Effect of Maitland Mobilization and Mulligan's Mobilization with Dynamic Balance Exercise Combined with Conventional Physiotherapy in Subjects of Ankle Sprain

Dr. Vikash Kumar Dwivedi[1], Dr Swati Dubey[2], Prof (Dr) Mali Ram Sharma[3], Dr Kazi Juyef Islam[4]

PhD Scholar[1], Associate Professor JPTC MVGU[2], Principal & Professor, Jaipur Physiotherapy College MVGU[3],PhD Scholar MVGU Jaipur[4]

ABSTRACT

Background and Objective: Ankle sprains are among the most common musculoskeletal injuries that lead to pain and functional impairment. This study was aimed at assessing the effectiveness of Maitland mobilization and Mulligan's mobilization in conjunction with dynamic balance exercises compared with conventional physiotherapy in reducing pain and improving functional outcomes.

Methodology: A total of 30 subjects with diagnosed ankle sprains were randomly assigned to two groups. Group A (experimental) received Maitland mobilization, Mulligan's mobilization, and dynamic balance exercises, while Group B (control) underwent conventional physiotherapy, including RICE protocols and standard rehabilitation exercises.

Results: Group A presented a marked decline in mean VAS scores from 6.66 pre-intervention to 2 post-intervention (t-statistic = 9.09, $p < 0.0001$) and considerable improvement in FADI scores from 85.96 to 21.33 (t-statistic = 16.13, $p < 0.0001$). However, in Group B, the VAS scores actually decreased from 7.53 to 4.4 (t-statistic = 3.81, $p = 0.0019$), as did improvement in the FADI scores to decrease them to 30.66 from 83.73 (t-statistic = 13.14, $p < 0.0001$)..

Conclusions: These results support the incorporation of advanced mobilization techniques and dynamic exercises into rehabilitation protocols for the optimal recovery of patients suffering from ankle sprains. Further research with higher sample sizes and longer follow-up is recommended.

Keywords: Maitland mobilization, Mulligan mobilization, ankle sprain, dynamic balance exercises, pain reduction, functional outcomes, physiotherapy, rehabilitation, manual therapy, joint movement.

INTRODUCTION

An ankle sprain is caused by the overstretching or tearing of the ligaments supporting the ankle. It typically results from a sudden twist, fall, or impact that forces the ankle to roll or twist abnormally. The injury often occurs in any form of sports, uneven surfaces when walking, or during high-impact exercises. Symptoms of an ankle sprain typically include swelling, bruising, pain around the affected joint, and difficulty bearing weight or moving the ankle. There are three grades of sprains: a Grade I sprain consists of minor stretching and micro-tears in the ligaments; a Grade II sprain consists of a more severe tear with intermediate instability;

and a Grade III sprain consists of tearing of the ligament completely, therefore severe instability and the swelling. Diagnosis is usually established through physical examination and may also be supported with imaging tests like X-rays or MRIs if fractures are ruled out. Most treatments for ankle sprains often follow the R.I.C.E. protocol: Rest, Ice, Compression, and Elevation, along with some nonsteroidal anti-inflammatory medication for pain control. For severe conditions, a rehabilitative phase that may involve strengthening and restoring some degree of strength and mobility with physical therapy and, at times, the application of a brace or immobilization. Recovery time differs for different patients and ranges from a few days for the more minor injuries to weeks for those that are much worse. The ankle should be prevented from spraining by strengthening exercises, supportive footwear, and careful avoidance of activities that place the ankle at risk.

Maitland mobilization is a manual therapy technique used by physical therapists to assess and treat joint and soft tissue dysfunction. It was developed by an Australian physiotherapist, Geoffrey Maitland, who emphasizes the improvement of joint mobility and relief of pain through specific, graded movements. It then separates the techniques into grades, from I to IV, in which Grade I constitutes small amplitude movement within the primary range of motion with the objective of decreasing pain, and Grade II is large amplitude movements that never reach the extremities of the range of motion. Grades III and IV include larger movements at the resistance barrier and small movements at the end of the available range, respectively, both aimed at increasing the range of motion. The process starts with assessing the joint's range of motion and pain levels, which informs the selection of appropriate mobilization techniques tailored to each patient's specific needs. Maitland mobilization is generally recommended for patients with joint pain and stiffness, post-surgical recovery, and sports injuries, although the precise mechanisms by which this mobilization enhances joint function remain controversial. Such mechanisms may include increased circulation of synovial fluid, stretching of the joint capsule, and neurological modulation of pain. Where very effective for some patients, therapeutic techniques must therefore be applied appropriately by therapists: they are sometimes contraindicated in persons with inflammatory joint disease, severe degeneration, and acute injuries, and proper assessment skills and the corresponding training are key issues for the effective and safe utilization of Maitland mobilization.

