



PHASES OF REHABILITATION AFTER INJURY – PRACTICAL GUIDELINES

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Providing coaches, referees, players, and administrators with the knowledge, skills, and leadership abilities to ensure that safety and best practice principles are incorporated into all aspects of contact rugby.

INTRODUCTION

The physical demands of rugby make the risk of injury to players higher than most other sports. The management of injured players is centred on an early return-to-play, despite 'best practice' principles which consider the biological healing process to ensure complete recovery and rehabilitation from injury. An injured player returning to play too early has a very high risk of getting re-injured. This is not an ideal situation as recurrent injuries in rugby are more severe and result in the player being away from the game for longer. The following section discusses, where possible, an evidence-based approach to sensible management of injuries sustained during rugby with the ultimate goal of a timely return to the sport.

COMMON RUGBY INJURIES

There is a high incidence of injury in rugby players. When expressed as a number of injuries per 1000 hours' playing exposure, there are between 69 and 218 injuries per 1000 playing hours for rugby players.

Injury locations



- Muscle and tendon, followed by joint and ligament are the tissues commonly affected.
- The **lower limb** is most commonly injured.
- The **knee** is the most injured region, followed by the **thigh** and the **ankle**.
- The most severe knee injuries include the **anterior cruciate ligament**, or ACL (ligament in the middle of the knee) injury, followed by **medial collateral ligament** or MCL (ligament on the inside of the knee) injuries. **Chondral and meniscal injuries** (padding between the 2 bones of the knee) and **patellofemoral pain syndromes** (pain around the knee cap) are also commonly described.
- **Hamstring injuries** (muscle on the back of the thigh) are the most common thigh injury.
- Common **shoulder injuries** are **acromioclavicular** joint (joint on the tip of the shoulder) injuries, **rotator cuff impingement syndromes** (problems with the muscles which stabilise the shoulder)

and **dislocation** or **instability** (this is when the shoulder joint partially or completely pops out of its socket). Shoulder injuries are often severe in nature, resulting in a large amount of lost play.

- The most **severe injuries** are knee injuries, resulting in the greatest number of playing days missed.
- **Training injuries** are largely muscular.
- **Recurrent injuries** result in more playing days lost.
- **Contact** is the most common mechanism of injury. The most common mechanism of injury for the **hamstring** was running followed by **kicking**.

Tables 1 and 2 present examples of the five most frequent and most severe injuries sustained by elite rugby players.

**TABLE 1: MOST FREQUENT INJURIES SUSTAINED BY ELITE RUGBY PLAYERS
(BROOKS ET AL., 2005)**

<i>Injury</i>	<i>Average severity (days play missed)</i>
Hamstring muscle injury	11
Calf muscle injury	11
Thigh haematoma	3
Shoulder joint sprain	6
Ankle lateral ligament	9

**TABLE 2: MOST SEVERE INJURIES SUSTAINED BY ELITE RUGBY PLAYERS
(BROOKS ET AL., 2005)**

<i>Injury</i>	<i>Average severity (days play missed)</i>
Anterior cruciate ligament	235
Knee cartilage/degenerative injury	155
Rotator cuff/ shoulder impingement	71
Cervical disc	45
Thoracic facet joint	35

STAGES OF HEALING

Following injury there are 4 basic stages of healing that tissue needs to go through, namely:

(1) The time of injury, (2) inflammatory (lag) phase, (3) fibroblastic (regeneration) phase and (4) the remodeling phase (Figure 1). At the time of injury there is a drop in tensile strength of the tissue and it is the purpose of the healing process to increase this.

