FLEX CEUs

Turf Toe:
Physical Therapy Intervention

Introduction

Turf toe is a sprain injury of the first metatarsophalangeal joint that commonly affects individuals participating in activities requiring rapid acceleration, cutting, and forceful push-off. Despite the injury being localized, it can significantly impair mobility, load tolerance, and athletic performance when not properly identified and managed. This course provides a comprehensive review of turf toe with emphasis on evidence-based physical therapy intervention. Foundational concepts including the definition, biomechanical mechanisms, characteristic symptoms, and injury epidemiology are presented to support accurate recognition and clinical reasoning. Clinically relevant anatomy of the plantar capsular and ligamentous structures is examined to clarify tissue involvement and guide assessment strategies. Injury grading and differential diagnosis are integrated to improve diagnostic accuracy and inform prognosis.

Section 1: Definition and Symptoms of Turf Toe

Turf toe is a sprain injury of the first metatarsophalangeal joint resulting from excessive dorsiflexion forces applied to the great toe, most commonly during athletic push-off activities. Although sometimes underestimated, this injury can significantly impair gait mechanics, force production, and sport performance. Establishing a clear understanding of the mechanism and clinical presentation provides the foundation for accurate recognition and appropriate management.

Mechanism of Injury

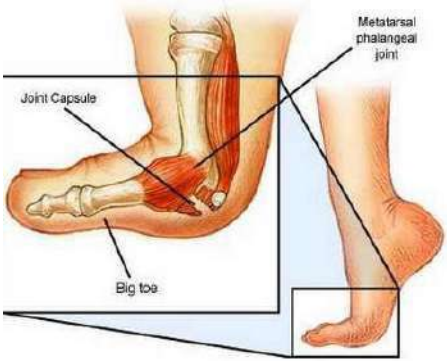
References: 1, 2

Turf toe occurs when an excessive dorsiflexion force is applied to the first metatarsophalangeal joint while the foot is fixed against the ground. This

mechanism typically involves a combination of axial loading through the forefoot and forced hyperextension of the great toe, resulting in tensile stress to the plantar stabilizing structures. The injury most commonly occurs during push-off, acceleration, cutting, or when an athlete's heel rises and body weight shifts forward over a planted forefoot. When an external force, such as contact from another player or sudden deceleration, drives the proximal phalanx into dorsiflexion beyond its physiological limit, the plantar capsuloligamentous complex becomes overstretched or torn.

https://my.clevelandclinic.org/health/diseases/17590-turf-toe

The primary structures stressed during this mechanism include the plantar plate, collateral ligaments, joint capsule, and the sesamoid complex embedded within the flexor hallucis brevis tendon. The plantar plate functions as a fibrocartilaginous structure that resists excessive dorsiflexion and distributes load across the joint. When the dorsiflexion moment exceeds the tensile capacity of these tissues, varying degrees of sprain injury occur, ranging from mild stretching to partial or complete disruption.



https://www.tnfootandankle.com/turf-toe

Several contributing factors increase susceptibility to this hyperextension mechanism. Playing surfaces with limited shock absorption, such as artificial turf, reduce energy dissipation and may increase forefoot loading. Footwear with flexible soles or inadequate forefoot stiffness may permit excessive dorsiflexion at the first metatarsophalangeal joint. Intrinsic factors such as limited first ray mobility, prior injury, or structural alignment variations can further alter load distribution and joint mechanics, increasing stress on the plantar stabilizers.

In some cases, the mechanism may also include a valgus or rotational component, particularly during cutting maneuvers. This combined loading pattern can increase strain on the medial collateral ligament and contribute to joint instability in higher-grade injuries. Understanding the precise mechanical forces involved in turf toe is essential for accurate grading, protection strategies, and development of rehabilitation programs that progressively restore load tolerance while minimizing reinjury risk.

Involved Plantar Structures

References: 2–4

Turf toe primarily involves injury to the plantar stabilizing structures of the first metatarsophalangeal joint, which function collectively to resist excessive dorsiflexion and maintain joint congruency during weight-bearing and push-off.

These structures form a complex support system that provides both static and dynamic stability to the great toe under high loading conditions.

The central structure most commonly affected is the plantar plate, a thick fibrocartilaginous structure located along the plantar aspect of the joint. The plantar plate attaches proximally to the head of the first metatarsal and distally to the base of the proximal phalanx. Its primary role is to limit dorsiflexion and distribute compressive forces across the joint during terminal stance and propulsion. Disruption of the plantar plate compromises joint stability and reduces the efficiency of push-off mechanics.

Surrounding the plantar plate is the plantar joint capsule, which provides additional passive restraint. The medial and lateral collateral ligaments contribute to frontal plane stability and help prevent excessive valgus or varus deviation during dynamic activities. In higher-grade injuries, these ligamentous structures may be partially or completely torn, resulting in increased joint laxity.

The sesamoid complex also plays a critical role in plantar stabilization. The medial and lateral sesamoid bones are embedded within the tendon of the flexor hallucis brevis and function to increase the mechanical advantage of the flexor mechanism while absorbing and redistributing load. The intersesamoid ligament and associated soft tissues maintain alignment of the sesamoids beneath the first metatarsal head. Injury to these components can disrupt force transmission and contribute to persistent pain or instability.

