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ORIGINAL ARTICLE

A COMPARATIVE STUDY OF FRENKEL EXERCISE VERSUS SWISS BALL TRAINING ALONG WITH RESISTED EXERCISE ON BALANCE IN TYPE 2 DIABETIC NEUROPATHY

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Elavarasi. M^{1*}, Kannan Dhasaradharaman², Vishnupriya. R³, Anantharaj. K⁴,
Kokilavani. S⁵

Authors:

²Principal, JKKMMRF College of Physiotherapy, The Tamil Nadu Dr. M.G.R. Medical University Chennai, Tamil Nadu

^{3,4,5}Professor, JKKMMRF College of Physiotherapy, The Tamil Nadu Dr. M.G.R. Medical University Chennai, Tamil Nadu

Corresponding Author:

^{1*}MPT Graduate, JKKMMRF College of Physiotherapy, The Tamil Nadu Dr. M.G.R. Medical University Chennai, Tamil Nadu Mail id: elavarasiphysio07@gmail.com

ABSTRACT

Background and Purpose: .Diabetic peripheral neuropathy is a common disorder affecting quality of life with in sensory and motor function, where the strength is absolutely weak with decreased stability and mobility of the lower limb. The aim of the study is to compare Frenkel exercise versus Swiss ball training along with resisted exercise on balance in type 2 diabetic neuropathy. **Method:** It is a Quasi experimental study with sample size 30 and subjects with age group 45 to 65 years of male subject are selected from the outpatient department of JKK Munirajah Medical Research Foundation College of Physiotherapy. Group A of 15 subjects receives Frenkel exercise with resisted exercise; Group B of 15 subjects receives swiss ball training with resisted exercise. Pre and post intervention were assessed by Berg balance scale and Single leg stance test. **Result:** Group B diabetic neuropathy patient included in the study completed the 10 repetition of Swiss ball training with resisted exercise were re-evaluated at the six month follow-up. The two-tailed P value is less than 0.0001, by conventional method; this result shows that it is extremely statistically significant. **Conclusion:** This study concludes that swiss ball training with resisted exercise has improvement of balance and reduce fall in this treatment.

Keywords: Keywords: Frenkel exercise, Resisted exercise, Swiss ball training.

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INTRODUCTION

Diabetes is a common metabolic disease having serious health implications and this incidence is increasing day by day¹. Diabetic neuropathy is one of the serious known micro vascular complications of the both type 1 and type 2 diabetes mellitus having been diagnosed in 20 to 50% of the diabetic population². The incidence of developing diabetic neuropathy is increasing with the chronicity of the disease and poor glycolic control. Moreover, balance affliction is found in 16% diabetics which may increase up to 30-50% with increase in the severity of the disease³.

Peripheral neuropathies occur deceptively and start with reduced sensitivity followed by motor nerve impairment following distal to proximal pattern. About 50% of patients may experience symptoms like burning pain, electrical (or) stabbing sensations, paraesthesia, hyperaesthesia, and deep aching pain⁴. In addition, as many as 30% of people with DPN experience muscle weakness, loss of reflexes, and decreased balance, co-ordination and gait control. All these Risk factors limit walking and other activities and increase the incidence of fall related injuries⁵.

Balance: Balance, or postural stability, is a generic term used to describe the dynamic process by which the body's position is maintained in equilibrium. Equilibrium means that the body is either at rest (static equilibrium) or in steady-state motion (dynamic equilibrium). Balance is greatest when the body's center of mass (COM) or center of gravity (COG) is maintained over its base of support (BOS)⁶.

Examination and Evaluation of Impaired Balance and Mobility: The examination of balance impairment can range from the simple to the complex. Simple, impairment level clinical measures, such as the ability to maintain a single-leg stance with the eyes

closed or the Romberg test, are commonly used in the clinic. Measures of activity limitations, such as the Berg balance scale (BBS) and timed up and go are commonly used by certified clinical specialists. Additionally, computerized balance testing systems are increasingly incorporated into clinical evaluation and treatment⁷.

As stated, balance impairment can arise from many sources. Thus, it is critical that the examination differentiate between biomechanical, motor, sensory, and other contributing causes of imbalance. This is the hallmark of a systems approach to examination. The systems model of postural control and orientation developed by Horak⁷ provides the foundation for this discussion regarding examination of balance⁸.

Resisted Exercise: Resisted Exercise Strengthening of all the muscles passing over a stiff joint by means of resisted exercise is, in many cases, the most effective means of increasing the range. The muscles must be exercised in the pain-free range or position, preferably with traction maintained throughout the movement. Should there be spasm in the muscles antagonistic to the movement, reciprocal relaxation of these muscles may be promoted by encouraging strong contraction of the agonists⁹.

