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## Effects of eccentric training and static stretching to improve hamstring flexibility among physiotherapy students

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### Abstract

**Background:** Hamstring muscle injuries are one of the most common musculotendinous injuries in the lower extremity. The lack of hamstring flexibility was the single most important characteristics of hamstring injuries in athletes. The peculiar characteristics of hamstring muscles is a bi arthroial, made predominantly of type two fibers and containing less amount of titin proteins may put the muscle group at higher risk of strains, so hamstring injuries are common in athletes.

Eccentrically training a muscle through a full range of motion theoretically could reduce injury rates and improve athletic performance and flexibility. Static stretching considered the Gold Standard for measuring flexibility, is elongating a muscle to tolerance, and sustaining the position for a length of time. Flexibility is the property of individual muscles and joints. Good muscle flexibility will allow muscle tissue to accommodate to imposed stress easily and allow efficient and effective movement. Flexibility is a major component of physical fitness, it is important to allow an adequate range of motion, to avoid sports injuries. Eccentric training and static stretching will improve hamstring flexibility.

**Objective:** The objective of the study is to obtain the effect of eccentric training and static stretching will improve hamstring flexibility among physiotherapy students.

**Methods:** This quasi-experimental design was conducted to test the effectiveness of eccentric training and static stretching will improve the hamstring flexibility among physiotherapy students. The study population included 30 participants fulfilling both inclusion and exclusion criteria. Informed consent was obtained from each participant. A description of the study was given to the participants before starting the exercise program. A 30 sample size was selected by convenient sampling method. The exercise program was about 6 weeks of duration. Both pre and post values of flexibility was assessed by using a 90/90 test and v-sit and reach test before and after giving the eccentric training and static stretching.

**Result:** The study showed significant improvement in the hamstring flexibility among physiotherapy students.

**Conclusion:** 6 weeks of eccentric training and static stretching Program will improve the hamstring flexibility among physiotherapy students.

**Keywords:** eccentric training, static stretching, flexibility ,v- sit and reach test , 90/90 test

### Introduction

Hamstring muscle injuries are one of the most common musculotendinous injuries in the lower extremity. They occur primarily during a high rate of recurrence. The lack of hamstring flexibility was the single most important characteristic of hamstring injuries in athletes. The peculiar characteristics of hamstring muscles are a bi arthroial, made predominantly of type two fibers, and containing less amount of titin proteins may put the muscle group at higher risk of strains, so hamstring injuries are common in athletes. Hamstring tightness is defined as the inability to extend the knee to less than 20 degrees of knee flexion with the femur held at 90 degrees of hip flexion while the person will be positioned in supine. Hamstring injuries accounts for 11 % of all injuries and 32% of all muscular strains.

Flexibility has been defined as the ability of a muscle to lengthened and allow one joint [or more than one joint in a series] to move through a range of motion. Loss of flexibility is defined as a decrease inability of a muscle to deform. Flexibility is the property of individual muscles and joints. Good muscle flexibility will allow muscle tissue to accommodate to imposed stress easily and allow efficient and effective movement.

Flexibility is a major component of physical fitness, it is important to allow an adequate range of motion, to avoid sports injuries. Adequate flexibility may help prevent muscle strain and such orthopedic problems such as backache. Flexibility gains in the hamstrings have been demonstrated after a multiple-day stretching program.

Three types of stretching have been traditionally defined in the literature to increase flexibility: Ballistic stretching, Proprioceptive Neuromuscular Facilitation, and Static stretching. Static stretching considered the Gold Standard for measuring flexibility, is elongating a muscle to tolerance, and sustaining the position for a length of time. Eccentrically training a muscle through a full range of motion theoretically could reduce injury rates and improve athletic performance and flexibility. Hence this study aims to determine physiotherapy students will able to improve hamstring flexibility after a 6-week eccentric training and static stretching.

### Methodology

**Study Design:** Pre-test post-test quasi-experimental study designs.

**Study Setting:** BCF College of Physiotherapy, chemmanakary, vaikom, kottayam.

**Sample Method:** Convenient sampling

**Sample Size:** 30 Physiotherapy students

### Selection Criteria

#### Inclusion Criteria

- Being studied in the same college
- Age between 18 to 25 years
- Both males and females
- Do not include in any fitness program
- Individual with hamstring tightness
- Co-operative students.

