Return to training and competition after COVID-19 in professional football

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Headline

If the COVID-19 pandemic situation improves quickly and governance permit to restart sports events, an appropriate sport-specific conditioning should be granted considering three key points: (i) the effects of possible asymmetrical detraining leading to modification of ligament, muscle and tendon properties; (ii) training load after inactivity periods and (iii) density of matches, which will necessarily be increased after break period to be able to finish the football competitions. This manuscript provides specific recommendations to the resumption of training.

The COVID-19. Consequences of the lockdown for professional footballers

The COVID-19 outbreak has caused a sudden stoppage to everyday activities and led to the isolation of millions of people. After the call off professional football training and competitions in many countries and because of the global health alert, players have generally been forced to quarantine at home. During this home confinement, footballers are likely exposed to some level of detraining as a consequence of insufficient and/or inappropriate training stimuli. If the COVID-19 pandemic situation improves quickly and governance permit to restart sports events, an appropriate sport-specific conditioning should be granted considering three key points:

The effects of possible asymmetrical detraining leading to modification of ligament, muscle and tendon properties due to the reduction or variation of training load and a worsening of neuromotor control following the absence of specific motor actions or pattern skills (1, 2). This period of enforced confinement is a transitional period in which there is a disappearance, reduction, or modification of the usual training load. This generates a series of adaptations that can be grouped under the term of *detraining*. In injury terms, this involves reducing the mechanical properties of tissues that require conditioning, especially tendons and muscles, but also of regulatory systems, such as neuromotor. Such degradation is likely to have followed an asymmetrical course in the different systems; for example, some maintenance of muscle and cardiovascular function may have been maintained, but there will be inhibition of the neuromotor control mechanisms required during the execution of sport specific skills. Similarly, this degree of degradation will vary in each country, team, and player, as the environmental constraints may have differed as may the equipment and space afforded to each individual player. Previously similar periods with large pauses in training (such as the NFL lockdown in 2011) generated changes in tissues such as tendon, which during periods of lower activity is deprived of a stimulation in its different degrees of tension.1 This causes a loss of its mechanical properties, especially the capacity to absorb loads. In this sense, it has associated higher prevalence of serious tendon lesions when resuming activity. Achilles tendon ruptures have been shown to feature more frequently during a short and overly concentrated preseason. In the previously mentioned NFL lockdown of 2011, Myer et al (2011) showed that on resumption of activity the number of Achilles ruptures increased from 6-10 per season to 10 in the pre-season period alone. Returning activity after long periods of inactivity can lead to significant negative adaptions, which are related to an increase in conditioning-dependent injuries. Returning activity after long periods of inactivity can lead to significant negative adaptions, which are related to an increase in conditioning-dependent injuries. Developing strength and conditioning programs that lead to an improvement in a players' physical capacity during the confinement phase would dampen potential functional losses and be a protective element when resuming normal training (3).

Training load after inactivity periods, to be taken into account to restart the activity (pre-season). There are a lot of variables that can influence the frequency of injuries in football and many of them are interconnected. Success in reducing injury rates requires in-depth knowledge of each of these individual risk factors, but also the study of relationships between them. The reality is that every time an injury occurs there is usually a confluence of many factors that complicate the examination of each situation. Among these factors, perhaps the most relevant to this particular situation could be training load, motor skill exposure and an injury prevention continuum (3):

- *Control of training loads*, proposing on the return to the activity a gradual increase of them to adapt the players to level to which they will be required in the competition, avoiding exposure to very aggressive load peaks to reduce injuries in this period.
- *Make sure that players are able to use their skills in the game safely and efficiently.* You should ensure a minimum time to work motor skills and movement skills in the first few days after resuming the activity as a strategy to reduce injuries.
- *Well-designed injury prevention programs are necessary.* Injuries could be placed on a "very, quite, some, little, or not preventable" continuum. In those preventable or likely to implement measures to reduce their likelihood of occurrence, there is plenty of evidence that the systematic implementation of multi-component prevention programs or plans could substantially reduce them and their severity (4).

Properly resuming training is a key element not only to optimize performance, but also to reduce injury risk. It could be accepted that there is a training-injury relationship, which would have various effects depending on the training load, appropriate or not, and the subsequent level of injuries and athletic performance achieved (5):

- A low load or absence of training, (or reduction by the effect of confinement) would result in detraining of certain structures and systems, related to increased likelihood of injury and poor performance as seen above (Myers et al, 2011).
- Optimal load is related to fewer injuries and higher performance. Long pre-seasons seem to have a protective effect on health of players acting as a kind of "vaccine", reducing the injury risk, the severity of injuries and increasing the availability of players in training and matches during the season (6, 7).
- Excessive load could lead to increased injury risk and lower performance. When the activity resumes, after the confinement period, it is likely that the preparation time (preseason) is very short, which could complicate the assimilation of loads by the players, in addition to very abrupt or sudden increases of them are associated with greater likelihood of injury, especially muscle injuries. Players have a maximum level of load that could assimilate. If the load raised is above that threshold, injuries are most likely to appear. The coaching staff have to identify the level of each player and take it into account in the preparation (8).

