PROGRESSIVE TASK-ORIENTED CIRCUIT TRAINING FOR COGNITION, PHYSICAL FUNCTIONING AND SOCIETAL PARTICIPATION OF INDIVIDUALS WITH DEMENTIA: A CASE STUDY

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OUTLINE

INTRODUCTION

Dementia is a chronic and progressive syndrome of the brain in which there is a disturbance of multiple higher cortical functions, including executive functioning, memory, thinking, orientation, comprehension, calculation, learning capacity without loss of consciousness (World Health Organization WHO, 2012). Dementia usually first appears as forgetfulness, but as the dementia progresses and becomes worse, symptoms are more obvious and interfere with the ability of individuals to take care of themselves and activities of daily living resulting in individual needing assistance in performing function or becoming totally dependent (World Alzheimer Report, 2015, Alzheimer's Association, 2017).

A survey in the Harvard University School of Public Health and the Alzheimer's Europe consortium revealed that the second leading health concern (after cancer) among adults is dementia (Swaminathan, 2012). In 2012, the World Health Organization (WHO) declared dementia to be a public health priority (WHO, 2012), citing the high global prevalence and economic impact on families, communities, and health service providers.

In the coming decades with the aging population, the number of individuals living with dementia in the communities will rise dramatically which will increase the burden on caregivers, community care and residential care services (Alzheimer Society of Canada, 2014).

Alzheimer's disease (AD) is the most common type of dementia and the cause is poorly understood (Ballard *et al,* 2009). About 70% of the risk is believed to be genetic with many genes usually involved (Ballard *et al,* 2009) and other risk

factors include a history of head injuries, depression, or hypertension (Ballard *et al,* 2009). The disease process is associated with plaques and tangles in the brain (Ballard *et al,* 2009). A probable diagnosis is based on the history of the illness and cognitive testing with neurological imaging and blood tests to rule out other possible causes. Initial symptoms are often mistaken for normal ageing (Ballard *et al,* 2009).

There is no cure for dementia, although some drugs may temporarily improve symptoms (Carl *et al,* 2007). Affected people increasingly rely on others for assistance, often placing a burden on the caregiver with remarkable pressures in many aspects of life including social, psychological, physical, and economic (Carl *et al,* 2007).

In 2015, there were approximately 29.8 million people worldwide with Alzheimer's disease (Global Burden of Disease Study GBD, 2015). It most often begins in people over 65 years of age, although 4% to 5% of cases are early-onset (Ballard *et al,* 2011). It affects about 6% of people of 65 years and older. In 2015, dementia resulted in about 1.9 million deaths (GBD, 2015).

As a first approach, the best practice guidelines currently recommend the exploration of behavioural and psychological interventions before initiating pharmacological interventions, due to the limited benefit of pharmacological treatments in reducing functional decline and their potential side effects (Forbes, 2008; Hogan 2008). Therapeutic exercise is among the potential protective lifestyle

factors identified as a strategy for treating the symptoms of dementia or delaying its progression (Lautenschlager 2010).

Many studies have examined the influence of exercise on healthy older people, a Cochrane review that included 11 randomized controlled trials (RCTs) of aerobic exercise programs for older people reported that eight studies showed improvement in at least one aspect of cognitive function with the largest effects on cognitive speed, delayed memory functions, auditory and visual attention (Angevaren, 2008). Further studies with older people have revealed that exercise improves depression (Chen, 2009), aerobic exercise training increases the size of the anterior hippocampus, with improvements in cognition (Erickson, 2011), and mid-life exercise may contribute to maintenance of cognitive function and may reduce or delay the risk of late-life dementia (Chang, 2010).

EPIDEMIOLOGY OF DEMENTIA

It was estimated that 36 million people were living with dementia in 2010, nearly doubling every 20 years to 66 million by 2030 and to 115 million by 2050 (World Alzheimer Report, 2015). In 2013, dementia resulted in about 1.7 million deaths up from 0.8 million in 1990 (Prince *et al*, 2013). The rate of the occurrence of dementia is increasing significantly with age affecting 5 % of population older than 65 years, 20-40 % >85years (Prince *et al*, 2013). The 2/3 of people with dementia live in Low and Middle Income Countries (LMICs) (Prince and Jackson, 2009).

It is only a few community-based studies that have been carried out in Africa. In Nigeria and most developing countries, studies have often reported a low prevalence of 2.6%- 2.79% for dementia (Vas *et al*, 2001; Shaji *et al*, 2005; Guerchet *et al*, 2010 and Yusuf *et al*, 2011). The suggested reasons for this include poor access or reluctance to seek medical care, the belief that an elderly person has completed their useful life, differential survival rates, hiding of cases by relatives concerned about the stigma of mental disease, defective case finding techniques and the belief that dementia is a normal part of aging (Ineichen, 2000; Ogunniyi *et al*, 2006; Ochayi and Thacher, 2006). Common factors like increasing age (65 years and above) and/or sex (females) have been associated with cognitive impairment in dementia in Nigeria, Benin and Central Africa (Ogunniyi *et al*, 2006; Gureje *et al*, 2006; Guerchet *et al*, 2010).There are 18 million people with dementia in Europe, Africa, Asia and Latin America, and nearly 29 million demented people are predicted by 2020 (Essink *et al*, 2002).

