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CRITICALLY APPRAISED TOPIC

The Effect of Fibular Reposition Taping on Postural Control in Individuals With Chronic Ankle Instability: A Critically Appraised Topic

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Clinical Scenario: History of acute ankle sprains can result in chronic ankle instability (CAI). Arthrokinematic changes resulting from CAI may restrict range of motion and contribute to postural control deficits. Mulligan or fibular reposition taping (FRT) has been suggested as a means to realign fibular positional faults and may be an effective way to improve postural control and balance in patients with CAI. ***Clinical Question:*** Is there evidence to suggest that FRT will improve postural control for patients with CAI in the affected limb compared with no taping? ***Summary of Key Findings:*** Three of the 4 included studies found no significant difference in postural control in patients receiving FRT compared with sham or no tape. ***Clinical Bottom Line:*** There is moderate evidence refuting the use of FRT to improve postural control in patients with CAI. ***Strength of Recommendation:*** There is grade B evidence to support that FRT does not improve postural control in people with CAI.

Keywords: Mulligan tape, ankle sprain, balance

Clinical Scenario

Ankle sprains are a common injury affecting both athletes[1] and the general population.[2] Physical deficits such as mechanical instability, sensorimotor impairment, and recurrent pain can persist after acute symptoms have resolved[3] and lead to a decrease in physical activity and health-related quality of life.[4,5] Chronic ankle instability (CAI) is a common residual problem resulting from lateral ankle sprains characterized by sensations of joint instability, episodes of "giving way" during activities of daily living, mechanical laxity,[6] and diminished postural control or balance.[7] Postural control impairments may be associated with alterations in arthrokinematics, which occur as a result of joint trauma.[8] Although other factors may also contribute to alterations in postural control, this paper will focus on the influence of arthrokinematic alterations following acute ankle sprains. Arthrokinematic restrictions resulting from lateral ankle sprains reduce the ability to achieve full physiological range of motion of the joint,[9] which has been demonstrated to negatively impact postural control.[10,11] One such arthrokinematic alteration associated with inversion ankle sprains is an anterior and inferior shift of the fibula relative to the talus. Positional faults of the fibula are thought to limit accessory motions in the ankle, which may result in hypomobility[12] and negatively affect sensorimotor function.[13,14] To address fibular positioning faults, it has been suggested that fibular reposition taping (FRT) may improve postural control in patients with CAI by mechanically realigning the fibula and restore preinjury arthrokinematics.[15–19] Therefore, FRT could become a useful tool to aid clinicians in the treatment of patients with CAI and lead to reduced symptoms and improved performance during physical activity.

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Focused Clinical Question

Is there evidence to suggest that FRT will improve postural control for patients with CAI in the affected limb compared with no taping?

Summary of Search, "Best Evidence" Appraised, and Key Findings

- The literature was searched for studies of level 3 evidence or higher that investigated the effect of FRT on postural control in patients with CAI.
- The search of the literature yielded 7 possible studies for inclusion.
- Four studies[16–19] met the inclusion criteria and were critically appraised using the 16-item Downs and Black checklist[20] in which individual studies were categorized as low (<60%), moderate (60%–74.9%), or high (>75%) quality based on the number of identified criteria.
  - Three of the studies[16–18] suggested that FRT does not improve postural control in individuals with CAI.
  - Whereas 1 study[19] indicated significant improvements in postural control in individuals with CAI.

Clinical Bottom Line

There is moderate evidence refuting the use of FRT to improve postural control in patients with CAI.

Strength of Recommendation

There is grade B evidence that FRT does not improve postural control in people with CAI. The Centre of Evidence-Based Medicine (CEBM) Levels of Evidence 2011 recommends grade B for a combination of level 1–3 evidence with consistent findings.