Mulligan's mobilization, also referred to as the Mulligan Concept, is a manual therapy technique developed by New Zealand physiotherapist Brian Mulligan. It focuses on the mechanical treatment of musculoskeletal pain and dysfunction. One of the fundamental aspects of this approach is Mobilization with Movement (MWM), where the therapist applies a sustained mobilization force to a joint while guiding the patient through a specific movement. This combination helps realign joint mechanics, enhancing mobility and reducing pain during movement. Central to the Mulligan approach is the pain-free philosophy, which asserts that mobilization techniques should not induce pain; adjustments are made until movements can be performed comfortably. Patients are often taught self-mobilization techniques, empowering them to engage actively in their rehabilitation. Mulligan's mobilization can be applied to a wide range of conditions, including musculoskeletal pain (such as neck, back, shoulder, and knee pain), joint stiffness, sports injuries, and post-surgical rehabilitation. The treatment starts with an assessment to identify specific restrictions and pain patterns, so that the treatment can be tailored. This technique integrates movement with manual therapy to

improve joint range of motion, reduce pain, and enhance functional performance, with some studies supporting its effectiveness for various conditions. In summary, Mulligan's mobilization combines pain-free manual techniques with active movement to restore normal joint function and support rehabilitation efforts.

The aim of dynamic balance exercises is to enhance the capacity of an individual to maintain stability and control of the body during movement. Hence, dynamic balance exercises are indispensable for enhancing coordination, preventing falls, and ensuring better functional movement in athletes as well as elderly people. These exercises differ from static balance exercises, which typically involve holding a position without moving. Dynamic balance exercises involve movement that challenges the balance in several directions and at different speeds. Such examples include single-leg stand with movement, walking along a balance beam, lateral shuffle, catching or throwing a ball, step up and step down, and finally heel-to-toe walking. Probably one of the main reasons to perform these exercises is due to improved stability during dynamic balancing activities, therefore significantly reducing fall occurrences. These exercises also build coordination among limbs, increase ankle strength, the legs, and core, thereby giving more self-assurance when doing physical skills. They will help athletes maximize their performance by preventing injury risks. For those aged, stability and less probability of falling down is a better target, as well as rehab patients regaining their strength in relation to injuries or surgeries. They are also easily changed in terms of difficulty, which can be easily increased from the simplest movements up to more complicated ones, for example, putting weights or running. In conclusion, dynamic balance exercises are vital in functional training, enabling an individual to maintain stability, coordination, and strength while in motion.

Traditional physiotherapy, commonly known as conventional physiotherapy, is a set of techniques and methods aimed at restoring movement and function in individuals affected by injury, illness, or disability. This practice usually includes a comprehensive assessment of the patient's condition, followed by a tailored treatment plan that may include manual therapy, therapeutic exercises, electrotherapy, and education on posture and ergonomics. Pain can be relieved through manual therapy techniques like joint mobilization and soft tissue massage, enhancing circulation and mobility. Therapeutic exercises help in the strengthening of muscles, improving flexibility, and regaining functional movement patterns. Pain management can also be done using modalities like ultrasound, TENS, or application of heat or cold therapy. Education is the cornerstone of traditional physiotherapy, as it equips patients with knowledge regarding their condition and teaches them how to manage and prevent injuries. While the strategy may differ according to the needs and goals of the patient, traditional physiotherapy is the backbone of rehabilitation and is widely known for its efficacy in recovery and quality of life improvement among diverse patients.

METHODOLOGY

1. Study Design

Type: Experimental study (pre to post)

Duration: 6 weeks.

2. Participants

Inclusion Criteria:

- Adults aged 18-40 years.
- Diagnosis of grade I or II ankle sprain (based on clinical examination).
- Written informed consent to participate.

