Video Analysis of the Mechanisms for Ankle Injuries in Football

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Background: Although ankle sprains are frequent in football, little is known about their mechanisms.

Purpose: To describe the injury mechanisms for ankle injuries in male elite football.

Study Design: Prospective cohort study.

Methods: Videotapes and injury information were collected for 313 of 409 matches from Norwegian and Icelandic elite football during the 1999 to 2000 seasons. Video recordings of incidents that resulted in ankle injuries were analyzed and cross-referenced with injury reports from the team medical staff.

Results: A total 46 acute ankle injuries were reported to have occurred, that is, 4.5 injuries per 1000 match hours. Of these, 26 (57%) were identified on the videotapes. Two mechanisms thought to be specific to football were found: 1) player-to-player contact with impact by an opponent on the medial aspect of the leg just before or at foot strike, resulting in a laterally directed force causing the player to land with the ankle in a vulnerable, inverted position; and 2) forced plantar flexion where the injured player hit the opponent's foot when attempting to shoot or clear the ball.

Conclusions: Systematic video analysis provides detailed information on the mechanisms for ankle injuries in football—for lateral ligament sprains and for the condition dubbed "footballer's ankle."

Keywords: biomechanics; video recording; footballer's ankle; incidence; ligament injury; anterior ankle impingement syndrome

Football is responsible for between one-fourth and one-half of all sports-related injuries in Europe.[6,22,24,26] A direct comparison between studies is difficult because of differences in study design and injury definitions, but the risk of injury is undoubtedly high. The injury incidence among adult male players is estimated to 10 to 35 injuries per 1000 match hours.[14,23] Injury severity is also a concern. In fact, in a recent study, Drawer and Fuller[13] concluded that the risk of acute injury in professional football is unacceptably high when evaluated against accepted occupational health criteria. Thus, attention needs to be directed at how to prevent injuries in football.

Ankle injuries are common among football players, accounting for 11% to 25% of all acute injuries.[11,16,21,29,33,41,52] Despite this, to our knowledge no study has examined the mechanisms for ankle injuries in football in detail. Since football is a contact sport requiring a variety of skills, including running, jumping, passing, shooting, kicking, dribbling, turning, heading, and tackling,[15,23] the mechanisms may differ from the inversion injuries typically seen among runners.[18]

Although the lateral ligament complex is the most commonly injured structure, an injury type thought to be specific to football has also been described. Morris[35] and later McMurray[34] originally described a condition referred to as "athlete's ankle" and "footballer's ankle" with talotibial osteophyte formation at the anterior joint capsule. Although this condition—later also referred to as "anterior ankle impingement syndrome"—is a common cause of anterior ankle pain,[17,38,44] the exact cause is unknown. Three different hypotheses have been suggested to explain the formation of osteophytes. First, recurrent maximal plantar flexion and stretching of the joint capsule from repetitive kicking has been suggested to result in traction spurs.[8,32,34] Second, repetitive kicking of the football ball is hypothesized to cause direct damage to the rim of the anterior ankle cartilage, resulting in inflammation, scar tissue formation, and calcification.[49] Finally, repetitive forced dorsiflexion causing minor fractures due to impacts between the bone surfaces of the anterior tibia and the talus has been suggested to cause exostoses to develop on the anterior edge of the tibia and talus.[39]

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A limitation with epidemiological studies is that the injury information is based on postinjury player interviews or medical staff reports.[2,21,22,36,42] However, determining the injury mechanism based on reports from the injured player or their medical staff is difficult. This approach may result in recall bias, and since injuries happen quickly, the player may not even be able to provide an accurate description of how the injury occurred. Since two players can be expected to be involved in the injury situation, at least in many cases, the injured player may not always be fully aware of what actually caused the injury.

A more revealing approach may be to examine videotapes of actual ankle injury situations to describe the mechanisms leading to injury. Thus, the objective of this study was to describe the specific injury mechanisms for ankle injuries in elite male football using video recordings.

METHODS

Videotapes and injury information were collected prospectively from the Norwegian professional football league during the 2000 season and from the elite division in Iceland during the 1999 and 2000 seasons.

The Norwegian Broadcasting Corporation (NRK) and TV2 Norway secured a weekly delivery of DVC pro or Beta SP–quality videotapes from the Norwegian professional football league, and Beta SP–quality videotapes were in the same way made available from the Sports Department of the Icelandic National Broadcasting Service–Television. National or regional television-production teams with one to three cameras were responsible for all recordings in Iceland and most of the recordings in Norway, although 20 matches from Norway were live broadcasts covered with six cameras.

Video recordings from 313 of 409 regular matches (77%), 174 of 182 (league matches only) in Norway (96%), and 139 of 227 (121 league and 18 cup matches) in Iceland (61%) were made available from the television companies. Of these, 296 covered the match in full, whereas for 17 matches the tapes covered 73 minutes on average (range, 36 to 87 minutes). This corresponds to 464.5 match hours, that is, 10,219 player hours. The tapes were reviewed to identify incidents, that is, all situations where the match was interrupted by the referee, one or more players laid down on the pitch for more than 15 seconds, and the player(s) appeared to be in pain or received medical treatment.[1] The incidents, including the play leading up to each of them, were transferred to a master videotape for further analysis.

