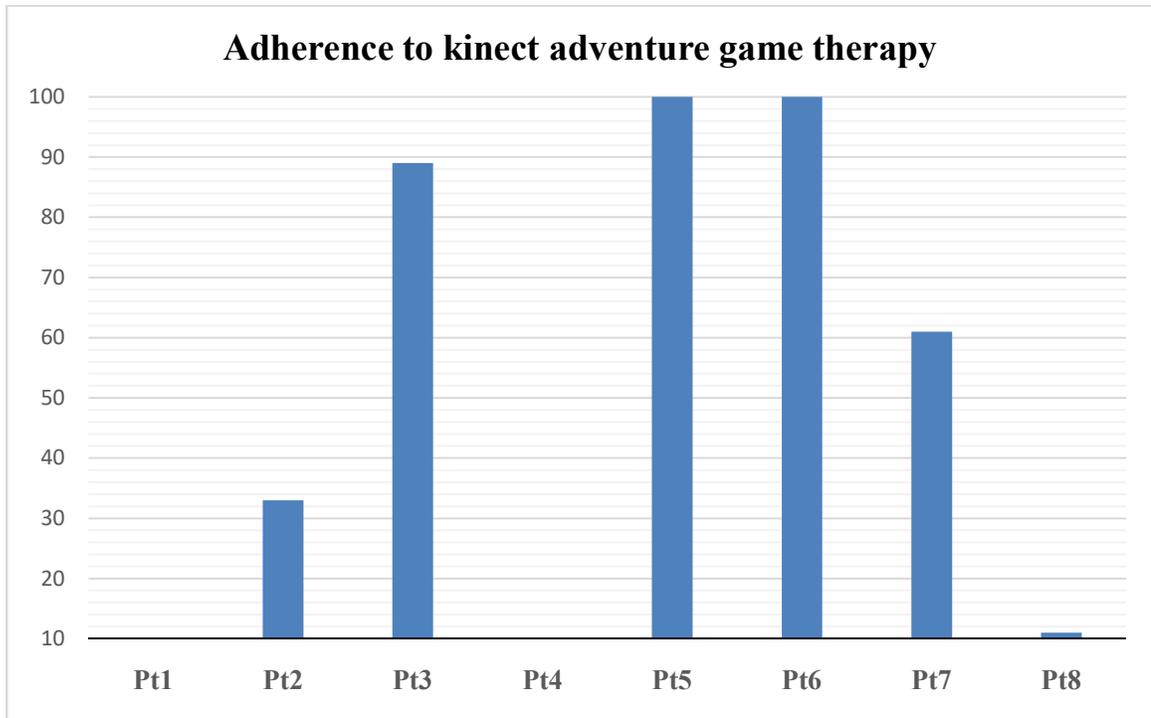


Table 8: Adherence percentage, no of participants, the range of pre and post best test of Kinect game therapy (n=8)

Adherent Percentage	Number of participants	Range of BESTest in the pre-test	Range of BESTest in post-test
<25%	3/11	70-85	68-85
25-50%	1/11	63	64
51-75%	1/11	73	75
≥75	3/11	77-92	80-95

From table 8, it shows that out of 8 participants, three participants adherence was less than 25%, one participant adherence was between 25-50%, one participant adherence was between 51-74% which indicates these participants were non-adherent to the home-based balance exercise and three participants adherence was more than 75% which indicates that participant is adherent to home-based balance exercises. The overall adherent percentage to Kinect adventure game therapy was 38%.

Table 9: Participants week wise analysis of adherence to Kinect game therapy (n=8)

S.no	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
1.	0	0	0	0	0	0
2.	100%	100%	0%	0%	0%	0%
3.	100%	100%	100%	100%	67%	67%
4.	0%	0%	0%	0%	0%	0%
5.	100%	100%	100%	100%	100%	100%
6.	100%	100%	100%	100%	100%	100%
7.	100%	100%	100%	67%	0%	0%
8.	67%	0%	0%	0%	0%	0%
≥to 75%	5	5	4	3	2	2

From table.9, it shows for 1st and 2nd week 5 participants were adhered to Kinect game therapy, from third week participant's adherent rate was dropping down. The percentage of adherent was reduced from 65% to 25%.

Secondary outcome measure: BESTest.

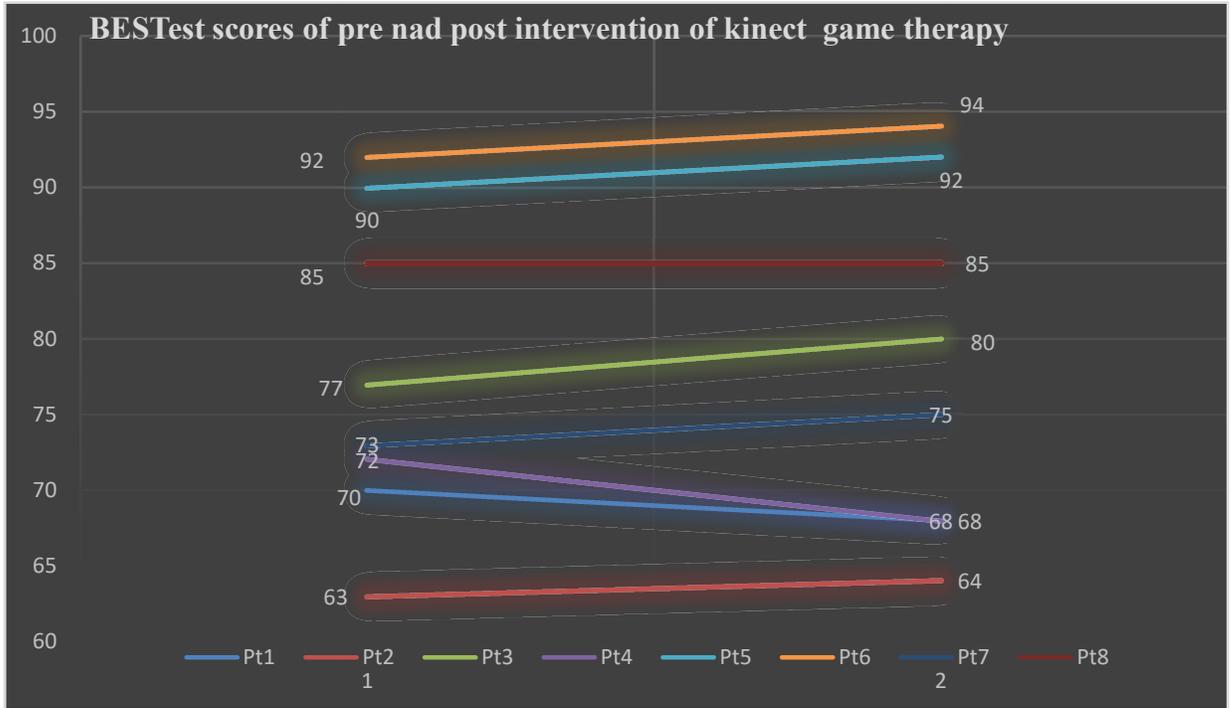
In a total of 11 patients, three dropouts were found. Remaining eight participants were considered for analysis and 6weeks post-test of BESTest score was considered as baseline score for game therapy. Baseline and post-test balance score were analyzed using descriptive statistics.

Table 10: Pre-test, post-test BESTest scores, difference and adherent % of game therapy (n=8)

S.no	Pre-test (BESTest %)	Post-test (BESTest %)	Difference	Adherent%
1.	70	68	-2	00
2.	63	64	1	33
3.	77	80	3	89
4.	72	68	-4	00
5.	90	93	3	100
6.	92	95	3	100
7.	73	75	2	61
8.	85	85	0	11

From table 10, it shows out of 8 participants the maximum difference found in BESTest score was 3% which is not clinically significant as the MCID of BESTest score is 6.5

Figure 12: BESTest scores of pre and post intervention of Kinect game therapy (n=8)



5. DISCUSSION

Eleven PD patients were enrolled in the study. Initially six weeks of home-based balance exercises were given and adherence was measured using the attendance percentage of the sessions completed and it is measured in terms of the frequency of the exercise performed and Kinect game therapy were implemented for another six weeks and adherence was measured using the attendance percentage of the sessions completed and it is measured in terms of the frequency of the game performed. The objective of this study was to check adherence to Kinect adventure games and home-based balance exercises in PD patients. The assumption was patients will be adherent to game therapy than the home-based balance exercise. However, the results showed that participants were non-adherent to both the interventions, but the adherent percentage for participants participated in home-based balance exercise was only 9% which was less when compared to the Kinect game therapy where the adherent percentage was 38%.

The advantages involved in home-based balance exercise were participants can perform the exercise in their home environment which was more comfortable for them.

The disadvantage involved in home-based balance exercise was lack of supervision of the exercise, limited access to exercise resources. The barriers stated by participants in home-based balance exercise were classified into intrinsic and extrinsic factors. The intrinsic factors included are lack of interest in performing exercises, fear of fall, poor health, fear of doing exercises as an individual and tiredness. Extrinsic factors include bad weather, lack of supervision from a caregiver, personal reasons like tourism, shifting to son/daughter place, attending family functions, are the reasons documented

from participants. Along with these, home-based exercises have extraneous disturbance of home which will become the first preference to be occupied, then indulging into the exercise. Moreover, there is no accountability to motivate them to compulsory indulge in the exercise programme. A cross-sectional study was done by Ellis T to elaborate the barriers in exercise program in people with PD, the barriers found were people did not expect to derive benefit from exercise (low outcome expectation), lack of time to perform exercises, poor health, discomfort in chest, depression, rainy climate, fear of fall, lack of interest, weakness, pain, discomfort with exercise and limited access to exercise resources.⁴⁸ In this study similar kind of barriers were reported. A systematic review done by Picorelli M, this study elaborated the program characteristics and personal factors, involved in adherence to exercise protocol. The report of the study states that various personal factors influenced the adherence to drop. The factors stated were reduced mental wellbeing, reduced physical wellbeing and patients who are in initial stages of depression reported with lower adherent rate to prescribed programs.⁴⁹

Kinect adventure game therapy was implemented for another six weeks after home-based balance exercises and adherence was measured using the attendance percentage of the sessions completed and it is measured in terms of frequency of the game performed. The attendance percentage of Kinect game therapy was 38% which is still less than 75% but the adherence percentage is better compared to the home-based balance exercises. The positives of Kinect game therapy reported by participants were they found games were interesting, fun, enjoyable, motivating and they themselves involved into the game therapy and their scores were increasing for each session. The game had the interaction between the user and virtual environments. The games involved

in the virtual environment with demands of both body(physical) and mind(cognition), it attracts the participant and challenges with visual and auditory feedback and it stimulates users to exercise as there are rewards and scores which would be motivating.⁴⁵ The barriers stated by participants non-adherent to Kinect game therapy are they felt difficult to come alone, lack of motivation from caregiver, as no caregiver to take them to the rehabilitation centre, poor health, migration and one of the participant stated that he is willing to perform exercise only in home which could also be the reason for drop out of 3 participants before starting the Kinect game therapy. In this study, all 11 participants underwent a baseline evaluation of BESTest and they have attended six weeks of home-based balance exercises. Before initiating Kinect adventure game there were three dropouts, with 2 participants migrated to other cities and one participant felt difficult to come.

Attendance percentage of home-based balance exercise was analyzed week wise up to six weeks. For the first week the percentage of adherent was 27%, three participants out of eleven adhered to 75% of attendance. For the second week the mean percentage of adherent was 27%, three participants out of eleven adhered to 75% of attendance. There was only 9% of adherence on the third week, fourth, fifth and sixth week, only one participant out of 11 adhered to 75% of attendance. It shows a trend that initially participants had more interest to perform exercise after knowing about the benefits of exercise and would have got motivated to do exercise to improve the balance after knowing their score in the BEST test results. As the week progress, they lost interest and they did not adhere due to the intrinsic and extrinsic factors which were reported by them.

