Evidence-based Clinical Protocols

5) Lateral Ankle Sprains

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INTRODUCTION

This manual contains information that is presented by Biodex Medical Systems as part of our commitment to provide continuing service to medical professionals and to the community at large.

IMPORTANT READ BEFORE PROCEEDING:

Suggested courses of rehabilitation for any specific conditions are meant as references and generalized program models, and are not intended as precise prescriptions for individual treatment. The information is a compilation of information based on the work of acknowledged experts, which has been published in respected medical journals.

We believe it is representative of current trends in scientifically derived and clinically proven principles and methods of rehabilitative medicine. Much of the published information that we review, however, is based on research and case studies involving very specific patient or test subject populations. Many research subjects, for instance, are highly-trained and well-conditioned athletes prior to treatment, or are chosen because they have no known medical problems other than the condition involved in the study. It should therefore be noted that the application of any published methods should be done with extreme care, and should be based on sound clinical judgment after thorough evaluation of the individual patient’s capabilities, limitations, and overall medical condition. In the presence of any doubt or question regarding the efficacy of initiating a procedure, seek advice from appropriate sources and/or consult with the patient’s physician.

NOTE: This protocol is intended as a guide for rehabilitation associated with Lateral Ankle Sprains. Consider appropriate program modification if additional tissue pathology or damage is present, and if associated repairs post surgically are present. This protocol was NOT intended to rehabilitate the patient post-surgically. Consult the patient’s physician prior to incorporating any of the rehabilitation principles incorporated in this protocol.

Please send any comments or concerns to:

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REHABILITATION GOAL:

The objective of rehabilitation for the grade I or II lateral ankle sprain is to quickly restore patients to their pre-injury, or better, level of activity with minimized risk of increased signs and symptoms, other related complications, or predisposing them to re-injury. This protocol is broken down into six phases, patients may skip phases and advance to the next depending on how well they are progressing based on attainment of goals.
REHABILITATION PROGRAM CONSIDERATIONS:

To successfully rehabilitate the lateral ankle sprain patient, the therapy team must understand and set into practice the following:

- Basic anatomy and function of the ankle joint and associated structures
- Mechanism of injury
- Healing process following acute injury
- Methods to optimize:
  - Patient compliance (rehabilitation potential and established realistic goals)
  - Reduction of pain and edema
  - Increase functional ROM
  - Increase muscle strength, power, and endurance
  - Improve neuromuscular proprioceptive capabilities
  - Improvement of agility and sport drills
- Appropriate allocations of resources and time to individual patient program
- Means of evaluating individuals and overall program effectiveness

ACUTE CARE MANAGEMENT CONSIDERATIONS:

It has long been established that ankle sprains are responsible for 25% of all time-loss injuries in running and jumping sports, and comprise approximately 10-30% of all sports injuries. Thus the need for proper acute management is as important as ever. As the lateral ligaments are chronically stretched, the anterolateral gutter fills with fluid thus the adjoining capsule is distended, and thus the ankle is placed at a greater risk for re-injury\(^{19}\). The best way to prevent long-term ankle instability is through proper acute care management. Focal compression has been demonstrated to be one of the best ways to ensure that capsule, ligamentous, and associated structures are placed in a position for optimal healing. Circular compression such as elastic wraps alone will not adequately assist in this healing process\(^{22}\). Thus, adding focal compression to the lateral ankle at all times post injury (except when at a therapy session) will assist in the removal of waste and at the same time place damaged tissue in optimal positioning for healing.

DEFINITIONS:

**Goals**: Specific improvements which must be met in order for patient to progress to next phase

**Clinical Evaluation**: Evaluations that are only to be performed by certified and/or licensed ATC, PT or OT, in association with supervising physician’s diagnosis

**Clinical Treatment Options**: Treatment options that should only be performed under the supervision of certified and/or licensed clinicians

**Supervised Program**: Rehabilitation program that should be done only under the direction of appropriately qualified personnel (i.e. Certified Strength and Conditioning Specialist)

**Home Program**: Rehabilitation program that after proper instruction by supervising clinician, can be done by patient without supervision

**Reports**: Test reports are to be completed at the end of each phase to ensure progress to the next phase is indicated
PHASE I

GOALS:

- Mentally prepare patient for rehabilitation
- Education of patient to understand the problems of ankle sprains
- Identify specific needs of the patient and potential problems
- Control edema and prevent secondary hypoxic injury
- Protection of damaged structures
- Prevention of long term functional instability
- Decrease pain as needed
- Regain AROM/PROM
- Progress weight bearing status as tolerated
- Normalize gait pattern

CLINICAL EVALUATION:

- Swelling and edema (measure a figure 8 around the ankle joint)
- Range of Motion (ROM):
  - Measure active and passive Plantarflexion, Dorsiflexion, Inversion, and Eversion
  - Record this initially and use as an objective measurement to determine progress
- Special tests: Anterior drawer, Talar tilt
  - NOTE: Caution should be taken when performing these tests. Perform bilaterally and note the degree of initial laxity.
- Neurological tests: Myotomes, Dermatomes and Reflexes for L4 – S2
- Functional tests: Activity of Daily Living (able to perform usual daily tasks)

TEST: Gait evaluation (able to ambulate, able to ambulate without antalgic gait)
- Device: Biodex Gait Trainer
- Report: Exercise Summary
- Speed: comfortable for patient
- Time: 6 min
- Elevation: 0%
- Recommendations: Gradually increase speed and duration of walking with proper gait. Emphasis on proper foot progression angle. Use the Biodex Unweighing System as needed to ensure proper and safe gait evaluation. Unweigh patient up to 40% of body weight (BW).
CLINICAL EVALUATION (cont):

- Biomechanical tests:
  
  Tibial/femoral torsion test: This test is performed to evaluate the rotational axis of the tibia. Increased tibial external torsion > 2° could be a predisposing factor to lateral ankle sprains. 10
  
  The testing procedures are as follows:
  
  For femoral torsion, first ensure that the femur is in correct position. Have the patient lie supine, leg fully extended. Position the greater trochanter in its most lateral position and assess the position of the motion of the femoral condyles in relationship to the frontal motion.
  
  To determine tibal torsion, ensure that the medial and lateral femoral condyles are in the frontal plane. Palpate the bissection of the medial and lateral malleoli. Identify the axis (malleolar axis) connecting and extending from the points of bissection of the medial and lateral malleoli. To obtain a measurement, measure the angle between frontal motion (motion of examining table) and the identified malleolar axis.

CLINICAL TREATMENT OPTIONS:

- Edema control should be the primary objective of early treatment 13
  
- P.R.I.C.E.: 10
    
    Protection of the injured structures:
    
    Casting is discouraged for grade I and II sprains because the biochemical character of the ligament is changed to a degradated state during immobility. 8
    
    Use an ankle stabilizer to keep the ankle in dorsiflexion during the swing phase of gait with crutches. There is a tendency for the patient to allow the foot to drop into plantarflexion, thus increasing intrarticular pressure within the capsule. 22
    
    Relative Rest of the injured structures will prevent any further tissue damage.
    
    Ice:
    Duration: 20 min 1
    Times a day: 6-8
    
    Compression:
    Focal compression over the lateral ankle at all times when not icing. 22
    
    Elevation:
    Elevation has been noted as an important process in decreasing edema in post acute ankle injuries. 16
    
- Crutch use as needed:
  
  It is imperative that the patient bears weight as soon as possible. Depression of the longitudinal arch during weight bearing causes longitudinal stretching of the venae commutates of the lateral plantar artery, which empties the veins. 9
  
  This will help to pump blood and lymph away from the injured area. The ability to bear weight will vary depending on the severity of the injury. Non-weight bearing, or toe touch weight bearing, may be required for the first 24-72 hours.
  
