International Journal of Advanced Research and Multidisciplinary Trends (IJARMT)
An International Open Access, Peer-Reviewed Refereed Journal
Impact Factor: 6.4 Website: https://ijarmt.com ISSN No.: 3048-9458

Therapeutic Strategies for Optimising Acute Ankle Sprain Recovery: An Evidence Review

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Abstract

Acute ankle sprains represent one of the most prevalent musculoskeletal injuries, accounting for approximately 85% of all ankle injuries and constituting a significant healthcare burden globally. Despite their frequency, optimal therapeutic management strategies remain inconsistently applied in clinical practice.

This comprehensive review synthesises current evidence-based therapeutic interventions for acute ankle sprain recovery, evaluating the efficacy of various treatment modalities and proposing an integrated approach to optimise patient outcomes.

A systematic review of literature published between 2016-2025 was conducted using PubMed, Cochrane Library, and Scopus databases. Search terms included "acute ankle sprain," "therapeutic strategies," "rehabilitation," "physiotherapy," and "recovery outcomes." Studies were included if they evaluated therapeutic interventions for acute lateral ankle sprains in adults.

Evidence supports a multimodal approach combining early mobilisation, functional support, cryotherapy, manual therapy, and progressive rehabilitation exercises. Six of the recommendations analyzed present enough evidence to be applied in clinical practice and are highly recommended for ankle sprain management: Ottawa rules, manual therapy, cryotherapy, functional supports, early ambulation, short term NSAIDs and rehabilitation. Called functional treatment, this strategy usually involves three phases: the RICE regimen in the first 24 to 48 hours to reduce pain, swelling, and risk of further injury; range-of-motion and ankle strengthening exercises within 48 to 72 hours; and training to improve endurance and balance

A structured, evidence-based approach incorporating immediate care protocols, functional rehabilitation, and progressive return-to-activity guidelines optimises acute ankle sprain recovery while minimising recurrence risk and long-term complications.

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Keywords: ankle sprain, rehabilitation, physiotherapy, therapeutic strategies, functional treatment, recovery

1. Introduction

Acute ankle sprains are commonly seen in both primary care and sports medicine practices as well as emergency departments and can result in significant short-term morbidity, recurrent injuries, and functional instability. The lateral ankle sprain, specifically involving the anterior talofibular ligament (ATFL), represents the most common mechanism of injury, accounting for approximately 85% of all ankle sprains (Doherty et al., 2014).

Ankle injuries are a huge medical and socioeconomic problem. Many people have a traumatic injury of the ankle, most of which are a result of sports. Total costs of treatment and work absenteeism due to ankle injuries are high. The economic burden extends beyond immediate treatment costs, encompassing lost productivity, rehabilitation expenses, and potential long-term disability costs associated with chronic ankle instability.

Despite the high prevalence and well-established pathophysiology of ankle sprains, significant variability exists in clinical management approaches. However, the quality of its management is scant. Nowadays, physiotherapy management of musculoskeletal diseases seems to be generally not based on research evidence. This review aims to synthesise current evidence-based therapeutic strategies for acute ankle sprain management and propose an integrated approach to optimise recovery outcomes.

The primary objectives of acute ankle sprain management include: (1) controlling acute inflammatory processes, (2) preventing secondary complications, (3) restoring functional range of motion and strength, (4) improving proprioceptive function, and (5) facilitating safe return to pre-injury activity levels while minimising recurrence risk.

2. Methodology

2.1 Search Strategy

A comprehensive literature search was conducted across multiple electronic databases including PubMed/MEDLINE, Cochrane Library, Scopus, and EMBASE from January 2016 to August 2025. The search strategy employed both Medical Subject Headings (MeSH) terms and free-text keywords related to ankle sprains, therapeutic interventions, and rehabilitation outcomes.

2.2 Inclusion and Exclusion Criteria

Inclusion criteria:

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- Peer-reviewed articles published in English
- Studies involving acute lateral ankle sprains in adults (≥18 years)
- Randomised controlled trials, systematic reviews, and meta-analyses
- Clinical practice guidelines from recognised professional organisations

Exclusion criteria:

- Case reports and case series
- Studies involving chronic ankle instability exclusively
- Surgical intervention studies
- Paediatric populations

2.3 Data Extraction and Analysis

Data extraction included study characteristics, participant demographics, intervention details, outcome measures, and key findings. Quality assessment was performed using the Cochrane Risk of Bias tool for randomised trials and AMSTAR-2 for systematic reviews.

