Return-to-Tennis Considerations and an Elusive Diagnosis for a Cuboid Avulsion Fracture: A Disablement Model Case Study

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ABSTRACT

This disablement-model case study is focused on a 23-year-old NCAA Division I men's tennis player that sustained an injury in a competitive singles tennis match. Upon initial examination, the athletic trainer diagnosed the individual with an anterior talofibular ligament sprain and treated conservatively. The patient experienced significant disruptions to his activities of daily living due to his difficulties with ambulation during the early stages of his recovery. Interestingly, the patient was eventually diagnosed with a cuboid avulsion fracture. Midfoot fractures are uncommonly experienced in the general population, and are particularly uncommon in tennis athletes, making them difficult to recognize. Clinical prediction rules may be used to guide the decision to order imaging, however, they must be used in conjunction with pertinent clinical findings when a midfoot fracture is suspected. With rest and targeted rehabilitation, the patient successfully returned to his pre-injury levels of strength, range of motion, and perceived level of physical function in his lower extremity.
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INTRODUCTION

Foot and ankle injuries have been reported as the fourth and fifth most common sites of injury in tennis athletes, and sprains are the most frequently reported injury to the ankle for these athletes (66%).[1] The abundance of ankle sprains amidst other possible injuries may confound the diagnostic process during the evaluation of a tennis athlete. Among the conditions presenting in the foot and ankle, cuboid fractures have been shown to be the most common midfoot fracture (50%).[2] Cuboid fractures can be classified using a rating system of types 1-5. The most frequent type of cuboid fracture is a type 1 fracture (48.4%) which involves avulsion at the calcaneocuboid joint.[3] Consensus for the treatment of an avulsion fracture of the cuboid includes conservative management guided by symptom control.[3]

Clinical decision-making tools, like the Ottawa Ankle Rules, can be used to assist the evaluating clinician in deciding to order x-ray images in the acute setting of a midfoot injury. Sensitivities for the Ottawa Ankle Rules approximate 90-100% for "clinically significant" ankle and midfoot fractures.[4] The use of such tools when evaluating a patient with an acute ankle or midfoot injury can reduce unnecessary radiographs by as much as 25% in the emergency room setting.[5] Such tools need to be utilized in conjunction with the patient's history and clinical exam, as well as the examiner's clinical suspicion for ankle or midfoot fractures. A lack of recognition of a fracture during an initial clinical evaluation may result in significant impairment of daily activities, societal roles, and exercise for an active individual.

PATIENT INFORMATION

Patient

The patient was a 23-year-old student-athlete who was participating on the men's tennis team at a large, southeastern, NCAA Division I university. He was injured while actively participating in a dual match at another Division I institution during the fall tennis season. The patient stated that he first inverted his right ankle while retreating to hit a forehand and loading his right foot. He reported that he experienced some minor pain in his ankle and foot after falling to the ground, but despite this, he began playing the next point moments after standing back up and regaining his footing. Several points in the match later, the patient reported inverting his ankle again while moving backwards diagonally to track down the ball. On this instance, he stated that he felt a considerable amount of pain in his lower extremity and remained on the ground. The host athletic trainers performed an immediate on-court evaluation within the allotted 2-minute medical timeout period. The patient officially retired from the match due to injury, and the athletic trainer provided ambulation assistance to the athletic training facility for further care.

Differential Diagnosis and Evaluation

The initial differential diagnosis list for this patient included: anterior talofibular ligament sprain, avulsion fracture of the base of the fifth metatarsal, and peroneal tendon injury. The patient was diagnosed with a grade II anterior talofibular ligament sprain following a structured evaluation by the host athletic trainer. He was given crutches and instructed to continue using them until he could return home.