Dementia drastically affects daily life and everyday personal activities, it is often associated with behavioural symptoms, personality change, and numerous clinical complications. Dementia increases the risk for hip fracture from fall, and most markedly dependence on nursing care. Therefore, it is not surprising that the costs of care for patients with dementia are immense (Haan and Wallace, 2004; World Alzheimer Report, 2015).

PATHOPHYSIOLOGY OF DEMENTIA

There are many types of dementia and so are their varying pathophysiologies. The most common ones (Alzheimer's disease International, 2011) and their pathologies are as follows:

Dementia with Alzheimer's disease: This is the most common type of dementia with 62% prevalence, it is characterized by cortical amyloid plagues which is the deposit of protein fragment and neuro-fibrillary tangles which build up within cells, and these block communication among nerve cells and disrupt processes that cells need to survive (Alzheimer's disease International, 2011). Alzheimer's disease is characterized grossly by progressive atrophy and gliosis, first of the hippocampus and mesial temporal lobe, followed by other association cortices (frontal and parietal lobes), and finally by primary motor or sensory cortex (occipital lobe) (Alzheimer's Association, 2017).

Clinical Symptoms

Difficulty remembering recent conversations, names or events is often an early clinical symptom; apathy and depression are also often early symptoms. Later symptoms include impaired communication, disorientation, confusion, poor

judgment, behavior changes and, ultimately, difficulty speaking, swallowing and walking (Solomon *et al*, 2011; Alzheimer's Association, 2017).

Vascular dementia: This is a type of dementia with 20% prevalence (Ladecola, 2013). This was previously known as multi-infarct or post stroke dementia, because it is common after stroke. A patient begins to forget or have trouble planning ahead or completing a task following a condition that blocks or reduce blood flow to the brain (Alzheimer's disease International, 2011). It is caused by disease or injury affecting the blood supply to the brain, typically involving a series of minor strokes. The symptoms of this dementia depend on where in the brain the strokes have occurred and whether the vessels are large or small (Solomon *et al*, 2011).

Clinical symptoms

Impaired judgment or impaired ability to make decisions, plan or organize is more likely to be the initial symptom (Alzheimer's Association, 2017).

Balance problems can also occur, hallucinations, loss of bladder or bowel control may occur (Alzheimer's disease International, 2011).

Dementia with Lewy Bodies (DLB): This has4% prevalence; it is caused by the breakdown of brain tissues following the formation of abnormal structures in nerve cells (Alzheimer's disease International, 2011). Lewy bodies are also found in other brain disorders, including Alzheimer's disease and Parkinson's disease dementia (Alzheimer's disease International, 2011).

Clinical symptoms

This type of dementia has the primary symptoms of visual hallucinations, delusions and "Parkinsonism". Parkinsonism is the symptoms of Parkinson's disease, which includes tremor, rigid muscles, presence of slower movement and frequency of fall and a face without emotion. The visual hallucinations in DLB are generally very vivid hallucinations. Other prominent symptoms include problems with attention, organization, problem solving and planning (executive function), and difficulty with visual-spatial function (Solomon *et al*, 2011).

Imaging studies cannot necessarily make the diagnosis of DLB, but some signs are particularly common (Solomon *et al*, 2011). A person with DLB often shows occipital hypoperfusion on SPECT scan or occipital hypometabolism on a PET scan. Generally, a diagnosis of DLB is straightforward and unless it is complicated, a brain scan is not always necessary (Solomon *et al*, 2011).

Fronto-temporal dementia: This is also known as fronto-temporal degenerative disorders, this has 2% prevalence, there is damage to the frontal or/and temporal part of the brain caused by progressive nerve cells damage leading to personality and behavior changes (Alzheimer's Disease International, 2011). Memory is less likely to be affected in the early stages.

Clinical symptoms

Typical early symptoms include marked changes in personality and behavior and/or difficulty with producing or comprehending language (Alzheimer's Association, 2017).

It characterized by prominent changes in personality, interpersonal relationships, language skills, speaking, writing, comprehension and disturbances of motor function (progressive supra-nuclear palsy) causing muscle stiffness, difficulty walking and changes in posture (Alzheimer's Disease International, 2011).

