

# *A Comprehensive Injury Review: Lateral Ankle Sprain*

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**Abstract:** 85% of all ankle sprains are lateral ankle sprains (LASs), the most prevalent lower extremity injury in both the general and athletic populations. Mismanagement of lateral ankle sprains can result in chronic ankle instability and increase the likelihood of re-injury. This article provides a comprehensive overview of lateral ankle sprains, including relevant anatomy, injury mechanism of injury, and symptoms. There is a description of evaluation techniques and methods, including subjective history taking, observation, palpation, and special tests. In the acute phase, common treatment options such as the POLICE protocol (protection, optimal loading, ice, compression, and elevation) are recommended. Rehabilitation regimens that include therapeutic exercises focusing on range of motion, flexibility, strength, and proprioception are crucial for a successful return to activity and reducing the risk of re-injury. Also discussed are injury prevention techniques such as external taping, bracing, and orthotics. Healthcare professionals must comprehend the pathophysiology and appropriate treatment of lateral ankle injuries in order to provide optimal care and prevent long-term complications.

## **1. Introduction**

Acute ankle sprains are the most prevalent lower extremity musculoskeletal injury in both general and athletic populations, accounting for 16% to 40% of all sports-related injuries [1]. The incidence rate is greater in highly active populations than in the general population. In addition, athletes who participate in sports characterized by sprinting, cutting, and leaping, such as field hockey, football, and basketball, are more susceptible to acute ankle sprains than athletes who participate in other sports. Mismanagement of the initial ankle sprain may contribute to a decrease in ankle ligament integrity and the development of chronic ankle instability (CAI), resulting in a re-injury rate of up to 70% [2].

Acute ankle sprains are defined as overstretching or traumatizing the ligamentous structures of the ankle. They are distinguished by three categories of ankle sprains: lateral, medial, and high or syndesmotic. The most common form of ankle sprain, accounting for 85 percent of all ankle sprains, involves the lateral compartment of the ankle ligaments [3]. Lateral ankle sprain (LAS) is caused by a forceful inversion of the talocrural joint of the ankle, which damages the anterior talofibular ligament, the posterior talofibular ligament, and the calcaneofibular ligament. The incidence rate of lateral ankle sprain is estimated to be 0.93 per 1000 athlete exposures; an AE is defined as one athlete participating in one competition or practice. Approximately 73% of all ankle sprains involve the lateral ligaments complex; the remaining 25% are medial (deltoid ligament) or high

ankle/syndesmosis (anterior-inferior or posterior-inferior tibiofibular ligament injuries)[1].

The purpose of this article is to provide a comprehensive overview of lateral ankle sprains, offering valuable insights and evidence-based practices for athletic trainers and healthcare professionals involved in the treatment of acute lateral ankle sprains. Practitioners can accurately determine the severity of a sprain through a combination of observation, palpation, and specialized tests. In addition, therapeutic modalities assist in the reduction of discomfort, while targeted therapeutic exercises improve ankle strength and overall joint stability, thereby facilitating the athlete's complete recovery. The sections that follow explore the progression of lateral ankle sprains and their respective treatment strategies.

## 2. Clinical Relevance

Since acute lateral ankle sprain has one of the highest incidence rates among athletes of different ages, athletic trainers and other health care providers must understand the injury's pathophysiology in order to provide the most effective diagnostic and rehabilitation methods. Mismanagement of LAS may result in impairments to physical abilities, a decline in athletic performance, negative psychological effects, financial burden, and an increased likelihood of re-injury and chronic ankle instability [4]. Appropriate methods of injury prevention can significantly reduce the incidence of injuries. External taping and bracing can provide additional support to the ankle joint, allowing it to withstand greater tension without sustaining ligament injury. Different varieties of orthotics can provide biomechanical support for the lower limb muscles or ankle joints in patients with ankle joint malalignment, thereby reducing ankle joint injury and enhancing joint stability[5]. The most significant risk factor for an ankle sprain is a history of injury, and improper management of an injury can increase the likelihood of re-injury and chronic ankle instability. Protection, optimal loading, ice, compression, and elevation (POLICE) should be applied immediately following acute ankle injuries in order to reduce edema. In the acute phases of ankle injuries, electrical stimulation, cryotherapy, and Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) are common adjuncts to POLICE. A well-designed rehabilitation program should include a variety of exercises that target range of motion, flexibility, strength, and proprioception to ensure an athlete's successful return to activity with minimal risk of re-injury [6]. Before returning to practice or competition, the injured athlete must pass a comprehensive return-to-play test that simulates all aspects of the sport. It can ensure that the athlete is physically able to return to their sport and that their strength has returned to pre-injury levels, thereby reducing the likelihood of re-injury [7].