Upon return to campus 72 hours post-injury, the patient was re-evaluated by the athletic trainer from his institution assigned to the men's tennis patient panel. The patient presented to the athletic training facility upon return from the tennis competition with significant edema and ecchymosis throughout the phalanges of his right foot and along the length of his fifth metatarsal. Edema was most prominent along the lateral side of his foot migrating into his midfoot. Capillary refill was still intact in his distal phalanges, and the patient was not experiencing any neurological symptoms. The patient reported his pain was most intense through the midfoot zone, particularly along the dorsolateral surface near the cuboid. He stated his pain was a 6/10 while at rest. The patient could ambulate for five steps when asked to as part of the structured evaluation, but he did so with a significant antalgic gait pattern. This gait pattern consisted of an elongated heel strike and excessive pronation during midstance and push off to avoid placing pressure on the lateral aspect of his foot. Excessive femoral retroversion bilaterally was also noted during the evaluation. No pain was elicited with palpation of the distal tibia, distal fibula, base of the fifth metatarsal, navicular bone, or through compression of the calcaneus. Selective tissue tests such as the anterior drawer test and the inversion talar tilt test were both positive with pain elicited. A bump test was also performed, but it was found to be negative. He was then referred to be seen by a sports medicine physician that evening. The collaborating physician determined that imaging would not be necessary due to the absence of any significant findings indicated by the Ottawa Ankle Rules. The patient was fitted for an ASO® EVO ankle stabilizing brace and instructed that he could begin weight-bearing as tolerated in the ensuing days.

On the patient's third day of treatment after returning to campus, he scheduled an appointment with another sports medicine physician affiliated with the university's on-campus healthcare system. The patient scheduled this appointment at the request of his parents who had become increasingly worried about his condition. His parents had been encouraging him to be sure he had imaging performed for everyone's contentment. The physician noted during this visit that the patient was continuing to use his crutches and demonstrated difficulty with weight-bearing. Due to the persistent clinical picture and the absence of significant improvement in the

patient's condition at day 8 post-injury, the physician ordered radiographs for the patient's ankle and foot. Upon reviewing the images, the physician diagnosed the patient with an avulsion fracture of the cuboid in his right midfoot. The patient was fitted for a tall walking boot in the clinic, and he immediately reported a decrease in pain while ambulating throughout the hallways. He was instructed to continue wearing the walking boot for 6 weeks and was scheduled for a follow-up appointment at that time.

Body Structure and Function

This patient's fracture of his cuboid directly impacted his musculoskeletal system. The patient presented with impaired joint mobility at his ankle and metatarsophalangeal joints shown through reduced range of motion while performing ankle inversion, ankle dorsiflexion, and flexion at each of the metatarsophalangeal joints. Muscle power function was also shown to be impaired through manual muscle testing at the foot and ankle compared bilaterally. This testing revealed that inversion and eversion were both rated a 3/5 with pain, dorsiflexion was a 4/5 with pain, and plantar flexion was a 3/5. The presence of significant edema surrounding the injury site (**Figure 1**) indicated disruption to his blood vessels and prohibited his body from being able to transport blood throughout his foot and ankle on the affected side. This would inevitably play a significant role in his body's ability to complete the rest of the healing process in a timely manner. As shown in the images of the patient's foot and ankle immediately post-injury (**Figure 1**), the patient had likely already completed hemostasis and was on to the inflammatory stage of healing.[6] When the patient returned to campus at 72-hours post-injury, his body was likely in transition between the inflammatory phase and the proliferation phase. The significant ecchymosis and subsequent reduction in joint mobility was most likely due to a rush of inflammatory markers and ensuing debridement taking place at the site of injury.[6] It was paramount that the first stage of rehabilitation would restore the patient's foot and ankle functioning by reducing the qualitative changes in structure, specifically the edema present.

