

# A CROSS SECTIONAL STUDY TO RULE OUT EFFECT OF CONVENTIONAL PHYSIOTHERAPY FOR POST-OPERATIVE DELTOID RECONSTRUCTION IN YOUNG ADULTS

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**BACKGROUND:** Deltoid ligament which is located on the medial side of the ankle joint is often associated with ligament rupture in the ankle injury. Isolated deltoid ligament lesions is accounting for nearly 5 to 15% of ankle sprains in the active population. The principles of protection, rest, ice, compression and elevation (PRICE) are used in the initial therapy of ankle sprain. Heating modalities, mobilization, strengthening, stretching and gait training constitute the main treatment approaches in conventional physiotherapy.

**AIMS AND OBJECTIVES:** To evaluate the effectiveness of conventional physiotherapy on post-operative deltoid ligament reconstruction in young adult patients.

**METHODOLOGY:** The sample consisted of 40 patients who underwent deltoid ligament reconstruction, aged between 18 years to 26 years, randomly assigned as per inclusion and exclusion criteria to either in group A ie. experimental (n = 20) or group B ie. control (n = 20) group. Both groups attended 16 weekly, 45 minutes sessions at least 5 days each week. Participants in the group A received conventional physiotherapy and Group B received no physiotherapy treatment. At pre and post-test, measures were collected for pain, stiffness, disability and functional limitations. Pain and disability was measured by foot and ankle disability index (FADI) and functional limitation was assessed by lower extremity functional scale (LEFS).

**RESULT:** The mean age of subjects in group A was  $22.60 \pm 0.57$  and in the group B was  $21.90 \pm 0.55$ . The pre-test and post-test values of foot and ankle disability index (FADI) were 61.10 and 114.50 for group A and 65.15 and 96.90 for group B and mean improvement was 53.40 in Group A and 31.75 in Group B. The pre-test and post-test values of lower extremity functional scale (LEFS) were 46.70 and 71.80 for group A and 49.50 and 60.60 for group B and mean improvement was 25.10 in Group A and 11.10 in Group B. The post-test mean difference for pain and disability scores between both groups was 17.60, which was significant and for lower limb functions were 11.20, which was significant. The study resulted that group A treated with conventional physiotherapy showed significant effects on reducing foot and ankle pain, stiffness, disability and improving lower limb functions on post-operative deltoid ligament reconstruction in young adult patients.

**CONCLUSION:** The study concluded that conventional physiotherapy protocol was effective treatment for improving pain and disability of foot and ankle as well as lower extremity functions in post operative deltoid reconstruction of young adults.

## INTRODUCTION

Ankle sprains are a common musculoskeletal injury in highly active and non-active populations. Ankle sprains are most common in sports including sprinting, cutting, and jumping such as basketball, volleyball, football and soccer.<sup>1</sup> Deltoid ligament which is located on the medial side of the ankle joint is often associated with ligament rupture in the ankle injury. Deltoid ligament injury could result in oblique displacement of joints, thus lead to the change of joint mechanics, causing joint stability decreased.<sup>2</sup>

Isolated deltoid ligament lesions is accounting for nearly 5 to 15% of ankle sprains in the active population. The reported incidence of deltoid ligament tears in patients with ankle fracture is 40% and 58% on arthroscopy and magnetic resonance imaging, respectively. MRI findings of focal detachment of the superficial deltoid origin or detachment of the fascial sleeve of the medial malleolus yielded sensitivity for superficial deltoid ligament tears of 83.3% and specificity of 93.9%. MRI findings of discontinuity or nonvisualization of discrete fibers yielded sensitivity for deep deltoid ligament tears of 96.3% and specificity of 97.9%.<sup>3</sup>

The main findings of the meta-analysis demonstrated a higher incidence of ankle sprain in females compared with males (13.6 vs 6.94 per 1,000 exposures), in children compared with adolescents (2.85 vs 1.94 per 1,000 exposures) and adolescents compared with adults (1.94 vs 0.72 per 1,000 exposures). Isolated deltoid ligament lesions, accounting for nearly 5 to 15% of ankle sprains in the active population.<sup>4</sup>

Ankle sprains are most common in accidents and sports including sprinting, cutting and jumping, such as basketball, volleyball, football and soccer. In the first two weeks after a sprain, mechanical instability in the ankle usually causes functional disability and pain. Despite the severity of mechanical instability, functional disability and pain remain for more than two weeks in several instances. If the mechanical instability of the ankle is not treated correctly and promptly, the ankle sprain can recur. Due to lost productivity and work time, ankle sprains place a high economic cost on society especially in young adults.<sup>5</sup>

The deltoid ligament is a complex structure that spans from the medial malleolus to the navicular, talus and calcaneus. It is primarily responsible for stabilizing the medial side of the ankle and its functions are to limit anterior, posterior and lateral translation of the talus and to restrain talar abduction at the talocrural joint. Specifically, the superficial deltoid resists eversion of the hindfoot and the deep deltoid is the primary restraint to external rotation of the talus. Deltoid ligament located in the medial ankle and its main function is to limit the anteroposterior translation of the talus which plays a key role in the maintenance of stability of the ankle and its medial structure. Meanwhile, the deltoid ligament had greater effects on the plantar flexion than dorsiflexion as both the lateral and medial ligaments work on keeping the inside and outside balance of joints in the glenoid fossa. The main stress loaded by the ankle joint is weight-bearing and twist, so the stability of ankle joint is crucial for the maintenance of its weight-bearing and motor function.<sup>6</sup>

