Chapter 11
Anterior Ankle Impingement

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Football is like life: pure art with little pure artists.

Herman Brusselmans
Writer

Abstract The anterior ankle impingement syndrome is the most common cause of chronic ankle pain in football players. It is characterized by anterior ankle pain on forced dorsiflexion movements. Clinical investigation reveals pain on palpation along the anterolateral and/or anteromedial ankle joint line. There is recognizable pain on forced dorsiflexion which is limited as compared to the contralateral side. In patients with anteromedial impingement, the plain X-rays are often negative and are therefore insufficient. An additional oblique view is required for visualization of the anteromedial osteophytes. The effectiveness of conservative treatment has not yet

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been well documented. After conservative treatment fails, an arthroscopic intervention is the treatment of choice for professional football players. Arthroscopic excision of soft tissue and/or the bony impediment is known to be successful in the players without signs of joint space narrowing. The majority of professional football players will return to their former level within 2 months after surgery.

Keywords Anterior impingement • Ankle • Football

11.1 Introduction Including Epidemiology

Anterior ankle impingement syndrome is the most common cause of chronic ankle pain in football players. The overall percentage of ankle injuries in elite football is 19 % [10], but the exact prevalence and incidence for anterior ankle impingement has not been documented. The typical clinical features are anteriorly located ankle pain, which increases with forced hyper dorsiflexion. The cause can either be soft tissue or bony impingement. In literature, the first authors describing bony impingement lesions in the ankle were Morris [13] and McMurray and classified this pathology as "athlete's" ankle or "footballer's" ankle. In recent literature, these terms have been replaced by the anterior ankle impingement syndrome [18, 22, 25].

11.2 Functional Anatomy

As for any pathology, anatomical knowledge is essential in the understanding and treatment of this pathology. Some believe that the traction spurs (osteophytes) originate due to recurrent capsular traction at the attachment sites at the distal tibia and talus.

Probably the anterior ankle pain is caused by the soft tissues being compressed in between the distal tibia and talus during forced dorsiflexion movements.

In specimens, the anterior joint capsule inserts in the distal tibia on an average of 6 mm proximal to the anterior tibial cartilage rim. On the talar site, the capsule inserts approximately 3 mm from the distal talar cartilage border [23]. Based on these anatomic observations, the hypothesis of formation of talotibial spurs due to recurrent traction to the joint capsule (traction spurs) is not likely to be true. In patients with bony impingement, the location of tibial spurs is reported to be at the joint level and within the confines of the joint capsule [26]. Along the distal tibia, the width of the non-weight-bearing cartilage rim extends up to 3 mm proximal to the joint line. It is this non-weight-bearing anterior cartilage rim that undergoes the osteophytic transformation. On the talar side, the typical osteophytes are found proximal to the talar neck notch [22].

11.3 Etiology and Injury Mechanism

In the ankle, osteophytes typically originate at the site of the non-weight-bearing cartilage, without pathologic changes of the weight-bearing ankle articular cartilage. It should therefore be differentiated from osteoarthritis.

In football players, the ankle osteophytes are a manifestation of repetitive trauma in combination with recurrent kicking of the ball [21]. The cause of the pain is most probably the inflamed and increased amount of soft tissue in the anterior ankle compartment which is squeezed in between the osteophytes during dorsiflexion, causing an impingement [26]. Typically in football players, pain is experienced on kicking, when the anterior capsule is stretched over the tibial and talar osteophytes. Recurrent trauma to this soft tissue component may lead to hypertrophy of the synovial layer, subsynovial fibrotic tissue formation, and infiltration of inflammatory cells.

11.4 Clinical Features

The typical symptomatic player will present with a history of previous ankle injuries [22]. On history taking, the main symptoms are persistent anteriorly located ankle pain during dorsiflexion movements or while kicking the ball, post-exercise ankle swelling, and restricted dorsiflexion. With an adapted training program, most players can continue playing.

The physical examination reveals recognizable pain on palpation along the anterolateral and/or anteromedial joint line. In plantar flexion the joint capsule stretches over the osteophytes, inducing pain and difficulties palpating the osteophytes. The optimal palpation position is at slight ankle dorsiflexion. Depending on the recognizable pain on palpation, a differentiation can be made being either an anteromedial or anterolateral ankle impingement. Forced hyper dorsiflexion can provoke the pain, but this maneuver might be negative in the prone position [26].

