

# Criteria for returning to play sports after an injury

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## Summary

One of the most decisive challenges clinicians and sports medicine specialists face is deciding when an athlete who has just come out of injury may return to play.

To take such a decision, the corresponding doctor must keep in mind several parameters such as: kind of sport, technical gesture to be performed in the sport, time of injury and its biological recovery stages; recovery of functional parameters and finally a full psychological recovery from such an injury.

In this paper, we will explain in detail the various specific features which are to be considered in order to take a suitable decision with the aim of avoiding complications, recidives and thus enabling the athlete to return to his/her state of form, prior to the injury. We will provide a general evaluation of the injury without considering specific aspects each injury may show.

Each variable must be both individually and collectively considered. An athlete should not be given the ok to return to play unless all criteria show adequate values.

We will establish various criteria: biological, functional, sport specific and psychological in order to obtain an overall analysis which will enable us to take the most adequate decision for each athlete and his/her injury.

We believe a patient may receive the trauma specialist's OK from three points of view: The clinical OK, received when the athlete is no longer "ill" and may begin his physical training regime. The sports activity OK which takes place when his general physical training period has terminated and is prepared to undergo workout sessions specific to his sport specialty and finally the competition OK, after which athletes can return to competition.

**Key words:**  
Return to play.  
Injury. Sports.

We propose a decision taking and check list for any sport injury which may be used as future reference for subsequent studies and possible modifications that may further help to define this important challenge in sports medicine.

## Criterios para el retorno al deporte después de una lesión

### Resumen

Uno de los retos más decisivos a los cuales se enfrenta el médico y traumatólogo del deporte es la toma de decisión de cuándo el deportista que ha sufrido una lesión puede reincorporarse a la práctica deportiva.

Para la toma de decisión el médico responsable tendrá que tener en cuenta distintos parámetros, como son: el tipo de deporte; el gesto técnico deportivo que tiene que realizar; el tiempo y las fases de la recuperación biológica de la lesión; la recuperación de los parámetros funcionales y la completa superación mental o psicológica de la lesión.

En este trabajo, vamos ir desgranando las distintas particularidades que es preciso tener en cuenta para una toma de decisión adecuada con el fin de evitar las complicaciones, recaídas y que el deportista vuelva al mismo nivel deportivo previo a sufrir la lesión. Valoraremos la lesión en general y no la particularidad de cada una de ellas.

Es importante valorar cada parámetro de forma individual y a la vez de forma colectiva. No puede ser dado de alta deportiva y autorizado a reincorporarse al deporte si no tiene todos los parámetros en los niveles adecuados.

Estableceremos distintos criterios: biológico; funcional; deportivo y criterio psicológico para que el análisis en su conjunto nos pueda ayudar a la toma de la decisión mas adecuada a cada deportista y a su lesión.

Consideramos que existen tres altas a nivel de la traumatología del deporte. El alta médica, cuando deportista deja de ser un enfermo y puede comenzar la preparación física. Alta deportiva, que acontece cuando ha terminado la preparación física general y está apto para los entrenamientos específicos de su especialidad deportiva, y por último, el alta de competición, después del cual el deportista puede competir.

**Palabras clave:**  
Retorno al deporte.  
Lesión. Deporte.

Proponemos una lista para el chequeo y toma de decisión de cualquier lesión deportiva, que sirva de base para posteriores estudios y modificaciones que concreten este importante reto de la medicina deportiva.

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## Introduction

The speciality of Sports Medicine is possibly the most demanding medical speciality available, because not only does it aim to cure the injured athlete, but also to speed up the recovery time as far as possible without the athlete suffering from any physical or psychological after effects, as the key objective is to reincorporate back into the sport and obtain peak physical and sporting performance whilst minimising the risk of relapse. These objectives place sports medicine at the forefront of innovation in diagnostic methods and treatments, even some not appropriate for use in everyday clinical practice. In the worst cases, this high therapeutic demand conditions the application of therapeutic methods and techniques without sufficient scientific grounds, as the athlete will look for whoever will promise a quick and effective recovery.