- Massage:
  Gentle massage in the elevated position has been shown to assist in the removal of lymph and other waste products.
CLINICAL TREATMENT OPTIONS (cont):

- Neuromuscular Electrical Muscle Stimulation (NMES) for edema reduction:
  Duration: 20 min
  Recommendations: Use in combination with ice and elevation to aid in the stimulation of venous and lymphatic return

- Neuromuscular Electrical Muscle Stimulation (NMES) for TENS effect
  Duration: 20 min
  Recommendations: The use of an interferential mode can be helpful with patients that may experience prolonged discomfort and are beginning to accommodate to the frequency of a TENS setting

- Flexibility exercises:
  Seated towel stretch (knee extended fully for Gastroc and flexed for Soleus)
  Sets and Duration: 5 x 20-30 sec
  Repeat: 4-5x/day

- Range of motion exercises: (when possible, ROM exercises should begin in a weight-bearing position) ^
  Device: Biodex Balance System
  Setup: Seated ankle plantarflexion / dorsiflexion
  Balance level: Initial 8 (progress toward 6)
  Sets and Reps: 2 x 20-30 reps (progress to 3 sets)
  Recommendations: Begin exercises in ankle brace and progress out of brace by end of the phase.
  NOTE: Avoid end ROM initially and progress as tolerated

- Passive Range of Motion (PROM) as needed
  Device: Biodex Multi-Joint System
  Setup: Supine with knee at 10° of flexion; elevated above the heart
  Mode: Passive
  ROM Setup: Begin from neutral (0°) dorsiflexion to maximal plantarflexion
  Speed: 2 deg/sec initially and progress to 10 deg/sec as ROM increases
  Duration: 20 min
  Recommendations: Can be used in combination with cryotherapy, EMS, and elevation. Set the ROM on the Biodex controller to 50% in each direction and increase ROM as tolerated.

- Cardiovascular activities:
  Device: Biodex Upper Body Cycle
  Mode: Constant Power
  Work rate: initially to patient tolerance, increase as tolerated
  Duration: 5 min (progress to 10)

  Device: Seated Versa Climber
  Resistance: As needed
  Duration: 5 min
  Recommendations: Use arms and legs to increase cardiac output if necessary

- Partial Weight Bearing Therapy:
  Device: Biodex Unweighing System
  Have patient work on forward ranges of motion, no lateral movements to start
  Non-weight bearing (NWB) Cardiovascular conditioning drills (jogging / running), on treadmill
  Begin WB activities with patient un-weighted to approximately 30% of body weight

- Closed chain proprioception exercises:
  Weight shifting
  Device: Biodex Balance System
  Position: Bilateral standing @ level 8 holding on to handrails
  Sets and Reps: 2 x 25-30 (progress to 3 sets)
  Recommendations: Have the patient begin to bear weight and shift from injured to non-injured and back again. Can also begin plantarflexion and dorsiflexion. Can also be performed initially using the Biodex Unweighing System.
SUPERVISED PROGRAM:

- **Control pain and edema:**
  
  P.R.I.C.E.

- **Crutch use:**
  
  First 24-72 hr as tolerated, attempt "walk through" gait as soon as tolerable

- **Range of Motion (ROM) exercises:**
  
  2-way wobble board (plantarflexion / dorsiflexion only):
  
  Sets and Reps: 2 x 15-20
  
  Recommendations: Begin seated and bearing no weight, progress WB as tolerated.

  Ankle pumps:
  
  Sets and Reps: 2-3 x 50
  
  Recommendations: Have the patient perform this exercise in an elevated position to assist in edema reduction

- **Flexibility exercises:**
  
  Seated towel stretch (knee extended fully for Gastroc and flexed for Soleus)
  
  Sets: 5-6
  
  Duration: 20-30 sec

  Seated heel cord stretches attempting to increase dorsiflexion
  
  Sets: 5-6
  
  Duration: 20-30 sec

- **Weight-bearing exercises:**
  
  Weight shifting standing between two chairs or tables
  
  Sets and Reps: 3 x 25-30
  
  Recommendations: Have the patient begin to bear weight and shift from injured to non-injured side and back again.

  Begin plantarflexion / dorsiflexion

- **Cardiovascular conditioning:**
  
  **Device:** Biodex Upper Body Cycle
  
  **Mode:** Constant Power
  
  **Work Rate:** initially to patient's tolerance and increase as tolerated
  
  **Duration:** 5 min

- **Gait training:**
  
  **Device:** Biodex Gait Trainer
  
  **Speed:** Very slow, comfortable for patient
  
  **Direction:** Reverse for retrowalking
  
  **Elevation:** 0%
  
  **Recommendations:** Gradually increase speed and duration of walking - emphasis on proper foot progression angle.

  Use the Biodex Unweighing System as needed to ensure proper and safe gait evaluation. Unweigh patient up to 40% of BW initially.
HOME PROGRAM:

The main focus of the home program is for the patient to reduce edema and progress weight bearing.

- **Protect the joint:**
  Bracing or strapping while the patient is ambulating - ambulate with crutches anytime at home until clinician clears for FWB

- **Control pain and edema:**
  P.R.I.C.E.

- **Active Range of Motion (AROM) exercises:**
  Ankle pumps:
  Sets and Reps: 3 x 50
  Repeat: 4-5 x/daily
  Recommendations: Have the patient perform this exercise in an elevated position to assist in edema reduction.

- **Flexibility exercises:**
  Seated towel stretch (knee extended fully for Gastroc and flexed for Soleus)
  Sets and Duration: 5 x 20-30 sec
  Repeat: 4-5 x/daily

- **Weight-bearing exercises:**
  Weight shifting standing between two chairs or tables
  Sets: 3 x 25-30
  Recommendations: Have the patient begin to bear weight and shift from injured to non-injured side and back again.

REPORTS:

- **Functional activity level:**
  Measurement of current AROM and PROM
  Girth measurements
  WB status

- **Biodex Gait Trainer Evaluation**
  Note Step length and Cycle time
PHASE II
range of motion & initial strengthening

GOALS:
- Decrease pain and edema
- Ensure full AROM/PROM
- Full Weight Bearing (FWB) by end of phase
- Isometric Strength:
  - Plantarflexion / Dorsiflexion < 30% deficit from uninvolved
  - Inversion/Eversion (I/E) = bilaterally
- Open Kinetic Chain (OKC) Proprioception
  - Plantarflexion (PF) < 20% deficit
- Biodex Balance System bilateral stance
  - Stability Index < 30% deficit of Normative value

CLINICAL EVALUATION:
- Amount and quality of swelling and edema (figure 8 measurement)
- Range of Motion:
  - Measure active and passive PF/DF and I/E
  - Record this initially and use this as an objective measurement on a daily basis
- Special tests:
  - Anterior drawer
  - Talar tilt
  - NOTE: Caution should be taken when performing these tests. Note the initial degree of laxity.
  - Can be performed in the seated, plantarflexed position to avoid a false negative.
- Neurological test:
  - Myotomes, Dermatomes and Reflexes for L4 – S2
CLINICAL EVALUATION (cont):

- Functional tests
  
  Activity of Daily Living (ADL)

  TEST: Gait assessment (able to ambulate, able to ambulate without antalgic gait)
  
  Device: Biodex Gait Trainer
  
  Speed: Very slow, comfortable for patient
  
  Elevation: 0%
  
  Recommendations: Gradually increase speed and duration of walking with proper gait. Emphasis on proper foot progression angle. Use the Biodex Unweighing System as needed to ensure proper and safe gait evaluation. Unweigh patient up to 40% of BW.

  TEST: OKC Proprioception evaluation of PF/DF and I/E
  
  Device: Biodex Multi-Joint System
  
  Active replacement (muscle spindle)
  
  Passive replacement (capsule, ligament, meniscus)
  
  Setup: Supine, support pad placed in distal femur, knee flexed to 10º
  
  Mode: Isokinetic and passive
  
  Movement patterns: PF/DF and I/E
  
  Repetitions: Average of three trials
  
  Target angle: ROM dependent (5-10º of movement see recommendations)
  
  Recommendations: Be cautious with the target angle selected. There should be NO incidence of pain or inhibition.

  NOTE: It has been demonstrated that diminished awareness of passive motion sense into plantarflexion associated with multiple sprains.  

  TEST: Bilateral PF/DF and I/E Isometric evaluation
  
  Device: Biodex Multi-Joint System
  
  Setup: Supine, support pad placed in distal femur, knee flexed to 10º
  
  Mode: Isometric
  
  Sets and Reps: 5 x 5 seconds for each direction
  
  Recommendations: Perform the test in subtalar neutral (STN) or at 0º of plantarflexion and 0º of inversion. The patient should not experience any pain or discomfort. This test is to establish a baseline for progression.

  TEST: Weight-bearing Balance test
  
  Device: Biodex Balance System
  
  Report: Stability Index
  
  Positioning: Bilateral [two foot] stance, knees flexed 10-15º
  
  Sets and Duration: 3 x 20 seconds
  
  Eyes: Open
  
  Recommendations: Begin this test when the patient has FWB status with no complaints of pain.
  
  If unable to fully WB, use Unweighing System.
CLINICAL TREATMENT OPTIONS:

- Verify home program compliance
- Control pain and edema:
  - P.R.I.C.E.
- Crutch use as needed
- Range of Motion (ROM) exercises:
  - Anterior/posterior manual glides
  - Grade I and II mobilizations (talus on the tibia) to decrease pain and facilitate ROM
  - Talocrural joint mobilizations will prevent random scar tissue formation and increase ROM in sagittal plane motions.