The deltoid ligament is a strong multi banded complex of various components and an important medial stabilizer of the ankle. The deltoid ligament (medial ligament of talocrural joint) is a strong, flat, triangular band, attached above to the apex and anterior and posterior borders of the medial malleolus.<sup>7</sup>

The deltoid ligament is a fan- shaped and composed of 4 fibers namely; anterior tibiotalar ligament, tibiocalcaneal ligament, posterior tibiotalar ligament and tibionavicular ligament.<sup>8</sup>

It consists of two sets of fibers, superficial and deep. It has vertical superficial layer and a short and more horizontal deep layer.<sup>8</sup>

Superficial fibers:

The superficial part consists of the tibionavicular ligament anteriorly, the tibiocalcaneal ligament in the middle (originating 1 to 2 cm above the tip of the medial malleolus and inserting into the sustentaculum tali of the calcaneus), and the superficial tibiotalar ligament posteriorly. The horizontal deep layer of the deltoid ligament consists of the strong anterior and posterior tibiotalar ligaments.<sup>8</sup>

The primary functions of the deltoid ligament are as follows:

- To provide medial stability to the tibiotalar joint by providing a firm fixation between the tibia and talus.
- To prevent the talus shifting into a valgus position, or to move anterolaterally, or to externally rotate.
- To transfer force between the tibia and tarsus.
- The broad insertion of the superficial deltoid ligament on the spring ligament also plays a key role in the stabilising function of the medial ligaments.
- The superficial layers of the deltoid ligament particularly limit the talar abduction, while the deep layers limit the external rotation.
- To prevent the talus shifting more than 2mm laterally, even if the lateral structures are not in place.
- The anterior tibiotalar ligament together with the anterior talofibular ligament on the lateral side is thought to restrict forward translation of the talus.
- The posterior tibiotalar ligament restricts internal rotation of the talus solely by means of its deep fibers.
- This spring ligament complex supports the talar head medially and stabilises the entire talocalcaneonavicular joint.<sup>8,9</sup>

Medial ankle stability is provided by the strong deltoid ligament, the anterior tibiofibular ligament and the bony mortise. Because of the bony articulation between the medial malleolus and the talus, medial ankle sprains are less common than lateral sprains. In medial ankle sprains, the mechanism of injury is excessive eversion and dorsiflexion.<sup>10</sup>

Isolated deltoid ligament injuries are extremely rare and usually occur in combination with fractures of the lateral malleolus. These are treated by recognising the injury complex and stabilising the lateral side, being sure that the mortise is reduced.<sup>11</sup>

### PROCEDURE

After collecting the written consent form the patients selected by inclusion and exclusion criteria, they were divided into two groups - group A and group B. Group A was experimental group and treated with Conventional Physiotherapy and Group B was control group and was not treated by any Physiotherapy treatment.

The demographic and clinical data was collected from each patient at the beginning of the study as pre-test data and after sixteen weeks as post-test data. Conventional Physiotherapy was demonstrated and given to group A for 45 minutes per day, 5 days in a week for 16 weeks and no post operative Physiotherapy treatment given to group B.

All the pre and post-test data of outcome measures was kept safely for analyzing and interpretation of results.

