

A Comparative Study on Aerobic Exercise Versus Short Foot Exercise in the Management for Diabetic Patients

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ABSTRACT

BACKGROUND AND PURPOSE: Diabetes mellitus is a group of metabolic condition in which there are high blood sugar levels over a prolonged period.

Diabetes has muscular weakness, a deficit of balance and reduced mobility at the ankle, subtalar and first metatarsophalangeal joints which interfere with normal rollover of the foot during gait, leading to orthostatic posture and walking abnormalities.

The aim of the study was to compare the effectiveness of Aerobic exercise versus short foot exercise in the management for diabetic patient.

METHODS: The study sample comprised of 30 patients of which is group A and group B the age of the subject from 40 to above 50 years of old. Among the 30 subjects. The group were randomly divided into two groups, Group A (n=15) and Group B (n=15). The subjects in group A were treated with aerobic exercises and the subjects in group B was treated with short foot exercises. An 8-week supervised training programme was part of the protocol, and 30 diabetic participants underwent it. Joint mobility and muscle strength at the ankle were assessed before and after exercise therapy using goniometers and MMT, respectively.

CONCLUSION: Based on the result, this study concluded that aerobic exercises are more effective than short foot exercises in diabetic patients.

KEY WORDS: Aerobic exercises, SFE, MMT, Goniometer, Diabetic patients

INTRODUCTION

Diabetes mellitus is a group of metabolic condition in which there are high blood sugar levels over a prolonged period.

Diabetes results from either an inadequate insulin production by the pancreas or an inadequate insulin response by the body's cells⁽¹⁾.

Absence or reduced insulin in turn leads to persistent abnormally high blood sugar and glucose in forbearance. It is presumably an oldest disease known to man. It is referred as black-death from the 14th century⁽²⁾.

Diabetes has muscular weakness, a deficit of balance and reduced mobility at the ankle, subtalar and first metatarsophalangeal joints which interfere with normal rollover of the foot during gait, leading to orthostatic posture and walking abnormalities⁽³⁾. Limited joint mobility is common in diabetics, with an insidious onset followed by asymptomatic progressive deterioration⁽⁴⁾. The range of motion deficit in diabetic patients' joint is due to periarticular limitations of the muscles, tendons, joint capsules, ligaments and skin⁽⁵⁾. A reduction

in the range of motion in the affected joints can occur in just a few years after diagnosis, even in young patients. Even in young individuals, a decrease in the range of motion in the afflicted joints can happen shortly after diagnosis⁽⁶⁾. At the same time, it is well known that there is a significant correlation between the range of motion of the joints and that of the ankle⁽⁷⁾. The important of muscle weakness leading to decreased muscle strength and leg muscle atrophy. Recently, type 2 diabetes has been shown to be associated, often permanently, with an accelerated loss of muscle strength and quality, determining early disability and worsening the patient's quality of life⁽⁸⁾.

METHOD

The study was conducted at JKK Muniraja Medical Research Foundation College of physiotherapy Out Patient department and also in supreme multi-specialty hospital, Komarapalayam, under the supervision of orthopedists and concerned authorities. A sample of 30 patients within the age group 40 to above 50 years of old with diabetic patients was randomly divided into two groups, group A and group B. Each group contained 15 subjects. Group A received aerobic exercises and Group B received short foot exercises for total duration of 4 weeks, 5 days per week, 1 session per day. The parameter used for this study was goniometer and Manual muscle Test. Exclusion Criteria of cognitive impairment, diabetic foot ulceration, symptomatic joint disease, uncontrolled heart diseases, chronic kidney diseases, post operative condition of Musculoskeletal disorder.

PROCEDURE:

GROUP-A: AEROBIC EXERCISES

PHASE -I: The training program consisted in a first phase of warm up: Walking or cycling for 10 minutes. The saddle of the stationary bike was positioned so that the patient's knee was 30 degrees bent when the patient's foot reached the bottom of the

pedal motion. The patient's location on the seat was moved forward during warm-up to encourage more ankle dorsiflexion, and the saddle of the bicycle was lowered by three inches.

PHASE -II:

Stretching muscles and tendons made up the second 25-minute period. The exercises were related to muscle and tendon structures of the spine, pelvis and lower limbs, performed while sitting and stand Stretching by step, wall bars and elastic bands. Program exercises included the following:

1 SEATED CALF RAISE:

PROCEDURE:

While perched on the bench with their feet flat on a soft cushion (withoutshoes)

To achieve dorsiflexion of the metatarsophalangeal joints, the patient raises the heels off the ground while maintaining the toes firmly planted.

The patient maintains the same posture while flexing both ankle and metatarsophalangeal joints in the plantar region of the foot.

2 ANKLE PLANTAR FLEXION: [RESISTED BAND]

PROCEDURE:

The patient bends his ankle plantar flexion in the same posture. To perform foot dorsal flexion, inversion, eversion, pronation, and supination, the patient holds elastic bands in both hands and passes them under the plantar surface of the foot.