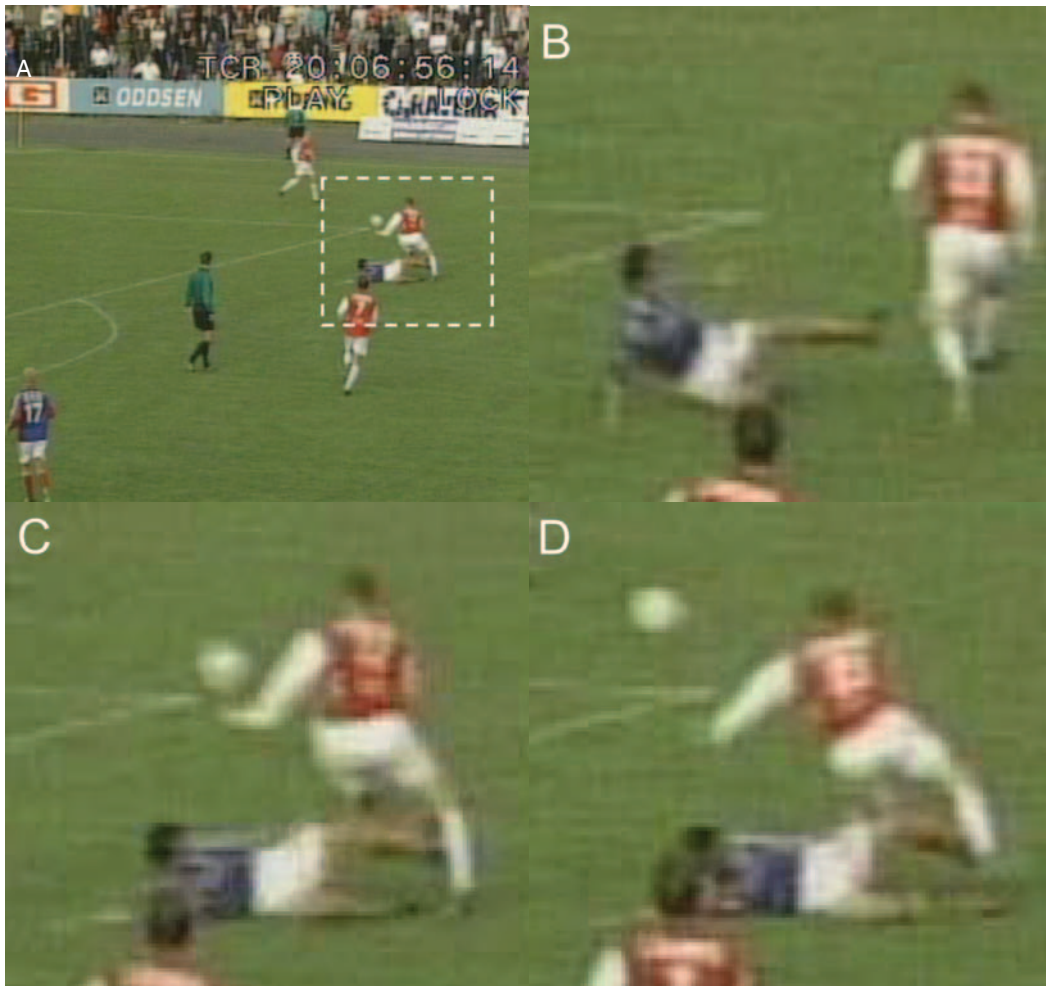

Figure 1. Case 3. A, overview of the playing situation; B, close-up of the injured player (in red) dribbling the ball prior to the tackle; C, the opponent player hits the injured player on the medial side of the right leg, whereupon the injured player transfers his weight fully to his right ankle while it is in an inverted position; D, the moment just after the ankle injury.

The medical staff of each club collected the injury information on all acute injuries that occurred during the season. An injury was recorded if the player was unable to participate in training or match play for at least 1 day following the incident. The incidence of injuries has been expressed as the number of injuries per 1000 match hours. Injuries were classified as minor when the player could not practice football normally or play matches for 1 to 7 days, moderate if absent for 8 to 21 days, and serious if absent for more than 21 days.[23,30] All players with an A-squad contract were covered by the injury registration. A standardized injury questionnaire was used, and reports were collected on a monthly basis. The form included information on the date of injury as well as the time during the match when the injury occurred. Furthermore, the injury location was registered, and injuries were classified as contusions, sprains, strains, fractures, or lacerations. Finally, each injury received a specific diagnosis using Orchard codes.[37]

Each incident identified on the videotapes was cross-referenced with the injury reports from the team medical staff. In addition, the original tapes were reexamined to find incidents that had not been identified in the first video review. The recordings of all ankle injuries were transferred to a separate master videotape. Each recording was edited to include three sequences, that is, the entire playing situation including the play leading up to the injury at normal speed, one repetition of the injury, and a slow-motion close-up repeat of the injury.

