



## Ankle Sprain: Acute Phase Care

**Short term goals:** limit inflammation, reduce pain, unload and protect the joints as necessary

**Functional goal:** Ability to weight bear

**Outcome measures:** observe gait for ability to walk without a limp (pass/fail), observe/measure degree of swelling, and measure pain intensity

### REST, ICE, COMPRESSION, ELEVATION (RICE)

- Elevate ankle as soon and often as possible (e.g., 25% of the time) for the first 12-24 hours.
- “High elevation” option on the field immediately after injury: athlete lies on the floor with his leg held up or supported at 90 degrees; limit to 10-15 minutes because of the extreme discomfort it can cause.
- Cryotherapy (bag of ice or a frozen gel pack) directly on the site of injury for 15 to 20 minutes every 1-2 hours or at least twice a day.
- A blood pressure cuff lined with a towel-covered ice pack can be placed around the ankle; inflate with mild pressure (60 seconds of compression alternating with release of pressure for 60 seconds for no longer than 15 minutes).
- Temporary compression can be achieved by elastic bandage or tape.

### MOTION (INITIALLY ANKLE PUMPS)

With ankles slightly elevated, the patient slowly dorsi-and plantar flexes through a pain free range of motion. Recommend 10-20 pumps per hour.

### MANUAL MOBILIZATION/MANIPULATION

Depending on degree of swelling and patient tolerance joint mobilization or thrust manipulation can be used (see Appendix B). One option is a distraction maneuver.

### PROTECT, BRACE & SUPPORT

#### Crutches

- Crutches may be necessary for grade II sprains; walking boot for severe grade II or III.
- Encourage light weight bearing as soon as is tolerable (around 5-10% of body weight on the injured ankle). As the patient recovers, slowly add more load to stimulate appropriate tissue repair and return of function.
- Progress from non-weight bearing to partial weight bearing with a heel to toe gait.

#### Bracing options

Use a walking boot for about 7-10 days, then transition into a functional brace. Semi-rigid braces are preferred over an elastic wrap. Brace recommendations: Lace up (rather than Velcro) and plastic rather than metal inserts (which are very rigid and may injure the wearer or other players).

### **Bracing options** (continued)

**Mild injury** (able to bear weight/walk/with edema): 3-4" elastic bandage wrap, semi-rigid brace, or "open" Gibney/basket weave taping.

**Moderate injury** (marginally able to bear weight/walk/with edema): semi-rigid brace to rigid brace (air cast stirrup type brace). Taping can be done temporarily until a brace can be procured.

**Severe injury** (unable to bear any weight, rule out fracture as part of the diagnosis):

- **Significant edema/questionable ability of patient to manage edema:** use posterior splint/crutches (accommodates edema and allows for cold application)
- **Mild-moderate edema/good ability of patient to manage edema:** use short leg walking cast (5-10 days of wear averaging 7 days, remove cast by bi-valve method to retain posterior portion as splint if necessary)

### **ADDITIONAL TREATMENT OPTIONS**

- **Low level laser therapy** (other modalities may be used to control pain or swelling in the short term but have poor or no supporting evidence for improving recovery).
- **NSAIDs and/or supplements.** NSAIDs can be effective but one study found that along with the positive therapeutic effects, those treated with NSAIDs had greater instability, less ROM, and more swelling 14 days after injury. Contraindications, adverse effects and other medical concerns must be factored into the decision. Dose as prescribed on the bottle; if you are going to recommend a higher dose and for more details, see CSPE protocol: NSAIDs—Use of Over-the-Counter Nonsteroidal Anti-Inflammatory Drugs and Analgesics.
- **Supplements.** See table below.

#### **Anti-inflammatory Supplements**

<b>Substance</b>	<b>Dose</b>
Bromelain Chymotrypsin Trypsin	4-8 tablets/capsules per day of high potency enzymes (2000 GDU per gram or equivalent) in divided doses between meals
Citrus bioflavonoids, Curcumin/tumeric	900-1800 mg/day: May be useful only before peak of inflammatory phase.
Proprietary enzyme/ flavonoid combinations	3-4 tablets, 3-4 times per day at least 30 minutes before meals

Beware of allergies and cross reactions (e.g., bromelain and pineapple). For more details, see the CSPE protocol Trauma: Diet, Nutritional Supplements and Botanical Considerations.

