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# Anteromedial Impingement in the Ankle Joint

## Outcomes Following Arthroscopy

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**Background:** Arthroscopic debridement is a well-accepted method of removing osseous and/or soft tissue impingement from the ankle joint. To the best of the authors' knowledge, this is the first case series reporting the outcomes following arthroscopic resection of anteromedial impingement.

**Purpose:** The authors report the results at a minimum 2-year follow-up of 41 patients who underwent arthroscopic resection for anteromedial impingement.

**Study Design:** Case series; Level of evidence, 4.

**Methods:** Arthroscopic surgery for anteromedial impingement was performed on 43 patients under the care of the senior surgeon between January 2005 and July 2007; 41 patients were included in the present study. All patients were assessed preoperatively and postoperatively using the American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot and Short Form 36 (SF-36v2) outcome scores. The mean patient age at the time of surgery was 31.12 years (range, 13-57 years). The mean follow-up time was 34.41 months (range, 24-52 months). Thirty-four patients (83%) were competing at some level of athletic sport.

**Results:** Thirty-eight patients (93%) were satisfied with the procedure. The AOFAS scores improved from 62.83 points preoperatively to 91.17 points postoperatively (range, 61-100 points) ($P < .001$). The SF-36v2 scores improved from 61.54 points preoperatively to 92.21 points postoperatively (range, 58-100 points) ($P = .002$). All but 1 patient returned to their prior level of sporting activity. Three patients (7%) reported a complication.

**Conclusion:** Arthroscopic resection for anteromedial impingement provides excellent functional outcomes, thereby allowing the athlete an expedited return to sport at previous levels of competition.

**Keywords:** ankle impingement; arthroscopy; osteophytes; athlete; soccer

Chronic anterior ankle pain is often caused by the formation of talotibial osteophytes along the anterior joint line, where they act as a mechanical obstruction to the normal biomechanics of the ankle joint.[20] The pain is secondary to the entrapment of an inflamed soft tissue component between the osteophytes. This is a common condition seen in many athletes, particularly soccer players, dancers, and cross-country runners. As many as 60% of professional soccer players are reported to have osteophytes located anteriorly within the ankle joint.[10] Similarly, ballet dancers are exposed to repetitive trauma in forced dorsiflexion of the ankle while in the plié or demi-plié positions, resulting in anterior impingement.[23]

The condition of anterior impingement was first recognized and named "athlete's ankle" by Morris[12] in 1943 and later renamed "footballer's ankle" by McMurray[11] in 1950; McMurray reported good results in athletes after surgical resection. Since then, the term "anterior ankle impingement syndrome" has been cited widely.[14,15,17,20] This condition is now recognized as 2 separate entities, namely anteromedial impingement syndrome and anterolateral impingement syndrome.

Although the exact cause of anteromedial impingement (AMI) is not fully understood, there are 3 primary theories, to date, that seek to explain the causality of this condition. McMurray[11] first hypothesized that the talotibial osteophytes were formed by repetitive capsular traction during kicking movements. This has since become known as the "traction spurs" theory, and has been cited frequently in the literature.[1,3,16] The second theory relates to direct and recurrent microtrauma to the joint capsule and

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TABLE 1
Contrasting Clinical Presentations and Etiologies of Anteromedial and Anterolateral Impingement

| | Clinical Presentation | Etiologic Factors |
|---|---|---|
| Anteromedial Impingement (AMI) | Chronic anteromedial ankle joint pain that is intensified by activity or placing the ankle into forced dorsiflexion<br>Pain on palpation of the medial ankle joint line on physical examination may reproduce typical symptoms of AMI but is not considered a definitive diagnostic sign | Repetitive capsular traction during kicking movements[11]<br>Chronic microtrauma to the anteromedial ankle joint[19]<br>Inversion ankle sprain, including the entrapment and/or tearing of the anteromedial joint capsule[18] and impaction between medial malleolus and medial facet of the talus[23]<br>Repetitive dorsiflexion[24] |
| Anterolateral Impingement (ALI) | History of prior ankle sprain with chronic and persistent lateral ankle pain on ambulation<br>Tenderness of the anterolateral gutter of the ankle joint on physical examination<br>Must distinguish symptoms of ALI from sinus tarsi syndrome | Reactive synovitis in the lateral gutter as a result of hematoma reabsorption after ankle sprain[4]<br>Inversion sprain leading to inflammation of torn ligaments after repetitive motion, thereby causing hypertrophic synovitis and scar tissue in the lateral gutter[2] |

hypothesizes that the impact forces of a soccer ball are of a great enough magnitude to incur damage to the anatomy of the anterior ankle region.[19] Repetitive dorsiflexion[1,15,24] of the ankle joint has also been hypothesized to result in spur formation and symptoms of anteromedial impingement; this may be particularly relevant in dancers. By comparison, anterolateral impingement syndrome has a different origin and different presentation (Table 1). The results following arthroscopic resection of anterolateral impingement syndrome have been reported on several occasions with good results.[2,7,8]

To the best of our knowledge, this is the first case series reporting the treatment and outcomes following arthroscopic resection of AMI. We report the results following arthroscopic resection for AMI in 41 consecutive patients.

