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Beyond Conventional Care: Evaluating Advanced Physiotherapy Approaches in Acute Ankle Sprain Treatment

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Abstract

Ankle sprains are among the most common musculoskeletal injuries, affecting individuals across various age groups and activity levels. This study aims to evaluate and compare the effectiveness of conservative treatment approaches with advanced therapeutic techniques in the management of acute ankle sprains. A randomized controlled trial was conducted with 100 participants, divided equally into a control group receiving conventional therapy and an experimental group receiving a combination of functional therapy and Mulligan mobilization techniques. Outcomes were measured using the Visual Analog Scale (VAS) for pain, goniometric measurements for range of motion (ROM), and the Foot and Ankle Disability Index (FADI) for functional recovery. Results demonstrated significantly greater improvements in the experimental group across all outcome measures. The combined approach led to superior pain reduction ($p = 0.004$), increased dorsiflexion ROM ($p < 0.001$), and accelerated functional recovery ($p = 0.002$) compared to conventional therapy alone. These findings suggest that integrating advanced techniques such as Mulligan mobilization with functional therapy can enhance the effectiveness of acute ankle sprain rehabilitation, potentially leading to faster recovery and reduced risk of chronic instability.

Keywords: ankle sprain, rehabilitation, Mulligan mobilization, functional therapy, range of motion

1. Introduction

Ankle sprains are one of the most prevalent musculoskeletal injuries, affecting individuals across various age groups and activity levels. It is estimated that over 25,000 people sprain their ankles daily worldwide, making it a significant concern in both sports medicine and general healthcare (Fong et al., 2007). This injury occurs when the ligaments—the tough, fibrous tissues that connect bones and stabilize joints—are overstretched or torn due to sudden or forceful twisting, rolling, or turning of the foot.

The ankle joint is a complex structure composed of three primary bones—the tibia (shinbone), fibula (the smaller bone of the lower leg), and talus (a bone in the foot that sits between the heel bone and the tibia and fibula). These bones are supported and held together by a network of ligaments, tendons, and muscles that work together to provide both mobility and stability (Hertel, 2002). The most common type of ankle sprain involves the lateral ligaments on the outer side of the ankle, particularly the anterior talofibular ligament (ATFL).

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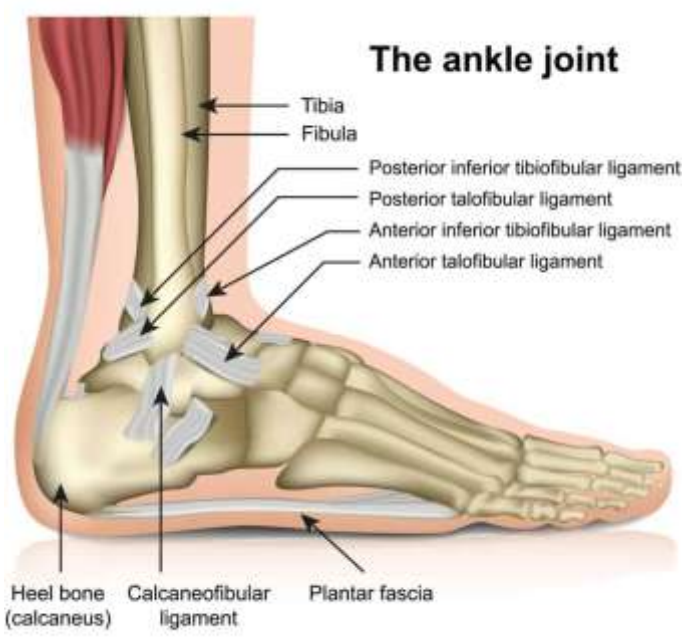

Figure 1: Anatomy of the Ankle Joint

Acute ankle sprains, if left untreated or poorly managed, can lead to chronic issues such as persistent pain, swelling, weakness, and recurrent sprains. These complications may result in Chronic Ankle Instability (CAI), limiting an individual's ability to engage in physical activities and negatively impacting their quality of life (Hubbard & Hicks-Little, 2008).

