# MODALITY MANAGEMENT OF AN ACUTE ANKLE SPRAIN IN A PROFESSIONAL BASEBALL PLAYER: CASE REPORT

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## CLASS IV LASER THERAPY CASE REPORT

### OBJECTIVE:

To describe two new treatment modalities that improved the healing time of a 33 year old professional baseball player with an acute grade 1 anteriortalofibular (ATF) ligament sprain.

### BACKGROUND:

Ankle sprains are one of the most common injuries in sporting events. Most of literature supports one week of rehabilitation with a first degree ankle sprain for full recovery. Athletic trainers follow the R.I.C.E. acronym (Rest, Ice, Compression, and Elevation) and use various modalities (such as electrical stimulation) to reduce pain and inflammation.

### DIFFERENTIAL DIAGNOSIS:

Ankle fracture and subluxation was ruled out by a medical exam from the visiting team physician. Radiographic images were not performed secondary to the results of the clinical exam. The ankle was point tender over the ATF ligament, with moderate swelling.

### TREATMENT:

Treatment focused on decreasing pain and inflammation. Four modalities, including two new ones, were used without therapeutic exercise or manual techniques. Immediate intervention was initiated with a class IV therapeutic laser, polymem bandage, open basket weave tape application, and ice. The athlete returned to play in two days.

### UNIQUENESS:

The use of modalities varies greatly between clinicians. This report offers two new ideas to decrease healing time: laser and Polymem bandage. The Avicenna therapeutic class IV laser accelerates the wound healing process and promotes anti-inflammation and pain properties. The Polymem bandage was also used providing a sponge-like application to clear waste products from the injured site.

### CONCLUSION:

The use of these new modalities not only reduced the time to return to play, but also reduced the effects of the pathology signs and symptoms observed in this individual case. Research trials are suggested to validate the use of the Avicenna class IV laser and the Polymem bandage.

### KEY WORDS:

Class IV Therapeutic laser, ankle sprain, Polymem bandage, open basket weave

### INTRODUCTION AND BASIC SCIENCE

Inversion ankle sprains are the most common sprain in athletic events today. Inversion ankle sprains commonly damage the anteriotalofibular (ATF) ligament. Inversion ankle sprains are rated in three different degrees. First degree is a partial stretching of the ATF. A second degree inversion sprain is a complete tear of the ATF and a stretch and/or tear of the calcaneofibular (CF) ligament. Lastly, a third degree inversion sprain involves the ATF, CF, and the posterior talofibular ligament[1]. Presentation consists of positive clinical signs such as point tenderness, local swelling, discoloration, and pain. Often ankle sprains occur with contact or external force in sporting activities, but frequently foot placement and the surface on which the activity is played has shown to affect the incidence of ankle sprains and injuries. Turf surfaces increase friction and cause injuries without external contact.

The diagnosis of ankles sprains is often from history, mechanism of the injury, and special tests. First degree ankle sprains are mild in severity and usually only involve the ATF ligament and have mild localized pain. Mechanism is associated with ankle inversion and plantar flexion. Anterior drawer and talar tilt special tests are negative. First degree sprain rehabilitation phases are as follows: acute phase 1-3 days, subacute 2-4 days, and rehabilitation phase 7 days[2].

The history of managing ankle sprains has typically followed a regimen of ice and rest for 1-2 days[1]. Modalities such as cryotherapy (ice pack, ice bucket-submersion) use vasoconstriction properties to control effusion. Over the years, taping techniques and wraps have provided compression to reduce swelling. Other modalities such as ultrasound and electrical stimulation have been useful as well to decrease pain and inflammation. Massage techniques, such as effleurage, are used to try to push the edema towards the heart for absorption in the body. This case report outlines new treatment modalities and alternative techniques to managing injuries.