11.5 Diagnostic Imaging

Standard weight-bearing lateral and anteroposterior radiographs can detect the anteriorly located osteophytes but might be false negative. Due to the anteromedial notch, anteromedial osteophytes up to 7 mm are undetected on these "standard" radiographs [23]. Medially located talar osteophytes remain undetected due to overprojection of the lateral part of the talar neck and body.

The oblique anteromedial impingement (AMI) view is recommended to detect the anteromedial osteophytes (Fig. 11.1). As compared to the standard lateral projection, the beam is tilted into a 45° craniocaudal direction with the leg in 30° external rotation and the foot in plantar flexion (Fig. 11.2). Routine computed tomography (CT) and/or magnetic resonance imaging (MRI) for the ankle impingement syndrome is not advised, although MRI has a high sensitivity to detect the (anterolateral) soft tissue impediments.

Ultrasound and conventional MRI have a debatable role on the footballers' population. Literature demonstrated that osteophytes are not strictly solely related to the clinical entity of impingement, suggesting that soft tissue pathology may also play a significant role [8]. As mentioned previously, the associated synovial abnormality

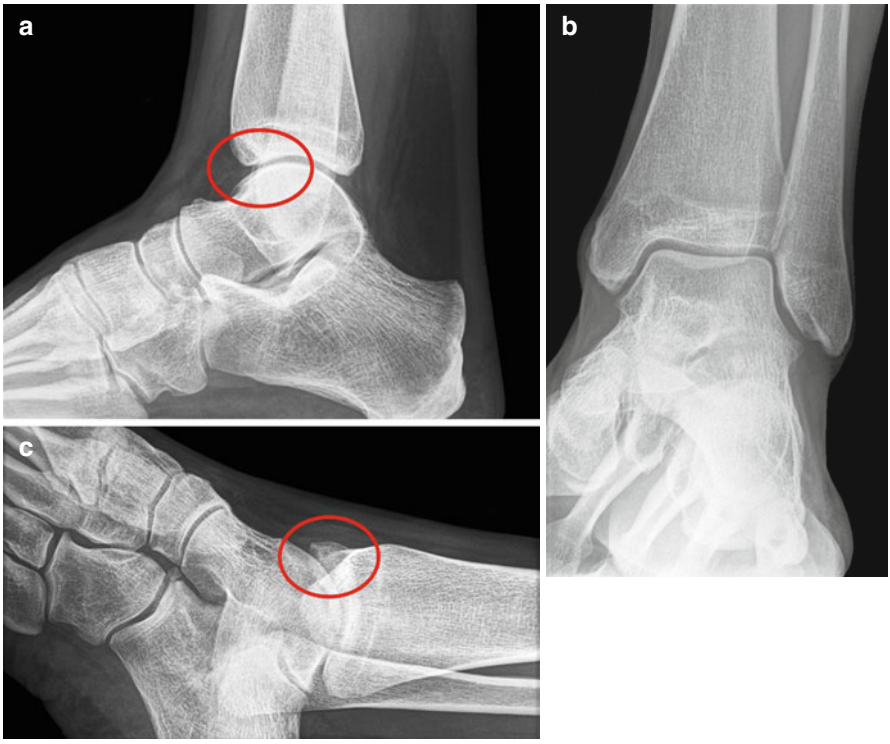

Fig. 11.1 Professional footbal player with an anteromedial impingement syndrome (*red circle*). (**a**) Lateral view shows a normal joint space and no osteophytes. (**b**) Anteroposterior view shows no significant abnormalities. (**c**) Anteromedial impingement (AMI) view shows a tibial osteophyte (*red circle*)