Exclusion Criteria:

- Previous ankle injury within the last 6 months.
- Neuromuscular or orthopedic conditions affecting balance or mobility.
- Surgery on the affected ankle.
- Inability to follow exercise protocols.

3. Sample Size- Total 30 subjects

4. Randomization

Randomize participants into two groups:

Group A: Maitland mobilization and Mulligan's mobilization with dynamic balance exercises.

Group B: Conventional physiotherapy (control group).

5. Intervention Protocol

Group A:

Maitland Mobilization: Specific mobilization techniques to the ankle joint, to be applied in grades I to II as appropriate.

Maitland Grade I–II Oscillatory Anterior-Posterior Talar Joint Mobilization

Useful in restoring motion back to the talocrural joint, especially with dorsoflexion and/or plantarflexion contraindications

Non-Weight Bearing Position

1. Place the patient supine or seated with the foot flexed over the side of the table.

- The tibia and fibula are stabilized by one hand while the other hand supports the talus.

2. Mobilization:

- Mobilizations are applied in an anterior-to-posterior direction to enhance dorsiflexion or posterior-to-anterior direction to enhance plantarflexion.

3. Technique:

- The therapist maintains oscillations sustained and rhythmic, thus keeping the patient comfortable as the joint's restrictive barrier is reached.

- Mobilizations are repeated for 10 reps for 3 sets, depending on the tolerance of the patient.

Weight Bearing (WB) Position:

1. Positioning:

- The patient should be made to stand in lunge position with the affected limb advanced forward and the knee somewhat flexed.

The foot should be positioned by the therapist on a support to maintain the alignment of tibia and talus.

2. Mobilization:

A talus will receive an anterior-to-posterior oscillatory glide through both hands, using both hands on an oscillating anterior to posterior way, while the patient sustains the lunge position.

- The therapist applies a controlled and rhythmic oscillatory motion using his body weight on the talus.

3. Facilitation

- The patient is assisted to lunge slightly deeper by the therapist and this is used to facilitate functional dorsiflexion in the weight-bearing position.

- Mobilizations are maintained for 10 reps for 3 sets

Mulligan's Mobilization: Mobilization with movement techniques application to regain function of the ankle

Mulligan's Mobilization with Movement (MWM):

This technique combines mobilizations into the joint by a manual provider with active or passive motion of the joint by a patient to enhance mobility with reduction in pain.

Non-Weight Bearing Position:

1. Positioning:

· The patient sits with a foot over the edge of the table.

· The therapist applies a long sustained posterior glide to the talus as the patient actively dorsiflexes and plantarflex their ankle.

2. TECHNIQUE

- The therapist maintains the glide throughout the movement, ensuring pain-free motion.

- The patient repeats 10 reps for 3 sets.

Weight Bearing (WB) Position:

1. Positioning:

- The patient stands in a lunge position, with the therapist stabilizing the talus from the anterior aspect.

- A sustained posterior glide is applied to the talus.

2. Technique:

- The patient performs a lunge forward (dorsiflexion movement). The therapist maintains the glide.

- The movements are repeated 10 reps for 3 sets with careful monitoring to ensure it causes no pain.

Dynamic Balance Exercise: Such activities include single limb stance on unstable surfaces, lateral hops and agility drills with a frequency of 2 to 3 sessions per week

Group B

Conventional Physiotherapy: This includes standard procedures like rest, ice, compression, elevation - RICE or even exercises with respect to movement range and muscle strengthening according to physiotherapist protocols

6. Outcome Measures

Pain. The assessment includes Visual Analog Scale - VAS.

Functional ability will be measured using the Ankle Function Score or the Foot and Ankle Ability Measure.