Search Strategy

Terms Used to Guide Search Strategy

- **P**atient group: chronic ankle instability
- **I**ntervention: Mulligan OR fibular reposition taping
- **C**omparison: no tape OR sham
- **O**utcome: postural control OR balance

Sources of Evidence Searched

- EBSCOhost
- SPORTDiscus
- CINAHL
- PubMed

Inclusion and Exclusion Criteria

Inclusion Criteria

- Studies that compared a FRT condition to a no tape or sham condition in people with CAI
- Studies that included a measure of postural control as an outcome measure
- Level 3 evidence or higher
- Limited to English language
- Limited to humans
- Limited to the past 10 years

Exclusion Criteria

- Studies that did not include subjects with CAI
- Studies that did not include a FRT condition
- Studies that did not include postural control as an outcome measure

Results of Search

Four relevant studies[16–19] were obtained and are categorized in Table 1 (based from Levels of Evidence, CEBM, 2011).[21]

Best Evidence

The studies in Table 2 were identified as best evidence and therefore selected for inclusion in this critically appraised topic. These studies were included because they were categorized as level 3 evidence or higher and examined the effect of FRT on postural control compared with no tape or sham tape in individuals presenting with CAI.

Implications for Practice, Education, and Future Research

Only one investigation[19] identified significant changes in postural control following FRT application, with the remaining studies concluding there were no changes in static or dynamic postural control following FRT application.[16–18] Based on the consistency of the findings and level of evidence, a grade B strength of recommendation was made as there is moderate evidence to refute using FRT as an intervention to enhance postural control in patients with CAI.

The method of assessing postural control did not appear to be an important factor in FRT outcomes. Most of the included studies utilized the Star Excursion Balance Test to assess dynamic postural control, while a single study[16] utilized a force plate to assess single-limb static postural control. The method of assessing postural control may be an important consideration when attempting to identify changes in postural control following an intervention in patients with CAI. This point is supported by a critically appraised topic[22] that identified postural control impairments following short foot exercises when assessed with dynamic measures but not with static measures in those with CAI. However, talocrural joint mobilization resulted in immediate improvements in static balance but not dynamic balance in those with CAI.[23] Therefore, the identification of postural control improvements following intervention may be directly related to the type and theorized treatment effect of the intervention under investigation. In the case of FRT, only one of the studies[17–19] that measured dynamic postural control identified a significant improvement, while the single study[16] that measured static balance also did not identify improvement. The study by Someeh et al[19] identified reach distance improvements of 4% to 5% associated with effect sizes ranging from moderate to large (0.60–0.75). Although this study did have the greatest quality index score, the consistency of the findings from the other included studies indicate that FRT may not improve postural control in those with CAI regardless of the measurement technique. Based on these results, future studies that further pursue this line of inquiry should give careful consideration to selecting postural control measures, which best assess the theorized benefits of FRT in those with CAI.

The application of the FRT intervention among the 4 studies[16–19] was very similar (Table 2). Three of the studies used tape directly on the skin starting at the distal malleolus of the fibula.[16,17,19] However, one investigation[18] utilized the same taping technique with the addition of cover roll between participant's skin and the leukotape but still did not alter postural control measurements.[18] Overall, a homogenous FRT technique was applied across all four studies.[16–19] However, none of the studies assessed fibular position at any time

Table 1 Summary of Study Designs and Level of Evidence Based on CEBM 2011

Level of evidence	Study design	Number located	References
2	Crossover	1	Wheeler et al[18]
2	One-way repeated measures	3	Hopper et al[16]
			Delahunt et al[17]
			Someeh et al[19]

Abbreviation: CEBM, Centre of Evidence-Based Medicine.

