

COMPARATIVE OF BALANCE EXERCISE AND RESISTED EXERCISE VERSUS RESISTED EXERCISE IN PATIENT WITH DIABETES TO IMPROVE BALANCE AND QOL (QUALITY OF LIFE)

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Abstract: Diabetes is the most common form of hereditary condition and can develop at any age. Physiotherapists have been exploring different forms of exercise intervention, like balance exercise, resisted exercise, aerobic exercise. Despite the number of studies showing evidence on particular intervention towards outcome measure, evidences are still needed for proving usefulness of balance training as a treatment for of diabetic patients.

Objective: To evaluate the efficacy of exercise intervention with improving balance in patient with diabetes.

Intervention: 51 individuals with diabetes were included and allocated to three groups (n=17). Groups were administrated with Resisted exercise, Balance exercise along with Conventional therapy and Conventional therapy alone for 4 weeks (5 days per week). Functional Reach Test Score and Balance Evaluation Test Score were used to assess changes between baseline and post intervention.

Results: The Control group (Group C) was associated with significant greater change in balance than Group A and Group B. The Scores of the functional reach test, have shown a significant change in all the three groups with ($p < 0.05$) but, the changes in scores of BES Test were not significant.

Conclusion: There was no additional effect of adding resisted therapy or balance therapy over conventional therapy on improving balance in Diabetic population.

Keywords: Diabetes, Balance, Diabetic Neuropathy, Functional Reach Test, Tuning fork, Romberg Test, Resisted Exercise, Balance Exercise, Balance Evaluation System Test.

1. INTRODUCTION

Definition

Diabetes is the condition in which the body does not properly process food for uses energy. Most of the food we eat is turned into glucose, or sugar, for our bodies to use for energy. Diabetes is the seventh leading cause of death in the United States.

Type 1 diabetes, previously called insulin-dependent diabetes mellitus (IDDM) or juvenile onset diabetes, may account for 5 percent to 10 percent of all diagnosed cases of diabetes. Risk factors are less well defined for Type 1 diabetes than for Type 2 diabetes, but autoimmune, genetic, and environmental factors are involved in the development of this type of diabetes.

Type 2 diabetes

was previously called non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes. Type 2 diabetes may account for about 90 percent to 95 percent of all diagnosed cases of diabetes. Risk factors for Type 2 diabetes include older age, obesity, family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, physical

inactivity, and race/ethnicity. African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans and Pacific Islanders are at particularly high risk for type 2 diabetes. Gestational diabetes develops in 2 percent to 5 percent of all pregnancies but usually disappears when a pregnancy is over. Gestational diabetes occurs more frequently in African Americans, Hispanic/Latino Americans, American Indians, and people with a family history of diabetes than in other groups. Obesity is also associated with higher risk. Women who have had gestational diabetes are at increased risk for later developing Type 2 diabetes. In some studies, nearly 40 percent of women with a history of gestational diabetes developed diabetes in the future. Blacks are 1.7 times as likely to develop diabetes as whites. The prevalence of diabetes among blacks has quadrupled during the past 30 years. Among blacks age 20 and older, about 2.3 million have diabetes – 10.8 percent of that age group. Blacks with diabetes are more likely than non-Hispanic whites to develop diabetes and to experience greater disability from, and increased risk of heart disease and stroke; Death rates for blacks with diabetes are 27 percent higher than for whites.⁽¹⁾

Complications commonly associated with diabetes are micro-vascular complications of the kidney (nephropathy), nervous system and vision (retinopathy). Macrovascular complication like coronary heart disease, stroke, peripheral arterial disease. However, and diabetes can also lead to other disturbances including a loss of motor and sensory functions and loss of balance.⁽²⁾

Balance is a complex process which requires input from the afferent receptor systems, vestibular, visual, proprioception. Balance control in normal adult usually takes place at subconscious level. Static balance is said to be achieved when an adopted position is maintained for a long period of time and dynamic balance is maintenance of balance when on the move. Postural adjustments which maintain balance are known as equilibrium reaction. The maintenance of standing balance is an automatic, active sensorimotor process which maintains the body centre of gravity over its base of support.⁽³⁾

