Physical Therapy Evaluation, Interventions and Outcomes for a Non-athlete Patient Status Post a Closed Left Malleolar Fracture

A Master’s Level Paper for PTY 668
Presented to the Faculty of The Sage Colleges Division of Health and Rehabilitation Sciences

In Partial Fulfillment
of the Requirements for the Degree of
Master of Science in Physical Therapy

Stephanie M. Waffle
May, 2003

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Faculty advisor / date
Physical Therapy Examination, Interventions and Outcomes for a Non-Athlete Patient
Status Post a Closed Left Malleolar Fracture.
Stephanie M. Waffle
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Background and Purpose: Ankle inversion fractures often result in residual impairments to the lateral structures of the ankle. These impairments may lead to functional and mechanical instability, even after the fracture site is healed. The purpose of this case report is to describe the physical therapy examination, interventions and outcomes of a non-athlete patient status post a closed left lateral malleolar fracture.

Case Description: The patient was a 54 year-old female who had suffered an inversion fracture to her left malleolus eleven weeks prior to initial evaluation. The patient had participated in physical therapy sessions at another facility without favorable results. The patient presented to this facility with decreased range of motion, strength and reflexes and increased girth measurements of the left ankle. The patient reported pain at three out of ten at her left ankle. She presented with an antalgic gait and a rigid left foot from stance phase to toe-off. The patient attended therapy three times per week for four and a half weeks for stretching, strengthening, gait training and coordination activities. Outcomes: The patient’s left lower extremity was equal to the right for measures of strength, range of motion, reflexes and girth at discharge. The patient reported that she was pain-free and presented with a normal gait pattern. The patient had met all short term and long term goals and was able to perform all activities of daily living without residual impairments. Discussion: Studies have been performed regarding rehabilitation of the athlete following an inversion injury. However, research has not been conducted for the non-athlete patient following an inversion malleolar fracture. This case supports the use of activities geared toward rehabilitation of the athlete performed a decreased intensity and frequency for the non-athlete to allow for optimal functioning in activities of daily living.
Introduction

Ankle fractures are common injuries that may or may not require surgical intervention (Colligne, 2000, Wester, Jespersen, Nielsen & Neurmann, 1996). In a study by Michelsen et al, it was determined that lateral malleolar fractures without a medial injury present normal kinematic motion. Therefore, they conclude that there is little reason to perform an operation geared toward the correction of mechanical behavior for a displaced, isolated, or closed lateral malleolar fracture (Michelsen, Ahn & Helgemo, 1996). In rare cases of abnormal mechanics, clinical studies show equivalent results between open anatomic and closed non-anatomic treatment (Michelsen, Ahn & Helgemo, 1996).

Ankle inversion injuries are among the most common orthopedic injury (Konradson, Olesen & Hansen, 1998), occurring once in every ten thousand people (Lynch & Renstrom, 1999). Ankle fractures lead to additional injuries to various areas of the ankle joint complex (Colligne, 2000). Inversion injuries cause damage to the lateral structures of the ankle, most commonly the anterior talofibular ligament as well as the talar and subtalar joints (Konradson, Olesen & Hansen, 1998, Bernier & Perrin, 1998). It is these lateral structures that are responsible for the mechanical behavior of the ankle (Michelsen, Ahn & Helgemo, 1996).

With ankle inversion injuries, it is believed that injury may occur to the mechanoreceptors of the lateral structures (Mattacola & Dwyer, 2002). This damage leads to decreased proprioceptive input that can cause a sensory deficit (Goldie, Evans & Bach, 1994). The numerous mechanoreceptors that are present in the joint capsule detect pressure and tension caused by static and dynamic positions of the ankle (Bernier &
Perrin, 1998). Konradsen reports that damage to the mechanoreceptors leads to decreased sensorimotor control of the ankle that can be related to recurrent inversion injuries. The disruption in the sensorimotor control may lead to poor postural control that adversely affects the body’s ability to maneuver at high speed or on uneven surfaces over a narrow base of support (Goldie, Evans & Bach, 1994). The ability to detect motion at the ankle to allow for postural adjustments and responses to detected motions, especially at heel strike, is necessary to prevent recurrent ankle injury (Bernier & Perrin, 1998).

