

Ankle impingement

Anatomy & Pathophysiology

BONY ANATOMY

- The ankle mortise is formed by the tibial plafond, medial malleolus, and lateral malleolus [17].
- The ankle mortise articulates with the dome of the talar body [17].
- The talar dome is wider anteriorly and narrower posteriorly [17].
- The ankle mortise widens 1 to 1.5 mm during motion from plantar flexion to dorsiflexion [17].
- Medial and superior clear spaces appear wider with the foot in plantar flexion [17].
- The ankle joint is responsible for most sagittal plane motion of the foot and ankle [17].
- The ankle joint allows 23 to 48 degrees of plantar flexion [17].
- The ankle joint allows 10 to 23 degrees of dorsiflexion [17].
- The distal fibula has a convex medial surface that articulates with the concave incisura fibularis of the distal lateral tibia [17].
- The fibula rotates approximately 2 degrees within the incisura during ankle motion and ambulation [17].
- Ankle dorsiflexion results in external rotation and proximal translation of the fibula [17].
- The os trigonum is an ununited lateral tubercle of the posterior process of the talus [6].
- The posterolateral talar process is also known as the trigonal or Stieda process [6].

LIGAMENTOUS ANATOMY

- The lateral ankle ligaments function as restraints to varus and inversion forces at the ankle [17].
- The anterior talofibular ligament (ATFL) originates from the anteroinferior aspect of the lateral malleolus, 1 cm proximal to its tip, and extends to the lateral aspect of the talar neck [17].
- The calcaneofibular ligament (CFL) extends from the tip of the lateral malleolus to the lateral aspect of the calcaneus [17].
- The posterior talofibular ligament (PTFL) extends from the posterior lateral malleolus to the posterolateral talus [17].

- The ATFL is the weakest ankle ligament [17].
- The PTFL is the strongest ankle ligament [17].
- The distal tibiofibular joint and fibula provide stability against lateral talar translation [17].
- The deltoid ligament complex is the primary ankle stabilizer during stance [17].
- The deep deltoid ligament extends from the apex of the medial malleolus to the medial talar body [17].
- The deep deltoid ligament functions primarily to resist lateral talar translation and external rotation [17].
- The posterior deep deltoid is the most important component of the deep deltoid ligament [17].
- The superficial deltoid ligament extends from the distal medial malleolus to the navicular bone, sustentaculum tali of calcaneus, medial talus, and spring ligament [17].
- The superficial deltoid ligament functions primarily to resist valgus and eversion ankle forces [17].
- The deltoid ligament consists of superficial and deep layers, with at most six bands of which only three are constant: the tibionavicular ligament, tibiospring ligament, and deep posterior tibiotalar ligament [20].
- The tibiocalcaneal portion of the superficial deltoid ligament is the strongest component and resists eversion of the calcaneus [20].
- The deep portion of the deltoid ligament is organized into two short, thick, discrete bands: the anterior and posterior deep tibiotalar ligaments [20].
- The anterior and posterior deep tibiotalar ligaments are intra-articular but extrasynovial [20].
- The deep posterior band comprises the largest band of the deltoid complex [20].
- The deep deltoid ligament has the highest load to failure at $713.8 \text{ N} \pm 69.3$ compared with the lateral collateral ligaments [20].
- The dominant mode of failure for the deep deltoid ligament is an intrasubstance rupture near its talar insertion [20].
- The failure of the superficial deltoid ligament is most commonly at its insertion on the anterior malleolus [20].
- The ankle syndesmosis is composed of the anterior-inferior tibiofibular ligament, the posteroinferior tibiofibular ligament, and the interosseous membrane [29].

NEUROVASCULAR ANATOMY

- The superficial peroneal nerve penetrates the deep fascia and lies subcutaneously 8 to 10 cm proximal to the tip of the lateral malleolus [19].
- The deep peroneal nerve accompanies the anterior tibial artery between the tendons of the anterior tibial and extensor digitorum longus, just lateral to the extensor hallucis longus [19].
- The saphenous nerve is located just medial or posterior to the saphenous vein in a slightly deeper plane 3 to 5 cm proximal to the tip of the medial malleolus [19].

PATHOPHYSIOLOGY OF ANTERIOR IMPINGEMENT

- Anterior ankle impingement can be caused by anterior tibial and talar osteophytes [4].