Attendance percentage of Kinect game therapy was analyzed week wise up to six weeks. For first week the percentage of adherent was 63%, five participants out of eleven adhered to 75% of attendance. For second week the percentage of adherent was 63%, five participants out of eleven adhered to 75% of attendance. For the third week the percentage of adherent was 50%, four participants out of eleven adhered to 75% of attendance. For the fourth week the percentage of adherent was 38%, three participants out of eleven adhered to 75% of attendance. For the fifth week the percentage of adherent was 25%, two participants out of eleven adhered to 75% of attendance. For the sixth week the percentage of adherent was 25%, two participants out of eleven adhered to 75% of attendance. It shows participants had more interest to play games because it is fun, challenging and motivated by scores and rewards of the game to perform each time better to increase the score and to progress for bronze medal to gold/platinum in the virtual environment. The reason to decrease the attendance percentage was the factors which were reported by them.

The secondary objective of the study is to evaluate the improvement in balance with home-based balance exercises in PD patients. To check the improvement in BESTest the attendance percentage was categorized into $\leq 25\%$, 26-50%, 51-75% and 76-100%. There were five participants adhered to 25% of attendance. The best test score range prior to the intervention was 67-78 and post-intervention the BEST TEST score improved to the range of 77-79. There were two participants with 26-50% adherence. The best test score range prior to the intervention was 80-86 and post-intervention the BEST TEST score improved to the range of 85-90. There were three participants with 51-75% adherence. The BESTest score range prior to the intervention was 65-74 and post-

intervention the BEST TEST score improved to the range of 63-80. One participant with adherence of 76-100 %.The BESTest score range prior to the intervention was 82 and the post-intervention BESTest score improved to 92 which is clinically significant with 80% adherence. The participants who adhered 51-75% the difference in BESTest score was 5 for 1 participant and 6 for 2 participants. This shows that the participant's balance is improved but not significantly. The participants in this group reported that they were satisfied and had the interest to participate in such games. The participants who adhered 26-50% the difference in BESTest score was 4 for 1 participant and 5 for 1 participant. The participants who adhered $\leq 25\%$ difference in BESTest score was 1 for 1 participant and remaining 4 participants there was no difference found in BESTest scores

Eight participants participated in Kinect game therapy. For analyzing the BESTest score it was categorized the same as home-based therapy. There were three participants adhered to 25% of attendance. The BESTest score range prior to the intervention was 70-85 post-intervention the BEST TEST score improved to the range of 68-85. There were one participant adhered to 26-50% of attendance. The BESTest score prior to the intervention was 63 and post-intervention the BEST TEST score improved to 64. There were one participant adhered to 51-75% of attendance. The BESTest score prior to the intervention was 73 and post-intervention the BEST TEST score improved to 75. Three participants adherence was 76-100% of attendance ((89%, 100%. 100%). The BESTest score prior to the intervention was 77-92 and post-intervention the BEST TEST score was 80-95.

The participants who adhered 76-100% the difference in BESTest score was 3 for all three participants. The participants participated in both home balance therapy and

Kinect game therapy was the same. The improvement in balance was better after post home-based therapy than Kinect game therapy because the improvement in balance would have reached to the maximum and it was maintained when Kinect therapy was continued after home-based therapy.

5.1 Strength of the study

The procedure of the main study was standardized with a pilot study of 3 PD patients.

Suggestions

The exercise intervention is a lifetime management and sustainability is needed for PD patients to maintain postural control. But this sustainability comes only if the therapy is going to be joyful, challenging. The sustainability or adherence to Kinect game therapy can be checked by prescribing it at home.

5.2 Limitations of the study

The Kinect adventure game was not prescribed to each participant's home for checking adherence rather asked the participants to visit the rehabilitation centre because of the cost-effectiveness of Kinect adventure games.

Moreover, the participants reported that coming to the rehabilitation centre was difficult for them which may reduce the percentage of adherence to Kinect game therapy.

The Small samples recruited for the study was very less were we could not find if there is adherence to both the intervention.

5.3 Future implications

Alternative forms of home exercise prescription should be implicated in order to enhance adherent rates and the home exercise programme should be prescribed in terms of making instructions to participants simple and less demanding.

Social support, providing reminder, reinforcement and family education can be implemented to increase the adherence rate.

6. CONCLUSION

The participants with Parkinson's disease did not adhere to Kinect adventure game therapy. For the attended sessions the balance improved for home-based balance exercise compared to Kinect game therapy.

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APPENDICES

APPENDIX A- Review from Rajiv Gandhi University of Health sciences

ACA/DCD/SYN/JJSCOP-M/T046/2017-18

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, KARNATAKA

REPORT OF REGISTRATION STATUS OF DISSERTATION TOPICS 2017 - 2018 ACADEMIC YEAR

FACULTY: PHYSIOTHERAPY Regular

JSS COLLEGE OF PHYSIOTHERAPY, MYSORE

Sl.No	Name of the Candidate	Guide Name and Designation	Title	As per Reviewer Status Observation and Remarks	Univ.Remarks
Course : MPT					
1	THILLAIVIGNESH.B	MRS.RENUKADEVI.M DESG:ASST-PROF	ADHERENCE TO KINECT ADVENTURE GAMES IN INDIVIDUALS WITH PARKINSON 'S DISEASE	<p>Status: Prov. Registered</p> <p>Observations: Described And Well Structured However The Numbering Of The Side-Heading Is Not Correct As Per RGUHS Synopsis Performa. It Should Be As Below Brief resume of the intended work: 6-6.1 need for the study 6.2-review of literature 6.3 -objectives of the study 7-7.1 Source of data 7.2-Method of collection of data(including sampling procedure, if any) 7.3-Does the study require any investigations or interventions to be conducted on patients or other humans or animals? 7.4-Has ethical clearance been obtained from your institution in case of 7.3 8-List of references CORRECTION IS MADE WITH REFERENCE PROFORMA FOR REGISTRATION OF SYNOPSIS FOR DISSERTATION</p> <p>Remarks : Follow the Proforma for registration of synopsis for dissertation RGUHS</p>	<p>PROVISIONALLY REGISTERED</p> <p>STATUS OF ADMISSION - APPROVED</p>

DR. DCD

1

Appendix B -Ethical certificate from Institutional Ethical Committee

JSS MEDICAL COLLEGE
(Constituent College)
JSS Academy of Higher Education & Research
(Deemed to be University)
Accredited 'A' Grade by NAAC



JSSMC/IEC / 3107 / 16 NCT /2018-19

Date: 06.08.2018

Members

Dr. M.Premanath
MD. General Medicine
Chairman

Dr.H.Basavana Gowdappa
MD. General Medicine
Member

Dr. R.Rajalakshmi
MD Physiology
Member

Dr.M.Guruswamy
MS. ENT
Member

Dr. Pratibha Pereira
Prof of Medicine
Member

Sri.NagendraMurthy M.P
B.Com. LL.M, M.Phil.
Member

Smt. Sudhaphaneesh
M.A., B.Ed.,(Ph.D)
Member

Dr.Madan Ramesh,
M.Pharm, PhD
Member

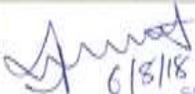
Sri. R.S.Nagaraj
B.Sc, MBA
Member

INSTITUTIONAL ETHICAL COMMITTEE

CERTIFICATE

This is to certify that the below mentioned Project was discussed and reviewed and the same has been cleared and approved by the Institutional Ethical Committee at its meeting held on 31.07.2018 at College Council Hall, JSS Medical College, Mysore.

Title of Project	"Adherence to Kinect Adventure Games in individuals with Parkinson's disease"
Principal Investigator	Mr. B.Thillaivignesh Ist Year MPT Student JSS College of Physiotherapy Mysore
Guide	Ms. Renuka Devi .M, MPT Lecturer JSS College of Physiotherapy Mysore


6/8/18
MEMBER SECRETARY
Institutional Ethical Committee
J.S.S. Medical College, S.S. Nagar
MYSORE-570 015

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Appendix C- Permission from Medical Superintend

From,

Date: 24.08.2018

B. Thillaivignesh
1st year MPT
JSS College of Physiotherapy
Mysuru-570008

To,

Dr.M Guruswamy
Medical Superintendent
JSS Hospital
Mysuru-570008

Respected sir,

Subject: Seeking Permission to take the patients of hospital as samples for MPT thesis.

I am a student of JSS College of physiotherapy pursuing Masters in Physiotherapy (Neurology and Psychosomatic disorders). In order to complete the criteria for course completion, I am planning to conduct a study. The title of this proposed study is "**Adherence to Kinect Adventure Games in individuals with Parkinson's disease**". Kinect adventures games is non immersive virtual reality training used to improve balance in Parkinson's disease. The aim of my study is to check adherence to kinect adventure games due to lack of interest, fear of falling and there is lack of adherence to exercise which becomes a barrier to sustain the effect for long term. This study requires patients with Parkinson's disease and if given permission, I would like to include the patients who are admitted to the inpatient Neurology ward and outpatient Neurology. I have received the clearance from the institutional ethical committee of JSS medical college, Mysuru as well from the Head of Department of Neurology. Hence, I request your good offices to kindly consider my request and grant permission to conduct this study.

Thanking you,

Yours sincerely,

S. Thillai
Thillaivignesh

*Approved for the
Neurology in
the Project. Review
is done.
S. Thillai*

R. M. D.
Principal
JSS College of Physiotherapy
Ramanuja Road, Mysuru-04
Guide:
(RENUKADON M)

Appendix D- Permission from Head of the Department (Neurology)

From,

Date: 24.08.18

B.Thillaivignesh
1st year MPT
JSS College of Physiotherapy
Mysuru-570008

To,

The Head of the Department
(Department of Neurology)
JSS Hospital
Mysuru-570008

Respected sir,

Subject: Permission for conducting research.

I am a student of JSS College of physiotherapy pursuing Masters in Physiotherapy (Neurology and Psychosomatic disorders). In order to complete the criteria for course completion, I am planning to conduct a study. The title of this proposed study is "**Adherence to Kinect Adventure Games in individuals with Parkinson's disease**". For which I require Parkinson's disease patients as the availability in basal ganglia society in-Mysuru is inadequate for my study population. Hence, I kindly request you to refer Parkinson's patients to physiotherapy Out Patient Department.

Yours sincerely,

B. Thilla
B. Thillaivignesh

R. L. M.
Principal:

R. L. M.
Guide:

(RANUKNDAM M)
PROFESSOR
JSS COLLEGE OF PHYSIOTHERAPY
MYSURU
JSS COLLEGE OF PHYSIOTHERAPY
RAMANUJA ROAD,
MYSORE-570 004

Forwarded to
Dr. Gubbinayya
Medical Superintendent
JSS Hospital Mysuru

Dr. S. HANISHA, MBBS, MD, DM
Professor & In-charge, Dept. of Neurology
JSS MC & Hospital, Mysore
KMS No. 250/18

Appendix E1- Informed Consent Form (English)

INFORMED CONSENT

Title: Adherence to Kinect Adventure Games in individuals with Parkinson's disease

Principal investigator: Thillaivignesh, JSS College of physiotherapy, Mysore.

Site: JSS College of physiotherapy primacies, Mysore.

Phone no: 8248160856

Please read this form carefully. If you don't understand the language or any information in this document, please discuss. If you decide to take part in this study you must sign at the end of this form.

Procedure: I understand that I will be made to stand on an even surface and I will be moving right and left side, forward and backward depends upon the video game will be displayed. I may withdraw from the study without any reasons if I want.

Risks and discomfort: I have been informed that there will be no risks during the study. On account of safety harness and gait belt will be arranged

Benefits: I understand that the results of the study will help the physiotherapists to use the Kinect adventure games in clinical setup to balance disorder patients.

Payment for participation: I understand that I may not be paid for participation and that this is a non-funded research.

Confidentiality: I understand that information produced as a result of this study will be treated as confidential. It will not to be revealed to any person without my written consent.

