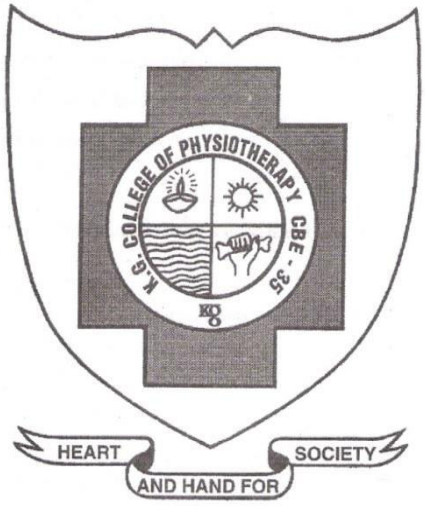
“EFFECT OF GRADED WALKING EXERCISES ALONG WITH COMPRESSION STOCKINGS ON INDIVIDUAL WITH PERIPHERAL VASCULAR DISEASE”



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ELECTIVE : PHYSIOTHERAPY IN CARDIO - RESPIRATORY

A DISSERTATION SUBMITTED TO THE TAMILNADU

Dr. M.G.R MEDICALUNIVERSITY, CHENNAI

AS PARTIAL FULFILLMENT OF THE

MASTER OF PHYSIOTHERAPY DEGREE

MAY 2019

CERTIFICATE

Certified that this is the bonafide work of **Ms. RINTU ELSA THOMAS** of K.G. College of Physiotherapy, Coimbatore submitted in partial fulfilment of the requirements for the Master of Physiotherapy Degree course from the Tamil Nadu Dr. M.G.R. Medical University under the **Registration No:271730184** for the MAY 2019 Examination.

Date: Principal

Place:

A Dissertation on

"EFFECT OF GRADED WALKING EXERCISES ALONG WITH COMPRESSION STOCKINGS ON INDIVIDUALS WITH PERIPHERAL VASCULAR DISEASE"

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Internal Examiner **External Examiner**

"EFFECT OF GRADED WALKING EXERCISES ALONG WITH COMMPRESSION STOCKINGS ON INDIVIDUALS WITH PERIPHERAL VASCULAR DISEASE"

Under the guidance of,

Principal: ……...

Dr. B. Arun, MPT, PhD

Principal,

K.G. College of Physiotherapy,

K.G. Hospital,

Coimbatore - 641035.

Guide: ……

Mr. C. H. Anand Chellappa, MPT

Professor, (Department of Cardio - Respiratory)

K.G. College of Physiotherapy,

K.G. Hospital,

Coimbatore - 641035.

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CONTENTS

LIST OF TABLES

LIST OF GRAPHS

I INTRODUCTION

Peripheral vascular disease (PVD) is the disease of blood vessels, it affect the peripheral circulation. Peripheral vascular disease comprises diseases of both peripheral arteries and veins. The pain usually improves with rest. It can also affect the vessels that supply blood and oxygen to your arms, stomach and intestine and kidneys. In PVD, blood vessels become narrowed and blood flow decreases. This can be due to arteriosclerosis or "hardening of the arteries" or it can be caused by blood vessel spasm.

Peripheral arterial disease (PAD) also called as peripheral vascular disease (PVD) or peripheral artery occlusive disease (PAOD) is an occlusive arterial disease which causes inadequate blood flow to the limb. The disease process is due to formation of atherosclerosis mainly affecting the vascularisation of the lower limb. (Robert et al.,2012). Peripheral arterial disease is an obstructive condition where the flow of blood through peripheral arteries is impeded. During periods of increased oxygen demand peripheral limb ischemia occurs, resulting in the sensation of muscle pain termed claudication. As a result of claudication subjects ability to exercise is greatly reduced affecting their quality of life (Andrew et al., 2004).

One of the most common symptom of peripheral vascular disease is intermittent claudication, which manifest itself in lower extremity muscle pain

during walking, which subside after short rest (Brzostek et al.,2004). Repeated episodes of muscle pain contribute to the lowering of physical activity of people with peripheral vascular disease, contributing to disease progression.(Dziubek et al.,2015).

The prevalence of peripheral vascular disease in men is slightly higher than in women. Overall prevalence of Indian population is 17.9% (Manuja et al.,2016). Lower extremity peripheral artery disease affect 8 million people in united states and over 200 million men and women worldwide (Mozaffarian et al.,2013). In United Kingdom it occurs in approximately 1 in 20 of the population between the ages of 55 and 74 years (Fowkes et al.,1991).

The two main types of PVD are functional and organic PVD. Functional PVD means there's no physical damage to your blood vessels structure. Instead, your vessels narrow in response other factor like temperature changes. The narrowing causes blood flow to decrease. Organic PVD involves changes in blood vessel structure like inflammation, plaques, and tissue damage.

According to the ACC/AHA (American college of cardiology/American heart association) guidelines for treatment of patients with intermittent claudication, a rehabilitation program lasting three to six months for 30-45 minutes at a time three time is recommended.(Norgren,et al., 2007,Smith et al.,2011). The purpose of physical training in patients with peripheral vascular disease is to

enhance muscle strength, extend the distance of claudication, improve exercise tolerance, hemodynamic parameters, neuromuscular coordination, quality of life, and postpone surgical treatment (Brzostek et al,2004, Haitt et al.,2014).

The various modes of exercise like active exercises, free exercises, aerobic exercises, facilitatory techniques are adopted to activate muscle action. The risk factors are regulated by applying stockings/ crepe bandage. Exercise training is generally viewed as an inexpensive, low-risk option compared with other more invasive therapies (De Vries et al.,2002).

Compression therapy has been used to treat chronic venous disease since antiquity, with the earliest recording found in the corpus hippocraticum(450-350 BC) (Felty et al.,2005). Mechanical method of compression includes techniques such as intermittent pneumatic compression and compression stockings (GCS) which are physiological and are used in moderate and high risk patient.

The exact mechanism of compression stockings is unknown. However, there is evidence to suggest that they exert graded circumferential pressure from distal to proximal, and when combined with muscular activity in the limb, are thought to displace blood from the superficial to the deep venous system via the perforated vein. It is argued that this effectively increase the velocity and volume of flow in the deep system thereby potentially preventing thrombosis (Benko et al.,2001).

Graded walking exercises training focus on management of risk factors and of achieves a normal lifestyle in a definite period. Pain- free walking and to increase venous oxygen saturation in victim's leg should be the primary goals of exercise therapy for PVD patients. Graded walking training to get improvement in the onset of claudication time and peak claudication time. Exercise therapy also promises in increasing capillary density, peripheral adaptation and oxidative enzymes in the vasculature. (Parr B et al.,2009, Haas et al.,2012).

Graded exercise therapy is physical activities that start very slowly and gradually and increase over time. Activity pacing is recommended in many complications like chronic fatigue syndrome and patient with PAD after the intervention. Graded activity and exercises are defined as starting from shallow, basic level of exercises and activity and gradually increasing it to a level where people can go about their daily life (Garget al.,2006, Gardner et al.,2007).

Exercise training improves walking tolerance in patients with peripheral vascular disease. The common mode of training in patients with peripheral vascular disease in the past decades has been walking exercises on level ground and on treadmill (Parr et al., 2006). Several randomized clinical trial have shown that walking can make a real difference for people with peripheral vascular disease (Emile Mohler et al., 2016).

Supervised exercise program have been recommended as first line therapy for treatment of claudication. Recent evidence demonstrates benefit of exercise training even among those patients with peripheral vascular disease who do not have claudication. Exercise therapy markedly improves walking ability in peripheral vascular disease patients with intermittent claudication. Difference in exercise intensity as well as adherence to exercise program may account for the observed variability in treatment effect (McDermott et al.,2009).

Exercise training has been incorporated into current guidelines for the management of peripheral vascular disease. Multiple societal guidelines including American college of Cardiology/ American Heart Association 2005 practice guidelines for the management of patients with Peripheral Arterial Disease, American Association of Cardiovascular and Pulmonary Rehabilitation 2004 guidelines for Cardiac Rehabilitation and Secondary prevention program, Inter-society consensus for the management of Peripheral Vascular Disease (TASC II), and American college of Sports Medicine 2010 guidelines for Exercise Testing and prescription all recommend supervised exercise training in the treatment of claudication symptoms in peripheral vascular disease.(Lippincott Williams.,2010).

A six minute walk test (6MWT) was conducted in accordance with the American thoracic society (ATS) statement recommendation on a marked 30-meter corridor. The test consisted of patient's walking at a comfortable pace that he or

she generally uses on a daily basis. In the situation of maximum pain, which forced the patient to stop during the test, the measured time was not halted.

Expressed in meters, the result of the test consisted of the distance of claudication and maximal distance. In a study conducted by (Katarzyna et al.,2018) tells that maximal distance was analyzed. The degree of subjective level of fatigue was assessed according to Borg's 10 degree scale. Before the test, subjects were informed that they could rest during the test in a standing or sitting position, if they experience intensifying symptoms of exercise intolerance.