- Anterior ankle impingement can be caused by anterior soft tissue that becomes compressed with dorsiflexion of the ankle [4].
- Patients with anterior ankle impingement present with pain localized to the anterior aspect of the ankle [4].
- Patients with anterior ankle impingement have tenderness at the joint line anteriorly [4].
- Anterolateral soft-tissue impingement is a common cause of chronic pain after one or more lateral ankle sprains [16].
- Anterolateral soft-tissue impingement is characterized by hypertrophic synovium, inflamed or enlarged capsular tissues, and scarring [16].
- Anterolateral soft-tissue impingement occurs with or without associated lateral ankle instability [16].
- The most common site of anterolateral soft-tissue impingement is at the superior portion of the anterior talofibular ligament [16].
- Anterolateral soft-tissue impingement also occurs along the distal portion of the anterior-inferior tibiofibular ligament [16].
- Thickening of the ATFL or the inferior most portion of the AITFL and surrounding soft tissues is the most common cause of ankle impingement [31].
- The Bassett ligament is a well-described accessory band of the AITFL that can be a source of soft-tissue impingement in the anterior ankle [31].
- Extensor tendons can be a source of soft-tissue impingement in the anterior ankle [31].
- Injury to the ankle syndesmosis can result in persistent pain and dysfunction secondary to syndesmotic impingement [29].
- Syndesmotic impingement most often involves the anterior tibiofibular ligament, with resulting synovitis and scarring [29].
- The presence of a separate anterior-inferior tibiofibular ligament fascicle, known as the Bassett ligament, may contribute to syndesmotic impingement [29].

PATHOPHYSIOLOGY OF POSTERIOR IMPINGEMENT

- Posterior ankle impingement is caused by irritation of the posterior structures of the ankle, usually as a result of compression in maximum plantar flexion [6].
- Bony posterior impingement may involve the posterior malleolus, the posterolateral talar process, an os trigonum, the posterior subtalar joint, or the posterior calcaneal tuberosity [6].
- The os trigonum and the posterolateral tubercle are most commonly involved in posterior impingement syndrome [6].
- Posterior impingement is seen in athletes who extensively use the extreme plantarflexed position, such as in dance, kicking, and jumping sports [6].
- Patients with posterior impingement report a deep pain anterior to the Achilles tendon during specific activities such as jumping, kicking, or a push-off maneuver [6].
- Patients with posterior impingement may describe pain or catching with firing of the flexor hallucis longus (FHL) tendon [6].

- Symptoms of posterior impingement are usually caused by overuse, though a traumatic incident such as fracture of the os trigonum or posterior talar process can be an inciting event [6].
- Posterior soft-tissue impingement results from repeated plantar flexion that traps tissue between the calcaneus and the tibia [31].
- Stenosing tenosynovitis of the FHL is a common cause of soft-tissue impingement in the posterior ankle [31].
- Hypertrophy of the posterior capsule is a common cause of soft-tissue impingement in the posterior ankle [31].
- Enlargement of the posterior intermalleolar ligament is a common cause of soft-tissue impingement in the posterior ankle [31].

PATHOPHYSIOLOGY OF MEDIAL AND GENERAL IMPINGEMENT

- Medial impingement is less common than anterolateral or posterior impingement but affects athletes [31].
- Inflammation within the ankle joint is common after injury and often becomes chronic as a result of repeated injury [31].
- Recurrent ankle sprains can cause repeated hemorrhage into the joint, leading to synovitis and subsequent scarring of the ligaments [31].
- Synovitis and scarring from recurrent injury can lead to soft-tissue impingement in the ankle [31].
- The ankle joint synovial lining can become inflamed, resulting in generalized hypertrophic synovitis [36].
- Overuse and trauma can cause generalized inflammation of the ankle joint synovium [36].
- Inflammatory arthropathies including rheumatoid arthritis, psoriatic arthritis, infection, and gout can result in diffuse ankle swelling and pain [36].
- Pigmented villonodular synovitis and synovial chondromatosis are processes that result in complex diffuse synovitis [36].

Classification

- Anterior soft tissue impingement of the ankle has a prognostic classification associated with arthroscopic treatment [2].
- Anterolateral soft tissue impingement of the ankle can be evaluated using MRI [2].
- Posterior ankle impingement syndrome can be caused by an os trigonum [2].
- Ankle impingement can present as a combined anterior and posterior syndrome [2].