#### Exclusion Criteria

- Individual with a history of knee and hip injury
- History of neurological complications
- Individual with systemic disease
- Uncooperative student

**Duration of The Study:** June 2019 to July 2020

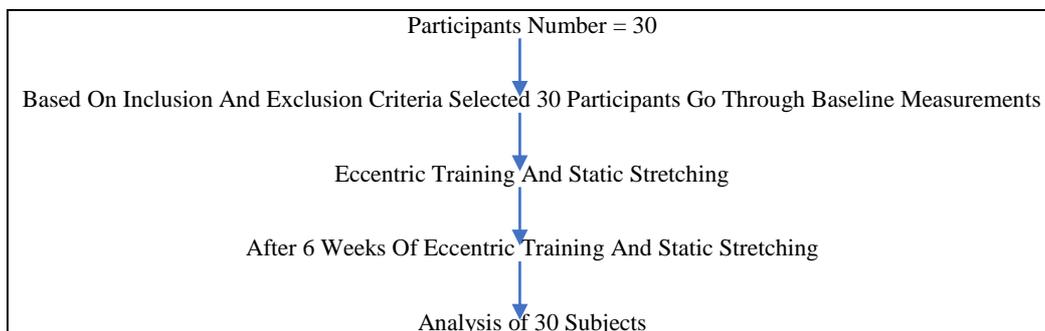
#### Materials Used

- Stopwatch
- Yoga mat
- Goniometer
- Step stool
- Inch tape

#### Variables

- Independent variable is the eccentric training and static stretching
- Dependent variable is the hamstring flexibility

#### Procedure



Flow Chart Describing the Methodology



**Fig 1:** Eccentric training with theraband



**Fig 2:** Stretching of Hamstrings

30 subjects were randomly selected to participate in eccentric training and static stretching. Before doing the exercise program patient undergone thorough warm-up exercise.

**Eccentric Training Program**

The eccentric group performed a full range of motion eccentric training for hamstring muscles. The subjects lay supine with left leg fully extended. A 3 ft piece of red theraband was wrapped around the heel and the subject held the ends of the theraband in each hand.

The subjects will be instructed to keep the right knee locked in full extension and hip in a neutral position. The subject will be then instructed to bring the right hip into full hip flexion by pulling on the theraband attached to the foot with both arms, making sure the knee remained locked in full extension at all times.

Full hip flexion was defined as a position of hip flexion at which a gentle stretch was felt by the subjects. As the subject pulled the hip into full flexion with arms, then instructed to simultaneously resist the hip flexion by eccentrically contracting the hamstring muscles, so that the entire range of hip flexion took approximately 5 seconds to complete.

Once achieved, this flexed hip position was held for 5 seconds, and then the extremity was gently lowered to the ground.

This procedure will be repeated 6 times with no rest between repetitions, thereby providing a total of 30 seconds of stretching at the end range.

**Static Stretching Program**

Subjects performed the hamstring stretch by standing erect with the left foot planted on the floor and toes pointing forward. The heel of the foot to be stretched will be placed on the plinth or chair with toes directed towards the ceiling.

The subjects then flexed forward at the hip, maintaining the spine in a neutral position while reaching the arms forward. The knee reminded fully extended. The subjects continued to flex at the hip until a gentle stretch was felt in the posterior thigh.

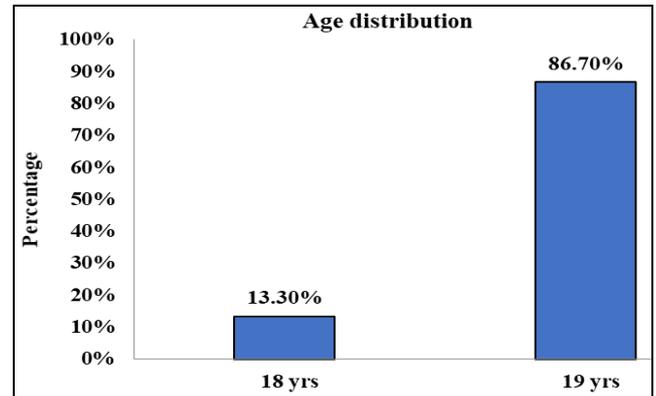
Once this position was achieved, the subjects maintained this position for 30 seconds 3 days per week for 6 weeks.

After 6 weeks treated subjects shall be evaluated for their score on outcome tools.

