



BARÇA
INNOVATION HUB
Universitas

INJURIES AND TEAM SPORTS

INJURY REHABILITATION

→ 1.2 Rehabilitation Chapter (RTP)

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In the world of elite sports, in terms of the health of athletes, or the absence thereof, we usually talk about injury processes, estimated recovery times, the evolution of the healing process, progressive reintroduction to new content, among other factors. More and more we talk about the concept of sports rehabilitation, with the most important question being when an injured athlete will be able to return to training. The answer to this question offers valuable information to both the player – the primary stakeholder – as well as to the coaching staff, and increasingly, the media.

With the evolution of professional sports, especially in recent decades, there has been an evolution in the medical care provided by health professionals working in the sports environment, as well as an evolution in treatment methods.

The way sports has evolved implies a higher physical demand on the athlete (higher training volume/intensity with less recovery), as well as a higher level of emotional stress and other factors of different kinds, which together result in a higher rate of injuries.

Athletes are injured as much or more than before, but the recovery process is increasingly specialized from the point of view of sports medicine and

physiotherapy. This is especially so in terms of rehabilitation work performed during the recovery process in order to return to training. The goal at the end of the process, when the injury is resolved, is that the player is able (or very close to being able) to participate in training at the same level in which he participated prior to the injury.

RTP Concept

Notwithstanding the above, the concept of return to play is still not well defined, either at the national or international level. International conferences have been held to integrate concepts in terms of: definition, criteria for decision-making, principles to follow for different injuries, different aspects to consider in regard to the athlete's injury, etc., but it is difficult to reach conclusions on the concepts related to this topic, given that is a very new, and as yet, very open area of knowledge. For example, we cannot compare the decision-making process in the medical field, nor the criteria that may be applied when making a pathology diagnosis, with the decision-making process involved in the evolution of the field work required of an injured athlete, nor what criteria to use when planning rehabilitation tasks. The clinic doesn't have to follow the same idea.

At the international level, Clare Anders published the Consensus assessment on return to play in 2016 at the First World Congress in Sports Physical Therapy (Anders et al., 2017).

Likewise, at the national level, there are various concepts for rehabilitation found in the literature and a lack of consensus on the definition (Lalín, 2006, Seirul-lo Vargas, 1986, Tarragó Costa, Cos Morera, Gordillo Molina, Lizárraga, and Martín Urrialde, 2004). These variations and lack of consensus regarding a definition are also reflected in how the process is defined, where we find terms such as the globally accepted concept of return to play or rehabilitation along with others such as *specific sport phase* to define this recovery period. In any case, the role of the rehabilitator remains unclear, although the clear trend is increasingly that a rehabilitator is a professional who can combine a knowledge of pathology and its treatment with a

knowledge of training and load dynamics. As such, a physiotherapist with a lot of experience in the world of training may need multiple qualifications.

Return to play (RTP) is usually understood as the recovery stage when field work is introduced, including specific athletic motor patterns and the physical and cognitive demands of the specific sport. This work involved in this recovery stage begins in combination with physiotherapy, which goes from having a secondary role to taking a leading role in terms of treatment. Furthermore, recovery work is combined with physiotherapy and lasts until the athlete returns to sports practice as usual. Thus it is proposed that rehabilitation is a continuous process in which work begins by developing basic skills through individual work, and the level of demand of these individual tasks is progressively increased until it becomes possible to participate in group trainings. Here, decisive and specific aspects of the sport that would be difficult to simulate in an individual way are worked on. The process is complete when the player is able to naturally perform with his training group. At this point, he is ready to return to normal competition.

One of the main objectives during this process is to work on all the skills, capabilities and abilities necessary for sports practice, according to an individually tailored plan for each athlete.

Rehabilitation as a continuum is adapted to the different populations that practice physical activity. Contextualizing the athlete's return to play is of the utmost important, as the concept of returning to sports is very broad. Whether we refer to an *amateur* athlete or a professional athlete, we are talking about a process of reintroducing the athlete to previous demands. However, we must be aware that these physical and cognitive demands will differ according to the athlete's level and, therefore, these differing levels must be addressed accordingly during this process.