RESULTS

Table 1.0

AGE DISTRIBUTION IN SUBJECTS					
		GROUP A (EXPERIMENTAL GROUP)		GROUP B (CONTROL GROUP)	
S.No	Age in years	No	%	No	%
1	20-25	4	26.6	5	33.3
2	26-30	6	40	5	33.3
3	31-35	3	20	2	13.3
4	36-40	2	13.3	3	20
TOTAL		15	100%	15	100%
MEAN		3.75		3.75	
SD		1.479019946		1.299038106	

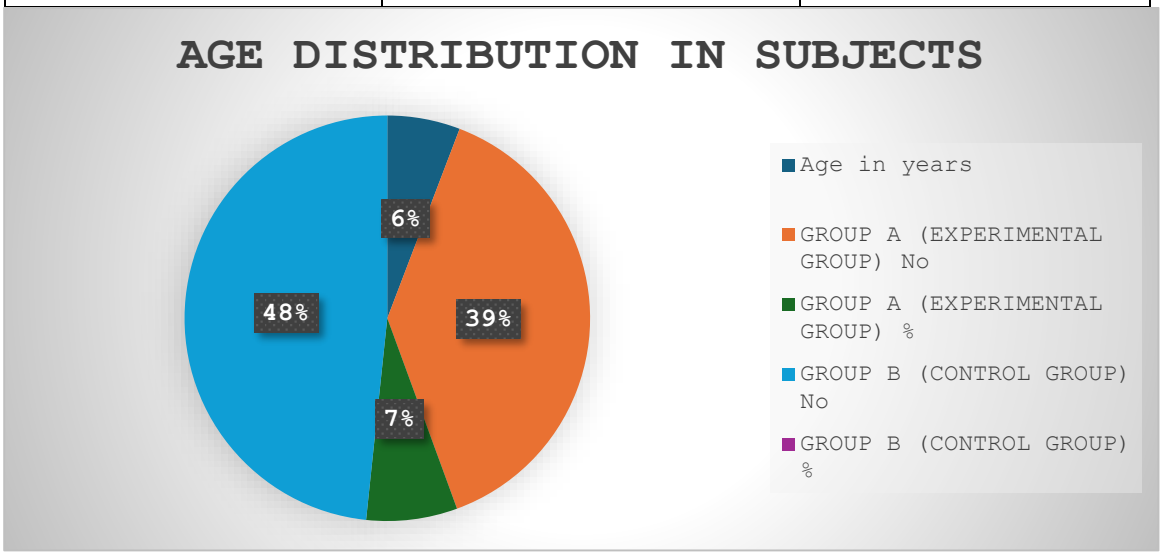
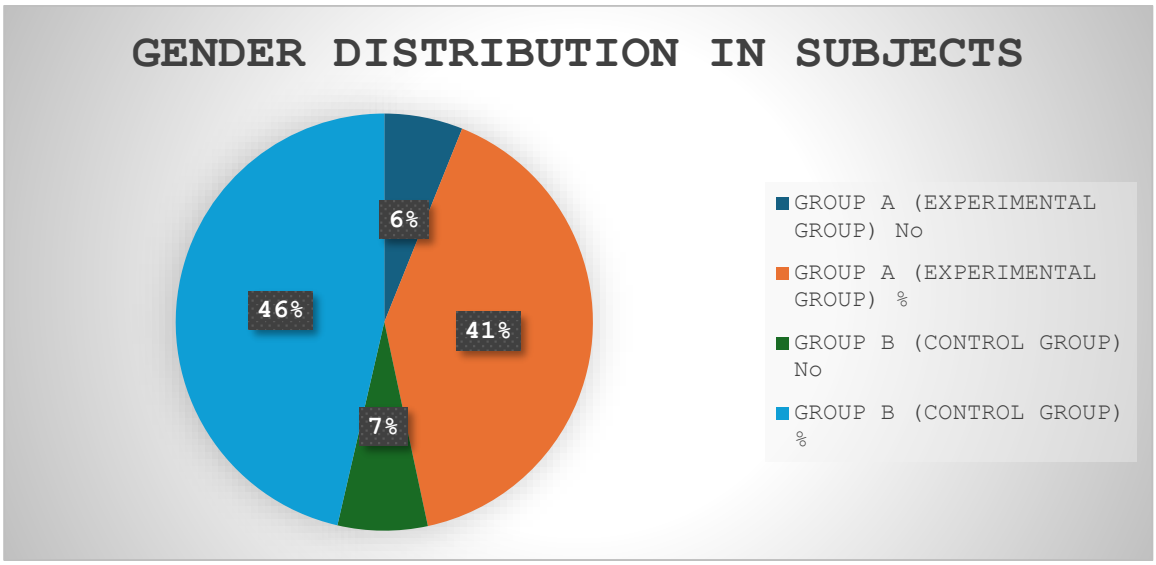
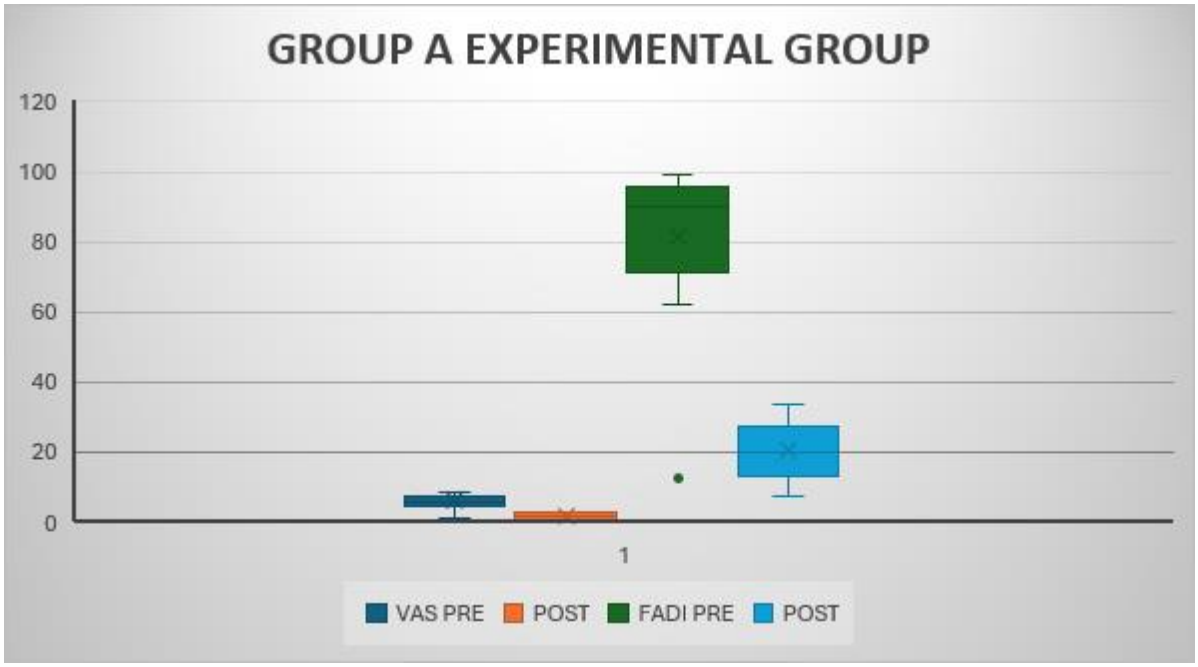