## MATERIALS AND METHODS

Arthroscopic surgery for AMI was performed on 43 patients (26 male and 17 female) between January 2005 and July 2007 under the care of the senior surgeon (J.G.K.). Exclusion criteria consisted of patients with preexisting degenerative joint disease and/or rheumatoid arthritis. Considering these criteria, 2 patients were identified as having a preexisting degenerative joint disease. These patients had an arthroscopic debridement as well as distraction arthroplasty and were therefore excluded from the present study. The study group thus consisted of 41 patients (26 male and 15 female).

Patient medical records and arthroscopic video recordings were reviewed for all study patients. Patient age, follow-up time, and participation in competitive sports were documented. The following intraoperative arthroscopic findings were noted from the video recordings: presence/absence of synovial hyperplasia, presence/absence of anteromedial tibial osteophytes, and presence/absence of anteromedial talar osteophytes. Ankle joint range of motion in dorsiflexion was also recorded preoperatively and postoperatively in terms of a + or − expression of the contralateral side. Finally, return to play (RTP) was calculated and defined as the time period elapsed between the date of surgery and the athletic patient's return to competition (including level of play). Patients who did not have any specific sporting activity were seen postoperatively until they reported being able to perform their required daily activities without pain. That time point was recorded and the amount of time elapsed was calculated from the date of surgery.

All patients who were included in the present study had complete preoperative and postoperative American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot and Short Form 36 (SF-36v2) outcome scores. The AOFAS score is a previously validated outcome-based assessment of clinical changes of pain and function.[6] The SF-36 questionnaire is a validated general health assessment tool that evaluates a patients' overall physical and mental health while comparing to the overall healthy population control group.[26] The same preoperative and postoperative questionnaires were used in all instances. In an effort to reduce any bias on behalf of the senior surgeon, the research fellow (C.D.M.) performed all data collection and analysis.

### Patient Demographics

The mean patient age at the time of surgery was 31.12 years (range, 13-57 years). All patients were followed for a minimum of 2 years after surgery. The mean follow-up time was 34.41 months (range, 24-52 months).

Of the 41 patients involved in the present study, a total of 34 (83%) reported that they were competing in some level of organized athletic sport before surgery (Table 2). Of the 7 patients (17%) who reported they were not currently competing in some level of athletic sport before surgery, 4 reported jogging recreationally at a distance of at least 2 miles with a frequency of 3 to 4 days per week.

TABLE 2
Athletic Patient Population of the Cohort Characterized Based on Sport and Gender

| Sport | Male | Female | Total |
|---|---|---|---|
| Soccer | 12 | 4 | 16 |
| Basketball | 3 | 1 | 4 |
| Distance running | 1 | 2 | 3 |
| Gymnastics | 0 | 3 | 3 |
| Ballet | 0 | 2 | 2 |
| Football | 2 | 0 | 2 |
| Track | 1 | 1 | 2 |
| Baseball | 1 | 0 | 1 |
| Triathlete | 1 | 0 | 1 |

The remaining 3 patients included a single retired professional soccer player in addition to 2 individuals who reported not taking part in any organized sporting activity throughout the prior 2 years. However, both of those patients were occasional joggers; this was limited by pain.

## Physical Examination

Patients with AMI typically presented with anteromedial ankle pain when running, kicking, or stair-climbing. This would be explained by the soft tissue entrapment with the ankle in a dorsiflexed position. Palpation over the anteromedial ankle joint and dorsiflexing the ankle can reproduce typical symptoms of AMI. Although palpation has been considered an inconsistent finding,[13] evidence of these symptoms satisfies clinical suspicion of AMI and, for that reason, further diagnostic tests are warranted.

