Syndesmosis and Lateral Ankle Sprains in the National Football League

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abstract

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Syndesmosis sprains in the National Football League (NFL) can be a persistent source of disability, especially compared with lateral ankle injuries. This study evaluated syndesmosis and lateral ankle sprains in NFL players to allow for better identification and management of these injuries. Syndesmosis and lateral ankle sprains from a single NFL team database were reviewed over a 15-year period, and 32 NFL team physicians completed a questionnaire detailing their management approach. A comparative analysis was performed analyzing several variables, including diagnosis, treatment methods, and time lost from sports participation. Thirty-six syndesmosis and 53 lateral ankle sprains occurred in the cohort of NFL players. The injury mechanism typically resulted from direct impact in the syndesmosis and torsion in the lateral ankle sprain group ($P=.034$). All players were managed nonoperatively. The mean time lost from participation was 15.4 days in the syndesmosis and 6.5 days in the lateral ankle sprain groups ($P\leqslant.001$). National Football League team physicians varied treatment for syndesmosis sprains depending on the category of diastasis but recommended nonoperative management for lateral ankle sprains. Syndesmosis sprains in the NFL can be a source of significant disability compared with lateral ankle sprains. Successful return to play with nonoperative management is frequently achieved for syndesmosis and lateral ankle sprains depending on injury severity. With modern treatment algorithms for syndesmosis sprains, more aggressive nonoperative treatment is advocated. Although the current study shows that syndesmosis injuries require longer rehabilitation periods when compared with lateral ankle sprains, the time lost from participation may not be as prolonged as previously reported.

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Ankle sprains are the most common injuries in athletes.[1] Previous studies have indicated that between 1% and 18% of all ankle sprains involve injury to the syndesmosis.[2-4] Although syndesmosis sprains are much less common than lateral ankle sprains, previous research has suggested that syndesmosis sprains have a higher morbidity, including a prolonged recovery period leading to a higher rate of chronic ankle dysfunction 6 months after ankle injury.[3,5]

A recent study evaluating football injuries of prospective professional football players in the National Football League (NFL) documented that ankle sprains were the most common diagnosis by far with an incidence of 29%.[6] Although syndesmosis sprains are much less common in the general athletic population, other studies have also shown an increased incidence occurring in football players.[3,4,7]

Despite the numerous studies documenting the diagnostic factors relating to syndesmosis and lateral ankle sprains, there is a paucity of published data comparing and evaluating outcomes of these injuries in professional football players, with most research only reporting small case series.[8-11] When evaluating lateral ankle sprains versus syndesmotic ankle sprains in professional football players, 2 previous studies documented that physical examination is the key to diagnosis, and syndesmotic ankle sprains often result in a prolonged recovery time with impairment and inability to fully participate for as long as 4 to 8 weeks.[8,9] However, these studies evaluated a relatively small number of patients and provided little information relating to treatment-driven outcomes. In fact, most syndesmotic and lateral ankle sprain treatment algorithms are ill defined and exhibit great variation among treating physicians.

The purpose of this study was to further elucidate the mechanism of injury, diagnosis, treatment, and outcomes for syndesmosis sprains in NFL football players and compare those injuries with the more common lateral ankle sprains. In addition, the authors aim to provide a qualitative analysis of current diagnostic and treatment algorithms used by NFL team physicians in their management of syndesmosis and lateral ankle sprains.

Materials and Methods

An analysis of syndesmosis and lateral ankle sprains in NFL football players was accomplished through 2 specific phases. The first phase involved conducting a retrospective review of prospectively collected data relating to syndesmosis and lateral ankle sprains in professional football players from a single NFL football team over a 15-year period. The second phase involved further evaluating diagnostic and treatment algorithms for syndesmosis and lateral ankle sprains among all 32 NFL team physicians using a structured questionnaire. Institutional review board approval was obtained for this study.