Inversion injuries often result in mechanical and functional instability of the involved ankle. Mechanical instability is defined as laxity of the joint due to structural damage (Hertel, 2000). Functional or chronic instability is thought to be caused by several factors. These factors include neural damage such as decreased proprioception, decreased reflexes and decreased reaction time. Decreased muscular strength, power and endurance can contribute to functional instability as well as mechanical factors, such as ligament laxity. Limitations in range of motion, decreased strength of ankle eversion and decreased joint proprioception all contribute to functional instability (Bernier & Perrin, 1998). Functional instability can lead to recurrent injury and the feeling that the ankle is “giving out” (Konradsen, Olesen & Hansen, 1998).

After injury, new collagen is laid down and the lateral ligaments generally heal well. However, there is little research regarding the healing time of the mechanoreceptors and afferent nerve fibers that were damaged with the inversion injury. Therefore, a healed ankle may appear mechanically stable while it is, in fact, functionally instable (Hertel, 2000).
Rehabilitation for lateral ankle injuries should be geared toward restoring function to prevent further injury to the involved ankle. The goal of treatment should be to eliminate functional instability (Balduini, Vegso, Torg & Torg, 1987). To achieve this goal, deficits in mobility and strength need to be addressed before higher level occupational and recreational skills are practiced (Goldie, Evans & Bach, 1994). Range of motion, muscular strength, power, and endurance need to be restored to pre-injury level to allow for asymptomatic functional activity (Mattacola & Dwyer, 2002). Strength and neuromuscular control should be addressed to allow for better control and protection of the foot and ankle during stance and on impact (Mattacola & Dwyer, 2002). Restored strength is necessary for normal movement patterns. Strengthening and flexibility exercises should be precisely executed to allow for development of these normal movement patterns (Mattacola & Dwyer, 2002).

In a study performed by Harrington, twenty-six out of thirty patients presented with degenerative arthritis of the ankle secondary to chronic instability. Harrington hypothesized that restoration of lateral ankle stability following injury would decrease the progression of degenerative changes (Balduini et al., 1987). Therefore, ankle rehabilitation is important after an inversion injury for restoration of the ankle mechanics, to improve strength and to prevent secondary complications and recurrent injury (Lynch, & Renstrom, 1999, Michelson, Ahn and Helgemo, 1996).

The patient's rehabilitation should follow a functional continuum, reaching each new level as the previous one is completed. Regular evaluations should be performed with all functional progressions (Kegerreis, 1983). Activities that increased symptoms should be modified to be less aggressive. The patient should be made aware that they
may experience occasional set-backs that cause them to regress to a less strenuous level (Kegerreis, 1983). If the rehabilitation process is not completed or the process is missing a major component, the patient is placed at a greater risk for re-injury (Mattacola & Dwyer, 2002).

Balduini et al. (1987) report that management of ankle injuries is controversial, as there is not an established procedure for treatment. There is abundant literature written about ankle sprains, especially those suffered by the athlete. There is very little research, however, geared toward the non-athlete following an ankle fracture. The purpose of this case report is to describe the physical therapy examination, interventions and outcomes of a non-athlete patient status post a closed left lateral malleolus fracture.

Case Description

Patient

The patient was a fifty seven year old female transportation provider for a local school district. The patient reported that she was standing on an upward sloping hill when her dog bumped into her from her right side. She slipped, causing her left foot to move sharply into inversion. The patient reported that she heard her left ankle break and experienced immediate pain. She was immediately transferred to the emergency room where x-rays confirmed a closed left fibular/lateral malleolar fracture. The patient was splinted from the left foot to above the knee and was prescribed with Lortab 7.5/500 mg every six hours and Motrin 800 mg twice per day. The patient visited her primary doctor four days later and was again x-rayed and re-casted from her left foot to above the left knee. She noticed increased pain and edema of the left lower extremity that forced her to return to the emergency room two days later. The doctor spilt the cast and secured it with
an ACE wrap. Over the next three days the patient’s edema decreased making the cast too large for her left lower extremity, causing the cast to slide down, allowing the leg to move within the cast. She returned to the doctor three days later to be re-casted. The patient noted that this cast application seemed different than the others with her left foot being placed into a position with the foot pointed downward.