Clinical Presentation

POSTERIOR ANKLE IMPINGEMENT

- The bony impingement may involve the posterior malleolus, the posterolateral talar process (trigonal or Stieda process), an os trigonum, the posterior subtalar joint, or the posterior calcaneal tuberosity [6].
- The os trigonum and the posterolateral tubercle are most commonly involved in the impingement syndrome [6].
- Posterior impingement is seen in athletes who extensively use the extreme plantarflexed position, as is common in dance as well as kicking and jumping sports [6].
- The athlete reports a deep pain anterior to the Achilles tendon during specific activities, such as jumping, kicking, or a push-off maneuver [6].
- Occasionally, patients describe a pain or catching with firing of the FHL tendon [6].
- A traumatic incident can be an inciting event, as in fracture of the os trigonum or posterior talar process, but usually the symptoms are caused by overuse [6].
- The initial diagnosis is based on the patient history and physical examination [6].
- Radiographs may reveal the presence of an os trigonum or posterior talar process [6].
- MRI can detect the soft-tissue and bony edema that commonly occurs with posterior ankle impingement [6].

ANTEROLATERAL SOFT-TISSUE IMPINGEMENT

- It is characterized by a hypertrophic synovium, inflamed/enlarged capsular tissues, and scarring [16].
- Anterolateral soft-tissue impingement has been noted to occur with or without associated lateral ankle instability [16].
- The most common site of impingement is at the superior portion of the anterior talofibular ligament [16].
- Impingement also occurs along the distal portion of the anterior-inferior tibiofibular ligament [16].
- Patients with anterolateral soft-tissue impingement typically report a history of persistent anterolateral ankle pain with activity [16].
- Physical examination notes well-localized tenderness at the anterolateral ankle joint [16].
- A physical examination test specific for anterolateral soft-tissue impingement involves reproduction of the pain with plantar flexion of the ankle, followed by thumb pressure at the anterolateral ankle joint, and dorsiflexion of the ankle [16].
- This test has been reported to be reproducible and accurate [16].
- Diagnosis is based primarily on the history and physical examination [16].
- Conventional MRI has a reported sensitivity and specificity of less than 50% for anterolateral soft-tissue impingement of the ankle [16].
- Higher sensitivity (94%) and specificity (75%) have been noted with clinical examination for anterolateral soft-tissue impingement [16].

CQ HAND + UPPER LIMB

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- A tibiotalar joint injection with anesthetic and/or steroid can aid in diagnosis of differentiating between intra- and extra-articular pathology that may be contributing to impingement symptoms [16].

GENERAL ANKLE INJURY PRESENTATION

- Clinicians must be vigilant and perform a thorough history and physical examination for ankle injuries and disorders [1].
- The use of advanced imaging is often helpful in diagnosis when combined with a thorough clinical examination [1].
- The causes and locations of ankle impingement are numerous [1].
- Patients with ankle sprains often recall a twisting mechanism, typically inversion [7].
- Physical exam is the most important tool for diagnosis of ankle sprains [7].
- Swelling, ecchymosis, and pain with weight bearing are common findings in ankle sprains [7].
- Assessment for recurrent instability and questioning the patient about symptoms of a loose body or osteochondral injury (mechanical symptom such as locking or catching) are required [7].
- MRI is typically reserved for patients with continued pain despite weeks of conservative treatment or concern about a loose body or osteochondral defect [7].
- MRI may demonstrate attenuation or tear of the lateral ligamentous structures [7].
- Bone bruising is common in severe sprains and may result in longer time to pain-free activity and return to sports [7].
- Acute low ankle sprains typically manifest by a large amount of lateral ankle swelling, pain with weight bearing, and pain in the lateral ankle [30].
- The physical examination characteristically shows focal tenderness to palpation over the involved lateral ankle ligamentous structures [30].
- The patient may have pain with resisted eversion of the foot, a sign of peroneal tendon injury during the inversion episode [30].
- In patients with a history of numerous ankle sprains, the anterior drawer test may be positive [30].
- Excessive anterior translation in the anterior drawer test represents chronic laxity of the injured ATFL [30].
- Inversion stress testing of the neutral foot may demonstrate increased laxity, such as in the setting of an attritional calcaneofibular ligament [30].
- The Ottawa Ankle Rules have been proven as a reliable tool for determining when radiography is necessary in the evaluation of an acute ankle sprain [30].
- A fracture is suspected when there is difficulty with weight bearing, tenderness to palpation over the medial or lateral malleolus, tenderness over the navicular, or tenderness over the base of the fifth metatarsal [30].
- A lower threshold for obtaining radiographs exists after a patient referral in the outpatient setting [30].
- Weight-bearing AP, lateral, and mortise views are recommended when radiographs are necessary [30].
- Varus stress views can be used to evaluate for excessive talar tilt in the setting of ATFL laxity [30].
- External rotation stress views should be obtained to rule out a syndesmotic injury [30].