In the first phase of the study, an NFL team injury database was reviewed for syndesmosis and lateral ankle sprains that were prospectively entered by the NFL team certified athletic trainer after consultation with the head orthopedic team physician. All injury and diagnostic measures were then analyzed, including player position, foot and ankle protective gear (none, tape, brace, or unknown), playing surface (grass, short pile synthetic turf, real grass synthetic turf, or unknown), field condition (normal, wet, hard, or unknown), place of injury (game or practice), time of injury in the game or practice (first quarter, second quarter, third quarter, fourth quarter, or unknown), type of play (collision, tackled, tackling, blocked, blocking, running/cutting, kicking, or unknown), and mechanism of injury (direct impact, torsion, shearing, or unknown).

Syndesmosis and lateral ankle sprains were then classified according to standard clinical classification guidelines. Syndesmosis sprains were classified in a similar manner to the West Point Ankle Grading System by Gerber et al[3]: grade 1: no instability, grade 2: some evidence of instability, and grade 3: definite instability. Lateral ankle sprains were classified according to clinical symptoms (grade 1, 2, or 3) as previously described by Wolfe et al.[12]

The diagnosis of both syndesmosis and lateral ankle sprains was based on clinical and radiographic information. For lateral ankle sprains, the clinical diagnosis was confirmed with a clinical history of inversion ankle injury with tenderness over the anterior talofibular ligament and/or calcaneofibular ligament in addition to pain with talar tilt. All patients had pain and various instability patterns with the anterior drawer test but did not have pain with calf compression or external rotation tests.[8] For syndesmosis ankle sprains, the clinical diagnosis was confirmed with tenderness over the anterior and posterior tibiofibular ligaments, interosseous membrane, and/or the interosseous ligament. In addition, the authors used special tests to elicit syndesmosis injury–related pain, including the calf compression and external rotation tests.[8] Radiographic information was derived from conventional radiographs, including anteroposterior, mortise, and lateral ankle views, in all cases and selective magnetic resonance imaging if clinically indicated. For clinically suspected syndesmosis sprains, anteroposterior and lateral tibia/fibular radiographs were also obtained.

Once the diagnosis was confirmed, treatment was then determined by the NFL medical team. For both syndesmosis and lateral ankle sprains, the initial treatment consisted of rest, ice, compression, and elevation. Regardless of the severity of injury for lateral ankle sprains, taping and/or bandaging was typically used with or without a short immobilization period using an AirCast brace (DJO Global Inc, Vista, California). For syndesmosis sprains with no diastasis, nonoperative management was accomplished with immobilization in a CAM walker boot with progression to weight bearing as tolerated. For syndesmosis sprains with latent dias-

tasis, management was instituted depending on the severity of injury; nonoperative treatment was recommended for injuries with minimal (less than 2 mm) diastasis and operative treatment for injuries moderate or severe diastasis. For syndesmosis sprains with frank diastasis, operative management was always indicated with open reduction and internal fixation using 2 nonabsorbable syndesmosis screws spanning a total of 4 cortices. After surgery, progression to full weight bearing and gradual return to contact sports was permitted after hardware removal. During nonoperative treatment for both syndesmosis and lateral ankle sprains, inflammation and swelling were initially addressed, and a comprehensive rehabilitation program was subsequently initiated focusing on gradual range of motion exercises, strengthening, and gradual advancement to proprioceptive exercises. A gradual return to play was allowed when the players' symptoms decreased with a return to full range of motion and strength. Time loss from participation was then recorded based on the dates of injury and return to play.

In the second phase of the study, an Internet-based structured electronic questionnaire was sent to all 32 NFL team physicians. The questionnaire was compiled to gather information relating to current diagnostic, treatment, and outcome algorithms in the management of syndesmosis and lateral ankle sprains involving professional football players among all 32 NFL teams. This questionnaire was sent via e-mail to all survey participants with an embedded link to a secure online survey resource (REDCap Survey Software, Version 1.3.9; Vanderbilt University, Nashville, Tennessee). Once the electronic questionnaire was completed by each NFL team physician, the results were exported in a spreadsheet format for descriptive data analysis.

Descriptive and/or statistical analysis was performed for all variables. An independent sample *t* test with corresponding *P* values was calculated for foot and ankle protective gear, playing surface, field condition, mechanism of injury, place of injury, and time loss from participation. For all other variables, a descriptive analysis was performed, including means and minimum-maximum range for quantitative variables and frequencies and percentages for qualitative variables.