## 3. Anatomy

The talocrural and talocalcaneal joints make up the ankle joint. Additionally known as the "real" ankle joint, the talocrural joint is also known as the "true" ankle joint. The distal tibia and fibula of the lower limb articulate with the talus of the foot. The talocrural joint is a synovial hinge joint that enables the foot to dorsiflex and plantarflex in relation to the lower limb. The talus and calcaneus of the foot articulate the talocalcaneal joint, or subtalar joint, which is located inferior to the talocrural joint. During movement, the talocalcaneal joint permits the genuine inversion and eversion of the foot. A lateral complex ankle joint sprain may be accompanied by injury to the interosseous talocalcaneal ligament, also known as the "ACL" of the talocalcaneal joint.

The lateral collateral ligament complex comprises three ligaments: the anterior talofibular ligament, the posterior talofibular ligament, and the calcaneofibular ligament [8]. The anterior talofibular ligament is derived from the lateral malleolus and attaches to the talus bone. This ligament is sprained when the ankle is plantarflexed and inverted. Additionally, the calcaneofibular ligament begins at the lateral malleolus of the fibula and ends at the calcaneus. Without plantar flexion, this

ligament will be sprained when the ankle is inverted. A lateral ankle sprain can also impair the posterior talofibular ligament, which is a component of the lateral ankle. With inversion and internal rotation, the PTFL will be sprained. Nevertheless, this form of sprain is extremely uncommon.

Typically, the severity of an acute lateral ankle sprain is evaluated using a three-grade classification system. In sprains of grade I, the ligament is stretched and tugged, resulting in a few minor tears. The anterior talofibular ligament of patients with grade I injuries may be tender and swollen, but there is no apparent instability. Typically, they can bear weight with minimal or no discomfort. Symptoms may include increased point tenderness over the lateral collateral complex of the ankle, edema, and bruising as the degree of injury increases. Possible minimal functional instability accompanied by impaired weight-bearing capacity. Grade II sprains entail incomplete ligament rupture, whereas grade III sprains indicate complete ligament rupture. In a grade III lateral ankle sprain, the anterior talofibular ligament (ATFL) and the calcaneofibular ligament (CFL) are both completely ruptured. The posterior talofibular ligament is rarely compromised during inversion ankle injuries. Symptoms of a grade III sprain may include tenderness on both the lateral and medial sides of the ankle joint, significant edema, functional instability, inability to bear weight, and a risk of ankle joint fracture [9].

#### 4. Mechanism of Injury

A lateral ankle sprain (LAS) occurs when the foot rolls outward, forcing the joint to move beyond its normal range of motion and injuring the ligaments of the lateral side of the ankle. These ligaments are the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL), and the posterior talofibular ligament (PTFL) from the lateral collateral complex (LCL). The primary mechanism of a lateral ankle sprain is excessive inversion and potential plantar flexion of the athlete's ankle. When this occurs, the ATFL can be harmed by inversion and plantar flexion, while the CFL can be harmed by inversion alone [10]. The ATFL is the weakest of the three lateral ligaments and is the ligament most commonly injured in lateral ankle injuries when excessive plantar flexion is combined with forced inversion. The only force that can cause injury to the CFL is the inversion force. ATFL injuries are isolated in 66% of LAS, while ATFL and CFL ruptures occur simultaneously in 20% [11]. The posterior talofibular ligament (PTFL) is rarely injured due to the large force required to cause injury and the quantity of dorsiflexion required to sprain the ligament. A secondary mechanism of a lateral ankle sprain is the athlete's ankle being injured by another athlete. In sports such as soccer or basketball, an athlete's ankle can be injured by a slide tackle by another player or by stepping on another player's foot, which produces a direct impact to the medial side of the ankle and forces the ankle into excessive inversion and possible plantar flexion.