Table 2 Characteristics of Included Studies

Characteristic	Hopper et al[16]	Delahunt et al[17]	Wheeler et al[18]	Someeh et al[19]
Study design	One-way repeated measures	One-way repeated measures	Crossover	One-way repeated measures
Participants	20 volunteers (8 men and 12 women; mean age = 23.0 [1.0] y; mean height = 173.1 [2.4] cm; mean weight = 69.3 [3.0] kg) with unilateral CAI. CAI defined by repetitive incidence due to lateral ankle instability. Subjects screened by using the FADI and FADI sport. Subjects only included if they had unilateral CAI. Subjects excluded if they had bilateral ankle injuries, ankle injury within the last 3 mo, or any type of neurological deficit that could alter proprioception. Subjects were randomized in a crossover trial design where each subject served as their own control. An initial coin flip was used to identify which limb was to be taped first. A second coin flip was conducted to determine limb testing sequence. Testing occurred during a single laboratory session.	16 physically active adults (10 women and 6 men; age = 21.32 [1.35] y; height = 1.76 [.08] m; weight = 74.94 [10.43] kg) with CAI. Ten participants had bilateral CAI, and 6 had unilateral CAI. Inclusion criteria were a history of ≥2 inversion sprains of the same ankle, subjective history of episodes of the ankle giving way, subjective reporting of feelings of ankle joint instability during sports participation, and a CAIT score ≥ 24. Exclusion criteria included a history of high ankle sprain, CAIT score >24, and ankle joint sprain within 1 wk of the study. For subjects with bilateral CAI (10 of 16), the limb with the lowest CAIT score was tested. Testing occurred during 1 session where both the 3 taping conditions (no tape, FRT, and subtalar sling) and reach direction sequence were randomized using a concealed envelop methodology. Once determined for the subject, reach direction sequence remained the same for all conditions.	23 participants (8 men and 15 women; age = 23.4 [2.5] y; height = 171.6 [12.4] cm; weight = 71.5 [13.1] kg; FAAM-sport = 71.0% [16.3%]; AII = 6.2 [1.7]; history of 3.5 [4.1] ankle sprains) with CAI participated. One participant withdrew from the study after the first session. Inclusion criteria included <85% on the FAAM-sport or a 3 on the AII and a minimum of 5° dorsiflexion difference from involved limb to uninvolved. For subjects with bilateral CAI (13 of 23), the limb with the greatest dorsiflexion range of motion restriction was tested. Subjects were randomized in a crossover trial design, where each subject served as their own control. Subjects were randomly assigned to one of 2 treatment sequences (sham and FRT). Subjects reported to the laboratory on 2 separate occasions to experience each treatment once.	16 professional-level athletes with unilateral CAI (10 men and 6 women; age = 23.2 [3] y; height = 175.4 [10.3] cm; weight = 73 [14.5] kg) and 16 healthy professional athletes (10 men and 6 women; age = 22.8 [1.7] y; height = 173.6 [12.2] cm; weight = 66.4 [11.4] kg). Inclusion criteria for the CAI group included a history of ≥2 acute ankle sprains that resulted in pain and swelling and a history of multiple episodes of the ankle giving way in the most recent 6 mo. Exclusion criteria were history of lower-extremity fracture, acute ankle sprain in the most recent 6 wk, or bilateral CAI. Subjects reported to the laboratory for a single testing session including a 10-min rest between conditions. Both the taping conditions (no tape and FRT) and reach direction sequence were randomized for each subject.
Intervention investigated	Two strips of leukotape applied to the distal aspect of the fibula. A pain-free posterior–lateral, superior glide applied to the fibula. Tape is then wrapped around the posterior aspect of the leg and anchored superior to the start.	Tape started at the distal end of the lateral malleolus. Tape was then oriented obliquely with a posterior lateral glide on the fibula. Tape finished on the lower one-third of the tibia superior to the malleolus.	With the ankle in a neutral position, tape started at the distal aspect of the fibula. It was then wrapped around the posterior leg and finished superior and medial to the start. Taping was completed by a posterior and superior force, whereas in the sham, there was no tension pulled. The first strip of tape used was a cover strip, and the second strip was rigid zinc oxide tape.	Two strips of leukotape applied to the distal aspect of the fibula. A pain-free posterior–lateral, superior glide applied to the fibula. Tape is then wrapped around the posterior aspect of the leg and anchored superior to the start.
Outcome measures	Single limb static and dynamic postural control measured on a force plate.	Anterior, posteromedial, and posterolateral directions of the SEBT.	Anterior, posteromedial, and posterolateral directions of the SEBT.	Anteromedial, medial, and posteromedial directions of the SEBT.