However, the information may be used for statistical analysis, publication or for teaching purposes with your right to privacy retained.

Request for more information: I understand that I may at any time request more information about the study. I will be informed about any significant new information that may affect me or influence my further participation in the study.

Withdrawal from the study: I understand that I may at any time withdraw from the study and my participation is completely voluntary.

Injury statement: I understand that it is unlikely to get injured directly during my participation in this study, and in such case first aid will be given but no further

compensation would be provided by the department or hospital. I am aware that by agreeing to participate in this study, I am not waiving any of my legal rights.

Investigator's statement: I have explained to the subject, purpose of the research, the procedures required and the possible risks and benefits to the best of my ability.

Sign of Investigator:

Date:

I have read this form, and I understand the test procedures, the risks and discomforts. Knowing these risks and discomforts and having had an opportunity to ask questions that have been answered to my satisfaction, I consent to participate in this test.

Sign of Participant:

Date:

Informed Consent Form

Thesis title: Adherence to Kinect Adventure Games in individuals with Parkinson’s disease.

Name of the Research Subject:

Age of the Research Subject:

I have read the Subject Information Sheet and its contents were explained. I had the opportunity to ask questions and received satisfactory answers. I understand that my participation in the study is voluntary and that I have the right to withdraw at any time without giving any reason, without my legal rights being affected.

I agree to take part in the above study. I confirm that I have received a copy of the subject information sheet along with this signed and dated informed consent form.

Signature & name of the participant

Date

Signature & the name of the witness

Date

Appendix E2 -Informed Consent (Kannada)

ಅಧ್ಯಯನದ ಮಾಹಿತಿ ಪತ್ರ / ಅಧ್ಯಯನದ ಸಮ್ಮತಿ ಪತ್ರ

ಶೀರ್ಷಿಕೆ:-

ಪಾರ್ಕಿನ್ಸನ್ ರೋಗದ ವ್ಯಕ್ತಿಗಳಲ್ಲಿ ರೆನೇಟ್ ಅಡ್ವೆಂಚರ್ಸ್ ಆಟಗಳ ರೀತಿ ಆಸಕ್ತಿ ಹಾಗೂ ನಿಷ್ಠೆ

ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ:-

ಥಿಲೈವಿಫ್ಲೋಕ್, ಜೆ.ಎಸ್.ಎಸ್ ಕಾಲೇಜ್ ಫಿಸಿಯೋಥೆರಪಿ, ಮೈಸೂರು.

ದೂರವಾಣಿ ಸಂಖ್ಯೆ:- +91 8248160856

ದಯವಿಟ್ಟು ಈ ಮಾಹಿತಿ ಪತ್ರವನ್ನು ಗಮನದಲ್ಲಿಟ್ಟು ಓದಿ. ಈ ಮಾಹಿತಿ ಪತ್ರದ ಭಾಷೆ ಅರ್ಥವಾಗದಿದ್ದಲ್ಲಿ ಅಥವಾ ಯಾವುದೇ ಮಾಹಿತಿಯನ್ನು ಕುರಿತು ಸಂಶಯವಿದ್ದಲ್ಲಿ ದಯವಿಟ್ಟು ತನಿಖಾಧಿಕಾರಿಗಳೊಡನೆ ಚರ್ಚಿಸಿ, ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ನಿಮಗೆ ಇಚ್ಛೆ ಇದ್ದಲ್ಲಿ, ನಿಮ್ಮ ಸಮ್ಮತಿಯನ್ನು ಈ ಮಾಹಿತಿ ಪತ್ರದ ಕೊನೆಯಲ್ಲಿ ಸಹಿ ಮಾಡುವ ಮುಖಾಂತರ ನೀಡಬಹುದು.

ಸಂಶೋಧನೆಯ ಉದ್ದೇಶ:-

ಪಾರ್ಕಿನ್ಸನ್ ರೋಗದ ವ್ಯಕ್ತಿಗಳ ಸಮತೋಲನದ ಮೇಲೆ ಕಿನೆಟ್ ಅಡ್ವೆಂಚರ್ಸ್ ಆಟಗಳ ಪರಿಣಾಮವನ್ನು ಕಂಡು ಹಿಡಿಯುವುದು / ಪರೀಕ್ಷಿಸುವುದು.

ಕಾರ್ಯವಿಧಾನ:-

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನಾನು ನೇರವಾಗಿ ಮೇಲ್ನಿಂತಿರುವಂತೆ ನಿಂತು ನನ್ನ ಎಡ ಹಾಗೂ ಬಲಗೈ ಚಲನೆಯನ್ನು ವೇಗವಾಗಿ / ರಭಸದಿಂದ ಮಾಡಬೇಕು ಎಂಬುದರ ಅರಿವು ನನಗಿದೆ. ವಿಡಿಯೋ ಗೇಮ್ ಆಟದ ಬಳಕೆಯನ್ನು ನನಗೆ ತೋರಿಸಲಾಗುವುದು. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನನ್ನ ಭಾಗವಹಿಸುವಿಕೆ ಸ್ವಇಚ್ಛೆಯಾಗಿದ್ದು, ಯಾವುದೇ ಸಮಯದಲ್ಲಾದರೂ ನಾನು ನನ್ನ ಸಮ್ಮತಿಯನ್ನು ಹಿಂತೆಗೆದುಕೊಳ್ಳಬಹುದು ಎಂಬುದರ ಅರಿವು ನನಗಿದೆ.

ಅಪಾಯಗಳು ಮತ್ತು ಅಸ್ವಸ್ಥತೆ:-

ನಾನು ಈ ವಿಡಿಯೋ ಗೇಮ್ ಬಳಸುವುದರಿಂದ ನನಗೆ ಯಾವುದೇ ದುಷ್ಪರಿಣಾಮಗಳಾಗುವುದಿಲ್ಲ ಎಂದು ತಿಳಿದಿದೆ. ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಸುರಕ್ಷತೆಗಾಗಿ ಸರಂಜಾಮು ಮತ್ತು ನಡಿಗೆ ಬೆಲ್ಟ್ ಅನ್ನು ಉಪಯೋಗಿಸುತ್ತಾರೆ ಎಂಬುದರ ಅರಿವು ನನಗಿದೆ.

ಪ್ರಯೋಜನಗಳು:-

ಸಮತೋಲನದ ತೊಂದರೆಗಳಿರುವ ಪಾರ್ಕಿನ್ಸನ್ ರೋಗಿಗಳಲ್ಲಿ, ಸಮತೋಲನವನ್ನು ವೃದ್ಧಿಗೊಳಿಸಲು ಕ್ಲಿನಿಕಲ್ ಸೆಟ್ಟಿಂಗ್‌ನಲ್ಲಿ ಕಿನೆಟ್ ಸಾಹಸ ಆಟಗಳನ್ನು ಬಳಸಲಾಗುವುದು. ಈ ಅಧ್ಯಯನದಲ್ಲಿ

ದೊರೆಕುವ ಫಲಿತಾಂಶಗಳು ಭೌತಿಕ ಚಿಕಿತ್ಸಕರಿಗೆ (ಫಿಸಿಯೋಥೆರಪಿಸ್ಟ್) ಮುಂದಿನ ದಿನಗಳಲ್ಲಿ ಉಪಯೋಗಕರವಾಗಿರುವುದು ಎಂಬುದರ ಅರಿವು ನನಗಿದೆ.

ಪಾಲ್ಕೊಳ್ಳುವಿಕೆಯ ಪಾವತಿ:-

ನಾನು ಪಾಲ್ಕೊಳ್ಳುವಿಕೆಗೆ ಪಾವತಿಸದೇ ಇರಬಹುದು ಹಾಗೂ ಈ ಸಂಶೋಧನೆ ಅನುದಾನರಹಿತವಾಗಿರುತ್ತದೆ.

ಗೋಪ್ಯತೆ:-

ಈ ಅಧ್ಯಯನದ ಪರಿಣಾಮವಾಗಿ ಉತ್ಪತ್ತಿಯಾದ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯವಾಗಿ ಪರಿಗಣಿಸಲಾಗುತ್ತದೆ ಎಂದು ನನಗೆ ಅರ್ಥವಾಗಿದೆ. ನನ್ನ ಲಿಖಿತ ಅನುಮತಿಯಿಲ್ಲದೆ ಯಾವುದೇ ವ್ಯಕ್ತಿಗೆ ಅದು ಬಹಿರಂಗಗೊಳ್ಳಬಾರದು. ಅಧ್ಯಯನದ ಸಂದರ್ಭದಲ್ಲಿ ದೊರೆತ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯತೆಯನ್ನು ಗಮನದಲ್ಲಿರಿಸಿ ಸಂಖ್ಯಾಶಾಸ್ತ್ರೀಯ ವಿಶ್ಲೇಷಣೆ, ಪ್ರಕಟಣೆ ಅಥವಾ ಬೋಧನಾ ಉದ್ದೇಶಗಳಿಗಾಗಿ ಬಳಸಬಹುದು.

ಹೆಚ್ಚಿನ ಮಾಹಿತಿಗಾಗಿ ವಿನಂತಿ:-

ಅಧ್ಯಯನದ ಬಗ್ಗೆ ಹೆಚ್ಚಿನ ಮಾಹಿತಿಗಾಗಿ ನಾನು ಯಾವುದೇ ಸಮಯದಲ್ಲಾದರೂ ವಿನಂತಿಸಬಹುದು. ಅಧ್ಯಯನದ ಅವಧಿಯಲ್ಲಿ ಯಾವುದೇ ಗಮನಾರ್ಹ ಹಾಗೂ ನನಗೆ ಅನುಕೂಲವಾದ ವಿಷಯ ದೊರಕಿದಲ್ಲಿ ನನಗೆ ಅದನ್ನು ತಿಳಿಸಲಾಗುವುದು ಎಂಬುದರ ಅರಿವು ನನಗಿದೆ.

ಅಪಾಯಗಳ ಕುರಿತು:-

ಈ ಅಧ್ಯಯನದ ಪಾಲ್ಕೊಳ್ಳುವಿಕೆಯ ಅವಧಿಯಲ್ಲಿ ನೆರವಾಗಿ ಗಾಯಗೊಳ್ಳುವ ಸಾಧ್ಯತೆಯಿಲ್ಲ ಎಂದು ನಾನು ಅರ್ಥ ಮಾಡಿಕೊಂಡಿರುತ್ತೇನೆ. ಗಾಯವಾದ ಸಂದರ್ಭದಲ್ಲಿ ನನಗೆ ಪ್ರಥಮ ಚಿಕಿತ್ಸೆ ನೀಡಲಾಗುವುದು, ಆದರೆ ಇಲಾಖೆ ಅಥವಾ ಆಸ್ಪತ್ರೆಯಿಂದ ಮತ್ತಷ್ಟು ಪರಿಹಾರವನ್ನು ನೀಡಲಾಗುವುದಿಲ್ಲ.

ಮುಖ್ಯ ತನಿಖಾಧಿಕಾರಿಯ ಹೇಳಿಕೆ:-

ನಾನು ಅಧ್ಯಯನ ಉದ್ದೇಶ, ಅಗತ್ಯವಿರುವ ಕಾರ್ಯವಿಧಾನಗಳ ಕುರಿತು ಹಾಗೂ ಸಂಭಾವ್ಯ ಅಪಾಯಗಳು, ಪ್ರಯೋಜನಗಳನ್ನು ಕುರಿತು ನನ್ನ ಸಾಮರ್ಥ್ಯದ ಅನುಗುಣವಾಗಿ ತಿಳಿಸಿದ್ದೇನೆ.

ತನಿಖಾದಾರರ ಸಹಿ

ದಿನಾಂಕ

ನಾನು ಈ ಮಾಹಿತಿ ಪತ್ರವನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ಓದಿ ಅರ್ಥೈಸಿಕೊಂಡಿದ್ದೇನೆ. ಅಧ್ಯಯನದ ಉದ್ದೇಶ, ಉಪಯೋಗಗಳು ಹಾಗೂ ಸಂಭವವಿರುವ ತೊಂದರೆಗಳ ಕುರಿತು ನನಗೆ ಅರಿವಿದೆ.