Table 2.0

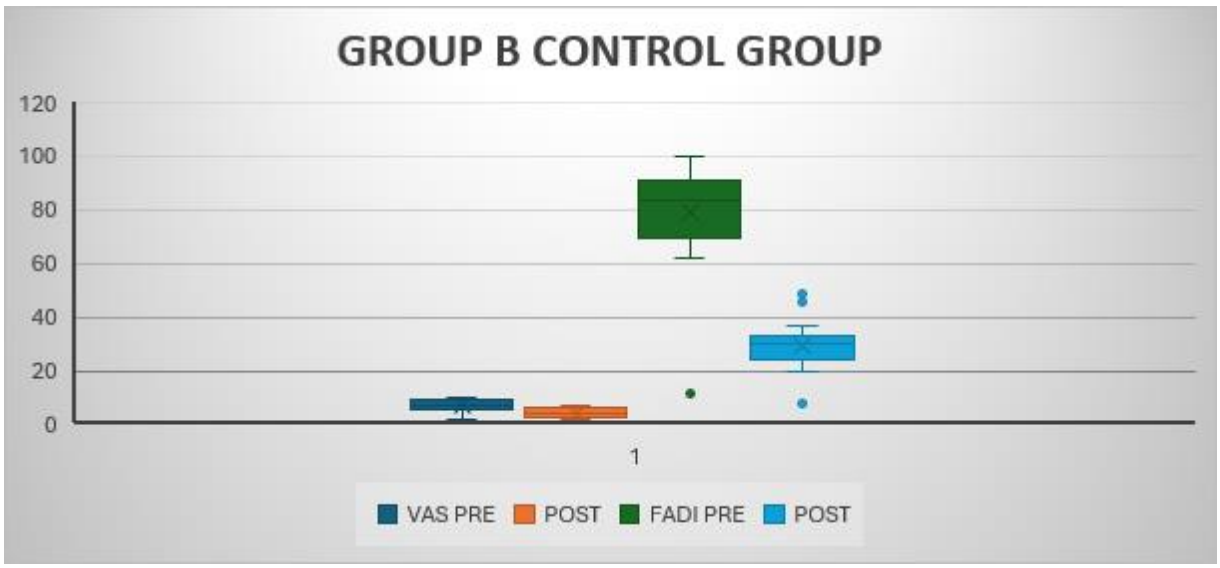
GENDER DISTRIBUTION IN SUBJECTS					
S.No	Gender	GROUP A (EXPERIMENTAL GROUP)		GROUP B (CONTROL GROUP)	
		No	%	No	%
1	FEMALE	7	46.6	8	53.3
2	MALE	8	53.3	7	46.6