Scientific Evidence and RTP

For many years now, science has been applied to sports medicine, and more and more, is also being applied to physiotherapy in elite sports. The

application of scientific evidence requires the definition of physiological characteristics, such as pain, flexibility, strength, etc. Tools such as the MSCS scale, pendular inclinometers, dynamometers, isokinetics and accelerometers allow us to accurately measure these variables, and the data offers us complementary information that is very useful to the whole process.

But these data cannot serve only as a criterion to increase the difficulty level of the proposed tasks or to continue progressing through the process. It is not about "phase changes"; the "phases" overlap on a work continuum, they are not separate stages with mutually exclusive content that will or will not be introduced because it belongs in one phase or another. The contents are introduced progressively.

The data will support a process in which the role of the rehabilitator as an observer, together with the sensations described by the player in response to the work assigned, are very important, but do not *indicate a phase change*. These collected data provide us with information on the athlete's specific state and can possibly give us an overview of the athlete's state in comparison to his state prior to being injured or his state compared to the rest of the group. But it is important to collect data which is of interest, and know how to interpret this data: it is not useful to have data on a player who plays in a certain position and compare this to a series of players with whom there are no similarities in terms of physical demands or who play different positions.



"Sports injuries are not treated, they are managed" (J. Brau)

Scientific evidence and its practical application through physical tests, musculoskeletal system assessments and load monitoring can help to identify potential injury risk factors. For example, it is known that weak adductor muscles and a decrease in range of motion of the hip joint can increase the risk of groin pain injury (Engebretsen et al., 2010).

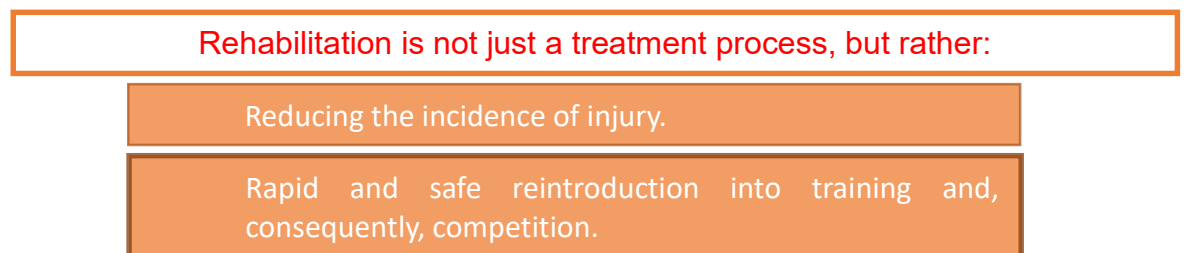
The evidence has also validated functional tests such as the Symmetry Limb Index, T-Test, *single leg jump* and *drop test*. The use of normative data allows for the use of functional tests, force ratios for different injuries and even potential algorithms, especially for hamstring injuries (Mendigutxia, 2017; Fournier-Farley, 2017; Van der Horst, 2016; Van Dick 2017), providing us with indicative information about optimal state. From the areas of physiotherapy and rehabilitation, other factors are taken into account, such as the integration of health components, the healing status of the injured structure, the load on the structure, the tolerance of the structure to the introduction of new content and kinematic mechanisms, and sports performance. These factors are difficult to exemplify, but they are relevant to the rehabilitation process.

FCB Model and Rehabilitator

FC Barcelona has its own characteristics and methodology in terms of return to play. Through innovation, evidence, experience and results, a unique rehabilitation system has been developed that is characterized by focusing on physical and cognitive qualities in an integrated manner.

The main objective of the physiotherapy department is that, at the end of the rehabilitation process, the player be able to return to group training in a condition where he is able to maintain a maximum level of demand and available to participate in competitions. Likewise, and of equal importance, is ensuring that the player does not suffer a recurrent or relapsing injury during the process or after his return to the training group.