The patient stated that she was casted for five weeks. Once the cast was removed, the doctor prescribed that the patient wear an over the counter compression garment on her left lower extremity at all times except for while sleeping. The patient received a prescription for evaluation and treatment for a left status post ankle fracture. She began therapy at a local out patient office three times a week. The patient attended therapy for six weeks without significant improvement. She stated that the therapy sessions consisted of soaking her left lower extremity in a bucket of warm water for twenty minuets, left lower leg massage, left gastrocnemius stretching, and biking for a maximum of ten minutes. The patient was performing a home exercise program that consisted of towel stretching for left ankle dorsiflexion, AROM for all left ankle motions and ball exercises for ten repetitions each. She returned to the doctor after six weeks of therapy requesting a new therapy prescription that would allow her to try an alternative treatment program hoping for more favorable results. The patient presented to our facility with a prescription to evaluate and treat three times a week for four weeks.

Initial Evaluation

Subjective Measures

The patient presented with an antalgic gait pattern, a rigid left foot from stance phase to toe-off, decreased left ankle dorsiflexion and left hip hike to clear the left foot
through swing phase. She reported constant pain rated at three out of ten on a ten-centimeter visual analogue scale and pain at a seven to eight out of ten with certain movements, on uneven terrain and after being on her feet for more than one hour. The patient was still working, as she was able to drive the school bus using her right lower extremity only. The patient reported difficulty ascending and descending stairs, waking up two to three times per night due to pain and difficulty performing activities of daily living in a timely manner due to her limp. She stated that the most recent x-rays taken by the doctor one week prior to evaluation showed good healing of the left lateral malleolus.

Objective Measures

L3-L4, S1-S2 reflexes were tested using a reflex hammer with the patient in sitting and were found to be 2+ for the right lower extremity and 1+ for the left lower extremity (Hertel, 2000). The patient demonstrated intact sensation to light touch throughout both lower extremities (Hertel, 2000). Myotome testing using the five-second brake test yielded normal results for both lower extremities. The patient was able to maintain single leg stance on her left lower extremity for ten seconds with eyes open (Hertel, 2000). Girth measurements were taken with a standard tape measure at the malleoli and two inches above and below. Measurements for the right lower extremity were 9.25 inches above the malleoli, 8.25 inches at the malleoli and 9.5 inches two inches below the malleoli. Measurements of the left lower extremity were 10.5 two inches above the malleoli, 9.25 inches at the malleoli and 9.5 inches two inches below the malleoli (table 1.1).

Active range of motion (AROM) measurements of both hips and knees were found to be within normal limits using a standard goniometer (Hertel, 2000). Using the
standard goniometer, it was determined that the patient’s left ankle AROM was decreased as compared to the right (table 1.2). Passive range of motion measurements taken with a standard goniometer (Hertel, 2000) showed right ankle dorsiflexion of 0 to 10° and left ankle dorsiflexion of 0 to 5°.

Using the brake test for manual muscle testing (Hislop & Montgomery, 1995, Hertel, 2000), it was determined that hip and knee strength was 5/5 bilaterally for all motions. Toe flexion and extension strength was determined to be 5/5 for all toes bilaterally. Left ankle motions were determined to be decreased as compared to the right (table 1.3).

**Assessment**

The patient presented with decreased AROM secondary to an inversion fracture of her left lateral malleolus. The patient presented with sharp pain on resisted left ankle inversion due to the position of her left foot when it was fractured. Being casted into left ankle plantarflexion for five weeks lead to decreased left ankle dorsiflexion. This caused the patient present with a left hip hike to clear her toes during swing phase of gait. She was experiencing little difficulty with activities of daily living, however she was frustrated with her slowed pace due to limping. The patient continued to be active in her daily life during the episode of care, which often caused persistent edema and pain. She was eager to walk without a limp and decrease the pain she was experiencing in her left ankle. She was motivated to achieve her goals. The patient was given a good to excellent prognosis for recovery without prolonged impairments.
al., 1987, Goldie, Evans & Bach, 1994, Hertel, 2000, Hoffman & Payne, 1995, Mattacola & Dwyer, 2002). The patient performed fifteen repetitions in all direction of the left ankle, dorsiflexion, plantarflexion, inversion and eversion and circles clockwise and counter clockwise, with partial weight bearing in the left lower extremity without wearing her shoe (Mattacola & Dwyer, 2002). Contract-relax stretching to increase left ankle dorsiflexion was also introduced on the second session (Knight et al., 2001, Wester et al., 1996, Young & Elliott, 2001). She was asked to push into resisted plantarflexion for ten seconds and then relax as the left ankle was passively moved into dorsiflexion. This was performed for a total of fifteen repetitions with three rest periods per patient request. Contract-relax stretching and the BAPS board were performed consistently throughout the course of treatment.