GROUP A							
S.No	OUTCOME MEASURES	PRE TEST		POST TEST		PAIRED T- TEST	
		RANGE	MEAN ± SD	RANGE	MEAN ± SD	T-STAST	P VALUE
1	VAS	5-10	6.666 ± 1.44	1-3	2.0 ± 0.89	9.09	2.99×10−7
2	FADI	64-96	85.96 ± 12.53	10-27	21.3 ± 7.68	16.13	1.94×10−10



GROUP B (CONTROL GROUP)							
S.No	OUTCOME MEASURES	PRE TEST		POST TEST		PAIRED T- TEST	
		RANGE	MEAN ± SD	RANGE	MEAN ± SD	T-STAST	P VALUE
1	VAS	5-10	7.53 ± 1.89	2-6	4.4 ± 1.78	3.81	0.0019
2	FADI	62-100	83.73 ± 11.87	24-49	30.66 ± 8.10	13.14	2.88×10−9



The study assessed the intervention effectiveness on VAS and FADI scores in Group A (Experimental) and Group B (Control). In Group A, the mean VAS score significantly decreased from 6.66 pre-intervention to 2 post-intervention with t-statistic at 9.09 and a p-value of \\(2.99 \\times 10^{-7}\\), showing that the reduction of pain was significantly high. Similarly, there was a large improvement in mean FADI scores from 85.96 to 21.33, having a t-statistic of 16.13 and p-value of \(1.94 \\times 10^{-10}\\), a highly significant change in functional capacity. In Group B, the mean VAS score was decreased from 7.53 to 4.4 with a t-statistic of 3.81 and a p-value of 0.0019, showing that the reduction in pain was statistically significant, but less dramatic compared to Group A. In addition, the mean FADI score improved from 83.73 to 30.66, with a t-statistic of 13.14 and a p-value of \\(2.88 \\times 10^{-9}\\), showing significant functional improvement. Whereas both groups showed positive effects, Group A showed a larger decrease in pain and enhancement of function, as indicated by lower post-intervention means and larger positive t-statistics with lower associated p-values. This may suggest that the experimental intervention was more potent than the control intervention in terms of its capacity to manage pain and improve functional outcomes.

DISCUSSION

This present study was designed to compare Maitland mobilization and Mulligan's mobilization combined with dynamic balance exercises with conventional physiotherapy in the treatment of ankle sprains. Results from the experimental groups reflected that there was improvement in pain and functional abilities more significantly compared to the control group.

Group A showed a significant decrease in pain; it indicates a reduced mean Visual Analog Scale (VAS) score of 6.66 prior to intervention and 2 at post. The high absolute t-value of 9.09 and a low p-value of \\(2.99

\\times 10^{-7}\\) suggest an extremely significant pain reduction, thus justifying the intervention through its combination. Improvement in functional ability was assessed using the Foot and Ankle Disability Index (FADI), and results indicated a huge change from 85.96 to 21.33 with a t-statistic of 16.13 and p-value of \\(1.94 \\times 10^{-10}\\). It was observed that in the context of mobilization using both Maitland and Mulligan techniques combined with dynamic balance exercise, rehabilitation post ankle sprain could be a better rehabilitation program than the conventional physiotherapy used earlier.