## Diagnosis

After a physical examination and clinical suspicion of impingement, standard lateral radiographs and oblique AMI view[25] radiographs were ordered (Figure 1). Standard lateral radiographs appreciate anterolateral tibial and talar osteophytes, while anteromedial osteophytes often remain undetected (Figure 2). An AMI view x-ray presents the talotibial articulation such that previously undetected medial lesions will be seen while anterolateral lesions become invisible (Figure 3). This specific treatment algorithm was used to distinguish and isolate anterolateral and anteromedial osteophytes. Furthermore, MRI was ordered in all instances to evaluate the extent of soft tissue swelling and impingement (Figure 4). Magnetic resonance imaging also allowed visualization of both the lateral ligament complex and the ankle joint cartilage to rule out the possibility of an osteochondral lesion. If radiographs and MRI confirmed the presence of AMI, a final diagnostic injection of local anesthetic was administered into the anteromedial ankle joint capsule and soft tissue. If the injection relieved the symptoms of the patient, this was considered a positive test for AMI.

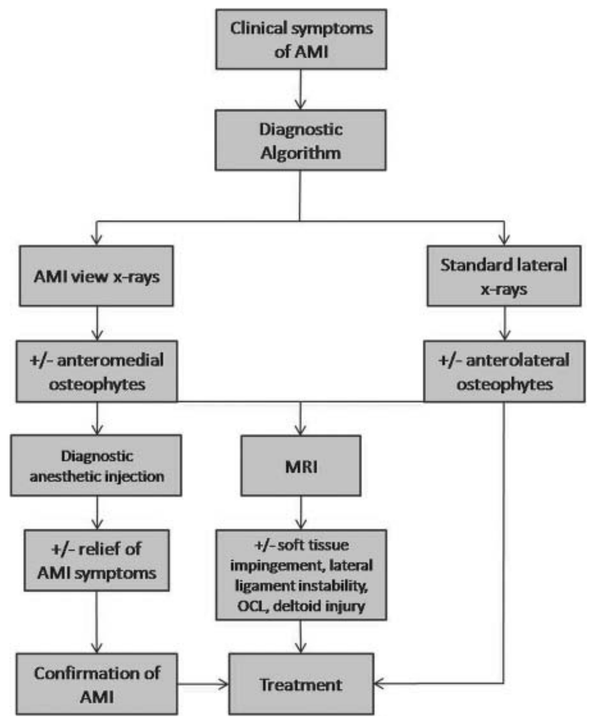


**Figure 1.** Flowchart characterizing our diagnostic strategy for anteromedial impingement.

Indications for surgery included difficulty performing daily and/or sporting activities because of chronic anteromedial joint pain exacerbated by placing the ankle in forced dorsiflexion. Once clinical suspicion of impingement was confirmed both radiologically and via a diagnostic local anesthetic injection, arthroscopic debridement was recommended as the first treatment option to the patient. Ferkel et al[2] and van Dijk et al[24] reported impingement symptoms as unresponsive to nonoperative therapy and thus nonoperative therapy was not considered in these cases. It was hypothesized that arthroscopic debridement commencing at an early time point would provide the patient, particularly an athlete, with expedited return from injury to competitive sport with minimum time lost to play.

## Surgical Procedure

Arthroscopy was performed in all cases by the senior surgeon with the patient under regional epidural anesthesia. The patient was placed in a supine position on the operating table in standard traction using an Arthrex distractor (Arthrex Inc, Naples, Florida) (Figure 5). Standard anteromedial and anterolateral arthroscopy portals were used and the joint was evaluated. Where medial impingement was identified, a 3.5-mm oscillating resector was used to remove scar, soft tissue synovial hyperplasia, and cicatrization from recurrent injury (Figure 6).

These were removed initially so that correct visualization of the anterior aspect of the joint could be determined. Once this was achieved, all tibial exostoses were also


**Figure 2.** A standard lateral radiograph of a 24-year-old gymnast with clinical suspicion of anteromedial impingement shows no evidence of tibial or talar osteophytes.

removed with the 3.5-mm resector (Figure 7). Tibial resection was quantitated by resecting all osteophyte, bone (normal and/or anatomic variant), and soft tissue impingement back to the anterior border of the medial malleolus and was therefore the extent of resection in all cases (Figure 8). Once this border is reached, the joint can dorsiflex to a normal position. The neck of the talus was then identified, and soft tissue was resected until sufficient material was removed to determine that no bony exostoses remained on the talus (Figure 9). At this point, the traction was removed and the joint was put through a range of motion under arthroscopic visualization as well as fluoroscopic assessment to ensure that no impingement remained. Occasionally, it was observed that the anterior fibers of the deltoid ligament were scarred and folded into the joint during dorsiflexion, thereby potentiating impingement. Under such circumstances, the resector was used to trim this impingement; the deltoid was otherwise left intact. A final examination of the remainder of the joint was made, and the portals were then closed with 4-0 nylon sutures.


**Figure 3.** The same 24-year-old patient as in Figure 2 also had an anteromedial impingement–view radiograph, which showed a large tibal osteophyte and a small talar osteophyte in the anteromedial aspect of the ankle joint; this was invisible on the lateral radiograph.

