The Effects of Hop Stabilization Training on Athletes with Chronic Ankle Instability: A Critically Appraised Topic

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Abstract

Clinical Scenario: Chronic ankle instability (CAI) is increasingly common among athletes due to a high prevalence in ankle sprains causing joint/ligament laxity which leads to altered biomechanics in the lower extremities. Altered biomechanics and reoccurring sprains are the hallmark sign of CAI in athletes. Hop stabilization training tends to be common in ankle injury prevention, but current research literature is limited concerning how hop stabilization interventions can affect the altered biomechanics of athletes who suffer from CAI.

Focused Clinical Question: In an athletic population, how does hop stabilization training affect athletes with CAI?

Summary of Key Findings: All three studies found significant improvements in ankle stability through measures such as feedforward and feedback neuromuscular control, patient-reported feedback, dynamic balance, and postural sway.

Clinical Bottom Line: Current findings suggest hop stabilization training is beneficial in rehabilitation for athletes/patients with CAI.

Strength of Recommendation: Grade B evidence shows significant statistical 15 support for the use of hop stabilization as a rehabilitation method for CAI.

Introduction

CAI is more properly defined 'as an encompassing term used to classify a subject with both mechanical and functional instability of the ankle joint.[1,2]. Residual effects of an acute ankle injury has shown to develop into CAI in 40 to 50% of athletes who suffer from an ankle injury. [3,4] Various rehabilitation methods are common in treating CAI including balance control training which has proven to improve postural sway as well as isolated strengthening interventions. Many of these strategies have demonstrated improvements for athletes with CAI, however, these strategies tend to focus on rehabilitating of the ankle locally rather than looking at the global system. The purpose of this CAT is to look at hop stabilization's effectiveness in the rehabilitation of CAI in athletes

RQ, Appraisal of Evidence

Focused Clinical Question: In an athletic population, how does hop stabilization training affect athletes with CAI?

PICO:
Patient/Client group: Athletes, ankle instability, intrinsic foot muscle weakness, altered biomechanics
• Intervention: hop stabilization
• Comparison: No terms listed (generic ankle rehabilitation, rest)
• Outcomes: No terms listed (ankle rehabilitation, improved kinematics)

Evidence Appraised: Our literature search identified 8 studies. In addition to this, a hand search of the EBSCO 43 database included an additional study, bringing our total to 9. Of these, 3 were excluded 44 as duplicates, 2 were excluded based on title or abstract, and one was excluded based on 45 lack of relevance to this critically appraised topic (CAT) (Figure 1). 46
• In total, 3 randomized controlled trials (RCT) were included based on the set inclusion 47 and exclusion criteria. A PEDro scale was used by the researchers to independently assess each article, with the average score returning a 7/10.

Search Strategies

Sources of Evidence Searched:
• CINAHL Plus
• Health Source - Consumer Edition
• Health Source - Nursing/Academic
• MEDLINE Ultimate
• MEDLINE Full text
• Sportdiscus
• PubMed

Inclusion Criteria:
• Written in the last 5 years (2018-2023)
• Human subjects all of whom were collegiate level athletes
• Includes a hop-stabilization intervention
• Focused on altered ankle biomechanics in athletes with CAI

Exclusion Criteria:
• Focused on altered biomechanics without an intervention
• CAI in non-athlete populations
• Intervention/treatments utilizing modalities rather than hop stabilization
• Systematic reviews

Results of Search: Three relevant studies were located using search terms and through hand search (Figure 1).Validity was determined using the PEDro scale (Tables 2,3)

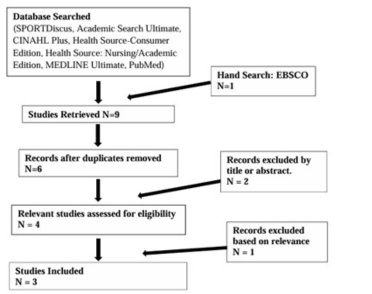

Figure 1- Search Strategy

Figure 2: Example of Plyometric Training
Image obtained from: speedendurance.com/2007/04/09/15-things-you-should-know-before-beginning-depth-jumps/

Table 1 Summary of Study Design of Articles Retrieved

Level of Evidence	Study Design	Number Located	Reference
1b	Randomized, controlled trial	2	Ardakani et al[5] Lee, Oh, & Wong[6]
2a	Randomized controlled trial	1	Minoonejad et al[4]

Table 3 Results of PEDro Scale for Each Article

	Ardakani et al[5]	Lee, Oh, & Wong[6]	Minoonejad et al[4]
1.Eligibility criteria specified (yes/no)	yes	yes	yes
2. Subjects randomly allocated to groups (yes/no)	yes	yes	yes
3. Allocation was concealed (yes/no)	no	no	no
4. Groups similar at baseline (yes/no)	yes	yes	yes
5. Subjects were blinded to group (yes/no)	yes	no	yes
6. Therapists who administered therapy were blinded (yes/no)	no	no	no
7. Assessors were blinded (yes/no)	yes	no	yes
8. Minimum 85% follow-up (yes/no)	yes	yes	yes
9. Intent to treat analysis for at least 1 key variable (yes/no)	yes	yes	yes
10. Results of statistical analysis between groups reported (yes/no)	yes	yes	yes
11. Point measurements and variability reported (yes/no)	yes	yes	yes
Overall Score (out of 10)	8/10	6/10	8/10