At the end of the third session, the patient demonstrated increased edema of the left ankle. A cold pack and bipolar interferential (BPIF) stimulation were applied to the left ankle for fifteen minutes with the patient supine to decrease pain and edema (Balduini et al., 1987, Mattacola & Dwyer, 2002). The BPIF electrodes were applied to the lateral left ankle, just superior and inferior to the lateral malleolus. The use of the BPIF was discontinued after the third session per patient request. She was unable to tolerate the sensation of the stimulation regardless of the intensity setting. She noted relief with the cold pack that became a consistent ending to each treatment to decrease pain and edema (Balduini et al., 1987, Wilkerson & Horn-Kinger, 1993).

Passive ROM (PROM) for left toe flexion and all motions of the left ankle was introduced on the fourth session and became a consistent addition to treatment to increase
ROM. Each motion was repeated for ten repetitions with the patient supine. Repetitions of left ankle motions on the BAPS board were increased to twenty in each direction.

On the fifth visit, the patient was instructed in the use of blue theraband as resistance to motions of the left ankle to increase strength (Hertel, 2000). While in long-sitting on the floor, she performed left ankle dorsiflexion, plantarflexion, inversion and eversion with the theraband for ten repetitions each (Docherty, Moore and Arnold, 1998, Mattacola & Dwyer, 2002, Shaffer et. al., 2000). Single leg stance on the left lower extremity was introduced on the sixth visit to increase proprioception and balance of the left ankle joint (Bernier & Perrin, 1998, Chong, Ambrose, Carzoll, Hardison and Jacobson, 2001, Goldie, Evans & Bach, 1994, Hertel, 2000, Kegerreis, 1983, Lynch & Renstrom, 1999). She was instructed to stand on the left lower extremity with a goal of maintaining balance for thirty seconds to assess postural control (Goldie et. al., 1994, Hertel, 2000). Over ten trials, the patient was able to maintain balance for a maximum of ten seconds. She was also instructed to push up onto her toes with minimal assistance of her upper extremities on the plinth for balance for ten repetitions to increase strength of the posterior muscle group (Balduini et. al., 1987). The patient was instructed to add this to her home exercise program to increase her strength into plantarflexion.

Treatment remained consistent until the ninth visit when the patient was increased to full weight bearing (FWB) in the left lower extremity on the BAPS board. The patient maintained balance with moderate assistance from the upper extremities on the plinth in front of her. She continued to present with a slight limp caused by decreased stance time on the left lower extremity. The patient was instructed in heel-to-toe walking on a level surface for twenty feet for five repetitions (Balduini et. al., 1987). She was also instructed
in side stepping to the left and right to increase inversion and eversion for twenty feet for three repetitions in each direction (Balduini et al., 1987). Single-leg stance on the left lower extremity was performed on the mini trampoline for a goal of twenty seconds (Goldie, Evans and Bach, 1994, Mattacola & Dwyer, 2002). Over ten trials, the patient was able to sustain balance for a maximum of ten seconds.

Over the course of the next two weeks treatment was focused on higher-level skill activities and gait training (Hoffman & Payne, 1995). Treatment remained consistent with fifteen minutes in the whirlpool, retrograde massage, contract-relax stretching into left ankle dorsiflexion, PROM for the left toes and ankle and FWB on the left lower extremity on the BAPS board for twenty repetitions in all directions. Jumping on the mini trampoline was introduced for the left lower extremity. With minimal assistance of the upper extremities for balance, she jumped forward, backward and to each side for five repetitions. The patient continued to perform heel-to-toe walking for twenty feet for five repetitions and side stepping for twenty feet for three repetitions to the right and left. She was instructed to add a hop with side stepping to increase single leg weight bearing. This was also performed for twenty feet for two repetitions in each direction.

The patient began walking on the treadmill in the eleventh visit at 1.5 miles per hour for five minutes to allow the patient to focus on a more normal gait pattern (Green, Refshauge, Crosbie and Adams, 2001, Kegerreis, 1983, Shaffer et., al., 2000). The patient noted continued difficulty with ascending and descending stairs. On the twelfth visit, she ascended and descended five steps for four repetitions with minimal support of the upper extremities on the railing (Kegerreis, 1983). Treatment remained consistent over the next two visits until discharge on the fourteenth visit.
Outcomes

Subjective

At discharge, the patient reported decreased pain and increased motion of the left ankle. She reported that the left ankle felt stronger than at initial evaluation. Her concerns included decreased ability to descend stairs and increased pain after being on her feet all day. She stated that she was independent and confident in her home exercise program and was eager to be discharged. She was instructed to notify her doctor with any increase in symptoms.

