

CONSERVATIVE MANAGEMENT OF SYNDESMOSIS INJURIES IN ELITE FOOTBALL

AN INJURY ON THE INCREASE OR AN INCREASE IN RECOGNITION?

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Ankle injuries in men's professional football are relatively common with a recent retrospective study by Hagglund et al¹ suggesting that they make up 13% of all injuries seen in the sport. The vast majority of ankle injuries include the lateral ligaments (51%) with syndesmosis injuries only making up 3% of all ankle injuries in professional football.

Syndesmosis injuries are of particular interest to professionals working in elite sport due to their association with persistent disability and pain, particularly in comparison to injuries affecting the lateral ligament complex of the ankle².

Despite the research suggesting that syndesmosis injuries don't occur very often this isn't in keeping with our experiences

this season. Since the start of the 2013/14 season we have sustained five injuries to the syndesmosis complex.

A large proportion of match related ankle injuries (40%) are due to foul play¹. In the case of the Syndesmosis injuries we have sustained in the last 6 months, two were due to fouls, two were due to high impact tackles (which could be considered fairly dangerous despite the referee not giving a foul) and one was due to a collision between a number of players which resulted in a the injured player's foot becoming trapped beneath an opponent.

Of these five injuries there has been a significant difference in terms of time loss, with a range of 1 to 10 weeks depending on the degree of injury and the structures

involved. The aim of this review is to discuss the implications of this apparent increase in syndesmosis injuries; is it due to an increase in the diagnosis of this type of injury or is the incidence of syndesmosis injuries actually increasing? Furthermore, which clinical tests and MRI findings are most useful in determining the severity of the injury? These can be used as guide when prognosticating and attempting to rehabilitate severe injuries whilst safely maintaining availability of those players with minor injuries.

SYNDESMOSIS JOINT ANATOMY

The syndesmosis joint is made up of a number of bony and ligamentous structures; viewed from above this creates a



Figure 1: Typical 'syndesmosis' mechanism of injury with a fixed weight-bearing foot forced into external rotation.

ring of stability at the distal end of the lower leg and mortise within which the talus sits.

The majority of the stability of the syndesmosis joint is provided by the tibia and fibula and specifically the medial and lateral malleoli. Between these bony prominences sit the anterior inferior tibiofibular ligament (AITFL), posterior inferior tibiofibular ligament (PITFL), interosseous ligament (IL) and the interosseous membrane.

These structures work in conjunction with the deep and superficial (anterior) deltoid ligament and the lateral ligament complex primarily to prevent diastasis of the fibula from the tibia³.

An injury to the syndesmosis joint will involve one or all of the primary syndesmotoc structures while more serious injuries can also include the lateral ligaments.

MECHANISM OF INJURY

One of the most important aspects of the diagnostic procedure is being able to review the mechanism of injury; again we were fortunate in that all of the syndesmosis injuries occurred during first team

matchplay and as such we were able to review multi-angle replays of the incidents leading to injury.

The mechanism associated with syndesmosis injury is that of direct impact to the syndesmosis region with a forced lateral rotation of the foot (relative to the tibia) with the ankle in dorsiflexion. This can occur in reverse with the tibia medially rotating over a fixed foot; the end range position is the same with the foot ending up dorsiflexed and laterally rotated (Figure 1).

This forced rotation coupled with the mortise shape of the joint results in an outward force within the syndesmosis joint and injury to the one or all of the main supporting structures. In effect the syndesmosis is forced apart by these rotational forces.

INJURIES

As can be seen in the following tables we experienced a full spectrum of syndesmosis injuries ranging from mild grade 1 injuries which resulted in pain but no loss of availability for games, moderate grade 2

injuries which resulted in 3 weeks out of competition, through to the more severe grade 3 injuries which resulted in significant time away from first team action (7 to 10 weeks) (Table 1).

For the purposes of this review we used the MRI grading of injury suggested by Sikka et al⁴:

- Grade 1 - isolated injury to the AITFL.
- Grade 2 - injury to the AITFL and IL.
- Grade 3 - injury to the AITFL, IL and PITFL.
- Grade 4 - injury to the AITFL, IL, PITFL and deltoid ligament.

We felt this gave a more relevant grading for the minor to moderate conservatively managed syndesmosis injuries than the clinical grading system⁵, which despite the differences in injured structures and severity would have graded them all as a grade I/II (see below).