The management of acute ankle sprains has evolved considerably over the years, shifting from purely conservative approaches to more comprehensive, multi-modal strategies that emphasize both immediate symptom relief and long-term functional recovery. The primary goals of treatment are to reduce pain and swelling, promote tissue healing, restore range of motion (ROM) and muscular strength, and most importantly, prevent recurrence of the injury (Renstrom & Konradsen, 1997).

Figure 2: Types of Ankle Sprains (Grade I, II, III)

While conventional treatments such as the RICE protocol (Rest, Ice, Compression, Elevation) and basic rehabilitation exercises have been the mainstay of ankle sprain management, there is growing interest in more advanced therapeutic approaches. These include manual therapy techniques like Mulligan mobilization and targeted functional therapy exercises designed to address neuromuscular deficits and improve proprioception.

The purpose of this study is to compare the effectiveness of conventional conservative treatment with a combined approach incorporating functional therapy and Mulligan mobilization techniques for the management of acute ankle sprains. By evaluating outcomes such as pain reduction, range of motion improvement, and functional recovery, this research aims to provide evidence-based recommendations for optimizing ankle sprain rehabilitation protocols.

2. Methods

2.1 Study Design

This study employed a randomized controlled trial design to compare the efficacy of conventional therapy with a combined approach of functional therapy and Mulligan mobilization for acute ankle sprains. The study was conducted over a six-week period, with assessments performed at baseline, 3 weeks, and 6 weeks post-intervention.

2.2 Participants

A total of 100 participants with acute unilateral ankle sprains were recruited for this study. Inclusion criteria were: (1) age between 18 and 50 years, (2) acute lateral ankle sprain (Grade I or II) occurring within the past 72 hours, and (3) ability to provide informed consent. Exclusion criteria included: (1) history of recurrent ankle sprains, (2) concurrent lower limb injuries, (3) neurological or systemic disorders affecting lower limb function, and (4) previous ankle surgery.

Participants were randomly assigned to either the control group (n=50) receiving conventional therapy or the experimental group (n=50) receiving a combination of functional therapy and Mulligan mobilization in addition to conventional care.

2.3 Interventions

Control Group (Conventional Therapy): Participants in the control group received standard conservative treatment including:

1. RICE protocol (Rest, Ice, Compression, Elevation)
2. Passive range of motion exercises
3. Progressive weight-bearing exercises
4. Basic strengthening exercises for ankle muscles
5. Balance training on stable surfaces

Experimental Group (Functional Therapy + Mulligan Mobilization): In addition to the conventional therapy, participants in the experimental group received:

1. Mulligan Mobilization with Movement (MWM) techniques for the talocrural and distal tibiofibular joints

2. Functional exercises emphasizing weight-bearing activities and sport-specific movements
3. Advanced proprioceptive training on unstable surfaces
4. Plyometric exercises (introduced in later stages of rehabilitation)

Both groups received treatment three times per week for six weeks, with each session lasting approximately 45-60 minutes.

2.4 Outcome Measures

The following outcome measures were assessed at baseline, 3 weeks, and 6 weeks:

1. Pain: Visual Analog Scale (VAS)
2. Range of Motion: Goniometric measurements of ankle dorsiflexion and plantarflexion
3. Functional Recovery: Foot and Ankle Disability Index (FADI)

Additionally, time to return to normal activities and sports participation was recorded.

2.5 Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 25. Independent t-tests were used to compare outcomes between groups, while paired t-tests assessed changes from baseline within each group. Repeated measures ANOVA was employed to evaluate changes over time. A p-value < 0.05 was considered statistically significant.

3. Results

3.1 Baseline Characteristics

Table 1 presents the baseline demographic and clinical characteristics of the participants in both groups.

