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## International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

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# Assessing the Effects of Exercise on Mild Alzheimer's Disease in the Context of Fall Recovery: A Case Study

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**ABSTRACT:** This case study presents an elderly patient with mild Alzheimer's disease (AD) who has experienced his first fall. Initial findings included poor balance, decreased strength, forgetfulness, reduced physical fitness and slow gait. The interventions consisted of an exercise-focused treatment program emphasising functional tasks and balance exercises. Outcomes included small improvements in balance, lower extremity strength, activities of daily living, and no noticeable decline in cognitive function. This case study focuses on physical exercise is important as the typical aim for Alzheimer's revolves around cognitive rehabilitation.

## I. INTRODUCTION

Alzheimer's disease (AD) is a chronic syndrome that leads to a significant deterioration of an individual's cognitive and functional abilities<sup>[1]</sup>. It is a progressive disease that primarily affects individuals over the age of 65 years old. Older adults often live with a wide range of physical impairments as a part of the ageing process, and those with AD must also deal with cognitive impairments that affect their ability to live independently.

There is currently no cure for AD, however, there are treatments that can slow the progression of the disease and improve the quality of life for patients<sup>[1]</sup>. Education on this disease is important for physiotherapists because in Canada, there are an estimated 747,000 people diagnosed with AD and Dementia per year<sup>[1]</sup>. As the population of older adults increase, this number is projected to reach 1.4 million in 2031<sup>[1]</sup>.

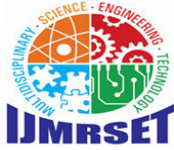
Physiotherapists play an important role in treating patients with AD since exercise has been shown to improve physical function, and functional independence, and slow the progression of the disease<sup>[1]</sup>. This case study outlines the role that physiotherapy plays in the assessment, treatment, and follow-up of a patient with AD. One of the challenges of dealing with the patient in this case is recognising that his memory loss and the progressive nature of the disease will often lead to worsening of symptoms over time. The physiotherapist took steps to ensure the patient's understanding of treatment measures and communicated with his wife to ensure proper delivery of the intervention at home.

## II. PATIENT CHARACTERISTICS

Mr J is a healthy 72-year-old male. He is currently retired and lives at home with his wife. The patient is an active pole-walker and shuffleboard player. Past medical history includes Alzheimer's Disease, a right knee replacement 10 years ago and controlled hypertension. The patient arrived at the Emergency Department following a recent fall at home and was discharged home with no injuries. The patient was referred to outpatient physiotherapy to address his balance deficits.

## III. EXAMINATION FINDINGS

The patient states that in the past three months, he and his wife have noticed his Alzheimer's disease has been progressing quickly. Past diagnostic tests have ruled out other serious neurological conditions. He has been more



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forgetful lately, and has trouble remembering important dates, and frequently misplaces his keys. It has been difficult to go upstairs and he has been tripping more often. After his most recent fall, he reports no pain. He has been having trouble with walking and therefore has not been as active in the past month due to his fear of falling. Chores such as reaching for dishes and lifting items off the floor are now difficult and simple tasks such as dressing have been becoming increasingly difficult. He feels frustrated about his lack of physical activity and decrease in functional ability. His wife has noticed his mood has been fluctuating lately. He would like to return to pole-walking and be able to help his wife with chores.

**Observation:** Normal posture

**ROM:** Within normal limit in all joints

**Sensation testing:** Normal for light touch, pinprick and temperature.

**Myotomes, Dermatomes, Reflexes:** Normal

### Manual Muscle Testing:

Muscle	R	L
Quadriceps	3+	3
Hamstrings	3	3
Gastrocnemius	3-	3
Tibialis Anterior	3	3-

### Grip Strength Hand Dynamometer

R: 37 kg L: 34 kg

(slightly weaker than normal for gender and age)

**Gait Analysis:** Decreased step length, decreased cadence, increased stance time bilaterally.

**BERG Balance Scale:** Scored 43/56 (At greater risk for fall)

- Only able to complete 4 steps without aid with supervision (2/4)
- Only able to lift leg independently and hold  $\geq$  3 seconds (2/4)
- Able to place feet together independently and stand for 1 minute with supervision (3/4)
- Able to take a small step independently and hold for 30 seconds (2/4)
- Unable to pick up and needs supervision while trying (1/4)
- Can reach forward 5 cm (2/4)
- Able to turn 360 degrees safely on one side in only 4 seconds or less (3/4)

**Mini-Mental State Exam:** 22/30 (Mild Impairment)

**5x Sit to Stand:** 13.5 seconds (At risk for fall)

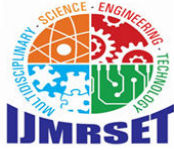
**Timed Up and Go:** 15 seconds (At risk for fall)

**Disability Assessment for Dementia:** 68 (mild disability; impairment in completing ADLs and IADLs)

## IV. CLINICAL IMPRESSION

The patient presents with mild-stage Alzheimer’s Disease. The patient shows a decline in cognitive capacity as seen in difficulty planning tasks and increased forgetfulness. The patient shows signs of motor impairment (reduced balance, decreased lower extremity strength, slower gait) and is at risk for falls. The patient is a good candidate for physiotherapy and will benefit from balance exercises, aerobic and strength training, and cognitive rehabilitation.





