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Effectiveness of Intrinsic and Extrinsic Muscle Strengthening on Heel Pain in Postmenopausal Women

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Key Words
Heel pain, Plantar fascia, Foot Function Index, Postmenopausal women.

Abstract
Context: In people nowadays extremely common overused injury is heel pain. In postmenopausal women it is most typical that various hormonal changes taking place after menopause. Heel pain is affected by this reduction as plantar fascia elasticity and length are being maintained by estrogen levels it is very important role on it. The purpose of this study was to find and analyze the effectiveness of intrinsic and extrinsic muscle strengthening on heel pain in postmenopausal women.
Aim: To find the effectiveness of intrinsic and extrinsic muscle strengthening on heel pain in postmenopausal women.
Methods: In this comparative study, 56 postmenopausal women were approached through emails. Subjects were randomized into two groups: Group A (n=28) was control group and Group B (n=28) was study group. Subjects from both groups exercised five times per week and followed the ergonomics. Pain intensity and disability were assessed at baseline and at the end of week 3.
Results: Comparison within the group was done by using One- ANOVA test and between the groups by unpaired t test. Based on the statical results, pre and post shown significant difference in foot function index scale. Post 3rd week intervention difference in the foot function index scale (<0.0001) is considered as extremely significant.
Conclusion: Intrinsic and extrinsic muscle strengthening exercises have proven to be effective on heel pain in postmenopausal women.

1. Introduction

The foot is being affected by one of the most common condition that is heel pain.[2] A dense, fibrous connective tissue structure is being originating from the medial tuberosity of calcaneous is heel pain. An important static support for longitudinal arch of the foot is plantar fascia with increased loads that act as a shock absorber plantar fascia get elongated but its ability to elongate is limited.[3]

It also act as a resilient pad when weight is being loaded to foot and this muscle also helps in increase balance in ankle.[3]In people nowadays extremely common overused injury is heel pain.[4]In postmenopausal women it is most typical that various hormonal changes taking place after menopause.[5]It is not always that due to overuse only this condition occurs instead these also who have sedentary lifestyle can be affected by it. Heel pain caused by various risk factors among which some are obesity, sedentary lifestyle, excessive running, prolonged weight bearing, flat feet, overtraining, reduced estrogen level, recent stress fracture, poor footwear, walking barefoot this risk factors are reduced by early detection of signs and symptoms which is necessary. Pain on sole of foot, pain while taking your first step of the day in morning when you wake up from bed.[6]

Pain on prolonged weight bearing increase in physical activity pain on prolonged standing excessive running or jumping activities and sudden weight gain are the signs for early detection.[7]Menopause is a natural process physiological changes in the body in the body

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such as hot flushes, fatigue, irregular or absence of menstrual cycle are experienced by women. Before menopause that is in perimenopause.[7]Various hormonal changes are also there such as after menopause reduction within the level of estrogen and androgen are there. Various signs and symptoms such as reduced bone density changes in mood and energy loss of pubic hair and effects on sexual function are produced by various changes in our body caused by that decreasing level of estrogens and androgens[7]. Heel pain is affected by this reduction as plantar fascia elasticity and length are being maintained by estrogen levels it is very important role on it.[5]Also the prevalence of heel pain was 0.4374%[10].

Menopause is associated with modification in body composition components like a decreased in fat free mass and increased fat mass. The only part of the body acts on external surface and an important role in the biomechanical function of the lower extremity played by the human foot which is a complex multiarticular mechanical structure. Support and balance during standing and body stability during gait is provided by the human foot. [8]

So the conservative treatment which is to be used for the first group of postmenopausal women is firstly shoe inserts, shoe wear modification including stretching exercises, mobilization of all the joints present below the ankle area, therapeutic ultrasound.[9]

Now the next group of postmenopausal women having heel pain is made and the following treatment is to be given for this group. The treatment includes with the first session the volunteers are to be instructed on how to correctly perform the following exercises. Frequency and manner by which the exercise are to be performed are supposed to be monitored once a week.[1]

Stretching of hamstrings and plantar flexors that is in SLR in supine is to be used for the following condition. (3 sets 15 repetition) self stretch of calf muscle can also be performed with patient in lean forward in standing position with affected foot further away from the wall while keeping the heel on the floor.[1]

Towel curl's exercises (3 sets 15 repetition) should be performed in these exercises the volunteers are supposed to pull a towel along a smooth surface with the help of their toes. In these exercise the progression can be done with the help of gradual resistance with the application of 1 or 2 kg weight placed on the towel.[1]

The another exercise which is to be followed is short foot exercise with one foot on the ground the volunteers should bring the head of metatarsophalangeal to the heel without removing the forefoot from the ground or flexing the toes, thereby shortening the foot in antero- posterior direction and elevating the medial longitudinal arch. (3 sets 1 min hold)[1]

Along with these exercises, specific plantar fascia stretching is also included in this protocol. There are two types of stretches which are to be performed. The one is weight bearing stretch of plantar fascia and the other is non-weight stretch of plantar fascia. The stretch is supposed to be hold for 30 seconds and then relax with 3 repetitions[10].