Mixed dementia: 10% prevalence (Alzheimer's Disease International, 2011).It is characterized by the hallmark abnormalities of more than one cause of dementia, most commonly Alzheimer's combined with vascular dementia, followed by Alzheimer's with DLB, and Alzheimer's with vascular dementia and DLB (Alzheimer's Association, 2017). Vascular dementia with DLB is much less common.4-5 Recent studies suggest that mixed dementia is more common than previously recognized, with about half of older people with dementia having pathologic evidence of more than one cause of dementia (Alzheimer's Association, 2017). Some studies also show that the likelihood of having mixed dementia increases with age and is highest in the oldest-old (people age 85 or older) (Alzheimer's Association, 2017).

AGING AND DEMENTIA

It is sometimes difficult to tell the difference between what is normal aging and what is the early onset of dementia. In normal aging, the term mild cognitive impairment describes problem with mental abilities such as thinking, knowing and remembering. People with mild cognitive impairment (MCI), often have difficulties with day-to-day memory. However, these signs do not mean that the person is suffering from dementia (Alzheimer Society Canada, 2014).

Comparisons have been made between the signs of early onset of dementia and normal aging as they tend to mimic each other (table 1). Although aging is associated with gradual reduction in capacity to memorise or to recall past events, memory reduction with normal aging is not associated with dependency in the performance of activity of daily living (Alzheimer Society Canada, 2014).

Table 1: Differences between early signs of dementia and normal aging (Alzheimers Society Canada, 2014).

Early Signs of Dementia	Normal Aging
Forgetting the names of people close to them	Forgetting the names of people they rarely see
Forgetting things more often than they used to	Briefly forgetting part of an experience
Repeating phrases or stories in the same conversation	Not putting things away properly
Unpredictable mood changes	Mood changes in response to an appropriate cause
Decreased interest in activities & difficulty making choices	Changes in their interests

STAGES OF DEMENTIA

Dementia is often times discussed by Health professionals in stages which refer to how far a person's dementia has progressed, this help to determine the best treatment approach to use in the management and it aids communication between health providers and caregivers (Solomon and Budson, 2011). Sometimes, the stage is simply referred to as early stage, middle stage, or late stage dementia, but often a more exact stage is assigned, based on person's symptoms (Solomon and Budson, 2011).The earliest stage of dementia is called mild cognitive impairment (MCI). Research has it that 70% of those diagnosed with MCI progress to dementia at some point (Solomon and Budson, 2011).

In MCI, changes in the person's brain have been happening for a long time, but the symptoms of the disorder are just beginning to show. These problems, however, are not yet severe enough to affect the person's daily function. If they do, it is considered as dementia. A person with MCI scores between 27 and 30 on the Mini-Mental State Examination (MMSE), which is a normal score. They may have some memory trouble and trouble finding words, but they solve everyday problems and handle their own life affairs well (Solomon and Budson, 2011).

Early stages

In the early stage of dementia, the person begins to show symptoms noticeable to the people around them. In addition, the symptoms begin to interfere with activities of daily living and usually scores between 20 and 25 on the MMSE (Solomon and Budson, 2011). The symptoms are dependent on the type of dementia a person has. The person may begin to have difficulty with more complicated chores and tasks

around the house. The person can usually still take care of him or herself but may forget things like taking pills or doing laundry and may need prompting or reminders (Solomon and Budson, 2011).

The symptoms of early dementia usually include memory difficulty, but can also include some word-finding problems (anomia) and problems with planning and organizational skills like executive function (Solomon and Budson, 2011). Other signs might be getting lost in new places, repeating things, personality changes, social withdrawal and difficulties at work (Solomon and Budson, 2011). When evaluating a person for dementia, it is important to consider how the person was able to function five or ten years earlier. It is also important to consider a person's level of education when assessing for loss of function (Solomon and Budson, 2011).

Middle stages

A person with moderate dementia scores between 6 to 17 on the MMSE. For example, people with Alzheimer's dementia in the moderate stages lose almost all new information very quickly. People with dementia may be severely impaired in solving problems, and their social judgment is usually also impaired (Solomon and Budson, 2011). They cannot usually function outside their own home, and generally should not be left alone. They may be able to do simple chores around the house but not much else, and begin to require assistance for personal care and hygiene other than simple reminders **(**Solomon and Budson, 2011).

Late stages

People with late-stage dementia typically turn increasingly inward and need assistance with most or all of their personal care. Persons with dementia in the late stages usually need 24-hour supervision to ensure personal safety, as well as to ensure that basic needs are being met (Solomon and Budson, 2011). If left unsupervised, a person with late-stage dementia may wander or fall, may not recognize common dangers around them, and may not realize that they need to use the bathroom or become unable to control their bladder or bowels (incontinent), appetite decline and may require complete assistance (Solomon and Budson, 2011). Commonly, the person no longer recognizes familiar people. He or she may have significant changes in sleeping habits or have trouble sleeping at all (Solomon and Budson, 2011).