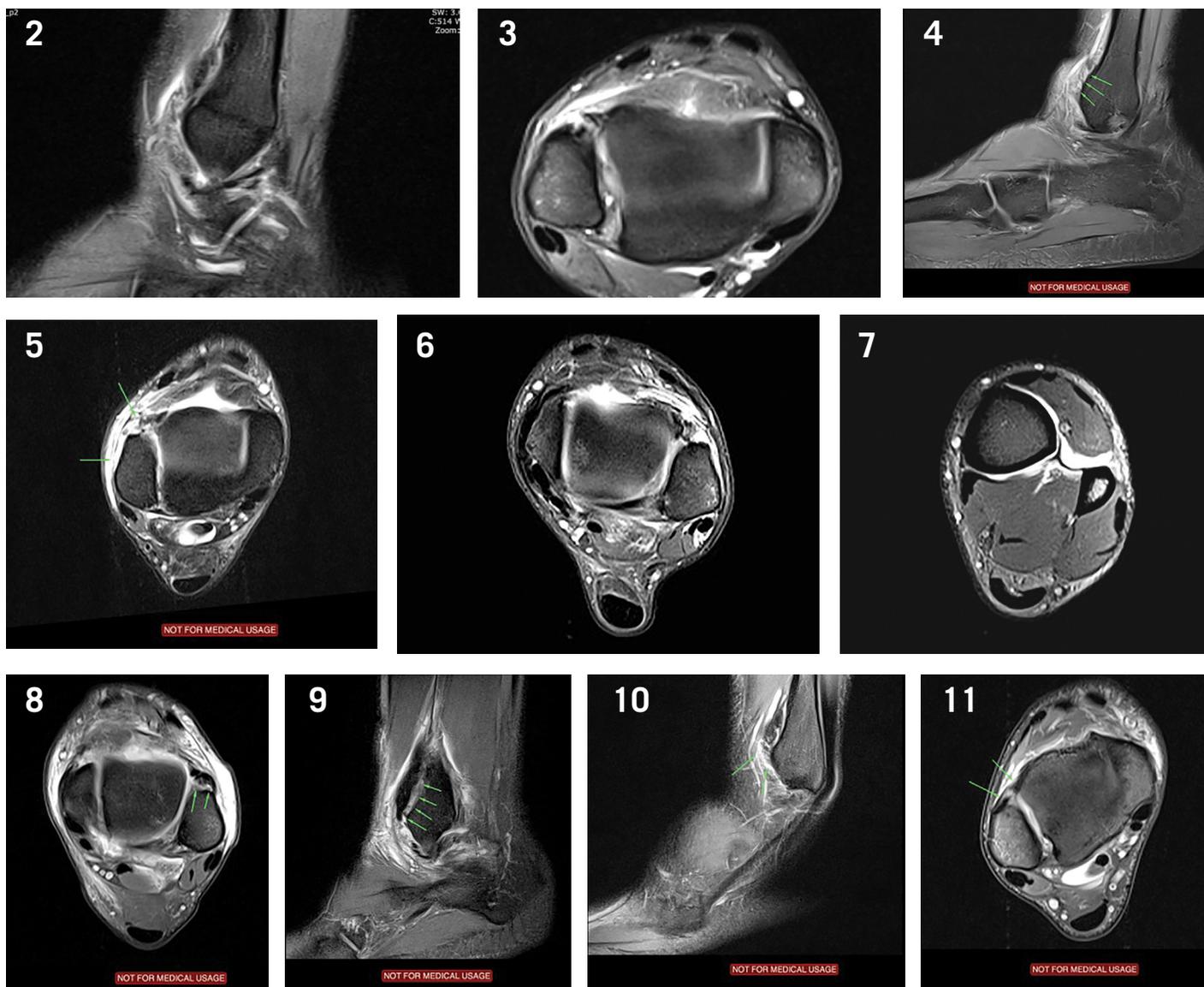
Clinical grading system:

- Grade I: Involves injury to the anterior deltoid ligament and the distal IL but without tearing of the more proximal syndesmosis or the deep deltoid ligament. The AITFL is often is very

MECHANISM, ASSESSMENT & IMMEDIATE MANAGEMENT

	Mechanism	Removed from play (Yes/No)	Clinical assessment	Special tests	Immobilisation & weight bearing status
1 – GRADE 1 SYNDESMOSIS INJURY	<ul style="list-style-type: none"> Tackle from lateral aspect with contact superior to ankle joint Forced external rotation of foot in dorsiflexion, poor challenge but no foul given 	NO	<ul style="list-style-type: none"> Pain on walking Pain on palpation of AITFL Mild swelling anterolateral joint line 	<ul style="list-style-type: none"> Ankle DF and ER test positive Squeeze test negative Active/passive ankle DF beyond neutral reproducing symptoms 	<ul style="list-style-type: none"> Tape to support syndesmosis joint FWB
2 – GRADE 3 SYNDESMOSIS INJURY	<ul style="list-style-type: none"> Tackle from behind which resulted in foot becoming caught between opponent's legs Forced external rotation/eversion mechanism 	YES	<ul style="list-style-type: none"> Pain on walking Pain on palpation of AITFL, PITFL and distal distribution of interosseous membrane Moderately swollen ankle joint 	<ul style="list-style-type: none"> Ankle DF and ER test positive Squeeze test positive 	<ul style="list-style-type: none"> Boot immobilisation NWB Week 1 to 4 PWB in boot Week 4 to 5 FWB week 5, strapped for activity
3 – GRADE 3 SYNDESMOSIS INJURY	<ul style="list-style-type: none"> Block tackle with right foot. Left foot planted and forced into DF and ER by opponent's fall. 	YES	<ul style="list-style-type: none"> Pain on walking Pain on palpation of AITFL Moderately swollen ankle joint 	<ul style="list-style-type: none"> Ankle DF and ER test positive Squeeze test negative 	<ul style="list-style-type: none"> Boot immobilisation NWB 14 days PWB in boot day 14 to 21 FWB day 21, strapped for activity
4 – GRADE 2/3 SYNDESMOSIS INJURY (ACUTE ON CHRONIC CHANGES)	<ul style="list-style-type: none"> Tackled from the side Ankle forced into ER 	YES	<ul style="list-style-type: none"> Pain on walking Pain on palpation of AITFL, antero-lateral tibio-talar joint and distal medial tibia Moderately swollen ankle joint 	<ul style="list-style-type: none"> Ankle DF and ER test negative Squeeze test positive Passive DF reproducing antero-lateral and antero-medial symptoms 	<ul style="list-style-type: none"> Boot immobilisation NWB 10 days Progressed PWB to FWB day 11 following ultrasound dynamic stress testing, strapped for activity
5 – GRADE 1 SYNDESMOSIS INJURY	<ul style="list-style-type: none"> Foot planted and ankle forced into ER and PF by opponent's contact from behind 	NO	<ul style="list-style-type: none"> Pain on walking Pain on palpation of AITFL and anterior fibres of deltoid ligament Mild swelling predominantly at the anteromedial joint line 	<ul style="list-style-type: none"> Ankle DF and ER test negative Squeeze test negative Passive ankle DF and eversion negative Passive PF and ER reproducing mechanism and deltoid symptoms 	<ul style="list-style-type: none"> Boot immobilisation PWB 48 hours FWB day 3, strapped for activity