## ULTRASOUND, ELECTRICAL STIMULATION, ICE AND COMPRESSION MODALITIES

### ULTRASOUND:

Traditionally, pulsed-low intensity mode therapeutic ultrasound is used for acute swelling and inflammation. Pulsed mode of ultrasound uses the non-thermal effects encouraging cavitations and dilation of the tissue cells. The non-thermal effects of ultrasound increases membrane permeability causing a stirring affect. This agitation of the ions in the cell increases the gradient, and ultimately yielding higher diffusion. The parameters for non-thermal ultrasound are an intensity of 1mhz frequency, 50% duty cycle, w/cm$^2$, and total treatment time of 10 minutes. Ultrasound has been studied for its effects and potential therapeutic qualities. For the best treatment delivery a 3 degree rise in tissue temperature needs to be achieved to increase metabolic rate and blood flow, reduce chronic inflammation and muscle spam, and elastic properties. These effects can be achieved by using thermal modes of ultrasound. To be most accurate, ultrasounding two times the total surface of the sound head in a continuous duty cycle is optimal for achieving 3 degrees of tissue temperature rise[3]. Draper and Ricard (1993 and 1995) reported therapeutic ultrasound has a depth of penetration approximately 2.5 cm into the tissue using 3mhz sound head with a continuous mode for 10 minutes. Using a 1mhz sound head for 10 minutes would achieve a depth penetration of 2.5 to 5 cm during ultrasound treatment. As stated previously when acute swelling is present, a non-thermal mode of ultrasound would be recommended. Nyanzi et al. completed a double-blind randomized controlled trail of the efficacy of using ultrasound to treat lateral ankle sprains. The trail reported that ultrasound is not a better form of treatment when compared to placebo. Conversely, pain perceived and range of motion (dorsiflexion) was statistically significant between the ultrasound and placebo groups.

### ELECTRICAL STIMULATION:

Electrical stimulation has shown to be a fairly positive modality to use in controlling acute edema[6 and 7]. There also have been positive results in controlling and reducing pain with use of electrical stimulation, primarily transcutaneous electrical nerve stimulation (TENS). Micro-stimulation is another mode of electrical stimulation to control edema. Micro-stimulation parameters are as follows: use these parameters 30 frequency, 250-300 intensity, for 20 minutes at a negative polarity for edema control. Interferential or IFC mode can be manipulated to control edema and pain by adjusting the frequency. IFC utilized for edema control is 1-10 Hz for 20 minutes. Pain control using IFC frequency is adjusted to 80-150 Hz for 20 minutes. High Volt stimulation is also helpful in combating acute edema and muscle spasm. Many wavelengths can be modified to help reduce pain and inflammation.

### ICE:

Ice is well understood to reduce edema and decrease pain. Ice initiates vasoconstriction properties and the cold numbs the tissue providing an analgesic effect. One study looked the effects of cooling, heat, and contrast baths with first degree and second degree ankle sprains in thirty subjects. Icing alone was the only modality found to reduce edema[8]. Heat was found to increase swelling and slow recovery in this study.

### COMPRESSION:

Compression dressings have always been an option to control the amount of edema controlled in a joint or extremity. Linde F et al. (1984) applied compression bandages for 4 days post-ankle sprain. Two groups were formed, one had no bandages applied and the other had bandages placed on the ankle. The results showed no significant in difference in pain, function, swelling, or limitation of motion between the two groups.

### THE NEW CLASS IV LASER AND ALTERNATIVE POLYMEM BANDAGE APPLICATION LASERS:

The Avicenna therapeutic class IV laser (VTR75) is the latest therapeutic modality technology. The Avicenna class IV laser generates 7500 mw (milliwatts) of power within a 980 nm (nanometer) treatment beam. The laser beam treatment depth is approximately 10 cm with a width of 7 cm. The Avicenna therapeutic laser accelerates tissue repair and cell growth, and establishes anti-inflammation and anti-pain properties. First, accelerated tissue repair is achieved by increased cellular reproduction. The cell has a higher uptake of nutrients and gets rid of waste products sooner. Second, the laser decreases inflammation by vasodilatation and activates the lymphatic drainage system. Lastly, the laser's analgesic properties reduce the nerve pain fibers (C fibers) sensitivity by blocking its transmission to the brain. The result of decreased inflammation and edema yields less pain for the athlete.