(continued)

Table 2 (continued)

Characteristic	Hopper et al[16]	Delahunt et al[17]	Wheeler et al[18]	Someeh et al[19]
Main findings	FRT had no significant effect on instrumented measures of static postural control compared with no tape ($P > .05$).	FRT had no significant effect on reach distances in anterior, posteromedial, or posterolateral directions compared with no tape or lateral subtalar sling ($P > .05$).	FRT produced a significant but not clinically relevant increase in posterolateral reach distance ($P = .03$) with fibular taping as opposed to sham. Anterior and posteromedial had no significant increase in reach distance ($P > .05$).	FRT significantly improved anteromedial, medial, and posteromedial reach distances in the healthy and CAI groups ($P < .05$).
Level of evidence	2	2	2	2
16-item Downs and Black checklist[13]	65%	59%	65%	82%
Conclusion	FRT does not improve postural control.	FRT does not improve postural control.	FRT does not improve postural control.	FRT significantly improved all directions of the SEBT.

Abbreviations: AII, Ankle Instability Instrument; CAI, chronic ankle instability; CAIT, Cumberland Ankle Instability Tool; FAAM, Foot and Ankle Ability Measure; FADI, Functional Ankle Disability Index; FRT, fibular repositioning tape; SEBT, Star Excursion Balance Test.

point during the investigation.[16–19] Whether subjects included in these investigations actually had a positional fault is unclear and therefore brings to question whether the FRT intervention achieved the intended purpose of mechanically correcting the patients fibular position and arthrokinematics at the ankle. As a result, it is possible that the FRT intervention was not indicated in these subjects or that the applied intervention was not achieving the intended purpose of mechanically addressing the positional fault. Both factors may have impacted the results of these studies contributing to a lack of significant findings. Future studies should consider examining FRT in patients who exhibit a confirmed malpositioning of the distal fibula and the concurrent mechanical effects to further understand the role of this treatment in the management of patients with CAI.

The use of FRT in patients with CAI has also been explored in the context of motor neuron excitability, which may play a role in postural control.[24] Current literature provides inconclusive results regarding the ability of FRT to provide clinically significant neuromuscular changes in patients with CAI as recent investigations have identified both significant changes[25] and no changes[26] in neuromotor excitability in this population. None of the investigations reviewed for this paper included any neuromuscular outcome measures and discrepancies in the FRT literature in both areas of motor neuron excitability and postural control are present. This highlights the complexity of CAI and the need for a multidimensional approach to treatment of this condition.

The included articles were critically appraised using the 16-item Downs and Black checklist,[20] which identified 1 low-quality, 2 moderate-quality, and 1 high-quality study (Table 2). Commonly missed items included recruitment over the same time period, description of confounders, adjustments for confounding in the analysis, and participants representative of the population.[20] Based on the consistent findings from level 2 evidence based on the CEBM 2011 guidelines, a grade B strength of recommendation was made as there is moderate evidence to refute using FRT as an intervention to enhance postural control in patients with CAI. All studies were categorized as level 2 because they utilized an experimental design that contained randomization and a control condition. It should be noted that the study by Wheeler et al[18] had a stronger design as it met the criteria of a crossover trial as subjects were randomized to a treatment order on different days, which created a true washout period between conditions. Although we categorized the included studies as a relatively high level of evidence, no randomized controlled trials were identified, which would be considered the gold standard experimental design for assessing therapeutic interventions. Based on the brevity of the FRT intervention in the included studies, the implemented designs are certainly appropriate and do not appear to have created bias based on the limited number of identified improvements. This critically appraised topic should be reviewed in 2 years or when additional best evidence becomes available, which may change the clinical bottom line for this clinical question.

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