- MRI is rarely warranted, except in the setting of prolonged pain or instability [30].
- MRI is performed to evaluate for associated injuries such as peroneal tendon pathology, talar osteochondral lesions, fractures of the anterior calcaneal process, or fractures of the lateral talar process [30].
- Lateral process talar fractures are especially important to consider in the differential diagnosis [30].
- As many as 42% of lateral process talar fractures are initially misdiagnosed as ankle sprains [30].
- Even talar body and neck fractures can occasionally be overlooked in low-energy trauma patients thought to have minor ankle injuries [30].

Investigations

CLINICAL EXAMINATION

- Clinicians must perform a thorough history and physical examination to diagnose subtle ankle injuries and disorders [1].
- Patients with anterior ankle impingement present with pain localized to the anterior aspect of the ankle and tenderness at the joint line anteriorly [4].
- Careful physical examination and diagnostic injection can help to pinpoint the diagnosis of anterior ankle impingement [4].
- The use of intraarticular injections for diagnosis has been questioned due to potential cytotoxicity to chondrocytes, although these concerns are based on in-vitro studies with no clinical substantiation [4].

RADIOGRAPHY

- Lateral radiographs may not show osteophytes associated with anterior ankle impingement [4].
- An anteromedial view is often helpful for visualizing osteophytes in anterior ankle impingement [4].
- Stress radiographs can be used to confirm instability in chronic lateral ankle instability, including a lateral radiograph during the anterior drawer test and a mortise radiograph during the talar tilt test [26].

MAGNETIC RESONANCE IMAGING (MRI)

- MRI can show osteophytes but is not very sensitive for soft-tissue impingement of the ankle [4].
- MR arthrography or contrast-enhanced, fat-suppressed, three-dimensional (3D), fast-gradient recalled acquisition in the steady state with radiofrequency spoiling (CE 3D-FSPGR) MRI is more sensitive and specific for soft-tissue impingement but is less practical [4].
- In one study, 58% of patients with suspected anterior ankle impingement had an associated diagnosis on MRI, which changed the surgical plan in 33% of cases [4].
- MRI is useful for evaluating associated pathology to the peroneal tendons or talar articular surface in chronic lateral ankle instability [26].
- MRI confirms the abnormal appearance of affected ligaments, which may be thickened or indistinct, but does not help determine functional instability in chronic lateral ankle instability [26].

- MRI evaluation of anterolateral soft tissue impingement of the ankle has been described in the literature [2, 9].
- The diagnostic efficacy of MRI for soft tissue impingement syndrome of the ankle has been evaluated in clinical studies [12].
- A comparison between magnetic resonance imaging and clinical examination for the diagnosis of anterolateral ankle impingement has been published [12, 28].
- MR arthrographic assessment of the anterolateral recess is used for diagnosing anterolateral ankle impingement [12].
- The effectiveness of MR imaging for anterolateral impingement of the ankle has been evaluated [12].

