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Knee injuries in football – types, circumstances, impact and prevention

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ABSTRACT

Football is a globally popular sport with millions of participants, including professional and amateur players, who face a high risk of injuries, particularly to the knee joint. This study explores the impact of football on knee injuries, detailing knee anatomy, common injuries, their circumstances, treatment methods, and preventive measures. Key findings reveal that knee injuries are prevalent in football, with a significant portion being severe, leading to substantial downtime for players. Effective prevention strategies, such as pre-season preparations and injury prevention programs like FIFA 11+, are critical in reducing injury rates and ensuring players' long-term performance and career longevity.

AIM OF THE STUDY:

The aim of the study is to summarize the available knowledge on the most common knee injuries in soccer and highlight their circumstances, impact on the health and careers of soccer players, and injury prevention options.

MATERIALS AND METHODS:

The literature available in PubMed, Google scholar, BJSM database was reviewed using the following keywords: „Football”, „Soccer”, „Knee”, „Injury”, „Prevention”, „Anatomy”, „Treatment”,

RESULTS:

A review of the literature has identified key risk factors for various knee injuries in football. An analysis of available studies indicates that various therapeutic interventions can provide pain relief and improve knee joint movement. However, the effectiveness of these methods may vary depending on individual patient characteristics

SUMMARY:

Football's global appeal sees over 270 million participants, with a significant number engaged at professional levels, heightening their risk of injuries due to the sport's physically demanding nature. The knee joint, a modified hinge joint comprising bones, ligaments, menisci, and other structures, plays a crucial role in football-related movements, making it susceptible to injuries.

Data from various studies highlight the prevalence and severity of knee injuries in football. UEFA reports knee injuries accounting for 12-17% of all injuries, with severe cases leading to over four weeks of absence. The injury rate is notably higher during matches than training, emphasizing the need for robust preventive measures.

Common knee injuries in football include ACL tears, meniscus damage, and MCL injuries. These injuries often result from non-contact mechanisms and require various treatments, from conservative methods to surgical interventions. Return-to-play times vary, with ACL injuries taking approximately 7.5 months for recovery, though performance levels may initially decline.

Preventive measures are crucial in mitigating knee injuries. The FIFA 11+ program, designed to enhance strength, balance, and stability, has proven effective in reducing injury rates. Intensive pre-season preparations and specific training modules focusing on posture stabilization, joint mobilization, and agility movements also contribute to lowering severe incidences.

KEYWORDS: Knee injury, Football, Prevention, Treatment, Knee joint, Injury

1. IMPACT OF FOOTBALL

Football is one of the most widespread sports disciplines in the world. Every day, many people on each of the seven continents play football at varying levels of skill and intensity. Everyone is susceptible to injuries, but the risk is particularly high for those with high physical activity levels, such as amateur athletes or intensively training professionals. According to FIFA's Big Count 2006, approximately 270 million individuals, both male and female, are engaged in football worldwide, with an annual growth rate of about 10%.[1] We can only estimate how many people are currently involved in playing.

In FIFA's 2023 report, there are 128,694 registered professional players and 3,986 registered football clubs worldwide for men.[2] Data presented by footballdatabase.eu shows that the number of professionals reaches nearly 550,000 players, including both men and women.[3] A professional player is defined as someone who has signed a contract with a club and receives a salary for their football activities that exceeds their expenses.[2]

Intense activities in football, such as jumps, tackles, collisions, accelerations and decelerations, passes, shots, and running of varying intensities, as well as sudden and frequent changes of direction, place significant physical strain on the player.[4] These actions create a risk of certain injuries and damage, especially in the lower limb, with a particular focus on the knee joint in this article. Any disruption in the structure of the knee impairs the harmony and

uniformity of the joint, which can lead to pain and reduced functionality. This may necessitate a break from training and participation in competitions to undergo appropriate treatment.[5]

2. KNEE ANATOMY AND FUNCTION

At the very beginning, it is worth paying attention to how the knee joint is constructed. Look at its components, the planes in which this joint operates, and how these influence the movements we can perform thanks to its presence in the human body.