Dynamic support is provided by musculotendinous structures including the flexor hallucis brevis, flexor hallucis longus, and intrinsic foot musculature. These muscles assist in plantarflexion of the great toe and provide active stabilization during gait and athletic activities. Compromise of the plantar ligament complex often results in altered muscle activation patterns and reduced push-off strength.

Understanding the anatomical relationships and functional contributions of these plantar structures allows clinicians to correlate specific examination findings with underlying tissue involvement. This knowledge supports accurate grading of injury severity and guides targeted rehabilitation strategies aimed at restoring stability, strength, and functional performance.

Clinical Signs and Functional Limitations

References: 1, 5

The clinical presentation of turf toe varies according to injury severity but typically includes localized pain at the plantar aspect of the first metatarsophalangeal joint. Patients often report a specific mechanism involving forced hyperextension during push-off, cutting, or contact. Acute signs commonly include swelling, tenderness to palpation over the plantar joint line, and discomfort with active or passive dorsiflexion of the great toe. Ecchymosis may be present in moderate to severe injuries, particularly along the plantar surface.

Range of motion is frequently limited due to pain, capsular irritation, or mechanical restriction associated with tissue swelling. In Grade I injuries, motion may be only mildly painful, whereas Grade II and III injuries often demonstrate more pronounced limitation and discomfort at end range dorsiflexion. Pain with resisted great toe flexion may indicate involvement of the flexor hallucis brevis or associated plantar structures. In higher-grade injuries, joint laxity or instability may be observed with stress testing, particularly if the collateral ligaments are compromised.

Functional limitations are primarily related to impaired push-off mechanics. Patients commonly demonstrate an antalgic gait pattern characterized by shortened terminal stance and reduced propulsion through the great toe. Activities requiring rapid acceleration, sprinting, jumping, or directional changes

are often significantly limited. Athletes may report decreased power generation and inability to tolerate cutting or pivoting maneuvers. In more severe cases, weight-bearing itself may be painful, resulting in compensatory offloading to the lateral forefoot.

Persistent deficits in mobility, strength, or stability can lead to prolonged functional impairment and altered movement patterns. Without appropriate management, individuals may develop compensatory strategies that increase stress on adjacent joints or soft tissues. Recognizing the relationship between clinical signs and functional limitations is essential for accurate grading, treatment planning, and progression toward safe return to activity.

Section 1 Key Words

Hyperextension - Excessive dorsiflexion of the first metatarsophalangeal joint beyond its normal physiological range, typically occurring when axial load is applied to a planted forefoot and the proximal phalanx is forced upward

Plantar Plate - A fibrocartilaginous structure located on the plantar aspect of the first metatarsophalangeal joint that resists dorsiflexion, enhances joint stability, and distributes compressive forces during push-off

Push-Off Mechanics - The propulsive phase of gait during terminal stance in which the first metatarsophalangeal joint dorsiflexes to allow efficient forward progression and force transmission through the great toe

Section 1 Summary

Turf toe results from excessive dorsiflexion of the first metatarsophalangeal joint under axial load, most commonly during athletic push-off, cutting, or acceleration activities. The injury stresses the plantar stabilizing structures, particularly the

plantar plate, joint capsule, collateral ligaments, and sesamoid complex, which collectively resist hyperextension and maintain joint congruency. Contributing intrinsic and extrinsic factors, including footwear characteristics and playing surface stiffness, can increase mechanical strain on these tissues. Clinically, patients present with plantar joint pain, swelling, reduced range of motion, and impaired push-off mechanics, leading to functional limitations in gait and sport performance. Understanding the interaction between injury mechanism, structural involvement, and clinical presentation supports accurate grading, targeted rehabilitation, and safe return to activity.

Section 2: Prevalence, Epidemiology, and Etiology

Turf toe is most frequently observed in athletic populations exposed to repetitive high-load forefoot demands, particularly in sports requiring sprinting, cutting, and rapid directional changes. Reviewing epidemiological trends, participation patterns, and common injury mechanisms provides important clinical context for identifying at-risk individuals. Understanding these contributing factors supports targeted prevention strategies, risk reduction education, and informed decision-making within physical therapy practice.

Incidence and Athletic Populations

References: 6

Turf toe continues to be reported most frequently in athletes participating in sports that require repetitive forefoot loading, rapid acceleration, cutting, pivoting, and explosive push-off. Contemporary literature confirms that the injury remains prevalent in American football, particularly at the collegiate and professional levels, where high-velocity directional changes and contact

mechanisms increase stress on the first metatarsophalangeal joint. Surveillance data indicate that in collegiate football, turf toe occurs at a rate of approximately 0.06 injuries per 1,000 athlete-exposures, with significantly higher incidence during games compared to practice sessions. This difference reflects the greater intensity, contact exposure, and propulsion demands present in competition.