Objective

The patient reported pain rated at zero out of ten at rest and with most activities of daily living on a ten-centimeter visual analogue scale. She rated the pain in her left ankle at three to four out of ten on the visual analogue scale with quick turning movements and while ambulating on very uneven terrain. L3-L4, S1-S2 reflexes were tested with a reflex hammer with the patient sitting and yielded normal results of 2+ bilaterally (Hertel, 2000). She was able to maintain single leg stance for greater than thirty seconds on her left lower extremity with eyes open (Hertel, 2000). Girth measurements taken with a standard measuring tape with the patient supine demonstrated significantly reduced edema of the left lower extremity with some residual swelling of the left malleolus (table 2.1). Girth measurements of the left lower extremity were equal to the right two inches above and below the malleoli at discharge.

AROM measurements were again taken with a standard goniometer with the patient supine. The patient demonstrated improved left ankle ROM for all motions as
compared to initial evaluation. Left ankle dorsiflexion increased to ten degrees and plantarflexion increased to fifty degrees. Both inversion and eversion increased to thirty degrees (table 2.2). AROM of left ankle inversion was equal to the right at discharge. AROM of left ankle dorsiflexion, plantarflexion and eversion were greater than the right at discharge.

Manual muscle testing using the brake test against gravity yielded increased strength grades of all motions of the left ankle compared to initial evaluation. The strength of left ankle dorsiflexion increased to 5/5, plantarflexion increased to 5/5, inversion increased to 4+/5, and eversion increased to 5/5 (table 2.3). Left ankle strength was equal to the right at discharge for all motion except ankle inversion.

The patient was able to perform single leg stance on the left lower extremity for thirty seconds on the level surface. She presented with an improved gait pattern with increased inversion and eversion from left heel strike to left toe off, increased left ankle dorsiflexion and decreased left hip hike.

The patient demonstrated significant improvements in strength and AROM with significantly decreased pain. Edema of the left ankle was significantly reduced with some residual swelling at the left malleoli that would worsen with high levels of activity and with prolonged standing. She demonstrated an improved gait pattern with less deviations resulting in decreased limping. She was better able to ascend and descend stairs with some difficulty weight bearing while stepping down onto the left lower extremity. At discharge, the patient had met all short-term and long-term goals established at the time of the initial evaluation.
Discussion

Optimal treatment for ankle malleoli fractures has yet to be determined (Shaffer et al., 2000). Ankle fractures lead to multiple injuries to the various joint structures (Colligne, 2001). Ankle inversion injuries lead to damage of the lateral structures of the ankle that largely determine the mechanical behavior of the ankle (Balduini et al., 1987, Kondradsen, Olesen and Hansen, 1998, Michelsen, Ahn and Helgemo, 1996). The functional and mechanical instability that often occur following an inversion injury are considered to be major contributing factors in chronic ankle instability (Hertel, 2000, Kondradsen, Olesen and Hansen, 1998). Ankle instability is caused by ligament laxity, muscle weakness and decreased joint proprioception (Docherty, Moore and Arnold, 1998).

Treatment of lateral malleolar fractures involves an extended period of immobilization. The most predictable consequence of this immobilization period is lean muscle atrophy and decreased muscle force. Patients experience increased muscular fatigue and decreased functional abilities, such as climbing stairs and walking (Shaffer, et al., 2000). In a study conducted by Shaffer et al. (2000) injured subjects experienced force deficits as great as 50% after four to six weeks of immobilization. The study concluded that with rehabilitation there was complete recovery in peak torque, stair climbing and muscle fatigue resistance within ten weeks.

Simple ankle sprains are often associated with more severe injuries (Title & Katchis, 2002). This leads to the assumption that the residual impairments the patient in this case report experienced following fracture healing were similar to those caused by an ankle sprain. Lateral ligament injuries result from supination and inversion of the foot
with external rotation of the tibia on the planted foot, as seen with this patient. The sequence of ligament tears is predictable, progressing with increasing severity of the injury. The first to tear is the anterior talofibular ligament, followed but the calcaneofibular ligament and lastly, the posterior talofibular ligament (PFL). Tearing of the PFL is associated with malleolar fractures (Safran, Benedetti, Bartolozzi and Mandelbaum, 1999.) Therefore, it can be assumed that the patient suffered ligamentous damage congruent to that of a Grade III sprain, the most severe sprain (Balduini et al., 1987, Lynch and Renstrom, 1999, Safran, et al., 1999, Title & Katchis, 2002).