The knee joint is a modified hinge joint. It consists of two joints: one is the connection between the articular surfaces of the femoral and tibial condyles, and the other is a saddle joint between the posterior surface of the patella. [6]

Besides the bony parts, the joint includes ligaments, menisci, the joint capsule, synovial membrane, bursae, and fat pads. Thanks to the aforementioned structures, it is possible to maintain the proper structure and shape of the knee, resistance to loads, proper transmission of overloads, and the ability to perform appropriate movements without experiencing pain in the joint.

The ligamentous apparatus of the knee consists of intracapsular and extracapsular ligaments. The intracapsular ligaments are mainly the anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL). The main extracapsular ligaments are the patellar ligament, the medial collateral ligament (MCL), the lateral collateral ligament (LCL), and the oblique popliteal ligament. [7]

The menisci are C-shaped structures made of fibrous cartilage located between the articular surfaces of the femoral and tibial condyles. There are two menisci in the knee joint: the medial meniscus, which is held in place by the medial collateral ligament, and the lateral meniscus, stabilized by the popliteal ligament. [8]

The proper functioning of the aforementioned structures and the presence of appropriate muscles enable specific movements in the joint. Primarily, the knee joint allows us to flex within the range of 120° - 150° (mm. semimembranosus, semitendinosus, biceps femoris, gracilis, sartorius, gastrocnemius, plantaris, and popliteus) and extend within 5°- 10° (mm. quadriceps femoris, iliotibial tract, gluteus maximus, tensor fasciae latae). Additionally, it is possible to perform movements in the horizontal plane, namely internal and external rotation (mm. semimembranosus, semitendinosus, gracilis, sartorius, biceps femoris) limited to 10°. Rotation up to 60° is possible with passive limb movement. [6][7]

3. KNEE INJURIES – TYPES, CIRCUMSTANCES, TREATMENT AND IMPACT ON HEALTH AND CAREER

Football is one of the sports leading to the highest number of injuries. [5] At this point, it is worth considering which knee injuries are most common among football players, who are at high risk, and under what circumstances they occur. Therefore, based on the analysis of reports, articles, and research findings, certain conclusions can be drawn.

According to the UEFA Elite Club Injury Study Report for the 2017/2018, 2018/2019, and 2019/2020 seasons, which contains results from teams that participated in the group stage of

the UEFA Champions League over these years, clubs reported 845, 868, and 576 injuries in these respective seasons. Knee injuries accounted for 17%, 12%, and 13% of these, respectively. However, when looking at the severity of knee injuries, they constituted 28% - 36% of all severe injuries, resulting in more than four weeks of absence.

It is also important to consider the circumstances in which the injury occurred and what type of activity was being performed, as the injury rate during training was on average 1.7 - 2.8 injuries per 1000 training hours. In comparison, the match injury rate ranged from 20 - 21 injuries per 1000 match hours. This suggests that the risk of injury during matches is several times higher, which emphasizes the importance of investigating preventive measures and proper preparation for each competition to reduce the incidence of injuries. [9][10][11]

Dellal et al. examined 16 international players from the French league during three different congested periods of matches (6 games in 18 days). According to the results, the total incidence of injuries during matches and training in prolonged congested periods did not differ significantly from that reported in periods with fewer matches. However, the injury rate during matches was significantly higher in the congested period, at 43.3 injuries per 1000 match hours, compared to 18.6 injuries per 1000 match hours in the less congested period. [12]