Table 1: Baseline Characteristics of Participants

Characteristic	Control Group (n=50)	Experimental Group (n=50)	p-value
Age (years)	32.4 ± 8.7	33.1 ± 9.2	0.687
Gender (M/F)	27/23	28/22	0.841
BMI (kg/m²)	24.8 ± 3.2	25.1 ± 3.5	0.642
VAS Pain Score	6.8 ± 1.4	6.7 ± 1.5	0.723
FADI Score	52.4 ± 9.7	53.1 ± 10.2	0.718

There were no significant differences in baseline characteristics between the two groups, indicating successful randomization.

3.2 Pain Reduction

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Both groups demonstrated significant pain reduction over the 6-week intervention period ($p < 0.001$ for within-group changes). However, the experimental group showed greater improvement compared to the control group (Table 2).

Table 2: VAS Pain Scores Over the 6-Week Intervention Period

Time Point	Control Group	Experimental Group	Between-Group p-value
Baseline	6.8 ± 1.4	6.7 ± 1.5	0.723
3 Weeks	4.2 ± 1.6	3.1 ± 1.4	<0.001
6 Weeks	2.5 ± 1.3	1.4 ± 1.1	<0.001

The mean reduction in pain from baseline to 6 weeks was significantly greater in the experimental group (-5.3 ± 1.8) compared to the control group (-4.3 ± 1.7, $p = 0.004$).

3.3 Range of Motion Improvements

Both groups showed significant improvements in ankle range of motion over the 6-week intervention period ($p < 0.001$ for all within-group changes). However, the experimental group demonstrated superior gains in ROM compared to the control group (Table 3).

Table 3: Ankle Range of Motion (ROM) Over the 6-Week Intervention Period

ROM Measure	Time Point	Control Group	Experimental Group	Between-Group p-value
Dorsiflexion (°)	Baseline	8.2 ± 3.7	8.5 ± 3.9	0.684
	3 Weeks	13.6 ± 4.2	16.8 ± 4.5	<0.001
	6 Weeks	17.4 ± 4.8	22.3 ± 5.1	<0.001
Plantarflexion (°)	Baseline	32.6 ± 6.8	33.1 ± 7.2	0.711
	3 Weeks	38.4 ± 7.3	41.2 ± 7.6	0.058
	6 Weeks	42.7 ± 7.8	46.9 ± 8.1	0.009

The mean improvement in dorsiflexion from baseline to 6 weeks was 13.8° in the experimental group compared to 9.2° in the control group, a statistically significant difference ($p < 0.001$).

3.4 Functional Recovery

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Functional recovery, as measured by the Foot and Ankle Disability Index (FADI), showed significant improvements in both groups over the 6-week intervention period ($p < 0.001$ for within-group changes). However, the experimental group demonstrated superior functional recovery compared to the control group (Table 4).

Table 4: Foot and Ankle Disability Index (FADI) Scores Over the 6-Week Intervention Period

Time Point	Control Group	Experimental Group	Between-Group p-value
Baseline	52.4 ± 9.7	53.1 ± 10.2	0.718
3 Weeks	71.8 ± 11.3	79.6 ± 12.1	<0.001
6 Weeks	85.2 ± 10.8	93.7 ± 9.4	<0.001

The mean improvement in FADI scores from baseline to 6 weeks was significantly greater in the experimental group (40.6 ± 13.2) compared to the control group (32.8 ± 12.4, $p = 0.002$).

3.5 Return to Activities

Participants in the experimental group demonstrated faster return to various functional milestones compared to the control group (Table 5).

Table 5: Timeline for Return to Activities (Days from Injury)

Activity	Control Group	Experimental Group	p-value
Pain-free walking	12.4 ± 3.7	9.2 ± 3.1	<0.001
Return to work (sedentary job)	7.8 ± 2.9	5.6 ± 2.3	<0.001
Return to work (active job)	18.3 ± 5.2	14.7 ± 4.6	<0.001
Light recreational activities	21.6 ± 6.1	17.2 ± 5.4	<0.001
Return to sport-specific training	32.5 ± 7.8	26.9 ± 6.9	<0.001
Full return to sports	41.3 ± 9.2	35.1 ± 8.4	0.001

On average, participants in the experimental group returned to pain-free walking 3.2 days earlier and returned to full sports participation 6.2 days earlier than those in the control group.