A specific ankle questionnaire was developed to describe the injury mechanism and the events leading up to the injury. The questionnaire included the case number and the side injured in each case. The variables used in the questionnaire were defined as follows: 1) the primary injury mechanism: tackling with the foot on the ground, tackling with the foot in the air, clearing or shooting, running, landing after jump, or other; 2) the movement intensity of the player at the moment of injury: high intensity (that is, sprinting and moderate intensity running) or low intensity (that is, jogging, walking, and standing); 3) whether the injured player was actively tackling an opponent (active) or whether he was being tackled by an opponent (passive); 4) the tackling types used by the injured player and the opponent: sliding tackle, locking tackle of the foot or leg, stepping, kicking, dribbling, or other; 5) whether it was a late tackle (that is, whether the tackle occurred after the ball had been passed by the injured player); 6) contact with another player: before the injury, at the time of injury, after the injury, or no contact; 7) the main

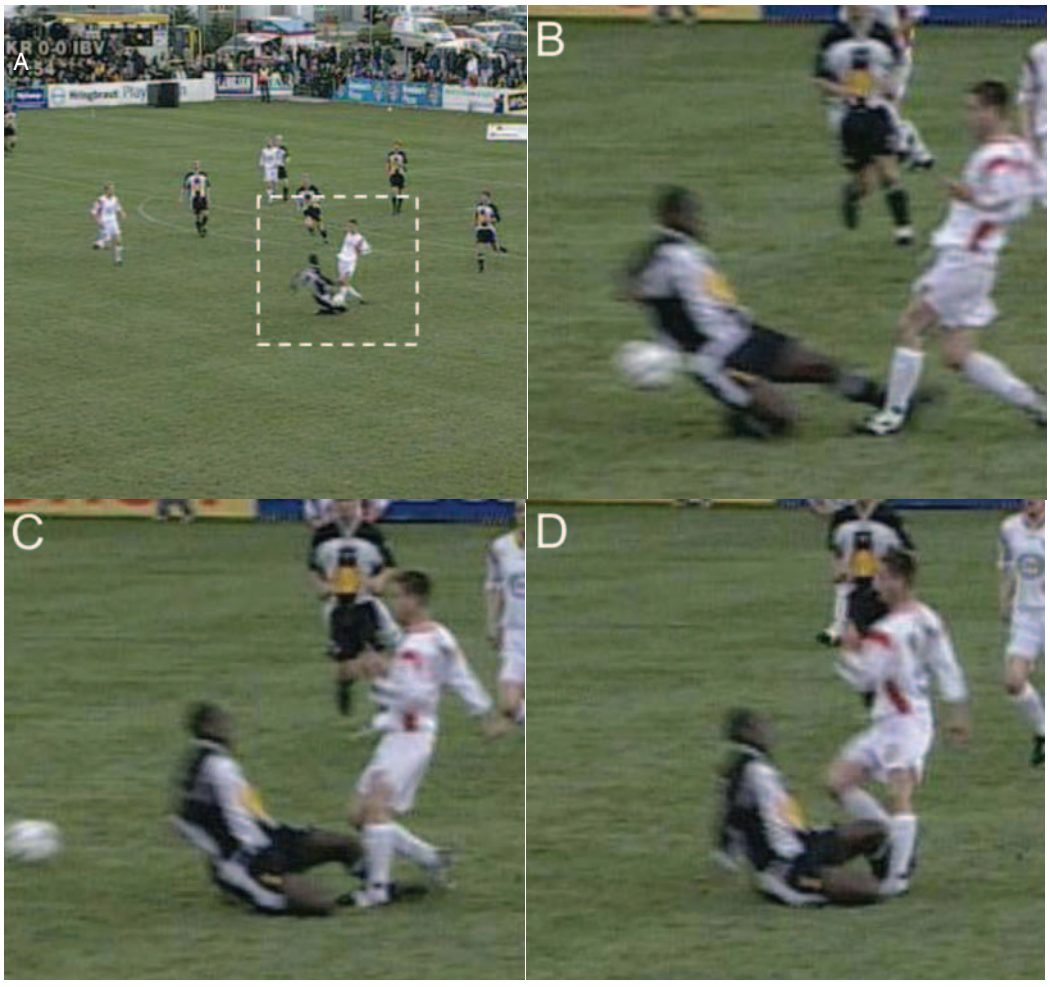

Figure 2. Case 6. A, overview of the playing situation. B, close-up from a slightly different view. The injured player (in white) has passed the ball and the opponent player makes a sliding tackle and hits the injured player on the medial side of the left leg (late tackle). C, the injured player transfers his weight fully to his ankle while this is in an inverted position. D, the moment just after the ankle injury.

