

Effectiveness Of Kinect Based Games On Balance And Gait In Geriatrics: A Single Case Study

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ABSTRACT

Background:

Every year, about 20% of the elderly in the United States suffer from balance issues. 68 percent of these patients have an unbalanced state and fear of fall. Balance problems are particularly frequent among the elderly, and they increase the chance of falling and constitute a serious health risk. Balance problems can significantly restrict everyday activities and are linked to depression and a lower quality of life.

Aim: The aim of this research is determining the effectiveness of kinect based games on balance and gait in geriatrics.

Method: A single case study was done in Saveetha Physiotherapy OPD, Saveetha medical college and hospital, Thandalam, Chennai. Geriatric patient with balance impairment age 70 years male was selected. The subject was selected and Tinetti test was used as pretest and post-test assessments. The Tinetti test score in preassessment, the patient had a total score of 15/28 and then intervention is given for duration of 4 weeks. The intervention was given thrice a week. After the completion of intervention, the Tinetti test score in post assessment, patient had a total score of 21/28 suggested that patient showed an improvement.

Result: The result of the study emphasizes that the kinect based games is effective in balance and gait in geriatric patient.

Conclusion: The conclusion of the study concluded that kinect based games is effective in enhancing the elderly's balance and gait. The Keywords are Kinect, balance, gait, Tinetti.

Keywords: Gait, balance, geriatrics, kinect-based games.

1. INTRODUCTION:

Elderly persons are prone to falling. More than a third of people age over 65 experience at least one annual fall^{1,2}. The possibility of falling is significantly higher in institutional residents than elders who live in the community, with an annual incidence of 1.5 falls per bed. On the other hand, Falls in the past, balance and gait impairment, have been found as important risk factors because they were strongly linked to falling^{2,3,5}. Moreover, falls are the primary root of catastrophic injuries, fatalities, and admissions to hospitals age over sixty-five and more¹. We can lower the risk of falls by taking precautions and executing programmes and treatments of fall prevention^{6,7}. Furthermore, decreasing the frequency of falls-related injuries could have a considerable positive impact. Furthermore, lowering the frequency of injuries caused by falls could improve older people's quality of life⁸. The majority of fall prevention programmes combine motor therapy and exercise. Serious games have recently been shown to be useful in the treatment of motor disorder⁹. Serious games are those that are created for a primary goal apart from pure amusement, and these games need to draw people in, for the activities of cognitive and motor. In therapy, recuperation, and rehabilitation, ten healthcare-related serious games might be used. These activities have been shown to be effective in retaining motor abilities by motivating patients to attend repetitive and intensive therapy sessions¹¹.

Patient demotivation is common in long-term rehabilitation programmes due to the repetition and boredom of rehabilitative exercises, which can lead to a lack of attention or abandonment of the programme, resulting in the therapy's value and effectiveness being lost. There have been numerous studies that have looked into the games' usefulness in balance training^{12,14}. Furthermore, vision-based technologies have been shown to be beneficial to the

elderly since they are motivating and noninvasive^{15, 18}. So that video games can be used to reduce the danger of falling^{19, 20}. While there are a variety of vision-based interfaces available, Kinect-based games have sparked a lot of interest in rehabilitation in recent years. Several research have looked into the impact of utilising Kinect to improve balance and gait in elderly people who were playing commercial games^{21, 22}. Nevertheless, Some readily available games on the market are not ideal for the purposes of treatment and deliver unpleasant auditory and visual feedback during gaming tasks, according to usability testing done²³. As a result, numerous research investigations offered prototype games that were specifically designed for rehabilitation and targeted at specific group of interest. For example, Hoda et al.²⁴ examined the people with Parkinson's disease for dynamic postural control with the viability of a therapeutic game; Ofli et al. examined the possibility of a therapeutic game for dynamic postural control in people with Parkinson's disease and advised a set of exercises for the improvement of balance, flexibility, strength, and endurance of independently living older adults²⁵.

The goal of this study is to see how successful prototype Kinect-based serious games for balance and gait therapy in elderly persons. We employed Kinect as the vision-based interface in the study, and we hypothesised that the games would benefit the elderly. Reaching out in various directions, tiny and large sideways steps, both sides weight shifting, neck movements (forward bending, backward bending, side bending, and rotation), shoulder movements (forward arm raising, backward arm raising, adduction and abduction), trunk movements (forward bend, backward bend, side bend, and rotation), knee movements (bending and extension), and hip movements(flexion, extension, rotation, adduction and abduction) are among the Traditional physical therapy activities are incorporated ²⁶⁻²⁸. These, on the other hand, had the added benefit of attempting to entice the patient into losing emphasis on the fact that he or she was in a rehabilitation session. For patients at danger of falling, a strategy using serious games is offered to help them improve their balance.

2.1 AIM:

To determine the effectiveness of kinect based games on balance and gait in geriatrics

2.2 OBJECTIVE

The goal of this study was to see how successful kinect- based games are at improving balance in the elderly.

.The goal of this study was to see how successful kinect-based games are at improving gait characteristics in the elderly.