Tuning fork is suitable for screening for sensation loss. Considering the simple and inexpensive nature of the tuning fork, its usefulness is already established for screening vibratory sensation loss in non-diabetic and diabetic subjects. Neurological tuning fork with damper and base vibrates at 64 Hz and 128 Hz and used to detect impaired vibration sensitivity known as paresthesia. Mostly used in diabetes, nerve damage and bacterial inflammation. Graduated tuning fork has a high specificity and a good sensitivity in the diagnosis of diabetic foot problems. It is a simple and inexpensive device and can therefore be used as an outpatient screening procedure, especially when facilities for more sophisticated tests are not available, as in the developing countries.⁽⁴⁾

Balance training improves body awareness and control on subconscious level, resulting in lasting improvements in posture, posture, balance, and thus the overall quality of movements. Prescribed and supervised long term exercise program may influence neuromuscular parameters in diabetic patients, thereby inducing adaptive changes in the neuromuscular system in response to exercise. Richardson JK, et al. (2001) conclude that exercise plays a crucial role in targeting balance problems in subjects with diabetic peripheral neuropathy.⁽⁵⁾

Resistance Training leads to hypertrophic response and a muscle fibre type shift in exercising muscles, which allows for a potential increase in whole body glucose utilization. The potential benefits of increases in muscle mass on body composition. Resistance training improves glycaemic control, decreases insulin resistance and increases muscular strength in adults with type 2 diabetes. Resistance training increases lean muscle mass and bone mineral density leading to enhanced functional status and prevention of sarcopenia and osteoporosis.⁽⁶⁾ More than 35% of community-dwelling older adults fall at least once annually. As these sequelae of falling are deleterious for this population, including loss of independence, severe injury, and death, it is important to identify which older adults are at increased risk for falling. Elucidating factors associated with balance impairment and which predispose the older adult to a fall is therefore an area of intense and ongoing investigation. Along with numerous other factors such as home environmental hazards and cognitive impairments, low balance confidence has been shown to be closely associated with falls in older adults. While there is no gold standard for assessing balance confidence, one commonly-used measure is the ABC scale. This 16-item scale, the ABC-16, includes questions addressing levels of balance confidence during performance of daily activities. Lower scores indicate lower levels of balance confidence and are associated with balance-impairment and falls in older adults. Despite its utility as a predictor of balance impairment and falls, a significant drawback of the ABC-16 is that it may take up to 20 minutes to administer. Recently, a shortened version of the ABC-16, the ABC-6, has been proposed for clinical or research purposes. The ABC-6 includes the six most balance challenging tasks from the original 16-item scale, making it considerably less time consuming to administer and more convenient for use in busy clinical or research settings.⁽⁷⁾

The Balance Evaluation Systems Test (BESTest) is a relatively new multitask balance assessment developed to identify specific postural control problems (i.e., biomechanical constraints, stability limits, postural responses, anticipatory postural adjustments, sensory orientation, dynamic balance during gait, and cognitive effects).⁽⁸⁾⁽⁹⁾ However, this 36-item assessment takes 30 to 35 minutes to complete and may not be feasible in real clinical settings, where time constraint is often a major concern. A shorter version of the test, the 14-item Mini-BESTest, has recently been developed.⁽¹⁰⁾ It takes only 10 minutes to complete, and good interrater and intratester reliability have been reported in a sample of people with mixed conditions.⁽¹¹⁾ Recent studies further showed that the Mini-BESTest has good interrater and intratester reliability and concurrent validity^{31,32} and is useful in predicting falls^{33,34} in patients with Parkinson disease (PD). However, the psychometric properties of the Mini-BESTest have not been specifically evaluated in the stroke population. Additionally, no study has evaluated the ability of the Mini-BESTest in distinguishing fallers from non-fallers among individuals with stroke. The current study was undertaken to (1) examine the reliability and validity of the Mini-BESTest and (2) compare the Mini-BESTest with 4 other balance measures based on the floor and ceiling effects and on sensitivity and specificity for distinguishing between individuals with and without a history of falls.