ಈ ಪರೀಕ್ಷೆಯಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ನಾನು ಸಮ್ಮತಿಸುತ್ತೇನೆ.

ಪಾಲ್ಗೊಳ್ಳುವವರ ಸಹಿ

ದಿನಾಂಕ

ನಾನು ವಿಷಯ ಮಾಹಿತಿ ಹಾಳೆಗಳನ್ನು ಓದಿದ್ದೇನೆ ಮತ್ತು ದೊರಕಿದ ಅದರ ವಿಷಯಗಳನ್ನು ವಿವರಿಸಲಾಗಿದೆ. ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲು ಮತ್ತು ತೃಪ್ತಿದಾಯಕ ಉತ್ತರಗಳನ್ನು ಪಡೆಯುವ ಅವಕಾಶ ನನಗೆ ಸಿಕ್ಕಿತು. ಅಧ್ಯಯನದ ನನ್ನ ಪಾಲ್ಗೊಳ್ಳುವಿಕೆ ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿದೆ ಮತ್ತು ನನ್ನ ಕಾನೂನು ಬಾಧೆಗಳಿಲ್ಲದೆ ಯಾವುದೇ ಕಾರಣವನ್ನು ನೀಡದೆಯೇ ಯಾವುದೇ ಸಮಯದಲ್ಲಾದರೂ ಹಿಂತೆಗೆದುಕೊಳ್ಳುವ ಹಕ್ಕಿದೆ ಎಂದು ನಾನು ಅರ್ಥ ಮಾಡಿಕೊಂಡಿದ್ದೇನೆ.

ಮೇಲಿನ ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ನಾನು ಒಪ್ಪುತ್ತೇನೆ. ನಾನು ಸಹಿ ಮಾಡಿದ ಮತ್ತು ದಿನಾಂಕದಂದು ತಿಳಿಸಿದ ಸಮ್ಮತಿಯ ರೂಪದೊಂದಿಗೆ ವಿಷಯ ಮಾಹಿತಿ ಪ್ರತಿಯನ್ನು ಸ್ವೀಕರಿಸಿದ್ದೇನೆ ಎಂದು ದೃಢೀಕರಿಸುತ್ತೇನೆ.

ಸಹಿ ಮತ್ತು ಸಹಭಾಗಿ ದಿನಾಂಕದ ಹೆಸರು

ಸಹಿ ಮತ್ತು ಸಾಕ್ಷಿ ದಿನಾಂಕದ ಹೆಸರು.

Appendix F- Balance Evaluation – Systems Test (BESTest)

TEST NUMBER/SUBJECT CODE

DATE

EXAMINER NAME _____

EXAMINER Instructions for BESTest

- Subjects should be tested with flat heeled shoes or with shoes and socks off.
- If subject must use an assistive device for an item, score that item one category lower.

Tools Required

- Stop watch
- Measuring tape mounted on wall for Functional Reach test
- Approximately 60 cm x 60 cm (2 X 2 ft) block of 4-inch, medium-density, Tempur® foam
- 10 degree incline ramp (at least 2 x 2 ft) to stand on
- Stair step, 15 cm (6 inches) in height for alternate stair tap
- 2 stacked shoe boxes for obstacle during gait
- 2.5 Kg (5-lb) free weight for rapid arm raise
- Firm chair with arms with 3 meters in front marked with tape for Get Up and Go test
- Masking tape to mark 3 m and 6 m lengths on the floor for Get Up and Go

Summary of Performance: Calculate Percent Score

		Biomechanical
Section I:	_____ /15 x 100 = _____	Constraints
	_____ /2	Stability
Section II:	1 x 100 = _____	Limits/Verticality
	_____ /1	
Section III:	8 x 100 = _____	Transitions/Anticipatoy
Section IV	_____ /18 x 100 = _____	Reactive
Section V:	_____ /15 x 100 = _____	Sensory Orientation
Section VI:	_____ /21 x 100 = _____	Stability in Gait
	_____ /108 points	
TOTAL:	= _____	Percent Total Score

Balance Evaluation – Systems Test (BESTest)

Subjects should be tested with flat heeled shoes or shoes and socks off. If subject must use an assistive device for an item, score that item one category lower. If subject requires physical assistance to perform an item score the lowest category (0) for that item.

I. BIOMECHANICAL CONSTRAINTS

SECTION I: _____/15 POINTS

1. BASE OF SUPPORT

- (3) Normal: Both feet have normal base of support with no deformities or pain
- (2) One foot has deformities and/or pain
- (1) Both feet has deformities OR pain
- (0) Both feet have deformities AND pain

2. COM ALIGNMENT

- (3) Normal AP and ML CoM alignment and normal segmental postural alignment
- (2) Abnormal AP OR ML CoM alignment OR abnormal segmental postural alignment
- (1) Abnormal AP OR ML CoM alignment AND abnormal segmental postural alignment
- (0) Abnormal AP AND ML CoM alignment

3. ANKLE STRENGTH & RANGE

- (3) Normal: Able to stand on toes with maximal height and to stand on heels with front of feet up
- (2) Impairment in either foot of either ankle flexors or extensors (i.e. less than maximum height)
- (1) Impairment in two ankle groups (eg; bilateral flexors or both ankle flexors and extensors in 1 foot)
- (0) Both flexors and extensors in both left and right ankles impaired (i.e. less than maximum height)

4. HIP/TRUNK LATERAL STRENGTH

- (3) Normal: Abducts both hips to lift the foot off the floor for 10 s while keeping trunk vertical
- (2) Mild: Abducts both hips to lift the foot off the floor for 10 s but without keeping trunk vertical
- (1) Moderate: Abducts only one hip off the floor for 10 s with vertical trunk
- (0) Severe: Cannot abduct either hip to lift a foot off the floor for 10 s with trunk vertical or without vertical

5. SIT ON FLOOR AND STANDUP

Time _____ *sec*

- (3) Normal: Independently sits on the floor and stands up
- (2) Mild: Uses a chair to sit on floor OR to stand up
- (1) Moderate: Uses a chair to sit on floor AND to stand up
- (0) Severe: Cannot sit on floor or stand up, even with a chair, or refuses

II. STABILITY LIMITS

SECTION II: _____/21 POINTS

6. SITTING VERTICALITY AND LATERAL LEAN

		<u>Lean</u>				<u>Verticality</u>	
<u>Left</u>	<u>Right</u>			<u>Left</u>	<u>Right</u>		
(3)	(3)	Maximum lean, subject moves upper shoulders beyond body midline, very stable		(3)	(3)	Realigns to vertical with very SMALL or no OVERSHOOT	
(2)	(2)	Moderate lean, subject's upper shoulder approaches body midline or some instability		(2)	(2)	Significantly Over- or under-shoots but eventually realigns to vertical	
(1)	(1)	Very little lean, or significant Instability		(1)	(1)	Failure to realign to vertical	
(0)	(0)	No lean or falls (exceeds limits)		(0)	(0)	Falls with the eyes closed	

7. FUNCTIONAL REACH FORWARD *Distance reached: _____ cm OR _____ inches*

- (3) Maximum to limits: >32 cm (12.5 in)
- (2) Moderate: 16.5 cm - 32 cm (6.5 – 12.5 in)
- (1) Poor: < 16.5 cm (6.5 in)
- (0) No measurable lean – or must be caught

8. FUNCTIONAL REACH LATERAL *Distance reached: Left _____ cm (_____ in) Right _____ cm (_____ in)*

- | <u>Left</u> | <u>Right</u> | |
|-------------|--------------|---------------------------------------|
| (3) | (3) | Maximum to limit: > 25.5 cm (10 in) |
| (2) | (2) | Moderate: 10-25.5 cm (4-10 in) |
| (1) | (1) | Poor: < 10 cm (4 in) |
| (0) | (0) | No measurable lean, or must be caught |

III. TRANSITIONS- ANTICIPATORY POSTURAL ADJUSTMENT SECTION

III. _____/18 POINTS

9. SIT TO STAND

- (3) Normal: Comes to stand without the use of hands and stabilizes independently
- (2) Comes to stand on the first attempt with the use of hands
- (1) Comes to stand after several attempts or requires minimal assist to stand or stabilize
or requires touch of back of leg or chair
- (0) Requires moderate or maximal assist to stand

10. RISE TO TOES

- (3) Normal: Stable for 3 sec with good height
- (2) Heels up, but not full range (smaller than when holding hands so no
balance requirement) -OR- slight instability & holds for 3 sec
- (1) Holds for less than 3 sec
- (0) Unable

11. STAND ON ONE LEG

Lef *Time in Sec:* _____ Right *Time in Sec:* _____

- | | |
|-------------------------------|------------------------------|
| (3) Normal: Stable for > 20 s | (3) Normal: Stable for > 20s |
| (2) Trunk motion, OR 10-20 s | (2) Trunk motion, OR 10-20 s |
| (1) Stands 2-10 s | (1) Stands 2-10s |
| (0) Unable | (0) Unable |

12. ALTERNATE STAIR

TOUCHING *# of successful steps:* _____ *Time in seconds:* _____

- (3) Normal: Stands independently and safely and completes 8 steps in < 10 seconds

- Completes 8 steps (10-20 seconds) AND/OR show instability such as inconsistent foot
- (2) placement,
excessive trunk motion, hesitation or a rhythmical
- Completes < 8 steps – without minimal assistance (i.e. assistive device) OR > 20 sec for 8
- (1) Steps
 - (0) Completes < 8 steps, even with assistive device

13. STANDING ARM RAISE

- (3) Normal: Remains stable
- (2) Visible sway
- (1) Steps to regain equilibrium/unable to move quickly w/o losing balance
- (0) Unable, or needs assistance for stability

IV. REACTIVE POSTURAL RESPONSE

SECTION IV: _____/18 POINTS

14. IN PLACE RESPONSE- FORWARD

- (3) Recovers stability with ankles, no added arms or hips motion
- (2) Recovers stability with arm or hip motion
- (1) Takes a step to recover stability
- (0) Would fall if not caught OR requires assist OR will not attempt

15. IN PLACE RESPONSE- BACKWARD

- (3) Recovers stability at ankles, no added arm / hip motion

- (2) Recovers stability with some arm or hip motion
- (1) Takes a step to recover stability
- (0) Would fall if not caught -OR- requires assistance -OR- will not attempt

16. COMPENSATORY STEPPING CORRECTION- FORWARD

- (3) Recovers independently a single, large step (second realignment step is allowed)
- (2) More than one step used to recover equilibrium, but recovers stability independently OR 1 step with imbalance
- (1) Takes multiple steps to recover equilibrium, or needs minimum assistance to prevent a fall
- (0) No step, OR would fall if not caught, OR falls spontaneously

17. COMPENSATORY STEPPING CORRECTION- BACKWARD

- (3) Recovers independently a single, large step
- (2) More than one step used, but stable and recovers independently OR 1 step with imbalance
- (1) Takes several steps to recover equilibrium, or needs minimum assistance
- (0) No step, OR would fall if not caught, OR falls spontaneously

18. COMPENSATORY STEPPING

CORRECTION- LATERAL

Left

- Recovers independently with 1 step of
- (3) normal length/width (crossover or lateral OK)
- Several steps used, but recovers
- (2) independently
- Steps, but needs to be assisted to prevent a
- (1) fall
- (0) Falls, or cannot step

Right

- Recovers independently with 1 step of
- (3) normal length/width (crossover or lateral OK)
- Several steps used, but recovers
- (2) independently
- Steps, but needs to be assisted to
- (1) prevent a fall
- (0) Falls, or cannot step

V. SENSORY

ORIENTATION

SECTION V: _____/15 POINTS

19. SENSORY INTEGRATION FOR BALANCE

(MODIFIED CTSIB)