#### GROUP A: CONVENTIONAL PHYSIOTHERAPY <sup>81,82,83</sup>

<p><b>Phase I: Weeks 1-2</b></p> <p><b>Guidelines</b></p> <ul style="list-style-type: none"> <li>• PWB (partial weight bearing) to FWB (full weight bearing) in cast.</li> <li>• Sutures removed at 10 -16 days. Back into a cast for another 4 weeks.</li> <li>• Education: surgery, healing time, anatomy, rehab phases</li> <li>• Encourage Activities of daily living (ADL)</li> <li>• Rest and elevation to control swelling</li> <li>• Icing to control pain</li> </ul>	<ul style="list-style-type: none"> <li>- Toe flex/extension</li> <li>• Continue with: <ul style="list-style-type: none"> <li>◦ Core exercises – progress to standing exercises</li> <li>◦ Hip strength exercises</li> <li>◦ Knee strength exercises</li> </ul> </li> <li>• Manual mobilization to joints not part of ligament reconstruction</li> </ul> <p><b>Phase IV: Week 11-12</b></p> <p><b>Guidelines</b></p>
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<ul style="list-style-type: none"> <li>• Hip and knee active range of motion (AROM)</li> </ul> <p><b>Phase II: Weeks 3-6</b></p> <p><b>Guidelines</b></p> <ul style="list-style-type: none"> <li>• Weight bearing as tolerated with or without crutches</li> <li>• Massage for swelling</li> <li>• Elevation to control swelling</li> <li>• At 6 weeks: after being removed from the cast: begin gentle active range of motion (AROM) of ankle: PF (plantarflexion) / DF (dorsiflexion), eversion / inversion and toe flexion/extension.</li> <li>• Stationary bicycle.</li> <li>• Core exercises: <ul style="list-style-type: none"> <li>- Abdominal recruitment</li> <li>- Bridging on ball</li> <li>- Ball reach</li> <li>- Arm pulleys or theraband using diagonal patterns.</li> </ul> </li> <li>• Hip: active range of motion (AROM) - strength: clam, side lift, glut max, SLR (straight leg raise)</li> <li>• Knee: AROM - strength: SLR (straight leg raise), theraband press or leg machine</li> <li>• Stretching: gluteus maximus, gluteus medius, piriformis, rectus femoris, hamstrings</li> </ul> <p><b>Phase III: Weeks 7-10</b></p> <p><b>Guidelines</b></p> <ul style="list-style-type: none"> <li>• Will be provided with an ankle brace and can start rehabilitation</li> <li>• Stationary bicycle</li> <li>• Active Range of Motion: <ul style="list-style-type: none"> <li>- Begin inversion/eversion</li> <li>- Continue with ankle plantar flexion/Dorsiflexion</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• In regular shoe</li> <li>• Still wearing the ankle brace</li> <li>• Control swelling +/- pain with elevation or modalities as required</li> <li>• Active range of motion in weight bearing</li> <li>• Manual mobilization as required</li> <li>• Muscle stimulation - intrinsics - invertors/evertors if required</li> <li>• Gait training</li> <li>• Continue strengthening core, hips and knees</li> <li>• Proprioceptive training: single leg stance on even surface</li> </ul> <p><b>Phase V: Week 13-16</b></p> <p><b>Guidelines</b></p> <ul style="list-style-type: none"> <li>• Still to use the ankle brace for certain sport specific activities (ie: basketball)</li> <li>• Proprioceptive training: <ul style="list-style-type: none"> <li>- Single leg stance on even surface with resistance to arms or weight bearing leg</li> <li>- Double leg stance on wobble board/ Balance board (weight bearing).</li> <li>- Single leg weight bearing on wobble board/ Balance board with resistance to arms</li> </ul> </li> <li>• Strength: <ul style="list-style-type: none"> <li>- Toe raises, lunges, squats</li> <li>- Hopping, skipping, running at 14+ weeks.</li> </ul> </li> <li>• Work specific or activity specific training <ul style="list-style-type: none"> <li>• Plyometric training</li> </ul> </li> </ul>
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## RESULT AND DATA INTERPRETATION

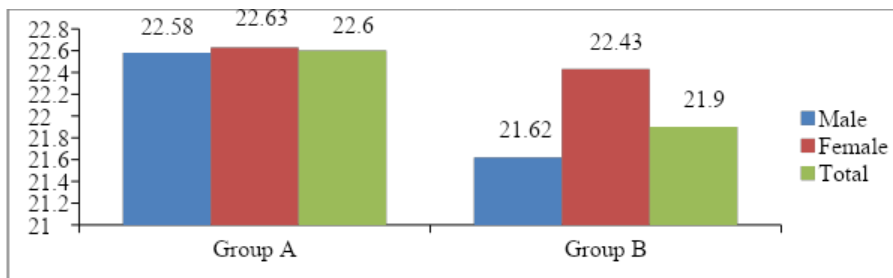
The cross-sectional study was carried out to rule out the effect of conventional physiotherapy for post operative deltoid reconstruction in young adults. The foot and ankle disability index (FADI) and lower extremity functional scale (LEFS) was used as outcome measures.

### 1. DEMOGRAPHIC PRESENTATION:

TABLE: 1

GROUPS	GENDER	NUMBER	MEAN AGE	TOTAL NUMBER	AGE IN YEARS	
					MEAN	SD
Group A	Male	12	22.58±0.82	20	22.60±0.57	2.56
	Female	8	22.63±0.80			
Group B	Male	13	21.62±0.68	20	21.90±0.55	2.47
	Female	7	22.43±1.00			
Total		40	22.25±0.40	40	22.25±0.40	2.51

### GRAPH: 1



**INTERPRETATION:**

The above table shows that Group A had a mean age of 22.60 years and Group B had a mean age of 21.90 years. The mean age of male and female patients in group A was 22.58 and 22.63 years, respectively. The mean age of male and female patients in group B was 21.62 and 22.43 years, respectively.

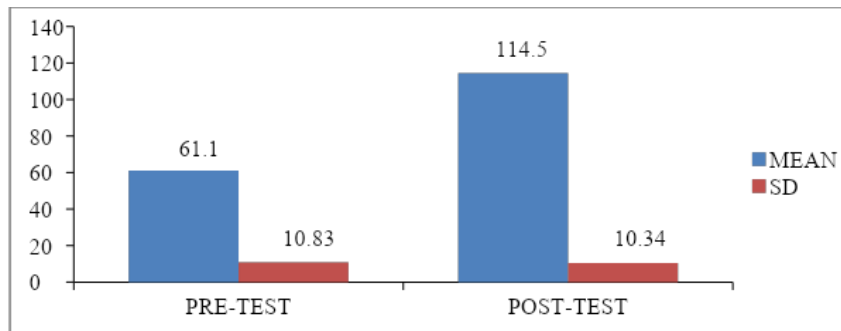
**2. FOOT AND ANKLE DISABILITY INDEX (FADI) – WITHIN GROUP A:**

**TABLE: 2**

	Mean	N	SD	SEM	Mean Diff	SD Diff	R	T	P
Pre-test	61.10	20	10.83	2.42					
Post-test	114.50	20	10.34	2.31	53.40	0.49	0.9092	52.657	<0.0001*

\* Significant difference (P<0.05)

**GRAPH: 2**



**INTERPRETATION:**

The above table shows the mean of pre-test and post – test values of foot and ankle disability index was 61.10 and 114.50, respectively. The mean improvement was 53.40. The ‘t’ value 52.657 and ‘P’ value <0.0001.

