INPLASY

Video-based Etiology of Anterior Cruciate Ligament Injuries in Professional Football: A Systematic Review with Meta-analysis

INPLASY202420026
doi: 10.37766/inplasy2024.2.0026
Received: 06 February 2024
Published: 06 February 2024

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ADMINISTRATIVE INFORMATION

Support - This review will be performed under financial support from the Ministry of Universities of Spain for personnel involved in the review (AMI), Grant Number: FPU21/04536.

Review Stage at time of this submission - Formal screening of search results.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202420026

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 06 February 2024 and was last updated on 06 February 2024.

INTRODUCTION

Review question / Objective This systematic review aims to investigate the mechanism inciting the anterior cruciate ligament (ACL) injury through video analysis in professional football players. Additionally, to explore biomechanics factors underlying ACL injury. To this end, the proposed systematic review will address the following question: What are the main outcomes that are commonly recorded through video analysis when an ACL injury occurs in football players during competition matches?

Rationale An ACL rupture is a severe injury for a soccer player, resulting in long layoff times (1), and a reduced career length (2). Furthermore, an ACL injury is associated with significant short and long-term consequences (3,4), increased risk of secondary ACL injury, and early onset osteoarthritis (3, 5). ACL injuries have doubled in the last two decades, despite efforts by researchers and clinicians to mitigate the risk (6). Understanding the mechanisms leading to an injury is an essential step in injury prevention (7). Although numerous approaches are at our disposal to augment our comprehension of ACL injury mechanisms, such as cadaveric studies, laboratory investigations, and mathematical modeling studies (8), video analysis is a widely adopted tool for scrutinizing playing scenarios and biomechanics preceding and during injuries. Several video analysis studies have previously been undertaken across different sports for both sexes (9-14). To the authors' knowledge, there is no published or recorded review dealing with the analysis of the mechanism of ACL injury recorded by video analysis in professional football players.
On the other hand, there is much heterogeneity in the video-based methodology used for the analysis of the mechanism of injury. Altogether results in a lack of knowledge about which are the

main characteristics that evoke ACL injury in this population. On this wise, it is important to understand the inciting situation in which the injury occurred, and the methodology involved in the outcomes' collection This will help to optimize the design of physical tests, and prevention and rehabilitation programs.

Condition being studied The present systematic review will address the situations and mechanisms that lead to ACL injuries focused on the mechanism type injury, the biomechanical factors of ACL injuries and contextual factors. Regarding mechanism type injury, we will consider if the injury has been suffered without contact, with indirect contact or direct contact, and the task inciting the ACL injury. Regarding biomechanical factors of ACL injuries, ankle, knee, hip, and trunk kinematics will be covered. Regarding contextual factors, the distribution of ACL injury across the match, season, pitch location, and player characteristics will also be considered.

METHODS

Search strategy PubMed ("anterior cruciate ligament" OR "ACL" OR "ACL tear*" OR "ACL ruptur*" OR "ACL injur*") AND ("video" OR "video-analysis" OR "visual analysis" OR "video inspection" OR "videotap*") AND ("soccer" OR "football") AND ("mechanism*" OR"wound*" OR "injury mechanism*" OR "injury event*" OR "injury situation*" OR "injury circumstance*" OR "injury occasion*" OR "injury activit*" OR "injury characteristic*" OR "injury context" OR "injury pattern*" OR "etiology" OR "situational pattern*")
Scopus ("anterior cruciate ligament" OR "ACL" OR "ACL tear" OR "ACL tears" OR "ACL rupture" OR "ACL ruptures" OR "ACL injury" OR "ACL injuries") AND ("video" OR "video-analysis" OR "visual analysis" OR "video inspection" OR "videotape" OR "videotaping") AND ("soccer" OR "football") AND ("mechanism" OR "mechanisms" OR "wound" OR "wounds" OR "injury mechanism" OR "injury mechanisms" OR "injury event" OR "injury events" OR "injury situation" OR "injury situations" OR "injury circumstance" OR "injury circumstances" OR "injury occasion" OR "injury occasions" OR "injury activity" OR "injury activities" OR "injury characteristic" OR "injury characteristics" OR "injury context" OR "injury contexts" OR "injury pattern" OR "injury patterns" OR "etiology" OR "situational pattern" OR "situational patterns")
Embase ("anterior cruciate ligament" OR "ACL" OR "ACL tear*" OR "ACL ruptur*" OR "ACL injur*") AND ("video" OR "video-analysis" OR "visual analysis" OR "video inspection" OR "videotap*") AND ("soccer" OR "football") AND ("mechanism*" OR "wound*" OR "injury mechanism*" OR "injury event*" OR "injury situation*" OR "injury circumstance*" OR "injury occasion*" OR "injury activit*" OR "injury characteristic*" OR "injury context" OR "injury pattern*" OR "etiology" OR "situational pattern*")
SPORT Discus ("anterior cruciate ligament" OR "ACL" OR "ACL tear*" OR "ACL ruptur*" OR "ACL injur*") AND ("video" OR "video-analysis" OR "visual analysis" OR "video inspection" OR "videotap*") AND ("soccer" OR "football") AND ("mechanism*" OR "wound*" OR "injury mechanism*" OR "injury event*" OR "injury situation*" OR "injury circumstance*" OR "injury occasion*" OR "injury activit*" OR "injury characteristic*" OR "injury context" OR "injury pattern*" OR "etiology" OR "situational pattern*")
Web of Science ("anterior cruciate ligament" OR "ACL" OR "ACL tear*" OR "ACL ruptur*" OR "ACL injur*") AND ("video" OR "video-analysis" OR "visual analysis" OR "video inspection" OR "videotap*") AND ("soccer" OR "football") AND ("mechanism*" OR "wound*" OR "injury mechanism*" OR "injury event*" OR "injury situation*" OR "injury circumstance*" OR "injury occasion*" OR "injury activit*" OR "injury characteristic*" OR "injury context" OR "injury pattern*" OR "etiology" OR "situational pattern*").