D -EYES CLOSED,

A -EYES OPEN, FIRM

B -EYES CLOSED, FIRM

C -EYES OPEN, FOAM

FOAM

SURFACE

SURFACE

SURFACE

SURFACE

Trial 1 _____sec

Trial 1 _____sec

Trial 1 _____sec

Trial 1 _____sec

Trial 2 _____sec

Trial 2 _____sec

Trial 2 _____sec

Trial 2 _____sec

(3) 30s stable

(3) 30s stable

(3) 30s stable

(3) 30s stable

(2) 30s unstable

(2) 30s unstable

(2) 30s unstable

(2) 30s unstable

(1) < 30s

(1) < 30s

(1) < 30s

(1) < 30s

(0) Unable

(0) Unable

(0) Unable

(0) Unable

20. INCLINE- EYES CLOSED

Toes Up

- (3) Stands independently, steady without excessive sway, holds 30 sec, and aligns with gravity
- (2) Stands independently 30 SEC with greater sway than in item 19B -OR- aligns with surface
- (1) Requires touch assist -OR- stands without assist for 10-20 sec
- (0) Unable to stand >10 sec -OR- will not attempt independent stance

VI. STABILITY IN GAIT

SECTION V: _____/21

POINTS

21. GAIT – LEVEL SURFACE

Time _____ sec

- (3) Normal: walks 20 ft., good speed (≤ 5.5 sec), no evidence of imbalance.
- (2) Mild: 20 ft., slower speed (>5.5 sec), no evidence of imbalance.
Moderate: walks 20 ft., evidence of imbalance (wide-base, lateral trunk motion, inconsistent step path)
– at any preferred speed.
Severe: cannot walk 20 ft. without assistance, or severe gait deviations OR severe
- (0) imbalance

22. CHANGE IN GAIT SPEED

- (3) Normal: Significantly changes walking speed without imbalance
- (2) Mild: Unable to change walking speed without imbalance
- (1) Moderate: Changes walking speed but with signs of imbalance,
- (0) Severe: Unable to achieve significant change in speed AND signs of imbalance

23. WALK WITH HEAD TURNS – HORIZONTAL

- (3) Normal: performs head turns with no change in gait speed and good balance
- (2) Mild: performs head turns smoothly with reduction in gait speed,
- (1) Moderate: performs head turns with imbalance

- (0) Severe: performs head turns with reduced speed AND imbalance AND/OR will not move head within available range while walking.

24. WALK WITH PIVOT TURNS

- (3) Normal: Turns with feet close, FAST (≤ 3 steps) with good balance.
- (2) Mild: Turns with feet close SLOW (≥ 4 steps) with good balance
- (1) Moderate: Turns with feet close at any speed with mild signs of imbalance
- (0) Severe: Cannot turn with feet close at any speed and significant imbalance.

25. STEP OVER OBSTACLES

Time _____ *sec*

- (3) Normal: able to step over 2 stacked shoe boxes without changing speed and with good balance
- (2) Mild: steps over 2 stacked shoe boxes but slows down, with good balance
- (1) Moderate: steps over shoe boxes with imbalance or touches box.
- (0) Severe: cannot step over shoe boxes AND slows down with imbalance or cannot perform with assistance.

26. TIMED “GET UP & GO”

Get Up & Go: Time _____ *sec*

- (3) Normal: Fast (< 11 sec) with good balance
- (2) Mild: Slow (> 11 sec with good balance)
- (1) Moderate: Fast (< 11 sec) with imbalance.
- (0) Severe: Slow (> 11 sec) AND imbalance.

27. Timed “Get Up & Go” With Dual Task

Dual Task: Time _____*sec*

(3) Normal: No noticeable change between sitting and standing in the rate or accuracy of backwards counting and no change in gait speed.

(2) Mild: Noticeable slowing, hesitation or errors in counting backwards OR slow walking (10%)

(1) Moderate: Affects on BOTH the cognitive task AND slow walking (>10%) in dual task.

(0) Severe: Can't count backward while walking or stops walking while talking.

Appendix G-Materials enclosed in Kinect Adventure games

Plate 4. Kinect Adventure games kit



Appendix H-Berg balance scale

Berg Balance Scale

The Berg Balance Scale (BBS) was developed to measure balance among older people with impairment in balance function by assessing the performance of functional tasks. It is a valid instrument used for evaluation of the effectiveness of interventions and for quantitative descriptions of function in clinical practice and research. The BBS has been evaluated in several reliability studies. A recent study of the BBS, which was completed in Finland, indicates that a change of eight (8) BBS points is required to reveal a genuine change in function between two assessments among older people who are dependent in ADL and living in residential care facilities.

Description:

14-item scale designed to measure balance of the older adult in a clinical setting.

Equipment needed: Ruler, two standard chairs (one with arm rests, one without), footstool or step, stopwatch or wristwatch, 15 ft walkway

Completion:

Time: 15-20 minutes

Scoring: A five-point scale, ranging from 0-4. "0" indicates the lowest level

of function and "4" the highest level of function. Total Score = 56

Interpretation: 41-56 = low fall risk
 21-40 = medium fall risk
 0 –20 = high fall risk

A change of 8 points is required to reveal a genuine change in function between 2 assessments.

Berg Balance Scale

Name: _____ Date: _____

Location: _____ Rater: _____

ITEM DESCRIPTION	SCORE (0-4)
Sitting to standing	_____
Standing unsupported	_____
Sitting unsupported	_____
Standing to sitting	_____
Transfers	_____
Standing with eyes closed	_____
Standing with feet together	_____
Reaching forward with outstretched arm	_____
Retrieving object from floor	_____
Turning to look behind	_____
Turning 360 degrees	_____
Placing alternate foot on stool	_____

Standing with one foot in front _____

Standing on one foot _____

Total _____

GENERAL INSTRUCTIONS

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

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.

Berg Balance Scale

SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hand for support.

- () 4 able to stand without using hands and stabilize independently
- () 3 able to stand independently using hands
- () 2 able to stand using hands after several tries
- () 1 needs minimal aid to stand or stabilize
- () 0 needs moderate or maximal assist to stand

STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding on.

- 2.) 4 able to stand safely for 2 minutes
- () 3 able to stand 2 minutes with supervision
- () 2 able to stand 30 seconds unsupported
- () 1 needs several tries to stand 30 seconds unsupported
- () 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR

OR ON STOOL INSTRUCTIONS: Please sit with arms folded for 2 minutes.

- () 4 able to sit safely and securely for 2 minutes

- () 3 able to sit 2 minutes under supervision
- () 2 able to able to sit 30 seconds
- () 1 able to sit 10 seconds
- () 0 unable to sit without support 10 seconds

STANDING TO SITTING

INSTRUCTIONS: Please sit down.

- () 4 sits safely with minimal use of hands
- () 3 controls descent by using hands
- () 2 uses back of legs against chair to control descent
- () 1 sits independently but has uncontrolled descent
- () 0 needs assist to sit

TRANSFERS

INSTRUCTIONS: Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

- () 4 able to transfer safely with minor use of hands
- () 3 able to transfer safely definite need of hands
- () 2 able to transfer with verbal cuing and/or supervision
- () 1 needs one person to assist
- () 0 needs two people to assist or supervise to be safe

STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

- () 4 able to stand 10 seconds safely
- () 3 able to stand 10 seconds with supervision
- () 2 able to stand 3 seconds

- () 1 unable to keep eyes closed 3 seconds but stays safely
- () 0 needs help to keep from falling

STANDING UNSUPPORTED WITH
FEET TOGETHER

INSTRUCTIONS: Place your feet
together and stand without holding on.

- () 4 able to place feet together independently and stand 1 minute safely
- () 3 able to place feet together independently and stand 1 minute with supervision
- () 2 able to place feet together independently but unable to hold for 30 seconds
- () 1 needs help to attain position but able to stand 15 seconds feet together
- () 0 needs help to attain position and unable to hold for 15 seconds

REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

- () 4 can reach forward confidently 25 cm (10 inches)
- () 3 can reach forward 12 cm (5 inches)
- () 2 can reach forward 5 cm (2 inches)
- () 1 reaches forward but needs supervision
- () 0 loses balance while trying/requires external support

PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: Pick up the shoe/slipper, which is in front of your feet.

- () 4 able to pick up slipper safely and easily
- () 3 able to pick up slipper but needs supervision
- () 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently
- () 1 unable to pick up and needs supervision while trying
- () 0 unable to try/needs assist to keep from losing balance or falling

TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE
STANDING

INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder.
Repeat to the right. (Examiner may pick an object to look at directly behind the
subject to encourage a better twist turn.)

- () 4 looks behind from both sides and weight shifts well
- () 3 looks behind one side only other side shows less weight shift
- () 2 turns sideways only but maintains balance
- () 1 needs supervision when turning
- () 0 needs assist to keep from losing balance or falling

TURN 360 DEGREES

INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full
circle in the other direction.

- () 4 able to turn 360 degrees safely in 4 seconds or less
- () 3 able to turn 360 degrees safely one side only 4 seconds or less
- () 2 able to turn 360 degrees safely but slowly
- () 1 needs close supervision or verbal cuing
- () 0 needs assistance while turning

PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING
UNSUPPORTED

INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.

- () 4 able to stand independently and safely and complete 8 steps in 20 seconds
- () 3 able to stand independently and complete 8 steps in > 20 seconds
- () 2 able to complete 4 steps without aid with supervision
- () 1 able to complete > 2 steps needs minimal assist
- () 0 needs assistance to keep from falling/unable to try

STANDING UNSUPPORTED ONE FOOT IN FRONT

INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)

- () 4 able to place foot tandem independently and hold 30 seconds
- () 3 able to place foot ahead independently and hold 30 seconds
- () 2 able to take small step independently and hold 30 seconds
- () 1 needs help to step but can hold 15 seconds
- () 0 loses balance while stepping or standing

STANDING ON ONE LEG

INSTRUCTIONS: Stand on one leg as long as you can without holding on.

- () 4 able to lift leg independently and hold > 10 seconds
- () 3 able to lift leg independently and hold 5-10 seconds
- () 2 able to lift leg independently and hold ≥ 3 seconds
- () 1 tries to lift leg unable to hold 3 seconds but remains standing independently.
- () 0 unable to try of needs assist to prevent fall.
- () TOTAL SCORE (Maximum = 56)

Appendix I- Mini-Mental State Examination (MMSE) (Kannada)

Kannada MMSE Sample Items

ಸಮಯಕ್ಕೆ ಹೊಂದಿಕೊಳ್ಳುವುದು

[Orientation to Time]

ಇದು..... ಯಾವ ದಿನಾಂಕ?

ಹೆಸರು ಹೇಳುವುದು:

[Naming]

ಇದೇನು? (ಒಂದು ಪೆನ್ಸಿಲ್ ಅಥವಾ ಪೆನ್ಸಿಲ್ ಕಡೆ ಬೆರಳು ಮಾಡಿ.)

ಓದುವುದು

[Reading]

ದಯವಿಟ್ಟು ಇದನ್ನು ಓದಿ ಅದು ಹೇಳುವುದನ್ನು ಮಾಡಿ. (ಪರಿಕ್ಷಾರ್ಥಿಗೇ ಹುರಿದುಂಬಿಸುವ ಫಾರ್ಮಿನಲ್ಲಿರುವ ಶಬ್ದಗಳನ್ನು ತೋರಿಸಿ.)

ನಿಮ್ಮ ಕಣ್ಣುಗಳನ್ನು ಮುಚ್ಚಿಕೊಳ್ಳಿ

Appendix J-Hoehn and Yahr Scale of Disability

Stage	Hoehn and Yahr Scale
1	Unilateral involvement only usually with minimal or no functional disability
1.5	-
2	Bilateral or midline involvement without impairment of balance
2.5	-
3	Bilateral disease: mild to moderate disability with impaired postural reflexes; physically independent
4	Severely disabling disease; still able to walk or stand unassisted
5	Confinement to bed or wheelchair unless aided

Appendix K-Handout for home-based balance exercises (6 weeks)

Exercise -1

Standing equal to shoulder-width

- ❖ Stand flat on the ground with your feet equal to shoulder-width and hold for 30seconds with eyes open and repeat for 5 times.
- ❖ Please take rest for 30seconds after the exercise.
- ❖ Exercise should be performed as shown in picture.