Although football remains the most studied population, turf toe is also observed in soccer, basketball, rugby, wrestling, dance, and track athletes. These sports share common biomechanical demands, including repetitive sprinting, abrupt deceleration, and forefoot push-off under load. Incidence rates vary by sport, competitive level, playing surface, and reporting methodology, but higher levels of competition are generally associated with greater injury frequency due to increased speed, force production, and cumulative exposure. Continued participation in year-round athletics and competition on high-traction synthetic surfaces may further contribute to injury occurrence in certain athletic populations.

Intrinsic Risk Factors

References: 6

Intrinsic risk factors include anatomical, biomechanical, and neuromuscular characteristics that increase strain on the plantar stabilizing structures of the first metatarsophalangeal joint. Limited first ray mobility may impair normal load absorption and alter dorsiflexion mechanics during terminal stance, increasing stress on the plantar plate and collateral ligaments. Structural variations such as pes planus, forefoot varus, or excessive pronation can modify load distribution across the medial forefoot and increase tensile stress during push-off. A history of prior turf toe or other great toe injuries may reduce tissue integrity and load tolerance, predisposing the athlete to reinjury. Weakness of the intrinsic foot

musculature or deficits in neuromuscular control may diminish dynamic stabilization of the joint during high-demand tasks. Additionally, reduced ankle dorsiflexion range of motion may shift compensatory motion distally to the first metatarsophalangeal joint, increasing susceptibility to hyperextension injury.

Extrinsic Risk Factors

References: 1

Extrinsic risk factors involve environmental, equipment-related, and training variables that influence mechanical loading at the forefoot. Artificial turf surfaces often provide increased traction and reduced shock absorption compared to natural grass, potentially increasing ground reaction forces transmitted through the first metatarsophalangeal joint. Footwear with flexible soles or inadequate forefoot stiffness may allow excessive dorsiflexion during push-off, particularly when combined with high traction from cleats. Cleat configuration and stud placement may also influence forefoot fixation and rotational forces during cutting maneuvers. Sudden increases in training intensity, frequency, or volume can result in cumulative overload of the plantar structures, particularly if recovery time is insufficient. Environmental conditions, such as cold temperatures that reduce tissue extensibility, may further contribute to injury risk.

Section 2 Key Words

Incidence - The number of new cases of turf toe occurring within a defined population and time frame, often reported in relation to athletic exposure

Intrinsic Risk Factors - Individual anatomical, biomechanical, or neuromuscular characteristics that increase mechanical stress on the first metatarsophalangeal joint and predispose an individual to injury

Extrinsic Risk Factors - External influences such as playing surface properties, footwear design, equipment configuration, and training demands that contribute to injury development

Section 2 Summary

Turf toe is most prevalent in athletes participating in high-demand sports that require repetitive propulsion, rapid acceleration, and directional changes. Incidence varies by sport, competitive level, and exposure conditions, with football and other field-based sports demonstrating notable reporting rates. Injury development reflects the interaction of intrinsic factors, including joint mobility, structural alignment, prior injury history, and neuromuscular control, with extrinsic influences such as surface stiffness, footwear flexibility, traction, and training load. A comprehensive understanding of these epidemiological and etiological factors supports targeted prevention strategies, risk modification, and informed clinical management.

Section 3: Clinically Relevant Anatomy of the First Metatarsophalangeal Joint

Effective management of turf toe requires a detailed understanding of the anatomical structures that provide stability and mobility to the first metatarsophalangeal joint. Anatomical knowledge supports accurate examination, grading, and rehabilitation progression.

Osseous Anatomy

References: 7

The first metatarsophalangeal joint is formed by the articulation between the head of the first metatarsal and the base of the proximal phalanx of the hallux. This joint functions as a condyloid synovial joint, allowing motion primarily in the sagittal plane with dorsiflexion and plantarflexion, while also permitting limited transverse and frontal plane movement. During normal gait, the joint must achieve adequate dorsiflexion in terminal stance to allow efficient forward progression and force transmission. The first ray, consisting of the first metatarsal and medial cuneiform, plays a critical role in load distribution across the medial forefoot. Proper alignment and mobility of the first ray are necessary to maintain joint congruency and prevent excessive strain on plantar soft tissues. Osseous morphology, including the shape of the metatarsal head and proximal phalanx base, influences contact area, load tolerance, and susceptibility to injury under hyperextension stress.

Plantar Capsuloligamentous Complex

References: 7

The plantar capsuloligamentous complex provides primary static stabilization to the first metatarsophalangeal joint. The central component of this complex is the plantar plate, a dense fibrocartilaginous structure that attaches proximally to the plantar surface of the first metatarsal head and distally to the base of the proximal phalanx. The plantar plate resists excessive dorsiflexion and enhances joint stability during weight-bearing and propulsion. The plantar joint capsule reinforces the articulation and contributes to passive restraint. Medial and lateral collateral ligaments provide frontal plane stability and limit excessive valgus or varus deviation during dynamic tasks. Together, these structures maintain joint congruency and protect against hyperextension forces. Disruption of this complex