In the cross-sectional survey study conducted by Almaawi et al. among 482 valid participants, 112 of them reported knee injuries, of which 85 occurred while playing soccer, with 68.7% being non-contact injuries. Among those admitted to the hospital, the majority were diagnosed with contusions (31.4%), followed by meniscus, ACL, and collateral ligament injuries, respectively. Most of them were treated conservatively, with only 10.7% requiring surgery. [13] The research team led by Majewski et al. recorded 19,530 sports injuries over ten years, of which 7,769 injuries (39.8%) were related to the knee joint. Among the 7,769 knee injuries, the three most common were: internal knee trauma - 3,482 (44.82%), distortion - 2,632 (33.88%), and cartilage lesions - 826 (10.63%). According to this study, football is the main cause of injuries to all internal knee structures. The total number of football-related knee injuries was 2,715, of which 1,179 cases were internal knee trauma - 43.42% of all football-related knee injuries. Eighty percent of the patients with internal knee trauma were assessed during arthroscopic surgery. The most common injury in this group was ACL injury (580 cases, 49.19%). The second most common injury was medial meniscus damage (274 cases, 23.24%), and the third was MCL lesion (162 cases, 13.74%). [5]

The integrity of the ACL is vital for effective training and competing at the highest level, which stresses the repaired ACL. Researchers have found that previous injury and repair of this ligament affect a football player's capabilities and the likelihood of re-injury. Della Villa et al. focused on ACL injuries and analyzed 134 cases across 10 seasons of professional Italian football. They found that most injuries involved single-leg loading of the injured limb. Fifty-nine (44%) of all ACL injuries occurred without knee contact, and 75 (56%) occurred with knee contact. There were 59 (44%) indirect contact injuries and 16 (12%) direct contact injuries to the knee. They also found that fatigue during the match was not crucial for ACL injuries, as the majority of injuries (62%) occurred in the first half of the match. [14] According to a study by Krutsch et al., the average time needed to return to play after an ACL rupture is about 7.5 months. This period extends by approximately one month in the case of a

subsequent injury. The return-to-play rate is high, with 98% of players resuming the sport. However, this influences their performance level, as only about 50% of these players maintain the same level of competition within the next three years .[15] Findings from the study by Della Villa et al. show a similar return-to-play time, averaging about 240 days. Moreover, nearly one-fifth of athletes suffered a second ACL injury on average over four years after the initial injury and ACL reconstruction.

A particularly high number of second ACL injuries occurred in players who originally suffered an isolated, non-contact ACL injury (42%). Approximately 60% of players continued to play at the highest level five years after ACL reconstruction . [16] Similar conclusions were reached by Barth et al., with over 93% of players returning to play at the highest level post-ACL reconstruction. Interestingly, they achieved lower performance scores within three years of returning to play. [17]

In 2019, Lundblad et al. published a study on MCL injuries based on reports from UEFA. Out of 4364 registered injuries, 130 (3%) were MCL injuries, where the majority, nearly three-quarters of the cases, occurred with a contact mechanism. The frequency of injuries during training was 50 cases, with over half (58%) being contact injuries. Contact injuries during matches accounted for 86.25% of all 80 injuries that occurred during competitions. Moreover, contact injuries were noted as single injury , without lesion of any other compartment, in opposite to non-contact loaded injuries that were more complex with ACL or menisci trauma. Additionally, the average time of absence and mandatory rest and treatment was 22 days. Only 1.5% of MCL injuries required surgical treatment (the return to play for those two players was longer, 85 and 119 days respectively), 25% underwent injection therapy, and the rest regained fitness through conservative treatment occasionally with the use of braces. [18]

It is important to consider the type of meniscal injury, the athlete's specific needs and goals, as well as the long-term implications of different surgical procedures when determining the best course of action for professional soccer players with meniscal injuries. While partial meniscectomy may result in a quicker return to play, meniscal repair and salvage procedures may offer better long-term outcomes and potential chondroprotective effects. Close monitoring and individualized rehabilitation programs are essential for successful outcomes in this population. Additionally, consideration should be given to the increased risk of knee osteoarthritis following lateral meniscectomy compared to medial meniscectomy in the long-term follow-up [19] Heath et al stated in group of Major League Soccer players that injuries had a negative impact on players' performance indicators in the first year after injury, but once they returned to full fitness in the second year, they were able to regain their previous levels of play. Nevertheless, the shortened careers of the injured players suggest that injuries can have a long-term impact on the development of sports careers. Therefore, it is important to prevent injuries and treat them appropriately to ensure players have long and successful sports careers.[20]