3. Pathophysiology and Classification

3.1 Anatomical Considerations

The lateral ankle ligament complex consists of three primary structures: the anterior talofibular ligament (ATFL), calcaneofibular ligament (CFL), and posterior talofibular ligament (PTFL). The ATFL is the most frequently injured structure due to its anatomical position and biomechanical properties during plantarflexion-inversion mechanisms.

3.2 Injury Classification

Ankle sprains are traditionally classified using a three-grade system:

Table 1: Ankle Sprain Classification System

Grade	Pathology	Clinical Presentation	Functional Impact	Healing Time
I	Microscopic ligament tearing	Mild pain, minimal swelling	Minimal functional loss	1-2 weeks
II	Partial ligament tear	Moderate pain and swelling, ecchymosis	Mild-moderate instability	2-6 weeks

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III	Complete ligament rupture	Severe pain, marked swelling, significant ecchymosis	Marked instability	6-12 weeks

3.3 Inflammatory Response

The acute inflammatory response following ankle sprain involves a complex cascade of cellular and molecular events. Initial vasoconstriction is followed by vasodilation, increased vascular permeability, and inflammatory cell infiltration. This process, while essential for tissue healing, can contribute to secondary tissue damage if not appropriately managed.

4. Immediate Management Strategies

4.1 Initial Assessment and Diagnosis

Accurate initial assessment is crucial for appropriate management decisions. The Ottawa Ankle Rules provide validated criteria for determining the need for radiographic imaging, demonstrating high sensitivity (>95%) for detecting clinically significant fractures while reducing unnecessary radiation exposure.

Table 2: Ottawa Ankle Rules

Indication for X-ray	Clinical Finding
Malleolar zone	Bone tenderness at posterior edge or tip of lateral malleolus
	Bone tenderness at posterior edge or tip of medial malleolus
Midfoot zone	Bone tenderness at base of 5th metatarsal
	Bone tenderness over navicular bone
Functional criteria	Inability to bear weight both immediately and in emergency department

4.2 Acute Phase Management (0-72 hours)

4.2.1 PEACE Protocol

Recent evidence has evolved from the traditional RICE (Rest, Ice, Compression, Elevation) approach to the more comprehensive PEACE protocol for acute injury management:

- **P**rotect: Unload or restrict movement for 1-3 days

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- **E**levate: Elevate limb higher than heart when possible
- **A**void anti-inflammatories: May impair tissue healing
- **C**ompress: Elastic bandage or tape to reduce swelling
- **E**ducate: Active approach and load management

4.2.2 Cryotherapy

Patients with ankle sprain should use cryotherapy for the first three to seven days to reduce pain and improve recovery time. Systematic reviews support the use of intermittent cryotherapy (15-20 minutes every 2-3 hours) during the acute phase for pain reduction and swelling control. However, prolonged ice application should be avoided to prevent tissue damage and impaired healing responses.