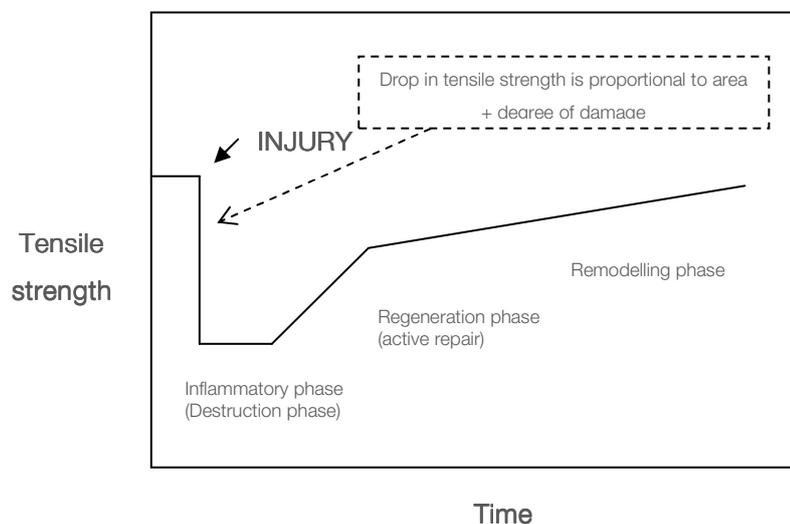


Figure1. The stages of healing reflected according to the tensile strength associated with each phase (Modified from Hunter, 1994)

There are some basic principles to be followed when it comes to the management of an injured player as he moves through the relevant phases. These will be discussed below in brief. A guideline for the length of the stage is given in brackets:

- a. **Time of injury:** At the time of injury the strength of the tissue injured decreases significantly.
Clinical management: The most essential part of management of this stage is protection of the injury to prevent making the injury worse. The more severe an injury, the longer it will take to get the player back to the game. Protection includes removing a player from the field if necessary, and immobilising (stopping the area of the injury from moving) and even giving patients a pair of crutches for lower limb injuries.

The reduction of further damage is the critical factor at the time of injury.



- b. **The inflammatory phase** (lasts approximately 4-6 days): During this stage there is bleeding into the injury site, which brings inflammatory cells to the site. A very delicate framework of tissues is set up across the injury site. This forms the scaffold that the scar will be laid down on. It is very delicate and moving of the muscle should be avoided to prevent further damage.

Clinical management: Fundamental to this phase of healing is a period of rest/immobilisation. It is advised that rest for a period of 3-5 days is beneficial for a smaller, more functional scar. This is preferable, as a thick scar is less extensible and may be prone to repeated rupture. To further control the extent of the inflammation, the use of the principles of rest, ice, compression and elevation remain critical. Ultrasound may be used. The use of frictions, stretching or exercise of the muscle is strictly avoided as this will prolong the phase of inflammation.

A "hands off" approach with a short period of rest is critical in this phase.

- c. **Repair/regeneration phase** (day 5 to 10-12 weeks): There is a significant increase in the tensile strength of the injured tissue as the scar is now laid down on the delicate scaffold set up in the previous stage. If immobilisation is continued into this stage a thick scar will result.

Clinical management: The aim of this stage is to ensure that the scar is laid down in line with the muscle fibres, as this will assist in accelerating the increase in the tensile strength of the wound. This is achieved by careful tensioning of the injured areas using stretching and specific soft-tissue mobilisations. Rehabilitation in the form of exercise therapy must be initiated during this phase to increase the strength of the muscle tissue adjacent to the scar, and to facilitate a healthy, functional scar being laid down.

A "hands-on" approach now occurs, with techniques to tension the scar in the line of the tissue. Movement is critical to this stage.

- d. **Remodelling phase** (begins at 21 days and continues for 6-12 months): At this stage the strength of the scar increases as the new tissue fibres bond with one another. The wound also starts to contract to make the scar smaller. This may cause shortening of part of the muscle and stretching is therefore important.

Clinical management: This stage includes continued stretching and specific soft tissue

mobilisations to ensure optimal length of the muscle. Exercise rehabilitation to reduce the effect of any identified risk factors is important. It is essential that the rehabilitation and training be vigorous enough to prepare the injured tissue for the demands of the game. Continued strengthening and stretching by the player after return to sport is important.

Continued stretching and the inclusion of functional (skills) rehabilitation are important.

A summary of the stages is presented in Table 3. The member of the medical team responsible for the different phases is presented here.

TABLE 3: THE SUMMARY OF THE REHABILITATION PROCESS OF A PLAYER ACCORDING TO THE STAGES OF HEALING.