Manual Resistance Exercise: Manual resistance exercise is a form of active resistive exercise in which the resistance force is applied by the therapist to either a dynamic or a static muscular contraction. When joint motion is permissible, resistance is usually applied throughout the available ROM as the muscle contracts and shortens or lengthens under tension.

- Exercise is carried out in the anatomical planes of motion, in diagonal patterns associated with proprioceptive neuromuscular facilitation (PNF) techniques, or in combined patterns of

movement that simulate functional activities.

- A specific muscle may also be strengthened by resisting the action of that muscle, as described in manual muscle-testing procedures.
- In rehabilitation programs, manual resistance exercise, which may be preceded by active-assisted and active exercise, is part of the continuum of active exercises available to a therapist for the improvement or restoration of muscular strength and endurance.
- There are many advantages to the use of manual resistance exercises, but there are also disadvantages and limitations to this form of resistance exercises¹⁰.

Frenkel Exercise: Frenkel's Exercises Dr H. S. Frenkel was Medical Superintendent of the Sanatorium 'Freihof' in Switzerland towards the end of the last century. He aimed at establishing voluntary control of movement by the use of any part of the sensory mechanism which remained intact, notably sight, sound and touch, to compensate for the loss of kinaesthetic sensation. The process of learning this alternative method of control is similar to that required to learn any new exercise, the essentials being a. Concentration of the attention. b. Precision. c. Repetition. The ultimate aim is to establish control of movement so that the patient is able and confident in his ability to carry out those activities which are essential for independence in everyday life¹¹.

Progression: Progression is made by altering the speed, range and complexity of the exercise. Fairly quick movements require less control than slow ones. Later, alteration in the speed of consecutive movements, and interruptions which involve stopping and starting to command, are introduced. Wide range and primitive movements, in which

large joints are used, gradually give way to those involving the use of small joints, limited range and a more frequent alteration of direction. Finally simple movements are built up into sequences to form specific actions which require the use and control of a number of joints and more than one limb, e.g. walking.

Swiss Ball: The ball is constructed of soft elastic with an approximate diameter of 14 - 34 inches and is filled with air. The air pressure of the ball can be changed with the help of the Valve stem it can fill air (or) let the ball deflate. The Swiss ball is now known by many names including Gym ball, Body ball, or Gymnastic ball and is widely employed in fitness and training programs.

METHODOLOGY

The study was conducted at JKK Munirajah Institutions, outpatient ward. Under the supervision of concerned authority, 30 subjects were selected in random sampling method. They were divided into 2 groups. Namely group A and group B with 15 subjects in each group.

Group A: Frenkel exercise with resisted exercise. Group B: Swiss ball training with resisted exercise.

Parameters: Berg balance scale; Single leg stance test

Inclusion Criteria:

- Patients With confirmed diabetic neuropathy type 2 with controlled hypertension.
- Age: 45-65 years old Sex : Male
- The patients had obtained 9-11 scores in Michigan neuropathy screening instrument (MANSI).

Exclusion Criteria:

- Visual or auditory impairment
- Cognitive impairment
- Unco – operative patients Other neurological conditions

- Advanced duration of diabetes disease
- Severe orthopedic condition Inflammation
- Severe cardiopulmonary disease
- Loss of joint integrity

- Knee flexion / extension
- Ankle dorsiflexion / plantar flexion
- Ankle eversion / inversion

Procedures and Protocols

Group A: Frenkel exercise with resisted exercise

Frenkel Exercise in Lying

- Hip flexion and extension
- Hip abduction and adduction
- Heel shin co- ordination
- Bicyclingposition

In Sitting

- Sitting: Place a position indicated by a mark on the floor.
- Sitting: Sit to stand.

Resisted Exercise

- Hip flexion / Extension
- Hip hyper extension
- Hip internal / external rotation
- Hip adduction and abduction

Group B: Swiss ball training with resisted exercise

Swiss Ball Training

- Bounce
- Hipcircle
- Seated leg lift
- Marching

Resisted Exercise

- Hip flexion / Extension
- Hip hyper extension
- Hip internal / external rotation
- Hip adduction and abduction
- Knee flexion / extension
- Ankle dorsiflexion / plantar flexion
- Ankle eversion / inversion

Duration: 40 Minutes per session, 5 days a week for 6 months

Data analysis and Interpretation

Group	Berg Balance Scale	Mean	Standard deviation	Paired t- test
Group A	Pre -test	37.33	1.23	8.5987
	Post -test	41.67	1.18	
Group B	Pre –test	36.93	1.39	31.8591
	Post –test	46.60	0.99	

Table 1. Descriptive statistic for berg Balance Scale in Group A and Group B

Descriptive statistic for berg Balance Scale in Group A shows that paired 't' test values of pre Vs post-test values of Group A was 8.5987 at 0.05% level which was greater

than tabulated 't' values (2.05). Group B shows that paired't' test values of pre Vs post-test values of Group B was 31.8591 at

0.05% level which was greater than tabulated 't' values (2.05).