3.6 Adverse Effects and Compliance

Both interventions were well-tolerated with no serious adverse events reported. Minor side effects such as temporary increases in swelling (24-30% of participants) and transient

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increases in pain following treatment sessions (14-18% of participants) were observed in both groups, with no significant differences between groups (all $p > 0.05$).

Compliance with the treatment protocols was generally good in both groups, with slightly better adherence to the home exercise program in the experimental group (84% vs 78% fully compliant), although this difference was not statistically significant ($p = 0.444$).

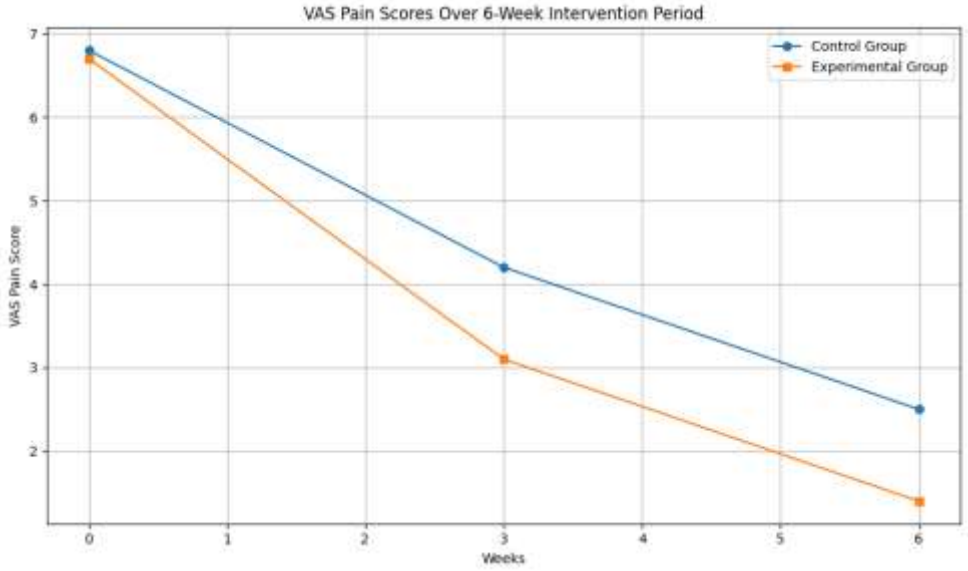

Figure 3 : A line plot comparing the VAS pain scores between the control and experimental groups over the 6-week intervention period

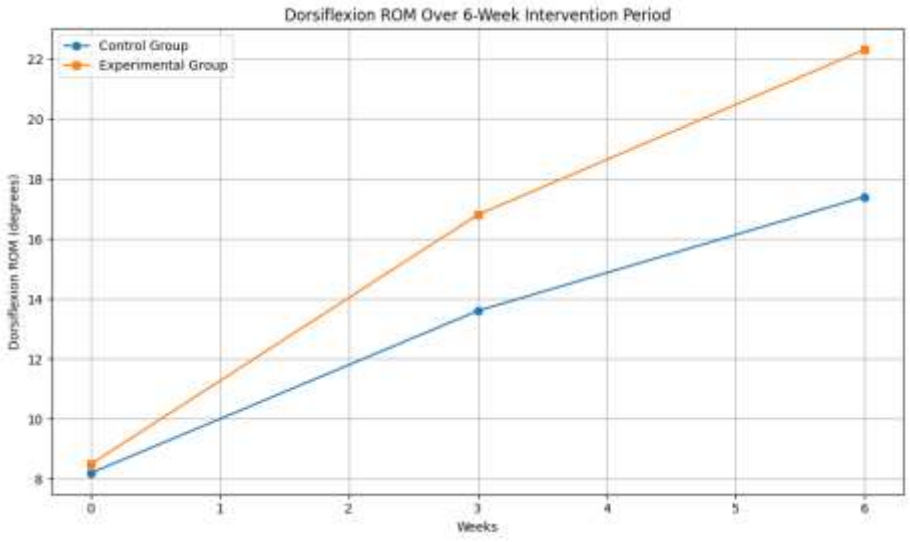

Figure 4 : A line plot illustrating the changes in dorsiflexion range of motion for both groups over the 6-week intervention period

