



Evidence-based

Clinical Protocols

5) Lateral Ankle Sprains

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**EVIDENCE-BASED CLINICAL
 PROTOCOL FOR
 REHABILITATION OF
 LATERAL ANKLE SPRAINS**

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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 advise 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.

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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. ⁴ 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 anteriolateral gutter fills with fluid thus the adjoining capsule is distended, and thus the ankle is placed at a greater risk for re-injury¹⁹. 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 process²². 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

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
- Control edema and prevent secondary hypoxic injury ^{2,18}
- Protection of damaged structures ¹⁴
- Prevention of long term functional instability ¹⁴
- Decrease pain as needed
- Regain AROM/PROM ⁵
- 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: ¹⁷
 - 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 analgic 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 tibial torsion, ensure that the medial and lateral femoral condyles are in the frontal plane. Palpate the bisection of the medial and lateral malleoli. Identify the axis (malleolar axis) connecting and extending from the points of bisection 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 degraded 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) ⁴
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 uninjured
 - Inversion/Eversion (I/E) = bilaterally
- Open Kinetic Chain (OKC) Proprioception ¹¹
 - Plantarflexion (PF) < 20% deficit
- Biodex Balance System bilateral stance ²⁰
 - 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 analgic 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 10°

Mode: Isokinetic and passive

Movement patterns: 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.

NOTE: It has been demonstrated that diminished awareness of passive motion sense into plantarflexion associated with multiple sprains. ⁷

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 10°

Mode: Isometric

Sets and Reps: 5 x 5 seconds for each direction

Recommendations: Perform the test in subtalar neutral (STN) or at 0° of plantarflexion and 0° 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 10-15°

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 10° of flexion; elevated above the heart

Mode: Passive

ROM Setup: Begin from neutral (0°) 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 10° 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

PHASE III

initial weight-bearing & intermediate strengthening

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 10°

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 10-15°

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 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.

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:
P.R.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 as 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 as tolerated. There should be NO incidence of pain or inhibition with this exercise.

Ankle isotonic (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 x 10
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 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)

- **Balance training:**
 - Device: Biodex Balance System
 - Positioning: Bilateral (two foot) stance, knees flexed 10-15°
 - 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:
P.R.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 30° 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

PHASE IV

progressive weight-bearing & strengthening

GOALS:

- No complaints of swelling or pain
- Ensure full AROM/PROM
- Isokinetic Strength:
 - PF/DF < 10-15% deficit from uninjured
 - 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 ²⁷
 - 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 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:
P.R.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 isotonic (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:*** ¹⁴

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 a 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. ⁵

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: 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

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 isotonic (use of cuff, weights or ankle specific device)
 - 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 isotonic (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**

PHASE V / VI

advanced strengthening / return to activity

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 uninjured
 - 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 ²⁷
 - 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 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

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 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:
P.R.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 isotonic
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:*** ¹⁴
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. ⁵

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: 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 isotonic (use of cuff, weights or ankle specific device)
 - 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 isotonic (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 minutes of exercise 3x/week.
 - Sports specific muscle and cardiovascular specific exercises.

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**

NORMATIVE VALUES:

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

Females are more stable than males:

<u>All ages</u>	<u>Stability Index</u>	<u>Standard Deviation</u>
Females	1.94	.80
Males	2.70	.08

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

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EVIDENCE BASED CLINICAL PROTOCOL FOR THE MANAGEMENT OF:

lateral ankle sprains

phase III:

Initial Weight-bearing and Intermediate Strengthening

phase IV:

Progressed Weight-bearing & Strengthening

phase V & VI:

Advanced Strengthening/Return to Activity

goals:

- Decrease edema (no residual swelling)
- Decrease pain
- Full AROM / PROM
- Isokinetic strength:
 - PF/DF < 30% deficit
 - I/E < 45% deficit
- OKC proprioception:
 - P < 10% deficit
 - I < 20% deficit
- Biodex Balance System bilateral stance: < 20% deficit*

*NOTE: deficit from established norm values for age

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

*NOTE: deficit from established norm values for age

- No complaints of swelling or pain
- Isokinetic strength:
 - PF/DF < 10-15% deficit
 - I/E < 15% deficit
- OKC proprioception:
 - PF/DF and I/E < 10% deficit
- Biodex Balance System unilateral stance: < 15% deficit
- Functional tests: < 15% deficit bilaterally

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 comparison
- TEST: Biodex Gait Trainer evaluation

- 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

- Verify home program compliance
- Swelling and edema
- ROM
- Special tests
- TEST: Biodex bilateral isokinetic PF/DF and I/E @ 30, 60, 120 deg/sec
- TEST: Biodex bilateral OKC proprioception
- TEST: Biodex Balance System