Table 1: Mechanism, assessment & immediate management. AITFL=anterior inferior tibiofibular ligament, PITFL=posterior inferior tibiofibular ligament, DF=dorsiflexion, ER=external rotation, PF=plantarflexion, NWB=non-weight-bearing, PWB=partial weight-bearing, FWB=full weight-bearing.



Figures 2-11: See Table 2.

tender to palpation and may have a higher-grade injury; because no diastasis is present, the injury is, by definition, stable.

- Grade II: involves disruption of the anterior and deep deltoid ligaments as well as a tear in a significant portion of the syndesmosis, resulting in an unstable ankle that is still normally aligned on non-stress radiographs. This poses particular diagnostic challenges, because the extent of the injury and its occult instability are often more difficult to recognise.
- Grade III: Involves severe external rotation and abduction, with complete disruption of the medial ligaments and

extensive disruption of the syndesmosis, frequently accompanied by fracture of the proximal fibula. Such injuries are overtly unstable on initial examination and standard radiographs.

In our study the five syndesmosis injuries sustained in such close proximity to each other could be considered unlucky in that all occurred due to contact mechanisms. While we continually strive to prevent soft tissue and ligamentous injuries, the nature of syndesmosis injuries means they are more or less impossible to prevent in a contact sport such as football.

It is apparent from our experience that one of the most important factors in determining the severity of injury is the

ability of the individual to continue playing. In both grade 1 injuries the players were able to complete the match and only mentioned the issue after the game; we would consider the ability of the player to complete the game immediately after the injury a good clinical guide for them making a fairly swift recovery and a diagnosis of low grade injury.

In the cases of the grade 2/3 injuries none of the players were able to complete the game and therefore we would consider this a fairly good clinical guide that the diagnosis was likely to be at least a grade 2.

Of course, further clinical assessment beyond the ability to continue playing was also carried out to further aid the

diagnosis and MRI imaging was carried out for a description of specific injured structures and radiological grading of injury (Table 2).

In the more severe injuries, the degree of pain at the time of initial assessment meant that it was difficult to gain exact information from the clinical testing. Therefore, in keeping with the algorithm suggested by Polzer et al⁶ a delayed clinical assessment was carried out (at 5 days) to allow the pain to settle. At day 5 we were mainly looking for pain or instability in the syndesmosis-specific tests.

CLINICAL ASSESSMENT

Along with a normal assessment of ankle function following injury, such as ability to walk, swelling, range of motion and strength, a number of specific syndesmosis stress tests were also carried out. We chose to focus on the tests with the highest specificity and usefulness in prognosticating.

External rotation test

With the player sitting on the edge of a raised bed and the knee at 90°, one hand is used to stabilise the leg while the other is used to exert an external rotation force on the foot and ankle. A positive test results

in pain and/or separation at the distal tibiofibular joint (Figure 12).

Squeeze test

With the player in a long sitting position, progressive pressure is exerted by squeezing the tibia and fibula together from proximal to distal. A positive test results in pain at the distal tibiofibular joint (Figure 13).

The external rotation test has shown excellent specificity in the diagnosis of syndesmosis injuries while the squeeze test has been shown to be more useful in prognosis⁷.

This was in keeping with the fact that, in our experience, the player with the longest RTP (of the grade 3 injuries) had a positive squeeze test despite a slightly better radiological report (player 2).

IMAGING EVALUATION

Initial imaging investigation of suspected syndesmosis injury may be performed with X-rays, the indications for which are bony point tenderness suggestive of a fracture, usually on the distal fibula, or suspected syndesmosis widening. X-rays of the proximal fibula may also be indicated for high energy syndesmosis injuries, looking for a fibula

neck fracture indicative of a Maisonneuve type injury.

X-rays are often not performed in the majority of high ankle sprains in elite sports clinical practice, as MRI is easily and quickly accessible for this patient group. Non-weight bearing X-rays are relatively insensitive to the detection of syndesmosis ligament injury and radiographic evidence of syndesmosis widening may not be present even in the setting of complete (grade 3) disruption of the AITFL. For syndesmosis widening to be visible on non-weight bearing X-rays, it may require complete disruption of the AITFL, IL and PITFL to be present.