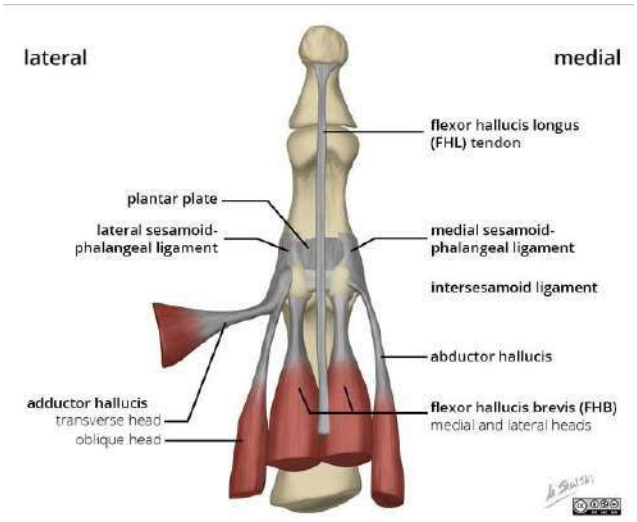
is central to the pathology of turf toe and directly affects joint stability and push-off efficiency.

https://orthofixar.com/anatomy/foot-anatomy/

Dynamic Stabilizers and Sesamoid Complex

References: 3

Dynamic stability of the first metatarsophalangeal joint is provided by musculotendinous structures and the sesamoid apparatus. The sesamoid complex consists of the medial and lateral sesamoid bones embedded within the tendons of the flexor hallucis brevis. These sesamoids function to increase the mechanical advantage of the flexor mechanism, reduce friction, and distribute compressive forces beneath the first metatarsal head. The intersesamoid ligament and surrounding soft tissues maintain proper alignment and coordinated motion of the sesamoids during gait. The flexor hallucis brevis, flexor hallucis longus, and intrinsic foot musculature contribute to active plantarflexion and stabilization of the great toe during propulsion. Effective coordination of these dynamic stabilizers supports load absorption, enhances push-off strength, and reduces stress on passive structures. Injury to the plantar complex may alter muscle activation patterns and compromise functional stability.



https://radiopaedia.org/articles/metatarsophalangeal-joint

Section 3 Key Words

First Ray - The functional unit consisting of the first metatarsal and medial cuneiform, responsible for load transmission and medial forefoot stability during gait.

Plantar Plate - A fibrocartilaginous structure on the plantar aspect of the first metatarsophalangeal joint that resists dorsiflexion and contributes to joint stability.

Sesamoid Complex - The medial and lateral sesamoid bones and associated soft tissues embedded within the flexor hallucis brevis tendon that enhance mechanical efficiency and load distribution.

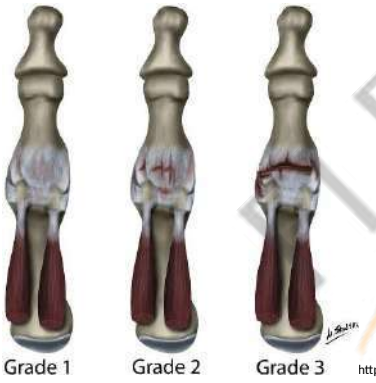
Section 3 Summary

The first metatarsophalangeal joint relies on coordinated interaction between osseous structures, the plantar capsuloligamentous complex, and dynamic musculotendinous stabilizers. The articulation between the first metatarsal and proximal phalanx allows essential motion for propulsion, while the plantar plate

and collateral ligaments provide static restraint against excessive dorsiflexion. The sesamoid complex and intrinsic musculature contribute dynamic stability and optimize force transmission during push-off. A thorough understanding of these anatomical relationships supports accurate assessment, grading, and rehabilitation planning in patients with turf toe.

Section 4: Grades of Injury

Turf toe injuries are classified using a three-grade system that reflects the degree of plantar soft tissue disruption and associated functional impairment at the first metatarsophalangeal joint. Accurate grading is essential for determining prognosis, guiding protection and loading strategies, and establishing appropriate timelines for rehabilitation progression and return to activity.



https://www.clinicalimaging.org/article/S0899-7071(14)00279-4/abstract

Grade I: Clinical Presentation

References: 1, 2, 7

Grade I injuries involve stretching of the plantar capsuloligamentous structures without macroscopic tearing. Patients typically report mild plantar pain at the first metatarsophalangeal joint following a hyperextension event. Swelling is minimal, and joint stability is preserved. Range of motion may be slightly painful, particularly at end-range dorsiflexion, but is generally maintained. Gait deviations

are mild, and athletes are often able to continue participation with discomfort. Push-off strength may be reduced due to pain inhibition rather than structural instability.

Grade II: Clinical Presentation

References: 1, 2, 7

Grade II injuries represent partial tearing of the plantar plate and associated ligamentous structures. Patients commonly present with moderate pain, swelling, and localized tenderness along the plantar aspect of the joint. Ecchymosis may be visible, particularly on the plantar surface. Dorsiflexion range of motion is often limited due to pain and capsular irritation. Weight-bearing and push-off are painful, and gait may demonstrate shortened terminal stance and reduced propulsion. Mild to moderate joint laxity may be present with stress testing, although gross instability is typically absent.