Ankle inversion injuries lead to pain, swelling and limited motion (Green et al., 2001). Rehabilitation needs to focus on training, maintaining and re-educating the foot and ankle (Balduini et al., 1987). Rehabilitaiton activities should incorporate ROM, strength, balance, normal gait patterns, endurance, power, proprioception and neuromuscular control (Hertel, 2000, Mattacola & Dwyer, 2002). Kegeles, 1983, reported that the rehabilitation process should be tailored to the individual’s needs and should approach each new level as subsequent levels are achieved. Activities that increase pain or instability should be stopped immediately or performed at a lower level.

The effectiveness of the rehabilitation program will determine the patient’s overall success (Mattacola & Dwyer, 2002). A rehabilitation program for an athlete following an inversion injury should involve sport-specific activities that stress tendons, ligaments, bones, and muscles without overstimulating to allow return to a high level of competition (Mattacola & Dwyer, 2002). For the non-athlete, rehabilitation should provide function specific activities to stress the structures of the ankle to achieve a pre-injury level of function in their activities of daily living.
Thermotherapy is used to decrease chronic swelling and to increase local metabolism to aid in tissue healing. Heat helps to decrease pain and prepare the area for exercise (Balduini, et al., 1987, Shaffer et al., 2000). Knight et al. (2001) report that elevating the tissue temperature prior to stretching increases the amount of elongation that will be retained from a stretch. Cryotherapy is recommended following exercise to decrease acute swelling and to decrease pain (Balduini et al., 1987, Kegerreis, 1983, Willkerson & Horn-Kingery, 1993).

Having the patient perform strengthening exercises aids in recovery and prevents reinjury (Kegerreis, 1983, Knight, et al., 2001). Research conducted by Docherty, Moore and Arnold (1998) concluded that using theraband for ankle strengthening lead to an increase in dorsiflexion, plantarflexion and inversion in subjects with functionally unstable ankles. The authors state that strength training has dual effects of increasing joint strength and position sense (Docherty, Moore and Arnold, 1998). Mattacola and Dwyer (2002) also report the use of theraband for strengthening of the ankle following injury. Decreased strength for ankle inversion is often seen, as was the case with this patient, due to reflexive inhibition of the muscles that caused the initial injury (Hertel, 2000).

ROM is often decreased following an ankle injury and is often a cause of functional instability. Often the ankle is held into plantarflexion due to tightness of the triceps surae leading to deficits in ankle dorsiflexion (Hertel, 2000). Stretching changes the physiological properties of connective tissue and increases ROM (Michelson, Ahn and Helgemo, 1996). Research conducted by Young and Elliott, 2001, determined that proprioceptive neuromuscular facilitation (PNF) or contract-relax stretching was the
preferred mode of stretching over static stretching. Knight et al. (2001) concluded that the group in their study that received ultrasound for seven minutes prior to stretching demonstrated the greatest increases in dorsiflexion over a six week period.


Many researchers suggest the use of a balance board to improve balance control. (Mattacola & Dwyer, 2002). Hoffmann and Payne (1995) found that patient’s use of the BAPS board decreased functional instability within ten weeks as measured by postural sway. Chong et al. (2001) also found improvements in balance and proprioception with the use of the BAPS system. However, they conclude that the BAPS program was not specifically targeted to the muscle of the ankle but rather the entire lower extremity. Goldie, Evans and Bach (1994) concluded that postural control was worse in subjects that did not perform specific balance exercises following a unilateral inversion injury as measured by their ability to perform one-legged stance.

The gait cycle is complicated by ankle inversion injuries and leads to deficits in dorsiflexion and joint positions sense. Humans require ten degrees of dorsiflexion for walking, kneeling and stair climbing. There is only five millimeters between the foot and the ground in late stance phase. If the patient is not able to detect the amount of inversion
at the foot in this phase there is a chance that the lateral foot will contact the ground leading to further complications or re-injury. Therefore, rehabilitation for a patient with decreased ROM for dorsiflexion should focus on specific gait training activities to increase dorsiflexion (Wester et al., 1996).