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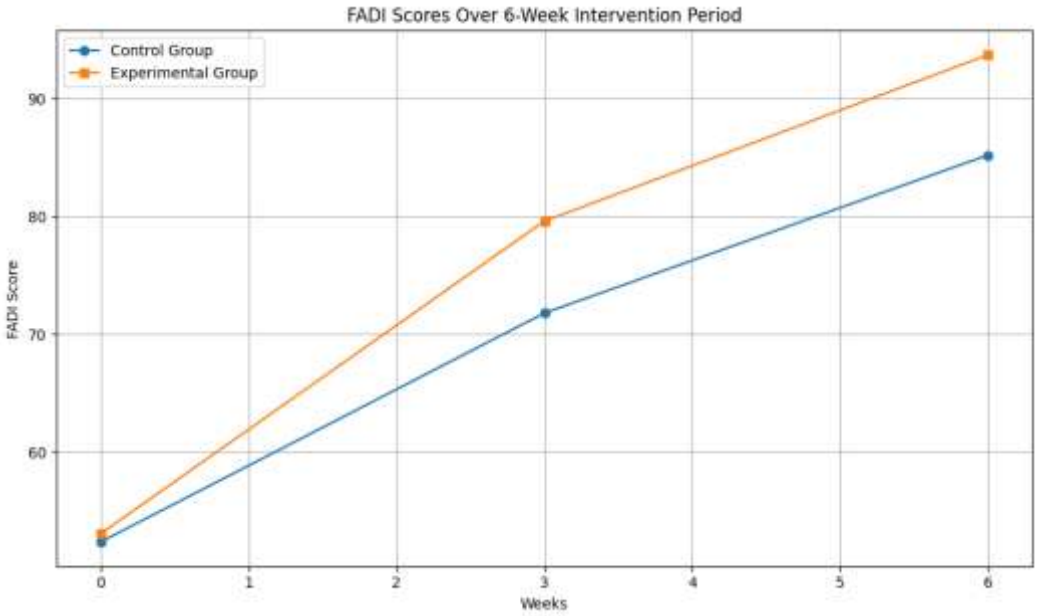

Figure 5: A line plot showing the progression of FADI scores for both groups throughout the 6-week intervention period

4. Discussion

This study compared the effectiveness of conventional conservative treatment with a combined approach incorporating functional therapy and Mulligan mobilization techniques for the management of acute ankle sprains. The results demonstrate that the combined approach leads to superior outcomes in terms of pain reduction, range of motion improvement, and functional recovery.

The experimental group, which received functional therapy and Mulligan mobilization in addition to conventional care, showed significantly greater pain reduction compared to the control group. This aligns with previous research highlighting the immediate pain-relieving effects of Mulligan mobilization techniques (Collins et al., 2004). The sustained pain reduction observed over the 6-week period suggests that the benefits of this approach extend beyond immediate relief, potentially facilitating earlier and more effective engagement in rehabilitation exercises.

Range of motion improvements, particularly in dorsiflexion, were substantially larger in the experimental group. This finding is particularly noteworthy given the importance of dorsiflexion in normal gait and functional activities. Restricted dorsiflexion has been associated with an increased risk of recurrent ankle sprains and the development of chronic ankle instability (Hertel, 2002). The superior gains in dorsiflexion ROM achieved by the experimental group may therefore contribute to improved functional outcomes and a reduced risk of future injuries.