Graph 1: Sports injury treatment process



Source: Prepared by the author

Rehabilitation is based on a work system managed by physiotherapists in a multidisciplinary environment in which they work daily with the medical team, physical trainers, the nutritionist and podiatrist, mainly, and also, of course, with the coaching staff.

The rehabilitation of a professional soccer player must be considered not only as treating a pathology and planning appropriate field work, but we must also understand it as managing a complex situation. Therefore, we must take into account a series of elements that occur in tandem with the injury and that can affect the implementation of the entire procedure, including: the moment of the season in which the injury occurs (is there a significant competition date coming up, or, to the contrary, is there room to maneuver?); the player's history of injuries; the culture or religion of the player and its impact on the day-to-day. Determining how a player tolerates certain types of work, the influence of media on the player, influence of his environment, etc., are just some of the aspects that can alter the process and that we must know how to manage.

Graph 2: Multidisciplinary team involved in RTP



Source: Prepared by the author

During the rehabilitation process concerning an injury, there is an evolution in terms of the type of efforts made, which will increase mainly in terms of difficulty, demand, intensity and load. But rehabilitation is a complex process that is not regulated in terms of "phases" or closed stages, within which we must introduce certain exercises or control tests that tell us how to proceed. Progress within a rehabilitation process is evaluated daily based on the tasks the athlete is able to perform and under the critical observation of the rehabilitator to determine correct execution, or not, and the achievement of the objectives that were established. Throughout the process, the player will work on elements of mobility, strength, motor control, balance, agility, coordination, among others, which will be structured within their work sessions, with a focus on specific elements depending on the moment.

As a general rule, the rehabilitator sets tasks for the player, which must always be consistent with the status of the injury and the state of the physiological repair process. These tasks together make up the scheduled work session. Let's say, for example, a session that takes place in the gym: a series of exercises is prepared and assigned to the player. If during the execution of any of these exercises the player does not feel safe or has a strange feeling, the exercise will be removed or exchanged for another until this sensation improves. In an example of work on the training field, the rehabilitator prepares an on-field training session, explains to the player what tasks he has to carry out, and the player performs them under the premise of prioritizing a sense of safety and well-being. The intensity will be progressively increased to reach an expected level of execution.

Combining the maintenance or restoration of physical condition, with work adapted to the needs of the injury, is a complex task.

The rehabilitator is a professional with knowledge in the areas of physical activity and sport sciences. This background facilitates their ability to manage and monitor the training loads that are applied to the injured player, protecting and stimulating his health while at the same time giving him sufficient stimulus to maintain or improve his physical condition. When the player rejoins the training group, he must be in at least the same physical condition as the rest of his teammates.

It is understood that for rehabilitation, it is essential to have excellent knowledge regarding how sports injuries evolve, along with how to manage the injury throughout the recovery period. Proper management is also necessary to try to avoid relapse during the recovery process, which is one of the main objectives of the entire rehabilitation process.



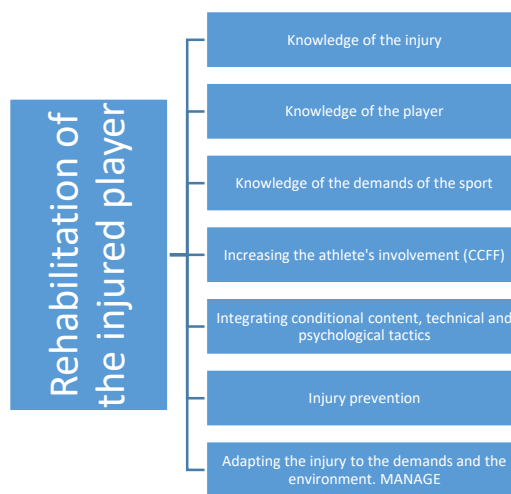
"There is no prevention, only reduction of risk" (J. Brau)

As is already the case with physiotherapy or medical treatment, during rehabilitation tasks, adverse physiological responses may appear, either

during the application of the work or afterwards. The professional must have the necessary knowledge for early identification of such a response and must be able to analyze if the response is related to the injury, to the type of work performed, to the load applied or to the mechanisms introduced. The rehabilitator must also be able to manage a situation in which the adverse response modifies the planned work and, in such case, create an adapted plan.