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**Problem List:**

Physical

- Increased risk of falls - poor balance, poor visual-spatial abilities
- Decreased gait speed
- Decreased upper and lower extremity strength

Cognitive

- Difficulty planning complex tasks
- Difficulty with functional memory

### V. INTERVENTION

His goals included returning to physical activity (pole walking & shuffleboard), improving his balance to prevent future falls, walking up stairs safely and maintaining his ability to complete activities of daily living (ADLs) despite memory decline.

In the absence of a cure for Alzheimer’s Disease (AD), there are many interventions that can be used in an attempt to slow down the progression of the disease while maintaining independence and improve quality of life. Exercise therapies has shown to assist in the maintenance of both the physical and cognitive function of individuals with AD. Our intervention plan was aimed to improve his muscular strength and aerobic capacity, with a higher focus on balance training and performance of functional tasks that can translate to ADLs.

Due to the patient’s cognitive impairments, measures were taken to ensure the exercise program was concise and easy to follow. Handouts with step by step instructions and pictures were created for each exercise and reviewed with the patient and his wife.

Intervention	Frequency	Intensity	Duration
<b>Balance Exercises</b> <ul style="list-style-type: none"> <li>• Tandem Stance (can progress to Tandem Walk)</li> <li>• Weight Shift Side to Side</li> </ul>	Daily	As tolerated	1 set of 3 repetitions, 10 seconds hold each side. Progress as needed
<b>Step Ups</b>	Daily	As tolerated	1 set of 10 repetitions. Progress as needed
<b>Sit to Stands</b>	Daily	As tolerated	1 set of 10 repetitions. Progress as needed
<b>Glute Bridges</b>	Daily	As tolerated	1 set of 10 repetitions, hold for 3 seconds at the top. Progress as needed
<b>Walking</b>	Daily	Light	Start at 20 min/day. Progress 5 mins per week or as tolerated
<b>Pushing Exercises</b> <ul style="list-style-type: none"> <li>• Wall Push Ups</li> <li>• Chair Dips</li> </ul>	3x/week	Moderate	1 set of 10 repetitions. Progress as needed
<b>Shoulder Elevation</b>	3x/week	Moderate	1 set of 10 repetitions. Progress as



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- Lifting objects (ex. canned foods, cups, dishes) from the table to the overhead needed
- Resistance band Shoulder Press

### VI. RESEARCH EVIDENCE FOR MANAGEMENT PLAN

#### Exercise Therapy

##### Balance Training

Falls are a major health concern in elderly populations. There is a strong correlation between fall occurrence and balance, which causes notable concern for people with AD as balance issues can appear early in the diagnosis<sup>[2]</sup>. Significant deficits in both static and dynamic balance can be noted, with specific difficulties in balance during turning, gait and dual-task activities<sup>[3]</sup>. Both individual and group exercise sessions were found to provide benefits<sup>[3]</sup>. Specific exercises aimed at people with mild to moderate AD include tandem walks, with and without eye tracking, high side steps and weight shifts<sup>[4]</sup>. Video game interventions also exist that are likely to play a larger role for future generations that develop AD<sup>[5][6]</sup>. Specifically, using a Wii-fit intervention was shown to decrease fear of falls and increase Berg Balance Scale scores compared to a walking program<sup>[6]</sup>. An important criterion of balance programs and exercise programs in general is to be adequately challenging to show noticeable improvements<sup>[7]</sup>. Therefore, clinicians should continue this protocol even in patients with AD.

##### Strength Training

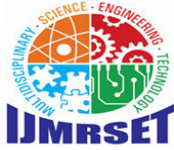
Strength Training promotes significant improvements in patients with AD<sup>[8]</sup>. Studies have shown the improvements were with respect to lower limb strength and balance. Resistance training with ADs not only increases muscle strength by 3-17%, but it also improves ambulatory abilities by increasing gait speed and enhances the individuals ability to perform ADLs<sup>[9]</sup>. By getting individuals with ADs to perform resistance exercises, we decrease the amount of muscle loss which decreases inactivity and the loss of functional ability. One study showed that with a 60 minute resistance training session 2x a week, balance and muscular endurance improved significantly<sup>[9]</sup>. Cardiorespiratory improvements were also noted in individuals who performed resistance training which would further promote an active lifestyle in individuals with AD<sup>[9]</sup>.