MRI is the imaging modality of choice as it clearly demonstrates acute injury of the syndesmosis and deltoid ligament complexes indicated by ligamentous oedema, fibre disruption and laxity. The severity of ligament disruption may be appreciated by careful evaluation of the extent of the ligament fibre injury, allowing grading of injury from grade 1 sprain (oedema) to grade 2 (partial tearing) and grade 3 (complete tearing).

Small cortical avulsion fractures are commonly detected at MRI that may be missed with X-ray, usually occurring



Figure 12: External rotation test.



Figure 13: Squeeze test.

MRI FINDINGS – SYNDESMOSIS COMPLEX

Player	AITFL	IL	Interosseous membrane	PITFL	Deltoid ligament	Summary & Figure legend
1	Oedematous thickening of the inferior bundle of the AITFL with oedema extending into the proximal fibres reflecting a grade 1 sprain. No ligament fibre disruption or laxity	The IL of the syndesmosis also showed oedema but no fibre disruption with no significant oedema extension into the interosseous membrane	Intact	Intact	Intact	These imaging findings are consistent with a grade 1 ligamentous injury of the syndesmosis. Figure 2 (sagittal) shows oedema and thickening of the inferior AITFL fibres with no focal tearing consistent with grade 1 injury. Figure 3 (axial) also demonstrates features of grade 1 AITFL injury with oedema over the lateral extensor retinaculum reflecting mild sprain but with absence of tearing.
2	Oedema and laxity throughout the AITFL with partial tearing of the majority of the fibres at the fibular insertion though continuity of some superior fibres was maintained reflecting a high grade partial tear. The tibial AITFL attachment was intact with no bone avulsion	The IL showed oedema and laxity reflecting a partial tear with oedema tracking into the lower extent of the interosseous membrane.		Subtle oedema in the PITFL was noted consistent with a low grade sprain though there was no acute tear.	Intact	These findings represent a grade 3 ligamentous injury of the syndesmosis. Figure 4 (sagittal) shows high grade partial tearing of the fibular insertion of the AITFL. Figure 5 (axial) demonstrates tearing of AITFL fibres at the fibular insertion and stripping of the fibular attachment of the lateral extensor retinaculum.
3	Laxity and complete tearing of the AITFL fibres at their fibular insertion. No osseous avulsion by the AITFL was present.	Avulsion of the periosteal attachment of the IOL with associated oedema and partial tear extension into the lower distal fibres of the interosseous membrane		The PITFL demonstrated oedema in keeping with a grade 1 injury.	The deep central and posterior deltoid ligament fibres showed features of old partial tearing and scarring but no acute injury	These features represent a grade 3 ligamentous injury of the anterior syndesmosis. Full thickness tearing of the antero-lateral extensor retinaculum was present and partial tearing and scarring of the anterior talofibular ligament was also noted. Axial Figure 6 shows full thickness tearing of the fibular attachment of the AITFL along with partial tearing of the PITFL fibres. Figure 7 demonstrates detachment and surrounding oedema of the tibial insertion of the interosseous membrane.
4	Abnormally thickened, scarred and lax with high grade partial detachment of the fibular attachment of the inferior and central fibres with an old, small cortical avulsion fracture beneath the fibular footprint. A thin band of superior AITFL fibres demonstrated signs of acute partial tearing with oedema and laxity.	The IL showed laxity and oedema reflecting acute partial tearing suggesting proximal extension of the force of the syndesmotic injury beyond the chronically deficient AITFL.		Thickened and scarred with oedema reflecting an acute on chronic low grade sprain	Intact	Collectively these features represent a grade 3 acute-on-chronic ligamentous injury of the syndesmosis. Figure 8 shows chronic low signal thickening of the AITFL with acute on chronic detachment of the fibular attachment. Oedema is also seen in the PITFL reflecting an acute grade 1 injury. Figure 9 shows a long region of detachment of the thickened, scarred AITFL fibres at the fibular insertion.
5	Oedema of the inferior fibres of the AITFL	Intact	Intact	Intact	Acute oedema of the deep anterior and central fibres of the deltoid ligament representing a low grade sprain	Despite the presence of associated deltoid ligament injury, this was classified as a grade 1 ligamentous injury of the syndesmosis. Figure 10 shows oedema and thickening of the inferior AITFL fibres reflecting grade 1 ligamentous sprain. Figure 11 shows grade 1 sprain of the AITFL with superficial oedema with intact fibular and tibial insertions.

Table 2: MRI findings – syndesmosis complex (See Figures 2-11). AITFL=anterior inferior tibiofibular ligament, PITFL=posterior inferior tibiofibular ligament, IL=interosseous ligament.

beneath the fibular footprint of the AITFL. MRI also identifies tearing of the IL and oedema within the interosseous membrane that would be otherwise missed if X-rays were used in isolation.

Acute on chronic injury of the syndesmosis is commonly seen in the setting of high ankle sprains in elite footballers, evidenced by thick low signal scarring of the syndesmotic ligaments with super-added oedema or tears. This is an important observation as it may influence the potential for the ligaments to primarily heal thus precluding conservative management.

