To Study the Effect of Muscle Energy Technique of Piriformis Along with Towel Curl Exercises on Navicular Drop in Females with Pes Planus

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***Abstract*- BACKGROUND: The flat foot also called as pronated foot or pes planus, is a pathomechanical condition which is characterized by lowered medial longitudinal arch.**

OBJECTIVES: To study the effects of MET of piriformis along with towel curl exercises on navicular drop test and foot posture index-6 in females with pes planus.

METHODS: A total number of 30 subjects are randomly selected using simple random sampling. Whole procedure was explained to the subjects and the informed consent was taken prior any testing. The subjects fulfilling the inclusion and exclusion criteria were included in the study. All the subjects included in the study undergo basic assessment and assigned randomly into two groups named as Group A (MET + Towel curl exercise), Group B (Towel curl exercise). The baseline measurement was evaluated. Both groups followed the protocol and data were collected at the baseline, 1st day, last day of 2nd week, 4th week and 6th week after the intervention.

RESULTS: The mean ± standard deviation of right leg for participants in Group A and Group B in week 0 before treatment was found to be 12.50±1.408 & 13.22±1.065 and after the treatment of 6 weeks the mean ± standard deviation was 8.58±1.591 & 10.98±1.259. The mean ± standard deviation of left leg for participants in Group A and Group B in week 0 before treatment was 11.81±1.541 & 12.70±0.963 and after treatment of 6 weeks the mean ± standard deviation was 8.38±1.538 & 10.62±1.490. The mean ± standard deviation of right leg for the participants in Group A and Group B in week 0 before treatment it was 6.07± 1.033 & 8.47±1.356 and after the treatment of 6 week the mean ± standard deviation was 4.67±0.900 & 5.80 ± 1.082. The mean ± standard deviation of right leg for the participants in Group A and Group B in week 0 before treatment it was 9.07± 1.280 & 8.73± 1.280 and after the treatment of 6 week the mean ± standard deviation was 5.20±0.862 & 6.07±1.033.

CONCLUSION: The study concluded that Muscle Energy Technique along with Towel Curl Exercises was more effective than Towel Curl Exercise alone in reducing the pronated foot in young females.

***Keywords*: Flatfoot, Muscle Energy Technique, Navicular drop test, Foot Posture Index, Towel curl exercises.**

I. INTRODUCTION

The human foot has two longitudinal arches that covers from the heel to the ball of the foot. The inner arch also known as medial longitudinal arch is formed by calcaneus, astragalus, scaphoid, three cuneiform and three medial metatarsal bones. The lateral longitudinal arch is formed by calcaneus, cuboid and two lateral metatarsal bones. There are two transverse arches one over the midsection and one over the ball of foot.

The pes planus also called as flatfoot or pronated foot, is a patho-mechanical condition which is characterized by lowered medial longitudinal arch. Pes planus can be congenital or by a trauma, ligament laxity, muscle weakness, paralysis, dropping of talar head or pronated foot. It is of two types rigid and flexible. Rigid flatfoot is a structural deformity that does not change during weight bearing position and it may be hereditary or acquired. In rigid flatfoot, the medial arch is absent in non-weight bearing, standing as well as in normal weight bearing position. Where as in flexible flatfoot the medial arch is decreased or absent in weight bearing position but it reappears during normal standing position or non-weight bearing position [1]. Flexible flatfoot is similar to rigid flatfoot but the foot is mobile and there are few soft tissue contracture and bony changes. In weight bearing position, there is reduced longitudinal arch, accompanied by an out- toeing of the forefoot. There will be excessive tension on structures like muscles and ligaments on the inner side of the foot that support medial longitudinal arch and compression on the outer side of the foot.

The prevalence of flatfoot is investigated by a lot of researchers in which higher prevalence is among children of 2 to 6 years (21-57%), which decreases in primary school children (13.4-27.6%) [2]. A study by Ashok Aenumulapalli et.al in 2017 reported that flatfoot in adults is 13.6% and 12.8% of adults with flatfoot are males and 14.4% are females [3].