  **Device:** Biodex Balance System (PF/DF)
  - Sets and Reps: 3 x 15-20
  - Recommendations: Begin seated and bearing no weight, progress WB as tolerated

  **Ankle pumps**
  - Sets and Reps: 3 x 50
  - Recommendations: Have the patient perform this exercise in an elevated position to assist in edema reduction.

  **Device:** Biodex Multi-Joint System
  - Setup: Supine with knee at 10º of flexion; elevated above the heart
  - Mode: Passive
  - ROM Setup: Begin from neutral (0º) dorsiflexion to maximal plantarflexion
  - Speed: 2 deg/sec (progress to 10 deg/sec as ROM increases)
  - Duration: 20 min
  - Recommendations: Can be used in combination with Cryotherapy and EMS. Set the ROM on the Biodex controller to 50% in each direction and increase ROM as tolerated.

- Active-Assisted Range of Motion (AAROM):
  - **Device:** Biodex Multi-Joint System
  - Setup: Supine with knee at 10º of flexion; elevated above the heart
  - Mode: Passive
  - ROM Setup: Within pain free ROM
  - Speed: 30 deg/sec (progress to 60 deg/sec)
  - Sets and Reps: 3 x 10-15
  - Recommendations: Instruct patient to contract sub-maximally and not to resist movement.

- Flexibility exercises
  - Seated towel stretch (knee extended fully for Gastroc and flexed for Soleus)
  - Sets and Duration: 5 x 20-30 sec

  - Seated heel cord stretches attempting to increase dorsiflexion
  - Sets and Duration: 5 x 20-30 sec

  - Standing heel cord stretch (Begin when FWB and eliminate seated)
  - Sets and Duration: 5 x 20-30 sec
CLINICAL TREATMENT OPTIONS:

- **Gait Training:**
  - **Device:** Biodex Gait Trainer
  - **Duration:** 3-5 min
  - **Incline:** 0%
  - **Speed:** Begin at a speed comfortable for the patient and progress as tolerated
  - **Recommendations:** Use the Biodex Unweighing System initially to help reduce the amount of weight bearing and allow regulation of step length.

- **Strengthening exercises:**
  - **Device:** Biodex Multi-Joint System
  - **Setup:** Supine, support pad placed in distal femur, knee flexed to 10°
  - **Mode:** Isometric
  - **Sets and Reps:** 3 x 10-15
  - **Duration:** 5 sec each rep
  - **Recommendations:** Begin exercise in subtalar neutral (STN) or at 0° of plantarflexion and 0° of inversion. Progress to other angles as ROM and pain allows. The patient should not experience any pain or discomfort. Can also place a towel on the footplate and have patient exercise without a to exercise intrinsic muscles of the foot.

  - **Foot intrinsic exercises**
    - Toe curls, pencil/pen pickup, and marble pickup
    - **Positioning:** Seated
    - **Sets and Reps:** 1 x 10 (toe curls), 10 each (pencil/pen pickup, marble pickup)

- **Open Kinetic Chain (OKC) Proprioception training of Plantarflexion/Dorsiflexion (PF/DF) and Inversion/Eversion (I/E)**
  - **Device:** Biodex Multi-Joint System
  - **Active replacement at 60 deg/sec**
  - **Passive replacement at 10 deg/sec**
  - **Setup:** Supine, support pad placed in distal femur, knee flexed to 10°
  - **Mode:** Isokinetic and passive
  - **Movement patterns:** PF/DF and I/E
  - **Sets and Reps:** 3 x 10 each pattern
  - **Target angle:** ROM dependent (5-10° of movement - see recommendations)

- **Weight-bearing exercises:**
  - **Device:** Biodex Balance System
  - **Positioning:** Bilateral stance (both feet), knees flexed 10-15°
  - **Sets and Duration:** 2 x 20 seconds (progress to 3 x 30)
  - **Stability level:** 8 (progress to 6)
  - **Eyes:** Open
  - **Recommendations:** Begin this exercise when the patient has FWB status and no complaints of pain.
  - **Weight shifting PF/DF and I/E**
  - **Sets and Reps:** 3 x 25-30 each direction
  - **Recommendations:** Have the patient begin to bear weight and shift from injured to non-injured side and back again.

  - **Mini squats to 30° of knee flexion**
  - **Sets and Reps:** 3 x 10-15
  - **Recommendations:** Begin when FWB

  - **Static balance**
    - **Stance:** Begin with bilateral stance and progress to unilateral
    - **Sets and Duration:** 1-2 x 20 seconds
    - **Eyes:** Open and progress to closed
    - **Recommendations:** Ensure that the patient has a secure post to grab PRN

- **Cardiovascular activities:**
  - **Device:** Biodex Upper Body Cycle and/or BioStep® Semi-Recumbent Elliptical
  - **Mode:** Isokinetic
  - **Speed:** 90-120 deg/sec
  - **Duration:** 15 min
SUPERVISED PROGRAM:

- **P.R.I.C.E.**
- **Crutch use as needed**

**Range of Motion (ROM) exercises:**

- **Device**: Biodex Balance System (PF/DF)
- **Sets and Reps**: 3 x 15-20
  - Level: Start at Level 1 and progress to Level 8 to increase resistance as tolerated.
  - Recommendations: Begin seated and bearing no weight, progress WB as tolerated.

- **Ankle pumps**
  - **Sets and Reps**: 3 x 50
  - **Recommendations**: Have the patient perform this exercise in an elevated position to assist in edema reduction.

**Flexibility exercises:**

- Seated towel stretch (knee extended fully for Gastroc and flexed for Soleus)
  - **Sets**: 5-6
  - **Duration**: 20-30 sec

- Seated heel cord stretches attempting to increase dorsiflexion
  - **Sets**: 5-6
  - **Duration**: 20-30 sec

- Standing heel cord stretch (Begin when FWB and eliminate seated)
  - **Sets**: 5-6
  - **Duration**: 20-30 sec

**Strengthening exercises:**

- Foot intrinsic exercises
  - Toe curls, pencil/pen pickup, and marble pickup
  - **Positioning**: Seated
  - **Sets and Reps**: 1 x 10 (toe curls), 10 each (pencil/pen pickup, marble pickup)

**Closed chain exercises:**

- Weight shifting PF/DF and I/E
  - **Sets and Reps**: 3 x 25-30 each direction
  - **Recommendations**: Have the patient begin to bear weight and shift from injured to non-injured side and back again.

- Mini squats to 30° of knee flexion
  - **Sets and Reps**: 3 x 10-15
  - **Recommendations**: Begin when FWB

**Cardiovascular activities**

- **Device**: Biodex Upper Body Cycle
  - **Mode**: Isokinetic
  - **Speed**: 90-120 deg/sec
  - **Duration**: 15 min
HOME PROGRAM:

- Control pain and edema:
  
  P.R.I.C.E.

- Crutch use as needed

- Active Range of Motion (AROM) exercises:
  
  Ankle pumps
  
  Sets and Reps: 3 x 50
  
  Times daily: 4-5
  
  Recommendations: Have the patient perform this exercise in an elevated position to assist in edema reduction.

- Flexibility exercises:
  
  Seated towel stretch (knee extended fully for Gastroc and flexed for Soleus)
  
  Sets and Duration: 5 x 20-30 sec
  
  Times daily: 4-5

  Seated heel cord stretches attempting to increase dorsiflexion
  
  Sets and Duration: 5 x 20-30 sec
  
  Times daily: 4-5

  Standing heel cord stretch (When FWB, begin this and eliminate seated)
  
  Sets and Duration: 5 x 20-30 sec
  
  Times daily: 4-5

  Recommendations: Extend the toes on a book to lock the subtalar joint and isolate the stretch to the gastrocnemius and soleus complex.

- Weight-bearing exercises:
  
  Weight shifting PF/DF and I/E
  
  Sets and Reps: 3 x 25-30 each direction
  
  Recommendations: Have the patient begin to bear weight and shift from injured to non-injured side and back again.

  Static balance (Begin bilateral stance and progress to unilateral)
  
  Sets and Duration: 1-2 x 20 sec
  
  Eyes: Open
  
  Recommendations: Ensure that the patient has a secure post to hold.

- Strengthening exercises:
  
  Foot intrinsic exercises
  
  Toe curls, pencil/pen pickup, and marble pickup
  
  Positioning: Seated
  
  Sets and Reps: 1 x 10 (toe curls, pencil/pen pickup, marble pickup)

- Cardiovascular activities:
  
  Ensure that the patient completes at least 20 min of exercise 3/week.