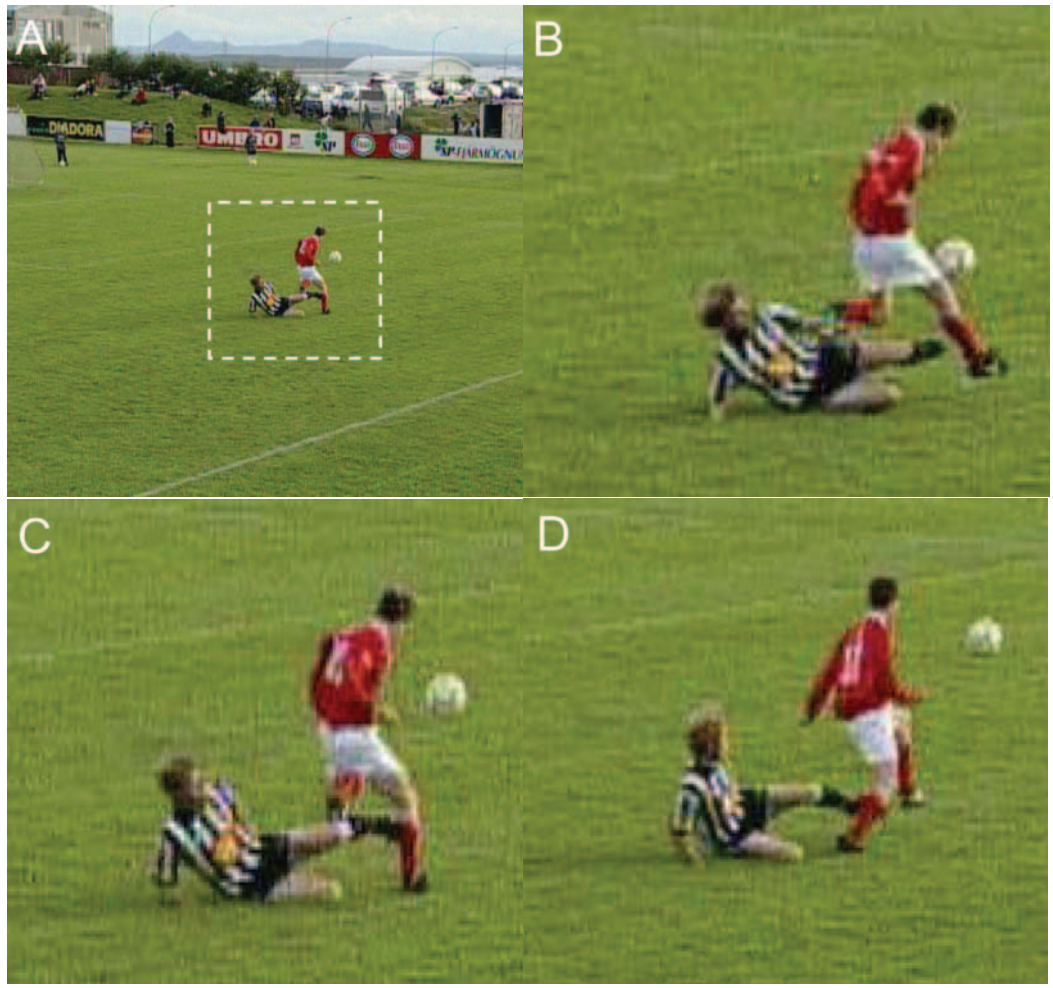

Figure 3. Case 4. A, overview of the playing situation. B, close-up of the situation. The injured player (in red) tries to avoid a tackle with the opponent player by jumping over him. C, opponent player hits the injured player on the medial side of the right leg at the moment the foot hits the ground. He tries to avoid the ankle injury by outwardly rotating the knee. D, the ankle is forced into an inverted position, the knee position can no longer compensate, and the player puts his full weight on it.

direction of ankle motion: eversion (pronation, external rotation, dorsiflexion), inversion (supination, internal rotation, plantar flexion), forced plantar flexion, or could not be evaluated; 8) point of impact on the injured player: medial side of the ankle or leg, lateral side of the ankle or leg, forefoot of the injured player, or other; 9) position of the injured foot at the time of injury: on the ground or in the air; 10) degree of weightbearing at the time of injury: full, moderate, or minimal; and 11) decision made by the match referee: no foul, free kick for or against the injured player, and whether the free kick resulted in a yellow or red card.

The master videotape was analyzed independently by two experienced specialists in sports medicine (TEA and RB). Disagreements were discussed in a consensus meeting, where the video recordings were reevaluated and a final decision was made.

RESULTS

Incidents and Injuries

During the 313 matches available on videotape (174 from the Norwegian professional league and 139 from the Icelandic elite division), 712 incidents were recorded (425 from Norway and 287 from Iceland), that is, 69.5 incidents per 1000 match hours (75.5 per 1000 match hours in Norway and 62.5 in Iceland). A total of 297 acute injuries were reported to have occurred during the same matches by the team medical staff (121 from Norway and 176 from Iceland). This corresponds to an incidence of 29.1 injuries per 1000 match hours (21.5 per 1000 match hours in Norway and 38.4 in Iceland). Of the 297 acute injuries reported, 46 (15%) were ankle injuries (18 from Norway and 28 from Iceland), which corresponds to an incidence of ankle injuries of 4.5 per 1000 match hours (3.2 per 1000 hours in Norway and 6.1 in Iceland). Of these ankle injuries, 26 (57%) were identified on the videotapes (10 from Norway and 16 from Iceland).

Of the 26 ankle injuries, 23 were classified as sprains and 3 as contusions (cases 8, 15, and 19; see Table 1).

Video Analysis

The video analysis of the 26 ankle injuries showed that 14 occurred during tackling, 4 during clearing or shooting, 4 during running, and 2 during landing after heading, whereas 2 were classified as other injury mechanisms

TABLE 1
Results From Video Analysis of the Mechanisms for Ankle Injuries in Elite Football[a]