Phase	Duration	Description	Management	Phase managed by
Injury event		Strength of tissue drops, tissue tears, bleeding starts	Reduce impact of injury. Remove from field. Immobilise.	Physiotherapist, doctor, medic, or coach.
Inflammatory phase	1-5 days	Inflammatory cells enter the injury site and a delicate scar network is formed. There is no increase in tensile strength.	RICE. Immobilisation for the first 1-3 days.	Medical doctor or physiotherapist.
Regeneration phase	Day 5-10 to week 10-12 (Dependant on the extent of the damage)	Collagen is laid down and a scar is formed. There is a gradual increase in tensile strength.	Mobilisation of the scar and joints. Exercise rehabilitation and stretching.	Initially physiotherapist, biokineticist may become involved later in the phase.
Remodeling phase	Starts around Day 21 to 6-12 months	Strength increases as cross-bridges (connections between muscle fibres) are formed. The scar starts to contract.	Stretching is essential. Continued strengthening of the muscle unit occurs.	Physiotherapist, biokineticist, trainer and coach

GRADING OF INJURIES AND SPECIFIC MANAGEMENT PROTOCOLS

(a) Muscle strains

The grading system for muscle strains is presented in Table 4. It is important to identify the grade of injury early as the more severe the strain the longer the healing time.

TABLE 4. THE GRADING SYSTEM FOR MUSCLE STRAINS

Muscle tear classification	Muscle damage	Loss of function	Associated symptoms
Mild (1 st degree)	Few muscle fibres torn	Minimal loss of strength and function	Mild swelling. Pain with contraction and stretching. Mild muscle spasm.
Moderate (2 nd degree)	Greater degree of muscle damage	Clear loss of function	Moderate to severe swelling. Significant pain with contraction and stretching Moderate to severe spasm.
Severe (3 rd degree)	Tear extends through cross section of muscle	Severe loss of function	Moderate to severe swelling. No pain with stretching and mild pain with contraction. Moderate to severe muscle spasm.

Specific management of muscle strains and contusions

The following principles are specific to muscle injuries:

1. Muscle injuries should be **immobilised** for 1-3 days depending on the severity of the injury in order to protect the delicate scar. Crutches and strapping are examples of how this can be achieved.
2. **Rest, ice, compression and elevation (RICE)** are essential in the early stages of muscle strains to control the inflammation and swelling.
3. **Exercise rehabilitation** should be introduced from Day 3-5. Players start with small isolated contractions free of pain and progress to more complex strengthening exercises. This helps facilitate a strong scar.
4. **Stretching** is important to prevent the scar contraction causing shortening in the muscle.
5. The use of **non-steroidal anti-inflammatory drugs (NSAID's)** is controversial. They should not be used automatically as they mask pain and as such may result in a premature return to sport or training. These should only be used in consultation with a doctor.

Time off rugby: This will be dependent on the severity of the strain or the state of recurrence. Return to play from a hamstring strain takes an average of 17 days, a recurrent hamstring injury takes 25 days to return to sport, and a hamstring injury sustained while kicking takes 36 days to return to play.

(b) Ligament injuries

Ligaments are very important for stability in joints and are important in controlling movement. The time for return to play following ligament injury is dependent on the severity of the injury and is very specific to the location of the ligament. Ligament injuries are graded in a similar fashion to muscle injuries (Table 5).

TABLE 5. THE GRADING SYSTEM FOR LIGAMENT SPRAINS

Grade	Ligament damage	Joint stability	Associated symptoms
Mild (1 st degree)	Few ligament fibres torn	No loss of joint stability	Local tenderness
Moderate (2 nd degree)	Greater proportion of ligament damage	Increased joint laxity. Definite end point when stressing ligament.	Swelling Marked tenderness
Severe (3 rd degree)	Complete tear of ligament	Significant joint laxity when stressing ligament with no definite end point.	Significant swelling Tenderness can be mild to severe. May be pain free.

Specific management of ligament sprains

The following principles are specific to ligament injuries:

1. **RICE** (Rest, ice, compression and elevation is important for healthy scar formation).
2. **Mobilisation** of the joint should be delayed for a longer period than muscle (around 3 weeks). Mobilisation should not be vigorous in the early healing stage.
3. **Laser treatment** is useful for treating superficial ligament injuries.
4. **Surgery** is important if joint stability is lost, particularly in ligament injuries such as the ACL ligament of the knee. This will prolong the time lost to injury.
5. **Exercise rehabilitation.** The focus is very much on stability and proprioception (balance).