If during the rest severe symptoms of exercise intolerance occurred, which did not disappear despite a temporary test, the test was immediately stopped. Intensifying symptoms of exercise intolerance that could interrupt the test included shortness of breath, dizziness, blurred vision, sudden sweating, cyanosis, tinnitus, loss of verbal control, general weakness, and fatigue. Before and after the 6MWT test, BP and HR measurement were taken using an automatic sphygmomanometer (Crapo et al.,2002).

Walking impairment questionnaire is utilized to assess the walking ability, walking distance, walking speed. (Mary Mc1998) shows the walking impairment questionnaire is a valid measure of community walking ability in a heterogeneous group of patients with and without PVD.

The walking impairment questionnaires discriminate best among patients in the highest and lowest quartiles of walking speed and endurance. The walking impairment questionnaire is a quantitative measure that best reflect actual ambulatory performance of the peripheral vascular disease patient.

1.1 NEED FOR THE STUDY

Peripheral vascular disease affects the lifestyle and daily practices in old people. Various studies have proved the effectiveness of active exercises, treadmill walking, pneumatic compression therapy in regulating risk factors of peripheral vascular disease and there are limited studies on using graded walking exercise along with compression stockings. Hence this study aims to find out the effect of Graded walking exercises along with compression stockings and Normal walking exercise along with compression stockings on pain-free walking distance and walking ability in patients with peripheral vascular disease.

1.2 AIM OF THE STUDY

Aim of the study is to find out the effect of Graded walking along with compressive stockings versus Normal walking exercise along with compression stockings on pain-free walking distance and walking ability in patients with peripheral vascular disease.

1.3 OBJECTIVE OF THE STUDY

- To study the effect of graded walking exercises along with compression stockings on pain-free walking distance and walking ability in patients with peripheral vascular disease.
- To study the effect of Normal walking exercise along with compression stockings on pain-free walking distance and walking ability in patients with peripheral vascular disease.
- To analyze the effect of graded walking exercise along with compressive stockings versus Normal walking along with compression stockings on pain-free walking distance and walking ability in patients with peripheral vascular disease.

1.4 HYPOTHESIS

1.4.1 NULL HYPOTHESIS

- There is no significant difference in the improvement of pain- free walking distance and walking ability following graded walking exercises along with compression stocking in patients with peripheral vascular disease.

1.4.2 ALTERNATIVE HYPOTHESIS

- There is a significant difference in the improvement of pain-free walking distance and walking ability following graded walking exercises along with compression stocking in patients with peripheral vascular disease.

1.5 KEYWORDS

- Graded walking exercises
- Compression stockings
- Normal walking exercise
- Pain-free walking distance
- Walking ability
- 6 minute walk test(6MWT)
- Walking impairment questionnaire

II REVIEW OF LITERATURE

Schirmang TC, Hills AJ, Ahn SH, Shalhoub J et al (2009):

Peripheral vascular disease is a term used to describe the impairment of blood flow to the extremities usually as a result of atherosclerotic occlusive disease. Generally speaking, the presence of symptom in PAD depends on the metabolic demand of ischemic tissue during exercise, degree of collateral circulation and the size and location of the affected artery.

Andrew C Bulmer, Jeff S Coombes et al (2004):

Peripheral arterial disease is an obstructive condition where the flow of blood through peripheral arteries is impeded. During periods of increased oxygen demand peripheral limb ischemia occurs, resulting in the sensation of muscle pain termed claudication as a result of claudication subject's ability to exercise is greatly reduced affecting their quality of life.

Norgren L, Selvin E, Hiatt WR, Fowkes FG et al (2007):

The incidence of Peripheral vascular disease varies in the general population from 3to 10% in people younger than 70years to 15- 20% in people older than 70years. However, 40% of PAD patients are asymptomatic, while only 10% of them present with typical intermittent claudication. One third of peripheral vascular disease patients will have a complete occlusion of a major artery to the leg at first presentation.

MeruAV(2006):

Peripheral vascular disease is caused by stenotic or occlusive atherosclerotic lesion in the major arteries supplying the lower extremities. Patients with intermittent claudication have normal blood flow at rest. With exercises, stenotic or occlusive lesion in the arterial supply of the leg muscles limit the increase in blood flow, causing a mismatch between oxygen supply and the metabolic demand of the muscle.

K Manuja, K Madhavi et al (2016):

The authors did a study in which they used intermittent compression therapy with sphygmomanometer and graded walking exercise for walking ability and pressure changes with 30 subjects and they find out that the group which received intermittent compression therapy along with graded walking exercises showed more improvement in walking ability than those received walking exercise alone.

Benko (2001):

Compression stockings are used in moderate and high risk patients. There is evidence to suggest that these stockings exert graded circumferential pressure from distal to proximal and, when combined with muscular activity in the limb, are thought to displace blood from the superficial to the deep venous system via the perforating vein. It is argued that this effectively increase the velocity and volume of flow in the deep system thereby potentially preventing thrombosis.

Rachel Nall(2018):

Compression stockings are traditionally used to improve circulation. Modern compression stockings are more sophisticated and designed to provide consistent pressure in the legs, helping blood to flow back towards the heart. Stockings usually exert more pressure near the ankles and feet, providing an extra squeeze that promotes blood flow.

Motykie GD, Noyes LD, christopoulos DG, Coleridge-smith PD,Ginsberg JS et al (2001):

Elastic compression stockings reduce hypertension, the amount of both venous reflux and venous volume and improve calf muscle pump function and ambulatory venous pressure in patients with established venous insufficiency. This result in improvement of venous symptoms, decreased edema and prevention of skin breakdown and leg ulceration.

Ginsberg JS, Merrett ND, Hanel KC et al (2001):

Compression profile seems to be an important determinant of stockings effectiveness. Graduated elastic compression stockings that exert an ankle pressure less than 30mmHg were not effective and that above 50mmHg would be effective without increasing the risk of ischemic complication.

Rohan CP, Travers JP, Mosti G, Flour M, Partsch H et al (2013):

It has recently been proved that the mechanism behind mechanical compression stockings is related to decrease in transmural pressure within the vein wall by increasing the perivenous tissue pressure. Compression may also provide additional benefit by reducing the vein remodeling known to occur in CVI patient. Compression therapy therefore, counteracts the force of gravity by applying perivenous tissue pressure. This external pressure provides force to move fluid from the interstitial space back into the intravascular space, as well as prevent reflux.

T Brzostek, WR Hiatt, AT Hirsch, et al (2014):

The purpose of physical training in patients with peripheral vascular disease is to enhance muscle strength, extend the distance of claudication, improve exercise tolerance, hemodynamic parameters, neuromuscular coordination, and quality of life, and postpone surgical treatment. At present, the gold standard of rehabilitation for patients with intermittent claudication is supervised walking training.

Ajitsingh, Hashir Kareem, Tom Devasia et al (2017):

Graded walking exercises seen as morale boosters in peripheral vascular disease patients after interventions, as it increases the pain tolerance; patients participating in the daily efforts effectively despite the pain. Exercise adherence

shows long-term success in its kind of patients. Six miunte walk test and graded exercise therapy are two essential components of peripheral vascular disease for diagnostic and management purposes respectively

Leeper NJ, Parmenter BJ, Raymond J,Watson L, Gardner AW et al (2013):

Exercise capacity has recently been shown to be strong predictors of mortality in peripheral vascular disease and it is well known that exercise training improve walking ability in peripheral vascular disease. Physical activity provides a protective effect against mortality in persons with claudication from peripheral vascular disease.

Belinda J, Parmenter, Gudrun Dieberget al (2014):

Exercise training improves peak VO2, total and pain-free walking distance, and graded treadmill performance in peripheral vascular disease. Sub-analysis suggest that exercise at vigorous intensity for at least 24 weeks maybe optimal and perhaps exercising to mild pain may yield better result than exercising to moderate or maximal pain.

B M Parr, E W Derman et al (2006):

The authors did a study on the effect of exercise training in patients with peripheral vascular disease and concluded that exercise training improves walking capacity in patients with peripheral vascular disease. The preferred mode of exercise training in the past decade has been walking on the treadmill. Both high

and low- intensity exercise training programs have proved to be beneficial for patients with peripheral vascular disease.

Maria Szymczak (2016):

The author did a study on the impact of walking exercises and resistance training upon the walking distance in patients with chronic lower limb ischemia in which they took 50 PAD patients with Fontaine's scale 2nd stage. Group one included of 24 subjects who underwent walking exercise and other group included of 26 subject who underwent resisted exercises and concluded that supervised rehabilitation program, in the form of both walking and resistance exercises, contributes to the increase in the intermittent claudication distance.

Watson L (2008):

The authors did a study on the effect of exercise program on intermittent claudication, particularly in respect to reduction of symptoms on walking and improvement in quality of life. And concluded that exercise programs were of significant benefit compared with placebo or usual care in improving walking time and distance in selected patients with leg pain from intermittent claudication.

Yoshitaka Iso (2015):

Exercise therapy like walking exercise has multiple benefits via multiple mechanisms in PAD patients with intermittent claudication, including reduced limb symptoms, improved functional capacity, and reduced systemic cardio-

vascular risk. Exercise training also shows, improving functional impairment in asymptomatic patients with PAD.