When compared to table value, the above ‘P’ value is lesser at P<0.05, which is extremely significant. It indicates that Group A treated with conventional physiotherapy had significant improvement in ankle and foot pain and disability within Group A.

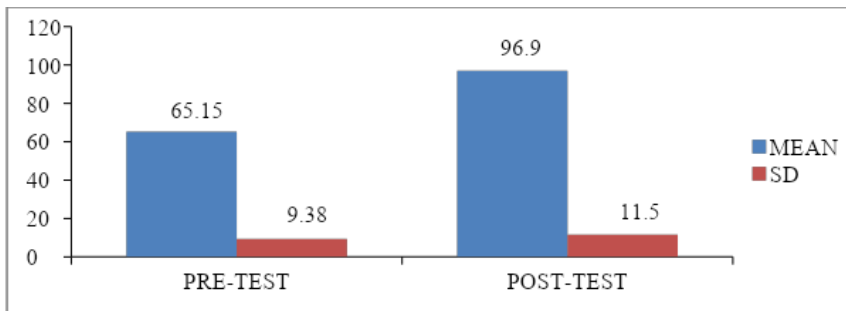
**3. FOOT AND ANKLE DISABILITY INDEX (FADI) – WITHIN GROUP B:**

**TABLE: 3**

	Mean	N	SD	SEM	Mean Diff	SD Diff	R	T	P
Pre-test	65.15	20	9.38	2.10					
Post-test	96.90	20	11.50	2.57	31.75	2.12	0.9341	32.814	0.0021*

\* Significant difference (P<0.05)

**GRAPH: 3**



**INTERPRETATION:**

The above table shows the mean of pre-test and post – test values of foot and ankle disability index was 65.15 and 96.90, respectively. The mean improvement was 31.75. The ‘t’ value 32.814 and ‘P’ value 0.0021.

When compared to table value, the above ‘P’ value is lesser at  $P < 0.05$ , which is highly significant. It indicates that Group B treated conservatively without physiotherapy also had significant improvement in foot and ankle pain and disability within Group B.

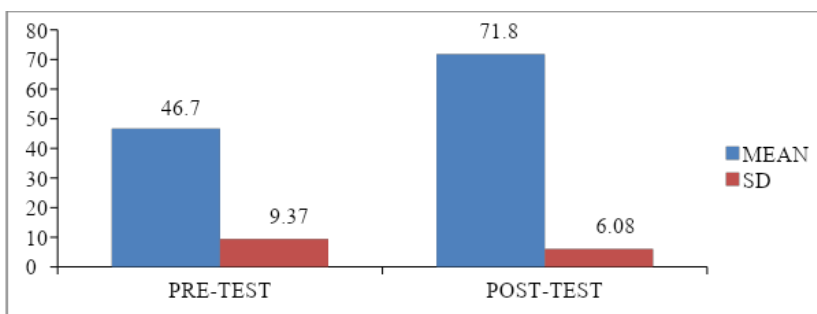
**4. LOWER EXTREMITY FUNCTIONAL SCALE (LEFS) – WITHIN GROUP A:**

**TABLE: 4**

	Mean	N	SD	SEM	Mean Diff	SD Diff	R	T	P
Pre-test	46.70	20	9.37	2.10	25.10	3.29	0.9133	24.656	<0.0001*
Post-test	71.80	20	6.08	1.36					

\* Significant difference ( $P < 0.05$ )

**GRAPH: 4**



**INTERPRETATION:**

The above table shows the mean of pre-test and post – test values of lower extremity functional scale was 46.70 and 71.80, respectively. The mean improvement was 25.10. The ‘t’ value 24.656 and ‘P’ value <0.0001.

When compared to table value, the above ‘P’ value is lesser at  $P < 0.05$ , which is extremely significant. It indicates that Group A treated with conventional physiotherapy had significant improvement in lower limb functions within Group A.

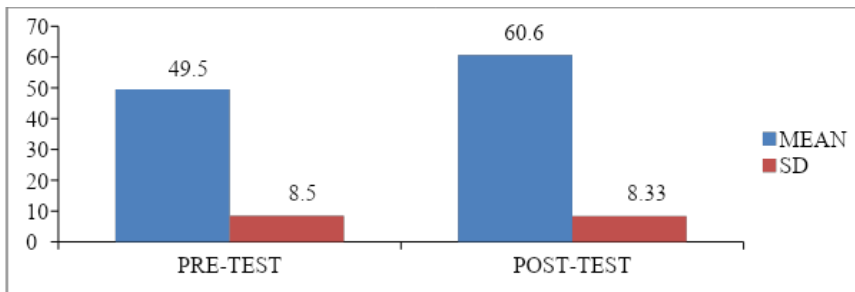
**5. LOWER EXTREMITY FUNCTIONAL INDEX (LEFS) – WITHIN GROUP B:**

**TABLE: 5**

	Mean	N	SD	SEM	Mean Diff	SD Diff	R	T	P
Pre-test	49.50	20	8.50	1.90	11.10	0.17	0.9572	20.108	0.0032*
Post-test	60.60	20	8.33	1.86					

\* Significant difference ( $P < 0.05$ )

**GRAPH: 5**



**INTERPRETATION:**

The above table shows the mean of pre-test and post – test values of lower extremity functional scale was 49.50 and 60.60, respectively. The mean improvement was 11.10. The ‘t’ value 20.108 and ‘p’ value 0.0032.