In this framework of demands, there is also a perversion of medical methods, with many athletes seeking treatment before receiving a precise and adequate diagnosis, which on many occasions leads to a loss of precious time, entailing injuries and complicated aftermaths, slowing down the recovery time that the injury first presented. However, many treatments applied innovatively have later been indicated for everyday clinical practice.

All the aforementioned is due to the existence of competition. Athletes must be at their best and peak physical, mental and functional condition, and at maximum performance to compete, otherwise it spells the failure of the entire diagnostic and customised therapeutic system applied.

Sports medicine is subject to pressure and demands from all sides: the athlete, the athlete's family, the media<sup>1</sup>, other athletes and trainers<sup>2</sup>.

There are numerous studies that establish criteria or times depending on the type of injury, for example after breaking the Achilles tendon<sup>3</sup>, after an anterior dislocation of the shoulder<sup>4</sup>, after shoulder surgery<sup>5</sup>, after a surgical reconstruction of the anterior cruciate ligament<sup>6</sup> or the rupture of the hamstring muscles<sup>7</sup>, in other cases serum markers have been sought to quantify the damage and recovery of the injured area, such as Tau-A<sup>8</sup>, the S-100-B protein, and the neuron specific enolase (NSE)<sup>9</sup>, in post-concussion brain injuries. There are also uncommon injuries, which pose a challenge for sports medicine<sup>10</sup>, other works suggest criteria models in decision making, but in our opinion these are incomplete and are limited to muscle, shoulder, brain concussion injuries, etc.<sup>11-16</sup>, but there are no studies that establish general criteria that can be applied to all injuries, which is the objective of this study, that can be used as a guide - applying the general concepts to any injury that occurs in sport.

Numerous factors establish the evolution of the different types of sporting injuries, such as the type and mechanism of breaks where they occur, for example, in the case of hamstring injuries<sup>17</sup>, the surgical reconstruction case of the anterior cruciate ligament can affect the return to the game, pre-operative, operative and post-operative factors<sup>18</sup>.

All sporting injuries have three unavoidable recovery periods for the complete restoration of the athlete. These periods do not have to be consecutive, dependent or subordinate. These periods in phases are:

**Table 1. Aptitude assessment criteria for discharge.**

Assessment criteria
Biological criteria
Functional criteria
Psychological criteria
Sporting criteria

biological, functional and psychological or mental, which condition the criteria that we will have to consider when allowing an injured athlete to return to the sport (Table 1).

## Biological period

The repair/regeneration of a tissue of the locomotive system will occur in consecutive and overlapping phases. Schematically and didactically we can distinguish:

- Inflammatory phase. We can consider inflammation to be the combination of genomic phenomena that translate into biochemical and cellular changes and that occur locally when a harmful agent has acted on a tissue. It is an urgent, immediate, non-specific and focal response that is implemented immediately the moment the injury occurs, and whose duration depends on the type of tissue injured, the intensity and extension of the damaged tissue. This phase is the key to the rest of the recovery process, which is why its modulation, control or medicated regulation is vitally important.
- The degeneration/neovascularisation phase. In this phase, the protein, cell, detritus remains, etc. are naturally cleaned from the point of injury, produced as a result of the traumatic agent action. Furthermore, there is an increase in angiogenesis, with the formation and arrival of new blood vessels in order to increase the contribution of cells and substances of various types that help to repair the injury.
- The cellular proliferation and extracellular matrix production phase. Cell stimulation generated by the biochemical substances produced in the previous phase, has its maximum expression in this phase. The cells that produce the restitution of the damaged tissue are different cell types, producing new tissue-specific cells or reserve stem cells. On the other hand, certain cells produce the framework and supportive tissue component, the extracellular matrix.
- Modelling and functional adaptation phase. Once the damaged tissue has been reconstituted, it must adapt to the mechanical load - essential in the world of sport - requiring vascular redistribution and innervation. The mechanical load, vascularisation and innervation are integral factors of the locomotive system tissues.

These previously described phases may vary in intensity and duration depending on the location of the injury (muscle, bone, tendon, etc.); its distribution throughout the affected tissue (tendon muscle

junction, muscle, osteotendinous junction, etc.) such as in the case of soleus injury<sup>19</sup>, personal factors (smoking, previous illness, etc.); anatomical factors, nearby areas, distal and medical factors, treatment applied, surgical technique used, etc.