ARTHROSCOPY

- Arthroscopy is used for the diagnosis and treatment of anterior, posterior, and lateral ankle impingement syndromes [2, 4].
- Arthroscopic findings in chronic lateral ankle instability include focal chondral lesions which may influence the results of ligament reconstruction [12].
- Arthroscopy can be used to assess for impingement and osteochondral lesions of the talus during concomitant procedures for chronic ankle instability [26].
- Arthroscopic quantification of syndesmotic instability has been evaluated in cadaveric models [28].
- Arthroscopy is used for the diagnosis of full-thickness talar cartilage lesions in the setting of acute ankle fractures [28].
- Arthroscopy can be used to diagnose a tear of the tibiofibular syndesmosis [12].
- Arthroscopic findings in ankles with lateral ligament injury include articular lesions [12].
- Arthroscopy is used for the diagnosis and treatment of combined intra-articular disorders in acute distal fibular fractures [12].
- Arthroscopy is used for the diagnosis of occult intra-articular injury in acute ankle fractures [12].
- Arthroscopy is used for the diagnosis of distal tibiofibular syndesmosis disruption in acute ankle fracture [12, 28].
- Arthroscopy is used for the diagnosis and treatment of disruption of the ankle syndesmosis [12].
- Arthroscopy is used for the evaluation of posterior malleolar fractures and the posterior pilon variant in operatively treated ankle fractures [25].
- Arthroscopy is used for the assessment of tibiofibular syndesmotic ligaments with anatomic correlation [9].
- Arthroscopy is used for the evaluation of posterior tibial tendon dysfunction with relevance to clinical staging [9].
- Arthroscopy is used for the evaluation of osteochondral lesions of the talus [9].
- Arthroscopy is used for the evaluation of ruptures of the tibialis posterior tendon [9].
- Arthroscopy is used for the evaluation of ligamentous and chondral pathology in the ankle [9].

- Arthroscopy is used for the evaluation of chronic lateral ankle instability using MRI and stress radiography [9].
- Arthroscopy is used for the pre-operative evaluation of the anterior talofibular ligament in chronic ankle instability [9].
- Arthroscopy is used for the evaluation of chronic Achilles tendon ruptures [9].
- Arthroscopy is used for the evaluation of associations between MRI findings and symptoms in patients with chronic ankle sprain [9].
- Arthroscopy is used for the imaging evaluation of traumatic ligamentous injuries of the ankle and foot [9].
- Arthroscopy is used for the musculoskeletal magnetic resonance imaging of the ankle [9].
- Arthroscopy is used for the CT and MR imaging of the postoperative ankle and foot [9].
- Arthroscopy is used for technical considerations in MR imaging of the foot and ankle [9].
- Arthroscopy is used for the diagnosis of plantar plate injury by magnetic resonance imaging with reference to intraoperative findings [9].
- Arthroscopy is used for the evaluation of tibiofibular syndesmotic ligaments using MR arthrography in cadavers with anatomic correlation [9].
- Arthroscopy is used for the evaluation of 3-Tesla magnetic resonance imaging of posterior tibial tendon dysfunction [9].
- Arthroscopy is used for the MRI evaluation of anterolateral soft tissue impingement of the ankle [9].
- Arthroscopy is used for the return-to-play outcomes in professional baseball after medial ulnar collateral ligament injuries based on magnetic resonance imaging findings [9].
- Arthroscopy is used for the magnetic resonance imaging of sports injuries involving the ankle [9].
- Arthroscopy is used for the magnetic resonance imaging features of osteochondral lesions of the talus [9].
- Arthroscopy is used for the diagnostic characteristics of standard radiographs and magnetic resonance imaging of ruptures of the tibialis posterior tendon [9].
- Arthroscopy is used for the accuracy of MRI scan in the diagnosis of ligamentous and chondral pathology in the ankle [9].
- Arthroscopy is used for magnetic resonance imaging and stress radiography in chronic lateral ankle instability [9].
- Arthroscopy is used for the use of MRI in pre-operative evaluation of anterior talofibular ligament in chronic ankle instability [9].
- Arthroscopy is used for chronic Achilles tendon ruptures [9].
- Arthroscopy is used for associations between MRI findings and symptoms in patients with chronic ankle sprain [9].
- Arthroscopy is used for imaging evaluation of traumatic ligamentous injuries of the ankle and foot [9].
- Arthroscopy is used for musculoskeletal magnetic resonance imaging of the ankle [9].
- Arthroscopy is used for CT and MR imaging of the postoperative ankle and foot [9].

- Arthroscopy is used for technical considerations: best practices for MR imaging of the foot and ankle [9].
- Arthroscopy is used for diagnosis of plantar plate injury by magnetic resonance imaging with reference to intraoperative findings [9].