Exercises that focus on functional tasks demonstrate a medium effect size on slowing the decline of cognitive ability, improving orientation, memory function and performance of functional task in AD patients<sup>[10]</sup>. These strategies focus on learning compensatory techniques that can be applied to activities of daily living<sup>[11]</sup>.

##### Aerobic Training

Aerobic Training has been shown to improve an AD's patients ability to independently perform activities of daily living (ADLs) by improving their overall functional capacity<sup>[12]</sup>. Studies have also shown that improvements in cardiorespiratory fitness were related to better memory performances<sup>[13]</sup>. Although currently still unsure of the optimal modality and dosage of aerobic exercise, there is evidence that shows cognitive and physical improvements can occur to help delay the progression of ADs while allowing the patient to live an active life.

A Reducing Disability in Alzheimer Disease (RDAD) program was designed to reduce impairments in independence and behaviour in AD populations. The RDAD has an exercise component that consists of 30 minutes/day of aerobic activities, strength training, balance, and flexibility training. A study that compared the RDAD to normal routine care showed improved physical functioning after 3 months in RDAD patients that exercised at least 60 minutes/wk. This effect lasted 2 years after the study. These patients also were less institutionalized<sup>[14]</sup>.



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### VII. OUTCOME

At 6 weeks post-intervention, the patient showed slight improvements in balance, strength, and reports improvements in performing ADLs at home. He is able to walk more regularly. He showed no decline in cognitive and disability impairments since the initial assessment.

#### Manual Muscle Testing:

	R	L
Quadriceps	4-	4-
Hamstrings	3+	3+
Gastrocnemius	3+	3+
Tibialis Anterior	4-	3+

#### Grip Strength Hand Dynamometer

R: 40 kg L: 37 kg

(improvement, slightly weaker than normal for age and gender range)

**BERG Balance Scale:** - Scored 48/56 (Improvement, but still at slight risk for fall)

- Able to stand independently and complete 8 steps in >20 seconds (3/4)
- Only able to lift leg independently and hold >= 3 seconds (2/4)
- Able to place feet together independently and stand for 1 minute with supervision (3/4)
- Able to place foot ahead independently and hold for 30 seconds (3/4)
- Unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently (2/4)
- Can reach forward 12 cm (3/4)
- Able to turn 360 degrees safely on one side in only 4 seconds or less (3/4)

**Mini-Mental State Exam:** 22/30 (Mild Impairment)

**5x Sit to Stand:** 11 seconds (No longer a fall risk)

**Timed Up and Go:** 12.35 seconds (Improved score, but still at risk for falls)

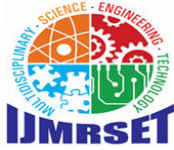
**Disability Assessment for Dementia:** 70 (mild disability; impairment in completing ADLs and IADLs)

#### Referrals

- Refer to Occupational Therapy to address cognitive impairments and to work towards completing ADLs and IADLs independently.
- Refer to Geriatrician to address and follow up with the progression of the disease as well as normal aging process.
- Refer to community resources (e.g. exercise programs, Alzheimer’s support group)

### VIII. DISCUSSION

The present case study demonstrates a typical presentation of a patient with mild Alzheimer’s Disease (AD). Signs include memory impairment, personality changes, balance deficiencies, and loss of independence in performing ADLs as the disease progresses. To address these concerns, we created a treatment that focused on an exercise intervention for mild AD. Research on general strength and aerobic exercise programs have



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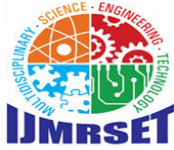
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demonstrated improvements in strength, balance, memory function and depression. Improvements specific to ADL performance can be optimized by using exercises that incorporate functional task as these are more meaningful. These exercises can also address balance, which with improvement through exercises such as weight shifting and tandem stance, are shown to decrease fall risk.

While these studies have been specific to AD populations, their findings can be implicated to other neurodegenerative conditions with cognitive impairments such as Vascular Dementia, Dementia with Lewy Bodies, Parkinson's, and Stroke. An exercise-focused rehabilitation program may be an effective method to address both physical deficits and cognitive decline. Beginning an exercise program early after symptom-development and diagnosis may bestow a slowing of future regression.

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