REPORTS:

- Functional activity level
  
  Measurement of current AROM and PROM
  
  Girth measurements
  
  WB status

- Biodex isometric bilateral comparison I/E and PF/DF

- Biodex OKC proprioception comparison I/E and PF/DF

- Biodex Balance System Stability Index
GOALS:

- Decrease pain and edema
  Patient should have no residual swelling by end of this phase

- Ensure full AROM/PROM

- Isokinetic Strength:
  Plantarflexion and Dorsiflexion < 30% deficit from uninvolved
  Eversion and Inversion < 45% deficit

- OKC Proprioception:
  Plantarflexion < 10% deficit
  Inversion < 20%

- Biodex Balance System bilateral stance
  Stability Index < 20% deficit of Normative value

- Patient should be able to bear full body weight by end of this phase
**CLINICAL EVALUATION:**

- **Swelling and edema (figure 8 measurement)**
- **Range of Motion:**
  - Measure active and passive PF/DF and I/E
- **Special tests:**
  - Anterior drawer
  - Talar tilt
  
  **NOTE:** Caution should be taken when performing these tests. Note the degree of laxity initially.
- **Neurological tests:**
  - Myotomes, Dermatomes and Reflexes for L4-S2

**TEST:** Bilateral PF/DF and I/E Isokinetic evaluation

**Device:** Biodex Multi-Joint System

**Report:** Isokinetic Evaluation – 2 Speeds

**Setup:** Supine, support pad placed in distal femur, knee flexed to 10º

**Mode:** Isokinetic

**Speeds:** 60 deg/sec and 120 deg/sec

**Reps:** 5 and 10 respectively

**Recommendations:** Isokinetic strength training may begin if the patient has [1] full ROM, [2] full weight-bearing status and [3] has no complaints of pain or swelling.

**TEST:** Bilateral Stance and Unilateral Comparison Balance test

**Device:** Biodex Balance System

**Report:** Stability Index

**Positioning:** Bilateral stance, knees flexed 10-15º

**Stability level:** 8 (most stable)

**Sets and Duration:** 5 x 20 seconds with 30 seconds rest between reps

**Eyes:** Open

**Recommendations:** Begin this test when the patient has FWB status with no complaints of pain.

**TEST:** OKC Proprioception evaluation of PF/DF and I/E

**Device:** Biodex Multi-Joint System

**Active replacement (muscle spindle)**

**Passive replacement (capsule, ligament, meniscus)**

**Setup:** Supine, support pad placed in distal femur, knee flexed to 10º

**Mode:** Isokinetic and passive

**Movement pattern:** PF/DF and I/E

**Repetitions:** Average of three trials

**Target angle:** ROM dependent [5-10º of movement-see recommendations]

**Recommendations:** Be cautious with the target angle selected. There should be NO incidence of pain or inhibition.

**TEST:** Gait evaluation (able to ambulate, able to ambulate without antalgic gait)

**Device:** Biodex Gait Trainer

**Report:** Exercise Summary

**Speed:** Comfortable for patient

**Elevation:** 0%

**Recommendations:** Gradually increase speed and duration of walking with proper gait - emphasis on proper foot progression angle.
CLINICAL TREATMENT OPTIONS:

- Verify home program compliance
- Control pain and edema:
  PR.I.C.E.
- AROM exercises:
  - Anterior/posterior manual glides
  - Grade I and II mobilizations (talus on the tibia) to decrease pain and facilitate ROM
  - Talocrural joint mobilizations will prevent random scar tissue formation and increase ROM in the sagittal plane.
- Lower extremity exercises:
  - It is important that the clinician continues to strengthen the entire lower extremity. Do not allow the focus to be completely on the ankle and foot.
- Strengthening exercises:
  - Isokinetic PF/DF and I/E concentric/concentric
    - Device: Biodex Multi-Joint System
    - Setup: Supine, support pad placed in distal femur, knee flexed to 10°
    - Mode: Isokinetic
    - Sets and Reps: 3 x 10-15
    - Speeds: 120 deg/sec (progress to 60 deg/sec)
    - Recommendations: Begin with PF/DF exercises and progress to I/E as pain and swelling permit.
    - Begin I/E exercises in 0° of inversion and progress at tolerated.
  - Isokinetic PF/DF and I/E eccentric/concentric
    - Device: Biodex Multi-Joint System
    - Mode: Isokinetic (System 2 – Passive Mode)
    - Setup: Eccentric towards/Concentric away
    - Sets and Reps: 3 x 10-15
    - Speeds: 60 deg/sec (progress to add 120 deg/sec)
    - Recommendations: Begin with PF/DF exercises and progress to I/E as pain and swelling permit. Begin I/E exercises in 0° of inversion and progress at tolerated. There should be NO incidence of pain or inhibition with this exercise.
  - Ankle isotonics (use of cuff weights or ankle attachment for Cable Column)
    - Sets and Reps: 3 x 12-15
    - Weight: (cuff weights) 2 lb, (ankle specific) as tolerated
    - Recommendations: If using cuff weights, begin seated for ankle dorsiflexion and side-lying for inversion and eversion
  - Reclining Squat System
    - Sets and Reps: 3 x10
    - Weight: Begin with 25% BW and progress as tolerated
    - Recommendations: Begin foot positioning so to limit the amount of dorsiflexion.
- Flexibility exercises:
  - Standing heel cord stretch (When FWB, begin this and eliminate seated)
    - Sets and Duration: 5 x 20-30 seconds
    - Recommendations: Perform this exercise with knee straight for the gastrocnemius complex and knee flexed for soleus complex.
- Cardiovascular activities:
  - Device: Biodex Upper Body Cycle
    - Mode: Isokinetic
    - Speed: 90-120 deg/sec
    - Duration: 20 min
CLINICAL TREATMENT OPTIONS (cont):

- **Gait Training:**
  - **Device:** Biodex Gait Trainer
  - **Duration:** 5-7 min
  - **Incline:** 0%
  - **Speed:** Begin at speed finished with last phase
  - **Recommendations:** Begin with normal ambulation and progress speed as tolerated, have patient retro-walk to improve ROM and muscular strength

- **Open Kinetic Chain Proprioception training of Plantarflexion/Dorsiflexion and Inversion/Eversion:**
  - **Device:** Biodex Multi-Joint System
  - **Active replacement at 60 deg/sec**
  - **Passive replacement at 10 deg/sec**
  - **Setup:** Supine, support pad placed in distal femur, knee flexed to 10º
  - **Mode:** Isokinetic and passive
  - **Movement patterns:** PF/DF and I/E
  - **Sets and Reps:** 3 x 10 each pattern
  - **Target angle:** ROM dependent (5-10º of movement. See recommendations)

- **Balance training:**
  - **Device:** Biodex Balance System
  - **Positioning:** Bilateral (two foot) stance, knees flexed 10-15º
  - **Sets and Duration:** 5 x 20 (progress to 10 x 45)
  - **Stability level:** 6 (progress to 4)
  - **Eyes:** Open (progress to closed)
  - **Recommendations:** Begin this exercise when the patient has FWB status with no complaints of pain - can progress to unilateral stance when tolerated by patient.
SUPERVISED PROGRAM:

- **Control pain and edema:**
  
  PR.I.C.E.

- **Flexibility exercises:**
  
  Standing heel cord stretch
  Sets and Duration: 5 x 20-30 sec
  Recommendations: Perform this exercise with knee straight for the gastrocnemius complex and knee flexed for soleus complex

- **Gait Training:**
  
  **Device:** Biodex Rehabilitation Treadmill
  Duration: 7-10 min
  Incline: 3%
  Speed: Begin last speed used in Phase II
  Recommendations: Forward ambulation walking or retro-ambulation as needed.

- **Flexibility training for entire lower leg**

- **Strengthening exercises:**
  
  Foot intrinsic exercises
  Toe curls, pencil/pen pickup, and marble pickup
  Positioning: Seated
  Sets and Reps: 1 x 10 each

  4-way Isometrics
  Sets and Reps: 3 x 10 (progress to 5 sets)
  Duration: 6 seconds
  Recommendations: Use of a wall to place foot against will provide a stable resistance

  Latex tubing exercises (Ensure that the entire ROM is being utilized)
  Sets and Reps: 3 x 15
  Resistance: Begin with level at end of Phase II

  Calf raises
  Sets and Reps: 3 x 12-15
  Recommendation: Begin with two feet on a flat surface. Progress to 4” step.