secondary to the osseous spurs is critical for inducing the clinical syndrome rather than the osseous spurs alone [17]. Gray-scale ultrasonography is performed with a linear probe (12–17 MHz) in an axial and coronal plain with the foot in slight dorsiflexion for better visualization of the etiologic causes. Sensitivity and specificity of the ultrasound examination is conflicting. Thickening of the synovium over 10 mm with nodular appearance of the synovial capsule, especially within the anterolateral recess (meniscoid lesion or synovitic lesion), is strongly associated with impingement [11, 27]. Cochet et al. elucidated in a more recent study that detection of smaller lesions can have a positive predictive value for diagnosing impingement [1]. Fluid effusion at the anterolateral side of the ankle can most efficiently be visualized in the sagittal plain. Even spurs in an early phase of formation can hereby be detected. The detection of these findings is not hampered by the presence of fluid at the ankle recess, which is a potential limitation in the conventional MRI. Color Doppler ultrasound might be helpful, since hypervascularity of the synovial or meniscoid mass seems to depend on the repetitive injuries and the amount of the fibrosis in it [1, 11]. Another advantage of sonography over MRI is the possibility to directly infiltrate the inflamed tissue with steroids in a controlled manner, most suitable anterolaterally.

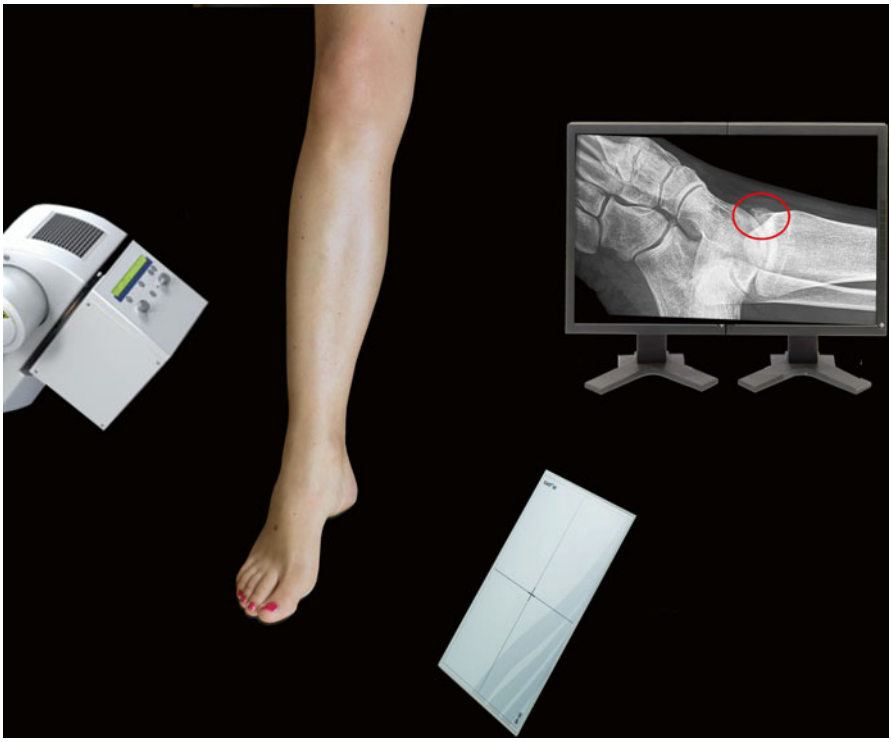

Fig. 11.2 Following patient's history and the physical examination, in case an anteromedial impingement is suspected, an anteromedial impingement view (AMI) can be made to confirm or reject an anteromedial bony impingement on the tibia and/or talus. The AMI view showing the medial osteofyt (*red circle*) is made with the ankle in plantar flexion and the leg in 30° external rotation, the beam tilted in a 45° craniocaudal direction

Conventional MRI is nowadays widely used as an additional diagnostic tool in case a clinical ankle impingement is suspected; however, results are conflicting. Sensitivity and specificity for the detection of abnormality varies widely, and the accuracy depends on the presence of a significant joint effusion [17]. Although the spatial resolution of the conventional MRI is nowadays increased and special sequences are used, anatomical variants are still difficult to recognize. An example in this case is the Bassett ligament; this anatomical variant, being an accessory anteroinferior tibiofibular ligament, can easily be pointed out as an increased soft tissue mass responsible for a clinically suspected anterolateral impingement with a negative conventional radiograph. In these cases, a static and dynamic ankle ultrasonography and/or anterior ankle arthroscopy is superior [8, 16, 27].