#### 5. Signs and Symptoms of Acute Lateral Ankle Sprain

The acute phase of a lateral ankle sprain lasts from the time of injury until the indicators of inflammation reach their apex and then begin to subside. Within the first 72 hours, pain, fever, edema, redness, and loss of function are the five most prominent symptoms of inflammation. Athletes may experience point tenderness and edema over the anterior talofibular ligament during the initial phase of injury, but without apparent instability [9]. Additionally, the inflammatory process may limit the range of motion of the ankle joint, reduce muscle strength, impair the proprioception function of the ankle, and increase joint and adjacent tissue rigidity. During the acute inflammation phase, athletes may also experience a decrease in sports performance and ability to perform daily activities, and after 72 hours, the five symptoms of inflammation should subside along with the reduced inflammatory response.

In cases of severe lateral ankle sprain, the Ottawa Ankle Rules may be used to rule out the possibility of fractures. The Ottawa Ankle Rule is a valuable clinical instrument used to determine whether X-ray imaging is required in cases of ankle injuries [12]. It can aid medical professionals in

efficiently and precisely identifying ankle fractures and reduce unnecessary X-ray use. If the patient exhibits tenderness, palpate the posterior tips of the medial and lateral malleoli, the base of the fifth metatarsal, and the navicular bone. In such a situation, the patient should be referred to a physician for diagnostic imaging to rule out a fracture.

## 6. Common Evaluation Tools and Techniques

When evaluating a lateral ankle sprain, it is crucial to follow "HOPS," which stands for "history, observation, palpation, and special tests." The athlete's history should include any previous injuries, surgeries, etc., as well as the results of the Foot and Ankle Ability Measure. CAI may be present if the athlete scores less than 90% for activities of daily living (ADL) and/or less than 80% for activity [13]. In addition, the athletic trainer must use the acronym "MAPSSO" to obtain an adequate history of the athlete. This involves gathering information regarding the mechanism of injury, whether the injury is acute or chronic, pain, previous injury, signs/symptoms, and audio, as well as any other information provided by the athlete.

Afterwards, the athletic trainer should conduct observations to obtain objective injury findings. Indicators of a lateral ankle sprain include ecchymosis and discoloration, inflammation surrounding the lateral malleoli, and an increase in ankle temperature. Ankle pain and tenderness when palpated and/or moved, limited range of motion (ROM), and inability to sustain weight on the injured ankle are all symptoms of an ankle sprain. The evaluator should use a goniometer to measure the athlete's plantar flexion and dorsiflexion range of motion (ROM). A healthy ankle should be able to dorsiflex between 10 and 20 degrees, and plantar flex between 40 and 55 degrees [14]. If the athlete's ankle is unable to accomplish the same range of motion as a healthy ankle, this observation can be used to diagnose a lateral ankle sprain. A healthy ankle should be able to invert 40 degrees and evert 20 degrees, but measuring these ranges of motion with a goniometer is challenging. To evaluate an athlete's ankle strength, one could conduct manual muscle tests. Similar to evaluating ROM, move in each of the four dimensions while applying resistance in the opposite direction.

Several anatomical structures should be considered in terms of palpation. Utilizing the Ottawa Ankle Rules is an essential rule to observe during palpations. Assume there is pain and tenderness in any of the areas highlighted by the Ottawa Ankle Rules. In such a case, the athlete should be referred to another physician for X-rays and other diagnostic procedures to check for possible fractures. The athletic trainer must palpate the lateral and medial malleolus, fibularis tendons, calcaneal tendon, anterior tibialis tendon, posterior tibialis tendon, calcaneus, the base of the first and fifth metatarsals, ATFL, CFL, and deltoid ligament. When palpating these anatomical structures, any deformities, pain, or tenderness should be meticulously documented.