Sara A, Myers Ms et al (2008):

Initial and absolute claudication distance and WIQ pain, speed and distance subscale are the measure that correlated the best with the ambulatory limitation of the patient with symptomatic peripheral vascular disease. These results suggest WIQ is the most specific questioner for documenting the qualitative deficit of the patient with claudication while providing strong relationship with the qualitative measures of arterial disease.

Mary MC, Grae McDermott et al (2002):

The walking impairment questioner is a valid measure of community walking ability in a heterogeneous group of patients with and without peripheral vascular disease. The WIQ discriminates best among patients in the highest and lowest quartiles of walking speed and endurance. The WIQ is a quantitative measure that best reflect actual ambulatory performance of PAD patients.

McDermott MM, RegensteinerJG, Coyne KS,Hiatt WR, Le Faucheur A et al (2008):

A qualitative approach to document daily walking ability is the walking impairment questionnaire (WIQ), a validated questionnaire which is short, easy to complete, and inexpensive. The questionnaire evaluates walking ability with a

focus on walking distance, walking speed, and the ability to climb stairs. The walking impairment questioner has been used in studied to evaluate the effect of treatment in patients with peripheral vascular disease.

Saskia P, A Nicolai, Lotte M, kruidenier et al (2009):

The authors told that the total walking inability questioner score can be used as an alternative to treadmill testing for objective assessment of functional walking ability in patients with intermittent claudication, both in daily practice and in clinical trial.

Jayaram L, Fox BD, Mansori F et al (2013):

Clinical trials of exercise in participants with PAD demonstrate that the six minute walk test consistently successfully quantifies and documents improvement in walking endurance in responsive to exercise interventions. No prior clinical trials of therapeutic medication in patients with PAD have used the six minute walk test as an outcome measure. However, six minute walk test is frequently used as a primary measure in the therapeutic trials of patients with chronic lung disease and pulmonary hypertension.

McDermott MM, Ades PA, Dyer A, Guralnik JM, Kibbe M, et al (2008):

The six minute walk test is the primary outcome measure because it is more closely correlated with physical activity during daily life than tread mill walking performance in PAD patients.

MaryM, McDermtt, Jack M, Guralnik, Micheal H et al (2008):

The authors did a study to prove that six minute walk test is better than treadmill test and concluded that walking performance measured by the six minute walk test better represent walking in daily life than treadmill walking performance. Among patients with PAD, six minute walk has excellent test re-test reliability, predict risk for mortality and mobility loss, is sensitive to the natural history of decline in walking endurance, and detect improved walking endurance in response to therapeutic interventions.

Cooper KH, Wright DJ et al (2001):

There is maximum correlation in the rehabilitation equivalent value when compared to rate of perceived exertion suggesting that the six minute walk test is more a sub maximal exercise test, and hence can be considered as the exercise testing procedure in cardiac rehabilitation setup. The reliability of test in healthy elderly persons and patients were high and it has been established as a valid and reliable test to assess the exercise capacity of various patient groups.

Mark R Elkins (2016):

Several types of interventions (often in combination) are used to improve walking capacity, including medication, surgery and exercise training. Previous systematic reviews have established that supervised progressive exercise training can improve both maximum and pain free walking distance, and that it is more

effective in this regard than unsupervised exercise training and usual care or placebo.

K.E. Pena (2009):

The pain free form of exercising consists in interrupting the sessions as soon as the patient reports a mild claudication pain and then restarting the session as soon as the symptoms of claudication have abated. The effect of pain free rehabilitation is indicated by the increase of the claudication distance without inducing the unfavorable inflammatory reaction.

Lotte M kruidenier (2009):

The authors did a study on functional claudication distance: a reliable and valid measurement to assess functional limitation in patients with intermittent claudication and concluded that functional claudication distance is a reliable aand valid measurement for determining functional capacity in trained patients with intermittent claudication. Furthermore it seems that functional claudication disease better reflect the actual functional impairment.

Kazuhiro Kawanabe (2007):

A study was conducted on effect of whole body vibration exercise and muscle strengthening, balance and walking exercises on walking ability in elderly patients in which they have divided 67 elderly participants into two groups, group A received whole body vibration exercise plus routine exercises and group B

received routine exercise alone. After 2 months of exercise program, the walking speed, step length, and the maximum standing time on one leg were significantly improved in the whole body vibration exercise plus routine exercise group while no significant changes showed in the parameters in routine exercise group.

Julie D, Ries PT et al (2012):

Examination of impairment likely to affect the actions influencing walking ability is integral to the physical therapist approach to the patient. Although an association is apparent, there is no direct formula to predict the strength of the correlation between each of these impairment and activity limitation in gait performance.

Corinna C Winter, MirkoBrandes, Carsten Miller et al (2010):

The authors did a study to analyze the walking ability during daily life in patients with osteoarthritis of the knee or the hip and lumbar spinal stenosis in which the selected 120 participants with 30 in each group with 4^{th} group having healthy individual and concluded that patients with degenerating musculoskeletal disorder suffer limitation in their walking ability. Objective assessment of walking ability appeared to be an easy and feasible tool for measuring such limitation as it provides baseline data and objective information that are more precise than patients own subjective estimates.

III METHODOLOGY

3.1 STUDY DESIGN

- Pre-test and Post-test comparative study design.

3.2 STUDY SETTING

- The study was conducted at Physiotherapy Outpatient department, K.G. Hospital, Coimbatore.

3.3 STUDY DURATION

- Total duration- 6 months. Each patient received treatment for 6 weeks.

Frequency: 5 days / week.

Duration: 60 - 80 minutes / Day.

3.4 STUDY SAMPLING

"The sample size was determined based on a pilot study. Ten participants were divided randomly into two groups and main part of study was conducted on them. The means and standard deviations (SDs) from the parameters from this pilot study, with $\alpha = 0.05$ and 90% power, were used to calculate the sample size".

By using simple random sampling method, 30 patients with peripheral vascular disease patients were selected according to inclusion and exclusion

criteria and divided into two Groups, as Group-A and Group-B, consisting of 15 patients each. Group-A received treatment with graded walking exercises along compression stockings and Group-B received Normal walking exercise along with compression stockings.

3.5 SAMPLE SIZE

30 patients were selected who fulfilled the inclusion criteria and exclusion criteria and divided into two groups each consisting of 15 patients.

3.6 CRITERIA FOR SELECTION

3.6.1 INCLUSION CRITERIA

- All patients with peripheral vascular disease.
- Ankle-brachial index less than 0.90.
- Age group between 50-70 years.
- Only male patients are included.
- Fontine's classification stage II - a and II – b.
- Rutherford's classification grade I - category 1 and 2.

3.6.2 EXCLUSION CRITERIA

- Chronic obstructive pulmonary disease.
- Patients with myocardial infarction.
- Ankle-Brachial index more than 0.90.

- Ischemic ulceration.
- Patients with arthritis.
- Patients with gangrene.
- Patients with angina.
- Patients with recent fracture in lower limb.
- Patients with renal disease.
- Patients with gross edema.

3.7 VARIABLE

3.7.1 INDEPENDENT VARIABLE

- Graded walking exercises.
- Compression stockings.
- Normal walking exercise.

3.7.2 DEPENENT VARIABLE

- Pain- free walking distance.
- Walking ability.

3.8 OPERATIONAL TOOLS

- Six minute walk test (6MWT).
- Walking impairment questionnaire.

3.9 PROCEDURE

30 patients with peripheral vascular disease were selected according to inclusion and exclusion criteria and divided randomly into two groups, as Group

- A and Group - B, consisting of 15 patients each. A brief explanation about the treatment session was given to all the patients and informed consent is obtained. Group - A was treated with Graded walking exercises along with Compression stocking and Group - B was treated with Normal walking exercise with Compression stockings.

Group A-(Graded walking exercises along with compression stockings):

For graded walking exercises, the training session duration has varied from 10 to 60 minutes with the majority using 60 minutes per sessions. 5 minutes at the beginning and end of each 45- minute's session to a warm up and cool down. Total treatment duration will be 60-80.

The protocol is by Manuja et al., (2016)

	Warm up- walk slowly	**Target zone walk briskly**	**Cool down- walk slowly**
Week 1	5 min	5 min	5 min
Week 2	5 min	10 min	5 min
Week 3	5min	15 min	5 min
Week 4	5 min	20 min	5 min
Week 5	5 min	25 min	5 min
Week 6	5 min	30 min	5 min

The stockings, which were flat-knitted, applied 30 to 40 mm Hg of pressure at the ankle; they were made of cotton, latex and rubber- polyamide. Subjects received stockings of Tynor brand. Subjects received 2 stockings, which were replaced by identical stockings. The stockings had to be used during the day. The stockings can be removed during night time when they go to bed.

Group B- (Normal walking exercise along with compression stockings):

The protocol is by Parr et al., (2006)

Step 1:

- The subject is asked to walk steadily with normal speed for 5-10 minutes before they start to feel claudication.
- The subject is asked to walk until feels that subject can't walk further.