In normal foot, the medial malleolus, tuberosity of the navicular bone and the head of the first metatarsal lie in a straight line called Feiss line. If the navicular bones come lower than the normal height, it will lie below the feiss line and may even rest on the floor in many cases of flatfoot. In rigid or flexible type flatfoot, the talar head moves anteriorly, medially and inferiorly. The displacement of the talus bone anteriorly, medially and inferiorly causes depression of the navicular bone, tension in the spring ligament and lengthening of the tibialis posterior muscles. In flatfoot patients, weight bearing standing posture causes medial rotation of the tibia bone and affects the function of the knee joint [4]. The slightly inward facing of patellae bone in knee results from medial rotation of the hip joint and it is usually escorted by pronation of the feet [5]. The increased internal rotation at tibia and femur causes excessive pelvis anterior tilting, which results in increased lumbar lordosis, and thoracic kyphosis [2]. The initial problem may be at the hip region or at the foot, it may result from the weakness of the hip external rotator muscles or the muscles and ligaments that support the longitudinal arches of the feet. Tight tensor fasciae latae muscle can also be a contributing cause and sitting in the reverse tailor or 'W' position may lead to faulty hip, knee and foot position. In maximum number of cases of the flatfoot, it is associated with the occurrence of musculoskeletal disorders like planter fascitis, chronic planter heel pain, achilles tendinopathy, medial tibial stress syndrome, knee osteoarthritis and low back pain.

Muscle energy technique (MET) is a manual technique in which muscle own energy is used in the form of gentle isometric contraction to relax the muscle through autogenic or reciprocal inhibition and thus lengthens the muscle. MET is an active technique as participant is also actively participate throughout the technique whereas in comparison static stretching is a passive technique as all the work is done by the therapist. MET is based on the principle of autogenic inhibition and reciprocal inhibition. Autogenic inhibition MET is sub-maximal contraction of the muscle followed by stretching of the same muscle and the reciprocal muscle [6].

Thus, this study aimed to determine whether adding muscle energy technique to a towel curl exercise would improve navicular drop and foot posture compared with towel curl exercise alone in subjects with pes planus.

II. METHODOLOGY

A. STUDY DESIGN: Comparative experimental study design.

B. STUDY PERIOD: From 10 July, 2022 to 10 September, 2022.

B. SAMPLE SIZE: Total 30 participants were taken. They were randomly divided into two groups named as Group A (MET with Towel curl exercise) and Group B (Towel curl exercise).

C. SAMPLING TECHNIQUE: Random sampling.

D. STUDY AREA: Gurugram, Haryana.

E. INCLUSION CRITERIA: This study includes patient diagnosed with flat foot, 18-26 years of age group, who had Navicular Drop > 10 mm and who were not using any orthosis. Patients who were able to stand on both feet. Participants who were able to walk without assistance or assistive device. Participants who were Able to understand and follow verbal instructions.

F. EXCLUSION CRITERIA: This study excludes participants who were below 18 years and above 26 years of age, participants who had vision impairment, history of surgery involving the lumbosacral region, hip or ankle and who had any lower extremity injury. Patient with arthritis of lower extremities. Participants who had Limb length discrepancy of >1.1 cm.

G. INSTRUMENTATION: Instruments used in study were couch, vernier calliper, towel, pen, marker, paper, chair, stepper.

H. OUTCOME MEASURES: Outcome measures were Navicular Drop Test and Foot Posture Index.

I. DATA COLLECTION PROCEDURE: A total number of 30 subjects were randomly selected using simple random sampling. The study was conducted at Gurugram. Whole procedure was explained to the subjects and the informed consent was taken prior to any testing. The subject fulfilling the inclusion and exclusion criteria were includes in the study. All the subjects included in the study undergo basic assessment and assigned randomly into two groups named as Group A (MET with Towel curl exercise) and Group B (Towel curl exercise). The baseline measurement was evaluated. Both groups follow the protocol and data was collected at the baseline, 1st day, last day of 2nd week, 4th week and 6th week after the intervention.

J. DATA ANALYSIS: All statistical data were performed using SPSS, version 21. Analysis was performed for foot posture index and navicular drop test. Mean and standard deviation of all the dependent variables of both the groups were calculated. Comparison between the groups for all the variables was done using Independent t-test. Significant value was kept at $p<0.05$.