Participant or population The present systematic will include professional football players of 18 years of age onwards.

Intervention Not applicable.

Comparator Not applicable.

Study designs to be included The design of the articles included will be a video-based analysis of injury context/mechanism/event.

Eligibility criteria Based on the PEO strategy (15), it will be as follows:- Population: Football players from 18 years onwards.- Exposure of interest: Mechanisms/contexts/events inciting ACL injury.- Outcome. Video-based analysis.Exclusion criteria:- Articles are written in other languages than English or Spanish.- Articles that are reviews or case reports.- Articles were excluded if another football code instead of soccer was investigated.- Articles were excluded if another method instead of video analysis was used for recording ACL injury context.

Information sources The databases that will be used in the present systematic review will be PubMed, Scopus, Embase, SPORTDiscus and Web of Science. Additionally, a complementary

manual search will be performed on the references list from the systematic review on the topic to avoid missing potential eligible articles.

Main outcome(s) The main outcomes of the review will be the situations and mechanisms that lead to ACL injuries focused on the mechanism type injury (i.e., no contact, indirect or direct contact and the task inciting injury), the biomechanical factors of ACL injuries (i.e., lower limb and trunk kinematics) and contextual factors (i.e., distribution across the match, season, and pitch location) analyzed through video. We will register these outcomes through the different methods employed by the articles. Nonetheless, if an article provides two methods for the same outcome, the one most used by the studies will be selected.

Additional outcome(s) Players' characteristics will be registered to analyze their impact as contextual factors on the main outcomes of the review. The contextual factors considered for players' characteristics will be sex, age, field position, previous injury, football experience, body mass index, and physical parameters if they were reported. If other contextual factors of interest are identified during the review process this will be updated in the manuscript.

Data management A specific codebook will be created for the systematic review, registering a) characteristics of the studies (e.g., country, year…), b) characteristics of the sample (e.g., sex, age…), c) characteristics of the player and injury event (e.g., type of video analysis, distribution across the match, season and pitch position), d) mean and standard deviation of the outcomes registered, e) quality and risk of bias of the studies. Two reviewers will independently screen, complete the data extraction and assess the quality and risk of bias of the potential articles. In case of disagreement, a third reviewer will be consulted.

Quality assessment / Risk of bias analysis The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist extension, and the STROBE Sports Injury and Illness Surveillance (STROBE-SIIS) will be employed to assess the risk of bias of the studies included (16).

Strategy of data synthesis Descriptive statistics and frequency distributions of the outcomes will be reported. Subgroup analysis will be performed on the contextual factors previously mentioned.

Subgroup analysis Subgroup analyses will be performed through meta-regression analysis if the number of studies available for each outcome is higher than 10, as recommended by Borenstein et al. (17). If not, subgroup analysis based on the median score will be averaged. Subgroup analysis will be performed on the contextual factors previously mentioned.

Sensitivity analysis Not applicable.

Language restriction Video-based analysis of the mechanism/context of ACL injury published in English or Spanish will be considered for inclusion in the systematic review.

Country(ies) involved All the authors involved in the review are from Spain and Colombia.

Other relevant information Contributorship: all authors will contribute equally to this work.

Keywords ACL injury, video-analysis, injury mechanism, biomechanical factors, soccer.

Dissemination plans The present systematic review is intended to be published in a journal included in the journal citation of reports.

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