This device is not to be confused with a low level cold laser. The effectiveness of the low level laser is questionable[10]. However, a low level laser or cold laser only has a penetration depth of .5cm. A study by Fung et al.[11] evaluated 16 MCL surgical transactions in rats. They concluded that one dose of low level energy laser improved the tensile strength and stiffness of the repairing MCL at 3 and 6 weeks from injury.

### POLYMEM BANDAGE:

Polymem bandage was originally developed for wound care, and not the treatment of ankle sprains or closed soft tissue injuries. The Polymem dressing provides a warm and moist optimal environment for healing of tissue. The dressing releases compounds that have been shown to stimulate healing. The dressing also promotes the concentration of the body's nutrients and regeneration of cells to the tissue site it is covering. The Polymem dressing also works as a waste product remover from the tissue while cleaning and moisturizing the application site. The cleansing agent is F-68 Surfactant and the super absorbent starch co-polymer absorbs and holds excess waste fluids and promotes growth to the site. This process is specifically advantageous to an open wound. Although, this dressing was designed for wounds and damaged tissue, acute edema and contusions have been very responsive to this application. This has been observed several times with different athletic injuries. The Polymem dressing when applied immediately to the injured site results in decreased pain and discoloration within 24 hours.

## CASE PRESENTATION

A 33 year old male professional baseball player with no previous history of ankle problems sustained an acute ankle injury. The player is 5'11" tall and weighs 195 pounds. The ankle was injured in plantar-flexion and inversion mechanism, while trying to catch a fly ball in the outfield. The player explained that his foot caught on the artificial turf and rolled. The athlete described instant pain without pop and the ankle felt weak. The athlete was unable to continue to play but could walk off the field without assistance. The goal of the player and athletic trainers was to have the player return to play quickly, sustaining the everyday endurance level and movements for his sport demands while avoiding re-injury.

## ASSESSMENT

The athlete was brought into the training room for further evaluation. The head and assistant athletic trainers performed special tests, which revealed no laxity of the ATF, CF, PTF, or deltoid ligaments. The anterior drawer, klieger and talar tilt were negative. Squeeze test and tapping revealed negative results for a fracture. On palpation there was tenderness over the ATF ligament. There was minimal-to-moderate swelling over the ATF and ankle mortise. Dorsiflexion was within normal limits and not painful. Plantarflexion of the ankle revealed pain. The diagnosis was then described as a first degree ATF ankle sprain.

## TREATMENT

### DAY 1:

The athlete was treated with an Avicenna therapeutic class IV laser for 10 minutes at 7.5 watts. The athlete could feel warmth from the laser, but otherwise no pain was reported during the application. Then, a Polymem bandage was applied to help with swelling and pain. The ankle also was treated with an open basket weave taping to be worn overnight. Ice pack was applied 2 times that evening for 15 minute intervals.

### DAY 2:

After the 1st day of treatment a minimal amount of discoloration (24 hours later) over the lateral ankle was noted, however, there was no palpable pain over the ATF ligament. The Polymem bandage and basket weave taping was taken off. The Polymem bandage was heavy and moist. Another application of the laser modality was used for 10 minutes, at the previous settings. Ice pack was applied 2 times that day at 15 minute intervals. The athlete may have been able to compete today. The athlete was also suffering from cold like symptoms and thus scratched from the game. The athlete described no pain and minimal soreness.

The athlete was advised to ambulate within comfort levels, but no additional treatments were applied.

### DAY 3:

After the 2nd day of treatment, the discoloration was completely gone and there was no palpable tenderness over the ATF. Swelling was also unremarkable. The athlete had a closed basket weave tape application and retuned to play. A discharge criterion was the ability to perform figure eights and cutting maneuvers without pain or apprehension. The athlete played a full professional baseball game without complaint. The athlete was not given an exercise program or proprioception program throughout the 2-3 days. After the game the athlete was iced for 15 minutes. On observation there was no palpable tenderness or swelling noted.