Step 2:

- The subject is asked to stop and rest so that the pain subsides.
- The subject can rest by standing or sitting.

Step 3:

- Again the subject is asked to walk for 5-10 minutes at the same speed until the pain start. But usually the pain initiates very lately than earlier.
- Then again the subject is asked to take rest.

Step 4:

- Repeat the process until the subjects walk for 45 minutes.
- The patient should cover 60-80 minutes including the rest time.
- Initially the subject will not be able to complete 45 minutes.
- The subject is asked to do as much as possible and progress the time of walking and reduce the rest time gradually.

The stockings, which were flat-knitted, applied 30 to 40 mm Hg of pressure at the ankle; they were made of cotton, latex and rubber- polyamide. Subjects received stockings of Tynor brand. Subjects received 2 stockings, which were replaced by identical stockings. The stockings had to be used during the day. The stockings can be removed during night time when they go to bed.

Graded walking exercises along with compression stockings:

3.10 STATISTICAL TOOLS:

Statistical analysis was done by using student ‘t’ test. Paired 't' test was used to find out the improvement within the group. Unpaired ‘t’ test was used to find out the difference between two groups.

Formula of paired ‘t’ test:

The paired t-test was used to compare the Pre and Post test values of pain from Group - A and Group - B.

$$S=\sqrt{\frac{\sum d^2-\frac{\sum_d 2}{n}}{n-1}}$$

$$t=\frac{\bar{d}\sqrt{n}}{s}$$

Where,

d = difference between the pre - test versus post - test

$\bar{d}$ = mean difference

n = total number of subjects

s = standard deviation

$\sum d^2$ = sum of the squared deviation

Formula of unpaired 't' tests:

The unpaired 't' test was used to explore the gait competency between Group - A and Group - B.

$$S = \sqrt{\frac{\sum(x_{1-\overline{x_2}})^2 + (x_2 - \bar{x}_2)^2}{n_{1+}n_2 - 2}}$$

$$T = \frac{\overline{x_1} - \overline{x_2}}{S} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where,

n_1 = total number of subjects in Group - A

n_2 = total number of subjects in Group - B

x_1 =difference between pre-test versus post-test of Group - A

$\overline{x_1}$ =mean of Group - A

x_2=difference between pre-test versus post-test of Group - B

$\overline{x_2}$ = mean of Group - B

S = Standard deviation

LEVEL OF SIGNIFICANCE=5%

IVDATA ANALYSIS AND INTERPRETATION

TABLE – I

SIX MINUTE WALK TEST

PAIRED 't' TEST – GROUP - A

GRADED WALKING EXERCISES ALONG WITH COMPRESSION STOCKINGS

S.NO	GROUP -A	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	't' VALUE
1.	PRE - TEST	303.2	94.8	2.35	40.22
2.	POST - TEST	398			

The comparison of pre-test and post-test values of six minute walk test for Group - A showed that the calculated 't' value 40.22 is significantly greater than the tabulated 't' value 2.145 at 5% level of significance. This shows that there is a significant improvement in pain-free walking distance following graded walking exercises along with compression stockings.

GRAPH – I

SIX MINUTE WALK TEST

PAIRED 't' TEST – GROUP - A

GARDED WALKING EXERCISES ALONG WITH COMPRESSION STOCKINGS

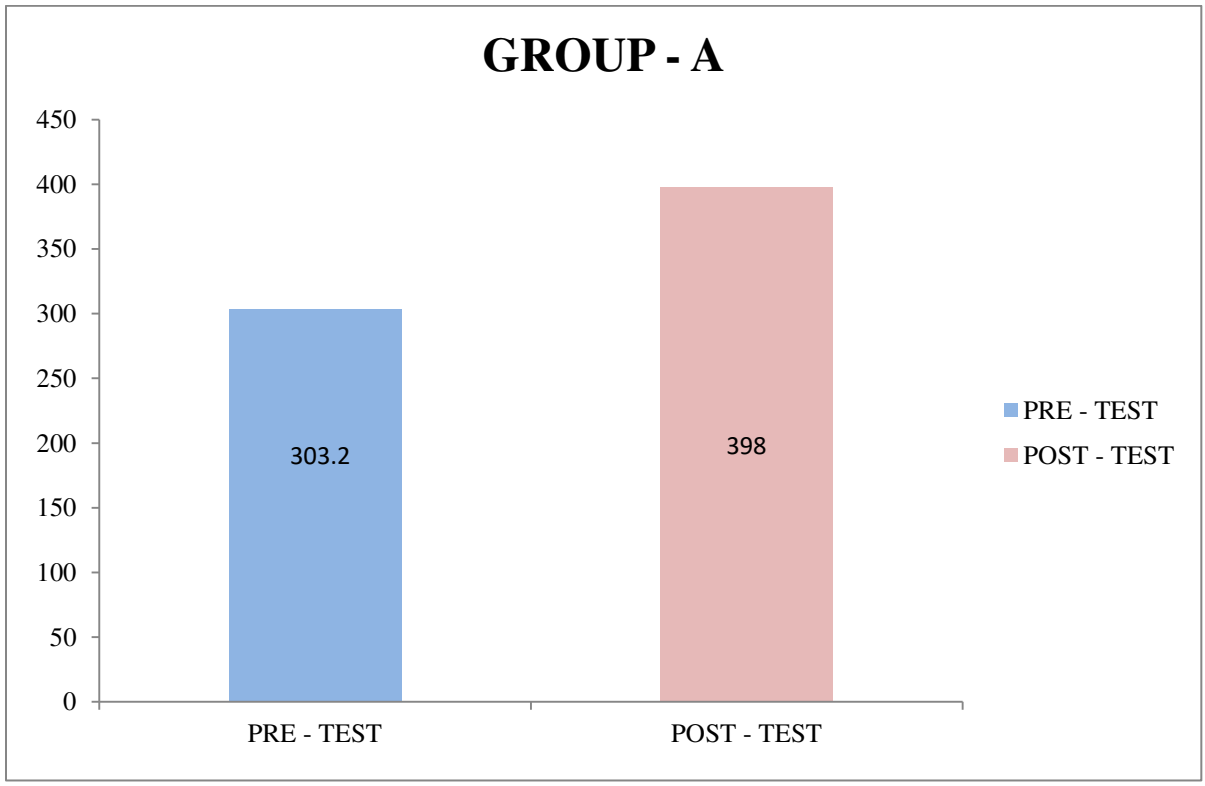


TABLE – II

SIX MINUTE WALK TEST

PAIRED 't' TEST – GROUP - B

NORMAL WALKING EXERCISE ALONG WITH COMPRESSION STOCKINGS

S.NO	GROUP - B	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	't' VALUE
1.	PRE - TEST	301.4	43.6	1.64	26.84
2.	POST - TEST	345.7			

The comparison of pre-test and post-test values of six minute walk test for Group - B showed that the calculated 't' value 23.84 significantly greater than the tabulated 't' value 2.145 at 5% level of significance. This shows that there is a significant improvement in pain-free walking distance following normal walking exercise along with compression stockings.