Although some authors have proposed MR arthrography enabling a high sensitivity and specificity as an additional diagnostic tool to diagnose ankle impingement [1, 8, 17], no large radiographic series have been published in literature up to present [8]. On an MR arthrography, an irregular or nodular contour of the anterolateral

soft tissues is considered to be pathological and would be highly correlated to ankle

Table 11.1 Classification of anterior ankle impingement [19]

Type	Characteristics
Type I	Synovial impingement. X-rays show an inflammatory reaction, up to 3 mm spur formation
Type II	Osteochondral reaction exostosis. X-rays manifest osseous spur formation greater than 3 mm in size. No talar spur is present
Type III	Significant exostosis with or without fragmentation, with secondary spur formation on the dorsum of the talus seen, often with fragmentation of osteophytes
Type IV	Pantalocrural arthritic destruction. X-rays suggest medial, lateral, or posterior, degenerative, arthritic changes

Table 11.2 Classification for osteoarthritic changes of the ankle joint [26]

Grade	Characteristics
Grade 0	Normal joint or subchondral sclerosis
Grade I	Osteophytes without joint space narrowing
Grade II	Joint space narrowing with or without osteophytes
Grade III	(Sub) total disappearance/deformation of the joint space

scar tissue and synovitis at arthroscopy. An indirect positive sign for anterolateral impingement is the extent of the anterior recess [17]. CT arthrography has also been used for the evaluation of anterolateral impingement with a lower sensitivity and specificity as compared to MR arthrography [1, 17].

11.6 Classification

Up to present, there is not a uniform classification system for anterior ankle impingement. Scranton and McDermott [19] published on the size of the osteophytes and their location, based on the lateral radiographs (Table 11.1). To predict the surgical outcome following the removal of the osteophytes, van Dijk et al. published an osteoarthritic classification [26] (Table 11.2).

11.7 Treatment

11.7.1 Conservative Treatment

Conservative treatment, consisting of intra-articular injections and/or heel lifts, is recommended in the early stages but has never been systematically studied and might frequently be unsuccessful [22].

11.7.2 Invasive Treatment

McMurray reported on the first surgically treated patients [12]. After removal of anterior located osteophytes by open arthrotomy, the patients successfully returned to professional soccer. In subsequent studies numerous authors have reported good results with an open ankle arthrotomy [7, 14, 15]. Open ankle arthrotomy can be complicated by cutaneous nerve entrapment, damage of the long extensor tendons, wound dehiscence, and formation of hypertrophic scar tissue [3]. Arthroscopic intervention with an earlier return to sports is generally accepted as the preferred procedure for professional football players [27].

Anterior ankle arthroscopy is carried out as an outpatient procedure under general or spinal anesthesia. The patient is positioned in the supine position with slight elevation of the ipsilateral buttock. The heel of the affected ankle is placed at the very end of the operating table (Fig. 11.3). In this way, the surgeon can fully dorsiflex the ankle by leaning against the foot sole. Routine anterior portals used are the anteromedial and anterolateral portal. A soft tissue distraction device can be used when indicated (Fig. 11.4). Accessory portals are located just in front of the tip of the medial or lateral malleolus.

The anteromedial portal is made just medially to the anterior tibial tendon through the skin only (Fig. 11.5); subsequently the subcutaneous tissue is spread with a mosquito clamp in ankle dorsiflexion, thereby preventing iatrogenic damage

Fig. 11.3 Patient positioning in anterior ankle arthroscopy: the patient is in the supine position, the hip on the contralateral side is supported, the ipsilateral buttock is elevated, and a tourniquet applied around the upper leg, with the affected ankle at the end of the operation table. Hereby, ankle dorsiflexion can be achieved by leaning against the foot during surgery

Fig. 11.4 In some cases, a noninvasive soft tissue distractor can be helpful. This device is positioned around the ankle and is connected to a belt around the surgeon's hips. Hereby, the surgeon can distract the ankle by leaning backwards