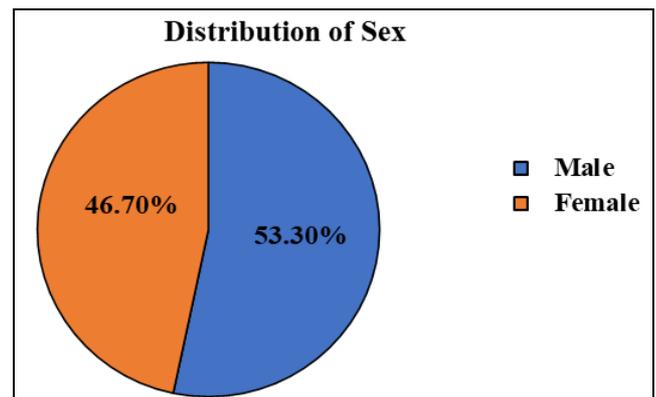
**Statistical Analysis: ‘T’ Test  
Statistical Tool**

- The collected information will be summarized by using descriptive statistics such as frequency, percentage mean, and standard deviation.
- Mean is compared with paired "t" using pre and post measurement. If it is not following a normal distribution, the Wilcoxon sign rank will be used (interferential statistics).
- The p-value less than 0.05 will be considered significant.

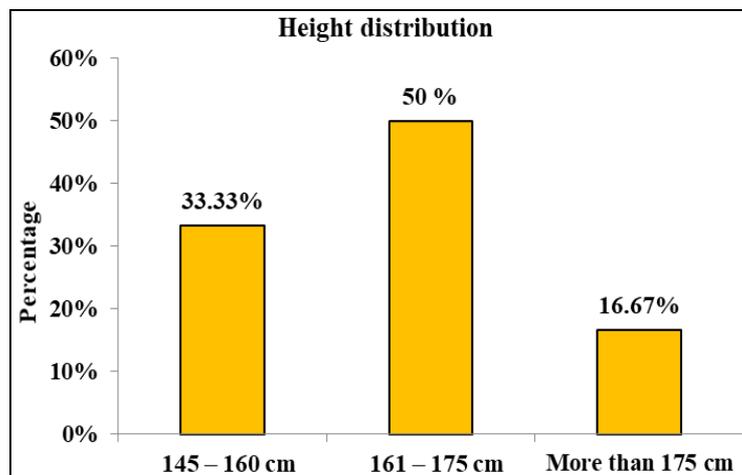
**Demographic profile of the Physiotherapy students**



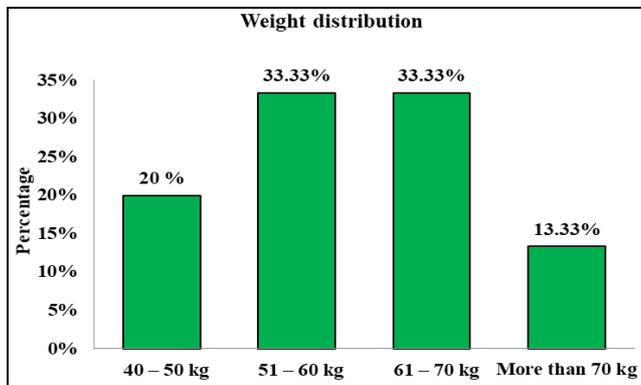
Age distribution



Sex distribution



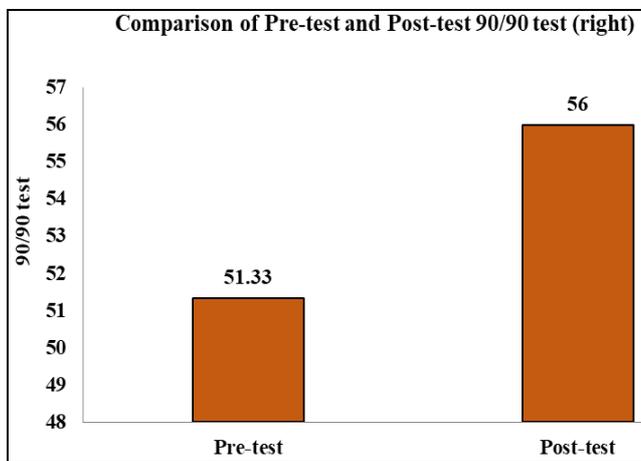
Height distribution



Weight distribution

Mean, S.D. and t-value to compare pre & post 90/90 test (right) among physiotherapy students

Test	Mean	SD	Mean change	N	T	df	p-value
Pre-test	51.33	7.98	4.67	30	20.15	29	< 0.001
Post-test	56	8.03					