Note: Item 1 was not included in overall score

Table 2: Characteristics of included studies

	Ardakani et al[5]	Lee, Oh, & Wong[6]	Minoonejad et al[4]
Study Design	Randomized Controlled Trial	Randomized Control Trial	Randomized Control Trial
Participants	28 Male College Basketball Players Experimental age= 22.78 ±3.09 years Control age= 22.57 ±2.76 years	14 College Taekwondo Performers Plyometric: Age=22 yrs ±1.73 yrs Ankle Stability: Age= 23.57 yrs ± 1.62 yrs	28 Male College Basketball Players Experimental: (age= 22.78 ±3.09 years Control: age= 22.57 ±2.76 years
Interventions Investigated	Hop-Stabilization group: A 6-week, progressive Hop-Stabilization training program CON: No treatment received	PYE 8 week plyometric program (sides, box jumps, SL/DL jumps) ASE: 8 week program focusing on balance pads and band focused ROM exercises	Hop-Stabilization group: 6 weeks of progressive Hop-Stabilization training, 3 days a week CON: No treatment received
Outcome Measures	Self-Reported Function: Subjective assessments throughout program cycle Lower Extremity Kinetics: Measured in the ankle, knee, and hip, assessing both joint angles, force at initial contact, and vertical GRF	Y balance test for dynamic balance Motion analysis system and force plate for kinematic and kinetics	Self-Reported Function: (FAAM, FAAMs, CAIT, FAOS) Lower Extremity: muscle activation levels and muscle onset time for 8 lower-extremity muscles. Neuromuscular control measures were also assessed.
Main Findings	Plyometric training improved self-reported function scores, hip and knee flexion readings, and ankle dorsiflexion. Decreased GRF and increased time to reach GRF were also reported	Dynamic balance and shock absorption increased in both groups. Postural sway decreased Ankle DF decreased, hip/knee joint flex increased at max knee flex for PYM group. Ankle PF increased at IC for ASE group	Muscle activation measurements were improved across the board for the experiment as opposed to the control group. Self-reported function assessments also returned higher scores.
Level of Evidence	1b	2a	1b
Validity Score	8/10	6/10	8/10
Conclusion	The hop-stabilization program proved effective in improving the chosen metrics for college basketball players and could serve to reduce reoccurrences on CAI in this population	Both groups reinforced dynamic balance and decreased postural sway. PYE group developed a different biom. landing strategy for hip/knee joints.	The 6 week program improved neuromuscular control and patient reported outcomes alike.

Abbreviations: CON, Control Group; PYE, Plyometric Exercise; CAI, Chronic Ankle Instability; IC, Initial Contact; DF, Dorsiflexion; PF, Plantarflexion; ASE, Ankle Stability Exercise; GRF, Ground Reaction Forces; ROM, Range of Motion; FAAM, Foot and Ankle Ability Measurement; FAAMs, Foot and Ankle Ability Measurement Sport; CAIT, Cumberland Ankle Instability Tool; FAOS, Foot and Ankle Outcome Score

Key Evidence and Results

Results: Evidence from these studies suggest that the implementation of a plyometric training program in the rehab process of those with chronic ankle instability can lead to a broader range of positive benefits than have previously been considered. Each program should be adapted for individual ability but that should not dissuade clinicians from implementing them in rehab programs.

Summary of Key Evidence:
3 randomized controlled trials (RCT) were included based on the set inclusion and exclusion criteria.
• Our three studies compared the effects of hop-stabilization/plyometric training (HST/PYE) on collegiate athletes with chronic ankle instability (CAI), each with an experimental group receiving a 6–8-week progressive training program. Hip and knee flexion, as well as other kinematic values were collected as outcome measures, in addition to self-reported measures of function throughout the time period. Other outcome 53 measures were assessed as well (Table 2).
• All three studies found that HST/PYE correlated with a statistically significant change in lower body kinematic readings, dynamic balance, shock absorption, and self-assessment measurements. In addition to this, it was found that HST/PYE induces a difference in the biomechanical patterns of athletes with this training background when presented with a landing scenario compared to the control group. From this we can maintain that patient-specific, modified plyometric training can be a critical component of the rehab process for many patients.

Discussion

These studies suggest that the implementation of a hop-stabilization/plyometric training program in the rehab process of those with chronic ankle instability can lead to a broader range of positive benefits than have previously been considered

When looking at clinical implications from this study the takeaway is not to implement a plyometric training method from a standalone sense, it is more so that the usage of these programming techniques leads to enhanced shock absorption and stability when paired with traditional rehabilitation methods, making it an important piece of the rehab puzzle, but merely a piece.

This is further seen from an in-depth physiological standpoint when looking at the study done by Ardakani et al[5], who compared metrics from the hip (internal/external rotation, flexion/extension, adduction/abduction), knee (flexion/extension, valgus/varus, adduction/abduction), and ankle (dorsiflexion/plantarflexion, internal/external rotation, abduction/adduction). These metrics were pre and post-tested to examine the values at IC and at peak vertical GRF. Their work found that reductions in knee valgus, plantar-flexion, and ankle inversion were noted across their experimental group, along with an increase in knee and hip flexion[5]. This is consistent with the findings of Lee, Oh & Wong[6] who concluded that plyometric training led to a biomechanical retraining of landing patterns in the observed athletes to more kinematically efficient patterns, lessening the chance for re-injury of this nature. Although all authors do indicate the need for broader research ventures, particularly in the long-term effects of this training method, it appears to be clinically beneficial in that aspect of biomechanical retraining.

Future Work

More research must be performed on this topic to determine the generalizability and long-term effectiveness of this training method on cases of CAI, which necessitates the review and potential update of this CAT in 2 years to determine if gaps in research have been sufficiently filled, or if contradicting evidence has come out regarding this topic which may change the conclusions or clinical bottom line of this CAT.

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