Fig. 11.5 Anteromedial portal location in anterior ankle arthroscopy: while palpating the joint line with the thumb (notch of Harty), the location of the anterior tibial tendon is observed, and subsequently with the ankle in dorsiflexion, the portal is made by a vertical incision through the skin only just medial to the anterior tibial tendon

to the tibial and talar cartilage. Routinely a 4.0 mm 30° angled arthroscope is introduced, again in maximal ankle dorsiflexion (Fig. 11.6). Iatrogenic cartilage lesions by instrument introduction can thereby be prevented. For irrigation, normal saline by an arthroscopic pump (50 mmHg, FMS DUO®+, DePuy Synthes-Mitek) is nowadays routinely used. By arthroscopic visualization laterally, the location of the anterolateral portal can be controlled directly. A spinal needle is introduced just

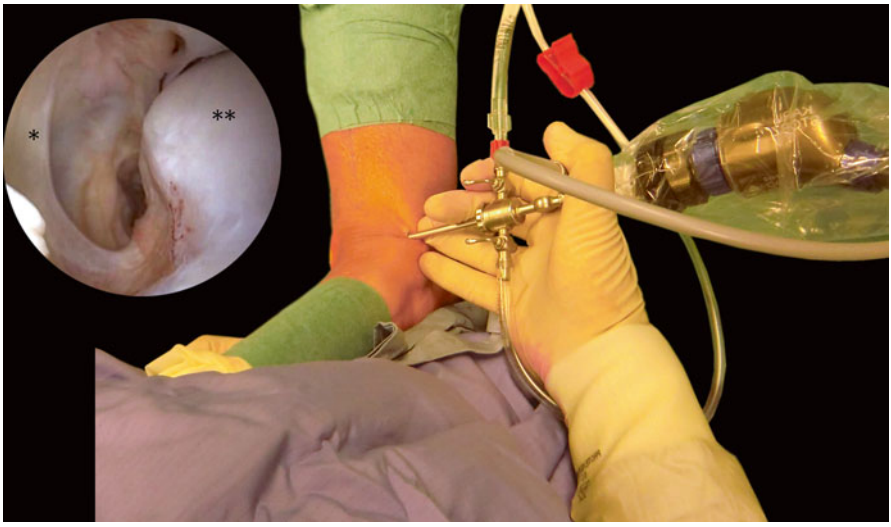

Fig. 11.6 A 4.0 mm 30° angled arthroscope is introduced while the ankle is in full dorsiflexion, thereby preventing iatrogenic damage to the talar cartilage (* ankle capsule, ** talus)

lateral to the peroneus tertius tendon. A vertical skin incision is made with respect for the local anatomy, being the superficial peroneal nerve. Although this nerve is unique for the human body with respect to its possibility being visualized by combined ankle plantar flexion and inversion, it is the most frequently reported complication with the creation of the anterolateral portal [5]. Another possibility to visualize this nerve is by means of fourth toe flexion [20]. Marking its course prior to the creation of the anterolateral portal is advised; nevertheless, one should realize that the course of this nerve changes with the *ankle* position. The anterolateral portal should be made medially to the position of the nerve in *ankle* plantar flexion and inversion [4]. Other important tricks to prevent superficial peroneal nerve injury include vertical skin incisions, through the skin only, followed by blunt dissection up to the joint and the use of transillumination [5, 20]. The contour of the anterior tibia is identified, and in case of an osteophyte, soft tissue superior from this osteophyte is removed with a shaver. The extent of the osteophyte is determined, and the osteophyte is subsequently removed using a 4 mm chisel and/or shaver. When an osteophyte is located on the medial distal tibial rim or the front of the medial malleolus, the arthroscope is moved to the anterolateral portal and the instruments are introduced through the anteromedial portal. Osteophytes at the tip of the medial malleolus and ossicles or avulsion fragments in this area can be removed in a similar manner. It can be helpful to create an accessory portal in front of the tip of the medial malleolus. In case of osteophytes at the tip of the medial malleolus, usually overcorrection of the tip is feasible using a bonecutter shaver. Also in case of a soft tissue impingement, a shaver is helpful for the debridement (Fig. 11.7).