DIAGNOSTIC CRITERIA FOR DEMENTIA

The commonly used criteria for the diagnosis of dementia is the Diagnostic and Statistical Manual of Mental Disorders (DSM) published by the American Psychiatric Association , APA (1994), it offers a common language and standard criteria for the classification of mental disorders. It is used, and relied upon, by clinicians, researchers, psychiatric drug regulation agencies, health insurance companies, pharmaceutical companies, the legal system, and policy makers together with an alternative like the International Classification of Diseases (ICD) used in the Classification of Mental and Behavioural Disorders, produced by the WHO (DSM-IV, 1997).

The DSM-IV-TR uses the multiaxial system, there are five axes involved and they are as follows:

i. Axis I: this asks questions about clinical disorders and other condition that could be a focus of clinical disorders.
ii. Axis II: this is about the personality disorder and mental status
iii. Axis III: it questions the general medical condition of the patient
iv. Axis IV: it asks questions about the psychosocial and mental problem
v. Axis V: this asks questions about the global assessment of functioning (GAF) within the last six months.

The International Classification of Diseases (ICD) is the other commonly used manual for mental disorders and it is actually the official system for the US. It is distinguished from the DSM in that it covers health as a whole. While the DSM is the most popular diagnostic system for mental disorders in the US, the ICD is used more widely in Europe and other parts of the world.

The DSM-IV (4th edition) contains specific codes that allows for comparisons between the DSM and the ICD manuals, which may not systematically match because revisions are not simultaneously coordinated.

The diagnostic criteria for dementia according to DSM-IV (1997) are as follows:

1. Memory impairment: impaired ability to new information or to recall old information.
2. One or more of aphasia (language disturbance), apraxia (impaired ability to carry out motor activities despite intact motor function), agnosia (failure to

recognize or identify objects despite intact sensory function), disturbance in executive functioning, impaired ability to plan and organize tasks given.

3. The cognitive deficits result in functional impairment (social/occupational).
4. The cognitive deficits do not occur exclusively solely during a delirium.
5. Not due to other medical or psychiatric conditions.

RECOGNIZING DEMENTIA AS A CLINICIAN

Diagnosing dementia can be difficult owing to its insidious onset and symptoms resembling normal aging (Kostopoulou *et al*, 2008). Series of laboratory tests, brain scanning, assessment and physical findings are carried out with emphasis on disturbance of cognitive function and activities of daily living (National Institute for Health and Clinical Excellence, 2007).

Cognitive Testing

There are many tests which have been studied (Karlawish and Clerk, 2003; Sager *et al*, 2006; Fleisher *et al*, 2007), there are some brief tests (5-15 minutes) that have reasonable reliability to screen for dementia, presently the Mini Mental State Examination (MMSE) is the best studied and most commonly used (Boustani *et al*, 2003).

The Mini-Mental State Examination (MMSE) is a useful tool for helping to diagnose dementia if the results are interpreted along with assessment of a person's personality, their ability to perform activities of daily living, and their behaviour (Creavin *et al*, 2016). It has a sensitivity of 71-92% and specificity of 56-96% (Boustani *et al*, 2003). It is a 30 point questionnaire that is used extensively in

clinical and research settings to measure cognitive impairment (Pangman *et al*, 2000). It is commonly used in medicine and allied health to screen for dementia. Administration of the test takes between 5 and 10 minutes and examines functions including registration, attention and calculation, recall, language, ability to follow simple commands and orientation.

Using the MMSE, any score greater than or equal to 24 points (out of 30) indicates a normal cognition. Below this, scores can indicate severe (≤ 9 points), moderate (10–18 points) or mild (19–23 points) cognitive impairment. The raw score may also need to be corrected for educational attainment and age. Low to very low scores correlate closely with the presence of dementia, although other mental disorders can also lead to abnormal findings on MMSE testing (Pangman *et al*, 2000). The presence of purely physical problems can also interfere with interpretation if not properly noted; for example, a patient may be physically unable to hear or read instructions properly, or may have a motor deficit that affects writing and drawing skills.

The MMSE has been able to differentiate different types of dementias. Studies have shown that patients with Alzheimer's disease score significantly lower on orientation to time and place, and recall compared to patients with dementia with Lewy bodies, vascular dementia and Parkinson's disease dementia (Pangman *et al*, 2000). Other cognitive tests include the abbreviated mental test score (AMTS), the Modified Mini-Mental State Examination (3MS), the Cognitive Abilities Screening Instrument (CASI) (Teng *et al*, 1994), the Trail-making test, and the clock drawing test (Royall *et al*, 1998).