Case number	Primary mechanism	Injured player	Late tackle	Action of injured player	Timing of contact	Injury mechanism	Contact	Location of contact	Foot location	Decision made by the referee	Severity of injury
1	Tackling	Passive	Yes	Dribbling	Before	Inversion	Foot/leg	Medially	On the ground	No foul	Minor
2	Tackling	Passive	Yes	Dribbling	During	Inversion	Foot/leg	Medially	On the ground	Yellow card	Moderate
3	Tackling	Passive	Yes	Dribbling	During	Inversion	Foot/leg	Medially	On the ground	Yellow card	Moderate
4	Tackling	Passive	Yes	Dribbling	During	Inversion	Foot/leg	Medially	On the ground	No foul	Moderate
5	Tackling	Passive	Yes	Dribbling	During	Inversion	Foot/leg	Medially	On the ground	No foul	Minor
6	Tackling	Passive	Yes	Passing	During	Inversion	Foot/leg	Medially	On the ground	Foul for	Minor
7	Tackling	Passive	No	Dribbling	During	Inversion	Foot/leg	Medially	On the ground	Yellow card	Minor
8	Tackling	Passive	No	Dribbling	During	Inversion	Foot/leg	Medially	On the ground	Yellow card	Minor
9	Tackling	Passive	No	Receiving pass	During	Inversion	Foot/leg	Forefoot	On the ground	No foul	Severe
10	Tackling	Passive	No	Receiving pass	During	Eversion	Foot/leg	Forefoot	On the ground	No foul	Minor
11	Tackling	Active	Yes	Tackling	During	Inversion	Foot/leg	Medially	On the ground	No foul	Moderate
12	Tackling	Active	No	Tackling	During	Inversion	Foot/leg	Medially	On the ground	No foul	Minor
13	Tackling	Active	No	Tackling	During	Inversion	Foot/leg	Medially	On the ground	No foul	Minor
14	Tackling	Active	Yes	Tackling	During	Inversion	Foot/leg	Other	On the ground	Yellow card	Moderate
15	Clearing/ shooting	Active	Yes	Kick	During	Cannot be evaluated	Foot/leg	Medially	In the air	No foul	Minor
16	Clearing/ shooting	Active	Yes	Kick	During	Forced plantar flexion	Foot/leg	Forefoot	In the air	Yellow card	Severe
17	Clearing/ shooting	Active	Yes	Kick	During	Forced plantar flexion	Foot/leg	Forefoot	In the air	No Foul	Moderate
18	Clearing/ shooting	Active	No	Kick	During	Forced plantar flexion	Foot/leg	Forefoot	In the air	No foul	Severe
19	Running			Passing	No contact	Inversion			On the ground	No foul	Severe
20	Running			Running	Before	Inversion			On the ground	Red card	Moderate
21	Running			Running	During	Inversion			On the ground	No foul	Minor
22	Running			Running	No contact	Inversion			On the ground	No foul	Minor
23	Landing			Heading	Before	Inversion			On the ground	Foul against	Severe
24	Landing			Heading	Before	Cannot be evaluated			On the ground	No foul	Moderate
25	Other			Dribbling	No contact	Inversion			On the ground	No foul	Moderate
26	Other			Running	During	Cannot be evaluated			On the ground	No foul	Moderate

[a] The horizontal lines indicate the grouping of the injuries into tackling situations, situations in which the injured player was clearing or shooting the ball, running, landing, and other situations.