In case besides the impingement also, an osteochondral defect needs to be addressed; the talus can be inspected by ankle plantar flexion. In some cases a soft tissue distractor

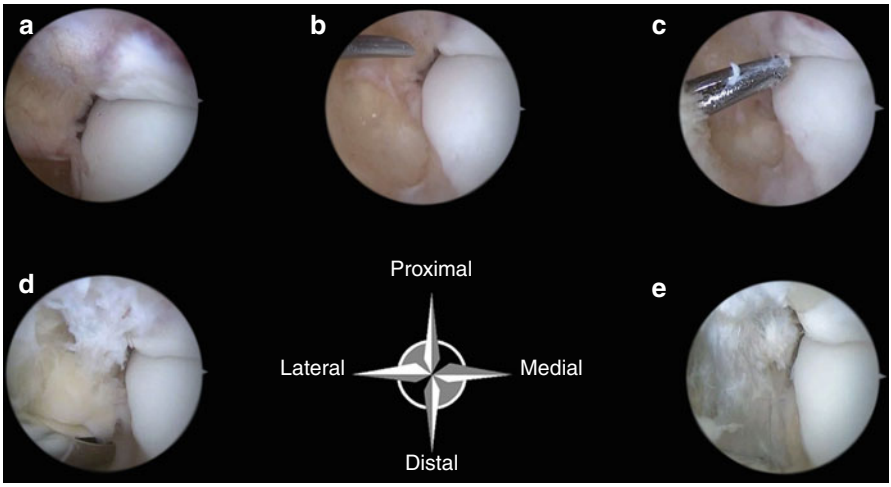

Fig. 11.7 Arthroscopic treatment anterolateral soft tissue impingement in a right ankle. (**a**) The 4.0 mm 30° arthroscope is introduced through the anteromedial portal, and the soft tissue impingement anterolaterally can be identified. (**b**) Under arthroscopic control a spinal needle is introduced to determine the optimal anterolateral portal position. (**c**) After skin incision only, a hemostat is used to spread the subcutaneous tissue to subsequently open the anterolateral ankle capsule. (**d**) A shaver is introduced to debride the soft tissue responsible for the impingement. (**e**) Postoperative arthroscopic image

can be helpful, mainly in case these lesions are situated in the tibial plafond. Most anteriorly located osteochondral lesions can subsequently be treated arthroscopically by debridement and bone marrow stimulation. In case history taking, physical examination, and the additional diagnostics indicate an anterior ankle impingement and an additional syndesmotic instability, the syndesmosis can be tested arthroscopically.

To prevent sinus formation, at the end of the procedure, the skin incisions are sutured with 3.0 Ethilon. A sterile compressive dressing is applied (Klinigrip, Medeco BV, Oud Beijerland, the Netherlands). Prophylactic antibiotics are not routinely given.

A recent review of the literature showed sufficient evidence for arthroscopic treatment of anterior ankle impingement [6]. The number of prospective cohort studies is still limited but shows an overall success rate of grade I (bony impingement without joint space narrowing) in over 85 %.

Osteophytes reoccur in 67 % at 5–8 years follow-up [24]. Coull et al. [2] reported even a recurrence of osteophytes in all their 27 patients who underwent open debridement. There was, however, no statistical correlation between the recurrence of osteophytes and the return of symptoms [24]. As mentioned previously it is probably not the osteophyte itself which causes the pain, but the compression of the synovial fold or fibrotic (scar) tissue. In theory, arthroscopic excision of the soft tissue can relieve pain. Talar and tibial osteophytes, however, reduce the anterior joint space. After arthroscopy, a postoperative hematoma may develop and again form an anterior soft tissue impediment. It is therefore important to restore the anterior space and reduce the chance of symptoms to reoccur.

11.8 Rehabilitation

Postoperative rehabilitation treatment consists of a compression bandage and partial weight bearing for 3–5 days. The athlete is instructed to actively dorsiflex his or her ankle and foot upon awakening and to repeat this exercise a few times every hour for the first 2–3 days after surgery [22, 24]. The added value of physical therapy has insufficiently been documented. A small retrospective series showed that patients receiving more than 1 month physical therapy scored better on a 7-point ankle scale as compared to the ones who were not treated with physical therapy [9]. In the absence of high-level evidence, in professional football players, physical therapy with a focus on restoration of dorsiflexion, reduction of swelling, functional training, and supervised return to sport specific training after 6–8 weeks is advised.

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