**Figure 4.** Sagittal MRI showing anteromedial osteophytes extending from the talus and tibia (circled), as well as inflammation of the soft tissue and joint capsule.

**Figure 5.** The standard arthroscopy setup includes the patient supine on the operating table with standard traction using an Arthrex distractor.

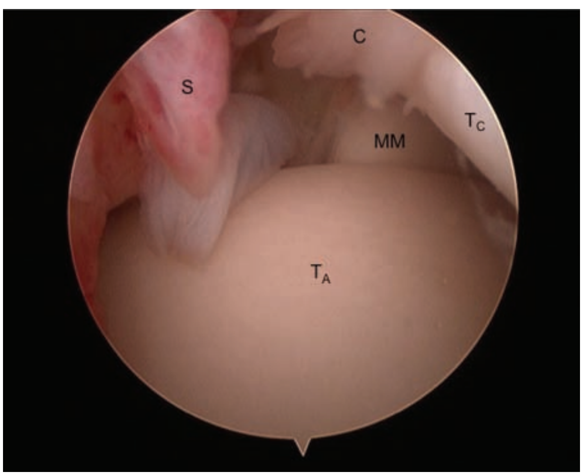


**Figure 6.** Before debridement, arthroscopic visualization of the anteromedial aspect of the ankle joint shows soft tissue synovial hyperplasia and cicatrization. C, cicatrized tissue in anteromedial impingement; MM, medial malleolus; $T_A$, talar dome; $T_c$, tibial cartilage; S, synovial hyperplasia.

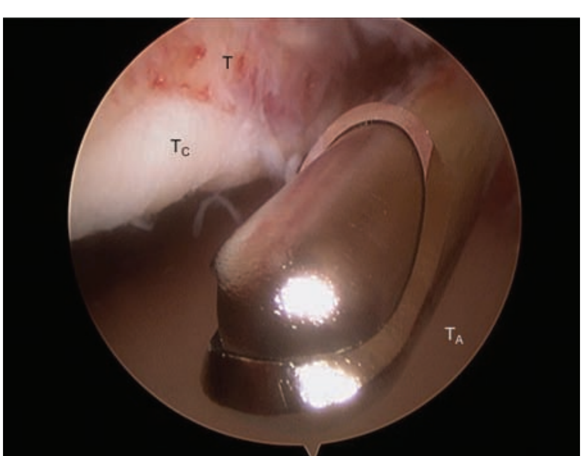


**Figure 7.** A 3.5-mm oscillating resector is used to remove osseous impingement from the anteromedial aspect of the tibia. T, tibia; $T_A$, talar dome; $T_C$, tibial cartilage.

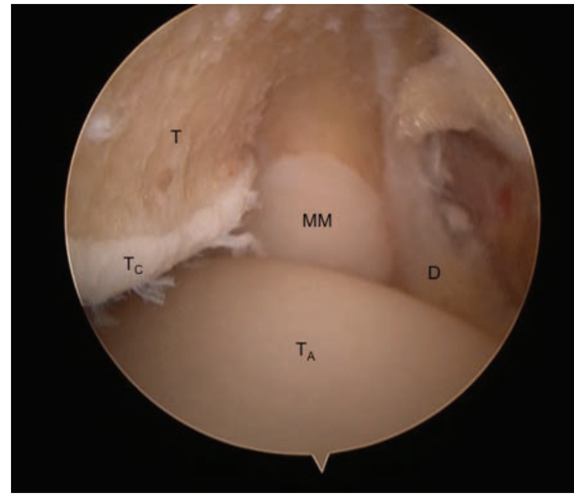


**Figure 8.** A postdebridement arthroscopic visualization of the anteromedial aspect of the ankle joint shows no remaining osseous or soft tissue impingement. D, anterior fibers of the deltoid ligament; MM, medial malleolus; T, tibia; $T_A$, talar dome; $T_C$, tibial cartilage.

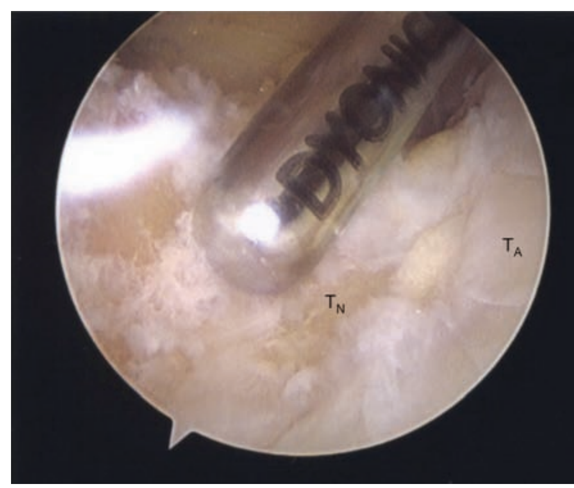


**Figure 9.** Soft tissue resection from the anteromedial neck of the talus reveals no evidence of osteophyte formation. $T_A$, talar dome; $T_N$, neck of the talus.