A physiotherapist is a specialized role, with knowledge in sports pathology, anatomy, physiology and sports pathological biomechanics. The FCB rehabilitator, in addition to pathological and physiotherapeutic knowledge, must have applied knowledge in the analysis of movement, the planning and application of therapeutic and functional exercises, athletic motor patterns, and the specific physical and cognitive demands of the sport. For this, a quality rehabilitator must possess knowledge and understanding on the sport and they must be able to reproduce actions, intensities and sporting contexts that are as similar as possible to a real situation.

Graph 3: Knowledge and aptitudes in relation to the injured player's RTP



Source: Prepared by the author

The FCB approaches the rehabilitation process from the starting point of the concept of *early functionalization*, which poses that the athlete will recover better from the injury by moving. Therefore, always following medical safety criteria, we commence activity by encouraging the athlete to move early on (when this begins will differ depending on the type of injury). This early activation is linked in time with the physiotherapy treatment itself and, in fact, we can consider this activation as part of the treatment itself. Thus, when we begin rehabilitation, the player will probably not have fully recovered his pre-injury strength, active/passive joint ORM, neuromotor patterns or ability to perform complex tasks, among other aspects, because these aspects will in fact be worked on during the rehabilitation process.

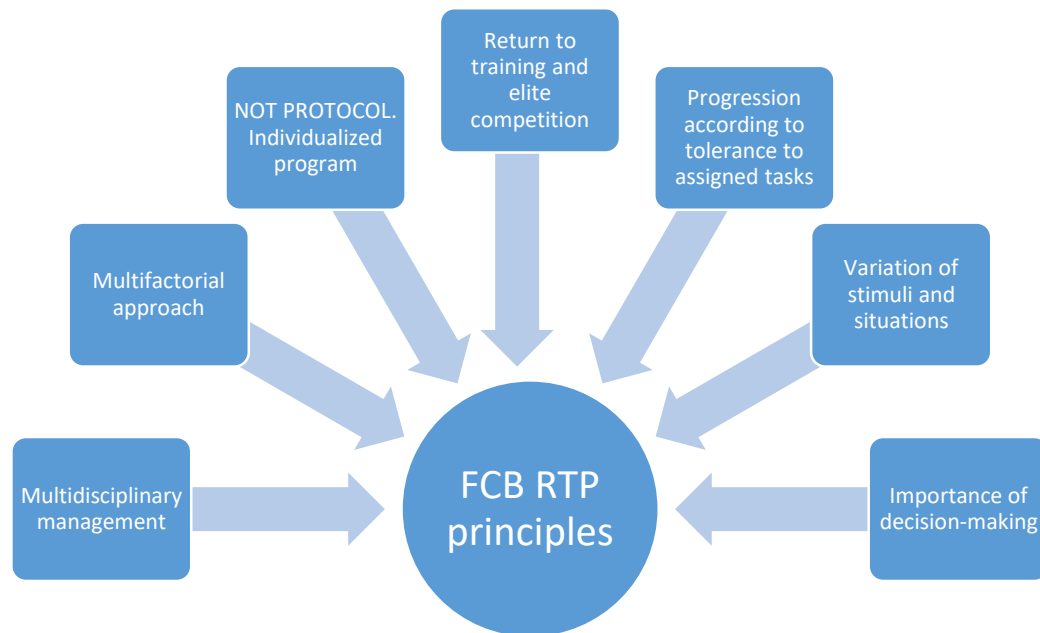
The rehabilitation system bases the criteria for progressions on a multifactorial assessment, in which the physical-sports abilities of competition are only some of the factors to be considered. The rehabilitator prioritizes cognitive, technical and physical abilities. In a similar way, Shrier (2015) describes the risk and tolerance assessment as part of the RTP decision (StARRT). The FCB rehabilitator, following Juanjo Brau's method for more than 15 years, performs a daily multifactorial assessment to plan each work session.