RESULTS

A retrospective review of the prospectively collected NFL single-team injury database revealed that there were 36 syndesmosis and 53 lateral ankle sprains during the study period. For player-, field-, and injury-specific data, the results including *P* values are summarized in the Table. All syndesmosis and lateral ankle sprain injuries were successfully treated with nonoperative management and allowed to return to play without the need for subsequent surgery within the same season. For the syndesmosis group, 16 grade 1, 20 grade 2, and 0 grade 3 injuries were reported, whereas the lateral ankle sprain group incurred 30 grade 1, 21 grade 2, and 3 grade 3 injuries. There was a statistically significant difference in time loss from participation in the syndesmosis (15.4±11.1 days) and lateral ankle (6.5±6.5 days) sprain groups ($P<.001$).

In terms of complications within the same season after return to play, recurrent injuries were reported for only 2 players with syndesmosis sprains and 4 players with lateral ankle sprains. For the 2 players with recurrent syndesmosis sprains, both recurrent injuries occurred during a game situation from a direct impact. One recurrent grade 1 injury developed on normal real grass synthetic turf and required only 4 days of time lost from participation, whereas the other recurrent injury was grade 2, occurred on hard short pile synthetic turf, and resulted in 16 days of time lost from participation.

Four football players from the lateral ankle sprain group went on to develop recurrent sprains during the same season, which all occurred during an actual game and resulted in an inability to return to play. Three of the players had 1 recurrent ankle sprain during the same season while playing on artificial turf (2 short pile synthetic turf and 1 real grass synthetic turf), and 1 player had 2 recurrent ankle sprains that both took place on short pile synthetic turf. The mechanism of recurrent injury in the 3 players with 1 recurrent ankle sprain was secondary to torsional injuries, whereas the 1 player with 2 recurrent ankle sprains had an injury mechanism resulting from direct impact followed by a subsequent torsional injury. All players were able to return to play after recurrent injury; however, return to play time was prolonged when compared with the primary injury in the same season. The three grade 1 recurrent ankle sprains resulted in 12.7 days of time loss from participation (range, 9-19 days), and the 1 grade 2 recurrent ankle sprain resulted in 24 days of time loss from participation. The overall player injury profile with 2 recurrent ankle sprains in the same season had a primary grade 1 sprain (3 days time loss from participation) followed by a recurrent grade 1 injury (9 days time loss from participation) and subsequent progression to a recurrent grade 2 injury (16 days time loss from participation).

The surveys from phase 2 of the study were completed by physicians from all 32 (100%) of the NFL teams. When ascertaining NFL team physician management decisions for syndesmosis sprains, results were evaluated according to the severity of injury including no, latent, or frank syndesmotic diastasis. When managing syndesmosis sprains with no diastasis, most team physicians use immobilization, including 28 with a boot (26 CAM walkers, 1 boot walker, and 1 AirCast boot) and 2 with a cast; however, 2 physicians use only ankle taping or an elastic bandage. Initial weight-bearing status varies among physicians, including 14 weight bearing as tolerated, 12 partial weight bearing, and 6 nonweight bearing; however, most

Table

Syndesmosis and Lateral Ankle Sprains According to Player-, Field-, and Injury-specific Data

Variable	No. (%) Syndesmosis (n=36)	No. (%) Lateral Ankle (n=53)	*P*
Position			NA
Running backs	5 (14)	3 (6)	
Quarterback	1 (3)	0 (0)	
Wide receivers	2 (6)	6 (11)	
Tight end	1 (3)	2 (3)	
Offensive lineman	7 (19)	9 (17)	
Defensive lineman	3 (8)	8 (15)	
Linebackers	10 (28)	9 (17)	
Defensive backs	5 (13)	9 (17)	
Special teams	2 (6)	7 (14)	
Foot & ankle protection			.38
Nothing	4 (11)	10 (19)	
Tape	28 (78)	36 (68)	
Brace	1 (3)	2 (4)	
Unknown	3 (8)	5 (9)	
Playing surface			.82
Grass	18 (50)	24 (45)	
FieldTurf	9 (25)	15 (27)	
AstroTurf	6 (17)	9 (17)	
Unknown	3 (8)	5 (9)	
Field condition			.71
Normal	27 (75)	39 (74)	
Wet	4 (11)	5 (9)	
Hard	2 (6)	4 (8)	
Unknown	3 (8)	5 (9)	