## Postoperative Protocol

After surgery the patient was asked to be nonweightbearing for 2 days to prevent fistula formation through the portal incisions and to allow the soft tissues to settle. Ankle pumps were encouraged the day after surgery for 20 minutes daily. After 2 days, instruction was given to increase weightbearing as tolerated. A postoperative AMI view radiograph was obtained at suture removal to once again assess the removal of the osseous impingement. The soft tissue aspect of AMI was evaluated clinically by pressing in the medial soft spot and dorsiflexing the ankle joint at final follow-up.

Physical therapy was commenced 1 week to 10 days after surgery once the sutures were removed. Sport-specific

TABLE 3
Results After Surgery of the AMI Group, AMI and Lateral Ligament Reconstruction Group, and AMI With Microfracture Group[a]

| Procedure(s) | Mean Preop AOFAS | Mean Postop AOFAS | *P* Value | Mean Preop SF-36 | Mean Postop SF-36 | *P* Value |
|---|---|---|---|---|---|---|
| AMI only | 65.11 | 92.93 | <.001 | 63.48 | 94.70 | .002 |
| AMI and lateral ligament reconstruction | 59.06 | 90.24 | .013 | 60.15 | 90.19 | <.001 |
| AMI and microfracture | 57.62 | 89.84 | .03 | 54.69 | 90.71 | .027 |

[a]AMI, anteromedial impingement; AOFAS, American Orthopaedic Foot and Ankle Society; SF-36, Short Form 36.

training was allowed 2 weeks after surgery and active participation in sports was encouraged thereafter based on the symptoms of the patient. In cases where concomitant surgery was performed, rehabilitation was modified accordingly.

### Statistical Analysis

The Student *t* test was used in statistical comparison of the preoperative and postoperative outcome scores and assigned a *P* value. A *P* value of ≤.05 was considered a statistically significant outcome.

## RESULTS

Of the 41 patients included in the present study who underwent arthroscopic resection for AMI, 93% were satisfied and would undergo the procedure again or recommend it to a friend. Mean AOFAS scores improved from 62.83 points preoperatively to 91.17 points postoperatively (range, 61-100 points), which was statistically significant ($P < .001$). Mean SF-36v2 scores improved from 61.54 preoperatively to 92.21 points postoperatively (range, 58-100 points). This was also statistically significant ($P = .002$). All but 1 patient who was involved in competitive sports before surgery returned to the same level of play; this patient developed complex regional pain syndrome.

Ten patients had an additional procedure(s) at the time of arthroscopic debridement for AMI (Table 3). In each case, these pathologic changes were observed on MRI and further procedures were thus decided upon before surgery. Six patients underwent an open lateral ligament reconstruction for mechanical instability of the lateral ankle ligament complex and 3 patients had arthroscopic microfracture surgery to repair an osteochondral lesion. One patient underwent both a lateral ligament reconstruction and arthroscopic microfracture surgery. Of the 4 patients having an osteochondral lesion, all lesions were relatively small in size, having a mean diameter of 4.11 mm (range, 2-5 mm) and were therefore amenable to microfracture. Three of the lesions were located on the talar dome (2 centromedial, 1 posteromedial), while the other was located on the reciprocating medial tibial plafond. Both medial ankle instability on physical examination and deltoid ligament disruption on MRI were negative on all patients in the present cohort.

Intraoperative findings included soft tissue synovial hyperplasia in all 41 patients. Anteromedial tibial osteophytes were noted in 34 patients, representing 82.9% of the cohort, whereas anteromedial talar osteophytes were seen in 21 patients, or 51.2% of the cohort. Twenty-one patients, representing 51.2% of the cohort, had both tibial and talar osteophytes located anteromedially in the ankle joint. No patient had a talar osteophyte in isolation.

Ankle joint dorsiflexion range of motion was slightly limited in all cases before surgery by a mean of 3.2° (range, 2°-5°) by comparison with the contralateral side. No single patient identified this slight decrease in range of motion as the reason for initial referral and many did not recognize this until it was noted on physical examination. Postoperatively, a normal range of motion (<2° of the contralateral side) was seen in all patients.