#### **Supplements to Promote Healing and Tissue Repair**

<b>Phase of Injury</b>	<b>Substance</b>	<b>Dose</b>
Rehabilitative (after inflammation has subsided)	Broad-spectrum vitamin and mineral supplement	At least 100% RDA or Daily Value of most ingredients
Rehabilitative	Vitamin C	Up to 1000 mg/day
Rehabilitative	Zinc	Up to 50 mg/day
Rehabilitative	Glycosaminoglycans (GAGs)	Chondroitin sulfate, 1200 mg/day; glucosamine sulfate, 1500 mg/day

For more details, see the CSPE protocol Trauma: Diet, Nutritional Supplements and Botanical Considerations.



## Ankle Sprain: Chronic Ankle Pain/Instability

**Patient compliance:** As you introduce new exercises, explain their purpose using the main components of the model below: initial care to maintain/improve ROM and muscle activity, stabilizing the ankle by strengthening the weak muscles and stretching/lengthening tight ones, retraining the sensorimotor system, and finally doing graded activities that mimic their ADLs. Note: Optimal program parameters in terms of duration, numbers of sets, number of repetitions etc. have not been determined.

Functional Rehabilitation Program	
<b>Initial Care</b> ROM & isometrics	<b>Balance muscles</b> Stretch & strengthen
<b>Sensorimotor</b> Wobble board, star excursion	<b>Activity specific</b> Dynamic exercises based on target activities
<b>Manual therapy as needed</b>	

### Summary of Interventions

Manual therapy	Resistance exercises	Taping
Balance exercises	Manually resisted PNF cross patterns	

- **Screen for signs of instability in those with moderate to severe ankle sprains 4-6 weeks after initial injury.**
- Tools to identify chronic instability, assess severity and measure progress include the Foot and Ankle Ability Measure [FAAM] and the Ankle Instability Instrument. (See Appendices F & G).
- Assess kinetic chain complicators and contributors: increased ankle laxity, impaired dorsiflexion, leg and hip weakness, and diminished postural control.

### MANUAL THERAPY

Manual therapy techniques should be used to restore motion and restore dorsiflexion (see Appendix B).

### TAPING

One residual effect of an acute lateral sprain is pain anterior to the lateral malleolus when dorsiflexing (e.g., during squatting). If pushing the distal fibula posteriorly relieves this pain, tape can be applied to pull the distal fibula into a posterior direction. Apply the tape starting in front of the lateral malleolus, pull it from A-P and spiral behind the Achilles tendon and then once around the crest of the tibia. Leukotape can be a good choice because it doesn't stretch and is very moisture resistant. Patients can be taught to tape themselves before aggravating activities.

### REHABILITATION

Rehabilitation (both open and closed chain exercises) should focus on balance, control, and strength and incorporate dynamic movements with changes in direction.

Participants with functional instability who were involved in one 6-week progressive rehabilitation program (10 minutes, 3 times per week) consisting of resisted ankle exercises in 4 directions improved their ankle dorsiflexion, eversion strength, and ankle-joint position sense.

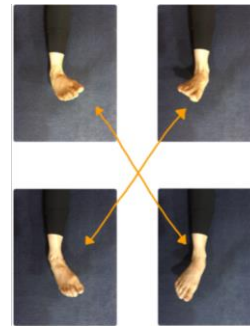
## Resistance exercises

Here is a sample of a 6-week resistance band exercise program for chronic instability. This was a supervised program, 3 times/week for 6 weeks consisting of dorsiflexion, plantar flexion, inversion and eversion exercises. Patients were instructed to exercise at a consistent pace of 3-5 seconds per repetition and to go through full range of motion.

Week	Tubing	Prescription
1	Heavy	3 sets, 10 reps
2	Heavy	4 sets, 10 reps
3	Super heavy	3 sets, 10 reps
4	Super heavy	4 sets, 10 reps
5	Ultra-heavy	3 sets, 10 reps
6	Ultra-heavy	4 sets, 10 reps

## In-Office PNF Treatment

Apply manual resistance at the metatarsal heads, either at the superior or inferior aspect depending on which direction of movement is being resisted. The D1 pattern: diagonal movement of dorsiflexion-inversion (an “up and in” motion) followed by plantar flexion-eversion (“down and out”). The D2 pattern: dorsiflexion-eversion (“up and out”) followed by plantar flexion-inversion (“down and in”).



Throughout the movement, patients exert maximal effort for each repetition, taking approximately 3 to 5 seconds to complete each direction. The patient rests for 60-seconds between sets, but there is no rest between repetitions. The treatment prescription is outlined below:

Week	Prescription
1	3 sets, 10 reps
2	4 sets, 10 reps
3	3 sets, 10 reps
4	4 sets, 10 reps
5	3 sets, 10 reps
6	4 sets, 10 reps

## Surgery for Chronic/Recurrent Ankle Pain & Instability

**Chronic ankle pain:** Patients with are reported to have good to excellent clinical outcomes for surgery in most of the studies. Although in many of the studies, no comparison was made with a control or usual-care group.

