

# ACL REHABILITATION IN ELITE FEMALE FOOTBALLERS

## SAME, SAME BUT SHOULD IT BE DIFFERENT?

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### IS THERE A PROBLEM?

As the Women's World Cup approaches in July, significant concerns are mounting regarding the participation of the world's top female football players, as five of the top 20 Women's Ballon d'Or players and over 20 of the top Women's players are currently recovering from anterior cruciate ligament (ACL) injuries. During the 2019 Women's World Cup, a survey of female footballers found that 15% of those surveyed had previously sustained an ACL rupture, with 20% of those players, participating in the tournament with ACL-deficient knees<sup>1</sup>.

ACL injuries are a major issue in women's football, with studies indicating that women are four to six times more likely to suffer from an ACL injury than male footballers<sup>2,3</sup>. Non-contact ACL injuries represents over half of all ACL injuries, with the proportion and incidence of such injuries higher in female than male athletes<sup>4</sup>.

The impact of ACL injury and reconstruction may differ between males and females. A study comparing outcomes between male and female patients who underwent ACL reconstruction (ACLR) found that females had inferior results in instrumented laxity measurements, revision rate, Lysholm score, Tegner activity scale, and incidence of not returning to sports, while other outcomes were comparable<sup>5</sup>. Another study reported that female football players with ACLR had nearly a 5-fold-higher rate of new ACL injuries and a 2- to 4- fold-higher rate of other new knee injuries, resigned from football to a higher degree, and reduced their level of competition and activity level to a greater extent compared to knee-healthy controls<sup>6</sup>. Furthermore, female athletes may exhibit greater psychological distress after ACLR than male athletes<sup>7</sup>. At 1 to 2 years after ACLR, female athletes demonstrated

higher levels of self-reported knee pain and symptoms, lower knee function in sports, lower quality of life, and less interest to return to play activity compared with matched controls<sup>8</sup>. This concerning decision to decrease overall secondary risk through behavioral modification may be partly due to the fact that the risk:reward balance that exists for men is simply not a realistic option for most women<sup>9</sup>.

As women's football receives more attention, the hope is that research and resources will follow suit, focusing on areas such as match performance, match analysis, periodization, load, small-sided games, and sport psychology that are currently underrepresented in research on female professional players<sup>10</sup>.

### WHAT ARE THE COMPONENTS OF REHABILITATION AFTER ACLR

Optimal rehabilitation after ACLR is a



**Image:** Rehabilitation session following an ACL operation. Illustration.

vital process for both male and female athletes who strive to return to their sport stronger and at the same or higher level of performance. Clinical practice guidelines suggest that interventions need not differ based on sex/gender<sup>11,12</sup>, and the approach and goals are the same: to identify pathomechanical movement strategies and strength deficiencies while developing robust and resilient athletes who can resume their sport at their previous level of performance.

The early phase of rehabilitation is critical for all patients after ACL reconstruction. Reducing joint related pain and inflammation, restoring flexion, extension, will facilitate progress through the middle phase of rehabilitation. However, the final phase of rehabilitation is particularly important and challenging for professional athletes, regardless of gender/sex.

Ultimately the return to play (RTP) continuum involves on-field rehabilitation,

return to non-contact team training, return to full contact during team training, return to competitive match-play, and finally, a return to full performance<sup>13</sup>. The entire rehabilitation protocol should be based on quantitative progression criteria, with chronological time since surgery being important but insufficient for progression unless combined with objective physical and psychological criteria. This approach more adequately ensures knee and graft protection. Psychological factors, particularly fear of reinjury, are the most significant contributors to not returning to sport<sup>14</sup>. A possible contributing factor could be inadequate exposure to a sports-specific training program.

#### **Sports-specific rehabilitation**

Sports-specific rehabilitation is a critical aspect of ACL reconstruction rehabilitation, as it simulates the loading experienced during training and competition<sup>15</sup>.