Activities of daily living (ADL**)** is usually assessed using the Barthel ADL index and Bristol Activities of Daily living (BADLs) (Santana-Sosa, 2008; Conradsson,2010; Venturelli, 2011; Vreugdenhil, 2012), Katz Index of ADLs (Rolland, 2007; Santana-Sosa, 2008), and Changes in Advanced Dementia Scale (CADS) (Francese, 1997). Higher scores in the Barthel ADL Index, Katz Index and the CADS indicate greater ability to perform ADLs.

Neurological imaging

The functional neuro-imaging modalities of Single-Photon Emission Computed Tomography (SPECT) and Positron emission tomography (PET) are more useful in assessing long-standing cognitive dysfunction, because they have shown a similar ability to diagnose dementia as a clinical examination and cognitive testing (Bonte *et al*, 2006). The ability of SPECT to differentiate the vascular cause (multi-infarct dementia) from Alzheimer's disease dementias, appears superior to differentiation by clinical examination (Dougall *et al*, 2004) in comparison to Computed axial Tomography (CT) scan or Magnetic Resonance Imaging (MRI scan) that are commonly done.

A research established the value of PET imaging using carbon-11 Pittsburgh Compound B as a radiotracer (PIB-PET) in predictive diagnosis of various kinds of dementia, in particular Alzheimer's disease. Studies from Australia have found PIB-PET 86% accurate in predicting which patients with mild cognitive impairment will develop Alzheimer's disease within two years and another study, carried out at the University of Michigan, carbon-11 dihydrotetrabenazine

(DTBZ), led to more accurate diagnosis for more than one-fourth of patients with mild cognitive impairment or mild dementia (Dougall, *et al*, 2004; Abella, 2009).

MANAGEMENT OF DEMENTIA

The management of dementia cut across all health providers and caregivers including supportive treatment, non-pharmacological, Pharmacological and treatment of complications and co-morbidities. The non-pharmacological rehabilitation efforts need to target 5 broad areas/targets which include memory enhancement, altering social contingencies and communication styles, improving self-care skills, the arrangement of physical environments to maintain and improve functioning, and increasing physical fitness/physical activity **(**Buchanan, 2011).

Physiotherapy helps in improving physical function (mobility, balance, coordination and strength), in treating difficulties associated with ageing such as limited range of .movement, swelling, pain and increased risk of falling and thus improves independence with ADL's and quality of life. It also plays an important role in advising and supporting family and carers to live easier lives by reducing stress levels (Jaswinder *et al*, 2012).

Behaviour Modification Techniques (BMT):

BMT is a psychotherapy that seeks to extinguish or inhibit abnormal or maladaptive behaviour by reinforcing desired behaviour and extinguishing undesired behavior (Jaswinder*et al*, 2012). Ullman and Krasner (1975) have described the essential nature of the behavioural approach as using 'systematic environmental contingencies' to alter directly the subject's reactions to situations.

Environmental design:

The environment should be supportive and therapeutic. Mobility aids or equipment should be advised for the home to ensure safety and promote mobility and function. Attention should be paid to: lighting, colour schemes, floor coverings, assistive technology, signage, garden design, and the access to and safety of the external environment. Designing should comply with the Disability Discrimination Acts 1995 and 2005, because dementia is defined as adisability within the meaning of the Acts.

Care and Equality:

People with dementia should not be excluded from any services because of their diagnosis, age or coexisting learning disabilities. People with dementia and their carers should be treated with respect at all times. Health and social care staff should identify and address the specific needs of people with dementia and their family members arising from gender, age, religion, ill health, physical disability, sensory impairment, communication difficulties, problems with nutrition, poor oral health and learning disabilities (Jaswinder *et al*, 2012).

Psychological interventions:

Psychological interventions for people with dementia should include assessment and monitoring for depression and/or anxiety. For people with dementia who have depression and/or anxiety, cognitive behavioural therapy, which may involve the active participation of their attendants, may be considered as part of treatment. A range of tailored interventions, such as reminiscence therapy, multisensory stimulation, and exercise, should be available for people with dementia who have depression and/or anxiety (Jaswinder *et al*, 2012).

PHYSIOTHERAPY INTERVENTION

A therapeutic exercise routine for the management of dementia should be composed of the following:

Flexibility exercises for Musculoskeletal System

Exercise is among the potential protective lifestyle factors identified as a strategy for treating the symptoms of dementia or delaying its progression (Lautenschlager 2010). Exercises increases joint range of movement and muscle strength making daily tasks easier, it includes:

i. Both active and passive ROM (Range of Movement) exercises, this should focus on strengthening the weak muscles

ii. Proprioceptive Neuromuscular Facilitation (PNF) Pattern: Muscle inhibition techniques. Hold Relax or Contract Relax. Contract Relax is the preferred technique because it combines autogenic inhibition from isometric contraction of the tight agonist muscles with active rotation of the limb (Jaswinder *et al*, 2012).

iii. Traditional Stretching Techniques (Jaswinder *et al*, 2012)**:** Gentle stretching of elbow flexors, hip, knee flexors and ankle plantar flexors. To maintain the stretch force at least 15 – 30 seconds. Ideally the stretches are repeated 3-5 times. Ballistic stretches (high intensity bounding stretches) and aggressive stretch should be avoided.