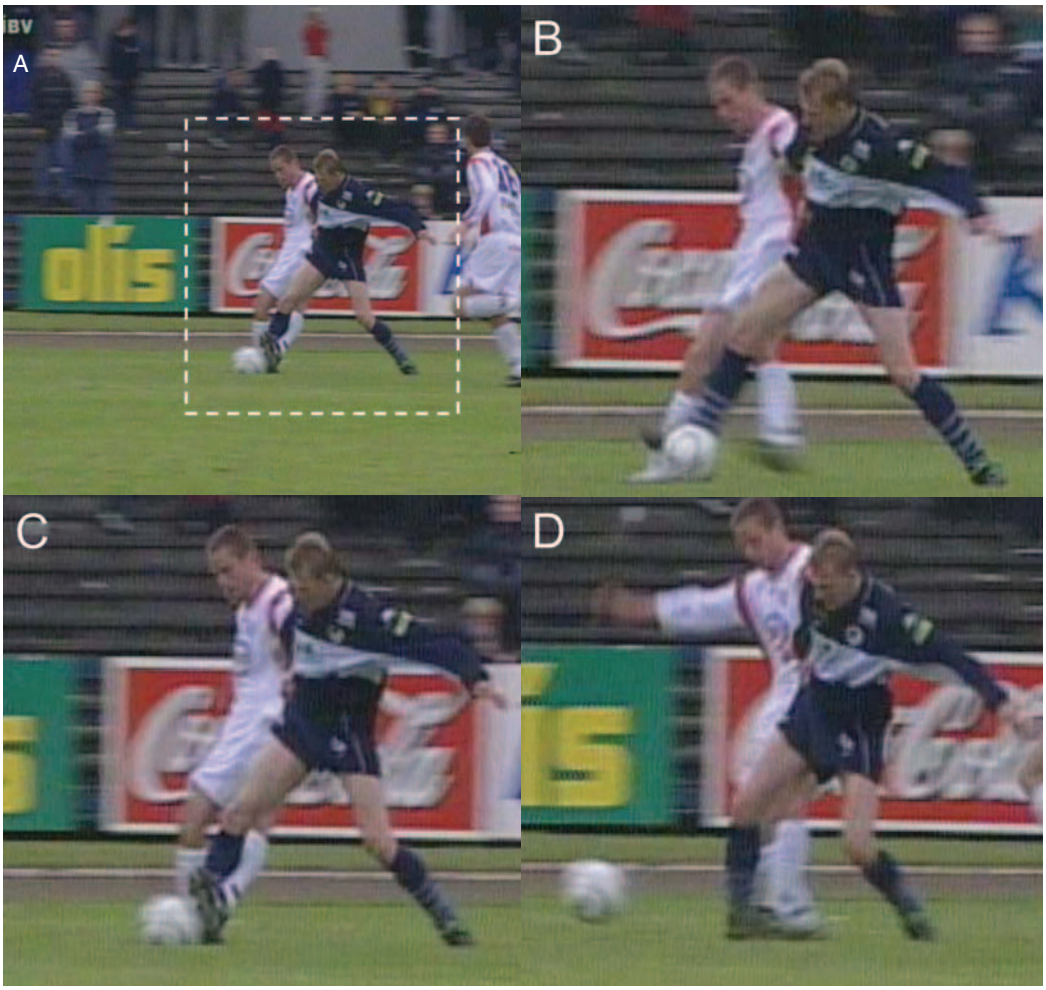

Figure 4. Case 7. A, overview of the playing situation; B, injured player (in blue) is trying to shield the ball from the opponent; C, opponent hits the ball; D, injured player is hit on the medial side of his right leg, forcing it into inversion before bearing weight on it.

(Table 1). Midfielders were injured in 14 cases, strikers in 4, and defenders in 7. The referee awarded no foul in 17 cases, whereas 6 incidents led to a free kick and yellow card, 1 to a free kick and red card, and 1 to a free kick only for the injured player. In 1 incident, a free kick was awarded against the injured player. Of the 11 incidents classified as late tackles (Table 1), a foul was called in 5 incidents. Four of these led to a yellow card.

Tackling Injuries. In 10 of the 14 tackling incidents, the injured player was tackled by an opponent. Of these, 6 were classified as a late tackle; that is, the player was tackled after the injured player had passed the ball. The injured player was dribbling the ball in 7 cases and receiving a pass or passing the ball in 3 cases. In 4 of the tackling incidents, the injured player was actively tackling; 2 of them were classified as late tackles. Of the 14 incidents, all except 1 involved contact between the injured player and the opponent at the moment of injury. Of the 14 tackling injuries, all except 1 were the result of an inversion mechanism. They occurred with the foot of the injured player touching the ground and with contact between the foot of the opponent and the leg of the injured player. In 11 cases, the injured player was hit on the medial side of the foot, whereupon the injured player transferred his weight fully to his ankle while it was in an inverted position (Figs. 1 to 4). In 11 of the 14 incidents, the injured player was moving at high intensity, whereas in 3 he was moving at low intensity. In all cases, the injured player had some part of the injured foot on the ground, and all of the injured players except one were transferring all of their weight to the injured foot at the moment of injury.

Kicking Injuries. Four injuries occurred when the player was attempting to clear the ball or shoot while an opponent tried to block the ball (Fig. 5). In all cases, the injured player was the active part, hitting the opponent's leg while kicking with the foot in an equinus position, resulting in a forced plantar flexion in three cases. The foot position of the final case could not be assessed from the video. All except from one were classified as late tackles. In all case incidents, the injured player was moving with high intensity. None of the players was disturbed at the time of injury.

Running Injuries. Four injuries occurred while the player was running: two while involved with an opponent player and two while alone. All injuries happened when the injured player placed his foot on the ground while it was in an inverted position. The injured player was moving with high intensity at the moment of injury in all four cases.

Other Injuries. Two injuries occurred during landing after a heading duel with an opponent. The final two incidents resulted from other mechanisms. In one case, the