- **Cardiovascular activities:**
  
  **Device:** Biodex Upper Body Cycle
  **Mode:** Isokinetic
  Speed: 90-120 deg/sec
  Duration: 15 min
SUPERVISED PROGRAM (cont):

- **Weight-bearing exercises:**
  - Mini squats to 30° of knee flexion
  - Sets and Reps: 3 x 12-15
  - Recommendations: Begin when FWB

  Static balance (Begin bilateral stance and progress to unilateral)
  - Sets and Duration: 2 x 20 seconds
  - Eyes: Open (progress to closed by end of phase)
  - Recommendations: Ensure that the patient has a secure post to grab as needed.

  Dynamic balance (Begin when able to stabilize the involved extremity without pain or instability)
  - Sets and Duration: 2–3 x 20 sec
  - Eyes: Open (progress to closed by end of the phase)

  Mini Trampoline exercises
  - Sets and Duration: 2 x 20-30 sec
  - Recommendations: Only bilateral work this phase. Use prophylactic bracing or taping PRN.
  - Exercises performed can be jogging in place, double leg bounding or weight shifting.

  Reclining Functional Squat System
  - Sets and Repetitions: 3 x 10-12
  - Weight: Begin with weight used at end of Phase II
  - Recommendations: Lower foot positioning to increase dorsiflexion

  Lower extremity exercises
  - It is important that the clinician continues to strengthen the entire lower extremity.
  - Do not allow the focus to be completely on the ankle and foot.
HOME PROGRAM:

- Control pain and edema:
  P.R.I.C.E.

- Flexibility exercises:
  Seated towel stretch (knee extended fully for Gastroc and flexed for Soleus)
  Sets and Duration: 5 x 20-30 sec
  Times daily: 4-5

  Standing heel cord stretch (When FWB, begin this and eliminate seated)
  Sets and Duration: 5 x 20-30 sec
  Times daily: 4-5
  Recommendations: Extend the toes on a book to lock the subtalar joint and isolate the stretch to the gastrocnemius and soleus complex.

- Weight-bearing exercises:
  Weight shifting PF/DF and I/E
  Sets and Reps: 3 x 25-30 each direction
  Recommendations: Have the patient begin to bear weight and shift from injured to non-injured side and back again.

  Static balance (Begin bilateral stance and progress to unilateral)
  Sets and Duration: 1-2 x 20 sec
  Eyes: Open
  Recommendations: Ensure that the patient has a secure post to hold

- Strengthening exercises:
  Mini squats to 30º of knee flexion
  Sets and Reps: 3 x 12-15

  Foot intrinsic exercises
  Toe curls, pencil/pen pickup, and marble pickup
  Positioning: Seated
  Sets and Rep: 1 x 10

  Latex tubing exercises (Ensure that the entire ROM is being utilized)
  Sets and Reps: 3 x 15
  Resistance: Begin with level at end of Phase II

  Lower leg strengthening exercises for hip and knee

- Cardiovascular activities:
  Ensure that the patient completes at least 20 min of exercise 3x/week.
REPORTS:

- Functional activity level
  - Measurement of current AROM and PROM
  - Girth measurements
  - WB status

- Cardiovascular Conditioning level

- Biodex isokinetic bilateral comparison I/E and PF/DF @ 60 and 120 deg/sec

- Biodex OKC proprioception bilateral comparison I/E and PF/DF

- Biodex Balance System Stability Index
GOALS:

- No complaints of swelling or pain
- Ensure full AROM/PROM
- Isokinetic Strength:
  - PF/DF < 10-15% deficit from uninvolved
  - I/E < 15% deficit
- OKC Proprioception:
  - PF/DF < 10% deficit
  - I/E < 10% deficit
- Biodex Balance System bilateral stance:
  - Stability Index < 15% deficit of Normative value
  - Stability Index < 20% deficit with Bilateral Comparison
- Functional hop tests:
  - Within 15% bilaterally
  
  **NOTE**: Prior to the return of activity, the patient should have the following objective test results:
  a. ROM at least 90% of the non-injured side
  b. 90% strength compared to the non-injured side
  c. Agility: able to sprint, cut, zigzag, 90° cuts, walk on inside and outside of heel and single leg hop
  d. Can do unilateral balance
CLINICAL EVALUATION:

- Swelling and edema (figure 8 measurement)
- Range of Motion (ROM):
  Measure active and passive PF/DF and I/E
- Special tests:
  Anterior drawer
  Talar tilt

*Note: Caution should be taken when performing these test. Note the degree of laxity initially.

- Neurological tests:
  Myotomes, Dermatomes and Reflexes for L4-S2

TEST: Bilateral PF/DF and I/E Isokinetic evaluation

Device: Biodex Multi-Joint System
Report: 3 Speed Isokinetic Evaluation
Setup: Supine, support pad placed in distal femur, knee flexed to 10°
Mode: Isokinetic
Test:
- 1 x 5 @ 30 deg/sec
- 1 x 5 @ 60 deg/sec
- 1 x 10 @ 120 deg/sec

TEST: Balance test

Device: Biodex Balance System
Report: Stability Index
Positioning: Bilateral and Unilateral
Stability level: 8 (most stable)
Sets and Duration: 5 x 20 sec with 30 sec rest between reps
Eyes: Open
Recommendations: Begin this test when the patient has FWB status with no complaints of pain.

TEST: OKC Proprioception evaluation of PF/DF and I/E

Device: Biodex Multi-Joint System
Active replacement (muscle spindle)
Passive replacement (capsule, ligament, meniscus)
Setup: Supine, support pad placed in distal femur, knee flexed to 10°
Mode: Isokinetic and passive
Movement pattern: PF/DF and I/E
Repetitions: Average of three trials
Target angle: ROM dependent (5-10° of movement-see recommendations)
Recommendations: Be cautious with the target angle selected. There should be NO incidence of pain or inhibition.
CLINICAL TREATMENT OPTIONS:

- Verify home program compliance

- Control pain and edema:
  
  PR.I.C.E.

- Range of Motion (ROM) exercises:
  
  Anterior/posterior Manual glides
  Grade I and II mobilizations (talus on the tibia) to decrease pain and facilitate ROM
  Talocrural joint mobilizations will prevent random scar tissue formation and increase ROM in the sagittal motion.

- Lower extremity exercises:
  
  It is important that the clinician continues to strengthen the entire lower extremity. Do not allow the focus to be completely on the ankle and foot.

- Strengthening exercises:
  
  Isokinetic PF/DF and I/E concentric/concentric
  
  **Device:** Biodex Multi-Joint System
  
  Setup: Supine, support pad placed in distal femur, knee flexed to 10°
  
  Mode: Isokinetic
  
  Sets and Reps: 3 x 10-15
  
  Speeds: 120 deg/sec (progress to add 60 deg/sec)
  
  Recommendations: Begin with PF/DF exercises and progress to I/E as pain and swelling permit. Begin I/E exercises in 0° of inversion and progress at tolerated.

  Isokinetic PF/DF and I/E eccentric/concentric
  
  **Device:** Biodex Multi-Joint System
  
  Mode: Isokinetic (System 2 – Passive Mode)
  
  Setup: Eccentric towards/ Concentric away
  
  Sets and Reps: 3 x 10-15
  
  Speeds: 60 and 120 deg/sec
  
  Recommendations: Begin with PF/DF exercises and progress to I/E as pain and swelling permit. Begin I/E exercises in 0° of inversion and progress at tolerated. There should be NO incidence of pain or inhibition with this exercise.

  Ankle isotonics (use of cuff weights or ankle attachment for Cable Column)
  
  Sets and Reps: 3 x 12-15
  
  Weight: (cuff weights) 2 lb, (ankle specific) as tolerated
  
  Recommendations: If using cuff weights, begin seated for ankle dorsiflexion and side-lying for inversion and eversion.

  **Device:** Recumbent Squat
  
  Sets and Reps: 3 x 10
  
  Weight: Begin with 75% BW and progress as tolerated
  
  Recommendations: Begin foot positioning so to limit the amount of dorsiflexion.

- Gait Training:
  
  **Device:** Biodex Gait Trainer
  
  Duration: 5-7 min
  
  Incline: 5-10%
  
  Speed: Begin at speed finished with last phase
  
  Recommendations: Begin normal ambulation and progress speed as tolerated
CLINICAL TREATMENT OPTIONS (cont):

- **Weight-bearing exercises:**
  
  **Device:** Biodex Balance System  
  **Stance:** Bilateral and Unilateral  
  **Stability level:** 6 (progress to 4)  
  **Sets and Duration:** 3 x 45 sec (progress to 5 x 60)

  Mini Trampoline exercise  
  **Sets and Duration:** 2 x 20-30 sec  
  **Recommendations:** Bilateral and unilateral work this phase. Use prophylactic bracing or taping. Exercises performed can be jogging in place, double leg bounding, and weight shifting.