The invertors, evertors and plantar flexors are supposed to be strengthen using elastic resistance for plantar fascia stretching an incline board (25^0) is to be used on which volunteers remain standing and elevated their heels from the board. (3 sets 10 repetition) [1]

The strengthening exercises for adductor and lateral rotator muscles of the hip are to be done by using elastic resistance. (3 sets 10 repetition) The exercise for lateral rotator is performed with the volunteer seated on the plinth, adjusted the position of hip at 60^0 the adductors are to be strengthening with three exercises. The side lying positions with limb to be strengthen position on top. In standing position and side stepping with elastic resistance with distal region of thigh.[1]

Therefore the following study is to recognize the effectiveness of exercises used for strengthening of intrinsic and extrinsic muscles for the same condition as mentioned above but in the population which includes post menopausal women.

2. Methodology

After approval from institutional protocol and ethical committee, this comparative study was performed in a postmenopausal women having heel pain. The studies major goal was to determine the effectiveness of intrinsic and extrinsic muscle strengthening on heel pain in postmenopausal women.

Fifty –six postmenopausal women having heel pain were selected for this study. Inclusion criteria were: postmenopausal women with heel pain. Subjects were

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excluded if they had a history of infection or tumor at the heel or any physical dysfunction in feet or ankle had any surgical condition.

These subjects were then selected and were divided into two equal groups using sequence of random numbers. Both Group A (control group) and Group B (study group) had 28 individuals each. The intervention program consisted of 60 sessions for both groups, with the sessions performed 3 times per week for 4 month. Each session lasted for 40 to 50 minutes.

PROCEDURE

All patients were approached and explained about the details related to the study and informed as well as verbal consent was taken pre test assessment was taken by using from them. Pre – test assessment was taken by using FFI (FOOT FUNCTION INDEX)[12] to determine heel pain and functional disability. Group A were given conventional exercises and Group B were given intrinsic and extrinsic strengthening exercises along with conventional exercises. The subjects were instructed on how to perform the exercise correctly. These both groups performed the exercise three times per week for 40-50 minutes under the supervision of the experienced person. Post – test assessment was taken by using FFI (FOOT FUNCTION INDEX) to determine heel pain and functional disability. The interpretation of the study was done on the basis of comparing pre test and post test values of both the group by using Instat software.

Outcome Measures

Before and following intervention, pain, disability was measured by foot function index scale respectively.

Foot Function Index Scale (FFI)

The FFI was used for pain evaluation and disability measure. In this scale the level of pain intensity perceived by the subject were measured using an 11 point scale 5 questions for pain intensity that range from 0 (no pain) to 10 (worst pain imaginable) for disability 11 point scale 12 question for disability that range from 0(no difficulty) to 10 (so difficulty unable to do). The reliability and validity of the questionnaire have already been demonstrated in previous studies.[5]

The study protocol and informed consent were approved by the Ethics Committee of Krishna Vishwa Vidyapeeth, KVV. All subjects were presented with the research objects and provided their written informed consent to participate in the study before any study related procedure was done.

Subjects in Group A (control group) received conventional physiotherapy treatment which included firstly shoe inserts, shoe wear modification including stretching exercises, mobilization of all the joints present below the ankle area, therapeutic ultrasound.

Subjects in Group B (intervention group) received intrinsic and extrinsic strengthening exercises. The exercise session included Stretching of hamstrings and plantar flexors that is in SLR in supine, towel curls exercise , short foot exercise, strengthening exercises for adductor and lateral rotator muscles of the hip,Non-weight bearing plantar fascia stretching, weight bearing plantar fascia stretch.

For analysis the independent sample t test was used for comparing the two groups. The paired t- test was used to compare variables before and after the intervention program in each group. Statistical significance for all tests was accepted below the 0.05 level.

3. Result

The total of 56 women was selected who were willingly ready to participate in the following study. Women in menopausal state who had heel pain were only been selected. Among which, they were divided in group A and group B. Group A was given conventional protocol of treatment for heel pain and group B was given conventional protocol with experimental protocol for treatment. Now both the group results were calculated.

The mean value of Group A (Control Group) pre treatment examination was 42.035± 5.146and its post treatment examination value was 19.142± 3.0952. Therefore, the p value thus calculated is 0.0085 and t value is 20.248 which are very significant Table 1. That indicates that the conventional treatment is effective in such conditions.

The mean value of Group B (Study Group) pre treatment examination is 42.920± 4.64 and its post treatment examination is 14.364± 3.452. Therefore, the p value thus calculated is <0.0001 and t value is 26.365 which is extremely significant Table 2. Thus, this indicates that the experimental group is also showing significant effects in post treatment stage.