Time off rugby: Again the time off rugby is dependent on the severity and the location of the injury. However, the following basic guidelines for ligament injury and return to play may be used. The following performance deficits exist for the different grades of injury (56):

- Mild ligament sprain: Minimal deficit lasting a few days
- Moderate ligament sprain: Performance deficit lasts up to 6 weeks but may be improved by protective bracing
- Severe ligament sprain: Performance deficit may be permanent, and will be apparent for a minimum of 6-8 weeks. If surgery is required, return to sport will take months and will be guided by the orthopaedic surgeon.

Ligament healing of partial ligament injuries takes several months. However, return to sport may occur earlier, especially if added protection is provided to the joint in the form of bracing or strapping.

(c) Tendon injuries



There are some fundamental differences between muscle and tendon injuries. Although inflammation is a component of acute tendon injury it is absent in chronic tendon injuries such as Achilles tendinosis. As a result it is referred to as a tendinopathy. These tissues are characterised by degenerative changes. Tendon healing is a much slower process than that of muscle and it can take up to 100 days to produce the collagen fibres needed to repair the tendon. There is no reliable grading system for tendinopathies but the grading of mild, moderate and severe cases are commonly used (Table 6).

TABLE 6: THE GRADING SYSTEM USED TO CLASSIFY TENDINOPATHY

Grade	Symptoms
Mild	Pain is felt after the activity. If pain is felt after activity it disappears when activity stopped
Moderate	Pain during sporting activities but not during activities of daily living
Severe	Pain during activities of daily living

Specific management of chronic tendon injuries:

1. The load must be decreased on the tendon, with a period of **modified rest**. The tendon should not be immobilised as this is detrimental to the health of the tendon.

2. Techniques such as electrotherapy and ice are wasted as there is no inflammation associated with these injuries.
3. **Eccentric strengthening** (contracting the muscle while the muscle lengthens) is the cornerstone to treatment of chronic tendon injuries. This mode of training is very successful. Unlike training programmes for muscle injuries, a significant degree of discomfort is tolerated. Eccentric training programmes must be performed **out of season** to ensure success. Stretching is important in the treatment of tendon injuries.
4. The use of **orthotics** can also contribute to the management of certain tendon injuries.

Time off rugby: Due to the slow healing rate of tendons return to sport can take months and not weeks if treatment is to be effective.

(d) Bone injuries

There are 2 distinct types of bone injury that can occur: fractures and stress fractures. The healing of bone follows the 3 stages of healing, namely inflammatory, repair and remodelling.

Fractures: Bone is different to other tissue in that it regenerates and so does not leave a scar once healed. Full function can only return when consolidation of the bone is achieved. Healing times for fractures vary depending on the site of the fracture and the severity.

Specific management of fractures

1. A fracture needs to be **reduced and then maintained** in that position by pins, plates, plaster casts or braces. This management of the fracture from reduction to healing will be overseen by an orthopaedic surgeon. Many of the decisions regarding mobilisation and loading will be done in consultation with the surgeon.
2. This is followed by a **period of immobilisation** to allow the bone to unite and consolidate.
3. Management of the soft tissue surrounding the fracture and the joints above and below follows the standard principles and modalities of soft tissue healing but is restricted by the loading and movement permitted around the fracture site.

Time off rugby: Healing time for fractures vary from 6-12 weeks in the upper arm to 8-20 weeks in the lower limb depending on the location of the fracture. The further the location of the fracture is from the midline of the body, the longer healing will take. Once consolidation has taking place there must be a

gradual increase in the loading of the bone. As a result, the time off rugby will be months and not weeks, to allow a gradual rehabilitation programme to be completed.

Stress fractures: Remodelling occurs in bone constantly. Stress fractures are the result of repeated micro-trauma that is not corrected adequately by this remodeling phase. The time from diagnosis to return to sport is determined by, amongst other things, the site of the stress fracture and the severity of the lesion. Stress fractures can be graded, using imaging, from mild (bone strain) to severe (bone stress).

Specific management of stress fractures

1. **Modified rest** from impact or loading activities is important.
2. **Strengthening** the muscles is important when managing stress fractures, as this increases the amount of force that can be absorbed by the muscle and so decreases the load on the bone.

Time off rugby: An uncomplicated stress fracture takes 4-8 weeks to heal before the player can return to sport. However, as a result of the loading nature of the sport, the return to sports activity must be done gradually to prevent overloading and recurrent injury at that site.