- **Lower extremity exercises:**
  
  It is important that the clinician continues to strengthen the entire lower extremity. Do not allow the focus to be completely on the ankle and foot.

- **Functional Activity Drills:**

  Initially, skills should be performed at half speed, in a controlled environment, and for short periods of time. The athlete should be evaluated periodically and increases or decreases should be implemented accordingly.
  
  Drills can include: jogging, forward ambulation, running, “S” curves, figure 8, zig-zag cutting, jumping and hopping. Running patterns should be started large and then made smaller and tighter.

  **NOTE:** It is important that specific drills related to the individual’s sport, or activity, be included.

- **Plyometrics:**

  Prior to the inception of a plyometric program, ensure that an adequate strength base has been established. Always use adequate shoes, a resilient surface and use a proper organized progression (S.A.I.D principle). Always train with knowledgeable supervision to ensure proper technique.

  Chu’s Plyometric Categories
  3
  In-place jumping  
  Standing jumps  
  Multiple response jumps and hops  
  In-depth jumping and box drills  
  Bounding  
  High stress sports specific drills

- **Cardiovascular activities:**

  **Device:** BioStep® Semi-Recumbent Elliptical  
  **Mode:** Isookinetic or constant power  
  **Speed:** 90-120 deg/sec  
  **Duration:** 10-12 min

  **Device:** Biodex Rehabilitation Treadmill  
  **Duration:** 7-10 min  
  **Incline:** 5-10%  
  **Speed:** Begin at speed finished with last phase  
  **Recommendations:** May perform sports specific activities as well

  **Device:** Biodex Upper Body Cycle  
  **Mode:** Isookinetic  
  **Speed:** 90-120 deg/sec  
  **Duration:** 7-10 min
SUPERVISED PROGRAM:

- **Flexibility exercises:**
  
  Standing heel cord stretch (When FWB, begin this and eliminate seated)
  
  Sets and Duration: 5 x 20-30 sec
  
  Recommendations: Perform this exercise with knee straight for the gastrocnemius complex and knee flexed for soleus complex.
  
  Hip, knee and lower leg flexibility training

- **Gait Training:**
  
  **Device:** Biodex Gait Trainer
  
  Duration: 3-5 min
  
  Incline: 3-5%
  
  Speed: Begin at speed used at end of Phase III and progress as tolerated
  
  Recommendations: Increase incline as needed

- **Strengthening exercises:**
  
  Ankle isotonics (use of cuff, weights or ankle specific devise)
  
  Sets and Reps: 3 x 12-15
  
  Weight: Begin with weight used at end of Phase III and progress
  
  Recommendations: If using cuff weights, begin seated for ankle dorsiflexion and side lying for inversion and eversion.
  
  Latex tubing exercises
  
  Sets and Reps: 3 x 12-15
  
  Resistance: Begin with level at end of Phase III and progress
  
  Recommendations: Ensure that the entire ROM is being utilized
  
  Heel raises
  
  Sets and Repetitions: 3 x 15-20
  
  Recommendations: Perform in the standing position. Can do over steps to increase the amount of dorsiflexion.

- **Cardiovascular activities**
  
  **Device:** BioStep® Semi-Recumbent Elliptical
  
  Mode: Isokinetic or constant power
  
  Speed: 90-120 deg/sec
  
  Duration: 10-12 min

  **Device:** Biodex Rehabilitation Treadmill
  
  Duration: 7-10 min
  
  Incline: 5-10%
  
  Speed: Begin at speed finished with last phase
  
  Recommendations: May perform sports specific activities as well

- **Weight-bearing exercises:**
  
  **Device:** Recumbent Squat
  
  Sets and Reps: 3 x 10-12
  
  Weight: Should be at 100% BW by end of phase
  
  Recommendations: Begin foot positioning so to limit the amount of dorsiflexion.
HOME PROGRAM:

- **Flexibility exercises:**
  - Standing heel cord stretch (When FWB, begin this and eliminate seated)
  - Sets and Duration: 5 x 20-30 sec
  - Times daily: 4-5
  - Recommendations: Perform this exercise with knee straight for the gastrocnemius complex and knee flexed for soleus complex.
  - Hip, knee and lower leg flexibility training

- **Weight-bearing exercises:**
  - Mini squats to 30° of knee flexion
  - Sets and Reps: 3 x 12-15
  - Recommendations: Begin when FWB
  - Static balance (Begin bilateral stance and progress to unilateral)
  - Sets and Duration: 2 x 20 sec
  - Eyes: Open
  - Recommendations: Ensure that the patient has a secure post to hold
  - Mini squats (standing)
  - Sets: 3 x 12-15
  - Recommendations: Begin bilateral and progress to unilateral when tolerated

- **Strengthening exercises:**
  - Foot intrinsic exercises
  - Toe curls, pencil/pen pickup, and marble pickup
  - Positioning: Seated
  - Sets and Reps: 1 x 10 each
  - 4-way Isometrics
  - Sets and Reps: 3-5 x 10
  - Duration: 5 seconds
  - Recommendations: Use wall to place foot against to provide a stable resistance
  - Ankle isotonics (use of cuff weights or ankle specific device)
  - Sets and Reps: 3 x 12-15
  - Weight: [cuff weights] 2 lb, [ankle specific] as tolerated
  - Recommendations: If using cuff weights, begin seated for ankle dorsiflexion and side lying for inversion and eversion
  - Latex tubing exercises (Ensure that the entire ROM is being utilized)
  - Sets and Reps: 5 x 12-15
  - Resistance: Begin with level at end of Phase III and progress PRN

- **Cardiovascular activities:**
  - 20 min of exercise 3x/week.
  - Sports specific muscle and cardiovascular systems are being stressed correctly

REPORTS:

- **Functional activity level**
  - Measurement of current AROM and PROM
  - Girth measurements
  - WB status

- **Cardiovascular conditioning level**

- **Biodex isokinetic bilateral comparison I/E and PF/DF @ 30, 60 and 120 deg/sec**

- **Biodex OKC proprioception bilateral comparison I/E and PF/DF**

- **Biodex Balance System Stability Index**
These two phases have been combined as by this time the patient should be full weight bearing and ready to return to activity with protective support.

**GOALS:**

- No complaints of swelling or pain
- Maintain full AROM/PROM
- Isokinetic Strength:
  - PF/DF < 10-15% deficit from uninvolved
  - I/E < 15% deficit
- Open Kinetic Chain (OKC) Proprioception:
  - PF/DF < 10% deficit
  - I/E < 10% deficit
- Biodex Balance System bilateral stance:
  - Stability Index < 15% deficit of Normative value*
  - Stability Index < 15% deficit with Bilateral Comparison
- Functional hop tests:
  - Within 15% bilaterally

**NOTE:** Prior to the return of activity, the patient should have the following objective test results 6:

- a. ROM at least 90% of the non-injured side
- b. 90% strength compared to the non-injured side
- c. Agility: able to sprint, cut, zigzag, 90° cuts, walk on inside and outside of heel and single leg hop
- d. Can perform unilateral balance
CLINICAL EVALUATION:

- Swelling and edema (figure 8 measurement)
- Range of Motion (ROM):
  Measure active and passive PF/DF and I/E
- Special tests:
  Anterior drawer
  Talar tilt
  *Note: Caution should be taken when performing these tests. Note the degree of laxity initially.
- Neurological tests:
  Myotomes, Dermatomes and Reflexes for L4-S2

TEST: Bilateral PF/DF and I/E Isokinetic evaluation

**Device:** Biodex Multi-Joint System

**Report:** 3 Speed Isokinetic Evaluation

**Setup:** Supine, support pad placed in distal femur, knee flexed to 10º

**Mode:** Isokinetic

**Test:**
- 1 x 5 @ 30 deg/sec
- 1 x 5 @ 60 deg/sec
- 1 x 10 @ 120 deg/sec

TEST: Balance test

**Device:** Biodex Balance System

**Return:** Stability Index

**Positioning:** Bilateral and Unilateral

**Stability level:** 8 (most stable)

**Sets and Duration:** 5 x 20 sec with 30 sec rest between reps

**Eyes:** Open

**Recommendations:** Begin this test when the patient has FWB status with no complaints of pain.

TEST: OKC Proprioception evaluation of PF/DF and I/E

**Device:** Biodex Multi-Joint System

**Active replacement (muscle spindle)**

**Passive replacement (capsule, ligament, meniscus)**

**Setup:** Supine, support pad placed in distal femur, knee flexed to 10º

**Mode:** Isokinetic and passive

**Movement pattern:** PF/DF and I/E

**Repetitions:** Average of three trials

**Target angle:** ROM dependent (5-10º of movement see recommendations)

**Recommendations:** Be cautious with the target angle selected. There should be NO incidence of pain or inhibition.
CLINICAL TREATMENT OPTIONS:

- Verify home program compliance

- Control pain and edema:
  
  PR.I.C.E.