The reality is that diabetes influences patients' lives. The mere presence of diabetes deteriorates a person's quality of life (QoL). When diabetes coexists with other chronic illnesses the effect is even worse. But what exactly is QoL? Is it the mere absence of sickness in a man's life? Is it something more? Is it measurable? The worldwide interest is reflected on the 1950000 articles and reviews published the last five years on this research area while the numbers of publications on each diabetic complication are between 15000 and 28000 depending on the complication. Notably only one article was found to assess family functioning. As Snoek et al [8] describes, we are not certain of the origin of the phrase QoL, but American economists Samuel Ordway (1953) and Fairfield Osborn (1954) are the first to have used the term. Others who used almost the same words was John Galbraith (1967), American president Lyndon B Johnson 1964 followed by social scientists in 1960's who were interested in the new topic of QoL, and particularly the correlation between markers of QoL (such as income level social interaction), and the way individuals perceive them to define their QoL. Surprisingly enough biological health wasn't a determining factor. Because of the social progress and the medical development, research focused on the issue of well-being as patients perceive it.⁽¹²⁾

2. METHODOLOGY

STUDY SETTING:

Physiotherapy department, parul sevashram Hospital.

STUDY POPULATION:

30 patients with diabetes.

STUDY DURATION:

6 months.

TREATMENT DURATION:

4 weeks.

STUDY DESIGN:

Comparative study

SAMPLE SIZE:

Total number of patient with diabetes 30

- 15 patient in group A

- 15 patient in group B

SAMPLING METHOD: Random method

INCLUSION CRITERIA:

1. Patient with 45 to 65 years of age with diabetes more than 5 years-controlled hypertension.

2. Patient should have ability to walk household distance without assistance with strength of ankle above grade 3 by MRC.

EXCLUSION CRITERIA:

1. Patient with evidence significant CNS dysfunction, musculoskeletal deformity, vestibular dysfunction, complete sensory, hypoglycaemia, angina,
2. Lower extremity arthritis or pain limits standing weight bearing were excluded.

MATERIAL USED:

- Consent form
- ABC scale (data collection sheet)
- Mini-BESTest scale (data collection sheet)
- Pen
- Pencil
- Weight cuff
- Tuning fork
- Chair
- Plinths
- Pillow
- Stop watch

3. OUTCOME MEASURE

Measurements were taken before and after the program scheduled.

1. The Activities-specific Balance Confidence (ABC) scale

- The Activities-specific Balance confidence (ABC) scale is a questionnaire developed to assess older individual's balance confidence in performing daily activities.
- ABC scale consists of a wide continuum of less and more challenging daily activities.
- The test can be given to older individuals as a test of their balance confidence, during or prior to an interview with the administrator, or over the telephone.
- There are 16 items, representing daily activities. Participants are asked to answer, with a score from 0% (not confident at all) to 100% (completely confident) in increments of 10%, how confident they are in performing each activity. The average score obtained is an indication on balance confidence.

Interpretation

- A score of > 80% indicates high level of functioning. A score of 50%-80% indicates moderate level of functioning. A score of < 50% indicates low levels of functioning. Additionally, a score of < 67% suggests substantial risk of falling.

2. Mini-BESTest

- **Subject Conditions:** Subject should be tested with flat-heeled shoes OR shoes and socks off.
- **Equipment:** Temper® foam (also called T-foam™ 4 inches thick, medium density T41 firmness rating), chair without arm rests or wheels, incline ramp, stopwatch, a box (9" height) and a 3-meter distance measured out and marked on the floor with tape [from chair].
- **Scoring:** The test has a maximum score of **28** points from **14 items** that are each scored from 0-2. "0" indicates the lowest level of function and "2" the highest level of function. If a subject must use an assistive device for an item, score that item one category lower. If a subject requires physical assistance to perform an item, score "0" for that item. For **Item 3** (stand on one leg) and **Item 6** (compensatory stepping-lateral) only include the score for one side (the worse score). For

Item 3 (stand on one leg) select the best time of the 2 trials [from a given side] for the score. For **Item 14** (timed up & go with dual task) if a person's gait slows greater than 10% between the TUG without and with a dual task then the score should be decreased by a point.

