

# Effectiveness of Balance Training and Strengthening Exercise on Pain and Functional Performance among the Athletes with Ankle Sprain

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## Abstract

**Background:** Ankle sprain happens more regularly in the athletic population. It results from the straining of ankle ligaments or collagen which produces the partial or full disruption of the ligaments fibers. Ankle injuries most commonly occur in the climbing of the wall ,indoor volleyball and events that occur in the grassland. This study was designed to inspect the effectiveness of balance training and strengthening exercise among the athletes with ankle sprain.

**Purpose:** To compare the effectiveness of balance training and strengthening exercise on pain and functional performance among the athletes with ankle sprain.

**Materials and Methods:** Total of 50 participants were selected according to the inclusion and exclusion criteria from the ortho speciality Neha clinic. The participants were treated for four weeks. The study duration from October 2022 to July 2023. Subjects willing to participate were randomly allocated into two groups: balance training group and strengthening exercise group. All the subjects underwent pretest measurement with VAS, FAAM and the same procedure repeated for post-test at the end of 4 weeks.

**Results:** The collected data was statistically analyzed using an unpaired t-test. When comparing the balance training group to the strengthening exercise group, the balance training group indicates more significant effects ( $p < 0.0001$ ) than the strengthening exercise in lowering pain and improving the functional performance, as assessed by VAS and FAAM.

**Conclusion:** Balance training was found to be more effective than strengthening exercise in reducing pain and improving functional performance among athletes with ankle sprain.

**Keywords:** Ankle sprain, VAS, FAAM, Ultrasound, Strengthening exercise, Balance training.

## Introduction

Ankle sprain happens more regularly in the athletic population. It results from the straining of ankle ligaments or collagen which produces the partial or full disruption of the ligaments fibers<sup>1</sup>.

Ankle injuries most commonly occur in the climbing of the wall ,indoor volleyball and events that occur in the grassland prevention of the ankle sprain have the most beneficial effect among the sport population all over the world<sup>2</sup>. Females have the major risk of the ankle sprain when differentiated with the males.

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Lateral ankle sprain is more common than other ankle sprain types<sup>3</sup>. Lateral ankle sprain requires the only immobilization in the acute stage if there is only the pain and edema. If it involves the reduction of the range of motion over the ankle joint it requires the mobilization techniques along with the combination therapy of the exercise. In terms of the functional support the external applications are more effective in both the acute and the recurrent ankle sprain. Proper diagnosis and preventive measures are important in order to prevent the ankle sprain<sup>4</sup>. For the acute lateral ankle sprain treatment should be involved with the weight bearing with the mobilization techniques, external supportive appliances, exercise and application of the ice should be used. The individual with the chronic ankle instability may require the mobilizing techniques and rehabilitation programs such as the balance training and proprioceptive training<sup>5</sup>. Functional impairment is characterized by feeling of impairment, recurrent sprain or fright. In addition healthy persons may have the incidence of the sprained ankles that produces the discomfort and limitation of the movements over the ankle joint that affects the functional status of individual<sup>6</sup>.

### Aim

To evaluate the effectiveness of balance training and strengthening exercise on pain and functional performance among the athletes with ankle sprain.

### Materials and Method

It was an experimental study conducted on 50 subjects with ankle sprain age between 15-25 years was taken from ortho speciality Neha clinic. Convenient sampling with a random allocation method was used in this study.

#### Inclusion criteria:

- Both men and women
- Age group 15-25 years
- VAS Score between 5-10
- FAAM score between 30-70%
- Sports person with the ankle sprain grade 2 and 3
- Subjects willing to participate in study

#### Exclusion criteria:

- Recent lower extremity fractures
- Previous ankle injury`
- Neurological impairment
- History of Diabetes

#### Outcome measures

Assessment was done before starting treatment and after 4 weeks of study.

##### • Visual Analog Scale

This scale has been determined to be one of the one of the most accurate pain outcome measures available. A straight line was drawn on the evaluation sheet with a 0 at the start and a 10 at the end, and the patients were asked to mark on the line based on the impression of pain, with 0 indicating "no pain" and 10 indicating "worst imaginable pain"<sup>20</sup>.

##### • Foot and Ankle Ability measure

To evaluate the subject's physical function with ankle and foot related impairment, the FAAM was used. The FAAM consists of eight items, each of which is scored from 0 to 4, with a score of 0 denoting "unable to do" and a score of 4 denoting "no difficulty at all". A final score can be determined by combining all of the points together divided by the maximum higher potential score multiplied by 100. The maximum highest potential score on the test is 32, and it can be expressed as a raw number. The patient may have reported more disability if the score was lower<sup>21</sup>.

#### Procedure

Total of 50 participants were selected according to inclusion and exclusion criteria and the participants were explained about treatment safety and simplicity of the procedure and written consent was obtained.

