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Research Article

A Systematic Video Analysis of Lateral Ankle Injuries in Elite Basketball Players

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ABSTRACT

We aimed to conduct a systematic video analysis of professional basketball players who experienced lateral ankle sprain using the YouTube database. On 05.02.2024, YouTube search engine was used. The terms 'lateral ankle sprain', 'lateral ankle injury', 'lateral ankle sprain sports', 'lateral ankle injury sports' were searched. 32 videos belonging to basketball players were included in the study. The mechanisms The foot and ankle position at the time of injury was evaluated. 24 videos occurred as a result of indirect contact injuries. Varus-adduction was present in 31 (%96,8) videos. Foot was in internal rotation in 22 (%68,75) videos and forefoot was in neutral position in 10 (%31,25) videos. Varus and internal rotation are the mechanisms that can cause lateral ankle sprain in basketball. In particular, indirect contact mechanisms may play a role in varus and internal rotation of the foot.

ÖZET

YouTube veri tabanını kullanarak lateral ayak bileği burkulması yaşayan profesyonel basketbolcuların sistematik video analizini yapmayı amaçladık. 05.02.2023 tarihinde YouTube arama motoru kullanıldı.'Lateral ankle sprain', 'lateral ankle injury', 'lateral ankle sprain sports', 'lateral ankle injury sports' terimleri ile arama yapıldı. Basketbol oyuncularına ait 32 video çalışmaya dahil edildi. Mekanizmalar Yaralanma anındaki ayak ve ayak bileği pozisyonu değerlendirildi. 24 video indirekt temas yaralanmaları sonucu meydana geldi. 31 videoda (%96,8) varus adduksiyon mevcuttu. Ayak 22 videoda (%68,75) iç rotasyonda ve 10 videoda (%31,25) ön ayak nötral pozisyondaydı. Varus ve iç rotasyon, basketbolda lateral ayak bileği burkulmalarına neden olabilen mekanizmalardır. Özellikle indirekt temas mekanizmaları ayağın varus ve iç rotasyonunda rol oynayabilir.

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Introduction

Ankle injuries are the most common musculoskeletal injuries among sports injuries (Doherty et al., 2014). In court sports, although some do not visit emergency, it has a high incidence of 7 in 1000, as reported by some authors (Doherty et al., 2014; Vuurberg et al., 2018). There are significant differences in the mechanism that causes lateral ankle sprain among court sports (Zeblisky et al., 2022; Fong et al., 2009).

The ligament complex located on the lateral side of the ankle, especially when the foot is in plantar flexion, Anterior Tibiofibular Ligament (ATFL), which is in a parallel position relative to the tibia, resists the inversion or varus tilt of the foot. Ankle injuries are the most common type of injury in basketball, where plantar flexion is important, especially after jumping and landing (Vuurberg et al., 2018; Herzog et al., 2019) and most athletes usually return to sports with a 2-4 weeks of treatment (Mattacola & Dwyer, 2002). The injury causing Lateral Ankle Sprain(LAS) is usually diagnosed by the clinician's suspicion based on the athlete's anamnesis (Zeblisky et al., 2022) . Recurrence or inappropriate treatment of misdiagnosed, incompletely healed LAS can cause chronic ankle instability and affect the return to sports (McCriskin et al., 2015; Anandacoomarasamy & Barnsley, 2005).

Analysis of the movement components of LAS in basketball and understanding the player position can help with physical therapy modalities to reduce its incidence.

In this study, we aimed to conduct a systematic video analysis of professional basketball players who experienced lateral ankle sprain using the YouTube database. We hypothesized that it could inform injury prevention studies developed to adapt to sudden changes in ankle position during competition.

While the Turkish healthcare system has made strides in digitalization, notably through the e-Nabız platform, which facilitates access to patient records and appointment scheduling (Sağlık Bakanlığı, 2023), targeted interventions to address surgical waiting times remain limited. This gap is particularly evident in the absence of innovative, technology-driven solutions tailored to Türkiye's unique healthcare challenges.

Recent advancements in artificial intelligence (AI) and digital health technologies offer transformative potential for optimizing healthcare delivery. Internationally, AI-driven systems have demonstrated success in streamlining surgical scheduling and resource allocation.

This study addresses this gap by proposing a conceptual framework for an AI-integrated mobile application designed to enhance transparency, optimize surgical scheduling, and improve resource utilization in Turkish public hospitals. The system leverages real-time hospital data and machine learning algorithms to provide patients with estimated waiting times and guide them to facilities with shorter delays, building on Türkiye's existing digital infrastructure, such as e-Nabız. Notably, the proposed framework requires no ethics approval, as it relies on anonymized, system-level data, ensuring compliance with Türkiye's Personal Data Protection Law (KVKK, 2016).