- Range of Motion (ROM) exercises:
  
  Anterior/posterior Manual glides
  Grade I and II mobilizations (talus on the tibia) to decrease pain and facilitate ROM
  Talocrural joint mobilizations will prevent random scar tissue formation and increase ROM in the sagittal motion.

- Lower extremity exercises:
  
  It is important that the clinician continues to strengthen the entire lower extremity. Do not allow the focus to be completely on the ankle and foot.

- Strengthening exercises:
  
  Isokinetic PF/DF and I/E concentric/concentric
  
  Device: Biodex Multi-Joint System
  Setup: Supine, support pad placed in distal femur, knee flexed to 10°
  Mode: Isokinetic
  Sets and Reps: 3 x 10-15
  Speeds: 120 deg/sec (progress to add 60 deg/sec)
  Recommendations: Begin with PF/DF exercises and progress to I/E as pain and swelling permit. Begin I/E exercises in 0° of inversion and progress at tolerated.

  Isokinetic PF/DF and I/E eccentric/concentric
  
  Device: Biodex Multi-Joint System
  Mode: Isokinetic (System 2 – Passive Mode)
  Setup: Eccentric towards/ Concentric away
  Sets and Reps: 3 x 10-15
  Speeds: 60 deg/sec and 120 deg/sec
  Recommendations: Begin with PF/DF exercises and progress to I/E as pain and swelling permit. Begin I/E exercises in 0° of inversion and progress at tolerated. There should be NO incidence of pain or inhibition with this exercise.

  Ankle isotonics
  Sets and Reps: 3 x 12-15
  Weight: (cuff weights) 2 lb, (ankle specific) as tolerated
  Recommendations: If using cuff weights, begin seated for ankle dorsiflexion and side-lying for inversion and eversion.

  Reclining Squat System
  Sets and Reps: 3 x 10
  Weight: Begin with 75% BW and progress as tolerated
  Recommendations: Begin foot positioning so to limit the amount of dorsiflexion.

- Weight-bearing exercises:
  
  Device: Biodex Balance System
  Stance: Bilateral and Unilateral
  Stability level: 6 (progress to 4)
  Sets and Duration: 3 x 45 sec (progress to 5 x 60)

  Mini Trampoline exercise
  Sets and Duration: 2 x 20-30 sec
  Recommendations: Bilateral and unilateral work this phase. Use prophylactic bracing or taping PRN. Exercises performed can be jogging in place, double leg bounding, and weight shifting.
CLINICAL TREATMENT OPTIONS (cont.):

- Lower extremity exercises:
  It is important that the clinician continues to strengthen the entire lower extremity.
  Do not allow the focus to be completely on the ankle and foot.

- Functional Activity Drills:*
  Initially, skills should be performed at half speed, in a controlled environment, and for short periods of time.
  The athlete should be evaluated periodically and increases or decreases should be implemented accordingly.
  Drills can include: jogging, forward ambulation, running, “S” curves, figure 8, zig-zag cutting, jumping and hopping.
  Running patterns should be started large and then made smaller and tighter.
  *NOTE: It is important that specific drills related to the individual’s sport, or activity, be included.

- Plyometrics:
  Prior to the inception of a plyometric program, ensure that an adequate strength base has been established.
  Always use adequate shoes, a resilient surface and use a proper organized progression (S.A.I.D principle). Always train
  with knowledgeable supervision to ensure proper technique.

  Chu’s Plyometric Categories
  In-place jumping
  Standing jumps
  Multiple response jumps and hops
  In-depth jumping and box drills
  Bounding
  High stress sports specific drills

- Cardiovascular activities:
  **Device:** BioStep® Semi-Recumbent Elliptical
  Mode: Isokinetic or constant power
  Speed: 90-120 deg/sec
  Duration: 10-12 min

  **Device:** Biodex Rehabilitation Treadmill
  Duration: 7-10 min
  Incline: 5-10%
  Speed: Begin at speed finished with last phase
  Recommendations: May perform sports specific activities as well

  **Device:** Biodex Upper Body Cycle
  Mode: Isokinetic
  Speed: 90-120 deg/sec
  Duration: 7-10 min

- Return to sport and functional activity with protective brace and or support taping
SUPERVISED PROGRAM:

- Flexibility exercises:
  Standing heel cord stretch (When FWB, begin this and eliminate seated)
  Sets and Duration: 5 x 20-30 sec
  Recommendations: Perform this exercise with knee straight for the gastrocnemius complex and knee flexed for soleus complex.
  Hip, knee and lower leg flexibility training

- Gait Training:
  Device: Biodex Gait Trainer
  Duration: 3-5 min
  Incline: 3-5%
  Speed: Begin at speed used at end of Phase III and progress as tolerated
  Recommendations: Increase incline as needed

- Strengthening exercises:
  Ankle isotonics (use of cuff, weights or ankle specific devise)
  Sets and Reps: 3 x 12-15
  Weight: Begin with weight used at end of Phase III
  Recommendations: If using cuff weights, begin seated for ankle dorsiflexion and side lying for inversion and eversion.

  Latex tubing exercises
  Sets and Reps: 3 x 12-15
  Resistance: Begin with level at end of Phase III
  Recommendations: Ensure that the entire ROM is being utilized

  Heel raises
  Sets and Repetitions: 3 x 15-20
  Recommendations: Perform in the standing position. Can do over steps to increase the amount of dorsiflexion.

- Cardiovascular activities
  Device: BioStep® Semi-Recumbent Elliptical
  Mode: Isokinetic or constant power
  Speed: 90-120 deg/sec
  Duration: 10-12 min

  Device: Biodex Rehabilitation Treadmill
  Duration: 7-10 min
  Incline: 5-10%
  Speed: Begin at speed finished with last phase, can increase to comfortable running speed
  Recommendations: May perform sports specific activities as well

- Weight-bearing exercises:
  Device: Recumbent Squat
  Sets and Reps: 3 x 10-12
  Weight: Should be at 100% BW by end of phase
  Recommendations: Begin foot positioning so to limit the amount of dorsiflexion.
HOME PROGRAM:

- **Flexibility exercises:**
  - Standing heel cord stretch (When FWB, begin this and eliminate seated)
  - Sets and Duration: 5 x 20-30 sec
  - Times daily: 4-5
  - Recommendations: Perform this exercise with knee straight for the gastrocnemius complex and knee flexed for soleus complex.
  - Hip, knee and lower leg flexibility training

- **Weight-bearing exercises:**
  - Mini squats to 30° of knee flexion
  - Sets and Reps: 3 x 12-15
  - Recommendations: Begin when FWB
  - Static balance (Begin bilateral stance and progress to unilateral)
  - Sets and Duration: 2 x 20 sec
  - Eyes: Open
  - Recommendations: Ensure that the patient has a secure post to grab PRN
  - Mini squats (standing)
  - Sets: 3 x 12-15
  - Recommendations: Begin bilateral and progress to unilateral when tolerated

- **Strengthening exercises:**
  - Foot intrinsic exercises
  - Toe curls, pencil/pen pickup, and marble pickup
  - Positioning: Seated
  - Sets and Reps: 1 x 10 each
  - 4-way Isometrics
  - Sets and Reps: 3-5 x 10
  - Duration: 5 sec
  - Recommendations: Use wall to place foot against to provide a stable resistance
  - Ankle isotonics (use of cuff weights or ankle specific devise)
  - Sets and Reps: 3 x 12-15
  - Weight: (cuff weights) 2 lb, (ankle specific) as tolerated
  - Recommendations: If using cuff weights, begin seated for ankle dorsiflexion and side lying for inversion and eversion
  - Latex tubing exercises (Ensure that the entire ROM is being utilized)
  - Sets and Reps: 5 x 12-15
  - Resistance: Begin with level at end of Phase III and progress PRN

- **Cardiovascular activities:**
  - 20 minutes of exercise 3x/week.
  - Sports specific muscle and cardiovascular specific exercises.