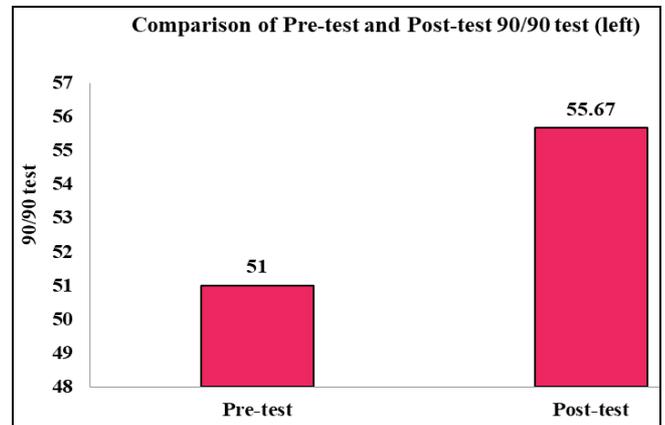
Comparison of pre-test and Post-test 90/90 test (right)

The mean column displays the mean pre-test and post-test 90/90 test scores (right) among physiotherapy students. SD is the standard deviations of the 90/90 test scores in pre & post respectively. The mean change 4.67 is the difference between pre-test and post-test (51.33 & 56). Since the *t-value*, 20.15 with  $p < 0.001$  indicates there is a significant difference existing between the pre-test and post-test 90/90 test scores

among physiotherapy students. The test scores have significantly improved in the post-test. This proves the effect of eccentric and static stretching to improve hamstring flexibility among physiotherapy students.

Mean, S.D. and t-value to compare pre & post 90/90 test (left) among physiotherapy students

Test	Mean	SD	Mean change	N	T	df	p-value
Pre-test	51	7.81	4.67	30	14.0	29	< 0.001
Post-test	55.67	7.63					

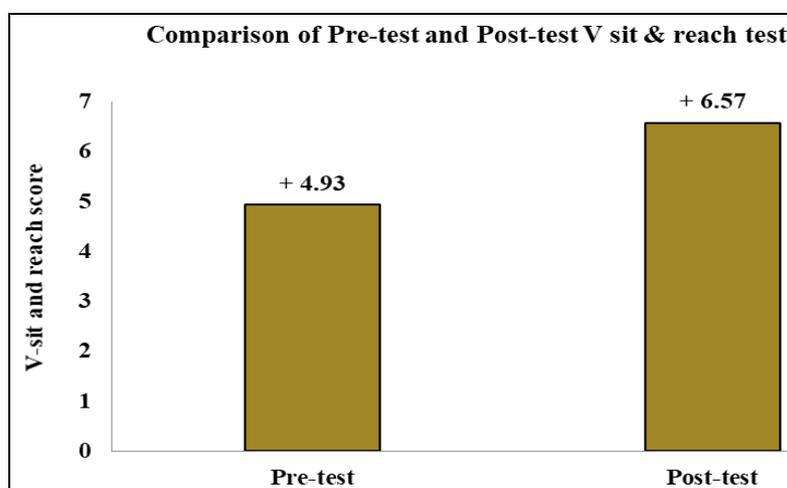


Comparison of pre-test and Post-test 90/90 test (left)

The mean column displays the mean pre-test and post-test 90/90 test scores (left) among physiotherapy students. SD is the standard deviations of the 90/90 test scores in pre & post respectively. The mean change 4.67 is the difference between pre-test and post-test (51 & 55.67). Since the *t-value*, 14.0 with  $p < 0.001$  indicates there is a significant difference existing between the pre-test and post-test 90/90 test scores among physiotherapy students. The test scores have significantly improved in the post-test. This proves the effect of eccentric and static stretching to improve hamstring flexibility among physiotherapy students.

Mean, S.D. and t-value to compare pre & post V Sit and Reach test among physiotherapy students

Test	Mean	SD	Mean change	N	t	df	p-value
Pre-test	+ 4.93	4.92	1.64	30	18.25	29	< 0.001
Post-test	+ 6.57	4.92					



Comparison of Pre-test and Post-test V sit and reach test

The mean column displays the mean pre-test and post-test V sit & reach test scores among physiotherapy students. SD is the standard deviations of the sit & reach scores in pre & post respectively. The mean change 1.64 is the difference between pre-test and post-test (+4.93 & +6.57). Since the *t-value*, 18.25 with  $p < 0.001$  indicates there is a significant difference existing between the pre-test and post-test V sit & reach test scores among physiotherapy students. The v- sit & reach test scores have significantly improved in the post-test. This proves the effect of eccentric and static stretching to improve hamstring flexibility among physiotherapy students.