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Method

On 05.02.2024, YouTube search engine was used. The terms 'lateral ankle sprain', 'lateral ankle injury', 'lateral ankle sprain sports', 'lateral ankle injury sports' were searched. Videos related to basketball, videos where the ankle, knee and hip could be clearly seen, videos with a resolution of at least 640*360 pixels and a frame rate of at least 25 Hz were included in the study. Videos with insufficient image quality where the injury was suspicious, videos with repetitions and videos thought to have additional injuries accompanying lateral ankle sprain were excluded from the study. Of the 44 videos obtained, 2 videos with repetitions, 8 non-basketball sports videos and 3 injury videos where the ankle was not clearly displayed were excluded. The remaining 32 videos belonging to basketball players were included in the study. 16 videos had images from 2 or more angles, while 16 videos had single angle images. 28 videos had slow motion images, while 4 videos did not have slow motion images.

Videos were reviewed blindly by three orthopaedics surgeon. The mechanisms occurring due to interventions to the foot and ankle by either the opposing athlete or a teammate were classified as direct contact injuries. Injury videos showing above-the-ankle incidents with contact were classified as indirect-contact. Videos where there was no contact were classified as non-contact. Injuries were categorized as follows:

1. Stop-turn: Sudden changes in direction, with or without the ball.

2. Rebounding: Occurred during landing after jumping.

3. Dribbling/Crossover Dribbling: When a player with the ball attempts to pass an opposing team member.

4. Running without the ball: Injuries during running without the ball.

In addition to these injury models, videos where an athlete stepped on the foot of an opposing player or a teammate were evaluated as sudden changes on the ground. The ankle was evaluated in the sagittal plane as plantarflexion, neutral and dosiflexion positions, and the foot was evaluated in the coronal plane as pronation, supination and neutral. The hindfoot position was evaluated as neutral varus or valgus, and the foot rotation was evaluated according to the internal rotation, external rotation and neutral positions of the forefoot. The degree of knee flexion was additionally evaluated. This methodology has previously been used in recent research (Dewan et al., 2020; Schreiber et al., 2013; Yüce et al., 2022).

Videos were evaluated blindly by all three authors. These data were analyzed statistically, and then intra- and inter-observer agreements were evaluated. The common position indicated by at least two observers in the obtained body positions was considered the correct position. In any case, where all observers indicated a different position, the three observers watched the video together to make a joint decision.

Intra- and inter-observer agreement was investigated using the Fleiss kappa (k) statistics for categorical data. The inter-observer agreement percentages were calculated by dividing the number of occasions of the complete agreement by the total number of occasions. It was interpreted as follows: <0.00= poor agreement; 0.00–0.20= slight agreement; 0.21–0.40= fair agreement; 0.41–0.60= moderate agreement; 0.61–0.80= substantial agreement; and 0.81–1.00= almost perfect agreement. Statistical significance was set at $P < 0.05$ SPSS® version 23.0 was used in the statistical analyses.

Results

Athletes included in the study included 31 males and 1 female. 29 (%90,6) of the injury videos occurred during the competition and 3 (%9.4) of the videos occurred during the warm-up training before the competition. 24 videos occurred as a result of indirect contact injuries and 8 videos as a result of non-contact injuries (Table 1).There was a restrictor preventing the athlete from making full contact with the ground in the injured position(Figure 1). Regardless of the activity, after preventing the foot from making full contact with the ground, hindfoot varus, foot inversion, and forefoot internal rotation were observed. This occurred in 8 (%25) videos with a stop-turn movement, 9 (%28,1) videos in a rebounding position, 9 (%28,1) videos during dribbling or crossover dribbling, and 6 videos during running without the ball (%18,75) (Table 2). 19 (%59,3) players were in attacking position and 13 (%40,6) players were in defending position. 10 (%31,25) right foot and 22 (%68,75) left foot injury videos were evaluated. Varus-adduction was present in 31 (%96,8) videos. Foot was in internal rotation in 22 (%68,75) videos and forefoot was in neutral position in 10 (%31,25) videos. While ankle was in plantar position in 12 (%37,5) videos, ankle was in neutral position in sagittal plane in 20 (62,5) videos. Interobserver agreement was excellent in data obtained from video recordings. (κ=0.936, $p<0.001$).