4. PROCEDURE

The present study aiming to check effect of resisted training or balance training on improving balance and QOL in diabetics was initiated, after being given permission by the "Parul University". A consent form was taken from the department heads regarding permission for approaching the patients.

CONSENT AND ASSESSMENT:

All these patients gave an assessment and written consent to actively participate in the study. A total of 30 patient who met with the inclusion criteria were included in the study.

BASELINE DATA (PRE –INTERVENTION DATA):

After this baseline data of all the two outcome measures (MiniBESTest, ABC Scale) were collected. For Mini BESTest, candidate was explained the method and scale was filled by the therapist. ABC was filled by candidates.

ALLOCATION OF SUBJECTS:

First subject with diabetes was allocated to Group A, second visiting subject to Group B. The same sequence of the procedure was followed throughout for consecutive subjects. Subjects who picked A were included in balance exercise and resisted exercise and subjects who Picked B were included in resisted exercise.

5. INTERVENTION

GROUP A:

Balance exercise and resisted exercise was given to these group for 1 set of 10 repetition, 5 days a week for 4 continuous weeks.

It includes:

BALANCE EXERCISE

1. Static quadriceps, ankle press:(10 times)

- Initially, the subject was asked to lie down in supine lying and the quadriceps board was placed below both knee.
- then the patient was asked to press both the knees on the quadriceps board downwards.
- The patient was in supine lying, place the quadriceps board below both the ankle and asked to press the heel down.

2. Intrinsic muscles of foot strengthening (beads transfer with fingers)

- The patient was asked to sit in the chair with feet apart.
- A bead was placed on the floor near the patient's foot and now the patient was asked to lift the bead with the fingers of foot and transfer to the side of the foot.

3. Active ROM exercise of the knee flexion and extension and dorsiflexion

- The subject was asked to sit on the plinth in the high sitting position and keep the back straight.
- Now perform knee flexion – extension and ankle dorsiflexion.

4. Marching in place

1. The subject was asked to stand on firm surface with feet apart and with help of therapist subjects were informed to lift his leg from knee joint for marching.
2. The subjects were asked to do repetition without any interval.
3. The subject was in the standing position and asked to move the right leg in front- neutral –back and place the foot side to side. Now repeat the same with the other leg.

5. step in front and back and side to side

6. step up

- The subject was in standing position and asked to put the right leg on the stair and back to neutral position. And repeat the same with other leg.

7. lunges

- The subjects were asked to do both side lunges with the use of hands on knee joint.
- Knee should be in slight flexion and abduction position and upper extremity should be rotate to same side while doing lunges.

8. Bipedal toe and heel raise.

- The subject was in standing position and asked to raise your heel and stand on your toes.
- The subject was in standing position and asked to raise your toes and stand on your heel.

9. Bipedal inversion and eversion

- The subject was in high sitting position and asked to move the foot away from the midline of the body.
- The subject was in high sitting position and asked to move the foot towards the midline of the body.

RESISTED EXERCISE

1. Knee flexion exercise

- The subjects were made to sit on high chair or table.
- The knee was bent slowly as far as possible, so that the foot with the weight cuff was bent behind.

2. Knee extension exercise

- The subjects were made to sit on chair with back support or table.
- The leg with the weight cuff was extended slowly in front, parallel to the floor for a period of 3 seconds.

3. Ankle dorsiflexion exercise

- The subjects were made to sit on chair.
- The subject was then asked to lift the foot tied with weight cuff and hold and back to the original position.

GROUP B:

Resisted exercise was given to these group for 1 set of 10 repetition, 5 days a week for 4 continuous weeks.

It includes:

1. Knee flexion exercise

- The subjects were made to sit on high chair or table.
- The knee was bent slowly as far as possible, so that the foot with the weight cuff was bent behind.

2. Knee extension exercise

- The subjects were made to sit on chair with back support or table.
- The leg with the weight cuff was extended slowly in front, parallel to the floor for a period of 3 seconds.

3. Ankle dorsiflexion exercise

- The subjects were made to sit on chair.
- The subject was then asked to lift the foot tied with weight cuff and hold and back to the original position.

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