Variable	No. (%) Syndesmosis (n=36)	No. (%) Lateral Ankle (n=53)	*P*
Place of injury			.24
Game	24 (67)	28 (53)	
Practice	9 (25)	20 (38)	
Unknown	3 (8)	5 (9)	
Time of injury			NA
1st quarter	6 (17)	8 (15)	
2nd quarter	9 (25)	14 (27)	
3rd quarter	7 (19)	16 (30)	
4th quarter	11 (31)	10 (19)	
Unknown	3 (8)	5 (9)	
Mechanism of injury			.03
Direct impact	20 (55)	16 (30)	
Torsion	11 (31)	26 (50)	
Shearing	2 (6)	6 (11)	
Unknown	3 (8)	5 (9)	
Type of play			NA
Tackling	11 (31)	7 (14)	
Tackled	4 (11)	5 (9)	
Blocking	8 (22)	12 (23)	
Blocked	4 (11)	7 (13)	
Collision	4 (11)	8 (15)	
Running/cutting	2 (6)	8 (15)	
Kicking	0 (0)	1 (2)	
Unknown	3 (8)	5 (9)	

Abbreviation: NA, not applicable.

physicians ideally progress players to full weight bearing by 2 weeks (31% immediately, 44% by week 1, 19% by week 2, and 6% by week 3).

When managing syndesmosis sprains with latent diastasis, NFL team physicians use radiographs and magnetic resonance imaging (MRI) to direct treatment algorithms. Most team physicians (78%) reported that the most important preoperative factor on conventional radiographs indicating a need for an operation was based on an increased tibiofibular clear space on a stress mortise view (53% manual stress and 22% weight-bearing stress). The remaining team physicians preferred other views to indicate the need for an operation, including increased tibiofibular clear space on the stress anteroposterior view (6%), increased tibiofibular clear space on the weight-bearing anteroposterior view (3%), and increased fibular migration on the stress lateral view (3%). In terms of MRI findings, most team physicians maintained that combined anteroinferior and posteroinferior tibiofibular ligament complete tears (47%) as well as an interosseous ligament tear greater than 10 cm up the leg (31%) were the most important predictive factors indicating the need for an operation. The other responders stated that other preoperative MRI factors, including interosseous membrane tears

(13%), interosseous ligament tears less than 10 cm up the leg (6%), and isolated posteroinferior tibiofibular ligament tears (3%), can also indicate the need for an operation.

In terms of syndesmosis sprains with frank diastasis, all (100%) of the NFL team physicians indicated that surgical management is warranted, with most recommending postoperative weight-bearing restrictions, including 84% nonweight bearing, 13% partial weight bearing, and 3% weight bearing as tolerated. Despite the similarities in postoperative treatment, there were differences in the surgical technique. The preferred method of operative management for syndesmosis sprains with frank diastasis included fixation across 4 cortices using 2 nonabsorbable syndesmosis screws. In fact, recommendations included 4 cortices by 75% and 3 cortices by 25% of NFL team physicians, whereas they most often suggested 2 nonabsorbable screws (59%) followed by 1 nonabsorbable syndesmosis screw (22%) and 2 nonabsorbable suture fixation devices (19%). When using a nonabsorbable syndesmosis screw, most (69%) of the NFL team physicians do not allow return to play until syndesmosis screws are removed; however, 25% do allow full participation with contact, and 6% allow partial participation with no contact. Therefore, the removal of syndesmosis screws is important for most NFL team physicians before considering return to play guidelines. There was also variance in terms of postoperative timelines for screw removal, including 41% from 11 to 12 weeks, 31% from 7 to 8 weeks, 13% from 9 to 10 weeks, 9% from 13 to 14 weeks, and 6% reported not removing the screw at all.