Figure 1. Patient Photos

6 Hours Post-Injury

24 Hours Post-Injury

24 Hours Post-Injury

Activity and Participation

The patient's injury had a profound effect on his participation in several activities throughout his daily routine. The patient reported struggling with walking short distances to and from the bathroom to urinate in the morning. He believed this was a result of a reduction in his foot and ankle mobility while sleeping. He also could not complete his daily routine of walking to and from class without the assistance of crutches due to the extended distance. He reported previously being highly dependent on his ability to walk to class due to the shortage of parking spaces near where his class was located. The walk to class was about one kilometer each direction, but this walk was particularly difficult to perform using crutches due to the variation in surfaces and sloped sidewalks. The patient estimated that his overall trip time to class was doubled while he was using the crutches. Additionally, the patient noted that he had trouble ascending stairs after arriving at the building his class was held within due to the considerable distance he had already covered. As a result of this difficulty, the patient would do his best to avoid the stairs by utilizing the elevator in the building. Unfortunately, he reported that the elevator inside the building was slow and located on the opposite end of the building from his classroom. These circumstances caused the patient to be tardy to class several times and meant that he had to allocate more time during his day for transportation to and from class.

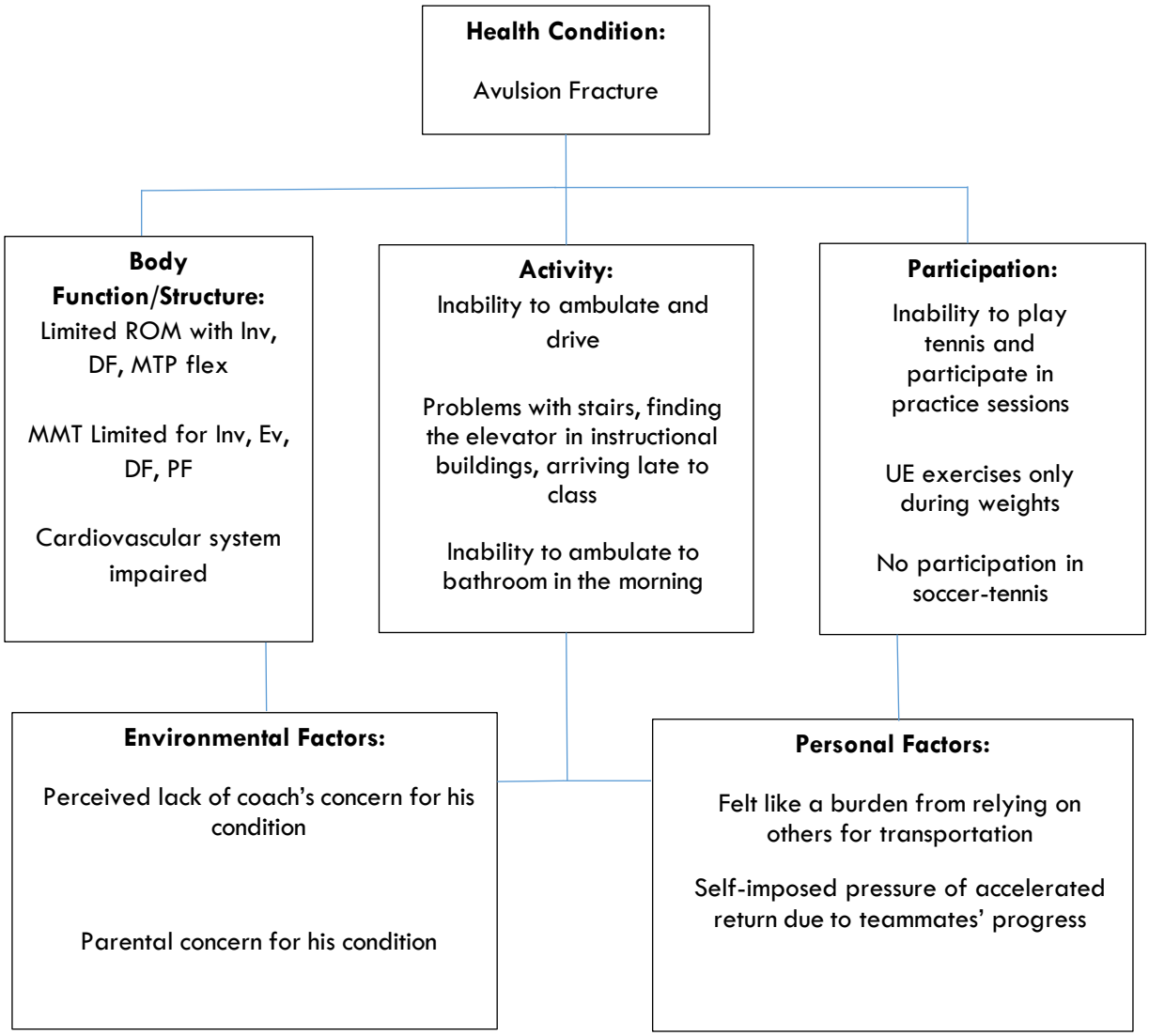
Throughout his non-weight-bearing and partial-weight-bearing stages of recovery, the patient was unable to utilize his privately owned motorized vehicle. This was due to the impairment to his right extremity which would normally control the gas and brake pedals in the vehicle. Instead, the patient routinely received transportation to tennis practice from a teammate using their own private motorized vehicle. The teammate's daily schedule differed from the patient's schedule, which made it more difficult for the patient to adhere to previously agreed-upon treatment times.