ವ್ಯಾಯಾಮ-1

ಭುಜದ ಅಗಲಕ್ಕೆ ಸಮಾನವಾಗಿ ನಿಲ್ಲುವುದು:

1. ನಿಮ್ಮ ಪಾದಗಳನ್ನು ಭುಜದ ಅಗಲಕ್ಕೆ ಸಮಾನವಾಗಿ ನೆಲದ ಮೇಲೆ ಇಟ್ಟು, 30 ಸೆಕೆಂಡ್ ಗಳ ವರೆಗೆ ನಿಮ್ಮ ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ನಿಂತು ಕೊಳ್ಳಬೇಕು .
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 30 ಸೆಕೆಂಡುಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
3. ಈ ಮೇಲ್ಕಂಡ ವ್ಯಾಯಾಮವನ್ನು 5 ಬಾರಿ ಮಾಡಬೇಕು.
4. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise-2

Standing with feet together

- ❖ Stand flat on the ground with feet together and hold for 30seconds, with eyes open and repeat for 5times.
- ❖ Please take rest for 30seconds after the exercise.
- ❖ Exercise should be performed as shown in picture.

ವ್ಯಾಯಾಮ-2

ಎರಡು ಕಾಲುಗಳನ್ನು ಒಟ್ಟಿಗೆ ಜೋಡಿಸಿ ನಿಲ್ಲುವುದು:

1. ನಿಮ್ಮ ಪಾದಗಳನ್ನು ನೆಲದ ಮೇಲೆ ಒಟ್ಟಿಗೆ ಜೋಡಿಸಿ. 30 ಸೆಕೆಂಡ್ ಗಳ ವರೆಗೆ ನಿಮ್ಮ ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ನಿಂತು ಕೊಳ್ಳಬೇಕು .
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 30 ಸೆಕೆಂಡುಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
3. ಈ ಮೇಲ್ಕಂಡ ವ್ಯಾಯಾಮವನ್ನು 5 ಬಾರಿ ಮಾಡಬೇಕು.
4. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise-3

Partial Tandem standing

- ❖ Stand flat on the ground and place one foot ahead of the other foot and hold for 30seconds, with eyes open and repeat for 5times.
- ❖ Please take rest for 30seconds after the exercise.
- ❖ Exercise should be performed as shown in picture.

ವ್ಯಾಯಾಮ-3

ಪಾರ್ಶಿಯಲ್ ಟ್ಯಾಂಡಮ್ ಸ್ಟಾಂಡಿಂಗ್:

1. ನಿಮ್ಮ ಪಾದಗಳನ್ನು ನೆಲದ ಮೇಲೆ ಇರಿಸಿ. ಒಂದು ಕಾಲಿನ ಮುಂದೆ ಇನ್ನೊಂದು ಕಾಲನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು 30 ಸೆಕೆಂಡ್ ಗಳ ವರೆಗೆ ನಿಮ್ಮ ಕಣ್ಣುಗಳನ್ನು ಮುಚ್ಚಿ ನಿಂತು ಕೊಳ್ಳಬೇಕು .
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 30 ಸೆಕೆಂಡುಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
3. ಈ ಮೇಲ್ಕಂಡ ವ್ಯಾಯಾಮವನ್ನು 5 ಬಾರಿ ಮಾಡಬೇಕು.
ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ



Exercise-4

Tandem standing

- ❖ Stand flat on the ground with one foot front to other foot, both the feet should be in same line and hold for 30seconds, with eyes open and repeat for 5times.
- ❖ Please take rest for 30seconds after the exercise.
- ❖ Exercise should be performed as shown in picture.

ವ್ಯಾಯಾಮ-4

ಟಾಂಡಮ್ ಸ್ಟಾಂಡಿಂಗ್:

1. ನೆಲದ ಮೇಲೆ ಒಂದು ಕಾಲಿನ ಮುಂದೆ ಇನ್ನೊಂದು ಕಾಲನ್ನು ಇಟ್ಟು, ಎರಡು ಕಾಲುಗಳು ಒಂದೇ ಸಾಲಿನಲ್ಲಿ ಇರುವಂತೆ 30 ಸೆಕೆಂಡ್ ಗಳ ವರೆಗೆ ನಿಮ್ಮ ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ನಿಂತು ಕೊಳ್ಳಬೇಕು. (ಮೊದಲು ಬಲಗಾಲು ನಂತರ ಎಡಗಾಲು)
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 30 ಸೆಕೆಂಡುಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
3. ಈ ಮೇಲ್ಕಂಡ ವ್ಯಾಯಾಮವನ್ನು 5 ಬಾರಿ ಮಾಡಬೇಕು.
4. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise 5

Standing in one leg

- ❖ Standing flat on the ground with one leg, and other leg will bend backward and hold for 30seconds, with eyes open and repeat with both the legs for 5times.(first with right then left)
- ❖ Please take rest for 30seconds after the exercise.
- ❖ Exercise should be performed as shown in picture.

ವ್ಯಾಯಾಮ-5

ಒಂದೇ ಕಾಲಿನಲ್ಲಿ ನಿಲ್ಲುವುದು:

1. ನೆಲದ ಮೇಲೆ. ಒಂದೇ ಕಾಲಿನಲ್ಲಿ 30 ಸೆಕೆಂಡ್ ಗಳ ವರೆಗೆ ನಿಮ್ಮ ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ನಿಂತು ಕೊಳ್ಳಬೇಕು. (ಮೊದಲು ಬಲಗಾಲು ನಂತರ ಎಡಗಾಲು)
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 30 ಸೆಕೆಂಡುಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
3. ಈ ಮೇಲ್ಕಂಡ ವ್ಯಾಯಾಮವನ್ನು 5 ಬಾರಿ ಮಾಡಬೇಕು.
4. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise-6

Weight-shift (Front)

- ❖ The exercise will be performed in standing position, where body moves forward by keeping one leg in front with mild knee bending and other leg back to it. During weight shifting, gently move your body and lean far as possible without falling and keeping the hip, and shoulders in a line with eyes open and holds for 45 seconds and repeat 10 times.
- ❖ Please take rest for 2minutes after the exercise.
- ❖ Exercise should be performed as shown in picture

ವ್ಯಾಯಾಮ-6

ವೈಟ್ ಶಿಫ್ಟ್(ದೇಹದ ಮುಂದಕ್ಕೆ ಭಾರವನ್ನು ವರ್ಗಾಹಿಸುವುದು)

1. ಈ ವ್ಯಾಯಾಮವನ್ನು ನಿಂತುಕೊಂಡು ಮಾಡಬೇಕು. ಎಡಗಾಲ ಅಥವಾ ಬಲಗಾಲನ್ನು ಮುಂದಕ್ಕೆ ಇಟ್ಟು ಆ ಕಾಲಿನ ಮಂಡಿಯನ್ನು ಮಾಡಿಸುತ್ತಾ ಮುಂದಕ್ಕೆ ಬಗ್ಗುತ್ತಾ ನಿಮ್ಮ ಸೊಂಟವನ್ನು ಮತ್ತು ಭುಜವನ್ನು ಬಂದೇ ಸಾಲಿನಲ್ಲಿ ಇಟ್ಟುಕೊಂಡು ನಿಧಾನವಾಗಿ ನಿಮ್ಮ ದೇಹವನ್ನು ಸಾಧ್ಯವಾದಷ್ಟು ಮುಂದಕ್ಕೆ ಸರಿಸಿಬೇಕು. ಮುಂದೆ ಇಟ್ಟಿರುವ ಕಾಲಿನ ಮೇಲೆ ತೂಕವನ್ನು ಬದಲಾಯಿಸಬೇಕು. ಬದಲಾಯಿಸಿದ ನಂತರ ಈ ಸ್ಥಾನವನ್ನು 45 ಸೆಕೆಂಡುಗಳ ಕಾಲ ಹಿಡಿದು ಕೊಂಡು, ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ಹತ್ತು ಬಾರಿ ಮಾಡಬೇಕು.
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 2 ನಿಮಿಷಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
3. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise-7

Weight shift (Backward)

- ❖ The exercise will be performed in standing position in which body moves backward by keeping one leg in front with mild knee bending and other leg back to it. During weight shifting, gently move your body and lean back as far as possible without falling and keeping the ankle, hip shoulders in a line with eyes open and holds for 45 seconds and repeat 10 times.
- ❖ Please take rest for 2 minutes after the exercise.
- ❖ Exercise should be performed as shown in picture

ವ್ಯಾಯಾಮ-7

ವೈಟ್ ಶಿಫ್ಟ್(ದೇಹದ ಭಾರವನ್ನು ಹಿಂದಕ್ಕೆ ವರ್ಗಾಹಿಸುವುದು)

1. ಈ ವ್ಯಾಯಾಮವನ್ನು ನಿಂತುಕೊಂಡು ಮಾಡಬೇಕು. ಎಡಗಾಲ ಅಥವಾ ಬಲಗಾಲನ್ನು ಹಿಂದಕ್ಕೆ ಇಟ್ಟು ಆ ಕಾಲಿನ ಮಂಡಿಯನ್ನು ಮಾಡಿಸುತ್ತಾ ಮುಂದಕ್ಕೆ ಬಗ್ಗುತ್ತಾ ನಿಮ್ಮ ಸೊಂಟವನ್ನು ಮತ್ತು ಭುಜವನ್ನು ಬಂದೇ ಸಾಲಿನಲ್ಲಿ ಇಟ್ಟುಕೊಂಡು ನಿಧಾನವಾಗಿ ನಿಮ್ಮ ದೇಹವನ್ನು ಸಾಧ್ಯವಾದಷ್ಟು ಮುಂದಕ್ಕೆ ಸರಿಸಬೇಕು. ಮುಂದೆ ಇಟ್ಟಿರುವ ಕಾಲಿನ ಮೇಲೆ ತೂಕವನ್ನು ಬದಲಾಯಿಸಬೇಕು. ಬದಲಾಯಿಸಿದ ನಂತರ ಈ ಸ್ಥಾನವನ್ನು 45 ಸೆಕೆಂಡುಗಳ ಕಾಲ ಹಿಡಿದು ಕೊಂಡು, ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ಹತ್ತು ಬಾರಿ ಮಾಡಬೇಕು.
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 2 ನಿಮಿಷಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
3. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise-8

Weight shift (left side)

- ❖ The exercise will be performed in standing position in which body moves to side by keeping both leg equal to shoulder width in which body gently moves to LEFT side and lean side as far as possible without falling and keeping the ankle, hip shoulders in a line with eyes open and holds for 45 seconds and repeat 10 times.
- ❖ Please take rest for 2minutes after the exercise.
- ❖ Exercise should be performed as shown in picture

ವ್ಯಾಯಾಮ-8

ವೈಟ್ ಶಿಫ್ಟ್(ದೇಹದ ಭಾರವನ್ನು ಎಡಕ್ಕೆ ವರ್ಗಾಹಿಸುವುದು)