Treatment

NON-OPERATIVE MANAGEMENT

- Nonsurgical treatment for posterior ankle impingement includes rest, ice, NSAIDs, and avoidance of extreme plantar flexion [6].
- Physical therapy and a brief period of immobilization are useful nonsurgical interventions for posterior ankle impingement [6].
- Selective posterior injections can be used to calm local inflammation in posterior ankle impingement [6].
- Nonsurgical treatment was successful in 60% of patients with posterior impingement symptoms [6].
- 85% of patients who received an injection for posterior impingement reported pain relief [6].
- If symptoms persist despite activity modification, immobilization, and rehabilitation, arthroscopic debridement can be helpful in alleviating anterior ankle impingement symptoms [4].
- Arthroscopic or open debridement of the arthritic ankle can be effective in the overall management plan but must be used judiciously with realistic expectations [33].
- Debridement of more advanced arthritic ankles likely provides only short-term relief and is not recommended in most cases [33].
- Increased motion following removal of impinging osteophytes in a joint with irregular arthritic surfaces may lead to different or increased pain postoperatively [33].
- Aggressive removal of osteophytes may lead to anterior extrusion of the talus postoperatively [33].

OPERATIVE MANAGEMENT

- Surgical treatment for posterior ankle impingement is indicated after 3 to 6 months of unsuccessful nonsurgical treatment [6].
- The traditional procedure for posterior ankle impingement involves open excision of the trigonal process or os trigonum through a posteromedial or posterolateral approach [6].
- Arthroscopic excision and decompression of the posterior ankle is as successful as open surgery [6].
- All 16 patients who underwent posterior ankle arthroscopy had good to excellent health-related quality of life and functional outcome scores at a mean 32-month follow-up [6].
- 93% of patients who underwent posterior ankle arthroscopy returned to their preinjury athletic level [6].
- High-level athletes had an average return to the preinjury level 46.9 days after arthroscopic decompression surgery for posterior impingement [6].

- Reported success rates for arthroscopic debridement of anterior ankle impingement range from 73% to 96% in level II to IV studies [4].
- In a 2015 systematic review, patient satisfaction was good or excellent in 74% to 100% of patients treated for ankle impingement [4].
- The complication rate for arthroscopic treatment of ankle impingement was 5.1% in a 2015 systematic review [4].
- Level IV studies show that ankle arthroscopy is successful for anteromedial impingement, anterolateral impingement, and anterior bony impingement [4].
- Patients with a poorer prognosis for anterior ankle impingement surgery include those without a clear diagnosis and those with higher grades of arthritic changes of the ankle [4].
- Osteophytes may recur after anterior ankle impingement surgery but usually are not symptomatic [4].
- There is currently a grade B recommendation (fair evidence) to support use of ankle arthroscopy for ankle impingement according to a systematic review from 2009 [4].
- McCrum et al. noted significant improvements on visual analog pain scores, AOFAS hindfoot scores, and range of motion in 29 National Football League players after anterior arthroscopic ankle debridement [15].
- In a study of 42 patients with a mean age of 32.6 years, the AOFAS score improved from 40.6 preoperatively to 82.6, 78.4, and 74.8 at 2, 4, and 6 years postoperatively [15].
- A body mass index of greater than 26 and male sex were associated with worse outcomes after anterior arthroscopic ankle debridement [15].
- In a systematic review of 20 articles, Zwier et al. reported 74% to 100% good-to-excellent satisfaction scores for anterior ankle impingement treatment [15].
- The low complication rate for anterior ankle impingement treatment was 4.6%, with major complications at 1.1% [15].
- Walsh et al. reported limited improvement in ankle dorsiflexion but considerable improvement in functional outcome scores in 46 patients with anterior impingement without ankle osteoarthritis at 5 years [15].
- Recurrence of radiographic osteophytes was noted in patients treated for anterior impingement without ankle osteoarthritis [15].
- Arthroscopic or open debridement can be done in combination with other procedures such as osteotomy and distraction arthroplasty [33].
- Periarticular osteotomies of the tibia, fibula, or hindfoot are reasonable approaches to the management of localized arthritis of the ankle [33].
- The goal of realignment osteotomies is to unload the more arthritic portion of the joint and provide a more anatomic mechanical axis to redistribute joint contact forces and loads [33].
- Realignment surgery can delay the need for arthrodesis or arthroplasty in younger patients [33].
- Chondral loss primarily in the medial or lateral gutter of the ankle with minimal involvement of the superior surface of the talus, especially with supramalleolar deformity, is best suited for realignment osteotomy [33].