Grade III: Clinical Presentation

References: 1, 2, 7

Grade III injuries involve complete disruption of the plantar capsuloligamentous complex and may include associated injury to the sesamoid complex or collateral ligaments. Patients present with severe pain, significant swelling, and often pronounced ecchymosis. Active and passive motion are markedly limited due to pain and instability. Weight-bearing may be substantially impaired, and push-off is typically not tolerated. Stress testing may reveal joint laxity or instability, particularly in the sagittal plane, and in some cases valgus or rotational instability may be present. These injuries often require prolonged protection and, in select cases, surgical consultation.

Section 4 Key Words

Grade I Sprain - Mild stretching of the plantar structures without tearing and with minimal functional limitation

Grade II Partial Tear - Partial disruption of the plantar capsuloligamentous complex with moderate pain and functional impairment

Grade III Complete Tear - Full disruption of plantar stabilizing structures with significant pain, instability, and functional loss

Section 4 Summary

This section outlines Grade I through Grade III turf toe injuries, correlating the extent of plantar soft tissue involvement with clinical presentation, joint stability, and functional limitation. Mild injuries present with minimal swelling and preserved stability, whereas moderate injuries demonstrate partial tearing with pain and limited push-off. Severe injuries involve complete disruption of plantar stabilizers and potential instability. Accurate grading supports prognosis, guides protection and rehabilitation intensity, and informs return-to-sport decision-making.

Section 5: Case Study 1

A 20-year-old collegiate soccer player presents two days after injuring the right great toe during a cutting maneuver. The athlete reports planting the forefoot with the heel elevated when contact from another player forced the great toe into excessive dorsiflexion. Immediate plantar pain at the first metatarsophalangeal joint prevented continuation of play.

Examination reveals moderate plantar swelling and localized ecchymosis. There is tenderness along the plantar joint line, pain with dorsiflexion, and discomfort with resisted great toe flexion. Gait demonstrates reduced push-off on the involved side. Mild sagittal plane laxity is present without gross instability. Findings are most consistent with a Grade II turf toe injury.

Reflection Questions

1. What aspects of the mechanism of injury are consistent with turf toe?
2. Which clinical findings support classification as a Grade II injury?
3. What initial rehabilitation priorities should guide early management?

Responses

1. The mechanism involves axial loading with forced hyperextension of a planted forefoot, which is characteristic of turf toe.
2. Moderate swelling, ecchymosis, pain with push-off, and mild laxity indicate partial tearing consistent with Grade II severity rather than mild stretching or complete disruption.
3. Early management should focus on protecting the plantar structures, limiting excessive dorsiflexion, controlling swelling, and gradually restoring pain-free mobility and strength before progressing to higher-level activities.

Section 6: Differential Diagnosis Compared to Other Great Toe Injuries

Because several great toe conditions present with plantar pain, swelling, and difficulty with push-off, accurate differential diagnosis is essential to ensure appropriate management and referral when indicated. Careful consideration of mechanism of injury, symptom behavior, location of tenderness, and response to stress testing helps distinguish turf toe from other common pathologies affecting the first metatarsophalangeal joint and surrounding structures.

Sesamoid Injury

References: 8

Sesamoid injuries include sesamoiditis, stress reactions, and acute fractures of the medial or lateral sesamoid. Patients typically report plantar pain localized directly beneath the first metatarsal head rather than along the plantar joint line. Pain is often aggravated by weight-bearing and forefoot loading but may not involve a clear hyperextension mechanism. Palpation directly over the sesamoids reproduces symptoms, and pain may increase with resisted flexor hallucis brevis activation. Unlike turf toe, passive dorsiflexion of the great toe may not produce significant capsular discomfort unless secondary irritation is present. Imaging may be indicated if fracture is suspected or if symptoms persist despite conservative care.

Hallux Rigidus

References: 9

Hallux rigidus is a degenerative condition characterized by progressive osteoarthritic changes at the first metatarsophalangeal joint. Patients commonly report gradual onset of dorsal joint pain and stiffness rather than an acute hyperextension event. Clinical findings include reduced dorsiflexion range of motion with a firm or bony end feel, dorsal joint tenderness, and possible osteophyte formation. Swelling is typically mild and chronic rather than acute. Unlike turf toe, hallux rigidus is associated with mechanical restriction due to joint degeneration rather than plantar soft tissue disruption. Radiographic evaluation often demonstrates joint space narrowing and osteophytes.

Tendinopathy and Fracture Considerations

References: 10

Flexor hallucis longus tendinopathy may present with plantar or medial great toe pain that increases with resisted toe flexion and repetitive loading activities. Symptoms are often activity-related and progressive rather than associated with a single traumatic event. Palpation along the tendon course may reproduce discomfort proximally into the midfoot. Phalangeal or metatarsal fractures should be suspected when there is significant swelling, deformity, focal bony tenderness, or inability to bear weight. A clear traumatic mechanism with high-force impact increases suspicion for fracture. Red flags such as severe instability, neurovascular compromise, or unremitting pain warrant prompt imaging and referral.

Section 6 Key Words

Differential Diagnosis - The clinical process of distinguishing one condition from others with similar presentation through history, examination, and diagnostic testing

Sesamoiditis - Inflammatory or stress-related pathology affecting the sesamoid bones beneath the first metatarsal head

Section 6 Summary

This section compares turf toe with other common great toe conditions, including sesamoid injuries, hallux rigidus, tendinopathy, and fractures. Distinguishing features include mechanism of injury, symptom onset, location of tenderness, range of motion findings, and presence of instability. Accurate differential diagnosis supports appropriate management, timely referral when indicated, and improved patient outcomes.