This showed that there was significant difference between pre Vs post test results.

In Group A and B, there was significant improvement in post – test values in response to BBS.

Result – Berg Balance Scale (Post Test Analysis)

Berg Balance Scale	Mean	Standard deviation	Unpaired t- test
Group A	41.67	1.18	12.4575
Group B	46.60	0.99	

Table 2. Unpaired t- test on Berg Balance between two groups

The above table shows the post-test analysis result in BBS for Group A and B. The mean value of Group B is 46.60 which was greater than Group A value of 41.67 and the unpaired't' test value was 12.4575 at 0.05%

level, which was greater than tabulated 't' value (2.15). It showed statistical significance difference between mean values of Group A and B.

Descriptive statistic for single leg stance test in Group A and Group B

Group	Single leg stance test SLST (sec)	Mean	Standard deviation	Paired t- test
Group A	Pre –test	11.33	2.06	43.8953
	Post-test	40.13	2.29	
Group B	Pre –test	11.80	3.05	94.8081
	Post –test	41.73	2.71	

Table 3: Descriptive statistic for single leg stance test in Group A and Group B

Descriptive statistic for Single leg stance test SLST (sec) in Group A shows that the paired 't' test values of pre Vs post-test values of Group A was 43.8953 at 0.05% level which was greater than tabulated 't' values (2.05). Group B shows that paired 't' test values of pre Vs post-test values of Group B

was 94.8081 at 0.05% level which was greater than tabulated 't' values (2.05). This

Showed that there was significant difference between pre Vs post test results. In Group A and B. There was significant improvement in post – test values in response to single leg stance test.

Result – single leg stance test (Post Test Analysis)

Single leg stance test SLST(sec).	Mean	Mean difference	Standard deviation	Unpaired t- test
Group A	40.13	1.6	2.29	1.744
Group B	41.73		2.71	

Table 4. Single leg stance test between two groups (Post Test Analysis)

The above table shows the post-test analysis result in Single leg stance test SLST (sec) for Group A and B. The mean value of Group B is 41.73 which was greater than Group A value of 40.13 and the unpaired 't' test value was 1.744 at 0.05% level, which was greater than tabulated 't' value (2.15). It showed statistical significance difference between mean values of Group A and B.

RESULT/DISCUSSION

The purpose of the study was to effectiveness of Frenkel Exercise versus Swiss ball Training along with resisted exercise on balance in type 2 diabetic neuropathy. The berg balance scale and Single leg stance test was taken as the parameters to assess the balance and fall.

The study sample comprised of 30 patients of age group 45-65 years grouped as A and B. In each group 15 subjects participated. Group A with Frenkel Exercise and resisted exercises, Whereas Group B with Swiss ball training with resisted exercises. The result of the statistical analysis brings out the following for consideration.

The result showed that there was statistical significant difference between Group A and B. The diabetic neuropathy were treated with

Swiss ball training with resisted exercises had shown good improvement in balance and reduce fall.

In the analysis and interpretation of berg Balance Scale in Group A and Group B for 15 patients in each group

The unpaired t test value of BBS in Group A and B post- test analysis was 12.4575 which were greater than the tabulated t value 2.15, for the analysis and interpretation of Single leg stance test between Group A and Group B for 15 patients in each group.

The unpaired t test value of SLST in Group A and B post- test analysis was 1.744 which was greater than the tabulated t value 2.15. The result showed that there was statistical significant difference between Group A and B. The diabetic neuropathy that was treated with Swiss ball training with resisted exercises had shown good improvement in balance and reduce fall.

There are a variety of effective training methods for improving static balance, and the choice of intervention to be applied goes beyond proven effectiveness, depending on reproducibility and/or financial cost^{12,13}.

CONCLUSION

The study which was conducted for 6 months period of intervention showed that Group B of those who received Swiss ball training exercises with resisted exercises resulted in improvement on balance and reduce fall than Group A, who received Frenkel exercises with resisted exercises.

The study concluded that Swiss ball training with resisted exercises was effective treatment for balance and reduce fall in type 2 diabetic neuropathy patients.

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