Finally, the patient was unable to participate in tennis practices and conditioning sessions in the same capacity as his teammates. He was able to complete a portion of his rehabilitation exercises in close proximity to the tennis courts, but he was unable to perform the same general actions as everyone else throughout the allotted practice times. The patient was also significantly limited during weight sessions, performing only upper extremity exercises for the first several weeks following the injury.

Environmental and Personal Factors

The patient experienced reductions in his formal and informal relationships while recovering from his injury. He felt that his informal relationships with his teammates and friends were hindered due to the burden he felt that he was placing on them by relying on them for transportation and assistance with obtaining goods such as groceries (**Figure 2**). He also felt his social relationships with teammates wore down due to his inability to connect with them after physically taxing practice sessions. Another contributing factor to the reduction in his social relationships was due to the patient's self-imposed pressure to return to tennis in time to compete for the final singles position for the upcoming spring season. He reported feeling like other members of the team were making strides forward with their skills, and that he was going to have even more work to do when he returned. The patient's formal relationships with the coaching staff also frayed due to a perceived lack of concern about his recovery. He stated that he felt the coaches rarely checked in directly with him about his progress and overall condition. This made the patient more reluctant to be willing to engage with the coaches, which had a second-hand effect on his willingness to engage in some team activities and made him feel even more distant from his teammates.

Figure 2. ICF Disablement Model Flow Chart



INTERVENTIONS

While at the host institution where the injury occurred, the patient was fitted for crutches, a tubular compression bandage, and had cryotherapy compression treatment (GameReady™, Concord, CA) administered twice daily. The patient was also instructed to take 650 mg of Ibuprofen every 4-6 hours as needed. Following arrival back to campus, the patient continued to utilize cryotherapy treatment, and he also began treatments consisting of Deep Oscillation Therapy (HIVAMAT®, Sebastian, FL) using parameters of 8 minutes at 120 Hz, 6 minutes at 80 Hz, and 6 minutes at 20 Hz. Deep Oscillation Therapy treatment was performed daily for the first week of rehabilitation with the goal of reducing the patient's persistent edema in the distal foot. Additionally, the patient was prescribed Naproxen Sodium 500mg to take twice daily during the acute phase of his injury.

Throughout his rehabilitation, the patient utilized several other modalities for tissue warming and pain relief prior to exercise. These modalities included Compex (DJO Global™, Lewisville, TX), therapeutic ultrasound (DJO Global™, Lewisville, TX) (1 MHz, 1.2 W/cm^2, 7 minutes), and class IV laser therapy (LightForce®, New Castle, DE) (18 W for 4 minutes). Beginning in the first week of rehabilitation, the patient began performing ankle range of motion exercises and intrinsic foot muscle exercises. He began without any resistance for the first week, and he progressed in resistance starting in the second week. The patient slowly progressed further with resistance using pain as a guide for intensity.