REPORTS:

- **Functional activity level**
  - Measurement of current AROM and PROM
  - Girth measurements
  - W/B status

- **Cardiovascular conditioning level**

- **Biodex isokinetic bilateral comparison I/E and PF/DF @ 30, 60 and 120 deg/sec**

- **Biodex OKC proprioception bilateral comparison I/E and PF/DF**

- **Biodex Balance System Stability Index**
**NORMATIVE VALUES:**

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Stability Index</th>
<th>Standard Deviation (+/-)</th>
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<tbody>
<tr>
<td>17-35</td>
<td>1.54</td>
<td>.72</td>
</tr>
<tr>
<td>36-53</td>
<td>2.13</td>
<td>.90</td>
</tr>
<tr>
<td>54-71</td>
<td>2.57</td>
<td>.78</td>
</tr>
<tr>
<td>72-89</td>
<td>2.70</td>
<td>.80</td>
</tr>
</tbody>
</table>

Females are more stable than males:

<table>
<thead>
<tr>
<th>All ages</th>
<th>Stability Index</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>1.94</td>
<td>.80</td>
</tr>
<tr>
<td>Males</td>
<td>2.70</td>
<td>.08</td>
</tr>
</tbody>
</table>

Values were collected by J.A. Finn, et al, Stability Performance Assessment among Subjects of Disparate Balancing Abilities. Southern Connecticut State University.
EVIDENCE-BASED CLINICAL PROTOCOL FOR REHABILITATION OF LATERAL ANKLE SPRAINS


18. Simko M., Seslarzes, C, Andrieu R. Hydrostatic compression therapy


**EVIDENCE BASED CLINICAL PROTOCOL FOR THE MANAGEMENT OF:** lateral ankle sprains

### phase III: Initial Weight-bearing and Intermediate Strengthening

**goals:**
- Decrease edema (no residual swelling)
- Decrease pain
- Full AROM / PROM
- Isokinetic strength: PF/DF ≤ 30% deficit
- OKC proprioception: I/E < 15% deficit
- Balance System: < 15% deficit normative values*< 20% deficit bilateral comparison

*NOTE: deficit from established norm values for age

**clinical evaluations:**
- Verify home program compliance
- Swelling and edema
- ROM
- Special tests
- Neurological tests
- TEST: Biodex isokinetic bilateral comparison of PF/DF and I/E @ 60/120 deg/sec
- TEST: Biodex proprioception bilateral comparison of PF/DF and I/E
- TEST: Biodex Balance System bilateral stance
- TEST: Biodex Gait Trainer evaluation

**clinical treatment options:**
- Control pain and edema
  - PR.I.C.E.
  - Strengthening
    - Biodex isokinetic (con/con) PF/DF and I/E ≥ 120 deg/sec
    - Biodex isokinetic (ecc/con) PF/DF and I/E ≥ 60 deg/sec
    - Isotonic all planes
    - Manual resistance PRE's
  - Flexibility training
  - Cardiovascular training: Biodex UBC, Versa Climber (seated)
  - Non-WB proprioception: Biodex MJS
  - WB proprioception: Biodex Balance System bilateral stance

### phase IV: Progressed Weight-bearing & Strengthening

**goals:**
- No complaints of pain or swelling
- Ensure full PROM / AROM
- Isokinetic strength: PF/DF ≤ 10-15% deficit
- OKC proprioception: I/E < 10% deficit
- Balance System: < 15% deficit normative values*< 20% deficit bilateral comparison

*NOTE: deficit from established norm values for age

**clinical evaluations:**
- Verify home program compliance
- Swelling and edema
- ROM
- Special Tests
- Neurological Tests
- TEST: Biodex isokinetic bilateral comparison of PF/DF and I/E @ 30, 60, 120 deg/sec
- TEST: Balance System bilateral comparison
- TEST: Biodex Balance System unilateral stance
- TEST: Biodex Gait Trainer evaluation

**clinical treatment options:**
- Control pain and edema
  - PR.I.C.E.
  - Strengthening
    - Biodex isokinetic (con/con) PF/DF and I/E ≥ 30, 60, 120 deg/sec
    - Biodex isokinetic (ecc/con) PF/DF and I/E ≥ 60 deg/sec
    - Isotonic all planes
    - Manual resistance PRE's
  - Non-WB proprioception: Biodex MJS
  - WB proprioception:
    - Biodex Balance System unilateral stance
    - Biodex Gait Trainer
    - Plyometrics
    - Cardiovascular Activities

### phase V & VI: Advanced Strengthening/Return to Activity

**goals:**
- No complaints of swelling or pain
- Isokinetic strength: PF/DF ≤ 10-15% deficit
- OKC proprioception: I/E < 10% deficit
- Balance System: < 15% deficit normative values*< 20% deficit bilateral comparison

*NOTE: deficit from established norm values for age

**clinical evaluations:**
- Verify home program compliance
- Swelling and edema
- ROM
- Special tests
- Neurological tests
- TEST: Biodex bilateral isokinetic comparison of PF/DF and I/E @ 30, 60, 120 deg/sec
- TEST: Biodex bilateral proprioception comparison of PF/DF and I/E
- TEST: Biodex Balance System unilateral stance
- TEST: Biodex Balance System bilateral stance

**clinical treatment options:**
- Control pain and edema
  - PR.I.C.E.
  - Strengthening
  - Cardiovascular activities: Versa Climber, Biodex UBC/VBC (isokinetic and constant power)
  - Functional Activity Drills: jogging, running, hopping

### supervised program:

- Control pain and edema
- Flexibility of hip, knee, lower leg and ankle
  - Mini squats and weight shifting
- Strengthening of hip, knee, lower leg and ankle
- Closed chain WB exercises
- Cardiovascular training

### home program:

- Control pain and edema
- PR.I.C.E.
- Flexibility of hip, knee, lower leg and ankle
- Strengthening of hip, knee, lower leg and ankle
- Cardiovascular training

### reports:

- Functional activity
- Biomechanical: bilateral comparison of all planes
- Biodex proprioception bilateral comparison of all planes
- Biodex Balance System bilateral balance comparison

- Functional activity level
- Cardiovascular conditioning level
- Biomechanical: bilateral comparison of all planes
- Biodex Balance System bilateral comparison

- Functional activity level
- Cardiovascular conditioning level
EVIDENCE BASED CLINICAL PROTOCOL FOR THE MANAGEMENT OF: lateral ankle sprains

post Injury:

phase I: Reduction of Acute Symptoms

goals:
- Mentally prepare patient for rehabilitation
- Education of patient to understand the problems of ankle sprains
- Identify specific needs of the patient and potential problems
- Decrease pain and edema
- Prevent secondary hypoxic injury
- Protection of damaged structures
- Prevention of long term functional instability
- Regain AROM/PROM
- Increase weight-bearing status
- Normalize gait pattern

- Decrease pain and edema
- Ensure full AROM / PROM
- Full weight bearing
- Isometric strength: PF/DF < 30% deficit
- OKC Proprioception: P < 20% deficit
- Biodes Balance System bilateral stance: < 30% deficit

*NOTE: deficit from established norm values for age

clinical evaluations:
- Swelling and edema (figure 8 measurement)
- Special tests (Anterior drawer, talor tilt, etc.)
- Neurological tests: myotomes, dermatomes and reflexes
- Biodes Gait Trainer analysis (as tolerated)*
- Functional status
- Biomechanical test: Tibial / femoral torsion test

*NOTE: Use Biodes Unweighing System as needed

clinical treatment options:
- PR.I.C.E.
- Crutches as needed
- Massage to reduce swelling / edema
- NMES for muscle reeducation
- TENS for pain
- Gait training: WB and/or partial WB*
- Flexibility training of ankle and lower leg
- WB Proprioception: Weight shifting
- Cardiovascular training: Biodes UBC or Seated Versa Climber

*NOTE: Use Biodes Unweighing System as needed

supervised program:
- Control pain and edema
- Flexibility of ankle and lower leg
- Strengthening of hip and knee
- Cardiovascular training

home program:
- Control pain and edema
- PR.I.C.E.
- ROM: ankle pumps
- Flexibility: towel stretches, heel chord stretches
- Weight shifting

- Control pain and edema
- Crutch use (if necessary)
- AROM and PROM
- AROM exercises:
  - Biodes Passive mode PF/DF @ 30 and 60 degree/sec
- Flexibility: Towel stretch, heel chord, Biodes Gait Trainer
- Strengthening:
  - Biodes Isometric PF/DF and UE - PRE's and intrinsic muscles
  - Non-WB Proprioception: Biodes MUS
- WB Proprioception:
  - Biodes Balance System bilateral stance
  - Mini squats and weight shifting
- Cardiovascular training:
  - UBC, Versa Climber (seated)

reports:
- Functional activity level
- Biodes isometric bilateral comparison PF/DF and UE
- Test: Biodes Balance System bilateral stance

- Functional activity level
- Biodes isometric bilateral comparison in all planes
- Biodes OKC Proprioception bilateral comparison in all planes
- Biodes Balance System bilateral stance