Figure 1. The sudden change in ground after stepping on the opponent's foot forces the athlete's ankle into varus

Table 1. Number of contact and non-contact videos

	Contact		Non-contact	Total
	Indirect	Direct		
Number	24 (%75,0)	0 (%0,0)	8 (%25,0)	32 (%100,0)

Table 2. Injury mechanism

	Number	Ratio
Stop-turn	8	%25
Rebounding	9	%28,1
Drippling-Crossover Drippling	9	%28,1
Running without ball	6	%18,75

Discussion

In the vast majority of athletes examined, the reason preventing the injured foot from fully contacting the ground was the foot of the opposing athlete or the athlete on the same team. This study showed that the foot does not need to be in plantar flexion for the injury to cause LAS. Another important finding was that the varus position of the hindfoot and the internal rotation of the foot are important movement components that cause LAS.

Basketball, where jumping, dribbling, and fast-paced play are common, is a limited contact team sport in which ankle injuries are very common (Moore et al., 2021). It can be seen frequently in athletes in the guard position, where drive cuts and jumps are made a lot (Zeblisky et al., 2022; Pasanen et al., 2017). Although some researchers have defined the main factor that can cause LAS in cord sports as landing on the 1/3 plantar surface (rebounding) after jumping (Moore et al., 2021), different indoor and court sports may cause this injury with different mechanisms (Panagiotakis et al., 2017; Bagehorn et al., 2024).

Direct trauma to the medial side of the foot in sports such as football (Fong et al., 2009; Andersen et al., 2004), stepping on another athlete's foot in basketball and netball (Herzog et al., 2019; Stuelcken et al., 2024; Kofotolis & Kellis, 2007), and lateral dribbling in sports such as tennis constitute the basic mechanisms defined. Basically, the sudden inversion and internal rotation of the foot and the delay in the reflex eversion of the peroneal muscles may cause the injury (Stuelcken et al., 2024). Similar to other studies on basketball, the most common mechanism in this study is the sudden inversion injury mechanism of stepping on the foot of an opposing team player (Kofotolis & Kellis, 2007). However, unlike other studies, it was observed in this study that there is no single mechanism that causes injury in basketball and affects the lateral ligament structure. Unlike other cord sports, the athletic level of basketball is higher, and athletes pay less attention to where they step when performing movements such as acceleration, stopping, and turning, and their eyes are on other athletes and the basketball hoop, which may be causing these injuries.

In biomechanical studies, inversion of the ankle in plantar flexion causes more tension on the anterior talocrural ligament, while inversion moment in dorsiflexion can lead to lateral ankle sprain (Purevsuren et al., 2018).

In volleyball and basketball injury videos, which usually include jumping and then landing, plantar flexion, which is the natural position of the ankle during landing, is considered to be the major component of this injury (Stuelcken et al., 2024). It has been stated that the most important component that can cause LAS in sports with a lot of lateral dribbling, such as tennis, is internal rotation (Fong & Wei, 2012). The main mechanism causing the injury may be rapid inversion rather than the ankle in plantar or dorsiflexion (Skazalski et al., 2018). The results of our study were consistent with studies indicating that sudden inversion and internal rotation movements cause the development of LAS (Herzog et al., 2019; Schreiber et al., 2013; Fong & Wei, 2012). The ankles of the majority of the athletes in the study were in a neutral position. Although different mechanisms that may cause LAS in different sports are considered, subtalar joint varus and internal rotation of the foot may be important components of this injury.

There were some important limitations of this study. The first of these was that although YouTube was a platform previously used for video analysis (Yüce et al., 2022; Saito et al., 2023; Schreiber et al., 2013), the videos were not uploaded by a single institution or person. The other was the quality of the images available at the time of injury. They were not full lateral and coronal images of the athlete's ankle. Therefore, it made it impossible to measure the angles of the ankle.

Another limitation was that the demographic data of the athletes, the degree of injury of the lateral ankle sprain, and the treatment and rehabilitation periods applied were unknown. Although there is an opportunity to analyze all angles of the foot and ankle joints and the speed of the joint movement that caused the injury with professional cameras taken from many directions in video analysis studies, YouTube videos may be insufficient in this regard. Despite these deficiencies, this study can provide literature information for lateral ankle sprain.

Conclusion

Varus and internal rotation are the mechanisms that can cause LAS in basketball. In particular, indirect contact mechanisms may play a role in varus and internal rotation of the foot. Multiple images taken from multiple angles in basketball may be useful in understanding the exact mechanisms of LAS injuries.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical approval

Ethical approval was not required as this study is a review article

Institutional Review Board

Information about the study was given to the personnel and informed consent for this study was obtainee

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