Now in the comparison of Group A (Control Group) and Group B (Study Group), the Group A and B pretreatment examination mean values are 42.920± 4.654 and 44.160±5.1690 Table 3. Thus the p value

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calculates of pretreatment stage is 0.3772 and t value is 0.8913 which is not at all significant.

Now, Group A (Control Group) and Group B (Study Group) post treatment examination mean values are 16.962± 3.092 and 14.346± 3.452 Table 4. Thus the p value calculated is <0.0001 and t value is 5.079 which are extremely significant.

Thus, the above result values indicate that the experimental group is showing significant results. This thus indicates that the experimental treatment protocol is useful and very effective for heel pain in postmenopausal women.

Table 1: Comparison of pre and post treatment of control group.

FFI	PRE	POST	p VALUE	T VALUE	Interference
GROUP A	42.035± 5.146	19.142± 3.0952	0.0085	20.248	Considered very significant

Table 2: Comparison of pre and post treatment of experimental group.

FFI	PRE	POST	p VALUE	t VALUE	Interference
GROUP B	42.920± 4.654	14.346± 3.452	<0.0001	26.365	Extremely significant

Table3: Comparison of pre treatment of both control and experimental groups

FFI	GROUP A	GROUP B	p VALUE	t VALUE	Interference
PRE	42.920±4.654	44.160±5.1690	0.3772	0.8913	Not significant

Table 4: Comparison of post treatment of both control and experimental groups.

FFI	GROUP A	GROUP B	p VALUE	t VALUE	Interference
POST	16.962± 3.092	14.346±3.452	<0.0001	5.079	Extremely significant

4. Discussion

In daily lifestyle foot is the most commonly affected part of the body. The most used as well as mostly neglected part of the body is our foot. This can be the major reason for occurrence of heel pain. Heel pain can be due to various reasons such as some previous history of fall, or any misalignment in the structure, or posture, or use of high heel sandals, etc. But the main factor which is going to be discussed over here is hormonal factor causing heel pain. Heel pains, ankle pains can also be hormonally related as hormones can cause major changes in body and joint mechanisms. Hormonal imbalance or changes in hormonal levels can cause the changes or reduction in elasticity of the ligaments and tendons, it can affect the bone density, it can also affect the joint alignment. Therefore, this topic focuses on foot and complaints related to foot which are to be caused due to hormonal level changes. Specially in postmenopausal women, heel pain is not always related to overuse, it can also be related to hormonal changes taking place in the body due to stoppage of menstrual cycles. Various hormonal changes that occur after menopause such as reduction in estrogen and androgen levels are seen.[4] Also in addition, the reduction in bone density is also seen due to hormonal changes which can contribute in heel pain. The elasticity of plantar fascia can also get reduced due to hormonal changes in the postmenopausal phase.[4] close chain exercises have shown significant improvement in foot dysfunction in post menopausal women[13].

Therefore, treatment groups were made of postmenopausal women. For one group, the conventional treatment is to be used. And for the next group, the experimental treatment is to be used. Postmenopausal women having heel pain were selected and those who willingly wanted to participate were chosen for the treatment.

The conventional treatment which is to be used is the one which is traditionally used and the experimental treatment plan includes the new techniques which will resolve the issues related to heel pain. These techniques were not used previously for hormonal related heel pain in postmenopausal women. The techniques include various types of exercises as well as stretches which will facilitate in resolving heel pain. The significance of this technique was calculated and thus proven the effectiveness of the same.

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The groups showed significant difference in the recovery rate of the patients. The Group A (control group) pre treatment examination showed the values of 42.035± 5.146 and post treatment examination showed the values such as 19.142± 3.0952. Here the p value is 0.0085 and t value is 20.248 which are very significant. Now, the Group B (study group) pre treatment examination showed the values of 42.920± 4.654 and post treatment examination values showed 14.346± 3.452. Here, the p value is <0.0001 and t value is 26.365 which are considered as extremely significant. Therefore, according to this we get the pre and post treatment significance. Now, it is to be compared as to get the difference between the effectiveness of treatment and to know which is more significant. With the consideration of both the Group A and B (control and study group) pre examination values the p value calculated is 0.3772 and t value is 0.8913 which is not considered as significant and now in the Group A and B (control and study group) post examination values the p value is <0.0001 and t value is 5.079 which is to be considered as extremely significant.

Therefore, with the help of above values, it gets to the conclusion that the experimental treatment method is extremely useful and effective and can be used for postmenopausal having heel pain.

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5. Conclusion

The current study concluded that, intrinsic and extrinsic strengthening exercises along with conventional treatment proved beneficial and effective rather than only conventional treatment on heel pain in postmenopausal women.

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