Balance Training:

It is important in patients with dementia to improve confidence and reduce the risk of falling. As balance is position specific so both standing and sitting balance exercises are encouraged. The balance training always begins from lower COG (Centre of Gravity) to higher COG (Jaswinder *et al*, 2012). Training should begin with weight shifts in both sitting and standing in order to help the patient develop an appreciation of his limits of stability (Jaswinder *et al*, 2012).

By giving the slight push to patient and patient tries to maintain the balance, reaching activities and activities on gym/medicine ball (Jaswinder *et al*, 2012). Heel-toe standing, partial wall squats and chair rises, single limb stance with sidekicks or back kicks and marching on a spot, all while maintaining light touch down support of the hands (Jaswinder *et al*, 2012).

Strength Training:

It helps in building lean muscle mass, increasing metabolism, controlling blood sugar levels. Ideally 10-15 repetitions of 8-10 exercises should be performed thrice a week. Resistance may be applied with thera-bands, light weight dumbbells etc (Jaswinder *et al*, 2012).

Gait Training:

Gait re-education helps in improving mobility and functional ability without support. The major goals are to lengthen stride, broaden Base of Support (BOS), improve stepping, improve heel–toe gait pattern, increase contralateral movement and arm swing and provide a programme of regular walking (Jaswinder *et al*, 2012). Weight transfer; standing on single limb, high stepping to strengthen the

flexors, side stepping or crossed stepping with or without support, PNF activity of braiding which combines side to side stepping with alternate crossed stepping to improve the lower trunk rotation with stepping movement (Jaswinder *et al*, 2012), normal heel-toe progression to overcome shuffling pattern, draw foot marks or parallel lines with red or yellow colours, then ask the patient to walk on it, the patient should practice stopping, starting, changing direction. Auditory cues can be effective in improving gait. Turning of 180 degree should be practiced first then 360 degree.

Aerobic Exercises:

Aerobic exercise helps in improving cardiovascular health (Fleg, 2012), and strengthen the hormones immune system. Physical activity decrease beta-amyloid proteins leading to decreased amyloid plaque, neural disruption, hence improving brain health (Angevaren, 2008; Erickson, 2011).

Aerobic exercise includes jogging, cycling, dancing, swimming or any physical activity that rejuvenate the patient's pulmonary and cardiac capacity (Fleg, 2012). For maximum benefits, 30 minutes session thrice a week is advised. Patients can start with 10-20 minutes sessions depending on fitness levels and can progress accordingly. Alternative exercise form such as dancing could be included in aerobic exercises. It is good for people who find standard exercises and weight training boring (Jaswinder, 2012).

PROGRESSIVE TASK-ORIENTED CIRCUIT TRAINING (PTOCT)

Circuit training:

Circuit training is a form of sustained high intensity resistance training which consists of different varied exercises over a period of time (Paoli *et al*, 2013).. It is a combination training which incorporates both multi-joint resistance training and callisthenic exercises that keeps the heart rate elevated for the duration of training session (Paoli *et al*, 2013). Circuit training is a form of body conditioning or endurance training or resistance training using high intensity. Circuit training is a method of fitness training that is designed to develop general, all round physical and cardiovascular fitness. It combines strength training with high intensity aerobic fitness workout where people work in groups and rotate through a series of exercises to the cadence of a timer (Paoli *et al*, 2013).

Morgan and Anderson at the University of Leeds first developed circuit training in the 1953. Circuit training is a versatile training method as it can be adapted for many different situations, sections of the population and fitness requirements, and can be used at any time (Lawal *et al*, 2015).

Progressive Task-Oriented Circuit Training: It is a form of task specific training that involves the practice of structuring tasks in a circuit or series of work stations whereby there is increase of intensity in progression (Wevers *et al*, 2009; Ingrid *et al*, 2012; Lawal *et al*, 2015).

During progressive task-oriented circuit training, an individual moves from exercise to exercise as quickly as possible with very little rest, which results in a short duration exercise session. The rests intervals taken during PTOCT are

important because heart rate and blood pressure product are increased and remain high as the rest intervals between sets and exercises are decreased (Castinheiras-Neto *et al*, 2010).

Activities in circuit training

A circuit should work each section of the body individually which aims at targeting the upper body, core and trunk, lower body, and total body (Castinheiras-Neto *et al*, 2010).

Exercises for upper body includes; squats up, bench dips, lifting weights, back extensions; for core and trunk includes sit up, stomach crunch; for lower body includes step ups, marching on the spot; for total body and cardiovascular endurance includes treadmill, bicycle ergometry, skipping, jogging, swimming etc (Castinheiras-Neto *et al*, 2010)..