GRAPH – II

SIX MINUTE WALK TEST

PAIRED ‘t’ TEST – GROUP - B

NORMAL WALKING EXERCISE ALONG WITH COMPRESSION STOCKINGS

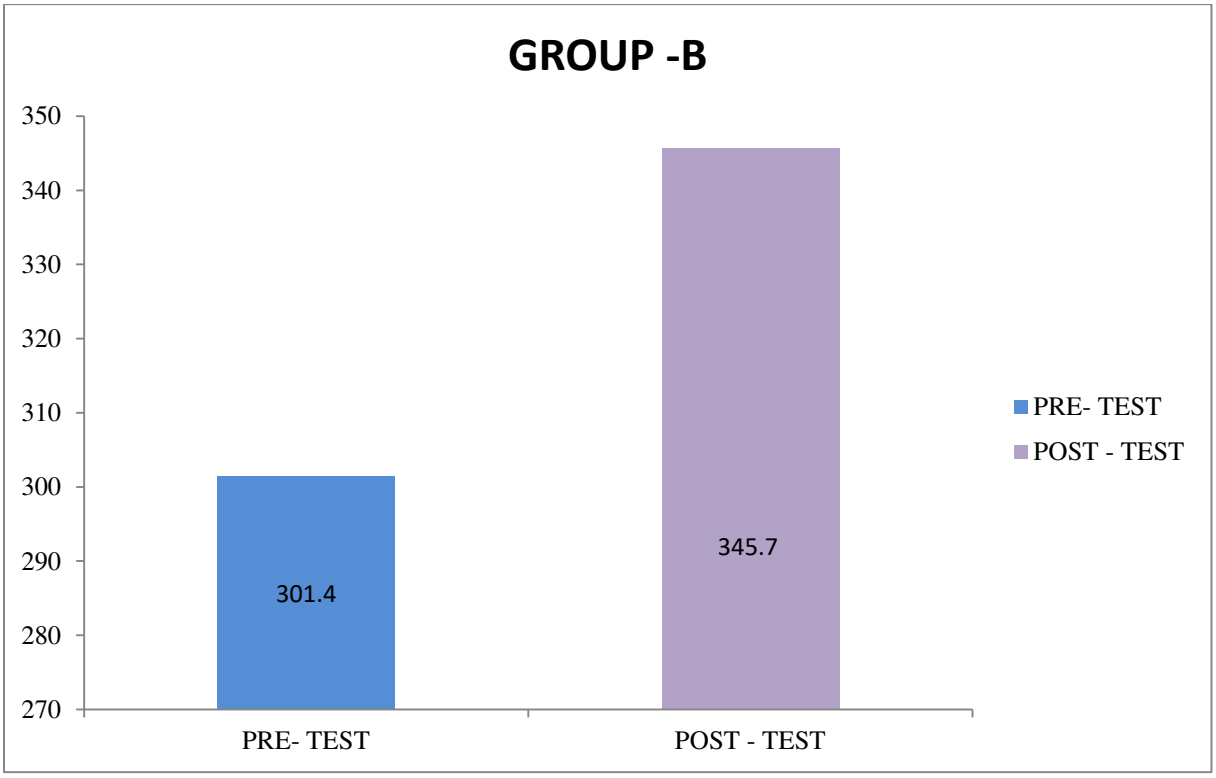


TABLE – III

GROUP - A vs GROUP - B

SIX MINUTE WALK TEST

UNPAIRED 't' TEST

S.NO	GROUPS	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	't' VALUE
1.	GROUP - A	398	52.3	2.59	20.13
2.	GROUP - B	345.7			

The comparison of post-test values of six minute walk test between Group - A and Group - B showed that the calculated 't' value 20.13 is significantly greater than the tabulated 't' value 2.048 at 5% level of significance. This shows that there is a significant improvement on pain-free walking distance in Group - A than Group - B.

GRAPH – III

GROUP - A vs GROUP - B

SIX MINUTE WALK TEST

UNPAIRED 't' TEST

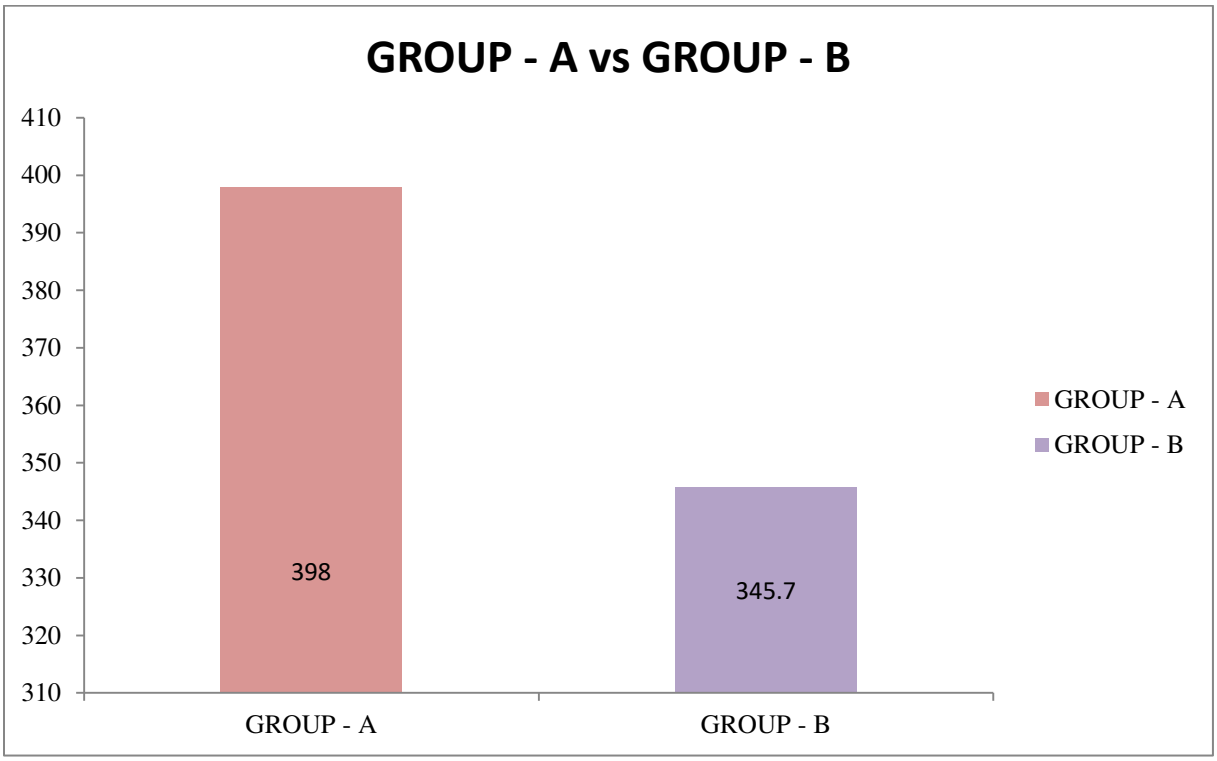


TABLE - IV

WALKING IMPAIRMENT QUESTIONNAIRE

PAIRED 't' TEST – GROUP - A

GRADED WALKING EXERCISES ALONG WITH COMPRESSION STOCKINGS

S.NO	GROUP - A	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	't' VALUE
1.	PRE - TEST	38.8	27.6	0.54	50.78
2.	POST - TEST	66.4			

The comparison of pre-test and post-test values of walking impairment questionnaire for Group - A showed that the calculated 't' value is 50.78 is significantly greater than he tabulated 't' value 2.145 at 5% significance level. This shows that there is a significant improvement in walking ability following graded walking exercises along with compression stockings.

GRAPH-IV

WALKING IMPAIRMENT QUESTIONNAIRE

PAIRED 't' TEST – GROUP - A

GRADED WALKING EXERCISE ALONG WITH COMPRESSION STOCKINGS

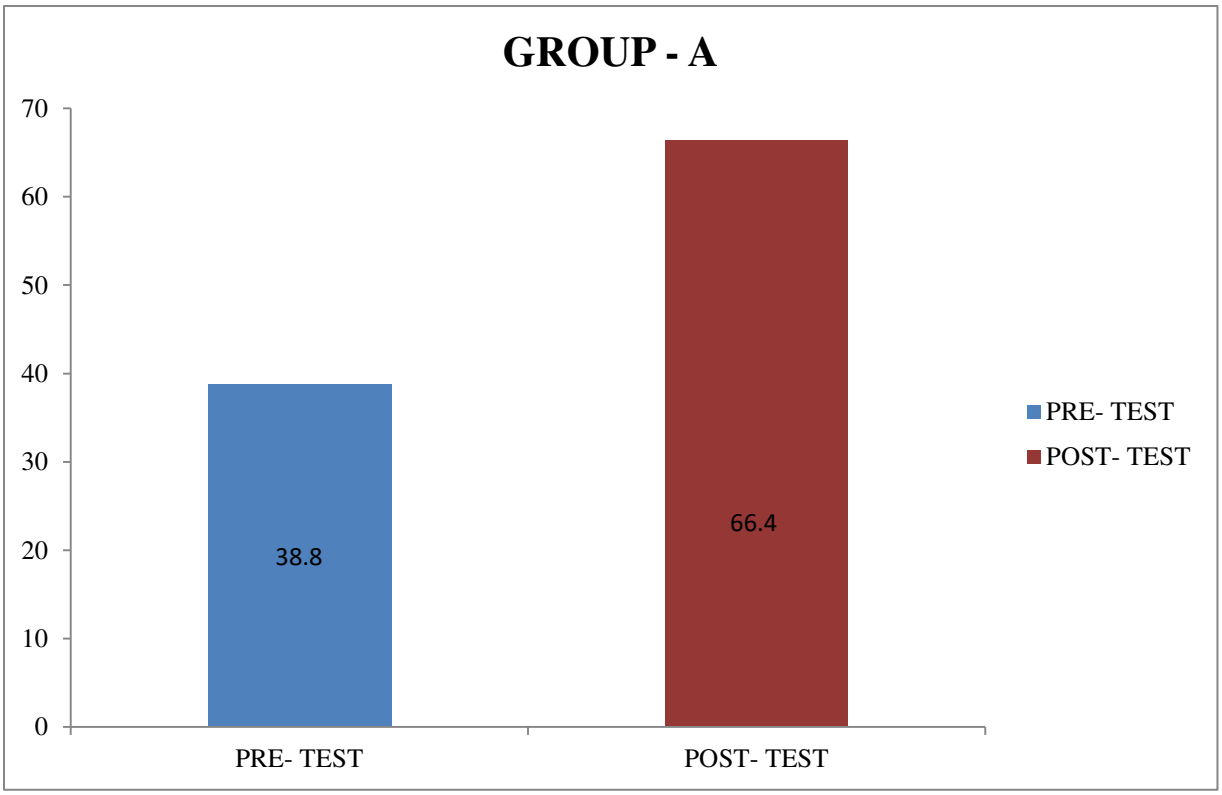


TABLE – V

WALKING IMPAIRMENT QUESTIONNAIRE

PAIRED 't' TEST – GROUP - B

NORMAL WALKING EXERCISE ALONG WITH COMPRESSION STOCKINGS

S.NO	GROUP - B	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	't' VALUE
1.	PRE - TEST	36.6	15.6	0.63	24.72
2.	POST - TEST	52.2			

The comparison of pre-test and post-test values of walking impairment questionnaire for Group - B showed that the calculated 't' value is 24.72 is significantly greater than he tabulated 't' value 2.145 at 5% significance level. This shows that there is a significant improvement in walking ability following normal walking exercise along with compression stockings.