Taberner et al<sup>16</sup> described the components and goals of the RTP decision and the return to performance phase of an elite female football player following ACLR and her journey to the FIFA Women's World Cup, including the gym-based physical preparation and the on-pitch/sports-specific reconditioning. Position-specific 'pass and move' and 'pattern of play' drills were introduced, with increasing volume and intensity of technical actions, challenging visual perception and spatial awareness, and incorporating reactive elements into positional speed drills. The aim was to develop load tolerance of the injury site and restore dynamic sport-specific qualities, including aerobic endurance and gym-based conditioning<sup>16</sup>.

Rehabilitation should be tailored to the individual, regardless of gender, taking into account the nature and extent of the injury, their competitive demands, positional demands, and their cognitive, neuromuscular, and mechanical response to the injury. A performance-based rehabilitation process should identify and address deficits in the player's aerobic and neuromuscular performance and provide conditioning of sufficient intensity, volume, and specificity to prepare an athlete for the demands of their sport and specific position. The integration and accumulation of adequate sports-specific loading and the use of objective tools to control and quantify load while monitoring the response are critical in mitigating the increased risk of reinjury associated with an accelerated return<sup>16</sup>.

#### **Return to sport criteria**

The association between passing a battery of objective tests and a lower risk of second ACL injury is currently unclear. Predicting relatively rare events, such as ACL reinjury, with absolute confidence is statistically challenging, if not impossible. Nevertheless, the clinical goal should be to restore all the identified deficits and impairments and return the player to their previous status or even better, while addressing any strength, proprioceptive, biomechanical and neuromuscular risk factors that may have been identified during the rehabilitation process. Completion of the rehabilitation protocol and clearance to return to sport is not the same as return to competition. Before an athlete can be cleared for unrestricted competition, there should be a transition

phase from sports participation to sports performance, with controlled exposure to contact within their sport<sup>17</sup>.

Hop tests have been used in sports medicine for over 30 years to evaluate an athlete's readiness to return to sport after ACL reconstruction. However, recent studies suggest that hop distance may not be the most effective measure of an athlete's knee status<sup>18,19</sup>, and their predictive validity is uncertain based on current literature<sup>20</sup>. While hop for distance can be used to monitor rehabilitation progress, it may not be an accurate measure of knee function at the end phase of rehabilitation. Low symmetry in distance values may reflect fear of landing rather than direct knee function. Additionally, symmetry in the distance is achieved earlier than symmetry in strength<sup>21</sup>. Therefore, hop distance does not add much to this decision-making process, and we do not propose its use in our return to sport criteria. However, hop performance may be analyzed throughout the course of rehabilitation from a qualitative perspective with respect to proper technique and optimizing biomechanics.

Instead, we recommend the utilisation of vertical jump testing since it is more sensitive in revealing asymmetries in performance metrics at the time to return to sport after ACLR than horizontal hop tests<sup>22</sup> and their performance metrics can be easily measured in the clinic without the requirement of expensive equipment. It is important to note that change of direction and landing during a horizontal hop might be the most challenging tasks for athletes after ACL reconstruction<sup>23-25</sup>. Athletes may compensate for their knee by increasing the contribution from the ankle, hip, and upper body<sup>25</sup>. While these tasks can provide valuable information on the knee joint's status, they require 3D biomechanical analysis, which may not be available in all clinical settings. However, these tests and metrics are important for professional athletes to ensure that their knee joint's status is fully restored before clearance to return to unrestricted training. At a minimum, we would recommend analysing movement from a 2D perspective, which may be easily and cost-effectively performed with hand-held devices/tablets.

Recently published Aspetar rehabilitation guidelines after ACLR<sup>26</sup> propose minimum criteria for professional athletes to be discharged from the outpatient clinic/

hospital setting and begin training with their club, whereupon they should then gradually return to full participation. These criteria should be adjusted and individualized based on the athlete's previous activity level.