**Second-stage ankle instability:** Evidence in favor of surgery over a functional training program is somewhat limited (measured at long-term follow-up). However, for chronic lateral ankle instability unresponsive to conservative treatment, surgical repair or reconstruction is recommended and can restore active patients to full athletic function.

**Recurrent ankle sprains (e.g.,  $\geq 3$  episodes):** Clinical research studies report that surgery had good results in patients with recurrent ankle sprains, as expressed in subjective scoring scales (high percentage of good to excellent results); however, the superiority of surgery over continued conservative care has not be assessed due to the lack of comparison to a nonsurgical control group.



## High Ankle Sprains

**Patient compliance:** As you introduce new exercises, explain their purpose using the main components of the model below: initial care to maintain/improve ROM and muscle activity, stabilizing the ankle by strengthening the weak muscles and stretching/lengthening tight ones, retraining the sensorimotor system, and finally doing graded activities that mimic their ADLs.

<b>Functional Rehabilitation Program</b>	
<b>Initial Care</b> ROM & isometrics	<b>Balance muscles</b> Stretch & strengthen
<b>Sensorimotor</b> Wobble board, star excursion	<b>Activity specific</b> Dynamic exercises based on target activities
<b>Manual therapy as needed</b>	

Note: Optimal program parameters in terms of duration, numbers of sets, number of repetitions etc. have not been determined.

**Clinical tip:** The pace of rehabilitation can be guided in part by the severity of posterior tibiofibular pain.

### PHASE I: DAY 1–4.

- **Complete non-weightbearing.** Use crutches. Premature load may induce heterotrophic ossification.
- **Posterior splint** with ankle at neutral (optional).
- **Cryotherapy** for pain and inflammation. (See p. 3.)
- **Manual isometric exercises**, performed at 30° of plantar flexion.
- **AROM exercises.** Introduce dorsiflexion exercises cautiously; limit the degree of dorsiflexion by starting from a plantar flexed position, extending back only to neutral. Also avoid end range eversion. A cycle ergometer and other machines can also be used to mobilize the joint. Manage amount of dorsiflexion by setting the seat position on an exercise bike higher or the seat further back on a leg press.

**Clinical tip:** Limit end range dorsiflexion and plantar flexion, especially when added resistance is provided.

- **Non-weight bearing resisted dorsiflexion.** Initially limit the amount of dorsiflexion.
- **Light passive dorsiflexion** stretching with a towel.

### PHASE II: DAY 4–5

- **Continue AROM.** Now full range, pain free dorsiflexion, but not forceful or ballistic dorsiflexion.
- **Daily wear of ankle brace.**
- **Initiate weightbearing exercises** (as tolerated), walking, and double toe raises.

- **Manual resistive exercises.** Full range dorsi/plantar flexion can be added cautiously with provider resistance.
- **Resistance exercises.** Home tubing exercises, focusing on calf and peroneal muscles, but eventually targeting each of the major ankle muscle groups.
- **Light proprioceptive exercises.** Double leg stance on surfaces that are minimally unstable. As the patient demonstrates good control with minimal pain, the balance challenges can be increased (see below).
- **Stretching calf muscles.** Low load, longer duration especially if muscles are stiff.

### PHASE III: DAY 6+

- **Full weightbearing.** In more severe cases some providers maintain non-weightbearing ambulation with the ankle in a cast or boot for 2-6 weeks. Full weight bearing is initiated when patients can walk on various surfaces and up and down stairs with minimal discomfort. Weight bearing exercises should avoid the ankle placed in an everted (i.e., toes pointed outward) position.
- **Squat exercises** on a decline board with heels higher than toes (limits the amount of ankle dorsiflexion).
- **Continue manual resistive exercises** with inversion/eversion added.
- **Functional exercises:** double then single toe raises, then single leg hopping. The external rotation test and stabilization test (see Appendix) can be used to assess when to progress to activities like jogging and hopping. Progress to lunges and lateral step up exercises. Limit extreme dorsi-flexion by emphasizing retro lunges initially and short step ups. Progress cautiously to more dynamic sport-specific drills.
- **Proprioceptive exercises:** single leg stance on rocker board, balance pad progressions (see progression in Lateral Ankle sprain p. 21). Single leg balance with the knee near full extension (focus on the ankle).
- **Walk, jog, run, cutting, explosive maneuvers.** These include running figure 8's and carioca drills.
- **Ankle brace/taping for return.**

### RECOVERY AND RETURN TO WORK/PLAY

Recovery ranges from days to 4-5 months--much longer (i.e., 2x) than for lateral ankle sprains. An athlete may return to activity when able to complete 15 single-legged hop off toes, has passed functional testing, and is mentally ready to return. An alternative set of indicators are comfort with push off and cutting maneuvers, 80-90% symmetry in single leg forward hop (see Appendix XX), and a normal FADI score. For grade I or II distal tibiofibular injuries, 4-6 weeks may be required before returning to unrestricted competition. Others report an average of 45 -55 days (range of 6-137 days). Chronic pain, instability, and functional impairment are common sequelae.