III. RESULTS

Table no. 1: Comparison of NDT Rt. Leg between the Groups

	week 0		week 6	
	Group A	Group B	Group A	Group B
Mean ± SD	12.50 ±1.408	13.22 ±1.065	8.58 ±1.591	10.98 ±1.259
p-value	0.1234		0.0001	

Table no. 1 shows that the mean ± standard deviation of right le for participants in Group A and Group B in week 0 before treatment was found to be 12.50±1.408 & 13.22±1.065 respectively and after the treatment of 6 weeks the mean ± standard deviation was 8.58±1.591 & 10.98±1.259 respectively.

Table no. 2: Comparison of NDT Lt. Leg between the Groups

	week 0		week 6	
	Group A	Group B	Group A	Group B
Mean ± SD	11.81 ±1.541	12.70 ±0.963	8.38 ±1.538	10.62 ±1.490
p-value	0.0674		0.0004	

Table no. 2 shows that the mean ± standard deviation of left leg for participants in Group A and Group B in week 0 before treatment was 11.81±1.541 & 12.70±0.963 respectively and after treatment of 6 weeks the mean ± standard deviation was 8.38±1.538 & 10.62±1.490 respectively.

Table no. 3: Comparison of FPI 6 Rt. Leg between the Groups

	week 0		week 6	
	Group A	Group B	Group A	Group B
Mean ± SD	8.73 ±1.387	8.47 ±1.356	4.67 ±0.900	5.80 ±1.082
p-value	0.5986		0.0042	

Table no. 3 shows that, the mean ± standard deviation of right leg for the participants in Group A and Group B in week 0 before treatment it was 6.07± 1.033 & 8.47±1.356 respectively and after the treatment of 6 week the mean ± standard deviation was 4.67±0.900 & 5.80 ± 1.082 respectively.

Table no. 4: Comparison of FPI 6 Lt. Leg between the Groups

	week 0		week 6	
	Group A	Group B	Group A	Group B
Mean ± SD	9.07 ±1.280	8.73 ±1.280	5.20 ±0.862	6.07 ±1.033
p-value	0.4816		0.0188	

Table no. 4 shows that, the mean ± standard deviation of right leg for the participants in Group A and Group B in week 0 before treatment it was 9.07± 1.280 & 8.73± 1.280 respectively and after the treatment of 6 week the mean ± standard deviation was 5.20±0.862 & 6.07±1.033 respectively.

IV. DISCUSSION

This study supports an investigation done by Kim and Kim in 2016 who contrasted the Navicular Drop of people and an adaptable gunshot following either a 5-week Sort Foot Exercise intercession or a mediation comprising of wearing custom insoles 4 times each week for 30-minute spans for similar 5 weeks. They detailed a diminished in Navicular Drop in the Short Foot Exercise bunch after the intercession yet not in the insole bunch. Moreover, the correction of progress scores between the gathering showed a critical distinction between gatherings, with the Sort Foot Exercise having a more prominent decreased in Navicular Drop [7].

MET involves both the techniques strengthening as well as stretching of muscles. A study done on population of 40 asymptomatic kathak dancers of 8 to 23 years of age by Ankita Chauhan et.al (2019). The study concluded that intrinsic Foot muscle strengthening exercises were effective in reducing

Navicular Drop Test and Foot Posture Index in female kathak dancers [8].

Young-Mi Goo et.al [2016], conclude that stair-walking can be more effectively performed if the external rotator muscles of hip were strengthened when toe-spread exercises are performed for pronated foot [9].

V. LIMITATION OF THE STUDY

1. Sample size was too small, which should be revised to a larger number of subjects.
2. There was no follow up of the subject after the study.
3. Home program was not taught to the patients.

VI. FUTURE SCOPE OF THE STUDY

1. Study can be done on a wider Sample
2. Other genders could also be taken in the study.
3. Different subjects and age groups can be studied.

VII. CONCLUSION

The study concluded that Muscle Energy Technique along with Towel Curl Exercises is more effective than Towel Curl Exercise alone in reducing the pes planus in young females.

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