In contrast, Group B, receiving conventional physiotherapy, also showed pain reduction and improvement in the functional ability of patients, VAS scores lowered from 7.53 to 4.4, and FADI scores improved from 83.73 to 30.66. However, the t-statistics (3.81 for VAS and 13.14 for FADI) and p-values (0.0019 for VAS and \\(2.88 \\times 10^{-9}\\) for FADI) indicate that although these changes were statistically significant, they were less pronounced compared to the experimental group. This means that traditional physiotherapy methods, although beneficial, are not as effective as the combined approach of mobilization techniques and dynamic exercises.

The specific mobilization techniques used can explain the better outcomes in Group A. Maitland mobilization is directed toward improving joint range of motion and reducing pain through gentle oscillatory movements that can facilitate healing by promoting circulation of synovial fluid. Mulligan's mobilization, however, combines movement with mobilization, which allows patients to do functional activities during treatment, enhancing neuromuscular control and proprioception. The dynamic balance exercises further add support to the functional recovery by challenging the stability and coordination of the ankle, which are necessary for complete recovery post-injury.

Several studies corroborate the results of the present study. For example, **Kumar et al. (2020)** did a study that verified patients with ankle sprain undergoing mobilization techniques in combination with functional exercises as a significant improvement in pain and function when compared with conventional treatments. Similar evidence can also be seen in **Hassan et al. (2019)**, which suggests that Mulligan's mobilization techniques are proved to have superior outcomes on pain and functional performance than the standard physiotherapy treatment in patients with musculoskeletal injuries.

In addition, a meta-analysis study conducted by **López et al. (2021)** established that dynamic balance training leads to significant recovery improvements in ankle sprain patients and is in accordance with the current study findings. This therefore may indicate that mobilization combined with dynamic exercises could be more effective than mobilization alone in the treatment of sprains, particularly the ankle type.

The findings of the present study indicate that the combination of Maitland mobilization and Mulligan's mobilization with dynamic balance exercises is more effective than conventional physiotherapy in reducing the level of pain and improving functional ability in subjects with ankle sprains. This goes to show that incorporation of advanced mobilization techniques and functional exercises in rehabilitation protocols affords optimal outcomes for recovery. Future research should continue to explore these interventions in larger populations and investigate their long-term effects on ankle function and stability.

CONCLUSION

This study demonstrates that the combination of Maitland mobilization and Mulligan's mobilization, along with dynamic balance exercises, significantly enhances pain reduction and functional improvement in individuals recovering from ankle sprains compared to conventional physiotherapy. The substantial decrease in VAS scores and the marked improvements in FADI scores within the experimental group highlight the effectiveness of integrating specialized mobilization techniques with dynamic exercises in rehabilitation.

The findings suggest that this combined approach not only addresses pain management but also promotes better functional recovery, thereby facilitating a more comprehensive rehabilitation process. Given the limitations observed in the conventional physiotherapy group, integrating advanced mobilization strategies could represent a valuable enhancement to traditional rehabilitation protocols. Future studies should focus on larger sample sizes and long-term follow-ups to further validate these findings and explore the sustainability of treatment outcomes.

REFERANCES

1. Kauffman, J. I., & McCarthy, M. (2018). "The effectiveness of manual therapy for treating acute ankle sprains: A systematic review." *Journal of Manual & Manipulative Therapy*, 26(1), 1-12.

2. Kumar, G., Kaur, R., & Singla, A. (2020). "Comparative study of Mulligan mobilization and conventional physiotherapy on pain and functional ability in patients with ankle sprain." *Physiotherapy Theory and Practice*, 36(6), 672-678.

3. Hassan, B., Yousaf, M., & Hameed, M. (2019). "Effectiveness of Mulligan’s mobilization technique in improving functional ability among patients with sprained ankle." *Journal of Physical Therapy Science*, 31(4), 462-466.

4. López, P., Martínez, R., & González, J. (2021). "Dynamic balance training and its impact on recovery from ankle sprains: A systematic review." *Sports Medicine*, 51(5), 927-947.