**Note: Monitor for possible complications for a minimum of 6 months (e.g., heterotopic ossification, syndesmotic calcification, anterior impingement syndrome).**

Outcomes 4 years out for 44 football players: mild-moderate stiffness (36%), mild-moderate pain with activity (23%), mild-moderate persistent swelling (18%). Ankle function rated as good to excellent (86%); none reported poor results.

### SURGERY FOR HIGH ANKLE SPRAINS

Surgery is recommended for obvious diastasis of the tibiofibular space on x-rays. Common cut points are a tibiofibular clear space > 6mm (as seen on radiograph AP and mortise views), tibiofibular overlap of  $\geq 24\%$  for the fibular width, on the AP view an overlap of 1mm on the mortise view, ankle mortise widening (>2mm), joint incongruity seen on standard or stress radiographs, or fibular fracture at least 2 inches above the ankle joint in the presence of a deltoid rupture. Some controversy as to whether radiographic measurements need to be accompanied by additional indicators (e.g., presence of fracture requiring fixation), evidence of other surgical treatable lesions (e.g., repairable syndesmotic tear, latent instability, scarring or calcification of the syndesmosis which have been correlated with chronic ankle pain). Surgical success rates are reported to be excellent.



## Ankle Sprain Prevention

Ankle sprain prevention programs may decrease the chances of re-injury by about 35% (NNT of 7-9) -50%. Evidence-based programs emphasize single leg balance activities with upper extremity tasks incorporated and with perturbation challenges as well as dynamic jumping activities. Strengthening hip extensors and abductors and ankle muscles (evertors, invertors, dorsi and plantar flexors) as well as ROM exercises are often included. An additional goal is to increase dorsiflexion ROM. Duration and frequency and program prescriptions differ widely. One recommendation is an injury prevention program lasting at least 3 months that focuses on balance and neuromuscular control.

Athletes with a history of previous ankle sprains should wear prophylactic ankle supports (e.g., taping or bracing during practice and games).

Both bracing (lace up, semi-rigid) and taping can help prevent both first time and recurrent injuries. Although wearing hiking boots or other high-top, lace-up shoes has generally thought to be helpful, two systematic reviews (3 RCTs, N=3140) could demonstrate no difference between high vs low fitted shoes in terms of reducing recurrence rates.

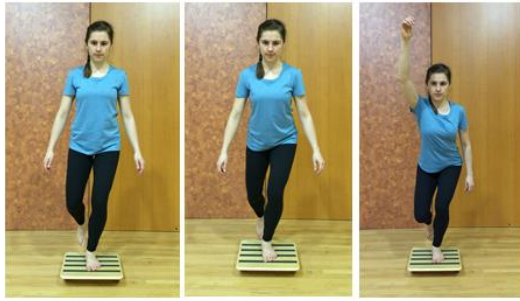
### A sample proprioceptive program preventing ankle sprain recurrence

- Begin 8 weeks after completing usual care and when sports activity is possible. Give both written and verbal instructions.
- Assign 3 training sessions per week.
- The program can be performed as part of the warm up for their sport.
- This program should be coupled with a balance program which incorporates perturbations.

For the sample program below, the letters (A-F) indicate the type of exercise; the first row of numbers indicate sessions 1-24; the numbers in the columns denote the progressive levels of difficulty (1-3) for each exercise.

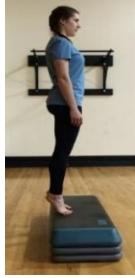
	Week 1			Week 2			Week 3			Week 4			Week 5			Week 6			Week 7			Week 8		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
<b>A</b>	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
<b>B</b>	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2
<b>C</b>	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>D</b>	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>E</b>	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	4	4	4	4	4	4	4	4
<b>F</b>	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2

When the patient is doing the exercises, postural “faults” should be observed and corrected. For example, “valgus collapse” of the weight bearing extremity while adopting the running pose or one legged stance may be simply habitual or may be secondary to inhibited/weak hip abductors or ankle pronation. Core stability should be encouraged by holding a neutral pelvis and performing abdominal bracing while performing the exercises.



