Effectiveness of manual techniques, exercise therapy, or combined treatments in the management of ankle sprains or chronic ankle instability in adult athletes: a systematic review protocol

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ABSTRACT

Objective: The objective of this review will be to synthesize the evidence on the effectiveness of manual techniques, exercise therapy, or combined treatments in the management of ankle sprains and chronic ankle instability in adult athletes.

Introduction: Acute ankle sprains and chronic ankle instability are common in athletes. These conditions can result in varying degrees of disability, including reduced athletic performance and time out of competition, which may have adverse psychological effects.

Inclusion criteria: The review will consider randomized controlled trials evaluating the effectiveness of manual techniques and/or exercise therapy for ankle sprain or chronic ankle instability in adult athletes. The comparators will include sham treatment, no treatment, and other conservative interventions. The outcomes of interest will be pain intensity, functional disability, ankle joint range of motion, ankle muscle strength, postural control, and subjective stability.

Methods: The review will follow the JBI methodology for systematic reviews of effectiveness. Searches will be conducted to locate published and unpublished studies in the following sources: MEDLINE (Ovid), CENTRAL (Ovid), Embase, SPORTDiscus (EBSCOhost), Physiotherapy Evidence Database (PEDro), Google Scholar, ClinicalTrials.gov, and the WHO International Clinical Trials Registry Platform (ICTRP). Two independent reviewers will select the study, critically appraise it, and extract data. Then, a narrative synthesis and, if appropriate, a meta-analysis will be performed. The certainty of findings will be determined using the GRADE approach.

Systematic review registration number: PROSPERO CRD42023493687

Keywords: ankle injuries; athletes; manual therapy; meta-analysis; systematic review

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Introduction

Acute ankle sprains, characterized by stretching or tearing of a part of the ankle ligament complex, are frequent in competitive athletes.[1,2] The most common mechanism of injury in ankle sprain is forced inversion and adduction of the foot combined with plantar flexion.[3] Therefore, the lateral ankle ligament complex has the highest risk of injury, followed by the syndesmotic complex and the deltoid (medial) ligament.[2,4] Traditionally, ankle ligament injuries have been classified in clinical practice into 3 grades representing increasing severity.[5,6] Grade I involves ligament stretch without macroscopic tearing, little swelling or tenderness, minimal or no loss of function, and no mechanical joint

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instability. Grade II is a partial macroscopic ligament tear with moderate pain, swelling, and tenderness over the involved structures, associated with some loss of joint motion and mild to moderate joint instability. Grade III is a complete ligament rupture with marked swelling, hemorrhage, and tenderness, associated with loss of function, abnormal joint motion, and marked instability.

Prevalence of ankle sprains among athletes ranges from 7% to 12%.[4,7] A review of injuries in 70 sports found that the ankle was the most frequently injured body region in one-third of the sports, with 77 % of these injuries being sprains.[2] High-risk activities for ankle injuries include team sports, court sports, and games that involve sudden changes of direction, jumping, contact, and running on uneven surfaces.[2,8]

Ankle sprains in sports can result in varying degrees of disability, including reduced athletic performance and time out of competition, which may have adverse psychological effects on the individual.[7] Although conservative rehabilitation restores a functional level of stability after most ankle injuries, the recurrence rate of ankle sprains is high.[9] More than half of athletes with a previous ankle sprain sustain a reinjury.[9] In addition, up to 40% of athletes with a history of ankle sprain develop chronic ankle instability (CAI).[10,11] CAI is a condition characterized by long-term (> 12 months after the initial sprain) perceived ankle instability or episodic "giving way," persistent pain and swelling, and self-reported dysfunction.[11-13] Furthermore, CAI may be associated with varying degrees of mechanical instability caused by connective tissue impairment and/or functional instability caused by sensorimotor impairment.[13]

Rehabilitation is an essential part of ankle injury treatment, as it can help restore muscle strength, range of motion, and joint function. Rehabilitation should begin as soon as possible after injury and should focus on reducing pain and swelling and restoring range of motion through gentle exercise.[12,14] A progressive, tailored rehabilitation program should be followed, including exercises to improve strength, balance, and proprioception.[12,14] In addition to exercise, manual techniques such as mobilization, manipulation, and soft-tissue techniques effectively reduce pain and improve ankle range of motion.[15] Although several recent clinical practice guidelines and reviews on ankle injury rehabilitation have been published, few specifically targeted athletes.[12,14,16] Given the greater physical demands associated with sports, the rehabilitation needs of athletes differ from those of the general population. In addition, reviews that have included athletes have not examined ankle sprains and CAI together.[17] These conditions are closely related; poor management of an acute ankle sprain can lead to chronic instability.[10,18] Since these 2 conditions are at different ends of a pathology continuum, studying them together would address the specific needs of athletes by identifying the best practices to improve management.