MRI is the imaging modality of choice to detect associated intra-articular pathology such as osteochondral lesions of the tibio-talar joint and injury to the peroneal tendon-retinacular complex. Occasionally the structural integrity of a syndesmotic ligament that appears diffusely oedematous and lax at MRI can be difficult to confirm. In this setting, the use of X-ray views taken during dynamic, manually applied syndesmotic stress is still advocated by many surgeons, as these may confirm the complete nature of syndesmotic ligament disruption that may be equivocal on MRI.

The role of CT in the acute setting of suspected syndesmotic injury is essentially for evaluation of fractures that are confirmed or suspected from an initial X-ray or, more commonly, an MRI. Small cortical avulsion fractures may be obscured at MRI by low signal ligament fibres or intense soft tissue oedema, and CT may be required to confirm or characterise the size of the fracture fragment or determine whether the fracture requires internal fixation.

REHABILITATION

The rehabilitation of the syndesmosis injuries sustained can be separated into the management of mild, moderate and severe injuries.

Mild syndesmosis injury – grade 1

With mild syndesmosis injuries in which the player has no instability and isolated ligament injury without significant fibre disruption the aim is to settle the initial injury and maintain availability for games through initial offload, gradual re-load, optimal proprioception and taping to support the syndesmosis joint.

In the two mild injuries which we treated (injuries 1 and 5), the treatment process (which lasted 8 days) was as follows:

Day 1 to 2:

- Soft tissue therapy.
- Pulsed-shortwave diathermy.
- Ultrasound.
- Pool walking/ankle mobilisation (10% bodyweight).
- Protect, rest, ice, compression, elevation (PRICE) regime.

Day 3:

- Concentric/eccentric manual ankle strength.
- Proprioception/dynamic stability circuit.
- Treadmill walking.
- Pool jogging (10% bodyweight).
- Alter-g jogging (50 to 100% bodyweight).

Day 4:

- Gym based ankle strengthening programme.
- Progressive mechanical pitch-based session.

Day 5:

- Regular training.

Day 8:

- Played 90 minutes English Premier League match.

In each case the player had no feelings of instability and had occasional discomfort with forced rotation for approximately 3 weeks; this typically occurred during a tackle. It could be argued that the player was at increased risk of a more significant syndesmosis injury if the mechanism of injury was repeated. However, it was felt that the specific taping applied to the joint, the players comfort and feeling of stability along with the fact that they did not feel any limit in their performance meant that this risk was outweighed.

Moderate syndesmosis injury – grade 2

In the case of the moderate grade 2 injury sustained by player 4 (acute on chronic changes) the rehabilitation process was as follows:

ROM limits:

- No dorsiflexion (DF) beyond neutral day 1 to 10.

Rehabilitation

Day 1 to 9:

- Soft tissue therapy.
- Pulsed-shortwave diathermy.
- Ultrasound.
- Pool mid-range ankle mobilisation (10% bodyweight).
- Tibialis posterior stability exercises (partial weight-bearing).
- Isometric manual ankle strengthening.
- PRICE regime.

Day 10 to 12:

- Manual therapy.
- Concentric/eccentric manual ankle strengthening.
- Proprioception/dynamic stability progressions.
- Gym-based ankle strengthening programme.
- Isokinetic ankle inversion/eversion strengthening programme.
- Alter-g jogging (60 to 100% bodyweight).
- Pool jogging (10% bodyweight).

Day 14 to 15:

- Progressive straight-line pitch-based work, cardiovascular (CV) and global positioning system (GPS) variables incorporated to address training/match fitness requirements.
- Pool multi-directional progressions.

Day 17 to 20:

- Progressive multi-directional pitch-based work, CV and GPS variables incorporated to address training/match fitness requirements.
- Plyometrics.

Day 21:

- Regular training.

This player has had no syndesmosis symptoms and continues with an individualised injury prevention and performance programme as discussed below.

Severe syndesmosis injury – grade 3

In the case of the severe grade 3 syndesmosis injuries sustained the rehabilitation processes were as follows:

Injury 2

ROM limits:

- No DF beyond neutral Week 1 to 4.

Rehabilitation

Week 1 to 4:

- Personal leave.

Week 5:

- Manual therapy.
- Proprioception (dry land sitting-standing/pool standing).
- Isometric/concentric manual ankle strengthening.
- Tibialis posterior stability exercises (partial weight-bearing).
- Non weight-bearing lower limb strength (quadriceps/hamstrings/gluteals).
- Isokinetic ankle inversion/eversion strengthening programme.
- Alter-g walking (60 to 100% bodyweight).
- Alter-g calf strengthening (50 to 100% bodyweight).

Week 6:

- Alter-g jogging (60 to 100% bodyweight).
- Pool multi-directional progressions.
- Static/dynamic stability progressions.
- Weight-bearing lower limb strengthening (quadriceps/hamstrings/gluteals).
- Calf occlusion training.
- Ankle DF seatbelt mobilisations with movement.
- Reformer ankle mobilisations.

Week 7:

- Progressive straight-line pitch-based work/multi-directional pitch-based work, CV and GPS variables incorporated to address training/match fitness requirements.
- Multi-directional Aerofloor progressions.

Week 8:

- Progressive straight-line pitch-based work/multi-directional pitch-based work, CV and GPS variables incorporated to address training/match fitness requirements.
- Plyometrics.

Week 9:

- As above plus reintroduction to training.

Day 72:

- Played 45 minutes pre-season friendly.