When compared to table value, the above ‘p’ value is lesser at  $p < 0.05$ , which is highly significant. It indicates that Group B treated conservatively without physiotherapy also had significant improvement in lower limb functions within Group B.

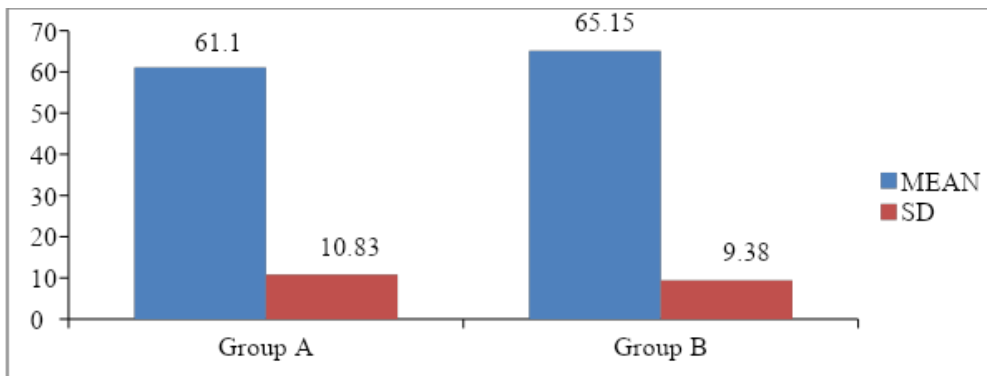
**6. FOOT AND ANKLE DISABILITY INDEX (FADI) – PRE-TEST SCORE BETWEEN GROUPS:**

**TABLE: 6**

Group	Mean	N	SD	SEM	Mean Diff	SD Diff	T	P
A	61.10	20	10.83	2.42	4.05	1.45	1.264	0.2138 <sup>NS</sup>
B	65.15	20	09.38	2.10				

<sup>NS</sup>Non-Significant difference ( $P < 0.05$ )

**GRAPH: 6**



**INTERPRETATION:**

The above table shows the mean of pre-test values of foot and ankle disability index was 61.10 and 65.15 in Group A and Group B, respectively. The mean difference was 4.05. The ‘t’ value 1.264 and ‘p’ value 0.2138.

When compared the table value, the above ‘p’ value is greater at  $p < 0.05$ , which is non-significant. It indicates the homogeneity in pre test values of both the groups.

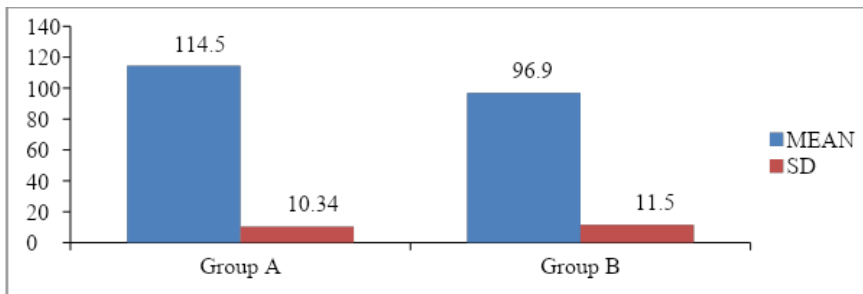
**7. FOOT AND ANKLE DISABILITY INDEX (FADI) – POST-TEST SCORE BETWEEN GROUPS:**

**TABLE: 7**

Group	Mean	N	SD	SEM	Mean Diff	SD Diff	T	P
A	114.50	20	10.34	2.31	17.60	1.16	5.088	0.0241*
B	96.90	20	11.50	2.57				

\*Significant difference ( $P < 0.05$ )

**GRAPH: 7**



**INTERPRETATION:**

The above table shows the mean of post-test values of foot and ankle disability index was 114.50 and 96.90 in Group A and Group B, respectively. The mean difference was 17.60. The ‘t’ value 5.088 and ‘p’ value 0.0241.

When compared the table value, the above ‘p’ value is lesser at  $p < 0.05$ , which was significant. The result showed that group A treated with conventional physiotherapy had superior effect on improving foot and ankle pain and disability than group B treated conservatively without physiotherapy protocol.