A preliminary search (in November 2024) of PROSPERO, MEDLINE (Ovid), the Cochrane Database of Systematic Reviews (Ovid), and *JBI Evidence Synthesis* did not identify any recent or ongoing systematic reviews on ankle injuries in athletes that specifically addressed the effectiveness of the 2 rehabilitation approaches (manual techniques and exercise therapy) considered in this study, taking into account relevant return-to-play criteria, a topic that is highly relevant for physiotherapists working with athletes. Therefore, the aim of this systematic review and proposed meta-analysis is to evaluate the effectiveness of manual techniques, exercise therapy, or combined treatment in the management of ankle sprains and chronic ankle instability in adult athletes.

Review question

What is the effectiveness of manual techniques, exercise therapy, or combined treatments in the management of ankle sprains and chronic ankle instability in adult athletes?

Inclusion criteria

Participants

This review will consider studies that identify some or all of their participants as adult athletes (recreational to elite,[19] female and male) with Grade I or II ankle sprains of the medial or lateral ligaments, or with CAI. We will exclude studies of athletes with Grade III ankle sprains, fractures (excluding Weber type A), or syndesmotic injuries and studies of surgical interventions.

If samples include adolescents (≥ 14 years), studies will be included if the median or mean age of the sample is ≥ 18 years or if the results for the adults can be extracted independently. Studies involving children (< 14 years) will be excluded unless any results for adults can be extracted independently. If samples include both athletes and non-athletes, the study will be included if the results for the athletes can be extracted independently. If samples include athletes with both Grade III and lower-grade ankle sprains, the data for lower-grade sprains will be included if reported separately.

Interventions

This review will consider studies that evaluate at least one of the following functional interventions: manual techniques (mobilization, high-velocity low-amplitude manipulation, and soft-tissue techniques) or exercise therapy (proprioceptive training, coordination training, strength training, range of motion exercises, and functional exercises), which may be supplemented by interventions usually advised after ankle injury. These include functional supports (such as ankle braces or taping), pain medication, or Rest Ice Compression Elevation (RICE) modalities. Functional intervention refers to interventions designed to optimize recovery of joint function (eg, freedom of movement and neuromuscular control). No restrictions regarding the frequency and duration of treatment sessions will be applied.

Studies evaluating manual techniques or exercise therapy in combination with non-functional interventions such as electrotherapy, laser therapy, shockwave therapy, ultrasound, or needling therapy will be excluded. Currently, there is no strong evidence to support the effectiveness of these non-functional modalities in treating conditions such as ankle sprains and CAI.[12,14,20] The exclusion of these non-functional interventions aims to enhance the clarity of findings and align the review with evidence-based practices for managing ankle sprains and CAI.

Comparators

This review will consider studies that compare the intervention to sham treatment, no treatment, or another conservative intervention.

Outcomes

This review will consider studies that include at least one of the following outcomes: pain intensity, functional disability, ankle joint range of motion, ankle muscle strength, postural control, or subjective stability. These outcomes represent important return-to-play criteria for athletes after ankle injuries.[18,21,22] Outcomes should be measured using devices, questionnaires, or patient-reported outcome measures before and immediately after the intervention.

Types of studies

This review will consider any randomized controlled trials evaluating manual techniques or exercise therapy (separately or combined) for ankle sprain or CAI. Based on a preliminary search, the authors determined it was feasible to restrict the review to RCTs; therefore, quasi-experimental study designs will be excluded.

Methods

The proposed systematic review will be conducted in accordance with JBI methodology for systematic reviews of effectiveness.[23] The protocol has been registered with PROSPERO (CRD42023493687).

Search strategy

The search strategy will seek both published and unpublished studies. An initial limited search was conducted on MEDLINE (Ovid), CENTRAL (Ovid), Embase, and SPORTDiscus (EBSCOhost) to identify studies on the topic. Then, text words from article titles and abstracts, as well as index terms used to describe the articles, were used to develop a full search strategy for each of the aforementioned databases (see Appendix I for the search strategy for MEDLINE). The search strategy was developed in collaboration with an expert in systematic reviews (including evidence searching) (ND) using an iterative process to test potential search terms for relevance. The search strategy will be adapted for each information source (listed below). Finally, the reference lists of included studies and relevant reviews found during the search will be screened for additional studies.

Articles in languages other than English or French (languages spoken by the authors) will be translated using DeepL (DeepL, Cologne, Germany); however, the translations will not be checked due to financial constraints.