Limiting factors of a good repair in the focal area are: oxygen supply, the level of vascularisation and metabolic contribution.

As well as the aforementioned, there are two genetic-level responses that condition the response of the tissue individually, the first being the epigenetic response. This term, coined by Conrad Hal Waddington in 1942, refers to the study of the interactions between genes and the atmosphere that occur in organisms, and therefore the epigenetic is the collection of chemical reactions and other processes that modify the activity of the DNA but do not alter its sequence. The second is the genomic response, which we can consider to be the mechanisms through which the genome responds to an external or internal stimulus, producing an activation/repression of genes and a modification of the protein synthesis.

This time, generally after a complete break, may require four to six months in a tendon, six to eight months in a bone, four to six months in a muscle, and around six months in cases of anterior cruciate ligament surgery, around four months in hockey players that have undergone an arthroscopy for the labral repair of the shoulder<sup>20</sup>, and approximately three months for the complete avulsion of the adductor treated conservatively<sup>21</sup>.

## Functional period

We could define it as the time that passes from the complete or relative functional impotence after the injury occurs to the full recovery of all functional parameters.

Inadequate immobilisation in time or form leads to a delay in the functional recovery of the affected tissue, increasing tissue stiffness, producing atrophy in the different tissues and increasing the appearance of complications.

The mechanical load, as we have seen previously, is an integral factor in the framework of functionality. A repaired or regenerated tissue that does not fulfil the mechanical requirements to which it is subjected, is a useless tissue from a functional perspective, a situation that should be avoided in the world of sport. However, it has been shown that an injured tissue that starts to receive a mechanical load early, on the one hand improves its biological repair, whilst on the other hand speeds up functional recovery time.

Each tissue has a different mechanical function. For example, the tendon transmits strength from the muscle to the bone, to mobilise the joint; the muscle has characteristics of elasticity, stiffness and different contraction types; the bone supports axial loads, traction and compression, torsion and arching; the ligaments stabilise the joints to enable a specific range of mobility, etc.

As injuries often condition losses of different functional parameters as they are involved more in one type of tissue, we have to generally assess the parameters that can be used as a base for functional criteria.

## Psychological period

We could consider it from the non-acceptance phase of the injury at the moment it occurs until it is psychologically overcome.

Injured athletes suffer from a high level of stress, emotional tension and anxiety because the incapacity of performing their sport and ergo competing has personal, economic and future repercussions on the athlete. Often injury cuts short years of training for a specific competition. What were dreams under normal conditions become nightmares and frustration with an injury.

The psychological recovery of an injury depends on its seriousness and its repercussion on a specific sport, as well as the maturity and psychological experience of the athlete. A veteran athlete is used to falling and getting back up, to overcoming obstacles and exceeding challenges on many occasions.

Psychological consequences, such as fear or apprehension towards a new injury, lead to a drop in performance during reincorporation into the sport, and this aftermath conditions the loss of self confidence during the performance of the sporting movement, which is why often new injuries occur, or habitual niggles increase during reincorporation. On other occasions, during the sporting reincorporation phase, pain is not differentiated from normal tiredness, or aches produced through physical exercise.

These psychological factors, despite physical parameters being fine, condition the incapacity to return to the game<sup>22</sup>.

## Criteria

Based on the previously mentioned times, we will establish a series of criteria to assess the finalisation of the recovery processes for each time.

### Biological criteria

We can consider three basic parameters: time parameter, as the time passed from the injury to the present moment. We have to consider that the type, seriousness and intensity of the injury of each tissue entails a minimum reparation/regeneration time, therefore it should be considered specifically and individually. Currently it is an unchangeable time as there are no therapeutic techniques that can shorten this biological recovery time, though it can be delayed through the application of unsuitable treatments.