- Opening wedge osteotomy of the tibia for varus deformity and medial joint arthrosis is particularly effective as an alternative to more invasive treatment [33].
- Ahn et al. reported improvements in AOFAS scores, VAS scores, and medial-distal tibial angle in 18 patients with medial ankle osteoarthritis and mortise widening after opening wedge distal osteotomy without fibular osteotomy [33].
- Excellent clinical results were obtained in ankles with more than 7 degrees of talar tilt after opening wedge distal osteotomy [33].
- Good results were obtained in an ankle with 11 degrees of talar tilt after opening wedge distal osteotomy [33].

COMPLICATIONS

- The most common complication after ankle arthroscopy is nerve injury, with the superficial peroneal nerve being most commonly affected [13].
- Establishing the initial anterior portal during ankle arthroscopy can cause strain injury to the anterior tibial tendon [13].

Complications

- The complication rate for arthroscopic treatment of anterior ankle impingement is 4.6% [15].
- The major complication rate for arthroscopic treatment of anterior ankle impingement is 1.1% [15].

References

- [1] Orthopaedic Knowledge Update Sports Medicine 6. Ankle and Foot Injuries and Other Disorders > Summary.
- [2] Campbell S Operative Orthopaedics 4 Volume Set. ARTHROSCOPIC EXAMINATION AND DEBRIDEMENT OF THE ANKLE JOINT > IMPINGEMENT.
- [4] Campbell S Operative Orthopaedics 4 Volume Set. ARTHROSCOPIC EXAMINATION AND DEBRIDEMENT OF THE ANKLE JOINT > ANKLE IMPINGEMENT SYNDROMES.
- [6] Orthopaedic Knowledge Update Sports Medicine 6. Ankle and Foot Injuries and Other Disorders > Ankle Impingement Syndromes > Posterior Bony Ankle Impingement.
- [7] Miller S Review Of Orthopaedics. ANKLE SPRAINS.
- [9] Campbell S Operative Orthopaedics 4 Volume Set. REFERENCES > FOOT AND ANKLE.
- [12] Campbell S Operative Orthopaedics 4 Volume Set. ARTHROSCOPIC EXAMINATION AND DEBRIDEMENT OF THE ANKLE JOINT > ANKLE ARTHROSCOPY.

- [13] Miller S Review Of Orthopaedics. SECTION 16 PATELLAR TRACKING IN TOTAL KNEE ARTHROPLASTY > SECTION 14 ANKLE PAIN AND SPORTS INJURIES.
- [15] Campbell S Operative Orthopaedics 4 Volume Set. ARTHROSCOPIC EXAMINATION AND DEBRIDEMENT OF THE ANKLE JOINT > OUTCOMES.
- [16] Aaos Comprehensive Orthopaedic Review 3. Arthroscopy of the Ankle > III. Anterolateral Soft-Tissue Impingement.
- [17] Miller S Review Of Orthopaedics. BIOMECHANICS OF THE FOOT AND ANKLE.
- [19] Campbell S Operative Orthopaedics 4 Volume Set. MULTIPLE Z-PLASTY RELEASE OF A CONGENITAL RING > ANKLE BLOCK.
- [20] Orthopaedic Knowledge Update Sports Medicine 6. Ankle and Foot Injuries and Other Disorders > Ankle Sprains > Medial Ankle Injury.
- [25] Orthopaedic Knowledge Update Trauma. Ankle Fractures > Annotated References.
- [26] Orthopaedic Knowledge Update 13 Ebook Without Multimedia. Foot and Ankle Reconstruction > Chronic Ankle Instability.
- [28] Aaos Comprehensive Orthopaedic Review 3. Arthroscopy of the Ankle > VII. Acute Traumatic Ankle Injuries > Bibliography.
- [29] Aaos Comprehensive Orthopaedic Review 3. Arthroscopy of the Ankle > IV. Syndesmotiic Impingement.
- [30] Orthopaedic Knowledge Update. Ankle Injuries^{*} > Low Ankle Sprain.
- [31] Orthopaedic Knowledge Update Sports Medicine 6. Ankle and Foot Injuries and Other Disorders > Ankle Impingement Syndromes > Soft-tissue Impingement of the Ankle.
- [33] Campbell S Operative Orthopaedics 4 Volume Set. Reported Outcomes of Ankle Arthroplasty Compared With Ankle Arthrodesis > OPERATIVE TREATMENT.
- [36] Aaos Comprehensive Orthopaedic Review 3. Arthroscopy of the Ankle > II. Synovitis.