The Effectiveness of Strength Training Protocols on Strength Development in Participants With Chronic Ankle Instability: A Critically Appraised Topic

Emily A. Hall, MS, ATC, Jordan Frank, MS, LAT, CSCS, and Carrie L. Docherty, PhD, ATC, FNATA • Indiana University

Clinical Scenario

Following a lateral ankle sprain, an individual is more susceptible to recurrent ankle sprains and other residual symptoms. Oftentimes, these residual issues lead to chronic ankle instability (CAI). CAI is a multifaceted condition defined as repetitive episodes of instability or giving way of the ankle. This condition often presents with strength, balance, and functional performance deficits. Strength and proprioceptive deficits create an environment where the joint relies heavily on the static stabilizers for support. This predisposes the joint to repetitive microtrauma to the articular cartilage, which can result in osteoarthritis. Improving strength will create a more stable joint and potentially decrease the deficits of CAI, subsequently preventing the repetitive trauma on the articular cartilage. Six-week rehabilitation protocols have been examined in research and include strengthening exercises such as resistance bands or tubing, manual resistance, and isokinetic resistance. These protocols will be evaluated to determine if they are effective at improving the strength deficits of CAI.

Focused Clinical Question

Are strength-training protocols effective at increasing strength of the muscles in the lower limb in subjects with chronic ankle instability?

Search Strategy

The search terms used were:

- Patient/client group: “chronic ankle instability” OR CAI OR “ankle instability” OR FAI
- Intervention (or assessment): strength AND training AND rehabilitation
- Comparison: no intervention AND control
- Outcomes: ankle AND strength

The search was completed using:

- The Cochrane Library
- Google Scholar
- PEDro Database
- SPORTDiscus
- Additional resources obtained via review of reference lists and hand search

The criteria for the study selection were:

- Studies with at least one strength-training protocol group
- Studies with at least one strength outcome measure
- Level 2 evidence or higher
- Limited to English language
Limited to humans
Limited to studies published in the last 20 years

Exclusion criteria
- Studies using multicomponent programs (strength + balance and/or plyometrics, etc.)
- Healthy participants without chronic ankle instability

The method used to appraise the quality of the evidence was the PEDro scale based on the CONSORT statement.

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

The literature was searched for studies that investigated the effect of strength-training protocols on increasing strength at the ankle in participants with chronic ankle instability. The following studies were identified as the best evidence and selected for inclusion for this critically appraised topic (Table 1). These studies were selected because they demonstrated a level of evidence of 2 or higher, studied strength-training protocols at the ankle in participants with chronic ankle instability, and used ankle strength as an outcome measure.

- Initial search yielded 51 studies, but 22 studies were excluded based on abstract content.
- Of the remaining 29 intervention studies, 23 studies were excluded because they incorporated a balance, range of motion, or function performance component to the rehabilitation protocol.
- One study examined an ankle strength-training protocol but was excluded from this CAT because the outcome measures did not include muscle strength, only muscle fatigue.
- Another study evaluating an isokinetic strength training protocol on muscle strength was excluded from this CAT because the level of evidence was a 3.
- Four relevant studies met the inclusion criteria and were included in this CAT (based on Levels of Evidence).

Clinical Bottom Line
Strength-training protocols at the ankle are effective at increasing strength, however, adequate resistance must be used to facilitate these improvements. Three studies demonstrated improvements in ankle strength following a six-week strength-training protocol at the ankle in participants with chronic ankle instability. One study identified no improvement in strength compared with the control group following a strength training protocol.

Strength of Recommendation
Level A evidence exists that strength-training protocols are effective at increasing lower limb muscular strength in participants with chronic ankle instability when sufficient resistance is used. The recommendation of level A was given due to the consistency of conclusions of the level 2 evidence included in this CAT.

Implications for Practice, Education, and Future Research

There are many different strength training protocols for the ankle used in the clinical setting. Research has examined the resistive tubing progressive training protocol (RTPTP),3,4 resistance band protocol (RBP),6 multiaxial ankle exerciser (MAE, Multiaxial, Inc., Lincoln, RI),5 and proprioceptive neuromuscular facilitation (PNF) strength protocols. The most common protocols, RTPTP and RBP, are performed for three sessions per week for six weeks using elastic tubing or bands3,5,6 with the amount of sets or resistance increased each week. The patient performed dorsiflexion, plantar flexion, inversion, and eversion while the resistance band was stretched out to 170% of its resting length to ensure adequate resistance is applied. Another study used the MAE in addition to the RTPTP. The MAE was designed to secure the foot into a closed kinetic chain position to complete exercises in different patterns with varying amounts of resistance. The multiplanar motion was similar to another protocol using PNF strength against a manual resistance in multiplanar patterns.

Three3,5,6 of the four studies using the resistance tubing or band protocols reported an increase in dorsiflexion,3,6 eversion,3,5,6 and inversion5,6 ankle strength. Only one study assessed plantar flexion strength, but did not yield improvements with neither the RBP nor PNF protocols. Investigators contributed this to the lack of appropriate resistance to challenge the gastrocnemius and soleus muscle groups. Clinicians should use exercises with much greater resistance to seek improvements in plantar flexion strength. Each