It is important to note that the healing, grading and treatment of muscle, tendon, ligament and bone injuries is given as a guideline. There are a number of factors which influence the time off rugby and therefore need to be considered when the management is planned and implemented.

PHASES OF REHABILITATION

The management of injuries during the stages of healing has been established. Dynamic loading in the form of exercise rehabilitation can be started as soon as the repair phase has begun (Figure 2).

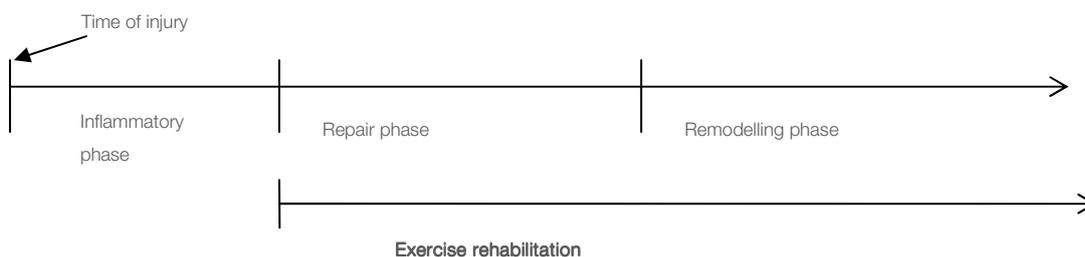


Figure 2. The interaction between the stages of healing and exercise rehabilitation.

Exercise rehabilitation for an injury is classically described to have 3 phases (cognitive, associative and autonomous). For the rugby player, an additional phase relevant to return to play is added. The aims of the four phases are presented in Table 7.

For the rehabilitation process to be successful, communication between the medical team, player, coach and trainer is critical. An interdisciplinary approach to player injuries has been described. The ideal scenario would involve the medical team, trainer, coach, player and any other necessary people meeting at the time of the injury to discuss diagnosis and management of the injury to ensure that each part of the team supports the process being undertaken prior to commencing the rehabilitation.

TABLE 7. THE PHASES OF EXERCISE REHABILITATION OF THE INJURED PLAYER

	Phase 1 Cognitive phase	Phase 2 Associative phase	Phase 3 Autonomous phase	Phase 4 Return to play
Aims of the phase	To activate and isolate the local stabilisers of the joint	To retrain movement patterns and isolated muscles	The aim is dynamic stabilisation with emphasis on skill training and functional rehabilitation.	This includes the process by which the player returns to the team in a graded process until full return

RETURN-TO-PLAY

Return-to-play is defined as ‘the process of deciding when an injured or ill player may safely return to practice or competition’. The early return to training and sport are considered sensible goals if the rate of return is based on the muscle affected, the severity of the injury and the position of the player. This should remain true for most injuries although the time-frame for returning to rugby may be different due to the contact nature of the sport.

There are 2 basic principles guiding the return to sport-specific training following a muscle injury:

1. The flexibility of the injured tissue should be the same as the uninjured tissue
2. There should be pain-free use of the muscle during basic movements. This is a sensible guideline to use for all injuries.

The medical team needs to constantly monitor the effect of their management, using functional tests which can assess the severity of the injury.

Guidelines for return to play are difficult to apply as there are a number of factors which may influence the recommendations:

1. There is a **medical component** which is constantly changing as the base of knowledge improves.
2. **Social and economic factors** constantly influence a player's return to play, especially with regards to income.
3. The **"political" influence** of who makes the final decision on return-to-play has an impact on the decision.
4. Finally, the **legal issues** surrounding return-to-play, and the medical team's responsibility towards player safety, needs to be considered.
5. For this reason it is imperative that guidelines for return-to-play be compiled by the medical support team to ensure that there is a standard process to follow.

Once a player has been medically cleared to return to play, there are some fundamental steps that need to be followed:



1. The player has to fulfill the fitness standards of the team he is returning to.
2. The player needs to pass some skill-specific tests applicable to his playing position.
3. The player may then begin practicing with the team.
4. Exposure to the match situation should be gradual, with the match time gradually increasing.

These are simple guidelines which need to be developed by each team with contributions and support from members of the medical team.

CASE-STUDY EXAMPLE

A brief case study of a 24-year-old with recurrent hamstring injury to his right leg is presented to demonstrate the treatment of a patient with respect to the stages of healing. This is a common injury amongst rugby players. Further, the risk of a hamstring injury recurring is high.