The sources to be searched (from inception to the present) will include MEDLINE (Ovid), CENTRAL (Ovid), Embase, and SPORTDiscus (EBSCOhost). In addition, Physiotherapy Evidence Database (PEDro), Google Scholar, ClinicalTrials.gov, and the WHO International Clinical Trials Registry Platform (ICTRP) will be searched to locate published and unpublished studies. A discontinuation rule similar to that described in Dobbin-Williams *et al.*[24] will be used to screen the results (sorted by relevance) of the Google Scholar searches. Once 20 ineligible results in a row are reached, 50 more results will be screened. If none of the 50 articles are eligible, the screening of results will be stopped.

Study selection

Following the search, all identified citations will be uploaded into Covidence (Veritas Health Innovation, Melbourne, Australia) and duplicates will be removed. Study selection will involve several stages. First, 2 reviewers will conduct a pilot test on 25 records to ensure consensus on the eligibility criteria. Then, the same reviewers will independently screen the titles and abstracts for eligibility, followed by an assessment of the full texts of the selected citations. Full-text studies that do not meet the inclusion criteria will be excluded, and the reasons for their exclusion will be recorded and reported in the systematic review. Any disagreements that arise at each stage of the study selection process will be resolved through discussion or with a third team member. The results of the search strategies, study selection, and inclusion process will be reported in full in the final systematic review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram.[25]

Assessment of methodological quality

Following a pilot test on 10% of included studies, the selected studies will be critically appraised using the revised JBI critical appraisal tool for assessing the risk of bias for randomized controlled trials.[26] Both stages will be independently conducted by 2 reviewers using Covidence. Any disagreements that arise will be resolved through discussion or with a third team member. The results of this assessment will be reported in narrative format and in a table. All studies will undergo data extraction and synthesis (where possible), regardless of the risk of bias assessment results.

Data extraction

Following a pilot test on 10% of included studies, data will be extracted independently by 2 reviewers. Data extraction will be performed using a standardized template. All records will be managed using Covidence. The initial data extraction tool was developed by the research team, and includes specific details regarding the publication and the study, the participants, the interventions, the comparators, the outcome measures, the statistical analysis, and the results (see Appendix II). This tool will be modified and revised as necessary during piloting, prior to full data extraction. Any disagreements that arise between the reviewers will be resolved through discussion or with a third member of the team. Article authors will be contacted by email to request missing or additional data if required. A second email will be sent if no response is received after 2 weeks.

Data synthesis

Studies will, where possible, be pooled with statistical meta-analysis using R statistical software (R Foundation for Statistical Computing, Vienna, Austria) and the relevant packages (metafor, meta tidyverse, esc, and WebPower). Effect sizes will be expressed as standardized mean differences (Hedges' g) and their 95% confidence intervals will be calculated for analysis. They will be computed using the sample size, mean and standard deviation for the intervention and control groups. If articles report standard error instead of standard deviation, they will be converted into standard deviation. When these values are not reported, other statistics will be used (eg, *t*-statistics, degrees of freedom, and *p*-values) to calculate effect sizes. If no statistics are reported but a figure representing the mean and standard error or standard deviation is present, these values will be extracted from the figure. For pre-post intervention designs, the effect size of the difference between the intervention and control groups at the post-test will be calculated.

As the types and characteristics of clinical interventions reported in the literature vary, between-study heterogeneity is to be expected.[27] Therefore, statistical analyses will be performed using the random effects model for each outcome category independently. Pooled effect sizes will be corrected with the Knapp–Hartung adjustment method.[28] Between-study heterogeneity will be assessed statistically using the standard χ^2 and I^2 tests using the restricted maximum likelihood estimator.[29] In addition, the prediction interval will be computed.[30] When a specific study allows computing of more than one effect size (because of the presence of multiple groups or conditions of outcome measures), these effect sizes will be aggregated to obtain a single effect size for each study, in accordance with the procedure described by Borenstein *et al.*[31] A within-study correlation coefficient of 0.5 will be assumed to aggregate effects within a study.

Sub-group analyses will be conducted when sufficient data are presented to investigate athletic level (recreational: ≥ 4 hours per week, competitive: ≥ 6 hours per week or elite: ≥ 10 hours perweek[19]), injury type (ankle sprain or CAI), intervention type (manual techniques, exercise therapy, or combined treatments), and outcome measures. Sensitivity analyses will be conducted to assess the variation of the pooled effect size when considering only the effect sizes of studies with a statistical power of at least 80% for the pooled effect size estimated with the random effects meta-analysis and low risk of bias. The risk of bias for each study will be evaluated by considering the first 10 items of the JBI critical appraisal tool.[26] The overall risk of bias is low if all domains are low risk; some concern if there is at least one domain with some concern and none with high risk; and high risk if any domain is high risk. When statistical pooling is not possible, the findings will be presented in a narrative format, with tables and figures where appropriate to facilitate data presentation.