1. ಈ ವ್ಯಾಯಾಮವನ್ನು ನಿಂತುಕೊಂಡು ಮಾಡಬೇಕು. ಎಡಗಾಲ ಅಥವಾ ಬಲಗಾಲನ್ನು ಎಡಕ್ಕೆ ಇಟ್ಟು ಆ ಕಾಲಿನ ಮಂಡಿಯನ್ನು ಮಾಡಿಸುತ್ತಾ ಮುಂದಕ್ಕೆ ಬಗ್ಗುತ್ತಾ ನಿಮ್ಮ ಸೊಂಟವನ್ನು ಮತ್ತು ಭುಜವನ್ನು ಬಂದೇ ಸಾಲಿನಲ್ಲಿ ಇಟ್ಟುಕೊಂಡು ನಿಧಾನವಾಗಿ ನಿಮ್ಮ ದೇಹವನ್ನು ಸಾಧ್ಯವಾದಷ್ಟು ಮುಂದಕ್ಕೆ ಸರಿಸಿಬೇಕು. ಮುಂದೆ ಇಟ್ಟಿರುವ ಕಾಲಿನ ಮೇಲೆ ತೂಕವನ್ನು ಬದಲಾಯಿಸಬೇಕು. ಬದಲಾಯಿಸಿದ ನಂತರ ಈ ಸ್ಥಾನವನ್ನು 45 ಸೆಕೆಂಡುಗಳ ಕಾಲ ಹಿಡಿದು ಕೊಂಡು. ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ಹತ್ತು ಬಾರಿ ಮಾಡಬೇಕು.
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 2 ನಿಮಿಷಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
3. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise-9

Weight shift (Right side)

- ❖ The exercise will be performed in standing position in which body moves to side by keeping both leg equal to shoulder width in which body gently moves to RIGHT side and lean side as far as possible without falling and keeping the shoulders and hip in a line with eyes open and holds for 45 seconds and repeat 10 times.
- ❖ Please take rest for 2minutes after the exercise.
- ❖ Exercise should be performed as shown in picture

ವ್ಯಾಯಾಮ-9

ವೈಟ್ ಶಿಫ್ಟ್(ದೇಹದ ಭಾರವನ್ನು ಬಲಕ್ಕೆ ವರ್ಗಾಹಿಸುವುದು)

1. ಈ ವ್ಯಾಯಾಮವನ್ನು ನಿಂತುಕೊಂಡು ಮಾಡಬೇಕು. ಎಡಗಾಲ ಅಥವಾ ಬಲಗಾಲನ್ನು ಬಲಕ್ಕೆ ಇಟ್ಟು ಆ ಕಾಲಿನ ಮಂಡಿಯನ್ನು ಮಾಡಿಸುತ್ತಾ ಮುಂದಕ್ಕೆ ಬಗ್ಗುತ್ತಾ ನಿಮ್ಮ ಸೊಂಟವನ್ನು ಮತ್ತು ಭುಜವನ್ನು ಬಂದೇ ಸಾಲಿನಲ್ಲಿ ಇಟ್ಟುಕೊಂಡು ನಿಧಾನವಾಗಿ ನಿಮ್ಮ ದೇಹವನ್ನು ಸಾಧ್ಯವಾದಷ್ಟು ಮುಂದಕ್ಕೆ ಸರಿಸಿಬೇಕು. ಮುಂದೆ ಇಟ್ಟಿರುವ ಕಾಲಿನ ಮೇಲೆ ತೂಕವನ್ನು ಬದಲಾಯಿಸಬೇಕು. ಬದಲಾಯಿಸಿದ ನಂತರ ಈ ಸ್ಥಾನವನ್ನು 45 ಸೆಕೆಂಡುಗಳ ಕಾಲ ಹಿಡಿದು ಕೊಂಡು, ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ಹತ್ತು ಬಾರಿ ಮಾಡಬೇಕು.
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 2 ನಿಮಿಷಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
3. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise -10 Perturbations from front

- ❖ Sternal (Front) Perturbation exercise were performed with the trained assistant standing on the side of the person with the sufficient pull or thrust were given front of the participant's shoulders or chest region with one hand of trained assistant and other hand were kept straight in back to prevent fall and the exercises were performed standing on the ground with eyes open and With each perturbation for 20 times.
- ❖ Please take rest for 2minutes after the exercise.
- ❖ Exercise should be performed as shown in picture.

ವ್ಯಾಯಾಮ-10

ಪಟ್ಟೂರ್ಬಷನ್ ಮುಂಬಾಗದಿಂದ:

1. ಈ ವ್ಯಾಯಾಮ ವನ್ನು ಸಹಾಯಕ ಸ್ಪರ್ಧಿ ಮಾಡಿಸಲಾಗುವುದು. ಸಹಾಯಕ ಸ್ಪರ್ಧಿಯು ರೋಗಿಯ ಪಕ್ಕದಲ್ಲಿ ನಿಂತು ಮುಂದಿನ ಎಡ ಭುಜ ಅಥವಾ ಎಡ ಭಾಗವನ್ನು ವನ್ನು ತಳ್ಳಲಾಗುವುದು. ಬೀಳುವುದನ್ನು ತಡೆಯಲು ಒಂದು ಕೈಯನ್ನು ರೋಗಿಯ ಹಿಂಭಾಗದಲ್ಲಿಟ್ಟು ಕೂಂಡಿರುತ್ತಾರೆ.ಈ ವ್ಯಾಯಾಮವನ್ನು ನಿಂತುಕೊಂಡು, ಕಟ್ಟುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ಮಾಡಬೇಕಾಗುತ್ತದೆ.
2. 20 ಪಟ್ಟೂರ್ಬಷನ್‌ಗಳನ್ನು ನಿಡಲಾಗುತ್ತದೆ.
3. ಈ ವ್ಯಾಯಾಮವನ್ನು ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 2 ನಿಮಿಷಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
4. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise-11(Perturbation from back)

- ❖ Dorsal (back) Perturbation exercise were performed with the trained assistant standing on the side of the person with the sufficient pull or thrust were given at the participant's posterior aspect of shoulder with one hand of trained assistant and other hand were kept straight in front to prevent fall and the exercises were performed standing on the ground with eyes open and With each perturbation for 20 times.
- ❖ Please take rest for 2minutes after repetition of 10times.
- ❖ Exercise should be performed as shown in picture.

ವ್ಯಾಯಾಮ-11

ಪಟ್ಟೂಬಷನ್ ಹಿಂದಿನಿಂದ:

1. ಈ ವ್ಯಾಯಾಮ ವನ್ನು ಸಹಾಯಕ ಸ್ವರ್ಧಿ ಮಾಡಿಸಲಾಗುವುದು. ಸಹಾಯಕ ಸ್ವರ್ಧಿಯು ರೋಗಿಯ ಪಕ್ಕದಲ್ಲಿ ನಿಂತು ಹಿಂದಿನ ಎಡ ಭುಜವನ್ನು ತಳ್ಳಲಾಗುವುದು. ಬೀಳುವುದನ್ನು ತಡೆಯಲು ಒಂದು ಕೈಯನ್ನು ರೋಗಿಯ ಮುಂಬಾಗದಲ್ಲಿಟ್ಟು ಕೊಂಡಿರುತ್ತಾರೆ.ಈ ವ್ಯಾಯಾಮವನ್ನು ನಿಂತುಕೊಂಡು, ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ಮಾಡಬೇಕಾಗುತ್ತದೆ.
2. 20 ಪಟ್ಟೂಬಷನ್‌ಗಳನ್ನು ನಿಡಲಾಗುತ್ತದೆ.
3. ಈ ವ್ಯಾಯಾಮವನ್ನು ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 2 ನಿಮಿಷಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ.
4. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise 12

Standing on toes

- ❖ Transfer the weight and stand on your toes with 5 sec hold for a repetition of 10 times.
- ❖ Please take rest for 2minutes after the exercise.
- ❖ Exercise should be performed as shown in picture

ವ್ಯಾಯಾಮ-12

ಬೆರಳುಗಳ ಮೇಲೆ ನಿಲ್ಲುವುದು:

1. ನಿಮ್ಮ ಭಾರವನ್ನು ಬೆರಳುಗಳ ಮೇಲೆ ಬಿಟ್ಟು 5 ಸೆಕೆಂಡ್ ಗಳವರೆಗೆ ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ಯಾವುದೇ ಸಹಾಯವಿಲ್ಲದ ನಿಂತುಕೊಳ್ಳಬೇಕು.
2. ಈ ವ್ಯಾಯಾಮವನ್ನು ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 2 ನಿಮಿಷಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ
3. ಈ ಮೇಲ್ಕಂಡ ವ್ಯಾಯಾಮವನ್ನು 10 ಬಾರಿ ಮಾಡಬೇಕು.
4. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಭಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise-13

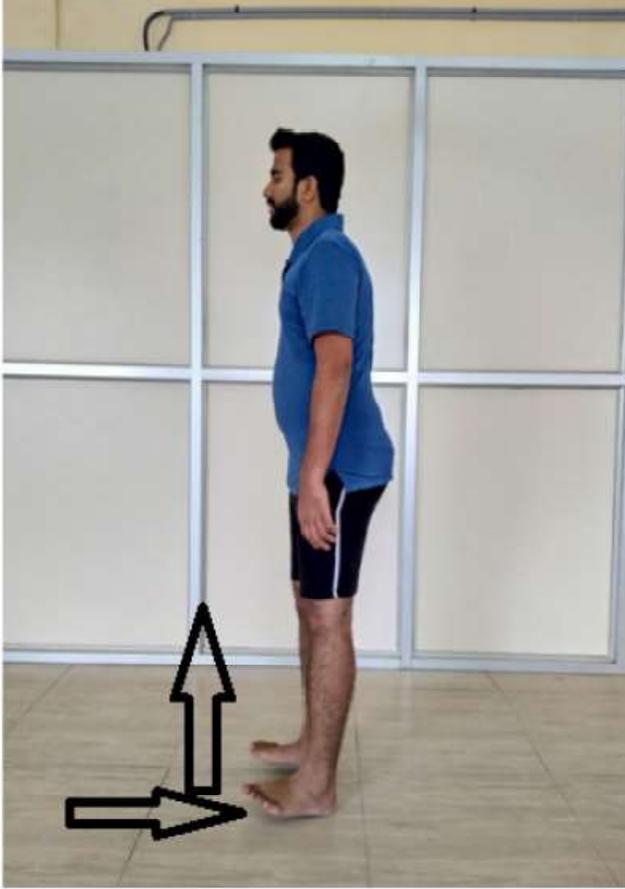
Standing on heels

- ❖ Transfer the weight and stand on your heels with 5 sec hold for a repetition of 10 times.
- ❖ Please take rest Period for 2 minutes after the exercise.
- ❖ Exercise should be performed as shown in picture

ವ್ಯಾಯಾಮ-13

ಹಿಮ್ಮಡಿಯ ಮೇಲೆ ನಿಲ್ಲುವುದು:

1. ನಿಮ್ಮ ಭಾರವನ್ನು ಹಿಮ್ಮಡಿ ಮೇಲೆ ಬಿಟ್ಟು 5 ಸೆಕೆಂಡ್ ಗಳವರೆಗೆ ಕಣ್ಣುಗಳನ್ನು ತೆರೆದಿಟ್ಟುಕೊಂಡು ಯಾವುದೇ ಸಹಾಯವಿಲ್ಲದೆ ನಿಂತುಕೊಳ್ಳಬೇಕು.
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 2 ನಿಮಿಷಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ
3. ಈ ಮೇಲ್ಕಂಡ ವ್ಯಾಯಾಮವನ್ನು 10 ಬಾರಿ ಮಾಡಬೇಕು.
ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



Exercise -14

Catching a ball

- ❖ Supervising caregiver should throw a ball in multiple directions, and patients had to catch the ball by stepping forward and laterally and squatting approximately with the repetition of each 10 times.
- ❖ Please take rest Period for 2minutes after the exercise.
- ❖ Exercise should be performed as shown in picture

ಚೆಂಡನ್ನು ಹಿಡಿಯುವುದು:

1. ರೋಗಿಯ ಮೇಲ್ವಿಚಾರಣಾ ಸಿಬ್ಬಂದಿ ಚೆಂಡನ್ನು ಬಹು ದಿಕ್ಕಿನಲ್ಲಿ ಎಸೆಯಬೇಕು ಮತ್ತು ರೋಗಿಯು ಚೆಂಡನ್ನು ಒಂದು ಹೆಜ್ಜೆ ಮುಂದಕ್ಕೆ ,ಪಕ್ಕಕ್ಕೆ ಮತ್ತು ಕೂತುಕೊಂಡು ಚೆಂಡನ್ನು ಹಿಡಿಯ ಬೇಕಾಗುತ್ತದೆ.
2. ವ್ಯಾಯಾಮ ಮಾಡಿದ ನಂತರ ದಯವಿಟ್ಟು 2 ನಿಮಿಷಗಳ ಕಾಲ ವಿಶ್ರಾಂತಿ ಪಡೆಯಿರಿ
3. ಈ ಮೇಲ್ಕಂಡ ವ್ಯಾಯಾಮವನ್ನು 10 ಬಾರಿ ಮಾಡಬೇಕು.
4. ಈ ವ್ಯಾಯಾಮವನ್ನು ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಛಾಯಾಚಿತ್ರದಲ್ಲಿ ಇರುವಂತೆ ಮಾಡಬೇಕು.



a) Catching ball from front

a) ಚೆಂಡನ್ನು ಮುಂಬಾಗದಿಂದ ಹಿಡಿದುಕೊಳ್ಳುವುದು.



b) Catching ball from left

b) ಚೆಂಡನ್ನು ಎಡಗಡೆ ಯಿಂದ ಹಿಡಿದುಕೊಳ್ಳುವುದು.



c) Catching ball from right side

ಁ) ಚೆಂಡನ್ನು ಬಲಗಡೆಯೆಂದ ಹೆಡೆದುಕೊಳ್ಳುವುದು.



d) Catching ball with squatting

ಁ) ಚೆಂಡನ್ನು ಕೂತುಕೂಂಡು ಹೆಡೆದುಕೂಳ್ಳುವುದು.