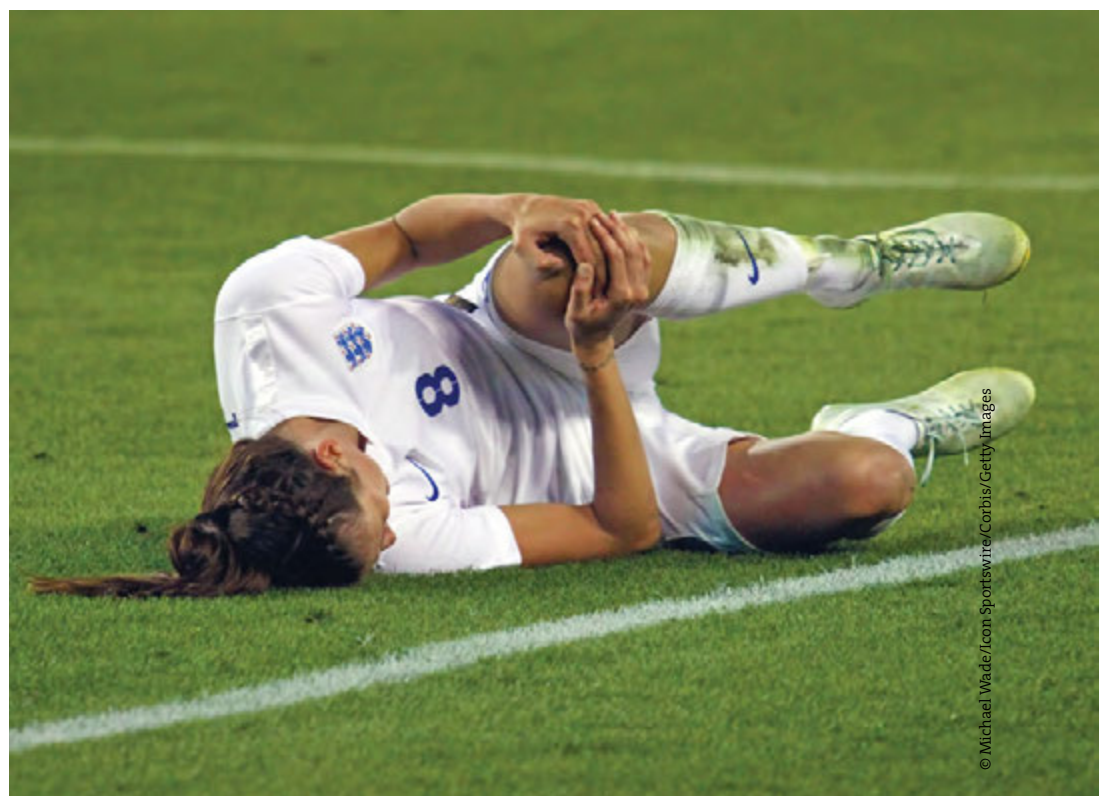
## GOALS

- Normalised subjective knee function and psychological readiness.
- Restore symmetry in running biomechanics and improve sprint capacity, acceleration and deceleration.
- Complete a sports-specific training programme.
- Restore strength in terms of symmetry, achieve pre-injury levels as a minimum and improve values to normative data.
- Restore vertical jump mechanics symmetry and performance metrics (jump height, reactivity) to reach normative values according to the sport and level of activity.
- Restore performance metrics like explosiveness, reactivity, cardiovascular endurance, stamina, etc
- Restore forward landing mechanics and symmetry at the ankle, knee, and hip work distribution.
- Restore symmetry in change of direction mechanics.

## WHY OUTCOMES AFTER ACLR ARE DIFFERENT IN FEMALE/WOMEN PLAYERS?

ACL injuries are less common among first-team players in top-flight men's clubs than in leading women's teams<sup>27</sup>. Although several theories have been proposed to explain this discrepancy, including anatomic differences between men's and women's bodies and their knee joints, the hormonal impact of the menstrual cycle, environmental concerns including pitch type and the lack of boots designed specifically for female players, biomechanical differences during landing, cutting and decelerating, individual genetic predisposition, and differences in medical resources available to women; there is insufficient evidence to provide a clear single explanation<sup>28,29</sup>.

The risk of injury in elite female football players is multifactorial and complex, associated with intrinsic and extrinsic factors such as previous injury, increased joint laxity, football exposure, playing position, increased BMI, low Hamstring/Quadriceps (H/Q), genetic predisposition, player's level of balance and co-ordination, and psychological issues<sup>30</sup>. However, the binary classification of factors as intrinsic or extrinsic is problematic, as many intrinsic factors are heavily influenced by the environment and society.