### A: Single leg knee flexion/squat

- **Level 1** on even surface (sessions 1-8, into week 3)
- **Level 2** even surface eyes shut (sessions 9-16, into week 6)
- **Level 3** balance board (sessions 17-24, to end of week 8)



### B: Toe stand and heel raise

- **Level 1** on high surface with handhold (sessions 1-12, into week 4)
- **Level 2** without handhold (sessions 13-24, to end of week 8)



### C: Single leg stance (lunge)

- **Level 1** on even surface (sessions 1-8, into week 3)
- **Level 2** even surface eyes shut (sessions 9-16, into week 6)
- **Level 3** balance board (see picture) (sessions 17-24, to end of week 8)



### D: Single leg runner's pose

- **Level 1** on even surface (sessions 1-4, into week 2) (see picture)
- **Level 2** even surface eyes shut (sessions 5-8, into week 3)
- **Level 3** balance board (sessions 9-24, to end of week 8)



### E: Cross leg sway

- **Level 1** on even surface with handhold (sessions 1-6, week 2)
- **Level 2** even surface, no handhold (sessions 7-12, end of week 4)
- **Level 3** even surface eyes shut, no handhold (sessions 13-16, into week 6)
- **Level 4** on balance surface (sessions 17-24, end of week 8)



### F: Toe walk

- **Level 1** on even surface walking (sessions 1-12, end of week 4)
- **Level 2** on even surface jumping (sessions 13-24, end of week 8)





## Ankle Sprains: Severe Sprains & Deltoid Sprains

Functional Rehabilitation Program	
<b>Initial Care</b> ROM & isometrics	<b>Balance muscles</b> Stretch & strengthen
<b>Sensorimotor</b> Wobble board, star excursion	<b>Activity specific</b> Dynamic exercises based on target activities
<b>Manual therapy as needed</b>	

**Patient compliance:** As you introduce new exercises, explain their purpose using the four main components of this model: initial care to maintain and improve range of motion and muscle activity, eventually balancing their muscles by strengthening the weak ones and stretching the tight ones, retraining the sensorimotor system and finally doing graded activities that mimic the activities that they are going back to pre-injury.

Note: Optimal program parameters in terms of duration, numbers of sets, number of repetitions etc. have not been determined.

### Severe Sprains

A grade III sprain is suspected on the grounds of significant swelling, bruising, and the inability to weight bear.

- Provide crutches and place in a functional walking orthosis. When there is significant edema, a posterior splint in the neutral position will better accommodate swelling and allow for icing. Weight bear only on the uninjured side.
- PRICE to reduce swelling along with thorough instruction in edema control.
- **Re-examine approximately 3 days later.** *If there is still no noticeable improvement or there are now detectable signs of joint laxity, an MRI should be ordered to assess the degree of injury.*
- Acute treatment should continue another 4 days before functional rehabilitation is introduced.

**NOTE: There is controversy regarding the optimal length of time and type of immobilization.** A common recommendation is to immobilize grade III sprains for approximately 7-10 days using a rigid stirrup brace or below-knee cast applied in the neutral position (90 degrees).

Transition to a semi-rigid brace and begin controlled exercise program. Rigid immobilization for an extended length of time in a cast is typically reserved for patients who are sedentary or with lower physical demands. It is worn for no more than 3 weeks followed by a course of muscle strengthening and proprioceptive retraining.

Functional management of the severe sprain is similar to sprains in general: early mobilization, weight bearing with appropriate bracing, and an exercise program focusing on muscle strengthening, ankle range of motion, and sensorimotor training. Proprioceptive therapy is thought to be crucial.

**Attention: Patients with moderate to severe ankle sprains should be re-examined 4-6 weeks after the initial injury to screen for signs of instability.**

### **Surgery for Severe Lateral Sprains**

Immediate surgical repair is a consideration but it may be delayed and reserved for treatment failure or select patients who have high physical demands. One 2010 RCT reported that acute grade III lateral ankle ligaments surgically repaired within one week of injury had similar recovery results compared to a functional treatment approach. Surgery had the advantage of a lower re-injury rate but a higher rate of post-surgical osteoarthritis. Secondary reconstruction of grade III injuries is possible even years after injury and outcomes are similar to those for primary repair.

## **Deltoid Sprains**

Management of deltoid sprains depends largely on whether there is a partial tear (usually involving just the superficial section of the ligament), a complete tear (which includes the deep portion leading to instability), or whether there are concomitant injuries. Deltoid sprains which involve only the superficial portion and which are rotationally stable are thought to have a good prognosis and can be treated non-operatively.