GRAPH- V

WALKING IMPAIRMENT QUESTIONNAIRE

PAIRED 't' TEST – GROUP - B

NORMAL WALKING EXERCISE ALONG WITH COMPRESSION STOCKINGS

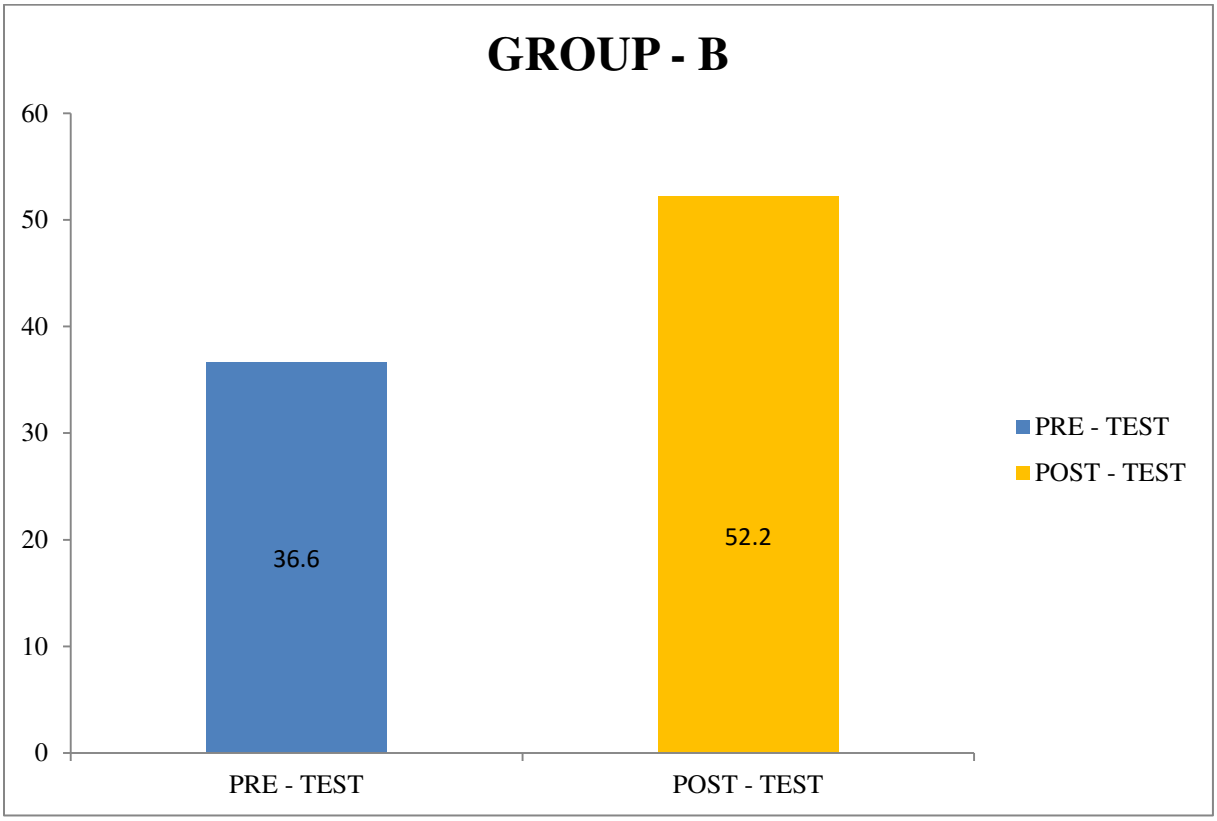


TABLE-VI

GROUP - A vs GROUP - B

WALKING IMPAIRMENT QUESTIONNAIRE

UNPAIRED 't' TEST

S.NO	GROUPS	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	't' VALUE
1.	GROUP - A	66.4	14.2	0.8	15.97
2.	GROUP - B	52.2			

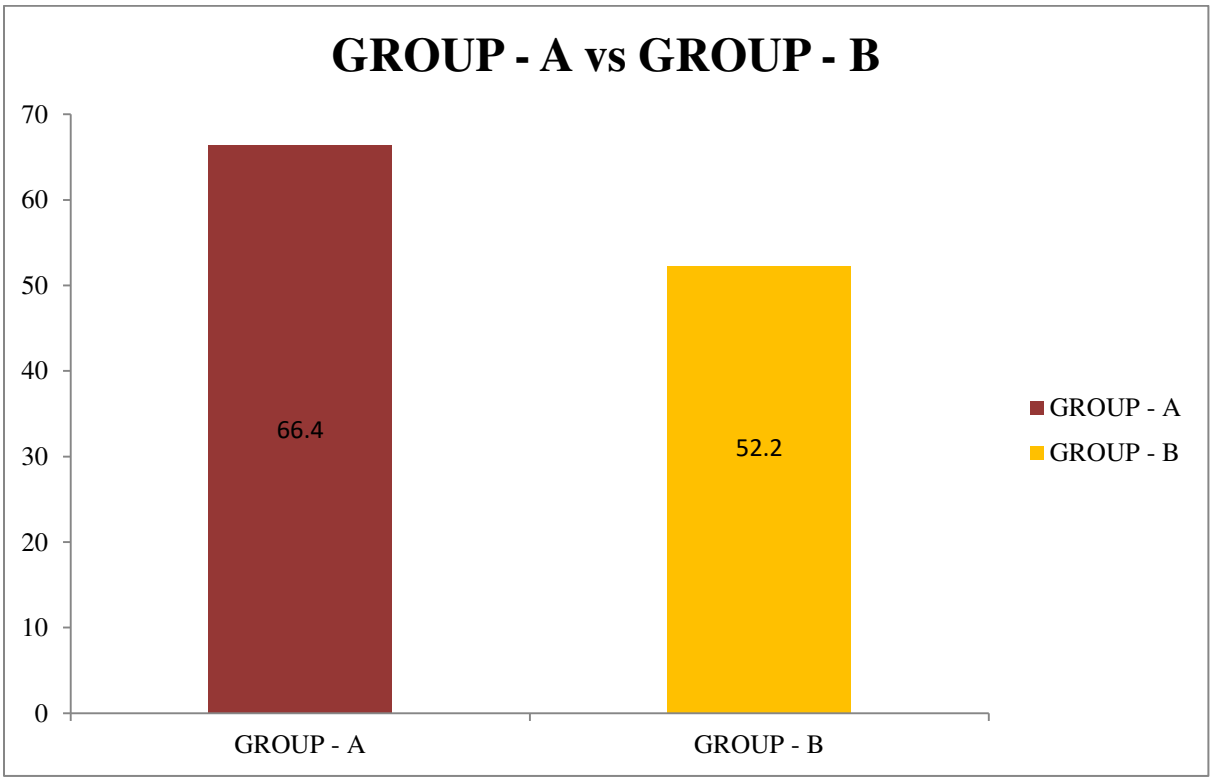
The comparison of post-test values of walking impairment questionnaire between Group - A and Group - B showed that the calculated 't' value 15.97 is significantly greater than the tabulated 't' value 2.048 at 5% level of significance. This shows that there is a significant improvement on walking impairment questionnaire in Group - A than Group - B following the treatment.

GRAPH- VI

GROUP - A vs GROUP - B

WALKING IMPAIRMENT QUESTIONNAIRE

UNPAIRED 't' TEST



V RESULT

In this study 30 subjects with peripheral vascular disease were selected according to inclusive and exclusive criteria and randomly divided into two group with 15 subjects in each experimental group (Group - A and Group - B). Treatment duration is 6 weeks. Age group of the participants varies from 50 years to 70 years. The demographic representations of the groups are given in table I to VI.

The paired ‘t’ test analyses for the pre-test and post-test variables six minute walk test for Group - A and Group - B patients with peripheral vascular disease which was shown in table I and II. Both the group show significant difference in the pre-test and post-test values. The ‘t’ value for Group - A is 40.22 and the ‘t’ value for the Group - B is 26.84.

The unpaired‘t’ test analysis for the post test variables of both group for six minute walk test for measuring pain free walking distance in patients is shown in the table III. There is significant difference shown between the Groups. Subjects in Group - A showed more improvement than Group - B. The unpaired‘t’ value for the post test variables for both groups is 20.13.

The paired‘t’ test analyses for the pre-test and post-test variable for the walking impairment questionnaire for measuring walking ability in patients with peripheral vascular disease which was shown in table IV and V. Both the groups

show significant difference in pre-test and post-test values. The‘t’ values for the Group - A is 50.78, the‘t’ value for Group - B is 24.72.