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**Image:** Knee injury. Illustration.



However, comparing post-surgical outcomes between men and women assumes that their preinjury status, rehabilitation, and subsequent training environments are equivalent, which may not be the case due to biases in healthcare settings and discrepancies in resource allocation<sup>5</sup>. These disparities may be due to unique biological and socio-contextual factors affecting females, but more research is needed<sup>31</sup>. To improve primary and secondary ACL injury prevention for females, it is important for the research community to explore additional factors beyond biological influences. The treatment environment plays a critical role in the rehabilitation and return to sport for individuals who have suffered an ACL injury, and it is important to consider gender as a potential influencer throughout this process. Clinicians should consider gendered roles and environments that may influence ACL rehabilitation outcomes and reflect on conscious and unconscious gender biases that may affect treatment decisions<sup>32</sup>.

To improve equality for female athletes after ACL injury, more studies are needed to assess, acknowledge, and address sex/gendered factors such as menstrual cycle symptoms, psychological factors, access to optimal care, social support, and gender-neutral resistance and performance training environments during rehabilitation<sup>32</sup>. Psychological factors can play an important role in an athlete's ability to cope with rehabilitation after ACLR. Female athletes may face obstacles in returning to sports after an ACL injury due to fear of reinjury and lack of knee and overall athletic confidence compared to men. On the other hand, men tend to be more motivated by competition and winning and are more likely to take risks to re-join active sports participation. Studies have identified three core themes of psychosocial factors that characterized first-time ACL-injured elite female football players showing resilience during rehabilitation: constructive communication and rich interaction with significant others, a strong belief in the importance and efficacy of one's own actions, and the ability to set reasonable goals<sup>33</sup>. These factors can be facilitated by medical teams and sports psychologists during the rehabilitation process. Additionally, the ability to achieve autonomy and set reasonable goals is related to dispositional optimism and adherence to rehabilitation goals.

## STRENGTH

The conventional binary classification of factors as either intrinsic or extrinsic is problematic, as many factors that are commonly believed to be intrinsic can be heavily influenced by society and the environment, according to Parsons et al<sup>5</sup>. An example of this is muscular strength, which is typically viewed as an intrinsic factor. However, gendered norms and environmental factors often hinder women's participation in strength-building programs, potentially impacting their ability to maximize muscular strength. While resistance training is a critical aspect of effective ACL rehabilitation protocol, it is not always socially acceptable or desirable for women due to aesthetic and other concerns about femininity and muscularity. The weight room environment itself is also gendered, and many women feel uncomfortable, and often end up reducing their exposure to and consumption of time, space, and equipment. Since S&C coaches have a significant role in shaping the training environment for athletes, their attitudes and beliefs can have a substantial impact on how athletes view resistance training. Therefore, coaches may be contributing to the ACL injury rate disparity between women and men, unknowingly, by creating gendered training dynamics that disadvantage girls and women. We should banish the assumption that training for ACL rehabilitation or injury prevention needs to be different for girls and women than for boys and men and focus on understanding the gendered environments that may exist and ensure that interventions are delivered equitably so that all athletes can optimally benefit.

## WHERE TO START?

When addressing the issue of ACL injuries in professional football, investing in backroom staff should be a primary consideration for clubs. Strength coaches, physios, and performance staff are responsible for setting and monitoring the weekly schedule of workload for players, and concerns have been raised regarding differences in S&C practices between coaches of men's and women's squads, particularly at academy level. However, the most critical area for improvement is likely how players are being prepared daily for competing at the elite level. While research into other factors continues, it's essential to act on what

we already know can make a difference. There is also a need for a more nuanced narrative around ACL injury rehabilitation and prevention, considering social, socioeconomic, contextual, and environmental factors, rather than just gender-based biology. There is a significant variability in training, coaching, and competitive resources in female sports compared to male sports, but there are typically lower salaries, diminished access to equipment and quality rehabilitation, and lower standards for coaching and medical staffing. Improving these areas will have a positive impact on ACL injury rates in female athletes<sup>9</sup>.

## References

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