Effects of circuit training

Many studies showed that circuit training is the most time efficient way to enhance cardiovascular fitness and muscular endurance (Heavin *et al*, 2004).

Morgan and Anderson 1953 reported that circuit training elicited oxygen consumption values of 39% to 50% of VO2max that meet established guidelines of the American College of Sports Medicine (ACSM) for the recommended intensity of 40% to 85% of VO2max of exercise for developing and maintaining cardio-respiratory fitness (Paoli *et al*, 2013).

CASE STUDY

Name: Mr XX

Age: 75 years

Sex: male

Address: xxxx

Religion: Christianity

Origin: Delta state

Marital status: Married

History source: wife

Presenting complaint: inability to walk long distance, occasional loss of memory and inability to make good decision and short attention span.

History: A known patient of Neurology and Psychiatry department of Lagos State University Teaching Hospital (LASUTH), Ikeja, Lagos. He is a known hypertensive but not diabetic and claimed to be regular on anti-hypertensives. Patient was said to have been in his usual state of health until about a year ago when he suddenly developed fever, slurred speech and sudden weakness of the right upper limbs and lower limbs. There was associated history of head ache, vomits (3 episodes), without loss of consciousness. He was brought to LASUTH and managed on account of Left hemorrhagic Cerebrovascular accident with Right hemiparesis. He was on admission for about 4 weeks and discharged home and given an appointment as an out-patient at the Neurology unit of LASUTH. About 4 months after, patient was said to begin to forget things, started having trouble planning ahead or completing a tasks. Over time, situation grew worse and wife noticed that he sometimes have irrational speech and then hardly remembers events that took place in recent times. She informed the children about the situation and

was advised to bring him back to the hospital. He was referred to the Psychiatry department of LASUTH from the Neurology unit and he was diagnosed and managed for vascular dementia following CVA.

N.B: patient never had any session of Physiotherapy while on the ward and patient recovered with almost 90% of function

Drug history: amlodipine, Lisinopril, Namenda, cocodamol, neurovite forte.

Past Medical and surgical history: known hypertensive, not known diabetic, astmatic, ulceric, nor epileptic.

Nil history of surgery.

Family and social history: Retired barrister of law, married with 5 children (2 males and 3 females) all married. He lives with his wife and a carer. He does not smoke nor take alcohol. He does not chew kolanut.

O/E: patient walked into the physiotherapy gym of LASUTH unaided but with mild atalgic gait and mild stoop head position, afebrile, acyanosed, anicteric and not in any obvious respiratory distress. Oriented in person but not in time and place.

Blood pressure: 130/84mmHg, Pulse rate: 84bpm, Respiration rate: 24cpb

Segmental examination

Head and neck: nil facial asymmetry, mild forward stoop head position, range of motion of the neck is full and pain free across all range

Abdomen and thorax: nil apparent deformity

Table 2: Upper limbs assessment

Upper limbs	Right	Left
Swelling	nil	nil
Shoulder subluxation	Nil	nil
Muscle bulk	Preserved	preserved
Muscle Atrophy	mild at deltoid and fore-arm	nil
Muscle tone	normotonia	normotonia
Spasticity	nil	Nil
Gross muscle power	4	5
Grip strength	Good	good

Skin sensation test (deep and light touch)	intact bilaterally
Range of motion	full and pain-free across all joints bilaterally

Table 3: Lower limbs assessment

Lower limbs	Right	Left
Pedal oedema	Nil	Nil
Tendon Achilles tightness	Nil	Nil
Muscle bulk	Preserved	Preserved
Muscle Atrophy	Nil	Nil
Muscle tone	Normotonia	Normotonia
Spasticity	Nil	Nil
Gross muscle power	4	5

Skin sensation test (deep and light touch)	intact bilaterally
Range of motion	full and pain-free across all joints bilaterally

Table 4: Outcome measures

Tests	Scores
Mini mental state examination (MMSE)	20/30
Bristol activities of daily living scale	24/60
ADAS-Cognitive Behaviour	30/70
Community integration questionnaire	4.5/29
6 minutes' walk test	153m

Treatment

Patient is being managed at the both the Neurology and Psychiatry department of Lagos State University Teaching Hospital on account of hypertension and vascular dementia respectively.

Patient was referred to the Physiotherapy department as an out-patient based on request for the purpose of the study. This was possible following ethical approval from the Health Research and Ethics Committee of Lagos state University Teaching Hospital (LASUTH), Nigeria.

Consent was taken from the participants and signed. The aim and objectives of the study was carefully explained to the patient including the detail of the research procedures.