3. PRONE QUADRACEPS STRETCH: PROCEDURE

- Lie face down.
- Bend knee and elastic band around ankle.
- Gently pull elastic band to stretch muscle on front of thigh.
- Perform 2 sets of 30 seconds.

4. CALF STRETCH: CALF STRETCH: PROCEDURE:

The patient stands with both hands on the wall bars, puts one foot forward on to the leg. So as to feel the stretching of the calf muscles.

5. ACHILLIS TENDON STRETCH:

PROCEDURE:

While standing on a step with one foot slightly behind the step, the person shifts weight onto the back heel and gently presses the ankle into dorsiflexion on the floor.

PHASE III:

A third phase of 15 minutes consisted in exercises to stimulate the patient's proprioceptive sensitivity, postural control and orthostatic dynamic balance.

The protocol consisted of following:

1. FIDEST FOOT ROLLER:

PROCEDURE:

The patient was seated on the bench and making an effort to maintain constant dorsal flexion of the fingers, as well as a normal pronation and supination of the foot, while gently gliding the plantar surface over the sensory roll from the toe to the heel.

2. HIGH KNEE WALKING

EXERCISE:

PROCEDURE:

The patient was instructed to walk in a straight path at various speeds while performing frontal-lateral normal and high knee walks.

PHASE IV:

The fourth 10 minute phase consisted in strengthening exercises for different muscular groups as follows:

1. SEMI-SQUATING WITH LUNGES

PROCEDURE:

The patient was instructed to execute forefoot lifting, semi-squatting, and forward and side lunges while standing with both hands on the wall bars.

2. BILATERAL KNEE DROPS:

PROCEDURE:

The patient was instructed to lay on the ground with their feet flat on the surface.

Keep the lower back flat, palms on the floor close to the pelvis.

Return to your starting posture after letting one side's knees drop together slowly.

3 FOOT AND ANKLE, SINGLE -LEG HEEL RAISE:

PROCEDURE:

In the starting position, the patient lift one foot from floor at the same time heel raises the opposite leg. Each exercise was to be performed with 8 to 12 repetitions and 1 minute of relaxation in between exercises.

PHASE V: COOL DOWN

PROCEDURE:

During the cool-down, patients were seated so that their feet wouldn't contact the floor and used both of their feet, one at a time, to draw the alphabet's widest letters in the air using the hallux.

GROUP B: SHORT FOOT

EXERCISES:

PHASE -I

1. TOE SPLAY: Using this motion, you can learn to regulate your toe muscles.

➤ Take a seat in a chair with a straight back and place your feet firmly on the ground.

➤ Separate each toe as far as is possible.

➤ Hold for five seconds.

➤ Repeat 10-15 times.

By encircling the soles of each foot with a rubber band, you can make this exercise more challenging.

2. BIG TOE PRESS:

➤ Press your big toe in to the floor while lifting your other four toes.

➤ Hold each press for 8 seconds and do 10-15 repetition per foot.

➤ Practice throughout the day.

3. TOWEL SCRUNCH:

- Lay a hand towel on the floor while sitting in a chair. A smooth surface, like a tile or wooden floor, is preferred (Carpet is not recommended).
- Curl your toes and grasp the towel with them to scrunch it while keeping your heel on the ground.
- Release your grip and continue to scrunch the cloth all the way up.
- At the end of the towel, grab it with your toes, scrunch it up, and press it away from you to reverse the process.
- Keep doing this until the complete length of the towel has been pushed away from you.
- To improve strength, use weights between 3 and 5 pounds (1.5 to 2.5 kilograms)
- The other end of the towel with something heavy (like a big can of fruit or veggies).
- Repeat 10-15 times

PHASE - II

4. MARBLE DROP:

The practise will tone the muscles in your toes and bottoms of your feet.

- Lie flat on the floor in a recliner with a straight back.
- Place 20 marbles and a small bowl on the floor in front of you. Your toes and the top of your foot should sense this exercise.
- Repeat with the other foot floor in front of you.
- Pickup one marble at a times with your toes and place it in the bowl.
- To gather up all 20 marbles, only use one foot.
- Repeat with the other foot.

Main muscles worked plantar flexors. Your toes and the top of your foot should sense this exercise.

- ### 5. SAND WALKING:
- Sand walking while barefoot provides your feet and toes a great calf workout as well as strengthening and stretching them. Making ensuring you turn around before

you've exhausted yourself is important because walking on sand is more exhausting than walking on hard surfaces.

- Find some sand - for example, at a beach, desert or volleyball court.
- Take off your shoes and socks.
- walk
- Repeat 10-15 times.
- Repeat 10-15 times.

6. DOMING:

- The stretch strengthens your toes and lifts (domes) the arch
- Place your feet level on the floor while seated
- Attempt to use your toes to grasp the ground.
- Make sure re using a grapping motion and not just curling your toes.
- Hold for 5 seconds.
- Relax your foot
- Repeat 10-15 times on each foot.

PHASE - III

7. BIG TOE STRETCH:

This stretch is beneficial if your toenails have been compressed from wearing tight or pointy shoes.