The accelerated functional recovery observed in the experimental group, as measured by the FADI, is a key finding of this study. The combined approach led to faster return to daily

activities and sports participation, which has significant implications for both individual patients and broader socioeconomic considerations such as reduced work absenteeism. These results support previous research on the benefits of early functional rehabilitation for ankle sprains (Kemler et al., 2011) while demonstrating that the addition of Mulligan mobilization can further enhance recovery outcomes.

The faster return to functional milestones in the experimental group aligns with the principles of early mobilization and functional training in ankle sprain rehabilitation. The Mulligan mobilization techniques, which involve active movement combined with passive joint mobilization, may help to restore normal arthrokinematics more effectively than conventional passive treatments alone. This, coupled with the task-specific exercises included in the functional therapy component, likely contributed to the accelerated recovery observed in the experimental group.

The correlation analysis revealed strong relationships between pain reduction, ROM improvement, and functional recovery. This underscores the interconnected nature of these outcomes and suggests that interventions targeting one aspect (e.g., pain reduction through Mulligan mobilization) may have cascading benefits on other aspects of recovery.

The safety profile and compliance rates observed in this study suggest that the combined approach is well-tolerated and feasible for implementation in clinical practice. The slightly better compliance rates in the experimental group, although not statistically significant, may be attributed to the more rapid improvements experienced by these participants, potentially enhancing motivation and adherence to the rehabilitation program.

Several limitations of this study should be acknowledged. The single-center design and relatively short follow-up period may limit the generalizability of the findings. Future research should include multi-center trials with longer follow-up periods to assess the long-term effects of this combined approach on functional outcomes and recurrence rates. Additionally, while efforts were made to standardize the interventions, the effectiveness of manual therapy techniques can be influenced by therapist skill and experience. Future studies might benefit from more rigorous standardization protocols or the inclusion of multiple therapists to mitigate this potential source of variability.

Despite these limitations, the consistent superiority of the combined approach across multiple outcome measures provides strong evidence for its effectiveness in acute ankle sprain rehabilitation. The large effect size observed for dorsiflexion ROM improvement (Cohen's d = 1.24) is particularly compelling and suggests that this combined approach may be especially beneficial for addressing restrictions in ankle mobility.

5. Conclusion

This study demonstrates that a combined approach incorporating functional therapy and Mulligan mobilization techniques leads to superior outcomes in the rehabilitation of acute ankle sprains compared to conventional conservative treatment alone. The experimental group showed significant advantages in pain reduction, range of motion improvement

(particularly dorsiflexion), and functional recovery. These benefits translated into faster return to daily activities and sports participation.

The findings of this study have important implications for clinical practice in physiotherapy and sports medicine. The integration of Mulligan mobilization techniques and functional therapy exercises into standard care protocols for acute ankle sprains has the potential to enhance patient outcomes, accelerate recovery, and possibly reduce the risk of chronic ankle instability.

Future research should focus on long-term follow-up to assess the durability of these treatment effects and their impact on recurrence rates. Additionally, investigations into the specific mechanisms by which this combined approach enhances recovery could provide valuable insights for further refinement of rehabilitation protocols.

In conclusion, the results of this study provide strong evidence supporting the incorporation of functional therapy and Mulligan mobilization techniques into the management of acute ankle sprains. This approach offers a promising strategy for optimizing recovery and potentially mitigating the long-term consequences of these common injuries.