Section 7: Physical Therapy Examination and Testing

A structured physical therapy examination is essential to confirm the diagnosis of turf toe, determine injury grade, identify contributing impairments, and establish objective baseline measures for progression and return-to-sport decision-making. Examination findings should correlate with the reported mechanism of injury, symptom behavior, and functional limitations. Consistent reassessment throughout rehabilitation allows for appropriate load advancement while minimizing reinjury risk.

Subjective Examination

References: 11

The subjective examination begins with a detailed history of the mechanism of injury, including whether the great toe was forced into hyperextension under axial load. Clarification of timing, onset, and immediate functional impact is important for differentiating acute sprain from chronic or degenerative conditions. Patients

should be asked about location of pain, presence of swelling or bruising, weight-bearing tolerance, and changes in gait or sport performance.

Symptom irritability, aggravating and easing factors, and prior history of great toe or forefoot injury provide insight into injury severity and potential risk factors. Information regarding footwear, playing surface, and recent changes in training volume further supports clinical reasoning.

Objective Examination

References: 11

Observation begins with comparison of both feet in weight-bearing and non-weight-bearing positions. Swelling, ecchymosis, and resting alignment of the first metatarsophalangeal joint are noted. The presence of plantar bruising may indicate more significant plantar plate involvement. Gait analysis focuses on terminal stance mechanics, noting reduced great toe extension, shortened step length, or lateral forefoot offloading.

Palpation is performed systematically along the plantar joint line, medial and lateral collateral ligaments, sesamoid complex, and dorsal capsule. Point tenderness localized to the plantar plate region supports turf toe diagnosis, whereas focal tenderness directly over a sesamoid may suggest sesamoid pathology. Palpation should also assess temperature, tissue thickening, and crepitus if present.

Active and passive range of motion of the first metatarsophalangeal joint are measured using goniometry when appropriate, with particular attention to dorsiflexion in both non-weight-bearing and weight-bearing conditions. Pain, end feel, and asymmetry compared to the contralateral side are documented. Painful end-range dorsiflexion with a soft or empty end feel may indicate capsular or

ligamentous compromise, whereas a firm bony end feel may suggest degenerative restriction.

Resisted isometric testing of great toe flexion assesses the flexor hallucis brevis and longus. Pain or weakness during resisted flexion may indicate involvement of the plantar structures or dynamic stabilizers. Joint stability testing includes sagittal plane dorsal translation of the proximal phalanx relative to the metatarsal head to assess capsuloligamentous integrity. Varus and valgus stress testing may be performed to evaluate collateral ligament involvement. Increased laxity compared to the uninvolved side suggests higher-grade injury. Neurovascular status should be screened when trauma is significant. If fracture is suspected due to focal bony tenderness, deformity, or inability to bear weight, referral for imaging is warranted.

Functional Testing

References: 12

Functional assessment evaluates load tolerance, propulsion capacity, and dynamic stability. Early-stage testing may include controlled bilateral heel raises to assess tolerance to forefoot loading. Progression to single-leg heel raises allows evaluation of strength symmetry and symptom provocation. Pain or inability to complete repetitions indicates insufficient load tolerance.

Weight-bearing dorsiflexion testing of the great toe during forward lunging can assess functional extension capacity required for gait. Step-down tests evaluate eccentric control and forefoot loading under controlled descent. Balance assessment, including single-leg stance on stable and unstable surfaces, provides insight into neuromuscular control and intrinsic foot muscle activation.

For athletic populations, graded return-to-running protocols are introduced once pain-free walking and heel raises are achieved. Jogging progression is followed by acceleration drills, cutting maneuvers, and sport-specific tasks. Plyometric testing such as low-level hopping or bounding may be used to assess tolerance to rapid loading and propulsion demands. Objective comparison of strength, range of motion, and task performance with the uninvolved side helps determine readiness for full participation. Symptom response during and after testing guides progression decisions.

Section 7 Key Words

Stress Testing - Manual application of directional force to a joint to assess capsuloligamentous integrity and detect laxity or instability

Propulsion - The push-off phase of gait during which the first metatarsophalangeal joint dorsiflexes and transmits force for forward movement

Section 7 Summary

This section outlines a detailed and systematic examination approach for turf toe, incorporating subjective history, targeted objective assessment, and progressive functional testing. Objective measures include observation, palpation, goniometric range of motion assessment, resisted testing, and joint stability evaluation to determine injury grade and tissue involvement. Functional testing progresses from basic weight-bearing tasks to sport-specific activities, emphasizing push-off mechanics and load tolerance. A structured and specific examination framework enhances diagnostic accuracy, guides individualized rehabilitation planning, and supports safe return to activity.

Section 8: Treatment Protocols for Each Grade of Injury

Rehabilitation strategies for turf toe must align with the degree of plantar soft tissue disruption, current symptom irritability, and the functional demands of the individual. Interventions should respect tissue healing timelines while progressively restoring mobility, strength, stability, and propulsion capacity. Objective criteria rather than time alone should guide progression across phases of care.