Specialized procedures conclude the evaluation of a lateral ankle sprain. To evaluate the ligamentous stability of the ankle, diagnostic special-tests such as the anterior drawer or talar tilt tests can be performed [15]. The anterior drawer test is used to evaluate the integrity of the anterior talofibular ligament (ATFL), which is commonly injured during excessive ankle inversion and plantar flexion. The calcaneus is dragged forward with the ankle held at a 90-degree angle, the distal tibia in one hand and the calcaneus in the other. This test is positive if the foot slides forward, a "clunk" is heard or felt, and there is discomfort. Additionally, one must verify bilaterally. The talar tilt test, on the other hand, evaluates the strength and integrity of both the calcaneofibular ligament (with inversion) and the deltoid ligament (with eversion). Starting in a position comparable to the anterior drawer test, passively invert and evert the ankle. Positive indicators include excessive motion and discomfort. Immediate care and rehabilitation should focus on enhancing the ligamentous physiological healing process in order to restore ankle joint stability after injury. The ankle ligament complex may require up to six weeks to conclude the physiological healing process [16].

Everything done with the athlete should be meticulously documented; without proper documentation, the evaluation would not only be invalid, but also pointless because it would not be accessible during treatment and rehabilitation planning.

## 7. Typical treatment options

Protection, optimal loading, ice, compression, and elevation (POLICE) should be applied immediately following acute ankle sprains in order to reduce discomfort and edema [17]. The objectives of acute care are to prevent further injury to the injured ankle, control pain and edema, and reduce secondary hypoxic injury caused by the acute inflammatory response. In the acute phases of ankle injuries, electrical stimulation, cryotherapy, and Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) are common adjuncts to POLICE. Electrical stimulation can control edema because it reduces capillary permeability and inhibits edema formation, thereby affecting the rate of normal function recovery [18]. Cryotherapy can reduce nerve conduction velocity, resulting in cutaneous analgesia, the elimination of edema formation, and a decrease in metabolic activity and secondary injury [19]. Cryotherapy can be administered in a variety of ways, including the use of ice packs, water immersion, ice cups, and icy sprays. Regarding Nonsteroidal Anti-Inflammatory Drugs, strong evidence supports their use. NSAIDs taken during the acute phase of ankle sprains can reduce pain and enhance short-term function [20]. Thermotherapy is appropriate for soft-tissue injuries to reduce pain and increase range of motion, but it cannot be used in the acute phase because heat increases edema and blood flow, which can exacerbate the injury [6].

Treatments for lateral ankle sprain will aim to restore normal range of motion, strength, and stability. Following the long-term rehabilitation exercise is the subsequent section. Utilizing ice packs, cold water immersion, and heat hydrocollator packs, cryotherapy and possibly thermotherapy can be used during long-term treatment and rehabilitation to reduce inflammation and increase blood flow, if necessary.

## 8. Rehabilitation Protocols

The rehabilitation of musculoskeletal injuries employs therapeutic exercise to assist the body in regaining various functions, allowing the athlete to return to or even transcend their previous level of competition. The rehabilitation progression exercises incorporate a comprehensive array of elements designed to facilitate an efficient recovery process. These elements include the management of pain, swelling, and inflammation, increased joint mobility and range of motion, neuromuscular activation and coordination, strength and endurance development, plyometric training, agility training, sports-specific exercises, and a systematic return-to-play progression. By tailoring each patient's rehabilitation program to their specific requirements and incorporating all of these elements, a safe and effective rehabilitation process can be accomplished, thereby reducing the risk of re-injury.

For athletes to advance in functional rehabilitation, it is essential to restore their range of motion. According to research, limited ankle dorsiflexion after a lateral ankle injury may contribute to the development of chronic ankle instability and gait impairments [21]. Consequently, addressing and enhancing dorsiflexion limitation is crucial for preventing these long-term complications. The range of motion of the ankle joint can be targeted with both active and passive range of motion exercises, and the exercise should be performed bilaterally.