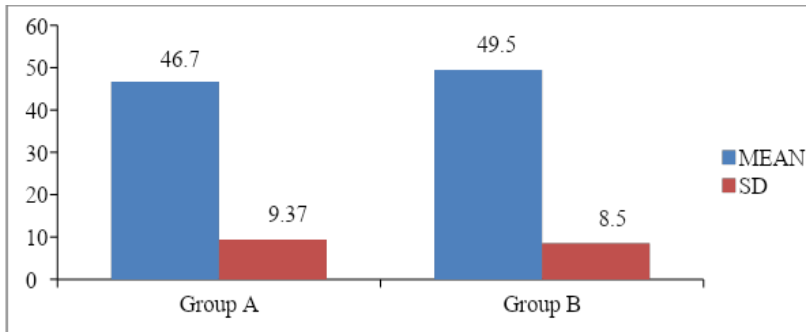
**8. LOWER EXTREMITY FUNCTIONAL SCALE (LEFS) – PRE-TEST SCORE BETWEEN GROUPS:**

**TABLE: 8**

Group	Mean	N	SD	SEM	Mean Diff	SD Diff	T	P
A	46.70	20	9.37	2.10	2.80	0.87	0.9898	0.3286 <sup>NS</sup>
B	49.50	20	8.50	1.90				

<sup>NS</sup>Non-Significant difference ( $P < 0.05$ )

**GRAPH: 8**



**INTERPRETATION:**

The above table shows the mean of pre-test values of lower extremity functional index was 46.70 and 49.50 in Group A and Group B, respectively. The mean difference was 2.80. The ‘t’ value 0.9898 and ‘P’ value 0.3286.

When compared the table value, the above ‘p’ value is greater at  $p < 0.05$ , which is non-significant. It indicates the homogeneity in pre test values of both the groups.

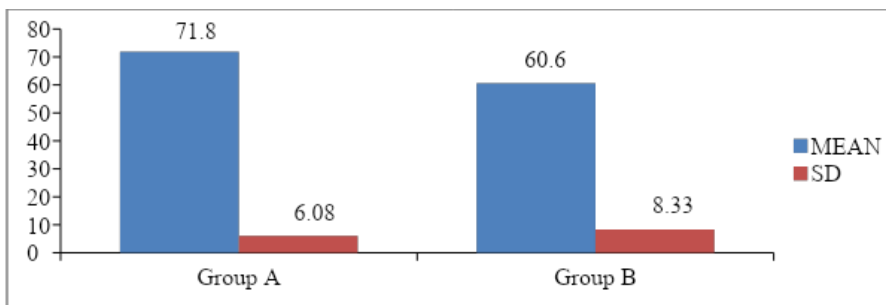
**9. LOWER EXTREMITY FUNCTIONAL SCALE (LEFS) – POST-TEST SCORE BETWEEN GROUPS:**

**TABLE: 9**

Group	Mean	N	SD	SEM	Mean Diff	SD Diff	T	P
A	71.80	20	6.08	1.36	11.20	2.25	4.858	0.0003*
B	60.60	20	8.33	1.86				

\*Significant difference ( $P < 0.05$ )

**GRAPH: 9**



**INTERPRETATION:**

The above table shows the mean of post-test values of lower extremity functional scale was 71.80 and 60.60 in Group A and Group B, respectively. The mean difference was 11.20. The ‘t’ value 4.858 and ‘p’ value 0.0003.

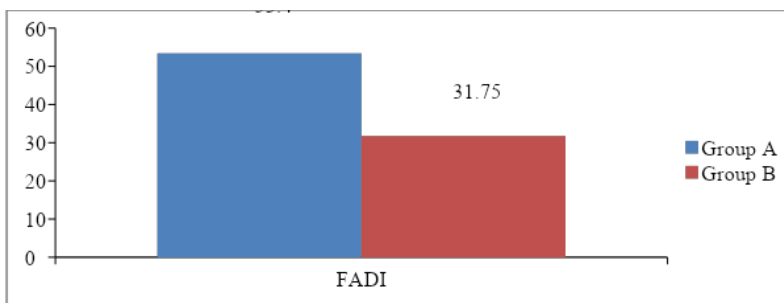
When compared the table value, the above ‘p’ value is lesser at  $p < 0.05$ , which was significant. The result showed that group A treated with conventional physiotherapy had superior effect on improving lower extremity functions than group B treated conservatively without physiotherapy protocol.

**10. MEAN IMPROVEMENT BETWEEN GROUPS – FOOT AND ANKLE DISABILITY INDEX (FADI):**

**TABLE: 10**

OUTCOME MEASURE	GROUP A	GROUP B
Foot and Ankle Disability Index (FADI)	53.40	31.75

**GRAPH: 10**



**INTERPRETATION:**

The above table shows that the mean improvement in foot and ankle disability index score was 53.40 in Group A and 31.75 in Group B. Both groups showed improvement in foot and ankle pain and disability. Hence, both conventional physiotherapy and conservative treatment without conventional physiotherapy were effective on pain and disability parameters of deltoid ligament reconstruction.

The mean difference in foot and ankle pain and disability improvement between both groups was 21.65. Thus, Group A treated with conventional physiotherapy showed more improvement in foot and ankle pain and disability.