Appendix L-Level of Evidence

Canadian Medical Association Journal (CMA) 1998

Level I: Evidence is based on RCTs (or meta- analyses of such trials) of adequate size to ensure a low risk of incorporating false- positive or false- negative results.

Level II: Evidence is based on RCTs that are too small to provide level I evidence.

Level III: Evidence is based on non- randomized, controlled, or cohort studies, case series, case- controlled studies, or cross- sectional studies.

Level IV: Evidence is based on the opinion of respected authorities or those expert committees as published consensus conferences or guidelines.

Level V: Evidence expresses the opinion of those individuals who have written and reviewed guidelines, based on their experience, knowledge of the relevant literature, and discussion with their peers.

Appendix M-Critical Appraisal Skills Programme (CASP)

L1.CASP for systematic review

Questions	Answer
Did the review address a clearly focused question?	Yes/No/Can't tell
Did the authors look for the right type of papers?	Yes/No/Can't tell
Do you think all the important, relevant studies were included?	Yes/No/Can't tell
Did the review's authors do enough to assess the quality of the included studies?	Yes/No/Can't tell
If the results of the review have been combined, was it reasonable to do so?	Yes/No/Can't tell
What are the overall results of the review?	
How precise are the results?	
Can the results be applied to the local population?	Yes/No/Can't tell
Were all important outcomes considered?	Yes/No/Can't tell
Are the benefits worth the harms and costs?	Yes/No/Can't tell

Appendix M1- CASP for Randomized Controlled Trial

Questions	Answer
Did the trial address a clearly focused issue?	Yes/No/Can't tell
Was the assignment of patients to treatments randomized?	Yes/No/Can't tell
Were all of the patients who entered the trial properly accounted for at its Conclusion?	Yes/No/Can't tell
Were patients, health workers and study personnel 'blind' to treatment?	Yes/No/Can't tell
Were the groups similar at the start of the trial?	Yes/No/Can't tell
Aside from the experimental intervention, were the groups treated equally?	Yes/No/Can't tell
How large was the treatment effect?	
How precise was the estimate of the treatment effect?	Yes/No/Can't tell
Can the results be applied in your context? (or to the local population?)	Yes/No/Can't tell
Were all clinically important outcomes Considered?	Yes/No/Can't tell
Were all clinically important outcomes Considered?	Yes/No/Can't tell

Appendix M2-CASP for Qualitative study

Screening Questions

1. Was there a clear statement of the aims of the research? Yes No

Consider:

- what the goal of the research was
- why it is important
- its relevance

-
2. Is a qualitative methodology appropriate? Yes No

Consider:

- if the research seeks to interpret or illuminate the actions and/or subjective experiences of research participants

Is it worth continuing?

Detailed questions

Appropriate research design

3. Was the research design appropriate to address the aims of the research? Write comments here

Consider:

- if the researcher has justified the research design (e.g. have they discussed how they decided which methods to use?)

Sampling

4. Was the recruitment strategy appropriate to the aims of the research? Write comments here

Consider:

- if the researcher has explained how the participants were selected
- if they explained why the participants they selected were the most appropriate to provide access to the type of knowledge sought by the study
- if there are any discussions around recruitment (e.g. why some people chose not to take part)

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.....
Data collection

5. Were the data collected in a way that addressed the research issue?

Write comments here

Consider:

- if the setting for data collection was justified
- if it is clear how data were collected (e.g. focus group, semi-structured interview etc)
- if the researcher has justified the methods chosen
- if the researcher has made the methods explicit (e.g. for interview method, is there an indication of how interviews were conducted, did they use a topic guide?)
- if methods were modified during the study. If so, has the researcher explained how and why?
- if the form of data is clear (e.g. tape recordings, video material, notes etc)
- if the researcher has discussed saturation of data

.....
Reflexivity (research partnership relations/recognition of researcher bias)

6. Has the relationship between researcher and participants been adequately considered?

Write comments here

Consider whether it is clear:

- if the researcher critically examined their own role, potential bias and influence during:
 - formulation of research questions
 - data collection, including sample recruitment and choice of location
- how the researcher responded to events during the study and whether they considered the implications of any changes in the research design

.....
Ethical Issues

7. Have ethical issues been taken into consideration?

Write comments here

Consider:

- if there are sufficient details of how the research was explained to participants for the reader to assess whether ethical standards were maintained
- if the researcher has discussed issues raised by the study (e.g. issues around informed consent or confidentiality or how they have handled the effects of the study on the participants during and after the study)
- if approval has been sought from the ethics committee

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Data Analysis

8. Was the data analysis sufficiently rigorous?

Write comments here

Consider:

- *if there is an in-depth description of the analysis process*
- *if thematic analysis is used. If so, is it clear how the categories/themes were derived from the data?*
- *whether the researcher explains how the data presented were selected from the original sample to demonstrate the analysis process*
- *if sufficient data are presented to support the findings*
- *to what extent contradictory data are taken into account*
- *whether the researcher critically examined their own role, potential bias and influence during analysis and selection of data for presentation*

Findings

9. Is there a clear statement of findings?

Write comments here

Consider:

- *if the findings are explicit*
- *if there is adequate discussion of the evidence both for and against the researcher's arguments*
- *if the researcher has discussed the credibility of their findings (e.g. triangulation, respondent validation, more than one analyst.)*
- *if the findings are discussed in relation to the original research questions*

Value of the research

10. How valuable is the research?

Write comments here

Consider:

- *if the researcher discusses the contribution the study makes to existing knowledge or understanding (e.g. do they consider the findings in relation to current practice or policy, or relevant research-based literature?)*
- *if they identify new areas where research is necessary*
- *if the researchers have discussed whether or how the findings can be transferred to other populations or considered other ways the research may be used*

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Appendix M3-CASP for Quantitative study

Critical Review Form – Quantitative Studies
 ©Law, M., Stewart, D., Pollock, N., Letts, L. Bosch, J., & Westmorland, M.
[McMaster University](http://www.mcmaster.ca)

- Adapted Word Version Used with Permission –

The EB Group would like to thank Dr. Craig Scanlan, University of Medicine and Dentistry of NJ, for providing this Word version of the quantitative review form.

Instructions: Use tab or arrow keys to move between fields, mouse or spacebar to check/uncheck boxes.

CITATION	Provide the full citation for this article in APA format:
STUDY PURPOSE Was the purpose stated clearly? <input type="checkbox"/> Yes <input type="checkbox"/> No	Outline the purpose of the study. How does the study apply to your research question?
LITERATURE Was relevant background literature reviewed? <input type="checkbox"/> Yes <input type="checkbox"/> No	Describe the justification of the need for this study:
DESIGN <input type="checkbox"/> Randomized (RCT) <input type="checkbox"/> cohort <input type="checkbox"/> single case design <input type="checkbox"/> before and after <input type="checkbox"/> case-control <input type="checkbox"/> cross-sectional <input type="checkbox"/> case study	Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.): Specify any biases that may have been operating and the direction of their influence on the results:
SAMPLE N = Was the sample described in detail? <input type="checkbox"/> Yes <input type="checkbox"/> No Was sample size justified? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?: Describe ethics procedures. Was informed consent obtained?:

<p>OUTCOMES</p> <p>Were the outcome measures reliable? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not addressed</p> <p>Were the outcome measures valid? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not addressed</p>	Specify the frequency of outcome measurement (i.e., pre, post, follow-up):	
<p>INTERVENTION</p> <p>Intervention was described in detail? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not addressed</p> <p>Contamination was avoided? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not addressed</p> <p>Cointervention was avoided? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not addressed <input type="checkbox"/> N/A</p>	Outcome areas:	List measures used.:
<p>RESULTS</p> <p>Results were reported in terms of statistical significance? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> Not addressed</p> <p>Were the analysis method(s) appropriate? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not addressed</p>	<p>What were the results? Were they statistically significant (i.e., $p < 0.05$)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?</p>	

<p>Clinical importance was reported?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Not addressed</p>	<p>What was the clinical importance of the results? Were differences between groups clinically meaningful? (if applicable)</p>
<p>Drop-outs were reported?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>	<p>Did any participants drop out from the study? Why? (Were reasons given and were drop-outs handled appropriately?)</p>
<p>CONCLUSIONS AND IMPLICATIONS</p> <p>Conclusions were appropriate given study methods and results</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>	<p>What did the study conclude? What are the implications of these results for practice? What were the main limitations or biases in the study?</p>

Appendix M4- Appraisal Tool for Cross sectional study

Question	Yes	No	Don't know
Were the aims/objectives of the study clear?			
Was the study design appropriate for the stated aim(s)?			
Was the sample size justified?			
Was the target/reference population clearly defined? (Is it clear who the research was about?)			
Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?			
Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?			
Were measures undertaken to address and categorise non-responders?			
Were the risk factor and outcome variables measured appropriate to the aims of the study?			
Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously?			
Is it clear what was used to determined statistical significance and/or precision estimates? (e.g. p-values, confidence intervals)			
Were the methods (including statistical methods) sufficiently described to enable them to be repeated?			
Were the basic data adequately described?			

Does the response rate raise concerns about non-response bias?			
If appropriate, was information about non-responders described?			
Were the results internally consistent?			
Were the results presented for all the analyses described in the methods?			
Were the authors' discussions and conclusions justified by the results?			
Were the limitations of the study discussed?			
Were there any funding sources or conflicts of interest that may affect the authors' interpretation of the results?			
Was ethical approval or consent of participants attained?			

Appendix N- (Description of Kinect Adventure Games)

In the “20,000 Leaks” game participant will be standing in virtual environment inside a glass cube in which shark/fish will begin to break the glass by poking which causes water to enter the glass cube, the participant role was to plug the holes with their hands and feet to prevent water entering inside the glass cube which require rapid upper limb and lower limb movements and concentration.



Plate 5. Description of Kinect Adventure games-20,000 leaks

In the “Space Pop” game the participant must fly by flapping their arms like a bird to pop the bubbles appearing on different directions in the screen.



Plate 6. Description of kinect adventure games-Space pop

In the “Reflex Ridge” game the participant will be moving around a platform on a track to avoid obstacles by rapidly shifting the body sideways or bending down.



Plate 7. Description of kinect adventure games-Reflex Ridge

Appendix O- Similarity Index Certificate

Turnitin Originality Report

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Thesis By Thillai Vignesh

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