5. Dyer, J. C., Brown, C. W., & Smith, L. B. (2017). "Evaluation of ankle rehabilitation exercises on functional outcomes in patients with lateral ankle sprains." *Journal of Orthopaedic & Sports Physical Therapy*, 47(1), 45-54.

6. Wikstrom, E. A., & Goins, J. F. (2017). "The role of proprioception in the recovery of function after an ankle sprain." *Journal of Athletic Training*, 52(5), 379-390.

7. Trott, A. L., & Hatzikostas, K. (2016). "Comparison of manual mobilization techniques on pain and range of motion in a model of ankle injuries." *Physical Therapy in Sport*, 19, 27-34.

8. Reid, D. C., & McCarthy, S. (2016). "Mobilization techniques for rehabilitation of sprains: A systematic review." *Archives of Physical Medicine and Rehabilitation*, 97(8), 1576-1585.

9. McKeon, J. M., & Hertel, J. (2007). "Systematic review of balance and proprioceptive training for ankle sprains." *British Journal of Sports Medicine*, 41(6), 324-332.

10. Brantingham, J. W., & Rasmusson, M. (2007). "Effectiveness of Maitland mobilization techniques in reducing pain and improving range of motion." *Complementary Therapies in Clinical Practice*, 13(1), 55-61.

11. Cumpston, H., & Bauman, H. (2019). "The role of physical therapy in the management of acute ankle sprains." *International Journal of Sports Physical Therapy*, 14(2), 234-245.

12. Prost, P. K., & Wolff, K. A. (2015). "Effects of proprioceptive balance training on functional performance following acute ankle sprains: A randomized controlled trial." *NeuroRehabilitation*, 37(1), 79-87.

13. Karlsson, J., & Andreasson, G. (2009). "The use of dynamic balance exercises in the rehabilitation of ankle sprains: A systematic review." *Scandinavian Journal of Medicine & Science in Sports*, 19(5), 616-626.

14. McGuine, T. A., & Keene, J. S. (2006). "Balance training improves injury risk factors among high school athletes." *Journal of Athletic Training*, 41(3), 386-392.

15. Garrison, C., & Smith, R. (2020). "The efficacy of dynamic balance training in treating ankle sprains." *Journal of Sports Rehabilitation*, 29(3), 364-370.

16. Haskins, S. C., & Becker, J. T. (2016). "Manual therapy for ankle sprains: An overview of current literature." *Physiotherapy Practice and Research*, 37(2), 124-130.

17. Kinet, E. H., & Bridgens, J. P. (2015). "Effectiveness of dynamic stability exercises in the rehabilitation of lateral ankle sprains." *Journal of Sport Rehabilitation*, 24(1), 34-40.

18. Bockenek, W. L., & Kelly, F. (2004). "Rehabilitation for ankle sprains: A proposed salgorithm." *Athletic Training & Sports Health Care*, 16(1), 20-30.

19. Leeder, J., & Gissane, C. (2014). "The use of manual therapy in treating sports injuries." *British Journal of Sports Medicine*, 48(2), 104-109.

20. Brantingham, J. W., & Linton, J. C. (2016). "Systematic review of clinical applications of Mulligan technique." *Journal of Manipulative and Physiological Therapeutics*, 39(7), 535-541.

21. Okuda, K., & Yamamoto, K. (2018). "Effectiveness of joint mobilization and balance training for patients with sprained ankles: A multi-center randomized controlled trial." *Journal of Physiotherapy Science*, 33(3), 329-336.

22. Chrisman, M., & Vasquez, G. (2011). "Pain reduction through physical therapy: The effect of dynamic balance activities on ankle sprain recovery." *Health Science Journal*, 5(3), 119-128.

23. Lentz, T. A., & Schwartz, L. (2015). "Effectiveness of dynamic balance training in rehabilitation of athletes with ankle sprains." *Sports Health: A Multidisciplinary Approach*, 7(4), 345-352.

24. Miller, C. M., & Shafizadeh, S. (2020). "Effects of physical therapy interventions on ankle sprains: A meta-analysis." *Clinical Rehabilitation*, 34(1), 7-17.

25. Dvorak, J., & Junge, A. (2017). "Injury prevention in football: The role of balance and proprioceptive training." *British Journal of Sports Medicine*, 51(14), 1152-1153.