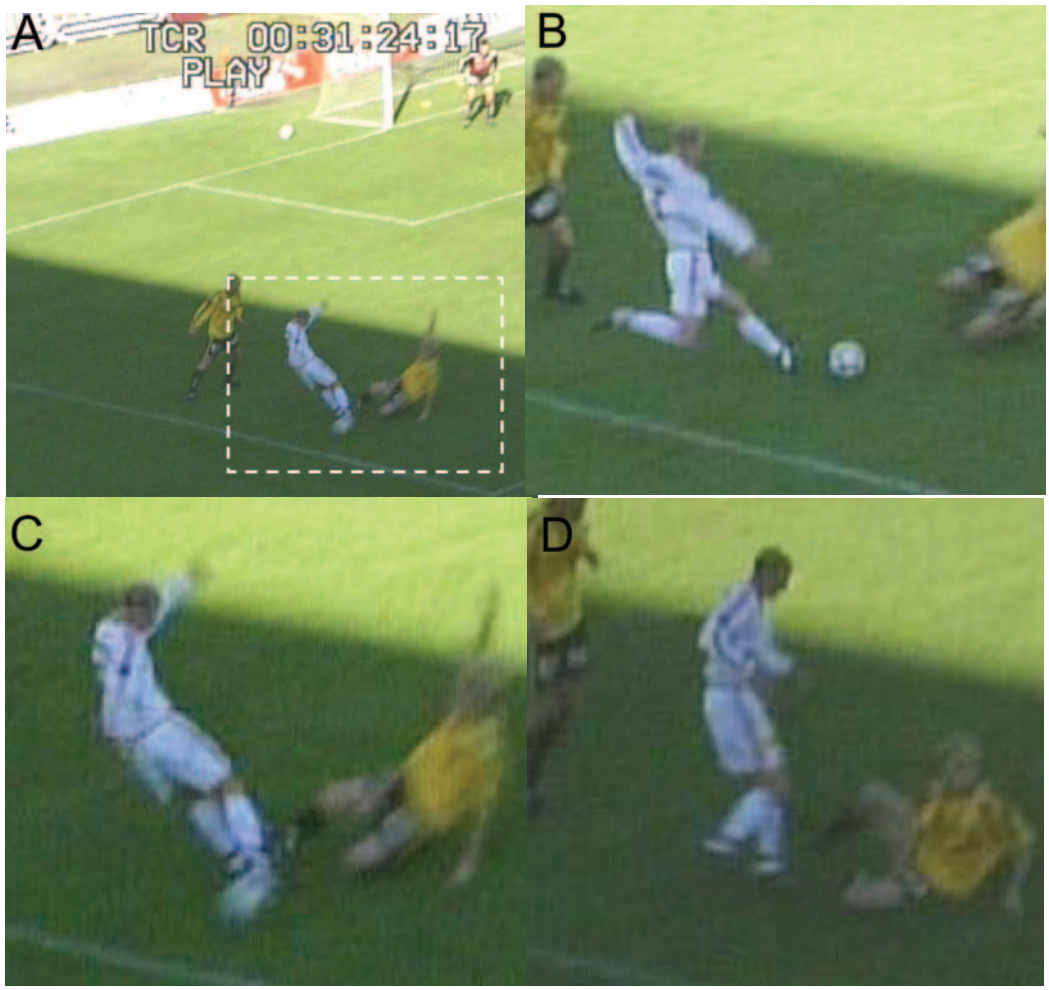

Figure 5. Case 18. A, overview of the playing situation. B, close-up of the situation prior to the contact. Player to be injured (in white) prepares to hit the ball with a forceful kick while opponent comes in with a sliding tackle. C, opponent player hits the ball before the injured player kicks maximally with his right foot, hitting the opponent's foot, and gets injured. D, moment just after the injury.

player was alone and appeared to simply stumble after having received the ball, perhaps resulting from an uneven pitch. The other incident occurred after the injured player was kicked unintentionally in the foot by a teammate.

DISCUSSION

The aim of this study was to describe the mechanisms of ankle injuries in football based on an analysis of video recordings of injuries from Norwegian and Icelandic elite football. A main finding was—as expected—that most injuries resulted from inversion trauma. However, in most cases involving player-to-player contact, accounting for about half of all injuries, the indirect cause of injury appeared to be contact to the medial aspect of the lower leg or ankle. Most likely, this laterally directed force did not produce the injury itself but caused the player to land with the ankle in a vulnerable, inverted position. The other main finding was that we observed four cases in which the injured player hit the opponent's foot with a full-force kick, resulting in forced plantar flexion of the ankle. This mechanism may explain the condition dubbed footballer's ankle.

Methodological Considerations

When interpreting the results of the present study, some obvious limitations must be considered. First, although we had information on the approximate time during the match each ankle injury occurred, we were able to identify only 57% of the acute ankle injuries that were reported by team medical staff to have occurred, even after close scrutiny of the tapes. This leads us to believe that the remaining 43% of the injuries resulted from minor trauma and mechanisms that may have been different from those identified on tape. At least they were more difficult to detect, possibly because they did not result from player-to-player contact or because they occurred outside camera view.

Second, the video recordings used in this study were from matches only. Therefore, only mechanisms for ankle injuries in match play could be evaluated. However, previous studies[2,14,16,20,23,31,36] have shown that most football injuries in elite players occur during match play, as was the case in the present study (data not shown). Whether the mechanisms for training and match injuries differ is unknown, although we would expect there to be fewer late tackles and less foul play during training than in match play.

Another limitation is that the assessment was subjective and qualitative and in some cases based on tapes with less than optimal quality and a limited number of views available. Nevertheless, the main mechanism for tackling injuries appeared to be remarkably consistent between cases, and it was easy to agree on the description and classification of mechanisms. Even keeping the limitations mentioned in mind, a systematic analysis of injury situations from video would seem to be the obvious approach toward a more detailed understanding of the mechanisms for sports injuries, providing more reliable information than retrospective player interviews.

However, it should be noted that this study was conducted on elite male football players. There may be differences in injury mechanisms between these players and other player populations (for example, younger players, female players) that warrant attention in future studies.

Injury Mechanisms

The majority (88%) of the ankle injuries we were able to identify on video resulted from contact with an opponent. This is in contrast to a study among youth and adult players participating at various competition levels in one football club in Denmark.[36] Based on reports from the coaches, they found that ankle sprains occurred equally during tackling and running. However, Chomiak et al.[11] in a similar study in the Czech Republic found that 68% of the ankle injuries were due to body contact, and in a recent study among professional English football players 59% of the ankle injuries were reported to be caused by contact mechanisms.[52] Although a direct comparison of the results is difficult, it seems reasonable to conclude that challenging ball possession is a situation with a high risk for ankle injuries.