Blood flow restriction (BFR) therapy (Delfi Personalized Tourniquet System, Vancouver, BC, Canada) was integrated into the patient's partial-weight-bearing exercises following the third week of rehabilitation. BFR has been validated as an effective means of increasing strength when used in conjunction with low-load resistance training.[7] This was especially useful throughout the partial-weight-bearing stage due to the inability of the patient to place high loads on his affected extremity. Despite the discomfort from the restriction of blood flow, the patient seemed to respond well to the intervention and welcomed the challenge of participating in fatiguing exercise when he was otherwise unable to do so. The patient was subjected to 65% occlusion the first 2 times he completed exercises with BFR, before advancing to 70-80% occlusion for the remainder of BFR sessions.

While the patient was unable to place high loads on his lower extremity, he also underwent aquatic therapy exercises and followed a progressive lower extremity strengthening program. In order to begin the patient's aquatic exercises, the patient was fitted with a custom removable plastic cast (ActivArmor®, Pueblo, CO). The patient engaged in aquatic therapy (SwimEx™, Fall River, MA) using the removable cast twice weekly. Aquatic therapy for the patient included a 5-minute walk, 5-minute jog (4 MPH), 10-minute run (6.0-7.0 MPH), and a variety of lower extremity functional exercises. His lower extremity strengthening program began with open kinetic chain exercises. The program incorporated balance and proprioception for the contralateral extremity while he was partial weight-bearing. The goal of using the contralateral extremity was to promote neuromuscular advances for the affected extremity without placing a load on it.[8]

Upon receiving physician clearance to cease wearing the walking boot at 7 weeks post-injury, the patient began engaging in anti-gravity running activity (AlterG®, Fremont, CA). These anti-gravity running sessions occurred three times per week and consisted of alternating running and light jogging for 5-minute intervals for a total of 30 minutes. The patient began at 60% body weight and progressed to 80% body weight before being allowed to begin running outdoors. When the patient reached 9 weeks post-injury, he began his agility exercise progression (**Table 1**). The patient was given instructions for progressions of each of the agility exercises prior to leaving campus for winter break.

At the conclusion of winter break and 12 weeks post-injury, the patient was consistently completing his agility exercises 4 times per week. Upon returning to campus for tennis practices, the patient was gradually integrated into full tennis practice using a guided return to tennis protocol (**Table 2**). After the patient successfully completed the return to tennis protocol, he officially returned to play in a full capacity at 13 weeks post-injury.

Table 1. Patient's home exercise program, including the agility exercises

Exercise	**Prescription**
4-Way ankle	3x15 repetitions
Knee to wall	2x20 seconds
Toe raises	2x15 repetitions
Wall sit w/ calf raise	2x15 repetitions

Wall sit w/ toe raise	2x15 repetitions
Seated calf raise	2x10 repetitions
Heel taps	2x15 repetitions (6-inch box or stair)
Lateral band walks	2x10 repetitions (each)
Monster walks	2x10 repetitions (each)
4-Way hip	3x10 repetitions
Clam shells	3x10 repetitions (every other day)
Agility	
Hurdles	2 in each (forward and lateral)
Icky shuffle	Normal and wide
Lateral shuffle	2x (down and back)
Back-pedal w/ lateral break	2x (down and back)
A-skips	Lateral and forward
Carioca	2x (down and back)
Box drill	2x (down and back)
6-ball drill w/ tennis balls on cones)	2x (down and back)
T Drill	2x (down and back)

Table 2. Return to Tennis Program

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Stationary Hit: 30 forehands (FH) 30 backhands (BH) Stationary biking (45 min)	Stationary Hit: 30 FH 30 BH 15 Crosscourt Stationary biking (30 min)	Stationary Hit: 30 FH 30 BH 15 Crosscourt 15 Volleys 15 serves Stationary biking (30 min)	*Complete Warm Up:* 30 FH 30 BH 15 Crosscourt 15 Volleys 10 Overheads 30 Serves Stationary biking (30 min)	*Complete Warm Up* Ground points allowed (rally begins with an underhand feed)	Unrestricted Return to Play