Return to play in the athletic population of patients receiving only arthroscopic debridement for AMI was seen at a mean time period of 7 weeks (range, 5-13 weeks). This does not include the single athletic patient who has yet to return to competitive sport. Of the 7 patients (17%) who were not involved in a competitive athletic sport before surgery, 6 reported having returned to their daily activities without pain at a mean of 9 weeks (range, 6-15 weeks) after surgery. The 1 patient who did not developed arthrofibrosis. Return to play in the group receiving AMI debridement in addition to lateral ligament reconstruction was seen at a mean time period of 15 weeks (range, 12-18 weeks). Lastly, RTP in the group receiving AMI debridement and microfracture was seen at a mean time period of 14 weeks (range, 11-20 weeks).

There were 3 complications after arthroscopy, representing 7% of the overall cohort. A single patient suffered a neurapraxia of the superficial peroneal nerve, which resolved 6 weeks postoperatively. In addition, there was a single case of arthrofibrosis after surgery that required a further manipulation under anesthesia and an injection of triamcinolone. Finally, 1 patient developed complex regional pain syndrome. This patient was a 21-year-old female Division I college soccer player who developed symptoms suggestive of complex regional pain syndrome 3 months after a second arthroscopic debridement. She has not returned to soccer to date.

The third and seventh patients in the present cohort required further arthroscopic debridement at 4 and 5 months after surgery, respectively, for recurrent scar tissue formation. One patient did well after a second debridement and subsequently returned to the previous level of athletic sport. Thus, the patient has not been included in the list of complications. The second patient, as noted above, developed complex regional pain syndrome. The recurrent scar formation was due to inadequate index resection in the initial procedures and has been addressed in subsequent procedures. No additional debridement procedures were needed in any patient thereafter.

## DISCUSSION

Chronic anteromedial ankle pain is a frequently overlooked entity that often leads to delayed diagnosis and thus a significant amount of time lost to play in athletes. As such, the need for a heightened suspicion on behalf of the surgeon is imperative to diagnose and treat AMI in a timely manner, thereby facilitating expedient return to competitive sport. To the best of our knowledge, this is the first case series to report the outcomes following arthroscopic resection of AMI.

The present hypotheses on the manifestation of AMI relate to repetitive capsular traction and also direct and recurrent microtrauma to the anteromedial aspect of the ankle joint. The "traction spurs" theory was first hypothesized by McMurray[11] in 1950, but later disputed by Tol and van Dijk,[21] who noted the capsular attachment an average of 6 mm proximal to the origin of the bony spurs. Tol et al[19] also tested their microtrauma hypothesis through a biomechanical study and its relation to spur formation. They found that the impact forces of a soccer ball on the anteromedial ankle joint region are of a high enough magnitude to damage anatomical structures. In the present study, 16 patients (39%) were involved in some level of competitively organized soccer before undergoing arthroscopic resection for AMI, thus supporting the fact that the traction spurs and/or microtrauma theories likely play a role in these cases. However, the exact mechanism of injury is not fully understood in many cases; the previous traction spurs and microtrauma theories are centered on the soccer player; they do not take into account ballet dancers and runners, who also frequently encounter symptoms of AMI. In the case of ballet dancers, repetitive and forced dorsiflexion can also be considered chronic microtrauma to the anteromedial ankle joint and, in so doing, causes the formation of osteophytes.[24] Hence, AMI must not be considered to have just a single cause. Rather, several causes must be considered based on the circumstances and activities of the patient.

A previous link between ankle instability and medial ankle pain has been noted in the literature.[20] Of the present cohort, 17.1% underwent lateral ligament reconstruction in addition to AMI resection. As such, it is likely that the causes for anteromedial impingement after ankle inversion trauma are twofold. The first occurs when the anteromedial joint capsule becomes entrapped or torn during inversion injury.[18] This may lead to cicatrization and hypertrophic scarring of the medial capsule as well as the synovial lining of the joint. The second is the repetitive impaction[23] between the medial malleolus and the medial facet of the talus, which may result in an osteochondral lesion, spur formation, inflammation and proliferation of the synovium, and scar tissue. In those cases requiring a lateral ligament reconstruction, scar tissue and hypertrophic synovium was resected laterally at the time of AMI resection to prevent any future symptoms of anterolateral impingement. Anteromedial impingement can therefore not be considered in isolation when ankle instability is evident. Moreover, although medial ligament instability would be expected to produce symptoms of AMI, no patient in the current series had medial-sided instability. At the time of arthroscopy, it was not uncommon to note scarring of the anterior fibers of the deltoid, thus causing a soft tissue impingement. Nevertheless, in all cases, the deltoid ligament was grossly intact and stable.