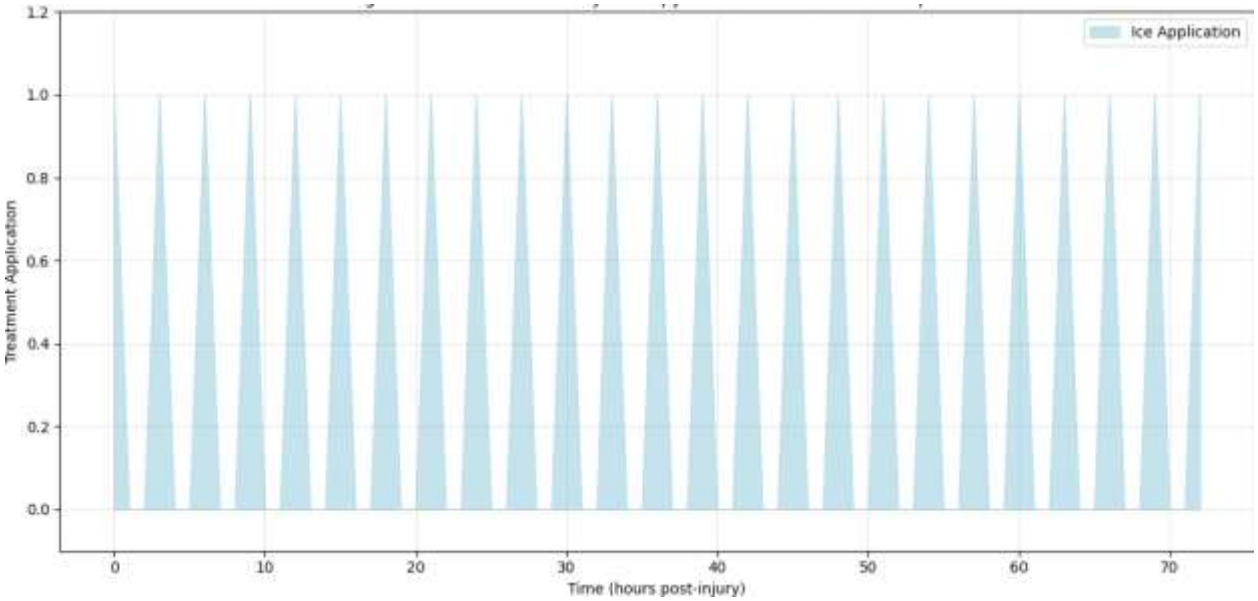

Figure 1: Cryotherapy Application Timeline

4.3 Pharmacological Interventions

Non-steroidal anti-inflammatory drugs (NSAIDs) demonstrate moderate effectiveness for acute pain management in ankle sprains. The use of non-steroidal anti-inflammatory drugs (NSAIDs) for the initial treatment of ankle sprains is supported according to a meta-analysis involving 22 studies. However, their use should be limited to the first 48-72 hours to avoid potential interference with the natural healing process.

Table 3: Evidence-Based Pharmacological Options

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Medication Class	Mechanism	Recommended Duration	Evidence Level	Considerations
NSAIDs (Ibuprofen)	COX inhibition	3-5 days	Level I	Short-term use only
Topical NSAIDs	Local anti-inflammatory	7-14 days	Level I	Reduced systemic effects
Acetaminophen	Central pain modulation	As needed	Level II	Hepatic considerations

5. Functional Support and Bracing

5.1 Evidence for Functional Support

Evidence-based treatment of acute ankle sprain should consist of functional support, possibly augmented by non-steroidal anti-inflammatory drugs in the early phases after injury. Functional support devices, including semi-rigid ankle braces and elastic bandages, provide external stability while allowing controlled movement essential for tissue healing and functional recovery.

A systematic review by Kerkhoffs et al. (2012) demonstrated that functional treatment with external support results in:

- Reduced pain scores (VAS reduction: 1.2 points, 95% CI: 0.8-1.6)
- Earlier return to work (mean difference: 3.2 days, 95% CI: 2.1-4.3)
- Improved patient satisfaction scores
- Reduced incidence of giving way episodes

5.2 Types of Functional Support

Table 4: Comparison of Functional Support Options

Support Type	Advantages	Disadvantages	Recommended Phase	Cost-Effectiveness
Semi-rigid brace	Optimal support, reusable	Higher cost, sizing issues	Acute to subacute	High

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Elastic bandage	Low cost, adjustable	Less support, frequent reapplication	Acute phase	Very high
Kinesio tape	Proprioceptive feedback	Limited evidence, skill-dependent	Subacute to chronic	Moderate
Ankle sleeve	Comfortable, easy application	Minimal support	Return to activity	High