Progressive Task-Oriented Circuit Training: the patient was taken through a 70 minutes treatment session (5 minutes warm up, 60 minutes exercises, 5 minutes cool down), 2 days a week over a 12 week period performing a set of core activities that addressed his functional activities limitation. A total of 6 work stations were made available in the circuit, arranged to progress in complexity. There was 8 minutes workout in each station and 2 minutes rest before proceeding to the next station. These core activities included;

Warming up: Stretching of the ankle dorsiflexors, ankle plantarflexors, shoulder extensors and flexors. Marching on a spot (5 min)

Station 1: Strengthening exercises of upper limbs (8 min)

Content: Active shoulder flexion, extention and abduction with weight of varying sizes (dumbbells).

Station 2: Sitting balance and Sit to stand (8 min)

Content: Sitting and reaching in different directions for objects beyond arm length. Repeated standing up from a chair and sitting back down.

Station 3: Standing (8 min)

Content: Throwing and catching balls, kicking of ball to the wall at 1m, 1.5m, 2 m

Station 4: Leg strengthening in weight-bearing positions (8 min)

Content: Stepping forward, backward and sideways onto blocks of various heights (participant places one foot on a step either to the side or in front and raises up to the front alternatively).

Station 5: Walking (8 min)

Content: standing up from chair, walk short distance (6 min), return to chair.

Station 6: Endurance exercise (8 min)

Content: Cycling ergometer

Cool down: Deep breathing in sitting position, resting.

RESULTS

Table 5: Results from the outcome measures

INSTRUMENTS/OUTCOME MEASURES	Week 1 (Baseline assessment)	Week 6	Week 12
MMSE	20	21	21
BADLs	24	20	18
ADAS-Cog			
Word recall task	7/10	7/10	7/10
Naming objects and fingers	2/5	2/5	2/5
Commands	1/5	1/5	0/5
Constructional praxis	2/5	2/5	2/5
Ideational praxis	2/5	2/5	2/5
Orientation	3/8	2/8	1/8
Word recognition task	7/12	7/12	6/12
Language	2/5	2/5	1/5
Comprehension of spoken language	1/5	1/5	0/5
Word finding difficulty	1/5	1/5	1/5
Remembering test instruction	2/5	2/5	1/5
Total score	30/70	29/70	23/70
CIQ 0-29			
Home integration	1.5	3.5	3.5
Social integration	1	4	4
Productivity	2	2	2
Total score	4.5	9.5	9.5
6 minutes' walk test	153m	250m	404m

A 3-month follow up progressive task-oriented circuit training for the patient has improved the patient's well-being and also cause a delay in the rate of progression of the symptoms that were initially reported. There was a slight increase (20-21) in the Mini Mental State Examination scores by the patient as at week 6 and at the end of the training. The cognition of the patient improved on the ADAS-Cog, the area of orientation, word recognition, language and remembering test as seen on table 5.

The physical functioning aspect of the patient was mildly impaired from the outcome measure using Bristol Activities of daily living scale, the first assessment score was 24 out of 60, by the end of week 6 it reduced to 20 and by week 12, it further reduced to 18. This improvement was seen in the aspect of food preparation if prompted step by step and use of telephone appropriately.

The cardiovascular endurance of the patient improved and the total distance covered using the six-minute' walk test improved. The distance covered at week 1 was 153m, at week 6, it increased to 250m and at the end of the training, the patient was able to cover 404m.

The community integration questionnaire showed an improvement in the patient's integration for the home and social participation as seen on table 5 from the first assessment to the end of the 12 weeks PTOCT.

DISCUSSION

The results of this study suggests that a progressive task-oriented circuit training for individuals with dementia is effective in improving functional abilities across a number of domain including cognition, physical functioning and societal participation. This study corroborates a randomized controlled study by

Vreugdenhil *et al,* 2012, on a community-based exercise program carried out to improve functional ability in people with Alzheimer's disease. The improvement in physical functioning and performance of activities of daily living corroborates the study of Rolland *et al*, 2007, where a group exercise program performed twice weekly for 12 months for individuals with dementia slowed the deterioration in the ability to perform ADLs.

This study confirms and corroborates a study by Vreugdenhil *et al,* 2012, in the findings regarding cognition but goes even further demonstrating that regular exercises significantly improved cognitive function across multiple cognitive domains using two well established measures of cognitive impairment (ADAS-Cog and MMSE).

CONCLUSION

This study suggests that participation in Progressive task-oriented circuit training for individuals with dementia can improve cognition, physical functioning and societal participation if there is early intervention.

Improving functional ability in people with dementia has a great potential to benefit not only the individual with dementia but also relieves burden of the informal carers, the wider health and age care system. Considering the rate of increase in the number of individuals with dementia and the limitation of the treatments available, early intervention is important. Further research into the role of exercise as an intervention for people with dementia is required, with larger trials over a longer period, with an assessment on the impact on carer and wellbeing.

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