For return to play guidelines, the injury severity, based on the presence of syndesmotic diastasis, was an important factor. Almost all (97%) of the NFL team physicians estimated that time lost from participation after a syndesmosis sprain with no diastasis is 1 to 8 weeks, with most estimating return to play between 1 and 4 weeks (21 physicians: 1-4 weeks and 10 physicians: 5-8 weeks). In addition, most (81%) of the NFL team physicians estimated that time lost from participation after a syndesmosis sprain with latent diastasis is 5 to 12 weeks (13 physicians: 5-8 weeks and 13 physicians: 9-12 weeks). Finally, syndesmosis sprains associated with frank diastasis were reported to have the most prolonged course for return to play because 81% of team physicians reported a time loss from participation between 9 and 16 weeks (17 physicians: 9-12 weeks and 9 physicians: 13-16 weeks).

As opposed to syndesmosis sprains, there was greater consensus in the management of lateral ankle sprains by NFL team physicians. In fact, 72% used ankle taping/bandaging in addition to standard rest, ice, elevation, and compression, whereas other physicians added a walker boot (19%) or AirCast-type ankle brace (9%). Weight-bearing algorithms were almost universally nonrestricted with 94% weight bearing as tolerated and 6% partial weight bearing. Compared with syndesmosis sprains, return to play guidelines were expeditious for lateral ankle sprains (12% immediately, 28% by week 1, 41% by week 2, and 19% by week 3).

DISCUSSION

Ankle sprains are a common injury encountered by sports medicine as well as foot and ankle physicians. There are an estimated 30,000 ankle injuries per day in the United States, which represent the most common athletic injury.[13-20] These injuries have a particularly strong association with certain sports, such as basketball and American football, where they may account for up to 13% of all injuries. A majority of treating physicians have historically recommended various forms of conservative management; however, a careful assessment of these injuries revealed that 10% to 40% result in persistent symptoms after acute injury.[13,14,16-19,21-23] Associated pathology can include peroneal tendon tears or subluxation, cartilage damage, anterolateral ankle impingement, and chronic ankle instability, especially in patients who report persistent symptoms after injury. Several authors have suggested that injury to the mechanoreceptors and attenuation of the lateral ligament complex are likely contributors to chronic symptomatology.[22,24] Furthermore, the severity of the initial injury will influence the level of disability, the length of recovery, and a successful return to play.

Most professional athletes are able to return to play with minimal long-term disability after lateral ankle sprains, which may be caused by a myriad of factors. Given the optimized neuromuscular training and conditioning of professional football players, they may have improved dynamic stability that allows for a stable ankle platform. In fact, even in the setting of severe lateral ligamentous complex injuries, a satisfactory anatomically aligned tibiotalar joint may be shown on weight-bearing radiographs. When the tibiotalar joint is not anatomically reduced, studies have shown that as little as 1 mm of talar translation in the mortise may lead to an approximately 40% increase in the contact stresses of the articular cartilage within the ankle joint.[25-27] In contrast to syndesmosis injuries, however, patients rarely, if ever, have diastasis with these lateral ankle sprain injuries.

Syndesmotic injuries have historically resulted in greater morbidity compared with lateral ankle sprains with prolonged recovery times. The syndesmosis connects the tibia to the fibula and is commonly stressed during external rotation at the ankle joint. When there is a sprain or tear of the syndesmosis, the tibia and fibula may maintain their anatomic alignment. This is caused by a variety of factors including the integrity of the lateral ligamentous complex and the medial deltoid complex, both of which attach to the talus. These injuries usually take longer to heal because they frequently involve larger segments of ligament (larger than

10 cm). Furthermore, football is a cutting-type sport in which players often externally rotate to cut. Such forces are difficult to protect against while allowing an athlete to perform at a high level. Despite most of these assertions in the literature, previous research has established that professional football players with syndesmosis sprains may have a more expedient return to play (potentially between 2 and 6 weeks) with nonoperative management.[5,7,8] In fact, Boytim et al[8] as well as the NFL team physicians surveyed in this study suggest that only 4 to 6 weeks may be necessary before a successful return to play. Although the study by Boytim et al[8] reported that the average number of missed games was 1.4 (return to play in 1-3 weeks), they stated that "most of these players were impaired and unable to participate fully for 4 to 6 weeks." Although syndesmosis injuries may be more debilitating than lateral ankle sprains, the current study also showed that, in a certain cohort of athletes with very mild injuries, a return to play after syndesmosis sprain may be even more rapid (around 2 weeks). In addition, this study found that only brief periods of immobilization and protected weight bearing may be necessary with some syndesmosis injury patterns.