The unpaired‘t’ test analysis for the post-test variables for both group for walking impairment questionnaire in patients with peripheral vascular disease is shown in the table VI. There was significant difference shown between the Groups. Subjects in Group - A showed improvement than that of Group - B. The‘t’ value for the post test variables for both groups is 15.97.

The statistical analysis revealed that there was significant improvement in the six minute walk test and walking impairment questionnaire in both the groups, and there is statistically significant improvement in the six minute walk test and walking impairment questionnaire between the Group - A and Group - B.

VI DISCUSSION

The purpose of the study is to find out the effect of Graded walking exercises along with compression stockings versus Normal walking exercise along with compression stockings on pain-free walking distance and walking ability in patients with peripheral vascular disease. 30 subjects with peripheral vascular disease were selected for the study and they were divided into two equal groups, 15 subjects in each group. Group - A subjects underwent Graded walking exercises along with compression stocking and Group - B subjects received normal walking exercise along with compression stockings.

Peripheral vascular disease is an occlusive arterial disease which causes inadequate blood flow to the limb. The disease process is due to formation of atherosclerosis mainly affecting the vascularisation of the lower limb. The prevalence of peripheral arterial disease in men is slightly higher than in women. Overall prevalence of Indian population is 17.9% (Robert G 2012).

Peripheral vascular diseases are treated conservatively with anticoagulants, antihypertensive, anti-cholinesterase drug. The main principle of physiotherapy are preventive therapy in early mobility phase, therapeutic walking distance, decrease edema, increase mobility, enhance vascularization in sub-acute phase, maintenance phase enhance vascularization and increase strength and endurance of muscle in chronic phase of peripheral vascular disease (S.K.Kakkos 2005).

Compression therapy, by bandaging or stockings, is routine for thromboprophylaxis and for chronic venous disease and its complication, including deep venous thrombosis. The degree of compression is dependent on the condition being treated. Compression stockings are used in mild to moderate patients. There is evidence to suggest that these stockings exert graded circumferential pressure from distal to proximal and, when combined with muscular activity in the limb, are thought to displace blood from the superficial to the deep venous system via the perforating vein. It is argued that this effectively increase the velocity and volume of flow in the deep system thereby potentially preventing thrombosis (Benko 2001).

Elastic compression stockings assist the calf muscle pump and reduce venous hypertension and reflux, thereby reducing edema and improving tissue microcirculation. However, evidence supporting the effectiveness of elastic stockings comes primarily from the result of a single randomized study conducted in patients with proximal DVT, which assessed the post-thrombotic syndrome by using a non-validated scale. Use of tailor-made and sized-to-fit elastic stockings decreased the incidence of mild to moderate sequelae from 47% to 20% and decreased the incidence of severe sequelae from 23% to 11% (Brandjes DP, Buller HR, Jagt H.,1997).

Graded walking exercises therapy is a physical activity that starts very slowly and gradually an increase overtime. Graded activity and exercise are defined as starting from a shallow, basic level of exercise and activity and gradually increasing it to a level where people can go about their daily life. After finding the baseline in the exercise, can gradually increase:

- The length of time that you do the exercise.
- The exercise intensity.

Graded walking exercises helps to get improvement in the onset of claudication time and peak claudication time. Exercise therapy also promises in increasing capillary density, peripheral adaptation and oxidative enzyme in the vasculature (Ajitsingh, Hashir Kareem 2017).

In this study the subjects in Group - A, underwent graded walking exercises along with compression stockings. All the subjects in the group underwent 6 weeks of training program. Following the treatment, their pre-test and post-test values are calculated and analyzed for the result.

Previous studies have shown significant improvement in walking ability and pain - free walking distance in both the groups. The graded walking exercise along with compression stockings has lead to regulation of arterial pressure gradient and increase arterial flow in calf muscles. Although evidence of improve nutrition to muscle tissue and improved performance of the muscle tissue perfusion with

increased capillarization, redistribution of the flow and diffusion based enhancement of arterial venous O_2 extraction is noted (Stephen F. Figoni, 2009).

Group - B subjects underwent normal walking exercise along with compression stockings. All the subjects in the group underwent 6 weeks of training program. Following the treatment, their pre-test and post-test values were calculated and analyzed for the results.

The graded walking exercises along with post compression stockings have induced greater concentration of walking performance and facilitated the increase in arterial blood flow, nutrition to muscle tissue in the ischemic exercising muscles (K. Manuja, K. Madhavi 2016).

So this study concludes from the statistical analysis that graded walking exercise along with compression stockings will improve walking ability and pain-free walking distance. Normal walking exercise along with compression stockings also shows improvement in walking ability and pain-free walking distance. Both the groups showed significant improvement but graded walking exercises along with compression stockings showed more improvement than normal walking exercise along with compression stockings.

VII SUMMARY AND CONCLUSION

SUMMARY

The aim of the study was to compare the effect of Graded walking exercises along with compression stockings and normal walking exercise along with compression stockings on pain free walking distance and walking ability in patients with peripheral vascular disease.

30 patients with peripheral vascular disease who fulfilled the pre-determined inclusive and exclusive criteria were selected and divided in two equal groups, 15 patients in each group. Group - A underwent graded walking exercises along with compression stockings and Group - B underwent normal walking exercise along with compression stockings.

Outcome for both the groups were measured by using operational tools before and after the treatment duration i.e. 6 weeks. The six minute walk test was used to measure pain-free walking distance and walking impairment questionnaire was used to calculated the walking ability.

Student‘t’ test was used to find out the difference between the pre-test outcome as well as the difference between the two groups. Based on this statistical analysis, both Group - A and Group - B showed significant difference in walking ability and pain-free walking distance.

CONCLUSION

- There is significant improvement of pain-free walking distance in both the groups.
- There is significant improvement of walking ability in both the groups.
- When the pain-free walking distance of Group - A and Group - B are compared, the result showed significant difference.
- When the walking ability of Group - A and Group - B are compared, the result showed significant difference.

So the present study concluded that there is significant difference in the effect of comparing Graded walking exercises along with compression stockings and Normal walking exercise along with compression stockings. The Group - A subjects who underwent graded walking exercises along with compression stockings showed more improvement than Group - B subjects who underwent Normal walking exercises along with compression stockings.

VIII LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS:

- High risk subjects not included such as patients with Cardiac problems, Dyslipidemia, Hypertension, Diabetes.
- Small sample size.
- Study duration was short.
- Only male patients are included.
- Patients with gait abnormalities were not included.

RECOMMENDATIONS:

- Warm up exercises can be included in further study.
- Long term, follow-up should be planned.
- Specific emphasis to individual condition can be done in further studies.
- Further study can be done with both males and females.
- Another variable can be measured such as Quality of life with SF-36 PF (Short Form Health Survey Physical Functioning Score).
- In further future study along with compression stockings, resistance exercises can be used.

- Instead of Graded walking exercises, Nordic walking training along with compression stockings can given for further future study.
- Compression stockings can be recommended for obese patients to reduce edema.

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X APPENDIX
APPENDIX - I
ASSESSMENT

DEMOGRAPHIC DATA

Name : OP No :

Age : Address :

Gender :

Date :

Phone /Mobile No :

Referred by :

Chief complaints:

PATIENT HISTORY

Peripheral artery occlusion : Unilateral/bilateral :

Fontine stage classification :

History of present illness:

1. Cough
2. Sputum

3. Dyspnea
4. Hemoptysis

Past medical history:

Surgical history:

Personal History:

1. Smoking
   Duration :
   Pack years :
2. Alcoholic
   Duration :
3. Tobacco Chewing

Family History:

Drug history:

Risk factors:

Occupational History:

History of Living Environment:

Previous Functional Status:

Pain History

Side :

Site :

Onset :

Duration :

Type :

Aggravating factors:

Relieving factors :

Intensity :

Vital signs

Temperature :

Heart rate :

Blood pressure :

Respiratory rate :

Sao_2 :

OBJECTIVE EXAMINATION

ON OBSERVATION

- Built :
- Attitude of limbs :
- Gait :
- Pressure sore :
- Tropical changes :

Posture :

Muscle wasting :

Edema :

External appliances :

- Clubbing :
- Cyanosis :
- Chest wall deformity:
- Breathing pattern :

ON PALPATION

- Palpation of pulses :
- Tone :
- Edema :
- Tenderness :
- Warmth :

ON EXAMINATION

1. RANGE OF MOTION FOR LOWER LIMBS

	RIGHT	**LEFT**
Hip: Flexion Extension Abduction Adduction External rotation Internal rotation		
Knee: Flexion Extension		
Ankle:		

Dorsi flexion Plantar flexion Inversion Eversion		

2. MUSCLE POWER FOR LOWER LIMBS

	RIGHT	**LEFT**
Hip: Flexors Extensors Abductors Adductors External rotators Internal rotators		
Knee: Flexors Extensors		
Ankle: Dorsi - flexors Plantar flexors Invertors Evertors		

3. INTEGUMENTARY

- Skin Color
- Skin Texture

4. CARDIO PULMONARY

- Cough
- Sputum
- Clubbing
- Cyanosis
- Edema

SENSORY INTEGRITY

- Superficial :
- Deep :

GAIT

ASSISTIVE DEVICES

FUNCTIONAL STATUS

- Bed mobility :
- Transfer :
- ADL :

AUSCULTATION

- Breath sounds:
- Added sounds:
- Vocal sounds:
- Heart sounds:

INVESTIGATIONS AND FINDINGS

MEDICAL DIAGNOSIS

PHYSICAL THERAPY DIAGNOSIS

- Direct impairments
- Indirect impairments
- Functional limitations

PHYSIOTHERAPY MANAGEMENT

Aims:

Means:

APPENDIX – II

SIX MINUTE WALK TEST

According to the American Thoracic Society Guidelines;

- "The 6MWT is easy to administer, better tolerated, and more reflective of activities of daily living than the other walk tests".
- The 6MWT is a practical simple test that requires a 100-ft hallway but no exercise equipment or advanced training for technicians..
- This test measures the distance that a patient can quickly walk on a flat, hard surface in a period of 6 minutes (the 6MWD).
- It evaluates the global and integrated responses of all the systems involved during exercise, including the pulmonary and cardiovascular systems, systemic circulation, peripheral circulation, blood, neuromuscular units, and muscle metabolism.