- Put your feet level on the floor and sit down.
- Place your foot on your left thigh while raising your right leg.
- Using your hands, move your toe up, down, and to each side while keeping each position for 5 seconds.
- Repeat 10 -15 times.
- Repeat on the big toe of your left foot, switching legs.

8. ANKLE ROTATION:

- Place your foot on the knee across from you.
- Take hold of the ball of your foot with one palm and the area just above your ankle with the other.
- For five seconds, gently rotate the ankle joint in a circular manner.
- Repeat 10-15 times.

These exercises can help you keep your feet and ankles can strengthen them to more easily bear your weight.

MMT	Mean	Mean Difference	Standard Deviation	UnPaired 't' Value
Group A	4.6			
Group B	4.4	0.2	0.18	1.08

RESULTS AND TABLE

GONIOMETER FOR GROUP A AND GROUP B (DORSIFLEXION)

Represents the mean values, mean difference, standard deviation and unpaired 't' values between post-test values of Group A and Group B on Goniometer (Dorsiflexion).

GONIOMETER	Mean	Mean Difference	Standard Deviation	UnPaired 't' Value
Group A	16.66			
Group B	13.2	3.46	0.53	6.39

GONIOMETER FOR GROUP A AND GROUP B (PLANTARFLEXION)

Represents the mean values, mean difference, standard deviation and unpaired 't' values between post-test values of Group A and Group B on Goniometer (plantar flexion).

GONIOMETER	Mean	Mean Difference	Standard Deviation	UnPaired 't' Value
Group A	38.53			
Group B	18.46	20.0	1.91	10.4

MMT FOR GROUP A AND GROUP B (DORSIFLEXION)

Represents the mean values, mean difference, standard deviation and unpaired 't' values between post-test values of Group A and Group B on Manual muscle test (Dorsiflexion).

MMT	Mean	Mean Difference	Standard Deviation	UnPaired 't' Value
Group A	4.8			
Group B	4.26	0.53	0.15	8.34

MMT FOR GROUP A AND GROUP B (PLANTARFLEXION)

Represents the mean values, mean difference, standard deviation and unpaired 't' values between post-test values of Group A and Group B on Manual muscle test (plantar flexion).

DISCUSSION

There is strong evidence supporting the effectiveness of regular physical activity in the primary and secondary prevention of several chronic diseases including diabetes, especially in previously sedentary individuals ⁽⁹⁾. Limited joint mobility and reduced muscular strength are very common in diabetic patients, even in the absence of diabetic complications. It has been shown that adults affected by diabetes have an accelerated loss of skeletal muscle strength ⁽¹⁰⁾.

Diabetic patients are most often unable to perform physical activity, especially if there are elderly and have previously had a sedentary life style ⁽¹¹⁾

All of which have negative effects on muscle mass, strength and physical performance in older adults ⁽¹²⁾

The purpose of the study was to compare the effectiveness of Aerobic exercise versus short foot exercise in the management for diabetic patient.

In the analysis and interpretation of Group A and Group B on Goniometer (Dorsiflexion) the unpaired 't' value of 6.39 was greater than the tabulated 't' value of 2.05 which shows statistically significant difference at 0.05 level between the Group A and Group B. The pre Vs post-test mean of Group A was 16.66 and the pre Vs post-test mean of Group B was 13.2 and mean difference of Group A and Group B was 3.46 which showed that there was statistically significant improvement in Group A than Group B.

In the analysis and interpretation of Group A and Group B on Goniometer (plantar flexion) the unpaired 't' value of 10.4 was greater than the tabulated 't' value of 2.05 which shows statistically significant difference at 0.05 level between the Group A and Group B. The pre Vs post-test mean of Group A was 38.53 and the pre Vs post-test mean of Group B was 18.46 and mean

difference of Group A and Group B was 20.0 which showed that there was statistically significant improvement in Group A than Group B.

In the analysis and interpretation of Group A and Group B on MMT (Dorsiflexion) the unpaired 't' value of 8.34 was greater than the tabulated 't' value of 2.05 which shows statistically significant difference at 0.05 level between the Group A and Group B. The pre Vs post-test mean of Group A was 4.8 and the pre Vs post-test mean of Group B was 4.26 and mean difference of Group A and Group B was 0.53 which showed that there was statistically significant improvement in Group A than Group B.

In the analysis and interpretation of Group A and Group B on MMT (Plantar flexion) the unpaired 't' value of 1.08 was greater than the tabulated 't' value of 2.05 which shows statistically significant difference at 0.05 level between the Group A and Group B. The pre Vs post-test mean of Group A was and the pre Vs post-test mean of Group B was 4.4 and mean difference of Group A and Group B was 0.2 which showed that there was statistically significant improvement in Group A than Group B. Therefore, the present study was accepting the alternate hypotheses and rejecting the null hypotheses.

CONCLUSION

Based on the result, this study concluded that aerobic exercise is more effective than short foot exercises in diabetic patients.

Declaration by Authors

Ethical Approval: Approved

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