Grade I Rehabilitation

References: 6

Grade I injuries involve mild stretching of the plantar capsuloligamentous structures without instability. During the acute phase, typically days 1 through 5, management emphasizes relative rest, protection from excessive dorsiflexion, and edema control. Rigid taping techniques, stiff-soled footwear, or carbon fiber inserts may be used to limit end-range dorsiflexion during gait. Pain-free active range of motion exercises are initiated early to prevent stiffness.

During the subacute phase, approximately days 5 through 14, progressive strengthening of the intrinsic foot musculature and great toe flexors is introduced. Double-leg heel raises, controlled lunges, and balance training are incorporated as tolerated. Gentle joint mobilization may be used to maintain accessory motion if not provoking symptoms.

By weeks 2 to 3, most individuals can progress to jogging and light sport-specific drills if pain-free gait and near-symmetric range of motion are restored. Full return to sport often occurs within 2 to 4 weeks, provided the athlete demonstrates pain-free propulsion, strength symmetry, and no instability.

Grade II Rehabilitation

References: 6

Grade II injuries involve partial tearing and require a more protective early phase. During the acute phase, typically weeks 0 to 2, immobilization in a walking boot or use of a stiff-soled shoe is often recommended to limit dorsiflexion stress. Weight-bearing is allowed as tolerated but may be modified. Edema control, pain modulation, and protected active range of motion within symptom-free limits are emphasized.

During weeks 2 to 4, gradual reintroduction of dorsiflexion mobility is initiated, avoiding aggressive end-range stretching. Intrinsic foot strengthening, isometric and then isotonic great toe flexion, and progressive heel raise exercises are introduced. Balance and proprioceptive training begin once weight-bearing is comfortable.

Between weeks 4 and 6, progression to jogging, controlled acceleration, and directional drills may begin if the patient demonstrates adequate strength, range of motion, and joint stability. Plyometric progression typically occurs around weeks 6 to 8, depending on sport demands. Return to full sport participation often occurs within 6 to 8 weeks, though some athletes may require up to 10 weeks depending on severity and sport intensity.

Grade III Rehabilitation

References: 6

Grade III injuries involve complete disruption of the plantar capsuloligamentous complex and may require prolonged immobilization or surgical consultation. During the acute phase, typically weeks 0 to 3 or longer depending on severity,

immobilization in a walking boot and limitation of dorsiflexion stress are common. Weight-bearing may be restricted initially based on pain and instability.

During weeks 3 to 6, controlled range of motion exercises are gradually introduced within protected limits to prevent excessive stiffness while maintaining joint integrity. Strengthening begins with isometric activation of intrinsic and extrinsic musculature and progresses cautiously to light closed-chain loading as tolerated.

Between weeks 6 and 12, rehabilitation focuses on progressive strengthening, restoration of first ray stability, and gradual reintroduction of functional loading. Heel raise progressions, resisted propulsion drills, and balance training are emphasized. Jogging and low-level plyometrics are typically introduced after 8 to 10 weeks if objective criteria are met.

Return to high-level sport participation may require 12 weeks or longer, and in some cases 3 to 4 months, particularly if surgical intervention was required. Advancement through rehabilitation should be guided by objective clinical benchmarks, with ongoing assessment for signs of instability or unresolved pain.

Return-to-Sport Criteria

References: 6

Regardless of grade, return to sport is based on objective findings rather than time alone. Criteria include pain-free full weight-bearing, near-symmetric dorsiflexion range of motion, restoration of great toe flexor strength to at least 90 to 95 percent of the uninvolved side, and the ability to perform repeated single-leg heel raises without compensation. Athletes must tolerate progressive sprinting, cutting, and plyometric tasks without pain, swelling, or instability during or after activity. Meeting these benchmarks supports safe reintegration and reduces reinjury risk.

Section 8 Key Words

Grade III Rehabilitation - Emphasizes extended protection, gradual restoration of mobility and strength, progressive load tolerance, and criterion-based return to sport due to the presence of instability and significant tissue disruption

Return to Sport - The process of safely resuming athletic participation following achievement of objective functional criteria

Section 8 Summary

This section outlines grade-specific rehabilitation strategies for turf toe, emphasizing protection in the early phase and progressive restoration of mobility, strength, and stability as healing permits. Grade I injuries require brief protection and rapid return to controlled loading, while Grade II injuries necessitate structured offloading and gradual progression. Grade III injuries demand prolonged protection and cautious advancement based on objective findings. Return-to-sport decisions are guided by restoration of range of motion, strength symmetry, propulsion capacity, and tolerance to sport-specific demands, minimizing reinjury risk and optimizing functional outcomes.

Section 9: Case Study 2

A 22-year-old collegiate football player presents following an acute injury to the left great toe sustained during competition. The athlete reports planting the forefoot while pushing off the line of scrimmage when another player fell onto the posterior aspect of the leg, forcing the great toe into excessive dorsiflexion under axial load. The athlete experienced immediate severe plantar pain and was unable to continue play.