The general approach is to immobilize the ankle with a boot and avoid weightbearing for 5-7 days. The rehabilitation program can be introduced when the patient can tolerate it and is similar to treating lateral sprains (see pp 16-22). For the athlete with an isolated deltoid sprain, early stress by returning too soon to activity may lead to the ligament healing in a stretched position, contributing to instability. Return to light training should be delayed to about 6-8 weeks.

There is less agreement concerning whether complete ruptures of both sections should be managed surgically or not. Musculoskeletal ultrasound or MRI can confirm the diagnosis of the sprain and the degree of tearing.

**Attention: Isolated deltoid sprains are rare.** Most deltoid sprains are associated with fibular or lateral malleolar fractures and other injuries. Large tears and ruptures affecting both layers are almost always associated with high ankle sprains, lateral malleolar fractures, lateral sprains, or high fibular fractures. The tibialis posterior, flexor hallucis longus, and saphenous nerves may also be injured. Generally, pain, swelling and hematoma occur rapidly, although instability may be initially difficult to appreciate until later.

The presence of a fracture extends the period of limited weight bearing which may actually provide additional time for the deltoid ligaments to heal. One 1995 RCT reported that whether the deltoid ligament was sutured or not there was no difference in outcome in those patients with displaced ankle fractures (providing the talus was reducible into the mortise).

Post-surgical management can include the following:

- Plaster cast for 6 weeks.
- Passive and active mobilization of the ankle joint, muscle training, and wearing a removable boot when walking,
- A walker or stabilizer shoe is recommended for 4-6 weeks after the cast removal, then continued to be used on uneven ground, during high risk sports and demanding outdoor work environments.



## Lateral Ankle Sprain Rehabilitation

**Patient compliance:** As you introduce new exercises, explain their purpose using the main components of the model below: initial care to maintain/improve ROM and muscle activity, stabilizing the ankle by strengthening the weak muscles and stretching/lengthening tight ones, retraining the sensorimotor system, and finally doing graded activities that mimic their ADLs.

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Note: Optimal program parameters in terms of duration, numbers of sets, number of repetitions etc. have not been determined.

### PROGRAM LENGTH

4-12 weeks. In one study of both acute and chronic sprains, a mix of manual therapy and supervised exercises were done twice a week for 4 weeks. Home exercises were performed daily.

### SETS AND REPS

Below are examples of various recommended sets and repetitions based on type of exercise.

- AROM exercises: 1-3 sets, 10-15 repetitions, 1-3 times per day.
- Stretches: 15 second-3 minute holds, 3-5x/day.
- Resisted exercises: 3 sets of 15.
- Balance: activities 1-5 minutes, twice per day.

### PHASES OF CARE

Functional rehabilitation programs are often divided into 3 or 4 phases of care. Progression through the phases is partly based on time but more importantly on the speed of a patient's improvement. Each phase has a cluster of recommended exercise and interventions; however, the timing of the introduction of a particular exercise and how it is progressed can cross phases and is determined in part by the patient's ability to successfully perform the activity/exercise with minimal pain.

**Rehabilitation Phase 1 (immediate post-acute phase lasts about 3 days).**

This phase overlaps with the acute phase intervention. Indicators for going on to phase II of care are the ability to partially weight bear along with a reduction in pain and swelling.


Summary		
Light weigh bearing	Achilles towel stretch	Provider administered passive ROM
AROM exercise	Pain-free isometrics	Toe crunches (with towel)/short foot

- **Light weight bearing.** In the case of grade II and III sprains, crutches may be necessary for 1-3 days, but light body weight (5-15%) should be transferred to the injured side to help prevent tissue shortening.
- **AROM** (progress from flexion and extension to ankle alphabet) Target: 1-3 sets of 15 repetitions, 3x/day. Note: In severe sprains ROM into plantar flexion and inversion should be avoided until palpatory tenderness over the anterior talofibular ligament has decreased.
- **Provider-administered passive ROM:** 3 sets of 10 with 3-5 second holds at end range with care taken in the direction that will stretch the sprained ligament.
- **Achilles tendon towel stretch** (15 seconds, 5x/day or 30 seconds, 3x/day).
- **Pain-free isometrics.** Begin as soon as patient can tolerate (this may even be in the acute phase of care). For example: press foot against the wall for inversion, eversion, and plantar flexion; use the opposite foot to provide resistance to dorsiflexion (5-second holds, 5 repetitions). Contractions should be pain free even if that means limiting effort to 10-15% of a maximum voluntary contraction (MVC).
- **Toe crunches with a towel (10 reps, 3x/day)/short foot.** Sometimes this may need to be delayed until the patient can bear 50% of weight without pain. For short foot, see Appendix E.

**Rehabilitation Phase II (early)** begins 3-5 days post injury

The patient’s goal is to fully weight bear, have little or no evident swelling, and nearly complete active ROM so move on to the last phase of rehabilitation. Patients should ice after activities.