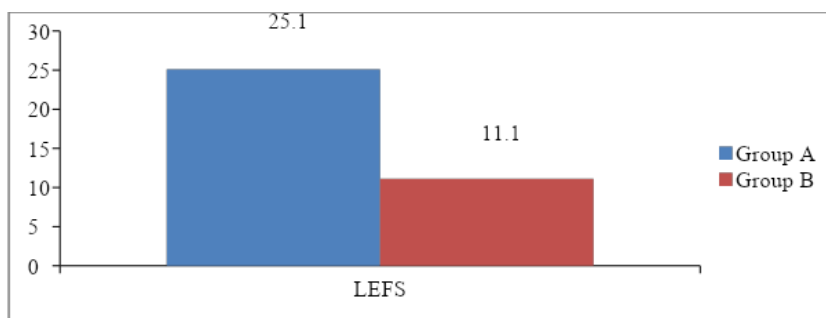
**11. MEAN IMPROVEMENT BETWEEN GROUPS – LOWER EXTREMITY FUNCTIONAL SCALE (LEFS):**

**TABLE: 11**

OUTCOME MEASURE	GROUP A	GROUP B
Lower Extremity Functional Scale (LEFS)	25.10	11.10

**GRAPH: 11**





### INTERPRETATION:

The above table shows that the mean improvement in lower extremity functional scale scores was 25.10 in Group A and 11.10 in Group B. Both groups showed improvement in lower limb functions. Hence, both conventional physiotherapy and conservative treatment without conventional physiotherapy were effective on lower limb functional parameters of deltoid ligament reconstruction.

The mean difference in improvement of lower extremity functional scale scores between both groups was 14.00. It showed that group A treated with conventional physiotherapy showed more improvement in lower limb functions.

### 12. RESULT OF THE STUDY:

The present study resulted that both groups showed significant effect of treatments within group were effective on foot and ankle pain and disability and improve lower limb functions in post-operative deltoid ligament reconstruction. On comparison of both groups, conventional physiotherapy were extremely effective in reducing foot and ankle pain and disability as well as improving lower limb functions on young adults undergo deltoid ligament reconstruction.

### DISCUSSION

The present cross-sectional study was done to rule out effect of conventional physiotherapy for post operative deltoid reconstruction in young adults. This study was done to compare two groups for the significant difference.

In present study, total 40 young individuals with deltoid ligament reconstruction were randomly selected according to inclusion and exclusion criteria and divided into two groups - Group A and Group B. Group A had 12 male and 8 female and group B had 13 male 7 female participants. Group A received conventional physiotherapy and group B received post-operative conservative treatment without physiotherapy. The duration of the study was sixteen weeks. The foot and ankle disability index (FADI) and lower extremity functional scale (LEFS) was used as outcome measures. The pain and disability score was assessed by foot and ankle disability index (FADI) and lower limb functional score was assessed by lower extremity functional scale (LEFS). Pre-test data were collected at the beginning of the study and post-test data were collected at the end of 16<sup>th</sup> week. The data were statistically analysed and compared both groups. Mean, standard deviation, paired and unpaired “t” test was used for data analysis. The differences between pre-test and post-test values were found. Paired ‘t’ test was performed to analyze the efficacy of treatment within the groups and unpaired ‘t’ test was performed to analyze the efficacy of treatment between both groups. An alpha level of  $p < 0.05$  was the level of significance for the test. The accurate level of significance was analyzed and interpreted from ‘t’ values. The result of study showed significant improvement in pain, disability and functional status of both the groups, but group A treated with conventional physiotherapy showed greater improvement as well as high degree of consistency with ‘t’ values than group B treated conservatively without physiotherapy. In this study, Group A had a mean age of 22.60 years and Group B had a mean age of 21.90 years. The mean age of male and female patients in group A was 22.58 and 22.63 years, respectively. The mean age of male and female patients in group B was 21.62 and 22.43 years, respectively.

### WITHIN GROUPS:

In present study, group A and B both showed improvement in pain, disability and lower limb functional ability. but group A treated with conventional physiotherapy was far superior to group B treated conservatively without any physiotherapy treatment.

The group A showed extremely significant improvement in pain and disability assessed by foot and ankle disability index (FADI) with 61.10 and 114.50 pre and post-test scores, respectively. The mean improvement was 53.40. The result showed extremely significant improvement in pain and disability within group A. The group A also showed extremely significant improvement in lower limb functions assessed by lower extremity functional scale (LEFS) with pre and post-test score 46.70 and 71.80, respectively. The mean improvement was 25.10. The result showed extremely significant improvement in lower limb functions within group A.

The group B also showed significant improvement in pain and disability assessed by foot and ankle disability index (FADI) with 65.15 and 96.90, pre and post-test scores, respectively. The mean improvement was 31.75. The result showed significant improvement in pain and disability within group B. The group B also showed significant improvement in lower limb functions assessed by lower extremity functional scale (LEFS) with pre and post-test score 49.50 and 60.60, respectively. The mean improvement was 11.10. The result showed significant improvement in lower limb functions within group B.

The result of the present study advocated that group A and B both showed improvement in pain, disability and lower limb functional ability within groups but group A treated with conventional physiotherapy was far superior to group B treated conservatively without any physiotherapy treatment.