Upon physical examination of any patient with medial ankle joint pain, we advocate a suspicion of AMI. Several pathologic changes may cause medial ankle joint pain, including an osteochondral lesion or injuries to the deltoid ligament,[5] spring ligament, and posterior tibial tendon. Although pain on palpation to the anteromedial ankle joint has been considered an inconsistent finding with AMI,[13] several factors may elucidate a positive diagnosis. We have developed a diagnostic algorithm and flowchart for AMI and associated pathologic changes by using radiographs and MRI.

Van Dijk et al[25] have shown that standard lateral radiographs do not detect all osteophytes located anteriorly within the ankle joint. In fact, only 32% and 40% of talar and tibial spurs, respectively, may be recognized.[22] The most prominent aspect of the tibia on standard lateral radiographs is anterolateral, hence appreciating anterolateral osteophytes.[25] In contrast, anteromedial osteophytes are often invisible on standard lateral films. Thus, when used as an adjunct to standard lateral radiographs, oblique AMI view radiographs (45° craniocaudal radiograph with 30° external rotation of the leg) may increase the recognition of talar and tibial osteophytes to 73% and 85%, respectively.[22] By using both standard lateral and AMI view radiographs, anterolateral and anteromedial osteophytes can be isolated. Even so, standard radiographs fail to show the soft tissue component of AMI, in addition to the possibility of associated pathologic lesions.

Magnetic resonance imaging has emerged as the gold standard of imaging. In addition to the soft tissue component of AMI, MRI will allow the surgeon to assess the lateral ligament complex, ankle joint cartilage, and deltoid ligament. An MRI scan with T2-weighted mapping has greater sensitivity to zonal changes in cartilage,[9] allowing accurate diagnosis of osteochondral and chondral lesions of the talus or tibia. Each patient in the present cohort had MRI before surgery. Although we acknowledge that a successful diagnosis of AMI can be made without the use of MRI, the accompanying diagnosis of an osteochondral lesion, mechanical instability of the lateral ligament complex, or possible deltoid ligament injury is strategic in determining the correct treatment strategy.

Intraoperative findings of the current study included soft tissue synovial hyperplasia in all 41 cases, which supports the fact that AMI is a multifactorial condition that includes osteophyte formation. Anteromedial tibial and talar osteophytes were seen in 82.9% and 51.2% of the present cohort, respectively. In all cases of a talar osteophyte, a tibial osteophyte was noted in conjunction, whereas tibial osteophytes were seen in the absence of talar osteophytes in some cases. These osteophyte findings are similar to those reported by van Dijk et al[25] on radiographs.

The previously unsuccessful results of nonoperative treatment for impingement are well recognized in the literature. Van Dijk et al[24] reported 62 patients with anterior ankle impingement who did not respond to nonoperative treatment and thus underwent surgery. Ferkel et al[2] also reported symptoms of impingement as unresponsive to nonoperative treatment. Having these data and understanding that losing up to 6 weeks for nonoperative treatment would likely be detrimental and not an option to a competitive athlete, the senior surgeon of the present study has recommended arthroscopic debridement as a first line of treatment. In this cohort, RTP in athletes receiving only arthroscopic debridement for AMI was 7 weeks. Although in cases where additional procedures were performed the RTP times were altered accordingly, AMI debridement in isolation provides an expedited RTP in athletes. Our hypothesis that arthroscopic surgery commencing at an early time point provides an expedited return to competitive sport is therefore supported.

Arthroscopic surgery for the removal of bony spurs in anterior ankle impingement syndrome has been shown to be reproducible.[2,7,14,16] The current study has confirmed that symptoms of AMI can be treated with expected outcomes similar to those of anterolateral impingement.

## CONCLUSION

The arthroscopic resection of AMI provides excellent functional outcomes, with few complications (7%) and reproducible results. Diagnosis and treatment should commence in a timely manner, allowing the competitive athlete an expedient return to sport. Heightened suspicion from the surgeon in recognizing this condition is fundamental in preventing significant time lost to play without a definitive diagnosis.

The current study is a retrospective study and has the inherent confounding variables associated with all retrospective studies. Whenever possible, these have been addressed with the senior surgeon being blinded to the outcome data and scores having been routinely collected for all patients before and after surgery, eliminating post hoc patient recollection. Although these deficiencies are apparent, the study has merit in that AMI is a common and unrecognized condition in which patients can be expected to do well when treated. The evidence from the largest set of data collected to date is therefore compelling.