Injury 3

ROM limits:

- No DF beyond neutral Day 1 to 21.

Rehabilitation

Week 1:

- Soft tissue therapy.
- Pulsed-shortwave diathermy.
- Ultrasound.
- Isometric manual ankle strengthening.
- Pool effusion control.
- PRICE regime.

Week 2:

- Personal leave.

Week 3:

- Manual therapy.
- Proprioception (dry land sitting-standing/pool standing).
- Concentric manual ankle strengthening.
- Tibialis posterior stability exercises (partial weight-bearing).
- Non weight-bearing lower limb strength (quadriceps/hamstrings/gluteals).
- Isokinetic ankle inversion/eversion strengthening programme.
- Alter-g walking (70 to 100% bodyweight).
- Alter-g calf strengthening (50 to 100% bodyweight).

Week 4:

- Alter-g jogging (60 to 100% bodyweight).
- Pool multi-directional progressions.
- Static/dynamic stability progressions.
- WB lower limb strength (quadriceps/hamstrings/gluteals).
- Calf occlusion training.
- Ankle DF seatbelt mobilisations with movement.
- Reformer ankle mobilisations.

Week 5:

- Progressive straight-line pitch-based work/multi-directional pitch-based work, CV and GPS variables incorporated to address training/match fitness requirements.
- Plyometrics.

Week 6:

- As above.

Week 7:

- Regular training.

Day 48:

- Played 80 minutes English Premier League match.



The mechanism associated with syndesmosis injury is that of direct impact to the region with a forced lateral rotation of the foot (relative to the tibia) with the ankle in dorsiflexion. This can occur in reverse with the tibia medially rotating over a fixed foot



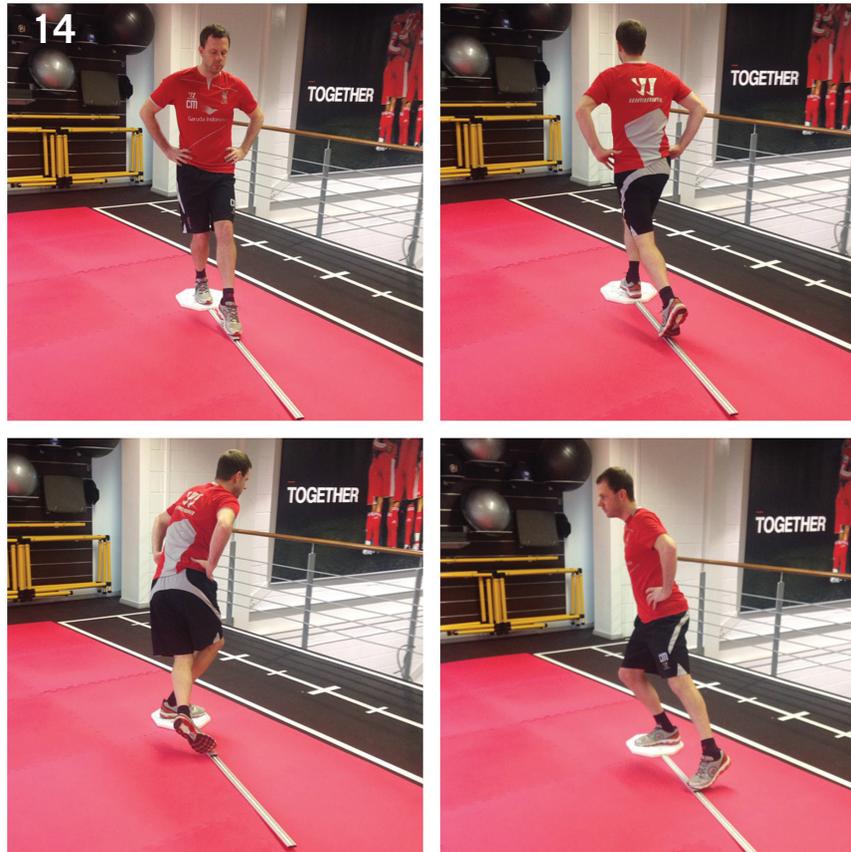


Figure 14: SEBT (Star excursion balance test).

As can be seen from these programmes there was a difference of 3 weeks between the RTP times of the two players. Based on MRI classification the player who came back in 7 weeks actually had a more significant injury whereas the player who had a RTP of approximately 10 weeks had a better MRI but had a positive external rotation test.

In terms of progressions, there is a lack of robust research evidence to support the specific management protocols we implemented. That which is available is purely anecdotal and less accelerated than the cases presented in this paper^{8,9}. The above injuries were progressed based on clinical experience, functional anatomy, subjective feedback and objective assessment. In terms of functional anatomy, the moderate syndesmosis injury was able to progress relatively quickly due to no PITFL involvement - the PITFL alone makes up 42% of the strength of the syndesmosis (Ogilvie-Harris et al 1994). In keeping with this principle the injuries that sustained PITFL damage followed a lengthier rehab protocol.

All players had to fulfil specific RTP criteria (Table 3) for which the following objective tests were important landmarks to allow return.

STAR EXCURSION BALANCE TEST (SEBT)

The SEBT involves a measure of maximum distance reached in each direction, scores are normalised against the subject's leg length with values being expressed as a percentage of leg length. A 6 to 8% change represents minimal detectable change and intra-rater reliability is excellent¹⁰.