In syndesmosis injuries, the injury may typically involve the medial malleolus or deltoid ligament. To develop diastasis between the tibia and fibula, usually 2 of the 3 ligament complexes (syndesmosis, deltoid ligament, and lateral ligamentous complex) will be compromised. When this is the case, operative intervention is typically indicated to facilitate a successful return to the playing field. Most surgeons would recommend reducing the syndesmosis with screws to hold the talus in an anatomic position in the mortise. This reduction should prevent even the minimal displacement that may result in increased articular contact stress and resultant long-term ankle arthritis. Because the distal tibiofibular joint is a dynamic articulation, most physicians (85%) in the current study recommend removing syndesmosis screws (between 7 and 12 weeks) after healing of the syndesmosis but before activity-related hardware failure because of fatigue. Although most surgeons commonly report the removal of hardware around 3 months, this study's findings suggest that some team physicians are removing hardware even earlier in the postoperative course. Although some surgeons are moving toward nonabsorbable suture fixation devices negating the need for the removal of hardware as well as the potential for improved syndesmosis reduction, caution should be undertaken in football players considering many of these athletes have a large body mass that may necessitate stronger initial fixation.

The current study also evaluated several ankle injury–related variables. The data indicate that syndesmosis injuries were more likely to occur secondary to a direct impact, whereas lateral ankle sprains typically resulted from torsional injuries. Although most syndesmosis injuries occurred as a result of contact during tackling or blocking, lateral ankle sprains resulted from a variety of football maneuvers, such as blocking, collisions, running/cutting, tackling, being blocked, and being tackled. Despite these findings, the study was in agreement with a prior study indicating that there was no difference in the type of injury (syndesmosis vs lateral ankle sprain) when several factors, such as protective gear, playing surface, field condition, place of injury, and time of injury, were considered.[8]

In the recent literature, there have been numerous studies evaluating the types of injury related to various playing surfaces and shoe types.[28,29] In fact, Drakos et al[28] showed with their novel biomechanical model that anterior cruciate ligament strain can be minimized when the interface consists of cleat on natural grass as opposed to any other combination with modern playing turf or short pile synthetic turf. In a recent presentation evaluating lower-extremity rates on real grass synthetic turf, Hershman et al[29] asserted that ankle eversion sprains and anterior cruciate ligament injuries are more common on real grass synthetic turf when compared with grass. Therefore, although the study found no difference between the number of syndesmosis and lateral ankle sprain injuries when compared with playing surface, playing surface may still be an important factor in the prevention of ankle injuries in general.

The current study has several limitations. The low number of lateral ankle sprains is likely based on not identifying less severe injuries that did not require time loss from participation; therefore, the authors cannot reasonably assess comparative injury incidence between syndesmosis and lateral ankle sprains. It was also not possible to differentiate the specific return to play level related to preinjury performance level. Furthermore, this short-term follow-up study is not able to elucidate the long-term consequences of these injuries. In fact, syndesmosis and lateral ankle instability could eventually result in posttraumatic early-onset degenerative joint disease.

Although ankle sprains can present with a spectrum of injury patterns, stable injuries involving the lateral ankle complex and syndesmosis (95% of all ankle ligament sprains) can be managed effectively with conservative management. This typically involves progressive weight bearing and a functional rehabilitation program. In agreement with the results of the current study, these patients will usually return to play within a couple of weeks. When there is evidence of more severe injury, including tibiofibular diastasis, operative intervention will typically be necessary to minimize functional disability and the potential for early-onset post-traumatic arthritis. Although this subset of injury is rare, the physician should critically evaluate the injury pattern to allow proper treatment and optimize return to play. When assessing any ankle injury, great care should also be

taken to rule out concomitant pathologies, such as occult articular cartilage lesions and peroneal tendon tears, which may prolong the period for return to play or result in long-term disability.

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