Pre-seasons are usually periods of accumulation of higher workload, and, in some cases also, increased injury incidence (9, 10), perhaps due to excessive volume or inadequate progression. In this situation, insufficient progression and an abrupt increase of training load could affect athletes' assimilation capacity. This adaptation deficit resulting from extreme load variation could be the injury trigger. Sudden changes in intensity, training load and type of training are risk factors for overload injuries, as the body is not able to adapt quickly enough to changes in the load pattern. This effect is recognizable in several structures or tissues, related to intensively resuming the activity (11, 12, 13).

Density of matches, which will necessarily be increased after break period to be able to finish the football competitions. After the confinement period and resumption of training, the change in dates caused by the interruption of the competition could generate two effects on the calendars:

i) The end of the current competition would be resumed in a short period of time with high or very high competitive density. A period of densely scheduled matches can lead to an increased risk of injury and poor performance over the next period (14). It has been proven that high competitive density increases injury risk). Understanding the fatigue of playing a football match and the recovery profiles of biological systems are two key elements in improving preparation programs and reducing injuries (15, 16, 17). The resumption of training after the confinement caused by the covid-19 will face a short and concentrated pre-season followed by a timetable of high or very high competitive density, with matches predictably every 72h, or even less exceptionally. The physiological and functional restoration appears to have a lower limit of 72 hours, observing 48 hours as insufficient (18).
ii) Since the current season would delay its completion, the next season (2020-21) would also begin later than expected, causing a compression of dates that would lead to a nearby season of high competitive density and perhaps without a period of vacation rest or winter break, which could be an aggravating factor.

The new scenario would be unknown in its effects since this high density would be maintained for much of the calendar, in addition to extending to all teams, no longer only to those most adapted by their frequent participation in international competitions and / or have a large number of players that add an extra load and matches with their national teams. Regulating exposure, and therefore the number of matches or minutes played in high-density conditions could be an important element in avoiding injury. Substitutions during matches could be used to minimize the effects of fatigue and injury. Identifying which players could be candidates for this (observing their response dynamics after several consecutive matches and monitoring their functional status), or increasing the chance of making more substitutions could be associated with risk reduction (19).

Practical Applications

Some recommendations should be considered to the resumption of training, especially considering the injury risk associated with this exceptional situation:

- Alleviate the effects of an excessively short preseason, proposing activities during confinement aimed at maintaining the properties of tendons, muscles, ligaments and motor control systems (3).
- Particularly for tendons, during the confinement period, activities should be encouraged to stimulate their mechanical capacities (isometric and eccentric exercises). Also, when resuming training should be carried out gradually with special attention to the progression of loads (1, 2).
- Include reconditioning programs at preseason startup that ensure progressive stimulation of tissues and systems that have been deprived during confinement: specific properties of the muscle-building system, mobility, and neuromotor control in specific skills, with multi-component programs with generic or universal tasks, focused on the most frequent football injuries, and other oriented to the reinforcement of individual tendencies (4).
- Ensure an adequate proportion and alternation of training exercises and their associated risk: Achilles tendon, related to high running volumes and accelerated and explosive actions; quadriceps, related to technical-tactical actions such as accelerations, changes of direction, jumps, or repeated passes or shoots; related to high volumes of high-speed running, and specific football tasks in wide spaces like 11x11 (11, 12).
- Propose a progression of loads and control intra and intermicrocycle, avoiding exposure to very aggressive load peaks that could lead to the increased occurrence of injuries (3, 8).
- Teams should design the preseason to have as many sessions as possible. Reducing training time can increase the risk of injury during subsequent months. These criteria may not be fully applied in the reinstatement after confinement, but as far as possible they should be taken in mind (6, 7).
- In a competitive high-density calendar, the inclusion of rest periods during the season can be a good measure to reduce the injury risk (e.g. Christmas break) (20).
- Recommend period between matches of at least 72 hours or more when resuming the new competitive schedule to ensure minimal functional reinstatement and reduce injury risk (18).
- Substitutions during matches could be handled to prevent possible injuries. Having accurate information about the physical response during matches could provide potential candidates for substitution (19).
- Teams should evaluate strategies to dose their players' playing time at times of high competitive density, establishing

a maximum number of matches to be played individually, based on: (i) the possible reduction of physical response in matches; (ii) post-competition fatigue markers; (iii) high risk indicators for injury (15).

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