## DISCUSSION

First degree anteriortalofibular ligament sprains are common. An athlete with this type of sprain presents with or without swelling or eccyhmosis, point tenderness over the ATF ligament, and negative anterior drawer and talar tilt. The ATF ligament is injured commonly with a plantarflexion and inversion roll of the ankle joint. Clinical exam is often enough for an accurate diagnosis. There are many modalities and treatment techniques used to speed up healing time, decrease pain, and reduce swelling in first degree ankle sprain. Treatment varies greatly between clinicians when rehabilitating ankle sprains. However, the efficacy of these modalities is debatable. For example, the problem with cryotherapy could be using a contrast bath versus ice bucket? Answer: The contrast bath has a flushing affect that promotes vasodilatation followed by vasoconstriction creating a circulation paradigm. The ice bucket treatment purely acts a vasoconstrictor and provides analgesic properties (numbing). Many believe that ice also provides increased blood flow after the thawing phase of the ice bucket application. A sound decision and evidence based usage of the modality provides the clinician with the option to use the ice bucket or contrast bath. The problem with ultrasound is that is has minimal effect if the sound head travels in a bigger distance than twice the sound head (covering greater tissue) if you are trying to reach 3 degrees of TTR. The problem with electrical stimulation has shown to be not as effective with athletes who have a lot of adipose tissue. A lot of adipose tissue impedes the current. Finally, the problems with the new cold low level lasers are there poor penetration depth to .5 cm. Ultimately, the area of treatment, the depth, and the goal of the modality needs to be addressed before usage.

The Avicenna therapeutic class IV laser is a new modality and has some definite clinical advantages over other modalities. There have been some positive research results that were sited earlier in this case report. The class IV laser depth of penetration is greater and wider than the other known modalities. Because of the depth of penetration the laser treatment affects intra- and extra-articular peripheral joint tissues. Ultrasound, electrical stimulation, ice and superficial heat applications do not penetrate as deeply. The athlete in this case recovered quickly and without strength loss. From day 1 to day 3, the laser treatments seemed to provide relief for the athlete. Subjectively, the athlete felt better after the treatment. The athlete reported less soreness and pain when walking. From observation the ankle swelling decreased quickly.

The mechanism of action of Polymem bandage on closed injuries is unknown. However, once you use it you may start believing. However, the discoloration that occurs from tissue damage seems to be reduced drastically. The Polymem bandage was soaked with waste possibly

from tissue damage secondary to the ankle sprain. In our experience, this professional baseball player's total injury time was decreased by 50%.

## CONCLUSION

In professional sports, the delayed return to play has many implications. One of the goals as the athletic trainer is to facilitate a quicker return to sport for their athletes. The athletic trainer provides a safe rehabilitative environment while avoiding re-injury. One of the primary early rehabilitation care decisions that athletic trainers make is to decide what modality to use to help reduce the initial injury symptoms. Combating the effusion and pain early provides success in achieving symptom reduction. As described in this case study there are many modality applications that can achieve this goal. In theory, many modalities seem to help. Data in the literature supports the use of a particular modality, and there is evidence that does not support its use. Due to the unreliable results with conventional modalities, this case report examines the use and efficacy of the class IV laser and Polymem bandage application. The laser has been recently approved by the FDA and is not yet used commonly in most rehabilitation centers. By the end of 2004 or early 2005 high level lasers will be more readily available and affordable for general practice. The results of this case report suggest favorable preliminary outcomes using the laser and Polymem bandage. We have shown that the use of these two modalities reduced the return to play time, pain, and swelling. Randomized controlled trial research studies are needed to investigate the treatment efficacy of the class IV laser.

Investigating the reliability of depth of penetration, healing time, and reduction of symptoms may strengthen the conclusion using the class IV laser. A study using the class IV laser and a placebo group may also be warranted. The Polymem bandage should also be investigated in a double blind trail to see if there is any evidence for support its use with closed skin tissue damage (i.e. swelling and bruising). This case provides some insight with new treatment modalities. Further research is needed to support the findings in this case report.

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Steve is the clinic director at Royal Oak. He has been in practice for 9 years. Steve serves as the physical therapist for the Detroit Lions and a physical therapist consultant for the Detroit Tigers. In 2007, Steve was accepted into the American Society of Shoulder and Elbow Therapists.

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