In the present study group A showed a significant reduction of pain and improvement of ankle dorsiflexion and function in subjects with post-operative deltoid ligament reconstruction. In line with this finding, Gogate et al. (2021)<sup>86</sup> stated that the application of mobilization with movement and exercise therapy tends to boost clinical and speedy improvement in pain, disability, range of motion and functions. Nguyen et al. (2021)<sup>87</sup> concluded that most (84%) of patients with dorsiflexion range of motion deficit after subacute lateral ankle sprain had responded well to the mobilization and exercises. The mobilization and movements applied to the fibula and its biomechanical effect might be responsible for improving range of motion and hypoalgesic effects, causing pain relief and improve functions.<sup>88</sup> The mechanical hypoalgesia from mobilization with movements and other exercises and modalities proposed a potential role of central mechanisms related to the non-opioid mediated descending pain inhibitory system activation, variation in muscle activation and behavioral mechanisms. Exercise therapy concentrating on neuromuscular and proprioceptive exercise and joint mobilization decreases pain and improves range of motion in treating deloid ligament sprain and post-operative cases of deltoid ligament reconstruction.<sup>89</sup>

#### **BETWEEN GROUPS:**

The present study showed no significant difference in pre-test values between both the groups but post test values of foot and ankle disability index (FADI) and lower extremity functional scale (LEFS) showed significant difference between both the groups.

The pre-test values of foot and ankle disability index (FADI) were 61.10 and 65.15 in group A and group B, respectively. The mean difference was 4.05. The study showed non-significant difference in pre-test values between both groups.

The post-test values of foot and ankle disability index (FADI) were 114.50 and 96.90 in group A and group B, respectively. The mean difference was 17.60. The study showed highly significant difference in post-test values of foot and ankle disability index (FADI) between both groups. When compared the values, the result of the study states that group A treated with conventional physiotherapy had superior effect on improving foot and ankle pain and disability than group B treated conservatively without physiotherapy.

The pre-test values of lower extremity functional scale (LEFS) were 46.70 and 49.50 in group A and group B, respectively. The mean difference was 2.80. The study showed non-significant difference in pre-test values between both groups.

The post-test values of lower extremity functional scale (LEFS) were 71.80 and 60.60 in group A and group B, respectively. The mean difference was 11.20. The study showed highly significant difference in post-test values of lower extremity functional scale (LEFS) between both groups. When compared the values, the result of the study states that group A treated with conventional physiotherapy had superior effect on improving lower limb functions than group B treated conservatively without physiotherapy.

In a comparison of both groups, it is inferred that there is a significant difference between the effect of conventional physiotherapy and no physiotherapy treatment on pain, ankle range of motion, disability and function in subjects with post-operative deltoid ligament reconstruction in young adults. After the sixteen weeks of treatment, conventional physiotherapy is found to be more effective than no physiotherapy treatment in reducing pain and improving ankle function and disability. This observed difference might be due to the biomechanical and hypoalgesic effects of modalities and exercises that alleviate pain and improve ankle function and dorsiflexion in the post-operative deltoid ligament reconstruction. Denegar et al. (2002)<sup>90</sup> found that mobilization with movement, stretching, strengthening and balance exercises showed better and long-term improvement in pain, functional dorsiflexion range of motion, balance and disability in people with an acute and subacute ankle sprain. Norouzi et al. (2021)<sup>91</sup> concluded that mobilization with movement was effective in reducing pain and improving range of motion in patients with ankle sprain due to reflex arc afferents and efferents interaction and active and passive mobilizing tensile forces.

#### **MEAN IMPROVEMENT BETWEEN GROUPS:**

The mean improvement in pre-test to post-test values of Foot and Ankle Disability Index was 53.40 in group A and 31.75 in group B. The mean improvement in foot and ankle pain and disability between both groups was 21.65. Thus, conventional physiotherapy showed more improvement in foot and ankle pain and disability than conservative treatment without physiotherapy on post operative deltoid reconstruction in young adults.

The mean improvement in pre-test to post-test values of lower extremity functional scale (LEFS) was 25.10 in group A and 11.10 in group B. The mean improvement in lower extremity functions between both groups was 14.00. Thus, conventional physiotherapy showed more improvement in lower extremity functions than conservative treatment without physiotherapy on post operative deltoid reconstruction in young adults.

The duration of the conventional physiotherapy for study was 16 weeks. Following the treatment duration, this group showed a significant reduction of pain and improvement of ankle mobility and function in subjects with the post-operative deltoid ligament reconstruction in young adults. In accord with this result, Mohd Salim et al. (2018)<sup>92</sup> observed that the standard physiotherapy program for one week decreased pain and increased ankle eversion to inversion ratio in grade I ankle sprain cases. The standard physiotherapy program comprised protection, optimal loading, ice, compression, elevation, stretching and balancing exercises. Further, neuromuscular training and balance exercises effectively manage muscle strength deficits. Strengthening exercises for weakened muscles are vital for a speedy recovery and such exercises prevent the recurrence of an ankle sprain. A static-stretching exercise showed a strong effect in improving ankle dorsiflexion following acute ankle sprains. Generally, stretching exercise is applied to regain full range of motion by aiming the calf muscles' flexibility. It might enhance flexibility prior to pain perception and permit the viscoelastic properties of muscle and tendon junctions to overcome the stretch reflex or raise the stretch tolerance.<sup>93</sup>

Hence, the result of the study stated that conventional physiotherapy was more effective treatment in improving pain and disability of foot and ankle as well as lower extremity functions than conservative treatment without physiotherapy on post operative deltoid reconstruction in young adults.

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