## Results

### Evaluation of 90/90 Test

The mean column displays the mean pre-test and post-test 90/90 test scores (left) among physiotherapy students. SD is the standard deviations of the 90/90 test scores in pre & post respectively. The mean change 4.67 is the difference between pre-test and post-test (51 & 55.67). Since the *t-value*, 14.0 with  $p < 0.001$  indicates there is a significant difference existing between the pre-test and post-test 90/90 test scores among physiotherapy students. The test scores have significantly improved in the post-test. This proves the effect of eccentric and static stretching to improve hamstring flexibility among physiotherapy students

### Evaluation of V Sit And Reach Test

The mean column displays the mean pre-test and post-test V sit & reach test scores among physiotherapy students. SD is the standard deviations of the sit & reach scores in pre & post respectively. The mean change 1.64 is the difference between pre-test and post-test (+4.93 & +6.57). Since the *t-value*, 18.25 with  $p < 0.001$  indicates there is a significant difference existing between the pre-test and post-test V sit & reach test scores among physiotherapy students. The sit & reach test scores have significantly improved in the post-test. This proves the effect of eccentric and static stretching to improve hamstring flexibility among physiotherapy students.

## Discussion

This study aimed to prove the Effects of 6- weeks of eccentric training and static stretching to improve the hamstring flexibility among physiotherapy students. This study shows significant improvement in hamstring flexibility. This eccentric training and static stretching is practically safe and inexpensive powerful conditioning program. The results of each outcome like the 90/90 test and v- sit reach test shows their improvement.

Static stretching considered the Gold Standard for measuring flexibility, is elongating a muscle to tolerance, and sustaining the position for a length of time. Eccentrically training a muscle through a full range of motion theoretically could reduce injury rates and improve athletic performance and flexibility.

The study aims to analyze the Effect of eccentric training and static stretching will improves the hamstring flexibility among physiotherapy students". In this study quasi-experimental design conducted in bcf college of physiotherapy .this study shows significant improvement in hamstring flexibility among physiotherapy students.

To some extent, our findings are following previous studies which have already reported the positive effect of the eccentric training program and static stretching program. Russell t. Nelson and William D. Bandy, Eccentric training and static stretching improve hamstring flexibility of high

school males. Conducted the study ‘ Eccentric training and static stretching improve hamstring flexibility of high scale males.’ According to the study result, it was suggested that the flexibility of high school-aged males would improve after a 6-week eccentric program had a significant improvement than static stretching in hamstring flexibility.

Likewise, Divan Mohaideen Abbas, Bilques sultana. Efficacy of active stretching in improve the hamstring flexibility” Conducted the study ‘Efficacy of active stretching in improving the hamstring flexibility’ According to the study result was find out the effectiveness of b stretching techniques used to improve the flexibility of the muscles. These are evident with the comparison of mean pre-test and post-test values of the outcomes like the 90/90 test and the v-sit test.

The mean column displays the mean pre-test and post-test taken by physiotherapy students. SD is the standard deviation of the 90/90 test in pre and post-test respectively. The mean change 4.67 is the difference between pre and post-test ((51 & 55.67). Since the *t-value*, 14.0 with  $p < 0.001$  indicates there is a significant difference existing between the pre-test and post-test 90/90 test scores among physiotherapy students. The test scores have significantly improved in the post-test. This proves the effect of eccentric and static stretching to improve hamstring flexibility among physiotherapy students

Overall the results of this study suggest that eccentric training and static stretching has a significant effect on hamstring flexibility among physiotherapy students.

Limitation of this study includes a small sample size which might affect the generalisation of results, short duration exercise programme, and all measurements were taken manually and this introduced human error which could affect the reliability of the study.

Suggestion for future studies includes: -larger duration exercise program is recommended for more reliability and validity to establish greater efficacy of the treatment. The study should be done in large sample size, long term follows up is needed to evaluate whether there occurs any sustain or carry-over effect after the exercise program.

## Conclusion

To conclude, the Physiotherapy students could improve their hamstring flexibility after 6 weeks of eccentric training and static stretching. The observation was supported by the statistical analysis. Based on the outcomes tools the eccentric training and static stretching meaningfully improved the hamstring flexibility among Physiotherapy students.

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