On examination two days post-injury, there is significant swelling and plantar ecchymosis extending along the first metatarsophalangeal joint. Palpation reveals marked tenderness over the plantar plate and medial collateral ligament. Active and passive dorsiflexion are markedly limited due to pain. Weight-bearing is painful, and the athlete demonstrates inability to perform a single-leg heel raise. Sagittal plane stress testing reveals increased dorsal translation compared to the contralateral side, suggesting instability. Imaging has ruled out fracture but confirms soft tissue disruption consistent with a complete tear of the plantar capsuloligamentous complex. Findings are consistent with a Grade III turf toe injury.

Reflection Questions

1. Which examination findings support classification as a Grade III injury?
2. What are the primary rehabilitation priorities during the first three weeks following injury?
3. What objective criteria should be met before initiating running and cutting drills?

Responses

1. Significant swelling and ecchymosis, marked limitation of motion, inability to tolerate weight-bearing propulsion, and increased sagittal plane laxity are consistent with complete disruption of the plantar stabilizing structures, supporting a Grade III classification.
2. Early rehabilitation priorities include joint protection through immobilization, limitation of dorsiflexion stress, edema control, and maintenance of mobility in adjacent joints such as the ankle and midfoot.

Weight-bearing may need to be modified, and strengthening is initially limited to protected isometric activation to preserve muscle function without stressing healing tissues.

3. Prior to initiating running and cutting drills, the athlete should demonstrate pain-free full weight-bearing, near-symmetric dorsiflexion range of motion, restoration of great toe flexor strength to at least 90 percent of the uninvolved side, absence of instability with stress testing, and the ability to perform repeated single-leg heel raises without pain or compensation.

Conclusion

Effective management of turf toe requires a clear understanding of injury mechanisms, structural involvement, and functional consequences. By integrating knowledge of epidemiology, anatomy, grading, and differential diagnosis with structured examination procedures, clinicians can develop targeted and appropriate plans of care. The evidence-informed, grade-specific rehabilitation strategies presented in this course are designed to restore joint mobility, strength, dynamic stability, and functional performance while minimizing reinjury risk. Through application of these principles, physical therapists and physical therapist assistants can support safe and efficient return to sport or activity and optimize patient outcomes.

References

1. Aran F, Ponnarasu S, Scott A. Turf Toe. In: *StatPearls*. StatPearls Publishing; 2025. Accessed February 25, 2026. http://www.ncbi.nlm.nih.gov/books/NBK507810/

2. Waldrop NE. Assessment and Treatment of Sports Injuries to the First Metatarsophalangeal Joint. *Foot Ankle Clin*. 2021;26(1):1-12. doi:10.1016/j.fcl.2020.07.003

3. Ayoola AS, Jastifer JR. Metatarsophalangeal Joint Instability: Anatomy and Physiopathology. *Foot Ankle Clin*. 2024;29(4):681-690. doi:10.1016/j.fcl.2023.12.006

4. French M, Thorhauer ED, Kimura T, Sangeorzan BJ, Ledoux WR. Displacement of the Metatarsal Sesamoids in Relation to First Metatarsophalangeal Joint Extension. *Foot Ankle Orthop*. 2022;7(3):24730114221126457. doi:10.1177/24730114221126457

5. Sebag JA, Clements RC, Togher CJ, Connolly EC. The First Metatarsophalangeal Joint: Updates on Revision Arthrodesis and Malunions. *Clin Podiatr Med Surg*. 2023;40(4):569-580. doi:10.1016/j.cpm.2023.05.002

6. Gupta A, Singh PK, Xu AL, Bronheim RS, McDaniel CM, Aiyer AA. Turf Toe Injuries in the Athlete: an Updated Review of Treatment Options, Rehabilitation Protocols, and Return-to-Play Outcomes. *Curr Rev Musculoskelet Med*. 2023;16(11):563-574. doi:10.1007/s12178-023-09870-y

7. Embaby OM, Elalfy MM. First metatarsophalangeal joint: Embryology, anatomy and biomechanics. *World J Orthop*. 2025;16(4):102506. doi:10.5312/wjo.v16.i4.102506

8. Rhim HC, Tenforde AS, Saxena A, McInnis KC. Sesamoid bone stress injury: revising the diagnostic framework for sesamoiditis. *Br J Sports Med*. Published online January 14, 2026:bjsports-2025-111018. doi:10.1136/bjsports-2025-111018

9. Williams BT, Hunt KJ. Hallux Rigidus: Anatomy and Pathology. *Foot Ankle Clin*. 2024;29(3):371-387. doi:10.1016/j.fcl.2023.12.002

10. Flores DV, Goes PK, Damer A, Huang BK. The Heel Complex: Anatomy, Imaging, Pathologic Conditions, and Treatment. *Radiogr Rev Publ Radiol Soc N Am Inc*. 2024;44(4):e230163. doi:10.1148/rg.230163

11. Guide | Physical Therapy Guide to Turf Toe. Choose PT. February 23, 2021. Accessed February 25, 2026. https://www.choosept.com/guide/physical-therapy-guide-turf-toe

12. Turf Toe - OrthoInfo - AAOS. Accessed February 25, 2026. https://www.orthoinfo.org/en/diseases--conditions/turf-toe/