Variation in stimuli is a key aspect in the rehabilitation process, whether at the level of strength recovery exercises in the gym, functional work, field work, and so on. The objective is to enrich the recovering player's kinematic possibilities to the greatest extent possible. Team sports, and especially soccer, are unpredictable. Therefore, during the rehabilitation process, we must look for non-repetitive stimuli to prevent the player from adapting to a specific movement or action pattern. Doing the same exercise with different resistances, varying ranges of movement, repetitions of random exercises, stable or unstable surfaces, etc., will all help us prevent the movement or contraction from adapting to a specific situation.

At the field-work level in a rehabilitation session, this non-adaptation can be explained by the different surfaces we work with: starting on a treadmill (including a flat treadmill), moving on to sand work, artificial turf, uphill running on a tartan track, and ultimately ending on natural grass. Variation in all aspects possible.

Another of FCB's rehabilitation principles is the individualization of recovery programs. Taking into account that the FCB game system determines a specific player profile, factors such as the match position, decision-making and execution, and the player's characteristics and his personality on the field, are considered when developing a rehabilitation program. The use of prescribed exercise programs or protocols is not part of the FCB's rehabilitation system. Each injury is treated as a particular case that must be managed individually, not only in the treatment, but also in the rehabilitation.

Graph 4: FCB principles in the RTP



Source: Prepared by the author

As we have discussed, scientific evidence uses functional tests to express player information, but when it comes to practical application, its use has been limited due to lack of individualization and limitation in sports specificity. Rehabilitators will continually develop exercises and functional tests specific to the club, which are related and orientated to match the type of demands that the game generates.

Below is a diagram of a series of exercises that can be applied in a rehabilitation session.