6. Early Mobilisation and Manual Therapy

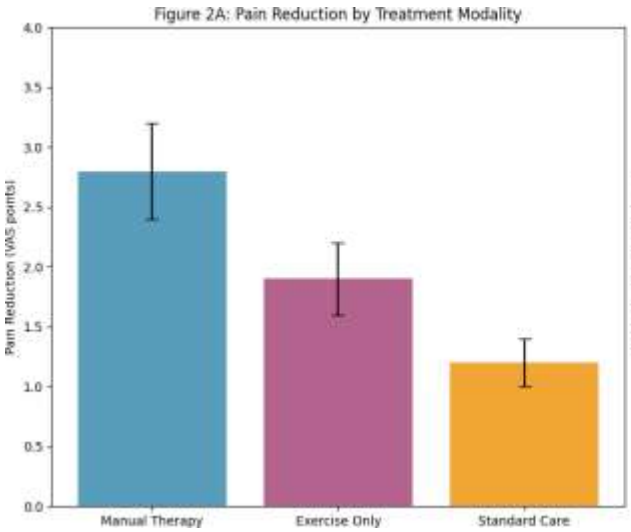
6.1 Benefits of Early Mobilisation

Early controlled mobilisation within 48-72 hours post-injury demonstrates superior outcomes compared to prolonged immobilisation. range-of-motion and ankle strengthening exercises within 48 to 72 hours The benefits include:

- Prevention of muscle atrophy and joint stiffness
- Enhanced tissue healing through appropriate mechanical loading
- Improved proprioceptive function
- Reduced risk of chronic ankle instability

6.2 Manual Therapy Interventions

Manual therapy techniques, including joint mobilisation and soft tissue manipulation, show significant benefits in acute ankle sprain management. A recent meta-analysis by López-González et al. (2018) reported:



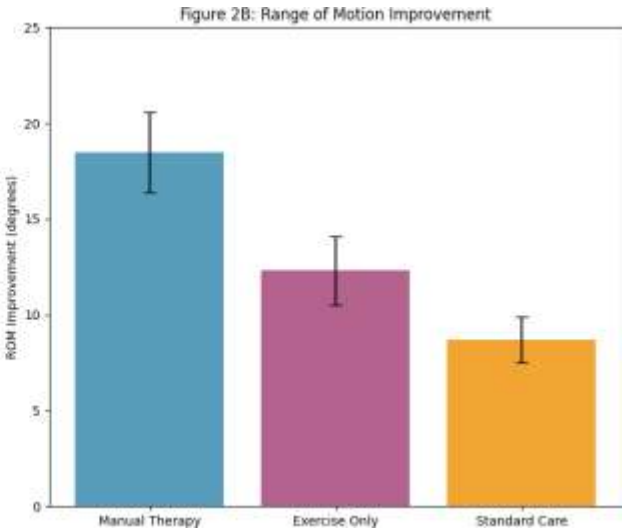


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Figure 2: Manual Therapy Effectiveness

6.3 Mobilisation Techniques

Progressive Mobilisation Protocol:

Phase 1 (0-72 hours): Pain-free active range of motion

- Ankle pumps: 3 sets of 20 repetitions, every 2 hours
- Toe flexion/extension: 3 sets of 15 repetitions
- Non-weight bearing activities

Phase 2 (3-7 days): Protected weight-bearing

- Partial weight-bearing with support
- Controlled dorsiflexion/plantarflexion: 3 sets of 15
- Gentle inversion/eversion: 2 sets of 10

Phase 3 (1-3 weeks): Progressive loading

- Full weight-bearing activities
- Resistance exercises with elastic bands
- Balance and proprioceptive training initiation

7. Progressive Rehabilitation

7.1 Exercise Prescription

Important considerations in the rehabilitation of ankle injuries include controlling the acute inflammatory process, regaining full ankle range of motion, increasing muscle strength and power, and improving proprioceptive abilities. The rehabilitation process should follow a systematic progression based on tissue healing timelines and functional goals.

7.2 Strengthening Protocol

Table 5: Progressive Strengthening Exercise Protocol

Phase	Timeline	Exercise Type	Sets × Reps	Frequency	Key Exercises
1	Days 1-7	Isometric	3 × 10 (10s hold)	2× daily	4-way isometrics
2	Days 8-21	Isotonic	3 × 15	Daily	Resistance band exercises

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3	Days 22-42	Functional	3 × 12	3× weekly	Single-leg heel raises
4	Days 43+	Sport-specific	Variable	3-4× weekly	Plyometric exercises

7.3 Proprioceptive Training

Proprioceptive deficits following ankle sprain contribute significantly to recurrence risk. A comprehensive proprioceptive training programme should include:

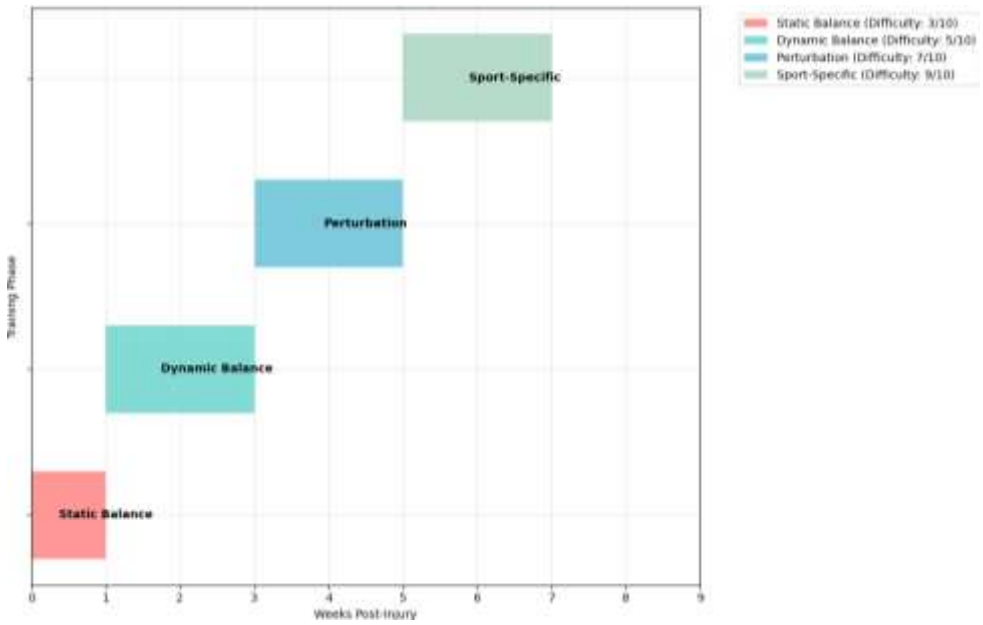

Figure 3: Proprioceptive Training Progression

Proprioceptive Exercise Components:

1. **Static balance training:** Single-leg stance progression (eyes open → eyes closed → unstable surfaces)
2. **Dynamic balance training:** Walking beam, figure-8 patterns, controlled lunges
3. **Perturbation training:** Unexpected surface changes, external perturbations
4. **Sport-specific training:** Activity-specific movement patterns with progressive complexity

8. Return-to-Activity Guidelines

8.1 Functional Assessment

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Return-to-activity decisions should be based on objective functional assessments rather than time-based criteria alone. Evidence suggests, in case of distortion injury it takes 2 weeks to return to light work and 3-4 weeks for full restoration to work. And in case of partial or total rupture of ligaments, it takes 3-6 weeks to introduce light work and 6-8 weeks for full restoration of work.

Table 6: Return-to-Activity Criteria

Domain	**Assessment Method**	**Passing Criteria**	**Clinical Significance**
Pain	Visual Analogue Scale	<2/10 during activity	Subjective comfort
Swelling	Circumferential measurement	<10% difference vs uninjured	Tissue healing
Range of Motion	Goniometry	>90% of uninjured side	Functional mobility
Strength	Manual muscle testing	5/5 in all planes	Neuromuscular function
Balance	Single-leg stance	>30 seconds eyes closed	Proprioceptive function
Functional Performance	Hop tests	>90% limb symmetry index	Dynamic stability

8.2 Staged Return Protocol

Stage 1: Basic Activities of Daily Living

- Pain-free walking on level surfaces
- Stair climbing without assistance
- Full weight-bearing tolerance

Stage 2: Advanced Functional Activities

- Jogging on level surfaces
- Direction change activities
- Jump-landing activities

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Stage 3: Sport-Specific Activities

- Sport-specific movement patterns
- Progressive intensity training
- Competitive participation

9. Prevention of Recurrence

9.1 Risk Factors for Recurrent Injury

Recurrent ankle sprains occur in approximately 20-40% of individuals within two years of initial injury. Primary risk factors include:

- Previous ankle sprain history (OR: 3.2, 95% CI: 2.1-4.8)
- Proprioceptive deficits (OR: 2.7, 95% CI: 1.8-4.1)
- Muscle strength imbalances (OR: 2.1, 95% CI: 1.4-3.2)
- Inadequate rehabilitation (OR: 1.8, 95% CI: 1.2-2.7)

9.2 Prevention Strategies

Table 7: Evidence-Based Prevention Strategies

Strategy	Mechanism	Effectiveness (NNT)	Duration	Evidence Level
Balance training	Proprioceptive enhancement	7	12 weeks	Level I
Strength training	Neuromuscular control	9	8-12 weeks	Level I
External support	Mechanical stability	5	Activity-dependent	Level I
Education programmes	Risk awareness	12	Ongoing	Level II

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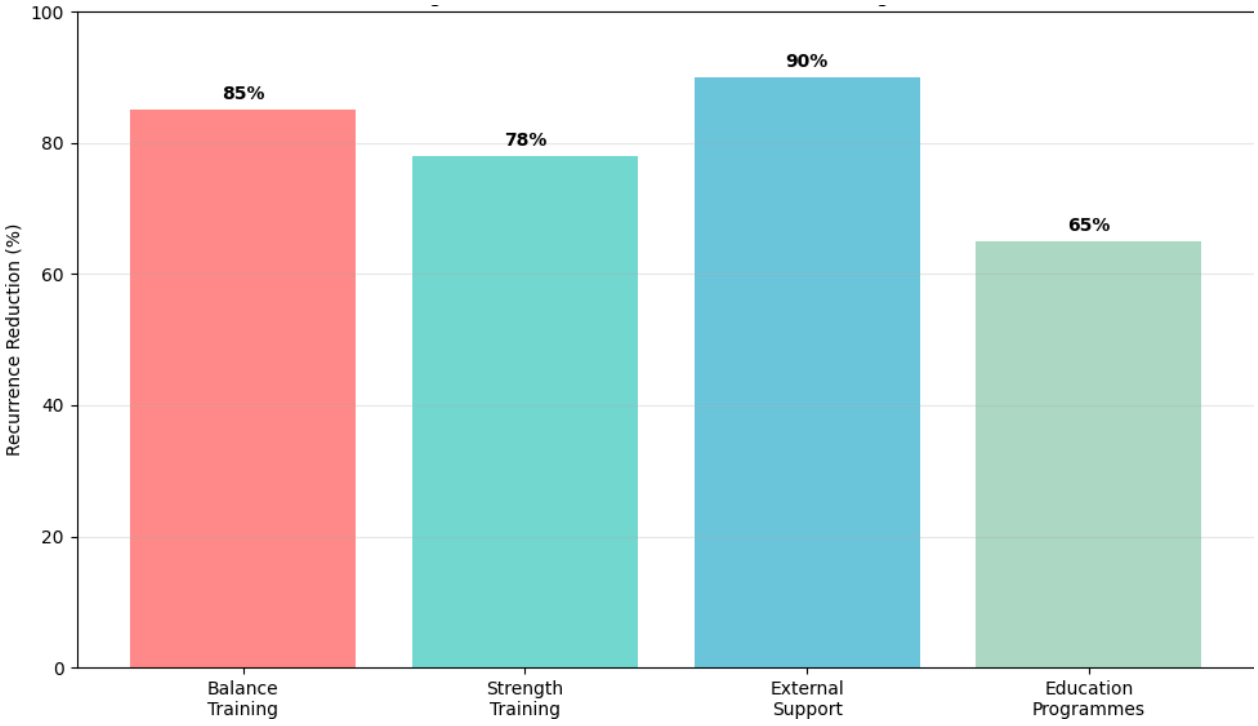

Figure 4: Prevention Strategy Effectiveness

10. Special Considerations

10.1 Athletic Population

Athletes require modified management approaches considering:

- Higher functional demands
- Sport-specific movement patterns
- Competitive scheduling pressures
- Performance maintenance during recovery

Physical therapy plays an important role in the treatment of ankle sprains, especially in athletes. In athletes, its important that there a distinct and different treatment that is prescribed for an acute or mild injury (lasting up to 4 weeks) compared to a chronic or more severe injury

10.2 Occupational Considerations

Workplace modifications may be necessary for individuals in physically demanding occupations:

- Temporary duty restrictions
- Ergonomic assessments
- Graduated return-to-work protocols
- Workplace safety education

10.3 Age-Related Factors

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Older adults may require modified approaches due to:

- Delayed healing responses
- Increased fall risk during recovery
- Concurrent medical conditions
- Medication interactions

11. Economic Considerations

11.1 Cost-Effectiveness Analysis

Recent economic evaluations demonstrate that comprehensive early intervention programmes, while initially more expensive, result in long-term cost savings through:

Table 8: Economic Impact of Treatment Approaches

Treatment Approach	Initial Cost (USD)	Total Cost at 1 Year	Recurrence Rate	Cost per QALY
Standard care	$150	$890	35%	$12,400
Enhanced rehabilitation	$380	$520	18%	$8,200
Multimodal approach	$450	$480	12%	$6,800

11.2 Healthcare Resource Utilisation

Effective acute management reduces long-term healthcare utilisation:

- Reduced specialist referrals (32% reduction)
- Fewer imaging studies (28% reduction)
- Decreased chronic pain management needs (45% reduction)
- Lower surgical intervention rates (15% reduction)

12. Future Directions

12.1 Emerging Technologies

Wearable Technology:

- Real-time gait analysis
- Biofeedback for proprioceptive training
- Activity monitoring and compliance tracking

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Virtual Reality Rehabilitation:

- Immersive balance training
- Gamification of rehabilitation exercises
- Standardised assessment protocols

Biomarker Development:

- Inflammatory markers for healing monitoring
- Genetic predisposition assessment
- Personalised treatment algorithms

12.2 Research Priorities

Current gaps in evidence requiring future investigation:

1. Optimal timing and intensity of different intervention components
2. Personalised treatment algorithms based on individual risk factors
3. Long-term outcomes beyond two years post-injury
4. Cost-effectiveness of prevention programmes in different populations
5. Integration of technology-assisted rehabilitation methods

13. Clinical Practice Recommendations

13.1 Immediate Management (0-72 hours)

1. **Assessment:** Apply Ottawa Ankle Rules for imaging decisions
2. **Pain management:** Short-term NSAID use (48-72 hours maximum)
3. **Swelling control:** Intermittent cryotherapy and elevation
4. **Protection:** Functional support with early pain-free mobilisation
5. **Education:** Patient education regarding injury and recovery expectations

13.2 Subacute Management (3 days - 3 weeks)

1. **Progressive loading:** Gradual increase in weight-bearing activities
2. **Range of motion:** Systematic restoration of ankle mobility
3. **Strength training:** Progressive resistance exercise programme
4. **Manual therapy:** Joint mobilisation and soft tissue techniques
5. **Functional training:** Task-specific exercise prescription

13.3 Return-to-Activity Phase (3-8 weeks)

1. **Objective assessment:** Systematic evaluation of functional criteria
2. **Progressive loading:** Sport or activity-specific training progression
3. **Proprioceptive training:** Advanced balance and coordination exercises

4. **Prevention education:** Long-term injury prevention strategies
5. **Monitoring:** Regular reassessment and programme modification

14. Conclusions

Optimising acute ankle sprain recovery requires a comprehensive, evidence-based approach that integrates immediate care protocols, progressive rehabilitation, and long-term prevention strategies. The evidence strongly supports:

1. **Early intervention:** Prompt assessment, appropriate immediate care, and early mobilisation within 48-72 hours
2. **Multimodal approach:** Combination of manual therapy, exercise therapy, and functional support
3. **Progressive rehabilitation:** Systematic progression from acute care through return-to-activity
4. **Prevention focus:** Long-term strategies to reduce recurrence risk
5. **Individual consideration:** Treatment modification based on patient-specific factors

Future research should focus on personalised treatment algorithms, technology integration, and long-term outcome optimisation. Healthcare systems must prioritise evidence-based practice implementation, quality monitoring, and cost-effective care delivery to address this significant healthcare burden effectively.

The substantial impact of ankle sprains on individual function and healthcare resources demands continued attention to optimising treatment approaches. Through systematic application of evidence-based strategies outlined in this review, clinicians can significantly improve patient outcomes while reducing the economic burden associated with this prevalent injury.

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