The SEBT is a valid dynamic test to predict risk of lower extremity injury, to identify dynamic balance deficits in people with lower extremity conditions and to be responsive to training programmes in healthy participants and those with lower extremity conditions¹¹.



Figure 15: Syndesmosis strapping for training/matches.

ANKLE SYNDESMOSIS INJURY – RTP CRITERIA

Name: _____ Date of injury: _____ Date of surgery (if relevant): N/A
 RTP estimate: _____

Clinical <input checked="" type="checkbox"/>										
Swelling		Nil/minimal								
ROM		Pain				Nil				
		Range				Left=Right				
DF-ER test		Painfree								
Core/dynamic stabilisation <input checked="" type="checkbox"/>										
Single leg balance		Star excursion balance test bilateral difference < 5%								
Running		GPS step balance bilateral difference < 5%								
IKD Testing <input checked="" type="checkbox"/>										
		60 °/s (9%)				90 °/s (5%)				
Concentric quadriceps peak torque		Left								
		Right								
		Bilateral difference 60 °/s < 10%								
		60 °/s (1%)				90 °/s (0%)				
Concentric hamstring peak torque		Left								
		Right								
		Bilateral difference 60 °/s < 10%								
		60 °/s (>57%)								
Hamstring/quadriceps muscle ratio		Left								
		Right								
		30 °/s								
Concentric inversion peak torque		Left								
		Right								
		Bilateral difference < 10%								
		30 °/s								
Concentric eversion peak torque		Left								
		Right								
		Bilateral difference < 10%								
Functional ankle tests										
Calf endurance test (bilateral difference <10%)		Single leg hop for distance (bilateral difference <10%)		Single leg vertical hop (bilateral difference <10%)		Triple hop for distance (bilateral difference <10%)		Multiple single leg hop stabilisation test (bilateral difference <10%)		
Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	
Yes/No		Yes/no		Yes/no		Yes/No		Yes/no		

Table 3: Example of a checklist used to monitor RTP progress after a syndesmosis injury. DF=dorsiflexion, ER=external rotation, IKD=isokinetic dynamometry