The patient can progress to the strengthening portion of rehabilitation once pain and edema are under control and joint range of motion has been restored. This phase entails the execution of progressive exercises utilizing isometric resistance, concentric or eccentric movements with TheraBand, dumbbells, or machine weights. Patients can regain strength and improve their overall functional abilities by progressively increasing the intensity and complexity of these exercises. Tendons, ligaments, bones, and muscle fibers can adapt to the tension placed on them, according to Wolf's law [22]. By implementing a progressive intensity level that targets the regeneration process without placing undue stress on the body is a crucial component of a successful rehabilitation program.

Balance and proprioceptive exercises are essential to rehabilitation programs because they can enhance joint sensory reception, neuromuscular control, and postural stability [23]. Incorporating balance exercises into multi-joint strengthening exercises can also improve the body's stabilization



function and boost overall strength.

The return to play protocol is a progressive plan that details the steps for injured athletes to return to sports activities in a safe and incremental manner [24]. It also functions as an objective testing instrument to ensure that athletes have no functional limitations and can securely perform sport-specific movements. Typically, return-to-play evaluations include multiple measures, such as strength, balance, plyometrics, and sport-specific movements. These include the bodyweight squat, the single-leg balance test, the 5-10-5 agility test, and the single-leg leap test.

## 9. Differential diagnosis and likely secondary injuries

Regarding lateral ankle sprains, numerous differential diagnoses and secondary injuries are possible. As previously stated, the primary mechanism of injury for a lateral ankle sprain is ankle inversion and plantar flexion. Assume that an athlete has a history of repeated lateral ankle injuries. In such a scenario, the individual may develop chronic ankle instability (CAI), which would ultimately result in the insufficiency of the lateral ankle ligament complex. In the article "Epidemiology of Ankle Sprains and Chronic Ankle Instability" by Mackenzie Herzog and her colleagues, they examine the likelihood of reinjuring their ATFL and CF ligaments as well as developing chronic ankle instability by referencing a number of studies from a variety of sports. Individuals with a history of ankle sprains were approximately three-and-a-half times more likely to sustain another sprain than those without a history of ankle sprains [2]. Chronic ankle instability resulting from a history of repeated ankle injuries can be a secondary diagnosis following an ankle sprain.

Depending on the severity of the forced inversion and plantar flexion of the ankle, the medial malleolus, distal tibia, and lateral malleolus may sustain fractures. When an athlete inverts their ankle excessively, the talus can exert a compressive force on the distal tibia and medial malleolus. This could result in transverse tibial fractures. In addition, depending on the magnitude of the inversion force, an avulsion fracture of the lateral malleolus (distal end of the fibula) can occur if the ATFL is stretched or ruptured, causing a portion of the fibula bone to be wrenched away [25]. Whenever an athlete sustains an ankle sprain, he or she should be evaluated for possible fractures of these structures, particularly if positive tests for the Ottawa ankle rules are performed.

Strains and subluxations of the peroneal tendon are the last secondary injury associated with lateral ankle sprains. The peroneus longus and peroneus brevis tendons insert into the base of the first and fifth metatarsals, respectively, below the lateral malleolus. These two tendons can elongate and develop microtears or complete tears during a lateral ankle sprain [26]. Additionally, the peroneal tendons may dislocate from the peroneal tubercle. If this occurs, the tendons will become prominent and visible directly on the lateral malleolus, and they will return directly into the tubercle. With a peroneal strain or subluxation, the athlete will be in excruciating agony.

## 10. Conclusion

Lateral ankle sprains are extremely prevalent in the athletics industry. Due to the prevalence of sprains across all sports, it is essential to follow all evaluation and treatment steps. First, a comprehensive understanding of the anatomy of the ankle is necessary for accurate diagnosis and prompt treatment. Without extensive knowledge of the subject, athletic trainers may struggle to provide timely and appropriate care. In addition, it is essential to document the injury's history and conduct a comprehensive evaluation for a proper assessment. To guarantee the validity of the injury assessment, the documentation must be revised. Utilizing modalities and exercises supported by scientific evidence is essential for treatment and rehabilitation, ensuring their efficacy. Failure to do so increases the likelihood of re-injury and chronic ankle instability (CAI). Despite its frequency, a lateral ankle sprain can be effectively treated through the application of exhaustive knowledge of ankle anatomy and appropriate treatment strategies.

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