4.PREVENTION

Injuries carry negative consequences, making it essential to effectively prevent them and implement appropriate strategies to prepare both amateur and professional soccer players for the season. This preparation helps players perform at their best, avoiding injuries, being fully

ready for each match, and not missing any training sessions or competitions .[21] Ekstrand et al. conducted a 15-year analysis concluding that teams with more intensive pre-season preparations and more frequent training sessions experienced fewer injuries, particularly severe ones, during the season. Players from these teams were also less likely to miss training and matches. However, numerous independent factors influence injury occurrence, but understanding proper preparation can aid teams in planning both pre-season and in-season activities to minimize injuries, ultimately impacting the team's performance.[22]

The FIFA 11+ program is a warm-up routine designed to prevent injuries among soccer players. Developed by a panel of international experts under FIFA's auspices, this program includes a series of exercises aimed at enhancing strength, balance, muscle control, and core stability. It is intended to be performed before training sessions and matches .[23] Various analyses have demonstrated its effectiveness in preventing injuries among both professional and amateur soccer players. According to Sadigursky et al., involving 6,344 players, with 3,307 (52%) in the FIFA 11+ intervention group and 3,037 (48%) in the control group, the number of injuries decreased by 30% following the implementation of this program. In the intervention group, 779 (24%) players sustained injuries, compared to 1,219 (40%) in the control group. [24] Furthermore, implementing the FIFA 11+ program both pre-training and post-training can reduce overall injury rates in male amateur soccer players more effectively than the program alone before training.[25] Silvers-Granelli et al. reported that proper application of this program resulted in a threefold decrease in knee injuries and a 4.25-fold reduction in ACL injuries, proving beneficial for physical trainers in tailoring training plans for players.[26]

A pre-season study by Krutsch et al. identified five modules to incorporate into training routines to prevent severe knee injuries in elite soccer. These modules include posture stabilization, lower limb joint mobilization, leg and torso stabilization, jumps and landings, and agility movements. During the season, the intervention group of 529 players, who adhered to the adjusted training modules, experienced 52 severe knee injuries (0.38 per 1000 hours of exposure) compared to 108 severe knee injuries in the control group of 601 players following a standard program, with an incidence rate of 0.68 per 1000 hours of exposure.[27]

5. CONCLUSION

Football, while universally loved and played by millions, poses a high risk of knee injuries, particularly for those engaged in professional and high-intensity play. The knee's complex anatomy makes it vulnerable to various injuries, which can significantly impact a player's career. This study highlights the prevalence and severity of knee injuries in football, underscoring the need for effective prevention and treatment strategies. Key findings from the analysis of multiple studies show that knee injuries, especially ACL lesion, meniscus damage, and MCL injuries, are common and often severe, leading to extended periods of absence and affecting players' performance post-recovery. The data also reveal that the risk of injury is substantially higher during matches compared to training sessions. Preventive measures, such as the FIFA 11+ program and targeted pre-season preparations, have shown significant efficacy in reducing injury rates. These programs focus on enhancing strength, stability, and overall physical preparedness, thereby mitigating the risk of knee injuries. In conclusion, a

proactive approach to injury prevention, through well-structured programs and thorough pre-season training, is crucial for reducing knee injuries in football. By prioritizing these measures, football clubs and players can ensure better health, prolonged careers, and optimal performance on the field. Continuous research and adherence to preventive strategies are essential for safeguarding players' health and enhancing their on-field performance.

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