We can assess the histological and anatomical recovery of the tissue externally using ultrasound<sup>16,19,23,24</sup> or resonance scans, though their reliability, specificity and sensitivity are questionable<sup>25-29</sup>. There have been attempts to fuse both technologies to gain a deeper understanding of the injury<sup>30</sup>. In other magnetic resonance studies a link is made between the radiological degree of the injury and the size of the swelling with time to return to the sport for both 1st and 2nd degree hamstring injuries. However, no relationship has been found between the time to returning to the sport and the location and the

type of injury<sup>31</sup>. Others deny this relationship and value<sup>32</sup>, even when fibrosis can be seen in the hamstrings after the injury, they found no relationship with the risk of relapse<sup>33</sup>; other authors, however, did find a link between these parameters<sup>34</sup>.

## Functional criteria

Within the functional criteria we consider the following parameters: mobility; muscle contraction; performing stretches; the response to bearing the load; neuromuscular coordination; executing basic and sport-specific movements. All of these should be performed without causing pain, or inflammatory symptoms. Moreover, these parameters can also be used to assess spinal injuries<sup>35,36</sup>.

Mobility assesses the state of joints: complete joint mobility is needed. Muscle tone considers the state of muscle and the response to executing the different contraction types. Stretches reveal the different degrees of elasticity and flexibility, as well as the response of the different musculoskeletal system structures. The response to bearing loads indicates the state of bones and joints.

At a more advanced stage of functional recovery, neuromuscular coordination exercises are initiated, with basic movements then later sport-specific movements. This progress is undertaken depending on the tolerance to increasingly complex, intense and prolonged exercises, that are dependent on the position of the player in the team sport, such as in the case of rugby<sup>37</sup>, or in the case of athletes with rhabdomyolysis<sup>38</sup>. The duration varies according to multiple factors, among which are two: previous physical state, type of technical sporting movement, sporting trainer or therapist, etc.

## Psychological criteria

Psychological and social factors influence rehabilitation and later the outcome of the recovery<sup>39</sup>.

Within this section we should consider, especially in contact sports, the existence of fear of practising the sport and of contact, apprehension towards the sport and emotions like psychological symptoms (anxiety, etc.) that limit sporting performance. This situation produces suffering in the athlete which threatens him/her, making it impossible to overcome the injury.

Despite receiving most of their treatment in the hospital or medical centre, it is very important for injured athletes to get back as soon as possible into the sporting setting or club, to experience the scenery or place where the injury occurred once again, and to continue to experience all the facets of the profession with their colleagues. This quick reinsertion into their setting softens their anxiety and fears, and the environment is not strange for them. Perhaps, if possible, it would be favourable to carry out physical recovery from their club from the outset.

A test has been proposed to assess the motivations and incentives for returning to the sport, though with no conclusive results<sup>40</sup>.

We propose a check list that can help make decisions in the return to the sport from any injury in the context of the different discharges conceded in the field of sporting medicine (Table 2).

**Table 2. Check list that brings together the different parameters to assess.**

Check list
<p><b>Biological criteria</b></p> <ul style="list-style-type: none"> <li>Time passed since the injury occurred or surgical treatment</li> <li>Follow-up ultrasound scan (not essential)</li> <li>Follow-up magnetic resonance scan (not essential)</li> <li>No pain upon exploring the site of injury</li> </ul>
<p><b>Functional criteria</b></p> <ul style="list-style-type: none"> <li>Complete joint mobility</li> <li>All kinds of painless contractions</li> <li>Painless stretches</li> <li>Painless load bearing</li> <li>Post-exercise painlessness</li> <li>No sign of post-exercise inflammation</li> <li>No neurological signs</li> </ul>
<p><b>Sporting criteria</b></p> <ul style="list-style-type: none"> <li>No pain with basic movements</li> <li>No pain with specific movements and sporting technical gestures</li> <li>Adequate sporting performance</li> </ul>
<p><b>Psychological criteria</b></p> <ul style="list-style-type: none"> <li>No negative signs or symptoms (fear, apprehension, anxiety, etc.)</li> </ul>

To conclude, we could consider the decision to return to the sport as one of the most important and demanding challenges of the practice of sporting medicine, for which sporting discharge does not merely depend on just one criterion or parameter, rather on the assessment of all of them as a group, requiring sincere, loyal, truthful and open communication between the multi-disciplinary team tending the athlete, with the sports doctor having the final word in decision making. More studies are needed to breakdown the individual differences between the different sporting injuries.

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