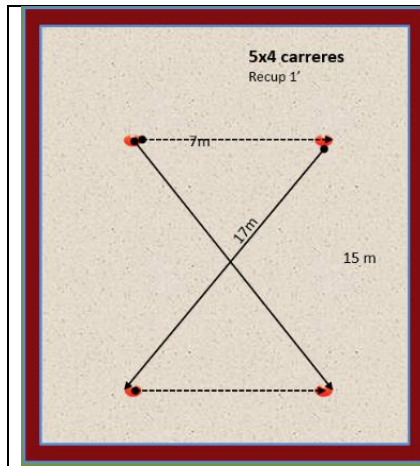


Figure 1: Linear running circuit on sand

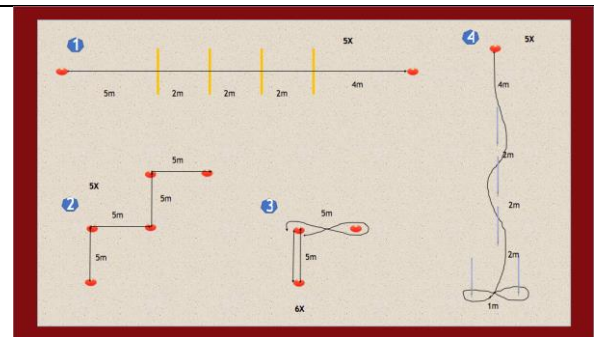


Figure 2: Multidirectional displacement circuit on sand

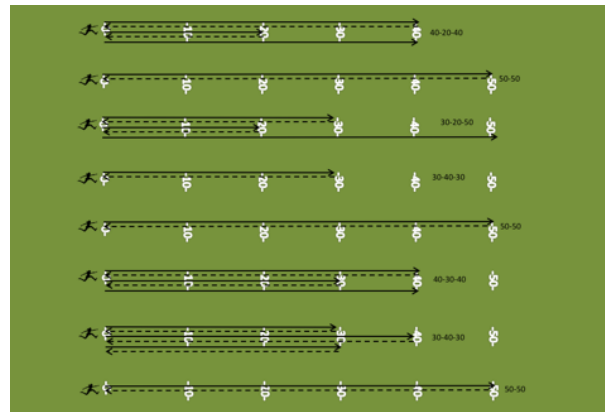


Figure 3: Linear running work on grass

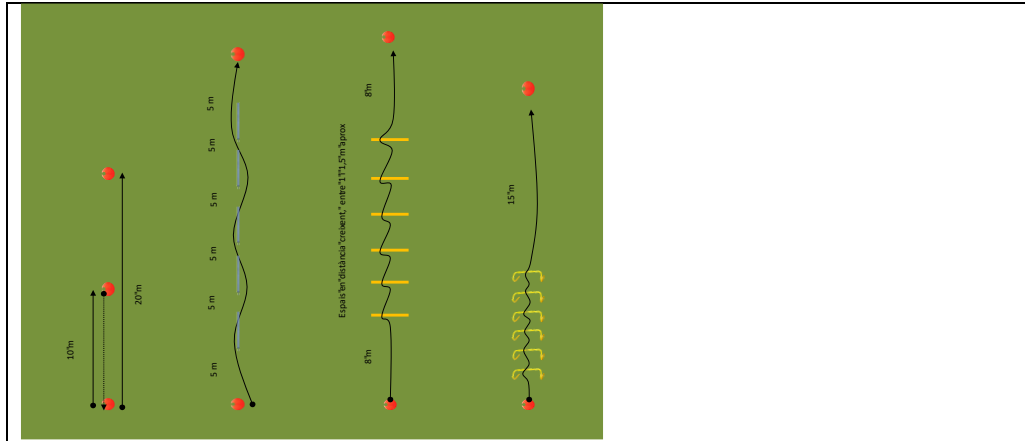


Figure 4: Resistance circuit on grass

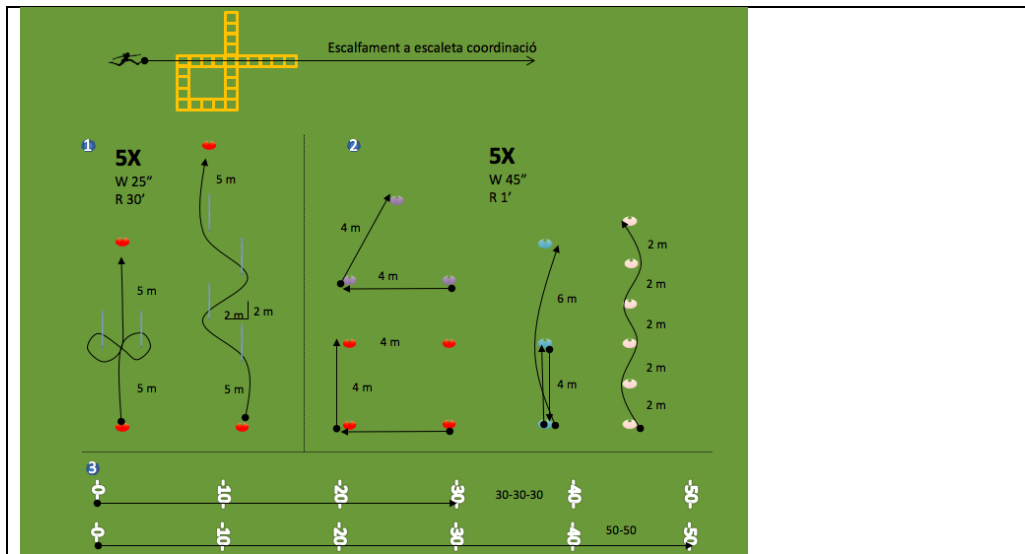


Figure 5: Strength circuit on grass

Source: Prepared by the author

RTP Technology

The use of functional tests, specific circuits and the introduction of technology such as GPS, have provided very useful information in the

rehabilitation phase. They allow us to make comparisons using reliable data on the physical demands achieved in a training group and in a rehabilitation training. The ability to organize and analyze the data that a player generates during a session, together with the critical role of the rehabilitator, provides very valuable information during the evolution of the process.