If 10 or more effect sizes are included in a meta-analysis, a funnel plot will be used to assess the small study effect. Statistical tests for funnel plot asymmetry (Egger test) will be performed where appropriate. Whether or not the results of the funnel plot asymmetry test are significant, 3 small study effect correction methods will be applied to our data: Trim-and-Fill, PET-PEESE, and Rücker's limit meta-analysis. Four estimations of the pooled effect size for each outcome measure will be obtained. Simulations will be conducted to determine the smallest detectable effect size with a statistical power of 0.80 and an alpha threshold of 0.05 for these 4 small study effect correction methods. These simulations will aid interpretation of the pooled effect sizes.

Assessing certainty in the findings

The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach[32] for grading the certainty of evidence will be followed, and a Summary of Findings (SoF) will be created using GRADEpro GDT (McMaster University, ON, Canada). Two reviewers will independently assess the certainty of evidence. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer. The SoF will present the following information where appropriate: standardized mean differences, a ranking of the quality of the evidence based on the risk of bias, directness, heterogeneity, precision, and risk of publication bias of the review results. The outcomes reported in the SoF will be pain intensity, functional disability, ankle joint range of motion, ankle muscle strength, postural control, and subjective stability.

Author contributions

SG, FL, and ND contributed substantially to the design and conception of the study. SG and ND developed the eligibility criteria and the search strategy, with input from FL and CD. FL developed the statistical analysis plan, with input from ND and SG. SG, FL, and ND drafted the initial manuscript. All authors revised the manuscript, approved the final submission, and agreed to be held accountable for all aspects of the work.

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Appendix I: Search strategy

Database: MEDLINE (Ovid)
Search conducted on November 28, 2024.

Search	Query	Records retrieved
#1	Exercise Therapy/	52,934
#2	Muscle Stretching Exercises/	2163
#3	Plyometric Exercise/	924
#4	Resistance Training/	13,618
#5	exercise*.ti,ab,kf.	390.882
#6	stretch*.ti,ab,kf.	95,002
#7	(neuromuscular adj3 facilitation*).ti,ab,kf.	693
#8	plyometric*.ti,ab,kf.	1442
#9	((Resistance or strength* or weight-bearing or weight-lifting or isometric) adj3 (program* or training*)).ti,ab,kf.	31,158
#10	((movement* or motion* or myofunctional) adj3 (therap* or training*)).ti,ab,kf.	5611
#11	(muscle* adj3 (training* or strengthening)).ti,ab,kf.	11,421
#12	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11	519,274
#13	Musculoskeletal Manipulations/	2382
#14	Manipulation, Chiropractic/	1140
#15	Manipulation, Osteopathic/	1272
#16	Manipulation, Orthopedic/	4008
#17	Therapy, Soft Tissue/	187
#18	((Manual or manipulative) adj3 (therap* or treatment* or medicine)).ti,ab,kf.	8269
#19	((adjustment* or manipulative) adj3 chiropractic).ti,ab,kf.	319
#20	((osteopathic or orthopedic or peripheral) adj3 manipulative).ti,ab,kf.	941
#21	manipulation*.ti,ab,kf.	154,377
#22	(mobilisation* or mobilization*).ti,ab,kf.	70,052
#23	soft tissue therap*.ti,ab,kf	147
#24	13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23	233,678
#25	Rehabilitation/	18,801
#26	Physical therapy modalities/	42,208
#27	rehabilitat*.ti,ab,kf.	244,455
#28	physical therap*.ti,ab,kf	36,596
#29	physiotherap*.ti,ab,kf.	38,947
#30	(Kinesiotherap* or kinesitherap*).ti,ab,kf.	941
#31	25 or 26 or 27 or 28 or 29 or 30	319,951
#32	12 or 24 or 31	1,004,156
#33	Ankle Injuries/	11,492
#34	Ankle/	13,429
#35	Ankle Joint/	20,476
#36	34 or 35	30,285
#37	“Sprains and Strains"/	5661
#38	36 and 37	854
#39	Joint Instability/	24,722

(*Continued*)

Search	Query	Records retrieved
#40	36 and 39	2520
#41	((Ankle* or tibiofibular or talocrural*) adj3 (injur* or sprain* or hypermobilit* or instabilit* or laxit* or hyperextensibilit* or lesion* or unstable)).ti,ab,kf.	10,222
#42	33 or 38 or 40 or 41	17,292
#43	32 and 42	2804

Appendix II: Data extraction instrument

Data extracted from individual studies will include the following:

- Study ID
- Author(s)
- Title
- Year of publication
- Country in which the study was conducted
- Aims/purpose
- Inclusion and exclusion criteria
- Participant characteristics
- Sample size (total and groups)
- Intervention characteristics
- Comparator characteristics
- Outcomes (categories, tools/measures, units, etc.)
- Methods of statistical analysis
- Results