A 24-year-old rugby player sustained a hamstring injury while sprinting for the tryline in the second half of a game. He felt his hamstring “go” and stopped running abruptly. The physiotherapist attended to him on the field. The player was assessed on the field and based on pain and inability to straight leg raise beyond 40°, was removed from the field. Clinical findings and an ultrasound confirmed a Grade 2 injury of the right hamstring. This was a recurrent injury, with the primary injury occurring two weeks prior.

<p>Immediate management</p> <p>The player was removed from the field. The principles of RICE (rest, ice, compression and elevation) were applied. The patient was placed on crutches and given a compression bandage.</p>	<p>(a) Crutch walking (b) Ice therapy</p> 
<p>Management of the inflammatory phase</p> <p>Immobilisation was continued for 2 days. Then gradual weight bearing was started. RICE was continued. Ultrasound treatment was provided from Day 2.</p>	<p>(a) Ultrasound</p> 

Management of the repair phase

Specific soft tissue mobilisation (SSTM) was started on Day 5. This involves transverse mobilisation of the soft tissue to provide mechanical loading for the developing scar. By the start of week 3, the SSTM was combined with a physiological stretching position to further load the scar. Graded stretching was started on Day 5. Stretching was done to a point short of pain by the start of week 3. This was done with minimal discomfort. Dynamic loading in the form of exercise rehabilitation was started at this stage. This included a progression from isometric, to concentric, to eccentric loading (The exercise rehabilitation programme initiated in this phase is discussed in detail below).

(a) Specific soft tissue mobilisation (SSTM)

These techniques apply a longitudinal tension by exerting a pressure 90° to the soft tissue



(b) Physiological loading

A longitudinal stretch is applied by the therapist



(c) Combination of (a) + (b)



Management of the remodelling phase

Exercise rehabilitation is the primary focus of this phase. The player continued through until functional and skills rehabilitation was complete.

Rehabilitation protocol is presented below.

Stretching: 3x30 seconds, 3xdaily. This is started in the repair phase but is only done to the point of mild discomfort.



Exercise rehabilitation: This included hamstring and trunk stability rehabilitation, which proceeded to full-body, functional rehabilitation.

Initial or cognitive phase (Day 5-8)

This included isometric contractions of the hamstring muscle and isolation of the transversus abdominis.

(a) Isometric contraction of the hamstring muscles.

(b) Isolation and activation of the transversus abdominis.



**Dynamic loading or associative phase
(Day 6-14)**

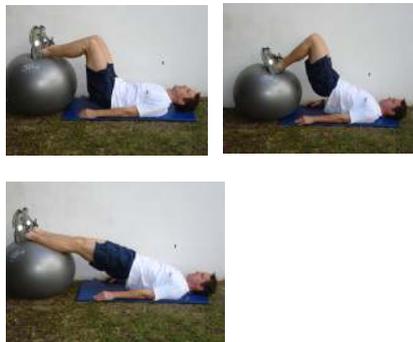
This phase included simple exercises aimed at both the isolated hamstring muscle and basic trunk stability exercises. Exercises included hamstring wobbles, bridging, bridging on the ball, segmental bridging.

Hamstring exercises

(a) Hamstring wobbles



(b) Bridging series on the ball



(c) The 'interflora'



(d) Cycling (non-weight bearing) for cardiovascular fitness



Functional loading or autonomous stage

The stage was characterised by functional loading activities and the introduction of skills training. Exercises included the diagonal arm squat, bridging with leg extension, and ball crunches. Functional loading included a graded running programme (started at Day 10) in straight lines, progressing to multiple directions by the 3rd week. Agility and ladder drills.

Advanced hamstring exercises

(a) Alternate leg raise from bridging on ball



(b) Diagonal arm squat



(c) Ball crunches



(d) Forward lean of trunk from kneeling



	<p>Functional loading strategy</p> <p>(a) Walking-jogging-walking progressing to sprinting gradually with specific protocols</p>  <p>(b) Agility drills</p>  
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RETURN TO SPORT

This player joined practice at half pace (50%) at the end of week 3, progressing to a full practice by the end of week 4. He played the first half for the next 2 weeks and only returned for a full game by week 7. He continued with his hamstring stretching and functional rehabilitation exercises for 6 months after the injury.

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