The current technological evolution means that every day there is more non-laboratory technology available that allows us to obtain data during the application of a training session. This is an element to explore in the years ahead.

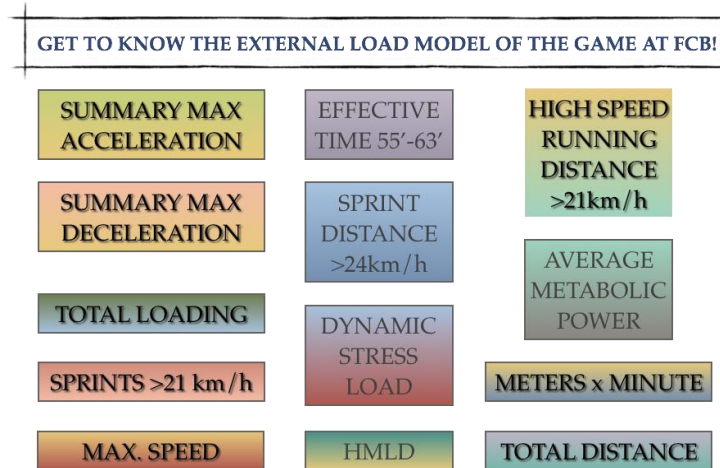
Currently, other systems such as satellite or 3D motion analysis, reaction speed circuits and decision-making, or analysis via wearable surface electromyography, are integrated into data collection and analyzed by rehabilitators, which is used to create individualized RTP criteria for each player.

In recent years the use of GPS has become widespread in professional soccer. It is used to monitor training loads and has become so commonplace that many teams even use this device in league games. Because of its use in rehabilitation it can be considered as a fundamental tool, since it helps us analyze the session results and identify whether the expected results have been achieved or not.

The final goal of the rehabilitation process is to ensure that the player is in the best possible condition when he returns to participate in group training. Through GPS we can also analyze whether the data obtained individually correlates with the data obtained from the players in the group who play in the same position, or the data can be compared with pre-injury data from the same player.

GPS is a very powerful tool that records thousands of data points per second, at the same time as it records a series of different relevant variables. However, it is important to know how to analyze and interpret this data. Variables include maximum accelerations or decelerations, maximum peak speed, maximum impacts generated, load indicators such as HMLD, number of meters covered at high intensity, among others, which add up to more than 180 variables that must be duly and carefully analyzed.

Graph 5: Match external load model



Source: Retrieved from Pons

Once the player is discharged and returns to group training and competition, preventing recurrence is a fundamental objective in recovery. The physiotherapy department defines prevention as the reduction of the risk of injury, understanding that there are many factors that can influence the incidence of injury and that it is not possible to control them all and, therefore, it is not possible to prevent injuries.

To try to reduce risk, it is necessary to ensure that the player is in optimal physical condition. Knowledge of injuries and their risk factors, the monitoring of the musculoskeletal characteristics of players and internal and external loads all help us to identify indicators of potential risk of injury. The use of RPE (Rating of Perceived Exertion) questionnaires serves to control internal load. RPE questionnaires provide information on motivation, fatigue and perception of the player's effort, and are conducted prior to the completion of each rehabilitation session.

In professional soccer, the rehabilitator is part of a multidisciplinary approach to injury management, and they provide fundamental information for decision-making in return to play. In FC Barcelona, the experience over

the last 15 years has led the rehabilitator, due to their significant player knowledge, experience in injury management and success in reducing numbers of recurrent injuries, to play a leading role in the process and decision-making for return to play.

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