These methods of rehabilitation have been sited in the literature as effective methods for returning athletes to sport following an ankle inversion injury. Research has not been conducted on the best methods of returning non-athletes to function following an inversion injury. Therefore, it has to be assumed that following standard athletic protocol for the non-athlete will aid them in recovery of function. It can also be assumed that the non-athlete does not need to perform rehabilitation activities at an increased intensity and frequency as does the athlete. Athletes need to train to return to running, jumping and cutting activities. A non-athlete’s highest level of desired function may be stair climbing. As with all rehabilitation programs, activities need to be specifically tailored to the individual’s needs.

The patient presented in this case study had received physical therapy at a different site for six weeks prior to coming to this facility. Per patient’s report, the therapy she received at our facility was more aggressive and intense than at the first facility. She believed that she gained results more quickly with the more aggressive treatment. It has to be taken into account that the patient was eleven weeks post injury when she came to our facility, therefore natural healing could have played a part in her gains at therapy. The patient was becoming frustrated with her residual impairments and was very eager to see improvements. Therefore her high level of motivation may have also played a part in her gains at therapy.
This case study provides support for the use of an athlete-based ankle rehabilitation template for the non-athlete following an inversion ankle injury, performed at a lesser intensity and frequency with skill activities geared toward functional activities of daily living rather than sport specific activities. However, the application of this type of treatment for a non-athlete following an inversion injury should be made with caution. Further research is necessary to determine the optimal treatment for the non-athlete following an inversion injury.
Table 1.1

Girth Measurements of Right and Left Lower Extremities at Initial Evaluation

<table>
<thead>
<tr>
<th>Measurement Site</th>
<th>Right Lower Extremity</th>
<th>Left Lower Extremity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inches above malleoli</td>
<td>9.25 inches</td>
<td>10.5 inches</td>
</tr>
<tr>
<td>Malleol</td>
<td>8.25 inches</td>
<td>9.25 inches</td>
</tr>
<tr>
<td>2 inches below malleoli</td>
<td>9.5 inches</td>
<td>9.5 inches</td>
</tr>
</tbody>
</table>

All measurements taken with a standard measuring tape with the patient supine.
Table 1.2

AROM Measurements for Right and Left Ankle Motions at Initial Evaluation

<table>
<thead>
<tr>
<th>AROM</th>
<th>Right Lower Extremity</th>
<th>Left Lower Extremity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle dorsiflexion</td>
<td>0-5°</td>
<td>0°</td>
</tr>
<tr>
<td>Ankle plantar flexion</td>
<td>0-45°</td>
<td>0-35°</td>
</tr>
<tr>
<td>Ankle inversion</td>
<td>0-30°</td>
<td>0-7°</td>
</tr>
<tr>
<td>Ankle eversion</td>
<td>0-20°</td>
<td>0-5°</td>
</tr>
</tbody>
</table>

All measurements taken with standard goniometer with patient in supine.
Table 1.3

<table>
<thead>
<tr>
<th>Motion tested</th>
<th>Right Lower Extremity</th>
<th>Left Lower Extremity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle dorsiflexion</td>
<td>5/5</td>
<td>4+/5</td>
</tr>
<tr>
<td>Ankle plantar flexion</td>
<td>5/5</td>
<td>4+/5</td>
</tr>
<tr>
<td>Ankle inversion</td>
<td>5/5</td>
<td>3+/5*</td>
</tr>
<tr>
<td>Ankle eversion</td>
<td>4+/5</td>
<td>4+/5</td>
</tr>
</tbody>
</table>

*Sharp pain noted at the left lateral ankle with resisted left ankle inversion

All measurements taken with patient performing motion against gravity.
Table 2.1

<table>
<thead>
<tr>
<th>Measurement Site</th>
<th>Left Lower Extremity</th>
<th>Left Lower Extremity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial Evaluation</td>
<td>Discharge</td>
</tr>
<tr>
<td>2 inches above malleoli</td>
<td>10.5 inches</td>
<td>9.25 inches</td>
</tr>
<tr>
<td>Malleoil</td>
<td>9.25 inches</td>
<td>9.5 inches</td>
</tr>
<tr>
<td>2 inches below malleoli</td>
<td>9.5 inches</td>
<td>9.5 inches</td>
</tr>
</tbody>
</table>

All measurements taken with a standard measuring tape with the patient supine.
References