PROCEDURE:

- Subjects were instructed to walk from one end to the other of a 100 ft, hallway at their own place, while attempting to cover as much ground as possible in the allotted 6 min.
- Therapist encouraged patients with standard statement "you are doing well" or "keep up the good work" but were asked not to use other phrases.
- Patients were allowed to stop and rest during the test, but were instructed to resume walking as soon as they felt able to do so**.**
- The therapist should monitor and note symptoms, number of rest taken.

APPENDIX-III

THE PERIPHERAL ARTERIAL DISEASE (PAD) WALKING IMPAIRMENT QUESTIONNAIRE

Overview: Regensteiner et al developed a questionnaire for evaluating walking impairment in patients with peripheral arterial disease (PAD). This can be used to identify patients with significant impairment and to monitor effectiveness of therapeutic interventions. The authors are from the Universities of Colorado and Rochester.

Parameters:

(1) Difficulty walking a distance during the past month

(2) Difficulty walking at a certain speed during the past month

(3) Symptoms associated with walking impairment.

Walking Distance	Degree of Difficulty	Points
Walking indoors(around the house)	No	3
	Some	2
	Much	1
	Did not do	0
walking 50 feet	No	3
	some	2
	much	1

	did not do	0
walking 150 feet (0.5 blocks)	no	3
	some	2
	much	1
	did not do	0
walking 300 feet (1.0 blocks)	no	3
	some	2
	much	1
	did not do	0
walking 600 feet (2.0 blocks)	no	3
	some	2
	much	1
	did not do	0
walking 900 feet (3.0 blocks)	No	3
	Some	2
	Much	1

	Did not do	0
walking 1500 feet (5.0 blocks) or more	No	3
	Some	2
	Much	1
	Did not do	0

Walking distance score =

= (20 * (points for walking indoors)) + (50 * (points for walking 50 feet)) + (150 * (points for walking 150 feet)) + (300 * (points for walking 300 feet)) + (600 * (points for walking 600 feet)) + (900 * (points for walking 900 feet)) + (1500 * (points for walking 1500 feet))

Where: each distance is walked is used as a weighting factor for the points from the degree of difficulty.

Fraction of maximal walking distance score = (walking distance score) / 6060

Walking speed	**Degree of difficulty**	**Points**
Walking one block slowly?(about 1.5mph)	No	3
	some	2
	much	1
	Did not do	0

Walking1block at an average speed(about 2.0 mph)	No	3
	Some	2
	much	1
	Did not do	0
Walking 1 block quickly(about 3.0mph)	No	3
	Some	2
	Much	1
	Did not do	0
Running or jogging 1 block(about 5.0mph)	No	3
	Some	2
	Much	1
	Did not do	0

Walking speed score = (1.5 * (points for walking slowly)) + (2 * (points for walking at average speed)) + (3 * (points for walking quickly)) + (5 * (points for running or jogging))

Where: each speed is walked is used as a weighting factor for the points from the degree of difficulty.

Fraction of maximal walking speed score = (walking speed score) / 34.5

Symptom of walking impairment	Degree of difficulty	Points
Pain or aching in your calves	no	3
	Slight	2
	Some	1
	much	0
Pain or aching in your thighs	No	3
	Slight	2
	Some	1
	much	0
Pain stiffness or aching in your joints(knees or hips)	No	3
	Slight	2
	Some	1
	much	0
Pain or discomfort in your chest	No	3
	Slight	2
	Some	1
	much	0
Weakness in one or both of your legs	No	3

	slight	2
	Some	1
	much	0
Shortness of breath	No	3
	slight	2
	Some	1
	much	0
Heart palpitations	No	3
	Slight	2
	Some	1
	much	0
Other problems?(please list)	No	3
	Slight	2
	Some	1
	much	0

Where:

- A total symptom score was not calculated. This was the questions "were not a ranked series."
- The data was presented as "a percentage of the maximal score possible of 4.0."

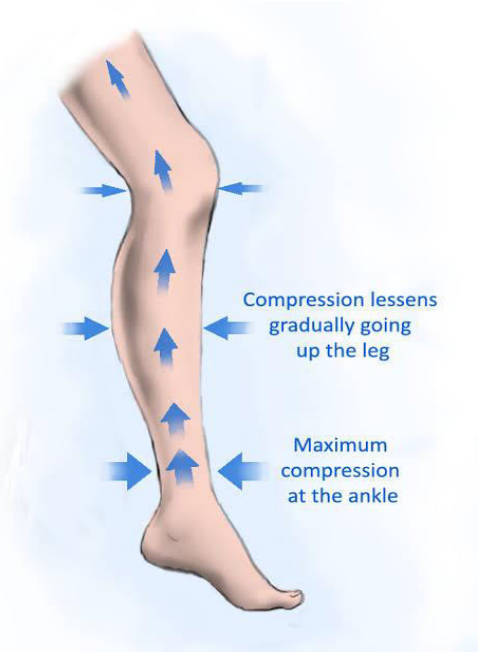
Interpretation:

- Minimum walking distance score: 0
- Maximum walking distance score: 34.5
- Minimum walking speed score: 0
- Maximum walking speed score: 6 60
- The score can be used to compare impairment before and after vascular surgery Performance:
- Changes in questionnaire scores correlated with some measurements of treadmill performance.
- Retesting in an untreated control group showed similar scores after 12 weeks.

APPENDIX-IV

COMPRESSION STOCKING

- The stockings, which were flat-knitted, applied 30 to 40 mm Hg of pressure at the ankle; they were made of cotton, latex and rubber- polyamide.
- Subjects received stockings of Tynor brand.
- Subjects received 2 stockings, which were replaced by identical stockings.
- The stockings had to be used during the day time.
- The stockings can be removed during night time when they go to bed.
- The patient and the care takers are taught how to wear the stockings and how to wash it. The patient and care takers are taught all the benefits of the usage of stockings.



APPENDIX- V

GRADED WALKING EXERCISES

For graded walking exercise, the training session duration has varied from 10 to 60 minutes with the majority using 60 minutes per sessions. 5 minutes at the beginning and end of each 45- minute's session to a warm up and cool down. Total treatment time is 60 - 80. The protocol by K Manuja et al (2016).

	Warm up walk slowly	**Target zone walk briskly**	**Cool down walk slowly**
Week 1	5 minute	5 minute	5 minute
Week 2	5 minute	10 minute	5 minute
Week 3	5 minute	15 minute	5 minute
Week 4	5 minute	20 minute	5 minute
Week 5	5 minute	25 minute	5 minute
Week 6	5 minute	30 minute	5 minute

APPENDIX-VI

NORMAL WALKING EXERCISES

The protocol is by Parr et al., (2006)

Step 1:

- The subject is asked to walk steadily with normal speed for 5-10 minutes before they start to feel claudication.
- The subject is asked to walk until feels that subject can't walk further.

Step 2:

- The subject is asked to stop and rest so that the pain subsides.
- The subject can rest by standing or sitting.

Step 3:

- Again the subject is asked to walk for 5-10 minutes at the same speed until the pain start. But usually the pain initiates very lately than earlier.
- Then again the subject is asked to take rest.

Step 4:

- Repeat the process until the subjects walk for 45 minutes.
- The patient should cover 60-80 minutes including the rest time.
- Initially the subject will not be able to complete 45 minutes.
- The subject is asked to do as much as possible and progress the time of walking and reduce the rest time gradually.

APPENDIX-VII

PATIENT CONSENT FORM

This is to certify that I ……. freely and voluntarily agree to participate in the study **"EFFECT OF GRADED WALKING EXERCISES ALONG WITH COMPRESSION STOCKINGS ON INDIVIDUALS WITH PERIPHERAL VASCULAR DISEASE".**

I have been explained about the procedures and the risk that would occur during the study. Questions have been answered to my satisfaction**.**

Participant :

Witness :

Date :

I have explained and defined the procedures to which the subject has consented to participate.

Researcher :

Date :