OUTCOMES

Body Structure and Function

The patient completed the Foot and Ankle Ability Measure (FAAM), a survey designed to probe an individual's perceived level of function in daily activities and in sport specific activities. The FAAM has been reported to be a valid and reliable measure for an individual's overall physical function while recovering from a lower-extremity musculoskeletal injury.[9] At the time of his return from winter break, the patient stated on the FAAM that his level of function during his activities of daily living was 80%, and he scored a 66% on the sports subscale. This indicated that he was still experiencing a moderate level of impairment while completing his sport-specific activities, but just a mild level of impairment throughout the rest of his daily activities. He stated that the perceived lack of function at that time was because he was still experiencing some discomfort while loading his right foot and forcefully pushing off to move laterally to the left. Despite

the perceived lack of function, the patient displayed normal levels of muscle power indicated through manual muscle testing for inversion, eversion, and ankle dorsiflexion.

During the patient's 6-week follow-up appointment with the university health services physician, he was cleared to begin weight-bearing exercises and to gradually cease wearing the walking boot. At approximately 13 weeks post-injury, the patient successfully returned to tennis activities in full capacity. The period to return to play was extended due to time spent away from tennis while at home for winter break, however, this allowed the patient to gradually return to sport following arrival back to campus.

Upon waking in the morning throughout his initial return to practice period, the patient expressed feeling limited mobility in his ankle that was still hindering his daily morning routine. The patient reported, however, that this limitation seemed to subside as he was awake and moving for several hours throughout the morning. Currently, the patient reports that his level of function during his daily activities and sports related activities is not impacted by his injury. He no longer reports discomfort moving in any direction while playing tennis. He also states that he believes he has built up a significant amount of endurance in his foot and ankle muscles to withstand entire practices and competitions without complications.

Activity and Participation

The patient reported feeling much better about his role on the team and in society following his return to play. He stated that he felt the burden lifted when he was able to transport himself to class, meals, and tennis practices. He felt an improvement in his educational experience as his attendance in classes improved following his recovery. Further, he felt a relief of pressure when he began playing tennis again. Tennis was often an outlet for his emotions and stress in everyday life, and it felt more normal to him to be able to participate in all the team's activities. Among the most significant activities the patient felt he missed while recovering from his injury was the team's daily match of soccer tennis before the beginning of practice. Soccer tennis was a game invented by several team members to include a combination of foot and header skills. The game was played within the service boxes of a regulation tennis court with a soccer ball. This game was a major source of team bonding, and he felt a greater sense of belonging and an improvement in his informal relationships with teammates after finally being allowed to take part in the game again. Altogether, the patient was successfully returned to all societal roles and activities that he was previously engaged in.

Environmental and Personal Factors

Overall, the patient presented with a positive attitude to improve his condition for all rehabilitation sessions. He seemed to have a strong social support system that wanted to see him recover and return to participation in previous activities. He was always eager to progress throughout his rehabilitation and advance to more challenging exercises. The patient did have moments where he was hesitant to schedule a time for rehabilitation due to feeling like a burden to the athletic trainer. He would often explain that he could complete his rehabilitation at any convenient time for the athletic trainer because he believed the other injuries his teammates were experiencing were more pressing. Due to these remarks, the athletic trainer explained multiple times that his injury and condition were just as concerning, and that they would receive the same amount of attention and care prior to beginning his rehabilitation sessions.

Just 24-hours after receiving clearance from the physician to begin weight-bearing and gradually move away from utilizing the walking boot, the patient contracted Influenza-A. The treating physician also suspected the patient had concurrently contracted viral pneumonia. He isolated himself at home and rested for about 3 days before feeling up to going to class. The presence of pneumonia complicated the patient's

ability to complete his rehabilitation, specifically his return to cardiovascular conditioning activities. Fortunately, no long-term consequences resulted from the pneumonia, and the patient was able to gradually work on conditioning activities without any further setbacks.