3. METHODS

3.1 Study design: Single case study

3.2 Study setting: Saveetha physiotherapy OPD, Saveetha medical college and hospital, Thandalam, Chennai.

3.3 Case description

A 70 years old male came to saveetha physiotherapy OPD with complaints of balance impairment. As a past H/O Diabetes mellitus, systemic hypertension for 10 years, under medication. Also as a H/O fall. He came to the physiotherapy department for improve balance and gait. He was taking the medications of Metformin and Amlodipine. All procedures were explained and Before the intervention, an informed consent was signed. MMSE (Mini Mental State Examination) was assessed, in addition to physiotherapy evaluations. The participant had no severe cognitive impairment suggested, according to the score higher than 20 by MMSE score.

3.4 Procedure

A single case study was done in saveetha physiotherapy OPD, saveetha medical college and hospital, Thandalam, Chennai. A 70 years old male with balance impairment was included. The subject is evaluated by using Tinetti test, as a pre test measurement. The kinect based games was given for duration of 4 weeks, thrice a week. After 4 weeks the Tinetti test was measured as a post test measurement. The values were tabulated and analysed. Requirements: an armless chair, a stopwatch and a uniform walkway and 15 ft even walkway. There are 2 sections: One section is balance assessment, assessed in a chair as well as in standing; the other section is gait assessment, assess dynamic balance on a 15 feet even walkway.

Assessment was done on the first day before the treatment intervention. **BALANCE TESTS:** The patient was made to sit in an armless chair and asked to rise up and instructed to stay standing. Then the patient was asked to stand at maximum position with feet as close together, pushes him lightly on his sternum with palm of hand 3 times, then instructed to stand with eyes closed with feet together, then asked him to turn 360° and then sit back down. **GAIT TESTS:** Here patient was instructed to walk at a normal speed for few meters, and then turning followed by fast walking but safe speed. At last instructed to sit back down. After the evaluation, the patient underwent the treatment session. The intervention took place over a four-week period. Three times a week, the patient received a 30-minute session. The following was the breakdown of the rehabilitation programme: The Reach game received 20 minutes, the HitIt game received 10 minutes, and the Watchout game received an additional 5 minutes. The length of each game was determined by the patient's understanding and acceptance of it. Every 10 minutes of play, a 2- to 3-minute break was permitted.

1. Reach game: The patient's centre of mass (COM) has to be moved in order for them to reach one of the five balls. When they approached a ball, it vanished and resurfaced after the physiotherapist selected a time based on the patient's speed.

2. HitIt: Soccer balls are thrown at random in this game. To hit them, the patient must take lateral steps and, once they become at his level, knock them with his head. During game play, any use of another portion of the body other than the head is undetected. It is also possible to play the game while seated. To be able to reach the objects with his head, the user must move his trunk in lateral movements.
3. Watch Out: In order to avoid falling eggs, the patient must shift laterally. Falling things fall at random within the patient's plan, with a variable rate and speed.

After the end of treatment session, the patient again evaluated using the tinetti test.

4. RESULT

The Tinetti test scores showed in table.1, showsan improvement in balance and gait.

5. DISCUSSION

To this extent I could tell, it was a single case study involving geriatric and kinect-based games for balance and gait. The patient's results were really encouraging. In terms of the Tinetti exam, the patient's total score improved by a few points over the research period, and the gain was noticeable. However, as a result of this improvement, the patient's fall risk decreased from high to low. Many investigations have emphasised the attentiveness and fun provided by a game-based setting^{29, 30, 31}. However, usability tests done demonstrate that some readily accessible games aren't appropriate for the purposes of treatment and during games it provides negative feedback over aural and visual²³. As a result, numerous research investigations offered prototype games that were specifically designed for rehabilitation and targeted at specific target groups. In terms of playtime, the time spent on WatchOut was significantly less than the time spent on HitIt, despite the fact that they both required the identical motions. In the HitIt game, the game score was motivating and competitive. The games were engaging and interesting and it could be used to restore confidence after fall and improve their balance and gait. After a fall, older persons reduce their works and lock up on themselves, and they also express dread of falling again³². When they fall, they frequently suffer "post-fall syndrome," in which they become extremely frightened and unable to rise or walk without assistance³³. As a result, the participant required further help and assurance. Games may help the faller reintegrate into his community and lessen the burden of post-concussion syndrome^{33, 34, 35}.

The prototype games supported the system and rehabilitative activities may be adequate and have allowed for more effective fall prevention rehabilitation training by recognising and improving concerns that senior individuals may have when interacting with the system. The findings suggest that employing Kinect-based prototype games to enhance balance and gait in the geriatric is safe and can be implemented into a fall prevention programme, despite the small sample size. This study could be expanded to a broader population, because game-based therapy has been shown to enhance balance and gait, albeit additional research is needed.

6. CONCLUSION:

In this case study where patient attended a 4-week treatment. During the sessions, the patient used kinect to play three prototype games. The goal of the study was to see how well kinect-based games affected senior people's balance and gait. Balance and gait marked effect was evaluated by the Tinetti test. They were present for the larger part of the training sessions, and no negative consequences were reported. Additionally, Tinetti test results improved.

CONFLICT OF INTEREST: Nil

SOURCE OF FUNDING: Nil

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Table 1. Outcome measures for balance and gait

OUTCOME MEASURES	PRETEST VALUE	POST TEST VALUE
Total score	15	21
Balance test score	7	11
Gait test score	8	10