## REFERENCES

1. Biedert R. Anterior ankle pain in sports medicine: aetiology and indications for arthroscopy. *Arch Orthop Trauma Surg*. 1991;110(6):293-297.
2. Ferkel RD, Karzel RP, Del Pizzo W, Friedman MJ, Fischer SP. Arthroscopic treatment of anterolateral impingement of the ankle. *Am J Sports Med*. 1991;19(5):440-446.
3. Ferkel RD, Scranton PE Jr. Arthroscopy of the ankle and foot. *J Bone Joint Surg Am*. 1993;75(8):1233-1242.
4. Guhl J. Soft tissue synovial pathology. In: *Ankle Arthroscopy: Pathology and Surgical Techniques*. Thorofare, NJ: Slack Publishing; 1988:93-135.
5. Hintermann B, Knupp M, Pagenstert GI. Deltoid ligament injuries: diagnosis and management. *Foot Ankle Clin*. 2006;11(3):625-637.
6. Ibrahim T, Beiri A, Azzabi M, Best AJ, Taylor GJ, Menon DK. Reliability and validity of the subjective component of the American Orthopaedic Foot and Ankle Society clinical rating scales. *J Foot Ankle Surg*. 2007;46(2):65-74.
7. Kim SH, Ha KI. Arthroscopic treatment for impingement of the anterolateral soft tissues of the ankle. *J Bone Joint Surg Br*. 2000;82(7):1019-1021.
8. Liu SH, Raskin A, Osti L, et al. Arthroscopic treatment of anterolateral ankle impingement. *Arthroscopy*. 1994;10(2):215-218.
9. Lusse S, Claassen H, Gehrke T, et al. Evaluation of water content by spatially resolved transverse relaxation times of human articular cartilage. *Magn Reson Imaging*. 2000;18(4):423-430.
10. Massada JL. Ankle overuse injuries in soccer players: morphological adaptation of the talus in the anterior impingement. *J Sports Med Phys Fitness*. 1991;31(3):447-451.
11. McMurray TP. Footballer's ankle. *J Bone Joint Surg Br*. 1950;32:68-69.
12. Morris LH. Report of cases of athlete's ankle. *J Bone Joint Surg Br*. 1943;25:220-224.
13. Mosier-La Clair SM, Monroe MT, Manoli A. Medial impingement syndrome of the anterior tibiotalar fascicle of the deltoid ligament on the talus. *Foot Ankle Int*. 2000;21(5):385-391.
14. Nihal A, Rose DJ, Trepman E. Arthroscopic treatment of anterior ankle impingement syndrome in dancers. *Foot Ankle Int*. 2005;26(11):908-912.
15. O'Donoghue DH. Impingement exostoses of the talus and tibia. *J Bone Joint Surg Am*. 1957;39(4):835-852; discussion, 852; passim.
16. Ogilvie-Harris DJ, Mahomed N, Demaziere A. Anterior impingement of the ankle treated by arthroscopic removal of bony spurs. *J Bone Joint Surg Br*. 1993;75(3):437-440.
17. Parkes JC 2nd, Hamilton WG, Patterson AH, Rawles JG Jr. The anterior impingement syndrome of the ankle. *J Trauma*. 1980;20(10):895-898.
18. Robinson P, White LM, Salonen D, Ogilvie-Harris D. Anteromedial impingement of the ankle: using MR arthrography to assess the anteromedial recess. *AJR Am J Roentgenol*. 2002;178(3):601-604.
19. Tol JL, Slim E, van Soest AJ, van Dijk CN. The relationship of the kicking action in soccer and anterior ankle impingement syndrome: a biomechanical analysis. *Am J Sports Med*. 2002;30(1):45-50.
20. Tol JL, van Dijk CN. Anterior ankle impingement. *Foot Ankle Clin*. 2006;11(2):297-310.
21. Tol JL, van Dijk CN. Etiology of the anterior ankle impingement syndrome: a descriptive anatomical study. *Foot Ankle Int*. 2004;25(6):382-386.
22. Tol JL, Verhagen RA, Krips R, et al. The anterior ankle impingement syndrome: Diagnostic value of oblique radiographs. *Foot Ankle Int*. 2004;25(2):63-68.
23. Umans HR, Cerezal L. Anterior ankle impingement syndromes. *Semin Musculoskelet Radiol*. 2008;12(2):146-153.
24. van Dijk CN, Tol JL, Verheyen CC. A prospective study of prognostic factors concerning the outcome of arthroscopic surgery for anterior ankle impingement. *Am J Sports Med*. 1997;25:737-745.
25. van Dijk CN, Wessel RN, Tol JL, Maas M. Oblique radiograph for the detection of bone spurs in anterior ankle impingement. *Skeletal Radiol*. 2002;31(4):214-221.
26. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I, conceptual framework and item selection. *Med Care*. 1992;30(6):473-483.