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 PREs
- Flexibility training
- Cardiovascular training: Biodex UBC, Versa Climber (seated)
- Non-WB proprioception: Biodex MJS
- WB proprioception:
 - Biodex Balance System bilateral stance

- Home program compliance
- ROM exercises
- LE exercises
 - Biodex Isokinetics and Eccentrics PF/DF and I/E
 - Biodex Recumbent Squat
 - Biodex Cable Column
 - PF/DF isotonic
- Gait Training
 - Biodex Gait Trainer
- Plyometrics
 - Cardiovascular Activities

- ROM: AROM / PROM in functional planes
- 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, 120 deg/sec
 - Isotonic all planes
 - Manual resistance PREs
- Non-WB proprioception: Biodex MJS
- WB proprioception:
 - Biodex Balance System unilateral stance
- Plyometrics
- Cardiovascular training: Biodex UBC/LBC (isokinetic and constant power)

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

- Flexibility exercises
- Gait Training
- Strengthening exercises
- Cardiovascular activities
- Weight-bearing exercises

- Flexibility of hip, knee, lower leg and ankle
 - Mini squats and weight shifting
- Strengthening of hip, knee, lower leg and ankle
- Cardiovascular activities: Versa Climber, Biodex LBC
- Functional Activity Drills: jogging, running, hopping

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

- Flexibility exercises
- Weight-bearing exercises
- Strengthening exercises
- Cardiovascular exercises

- Closed chain WB exercises
- Flexibility of hip, knee, lower leg and ankle
- Strengthening of hip, knee, lower leg and ankle
- Cardiovascular activities: 20 min 3x per week

reports:

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

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

- Functional activity level
- Functional ROM
- WB and Non-WB Proprioception
- Biodex bilateral isokinetic comparison PF/DF and I/E
- Biodex Balance System unilateral stance

EVIDENCE BASED CLINICAL PROTOCOL FOR lateral ankle sprains

THE MANAGEMENT OF:

post Injury:

phase I:

Reduction of Acute Symptoms

phase II:

Range of Motion and Initial Strengthening

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
 - I/E = bilaterally
 - OKC Proprioception:
 - P < 20% deficit
 - Biodex Balance System bilateral stance:
 - < 30% deficit*
- *NOTE: deficit from established norm values for age

clinical evaluations:

- Swelling and edema (figure 8 measurement)
 - PROM and AROM
 - Special tests (Anterior drawer, talar tilt, etc.)
 - Neurological tests: myotomes, dermatomes and reflexes
 - Biodex Gait Trainer analysis (as tolerated)*
 - Functional status
 - Biomechanical test: Tibial / femoral torsion test
- *NOTE: Use Biodex Unweighing System as needed
- Verify home program compliance
 - Amount and quality of edema (figure 8 measurement)
 - AROM and PROM
 - Special tests (Anterior drawer, talar tilt, etc.)
 - Neurological tests: Myotomes, dermatomes and reflexes
 - Functional tests: Biodex Gait Trainer, ADLs
 - TEST: Biodex isometric bilateral comparison PF/DF and I/E
 - TEST: Biodex Balance System bilateral stance

clinical treatment options:

- P.R.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: Biodex UBC or Seated Versa Climber
- *NOTE: Use Biodex Unweighing System as needed
- P.R.I.C.E.
 - Crutch use (if necessary)
 - AROM and PROM
 - AAROM exercises:
 - Biodex Passive mode PF/DF @ 30 and 60 deg/sec
 - Flexibility: Towel stretch, heel chord, Biodex Gait Trainer
 - Strengthening:
 - Biodex Isometric PF/DF and I/E
 - PRE's and intrinsic muscles
 - Non-WB proprioception: Biodex MJS
 - WB proprioception:
 - Biodex Balance System bilateral stance
 - Mini squats and weight shifting
 - Cardiovascular training:
 - UBC, Versa Climber (seated)

supervised program:

- Control pain and edema
 - Flexibility of ankle and lower leg
 - Strengthening of hip and knee
 - Cardiovascular training
- Control pain and edema
 - Crutch use (if necessary)
 - ROM
 - Flexibility
 - Strengthening: Isometrics (4 way), intrinsic muscles
 - WB: Mini squats, balance
 - Cardiovascular training: 3x/wk >20 min
 - Aquatherapy

home program:

- Control pain and edema
 - P.R.I.C.E.
 - ROM: ankle pumps
 - Flexibility: towel stretches, heel chord stretches
 - Weight shifting
- P.R.I.C.E.
 - ROM: ankle pumps
 - Flexibility: towel and heel chord stretches
 - Strengthening: isometrics and intrinsic muscles
 - Cardiovascular training: 3x/wk >20 min.

reports:

- Functional activity level
- Functional activity level
 - Biodex isometric bilateral comparison in all planes
 - Biodex OKC proprioception bilateral comparison in all planes
 - Biodex Balance System bilateral stance