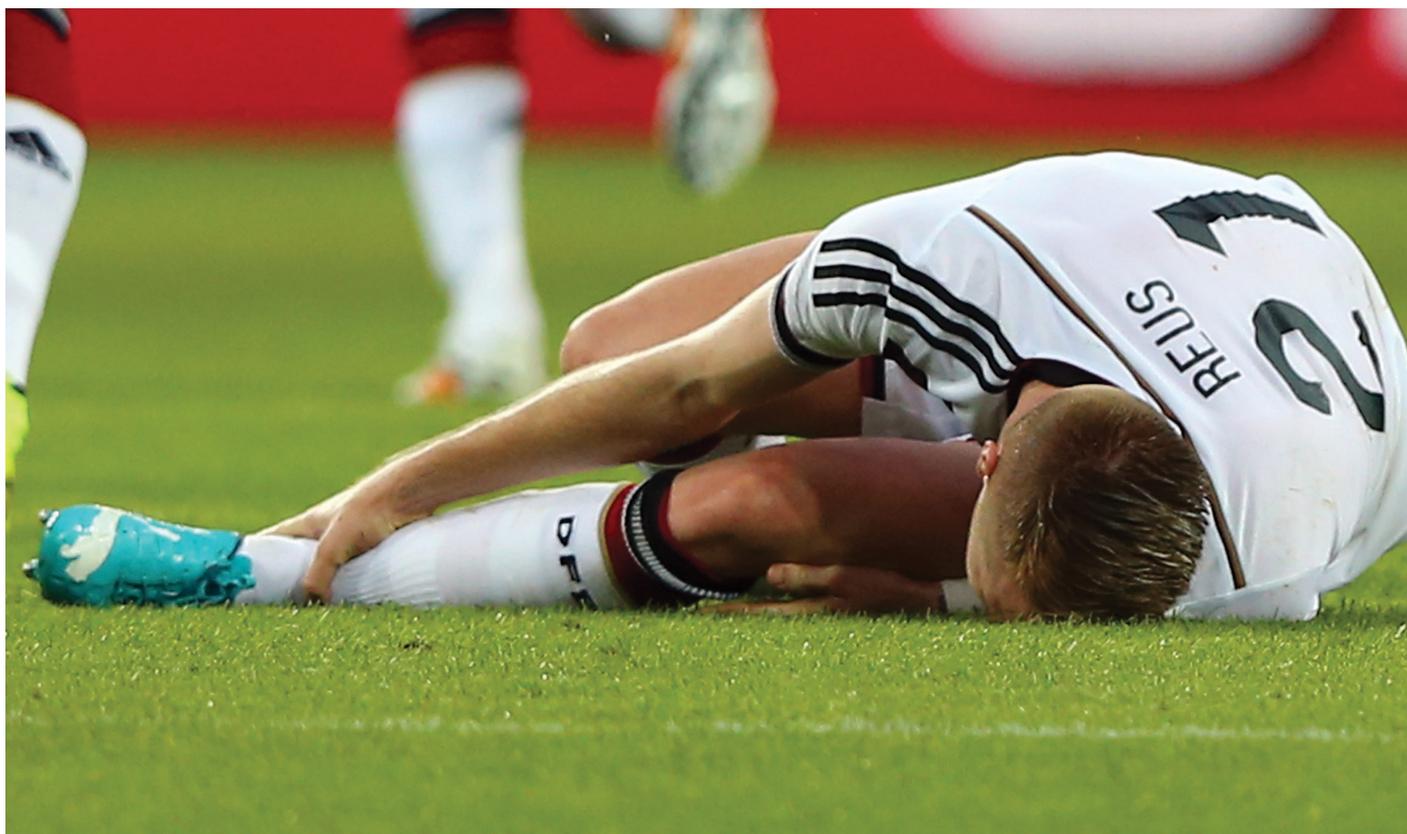


Image: Germany's Marco Reus missed the 2014 FIFA World Cup in Brazil after suffering a syndesmosis injury during a friendly match against Armenia.

ISOKINETIC DYNAMOMETRY

In terms of isokinetic dynamometry, there is conflicting evidence with regards to which muscle group is more adversely affected following ankle injury; the invertors or evertors¹².

Our experience suggests that ankle invertor strength diminishes more than evertor strength in those athletes undergoing rehabilitation in excess of 3 weeks. At present, it seems most sensible to strengthen both muscle groups using the contralateral limb or pre-injury screening data for comparison. In particular, according to our own clinical experience, we advocate eccentric strengthening of the ankle invertors as during closed-chain eversion (a common component of the syndesmosis injury mechanism) pronation and lateral displacement of the leg relative to the stationary foot is controlled by eccentric contraction of tibialis anterior and posterior.

Pontaga¹¹ established that there is a large variation in the eversion/inversion ratio depending on joint angle and speed, which requires further investigation. Swan et al¹³ addressed the limitations of the aforementioned studies and concluded that the eversion/inversion ratio did not increase

the risk of ankle syndesmosis injury. However, direct comparison of studies evaluating the ratio is limited as Swan and colleagues evaluated muscle strength with a handheld dynamometer i.e. an isometric contraction rather than an isokinetic contraction.

ONGOING MANAGEMENT:

- Isokinetic dynamometry concentric/eccentric inversion/eversion strengthening.
- Gastrocnemius/soleus strengthening.
- Balance/Proprioception training.
- Dynamic stability exercises.
- Plyometrics.
- Syndesmosis Strapping – see Figure 15.

DISCUSSION

- Previous epidemiological studies have suggested syndesmosis injuries to be fairly rare in professional football and this has certainly been our experience at the club over the past 10 seasons.
- However the current season has seen a significant increase in the number of syndesmosis injuries seen within the first team squad at a Premier League football club.

- The contact nature of the mechanism of injury means that this isn't an injury which can be easily prevented by the specific proprioception exercises which have been shown to reduce non-contact lateral ligament injuries.
- Having analysed the specific mechanisms of injury for the five different injuries, it is our conclusion that we have been unfortunate in sustaining so many syndesmosis complex injuries in such a relatively short period of time.
- The injury can be associated with on-going weakness of the invertors/evertors, the strengthening of which (particularly eccentric strengthening of the invertors) should form part of the post-injury prevention programme along with calf strength, proprioception and taping/strapping to support the joint.

CONCLUSION

The aim of this paper is to give clinical details of the diagnosis and management of syndesmosis injuries in elite football. While a paper of this type will always have limitations due to the small sample size and innovative nature of the treatment we

hope that it gives a snapshot of the clinical management of these difficult injuries set within, but not dictated by, available evidence.

Our conclusion is that grade 1 syndesmosis injuries which do not result in diastasis of the joint can be managed in terms of pain. Our experience is that while players may continue to experience transient discomfort in specific 'injury mechanism repeating actions' for 3 to 4 weeks they are able to function at a level which is compatible with elite football and can be kept available with specific strapping and on-going treatment.

Moderate grade 2 injuries are likely to result in approximately 3 weeks out of competition as long as no diastasis is present. They should initially be protected for a short period of time then progressed based on symptoms and strength until all RTP markers are met.

Our experience of grade 3 injuries was that they can result in significant period of time out of professional football. In our case the range of time lost due to a grade 3 injury was 7 to 10 weeks. On reflection, we feel that 3 weeks immobilisation followed by a graded return to training and activity, which allows enough time to be reconditioned for professional sport would result in around 8 weeks out. This would be a reasonable estimate when suggesting a RTP time at the point of injury.

Whilst we haven't experienced a grade 4 (MRI grading system) syndesmosis injury in the past 2 seasons it is highly likely that we would recommend surgical stabilisation of the complex followed by recovery guided by the surgeon.

The diagnosis of syndesmosis injuries is relatively straight forward with pain over the injured structures, positive special tests, recognition of the mechanism of injury and radiological reporting resulting in a significant amount of information to aid the diagnosis.

This paper has focussed on conservative management of syndesmosis injuries as none of those sustained resulted in radiologically confirmed diastasis; however we can conclude that in grade 1 to 3 syndesmosis injuries in professional footballers, conservative management is successful in returning players to previous levels of activity in 1 to 8 weeks whilst clinical indicators can enable us to be more specific in the timescale for each specific case depending on the grade of diagnosis.

in grade 1 to 3 syndesmosis injuries in professional footballers, conservative management is successful in returning players to previous levels of activity in 1 to 8 weeks

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