Finally, the patient's care and overall return to play was disturbed by travel for winter break. The patient was about to progress into his agility exercises when the fall academic semester ended, and the break began. This break was a result of the educational system's policies regarding scheduled holidays as well as societal norms that have been constructed for rest during the holiday season. Over the break, the patient was going home to his parents' residence and would not be available to work on his rehabilitation at the athletic training facility for 2 weeks. He was provided with an at-home exercise program and was guided through the variety of agility drills prior to traveling. In addition, he was instructed on the progression of exercises moving forward. The athletic trainer was tasked with consistently checking on the patient's condition through virtual means before instructing him to progress further with his exercises. The patient's lack of access to a tennis facility also acted as a barrier to his success over this break. As a result, he was only able to perform some functional sport-specific activities, and he was not able to begin his progression into full tennis activities until he returned from the break.

DISCUSSION

The high sensitivity of the Ottawa Ankle Rules indicates it is a reliable tool to rule out fractures of the foot and ankle,[4] but this case provides evidence that caution still needs to be taken during its acute implementation. It proved essential for the second physician in this case to order radiographs, as the patient was still presenting with pain and an inability to bear weight 5-7 days after his first visit. The use of additional clinical factors, such as the significant amount of edema as many as 72-hours post-injury, could have been an important indicator for the practical use of radiographs to rule out a possible fracture. In addition, it is also important to consider the relative ease of obtaining radiographs at the NCAA Division I level, as well as the relatively low cost and low dose of radiation exposure compared to other sources of imaging.

The plan of care initiated by the university heath affiliated physician followed the published recommendations regarding the treatment of low-energy cuboid fractures. This evidence currently suggests that about 4-6 weeks of partial weight-bearing in a walking boot is an effective intervention to promote healing of the bone.[10] Following that period, the patient could then transition away from the boot and begin weight-bearing as symptoms allow.

A complication with the patient's return to tennis program was the timing of the university's winter break. The beginning of winter break coincided with the patient's start of his functional agility exercises. This presented a challenge in terms of the delivery of form instruction and corrective cues. The athletic trainer could not be present for the entirety of his agility exercises, so the patient was first guided through all the baseline agility exercises prior to leaving for break. The athletic trainer included examples of the progressions for the athlete to utilize moving forward. Many of the progressions for the agility exercises and the sport-specific exercises included drills that the patient had been regularly completing in fitness sessions prior to his injury. The patient was allowed to take several hurdles and cones for use at home throughout his program. The patient's home exercise plan was also tailored toward utilizing objects the patient would already have access to at home. An example of this included performing heel taps using a single step of a set of stairs as the raised platform. Throughout this period at home, the patient was instructed to check-in with the athletic trainer weekly to assess his condition and discuss his progression for the following week.

The patient's subsequent return to tennis plan (Appendix A) had to include consideration for the extended time he had been removed from activity. Tennis can be a very physically demanding sport that combines aerobic exercise during long rallies with anaerobic bursts of power and agility. Tennis also requires a large amount of upper extremity acceleration, deceleration, and dexterity. The patient required proper reconditioning of both his lower extremity and upper extremity during his return to tennis progression. This was performed using a progressive loading period that consisted of a combination of sport-specific tennis activities and low-impact aerobic exercise on a stationary bike.

The patient was ultimately able to successfully return to his normal daily activities, roles in society, and level of functionality in sport following his injury. This process consisted of careful consideration of the patient's physical condition and emotional stability. Several confounding factors contributed to a delay in the patient's complete return to play, however, he does not report any frustrations with this delay. The patient recognizes that the timing of contracting influenza and winter break had a significant impact on his recovery and does not attribute this delay to his persistent symptoms experienced throughout his first two weeks post-injury. Overall, the patient is satisfied with his ability to perform his role in sport and society after his recovery despite the significant injury that occurred.