Subjects willing to participate were randomly allocated into two groups: balance training group (N=25) and strengthening exercise groups (N=25). All the subjects underwent pretest measurement with the VAS and FAAM and the same repeated for post test at the end of 4 weeks. The participants were treated for four weeks. The study duration from October 2022 to July 2023.

## Balance training group

Subjects treated with the ultrasound for the first two weeks followed by balance training from the second week, the following training is performed.

### 1. Single leg stance (open and closed eyes)

Ask the patient to stand barefoot and instruct them to stand on one leg unassisted.

### 2. Single leg stance with the movement (open and closed eyes)

#### a) arms out for 30 secs on hard surface

Ask the patient to stand on one leg unassisted and instruct them to open the arms away from the body and hold it for 30 secs.

#### b) arms across the chest for 30-60 secs (open and closed eyes)

Ask the patient to stand on one leg unassisted and instruct them to fold the hand across the chest and hold it for 30 -60 secs.

### 3. single leg step down

Ask the patient to stand on the corner of the steps on the side ways and instruct them slowly down the one leg like the step down by placing the one leg on the same place.

### 4. Tandem standing

Ask the patient to stand on hard surface and instruct the patient to place one leg behind the other in the same line.

### 5. Heel and toe walking

#### Heel walking

ask the patient to stand and instruct them to stand on the heel and walk without any assistance as you can.

#### Toe walking

Ask the patient to stand and instruct them to stand on their toes and walk without any assistance as you can.

## Strengthening exercise group

Ultrasound was given to the patient for initial two weeks followed by strengthening exercise from the second week. The following exercise are performed:

### 1. Inversion isometric exercise:

Ask the patient to stand near the fixed object such as couch or table and instruct them to push against the object "down and inwards". Hold the position for 10 counts and repeat for 10 times.

### 2. Eversion isometric exercise:

Ask the patient to stand near the fixed object such as couch or table and instruct them to push against the object "up and outward". Hold the position for 10 counts and repeat for 10 times.

### 3. Flexion isotonic exercise

A resistance band is used. Ask the patient to sit on the couch with the leg extended resistance band wrap around the foot. Instruct the patient to pull the foot upward against the resistance. Repeat for 10 times.

### 4. Extension isotonic exercise

The resistance band is used. The resistance band is wrapped around the foot. Instruct the patient to push the foot downward against the resistance.

### 5. Inversion isotonic exercise

A resistance band is used . Ask the patient to sit on the couch with the leg extended. The resistance band is wrapped around the foot. Ask the patient to move the foot "down and inward" against the resistance.

### 6. Eversion isotonic exercise

The resistance band is used to ask the patient to sit on the chair, tie the resistance band on the fixed object and wrap the band on the foot. Instruct the patient to move the foot up and downward against the resistance.

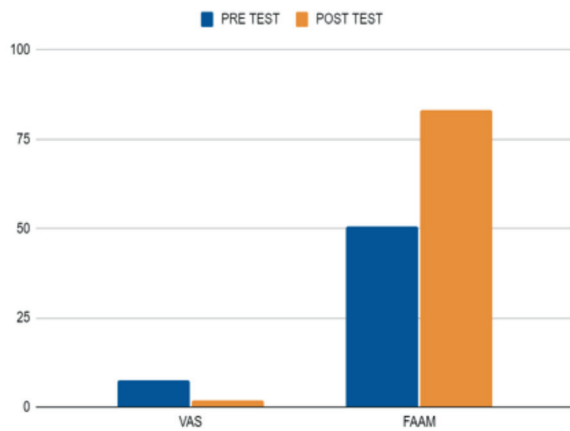
### 7. Calf raise:

Ask the patient to stand on the floor and instruct them to slowly raise the heel away from the floor and then land. Repeat for 10 times.

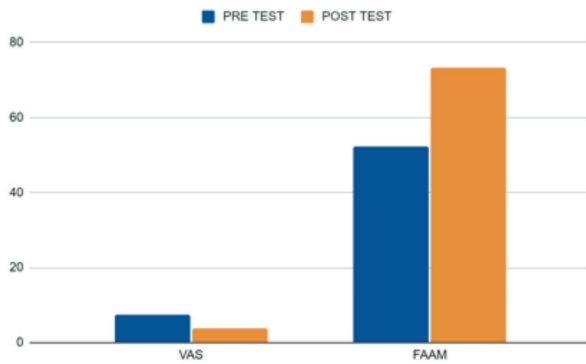
### 8. Towel curls:

Ask the patient to sit comfortably on the chair by placing the foot on the floor. Instruct the patient to place the towel under the foot and instructed to curl the toes to grip the towel and lift off the ground. Hold it for 5 seconds. Repeat for 10 times.