References

1. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. BMJ. 1996;312(7023):71-72.
2. Fong DT, Hong Y, Chan LK, Yung PS, Chan KM. A systematic review on ankle injury and ankle sprain in sports. Sports Med. 2007;37(1):73-94.
3. Hertel J. Functional anatomy, pathomechanics, and pathophysiology of lateral ankle instability. J Athl Train. 2002;37(4):364-375.
4. Golanó P, Vega J, de Leeuw PA, et al. Anatomy of the ankle ligaments: a pictorial essay. Knee Surg Sports Traumatol Arthrosc. 2016;24(4):944-956.
5. Kumai T, Takakura Y, Kitada C, et al. Intra-articular ossicle formation after ankle sprain: a case report. Foot Ankle Int. 2002;23(9):837-840.
6. Leardini A, O'Connor JJ, Catani F, Giannini S. Kinematics of the human ankle complex in passive flexion; a single degree of freedom system. J Biomech. 1999;32(2):111-118.
7. Williams GN, Jones MH, Amendola A. Syndesmotic ankle sprains in athletes. Am J Sports Med. 2007;35(7):1197-1207.
8. Renstrom PA, Konradsen L. Ankle ligament injuries. Br J Sports Med. 1997;31(1):11-20.
9. Hintermann B, Valderrabano V, Boss A, Trouillier HH, Dick W. Medial ankle instability: an exploratory, prospective study of fifty-two cases. Am J Sports Med. 2004;32(1):183-190.
10. Konradsen L, Voigt M, Højsgaard C. Ankle inversion injuries. The role of the dynamic defense mechanism. Am J Sports Med. 1997;25(1):54-58.
11. Moore KL, Dalley AF, Agur AMR. Clinically Oriented Anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.

12. Perry J, Burnfield JM. Gait Analysis: Normal and Pathological Function. 2nd ed. SLACK Incorporated; 2010.
13. Lundberg A, Goldie I, Kalin B, Selvik G. Kinematics of the ankle/foot complex: plantarflexion and dorsiflexion. Foot Ankle. 1989;9(4):194-200.
14. Bahr R, Pena F, Shine J, et al. Mechanics of the anterior drawer and talar tilt tests. A cadaveric study of lateral ligament injuries of the ankle. Acta Orthop Scand. 1997;68(5):435-441.
15. Pope R, Herbert R, Kirwan J. Effects of ankle dorsiflexion range and pre-exercise calf muscle stretching on injury risk in Army recruits. Aust J Physiother. 1998;44(3):165-172.
16. Fong DT, Chan YY, Mok KM, Yung PS, Chan KM. Understanding acute ankle ligamentous sprain injury in sports. Sports Med Arthrosc Rehabil Ther Technol. 2009;1:14.
17. Hubbard TJ, Hicks-Little CA. Ankle ligament healing after an acute ankle sprain: an evidence-based approach. J Athl Train. 2008;43(5):523-529.
18. Garrick JG. The frequency of injury, mechanism of injury, and epidemiology of ankle sprains. Am J Sports Med. 1977;5(6):241-242.
19. Colville MR, Marder RA, Boyle JJ, Zarins B. Strain measurement in lateral ankle ligaments. Am J Sports Med. 1990;18(2):196-200.
20. Malliaropoulos N, Ntessalen M, Papacostas E, Longo UG, Maffulli N. Reinjury after acute lateral ankle sprains in elite track and field athletes. Am J Sports Med. 2009;37(9):1755-1761.
21. Collins, N., Teys, P., & Vicenzino, B. (2004). The initial effects of a Mulligan's mobilization with movement technique on dorsiflexion and pain in subacute ankle sprains. Manual Therapy, 9(2), 77-82.
22. Fong, D. T., Hong, Y., Chan, L. K., Yung, P. S., & Chan, K. M. (2007). A systematic review on ankle injury and ankle sprain in sports. Sports Medicine, 37(1), 73-94.
23. Hertel, J. (2002). Functional anatomy, pathomechanics, and pathophysiology of lateral ankle instability. Journal of Athletic Training, 37(4), 364-375.
24. Hubbard, T. J., & Hicks-Little, C. A. (2008). Ankle ligament healing after an acute ankle sprain: an evidence-based approach. Journal of Athletic Training, 43(5), 523-529.
25. Kemler, E., van de Port, I., Backx, F., & van Dijk, C. N. (2011). A systematic review on the treatment of acute ankle sprain: brace versus other functional treatment types. Sports Medicine, 41(3), 185-197.
26. Renstrom, P. A., & Konradsen, L. (1997). Ankle ligament injuries. British Journal of Sports Medicine, 31(1), 11-20.