Summary		
Continue ROM exercises	End range isometrics	Weight bearing Achilles stretch
Manipulate/mobilize ankle	Side lying resisted abduction exercises	

 **Clinical warning:** If the patient is still in significant pain and/or still cannot weight bear, the ankle should be re-examined for a possible talar dome fracture often missed on initial radiographs.

- **Continue ROM exercises.** Add 3-5 second holds at end range, increase hold duration.
- **Manipulate/mobilize ankle** (e.g., talocrural, subtalar, and midtarsal joints). See Appendix B.
- **End range isometrics.** The patient can begin to perform isometric contractions more at an end range position if pain permits.

- **Self mobilization of the ankle:** 1) In quadruped position (see below), rock back and forth so that the heel is on and off the floor. 2) In a standing position, maintain a short foot, bend the knee, passing it between the 3<sup>rd</sup> and 5<sup>th</sup> toes toward the wall *without picking up the heel*; rock back in forth toward and away from the wall.



- **Weight bearing Achilles stretch** (3 minutes, 3-4x/day) Progress to standing stretches for gastrocnemius (leg straight) and soleus (knee bent); 3 stretches of 30 seconds' duration.
- **Side lying resisted hip abduction exercises** (to activate gluteus medius which sometimes becomes inhibited in ankle injuries). (Optional.) If necessary start with clam exercise (bent kneed, side-lying hip abduction keeping both heels on the floor), progress to single leg raises (hip abduction) while lying on side, add resistance with ankle weights (1-3 lbs, 3 sets of 10-15 reps)
- **Heel raises.** When the patient is fully weight bearing, double and single heel raises can be introduced in the following progression: bilateral, hold on to a table or sink (for balance and partly to decrease the load); when 20 repetitions can be performed without pain, got to the next step, single heel raises (holding on to table);

## Rehabilitation Phase II (late)

### Summary

Heel raises (single leg), hopping & skipping Proprioceptive training: leg reaches	Sensory motor exercises on unstable surface Modified activities	Resisted ROM exercises
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- **Continue heel raises, add hopping and skipping activities.** Single heel raises can be introduced in the following progression:
  - single heel raises without support (shift weight to injured ankle and then slowly lower)
  - single heel raises performed on slant board or stair (allowing the heel to drop into a stretch);
  - heel walk and toe walk;
  - 3 to 4 short hops.
- **Resisted ROM exercises** with tubing/elastic band (inversion, eversion, dorsiflexion, plantar flexion). Non-weight bearing: 3 sets of 10-15 repetitions with the goal of achieving muscle fatigue at the end of 3 sets. Progressively increase range of movement, duration of holds at the end range, and resistance level of the elastic band over time. Increase the resistance (e.g., strength of elastic band) when 3 sets of 15 repetitions are completed in the full range.

A weight bearing tubing exercise is added to target the stabilizing role of the ankle muscles. The non-injured ankle pulls the tubing through hip flexion, extension, abduction and adduction while the injured ankle (circled in the picture below) maintains its position.



- **Proprioceptive training: leg reaches.** Once fully weight bearing, training should begin with single leg balance and progress to opposite leg reaching out to points on the clock.
- **Sensorimotor training on unstable surface** (pillow, disc, balance pad, air filled cushion, rocker or wobble board). 4-6 weeks of wobble board training may be superior to a two-week program for patients with chronic ankle sprain. Incorporate progressively more complex arm and leg movements. When the patient can balance

on the injured ankle with minimal pain (often about a week after the injury), progress from a more stable to less stable platform (e.g., the ground to a balance pad to rocker board to wobble board), two legged balance to single leg balance, and eyes open activities to eyes closed. Incorporate perturbations to train balance response. The patient can be taught to do these exercises using the “short foot.” (See Appendix E).

### Sample progression

- Start on stable surface, single leg standing on the injured limb, hold on to counter or sink if necessary, eyes open; 3 sets of 30 seconds duration. Progress to eyes closed.
  - Double leg standing on the injured limb on unstable surface, arms abducted, and eyes open; 3 sets of 30 seconds’ duration quickly progressed to single leg stand.
  - Progress from arms abducted to arms across chest, 3 × 30 seconds.
  - Progress from eyes open to eyes closed, 3 × 30 seconds
  - Options for progression: decrease the standing base, throwing and catching a ball.
- **Modified activity.** A sample workout would be a 5 minute warm up walk, then a 3 minute run at easy intensity, then a 2-minute walk, repeat these cycles for a total of 20-30 minutes. When this can be done without stopping and no noticeable increase in pain or swelling, the mileage and/or intensity can be slowly increased (e.g., 10% per week) (Dubin 2011)

### Rehabilitation Phase III (begin approximately 2-3 weeks after initial care)

The patient should be able to run and hop without pain, though there may be pain at end range inversion. Training may extend another 3-9 weeks based on degree of injury and sports or work demand.