CLINICAL BOTTOM LINE

While midfoot fractures are not commonly seen in competitive tennis players, it is important that the health care team work to integrate clinical prediction rules and pertinent clinical findings to ensure suspected midfoot fractures are not missed. When implementing the Ottawa Ankle Rules, consideration of the findings in the history and physical exam, as well as the examiner's clinical concern, need to factor into the decision to have imagining performed on a patient. While it is important to limit unnecessary x-ray imaging, clinical concern may reasonably override the recommendation of a clinical prediction rule.

PATIENT PERSPECTIVE

The patient emphasized the significant impact that not being able to transport himself had on his perceived role in society throughout his rehabilitation. He did not appreciate the burden that he felt he was on other people, and he also struggled with being on other individuals' time schedules. He is typically an individual that enjoys arriving early for practices and competitions, and he was no longer able to do this after suffering the injury. Interestingly, the patient expressed frustration with the accessibility of campus instructional buildings due to the lack of efficient elevator services. He noted how fortunate he was to only have to deal with these shortcomings for a relatively short amount of time. He could not imagine having to continue devoting such a large amount of additional time for his commute to daily activities. The patient was pleased with the outcome from his recovery, and he expressed gratitude for having the opportunity to play tennis competitively again.

REFERENCES

1. Fong DT, Hong Y, Chan LK, Yung PS, Chan KM. A systematic review on ankle injury and ankle sprain in sports. *Sports Med*. 2007;37(1):73-94. https://doi.org/10.2165/00007256-200737010-00006.
2. Court-Brown CM, Zinna S, Ekrol I. Classification and epidemiology of mid-foot fractures. *The Foot*. 2006;16(3):138-141. https://doi.org/https://doi.org/10.1016/j.foot.2006.03.003.
3. Fenton P, Al-Nammari S, Blundell C, Davies M. The patterns of injury and management of cuboid fractures. *Bone Joint J*. 2016;98-B(7):1003-1008. https://doi.org/10.1302/0301-620x.98b7.36639.

4. Jenkin M, Sitler MR, Kelly JD. Clinical usefulness of the Ottawa Ankle Rules for detecting fractures of the ankle and midfoot. *J Athl Train*. 2010;45(5):480-2. https://doi.org/10.4085/1062-6050-45.5.480.
5. Stiell I, Wells G, Laupacis A, et al. Multicentre trial to introduce the Ottawa ankle rules for use of radiography in acute ankle injuries. Multicentre Ankle Rule Study Group. *BMJ*. 1995;311(7005):594-7. https://doi.org/10.1136/bmj.311.7005.594.
6. Houglum PA. Therapeutic Exercise for Musculoskeletal Injuries 4th Edition. *Human Kinetics*; 2016.
7. Slysz J, Stultz J, Burr JF. The efficacy of blood flow restricted exercise: A systematic review & meta-analysis. *J Sci Med Sport*. Aug 2016;19(8):669-75. https://doi.org/10.1016/j.jsams.2015.09.005.
8. Oliveira AS, Brito Silva P, Farina D, Kersting UG. Unilateral balance training enhances neuromuscular reactions to perturbations in the trained and contralateral limb. *Gait Posture*. 2013;38(4):894-9. https://doi.org/10.1016/j.gaitpost.2013.04.015.
9. Martin RL, Irrgang JJ, Burdett RG, Conti SF, Van Swearingen JM. Evidence of validity for the Foot and Ankle Ability Measure (FAAM). *Foot Ankle Int*. 2005;26(11):968-83. https://doi.org/10.1177/107110070502601113.
10. Angoules AG, Angoules NA, Georgoudis M, Kapetanakis S. Update on diagnosis and management of cuboid fractures. *World J Orthop*. 2019;10(2):71-80. https://doi.org/10.5312/wjo.v10.i2.71.