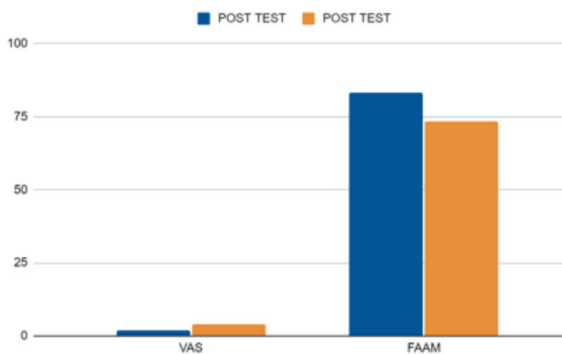
**Data analysis**



**Graph- 1 Comparison of Pre and post-test values of VAS and FAAM in balance training group**



**Graph - 2 comparison of pre-test and post-test values of VAS and FAAM in strengthening exercise groups.**



**Graph - 3 comparison of post test values of VAS and FAAM in both groups.**

**Result**

The FAAM post test mean value in the strengthening group was 73.32(+7.09), while it was

83.04(+8.13) in the balance group. This indicates that the balance group FAAM score was significantly higher than the strengthening group with  $P < 0.0001$ .

The balance group VAS post-test value was 2.04(+1.34), whereas the strengthening group was 3.84(+1.18). This indicates the balance group VAS was significantly higher than the strengthening group with the  $P < 0.0001$ .

Statistical analysis of the VAS and FAAM post-test values revealed that the balance training group and strengthening group showed similar statistically significant differences. As a result, the balance training group exceeds the strengthening group statistically.

**Discussion**

The goal of the study is to compare the effectiveness of balance training strengthening exercise on pain and functional performance among the athletes with ankle sprain. It also assess the effectiveness in terms of reducing pain and improving functional performance. This comparison is demonstrated with a duration of 4 weeks. The outcome result was measured by VAS and FAAM before and after treatment. Beneficial effects were significantly greater in balance training than the strengthening exercise. When the responses were compared between both groups, the result showed a significant difference in the balance training group than the strengthening exercise group. In strengthening exercise group pre-intervention mean of FAAM was 52.12(+10.02) and VAS was 7.5(+1.74). where; after treating the subject with strengthening exercise, the mean value of VAS is decreased to 3.84(+1.18) where; as FAAM was increased to 73.32(7.09), which shows statistically significant difference between the groups. In the balance training group pre-intervention mean of FAAM was 50.64 (+11.01) and VAS was 7.5(+1.74). After treating the subject with balance training exercise, the mean value of is VAS decreased to 2.04(+1.34) where; as the FAAM was increased to 83.04(+8.13), which shows statistically significant difference between the groups. Based on the statistical analysis, both groups showed improvement in VAS and FAAM. However, subjects in balance training groups who received balance training exercise showed better improvement in VAS and FAAM

than the subjects in the strengthening groups who received strengthening exercise. AN early study by McKeon PO, Ingersoll CD, et.al., (2008) conducted the randomized control trial on does the balance training improve function and postural control in those with chronic ankle instability concludes that functional performance and static postural balance are increased after the prolonged balance training programme done in the various of directions <sup>6</sup>. An early study by Rivera MJ, Winkelmann ZK, et.al., (2017) conducted the study an evidence based review concludes that proprioceptive training has more beneficial effects and reduces the risk of further impairment or worsening condition on the patient with the previous ankle sprain during physical functioning <sup>7</sup>. An early study by Maxwell et.al., (1992) therapeutic ultrasound its effect on the cellular and molecular mechanism of inflammation and repair concludes that the ultrasound may increase or decrease the healing mechanism depending on the various influences and its significance <sup>8</sup>. An early study by Ivins D, et.al., (2006) conducted the study concludes that using of supportive devices may helpful in the protection of the recurrent of the ankle sprain. The proprioceptive exercise may also be helpful <sup>9</sup>. An early study by Verhagen EA, et al., (2013) a review of study concludes that the ultrasound is helpful in the overall improvement by reducing the pain and able weight bear in the involved leg with the acute ankle joint <sup>14</sup>. An early study by van den Bekerom et al., (2011) cochrane database systematic review states that the ultrasound has little more beneficial effect over the acute ankle sprain <sup>15</sup>.

### Conclusion

According to the study, balance training and strengthening exercise both reduce pain and improve functional performance. The findings suggest that the balance training exercise is more beneficial than strengthening exercise in lowering pain and enhancing functional performance in athletes with ankle sprain.

**Ethical clearance:** The research work has been approved by the ISRB Committee. (Application No: 03/053/2022/ISRB/SR/SCPT)

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**Conflict of interest:** Nil

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