#### Summary

Continue strengthening exercises	Continue balance training; add sports specific drills
Progress to running & jumping	Sports specific exercises

- **Continue strengthening exercises.** Increase tubing repetitions and/or resistance.
- **Progress to running and jumping activities.** When strength, range of motion, and balance exercises have been progressed fully as outlined above, progress from walking to running (forward, then backward, then zigzags and figure 8’s), skipping, and hopping, an/or jumping rope based on patient’s activities and recreational demands. Running and jumping activities must be multidirectional. The following are examples of progressive jumping exercises:
  - Jump forward and backward over a line
  - Jump laterally over a line
  - Box drills: jump in the center of 4 boxes (jumping in various combinations: clockwise, counter clockwise, diagonals).
- **Continue balance training and add sports specific drills** on stable and unstable surfaces (wear brace or tape).
  - Begin with mimicking sports activity (e.g., kicking a ball, catching a ball, spiking a ball).
  - Progress to unstable surface, keeping the motion shortened and close to the body.
  - Progress to reaching further out, following through with the motion.
- **Sports specific exercise:** Practice stopping, changing directions, running figure 8’s, etc. as would be performed during the sport.

### Return to Play/Return to Activity

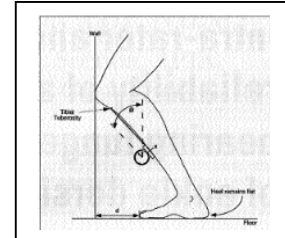
Mild sprains should be able to return to light activities at work within two weeks. Temporary limitations include lifting no more than 10kg and curtailing standing for extended periods and walking on uneven surfaces. Full return to work activities expected in 3-4 weeks depending on the load demand. For partial tears or total ruptures returning to light work could be delayed for 3-6 weeks. In those cases, full activities may be delayed for 6-8 weeks.

## Outcome Measures

- **Foot and Ankle Outcome Score, Lower Extremity Function Test (LEFS) (for acute and chronic ankle sprains)**
- **Foot and Ankle Disability Index (FADI) (for chronic ankle instability)**
- **Foot and Ankle Ability Measure (FAAM) (for chronic ankle instability)**

**Functional Performance Testing** (Before returning to sport-specific tasks, the injured limb should measure *at least 80% of the uninvolved ankle*)

- **The single leg hop for distance** (see Appendix C)
- **The Star Excursion Balance Test** (See Appendix H) can be used to help determine return to activities.
- **Forward lunge measure:** A standardized measure of weight bearing dorsiflexion can be done with a forward lunge. (See pp 26.)



Other tests that can be used as outcome measures and return to sports indicators include the single leg stand (see Appendix I), repeated step up test, the single leg squat, and single legged heel or toe-rising test (performed at a pace of 60 times per minute). (Kaminski 2013)

## Prognosis for Lateral Ankle Sprains

Eventually most patients fully recover from lateral ankle sprains. Recovery ranges from 36-85% of patients reported over a 3-year period Improvement is rapid over the first two weeks and then continues more slowly.

Residual complaints can occur and include joint instability, stiffness, and intermittent swelling, with pain and intermittent swelling being the most common. These are more likely to occur after more extensive cartilage damage. Various studies have reported anywhere from 3-34% of patients will experience some combination of residual pain, swelling, a giving way sensation or activity limitations.

- 5-33% of patients still experienced pain after 1 year. Even after 3 years some patients still reported pain and/or subjective instability. One study found that training more than 3 times a week is a prognostic factor for residual symptoms.
- 3% to 34% of the patients had re-injuries (i.e., sprains) from 2 weeks to 96 months post injury. Recurrent sprains may accelerate long term degeneration of the ankle joint. (Struijs 2014).
- 0% to 33% reported subjective instability.

## Poor Response to Treatment

Re-assess for these injuries: a peroneal (i.e. fibularis) muscle tear, an osteochondral lesion of the talar dome, a fracture of the anterior process of the calcaneus or lateral malleolus, and neuritis of the superficial peroneal or sural nerve.

## Surgery for Lateral Ankle Sprains

Surgical consideration for athletes with objective signs of increased instability and for those with extensive grade III sprains, involving all three lateral ankle ligaments and accompanied by significant hematoma. Consider surgery for instability with displacement of  $\geq 2$  mm compared to the uninjured ankle.