An inversion mechanism was found in all but one of the tackling injuries, all running injuries, and in one of two after landing after a heading duel. Based on questionnaire data, inversion of the ankle has been described to be the most frequent injury mechanism for ankle sprains in football[11,47] and among runners.[18] Studies of ankle sprains in volleyball have shown the main mechanism to be landing on the foot of an opponent or teammate after blocking or attacking at the net.[4] From the present study, it appears that there is a specific mechanism for football injuries as well. The injured player received a laterally directed hit on the medial side of the ankle or lower leg, whereupon landing in a supinated position led to an inversion injury (Fig. 6). In some cases, it appeared that the players tried to avoid the ankle injury by flexing their knee and externally rotating their thigh to avoid putting weight on the ankle joint. However, when he no longer could compensate, the player had to put weight on the ankle and an injury occurred. Ankle inversion torques that result in lateral ligament lesions are thought to arise primarily in situations in which the ankle goes through a transition from an unloaded to a loaded condition.[46] Other biomechanical studies have shown that the anterior talofibular ligament (ATFL) is the first ligament to be tensed and so the first to rupture when forced inversion of the ankle occurs.[7,10]

Figure 6. Typical mechanism for lateral ligament injury in football: opponent contact to the medial side of the leg, causing the player to put weight on an inverted ankle. Illustration reproduced with permission by ©Oslo Sports Trauma Research Center/T. Bolic.

Broström[9] and van der Ent[48] have presented data from surgery showing that half of all ankle sprains were isolated ATFL tears and about 25% were combined ATFL and calcaneofibular ligament tears. In other words, the findings from clinical studies, biomechanical research, and surgical findings correspond well with the present findings, suggesting that the typical football mechanism is an inversion sprain after a laterally directed hit on the medial side of the ankle or lower leg.

In three of the four incidences classified as "clearing or shooting," the injured player was actively kicking with the foot placed in a forced plantar flexion. It may be hypothesized that this is the mechanism whereby footballer's ankle occurs, even if the number of cases is small in this study. McMurray,[34] after Morris[35] first had described this specific condition, suggested that kicking the ball with the foot usually in a position of full extension leads to strain on the anterior capsule of the ankle joint, eventually giving rise to osteophyte formation. The mechanism for footballer's ankle is controversial, and three theories exist to explain the formation of osteophytes. Recurrent maximal plantar flexion and stretching of the joint capsule from repetitive kicking is suggested to result in traction spurs.[8,32,34] Van Dijk et al.[49] suggested that repetitive kicking of the football ball caused direct damage to the anterior joint cartilage, resulting in inflammation, scar tissue formation, and calcifica-

tion. Finally, repetitive forced dorsiflexion causing minor fractures due to impacts between the bone surfaces of the anterior tibia and the talus has been suggested to cause exostoses to develop on the anterior edge of the tibia and talus.[39] The present video analysis suggests that the first theory, with forced plantar flexion, may be the cause of footballer's ankle (Fig. 7).

Perspectives for Injury Prevention

Ankle sprains can be prevented.[5,43,51] The protective effects of taping and bracing have been shown persuasively in football, although only for players with previous ankle injury.[42,45] The most important risk factor for ankle injuries is history of a previous sprain.[3] Neuromuscular function is reduced in athletes with persistent instability complaints after injury[25,28,46] and even in the immediate recovery period after an acute injury.[27] How tape and orthoses work is uncertain, but they may simply enhance neuromuscular control of the ankle joint. This view is corroborated by the fact that their effect is limited to players with previous injury,[40,42,45] where proprioceptive function is reduced,[25,28,45] and that orthoses do not seem to restrict inversion enough to substantiate their prophylactic effect.[12,50] If the protective effect were mechanical, one would expect an effect in healthy ankles as well. It is also important to note that neuromuscular control in chronically unstable ankles can be restored with a balance board training program[19] and that such a program appears to reduce the risk of reinjury at the same level as healthy ankles.[45]

The present study shows that a significant proportion of ankle injuries are contact injuries resulting from a medial blow to the ankle or lower leg, a mechanism where neither balance training nor ankle support would be expected to have a protective effect. However, as mentioned above, it may be that the laterally directed blow is not the direct cause of injury but merely serves to put the ankle in a vulnerable position when landing or running. Thus, increased neuromuscular control through training or bracing could aid the player in correcting foot position before putting weight on the ankle, at least in some cases.

The role of fair play and proper refereeing is frequently discussed in injury prevention. Based on our assessment of the videotapes, there were a number of cases in which injuries resulted from late tackles without penalty to the offender. In some cases, our impression was that these were intentional, professional fouls. Although we acknowledge that the task of enforcing the laws of the game is difficult—the match referee not having the benefit of video replay—we would argue that the present findings show that there is a need for stricter enforcement of the laws of the game in tackling situations. A number of measures can potentially be effective, including improved referee training focusing on situations with injury potential, immediate or delayed video review by the match referee in such cases, more specific wording of the laws of the games regarding late tackles, and stricter penalties for this type of rule violation. It appears that free kicks or even yellow cards do not have the desired deterrent effect on player behavior, and we therefore suggest that the introduction of timed suspensions (for example, 10 minutes for dangerous play) be considered. Such suspensions would—unlike free kicks or yellow cards—in many cases directly influence match outcome and may be a more effective disincentive on dangerous foul play.

Figure 7. Probable mechanism for development of footballer's ankle. Illustration reproduced with permission by ©Oslo Sports Trauma Research Center/T. Bolic.

CONCLUSION

This study showed that a thorough video analysis seems to give detailed information about mechanisms of ankle injuries in football. The most frequent injury mechanism found was player-to-player contact with impact on the medial aspect of the lower leg or ankle of the injured player. Most likely, this laterally directed force caused the player to land with the ankle in a vulnerable, inverted position. In addition, we observed four cases in which the injured player hit his opponent's foot, resulting in forced plantar flexion of the ankle. This mechanism may explain the condition dubbed footballer's ankle.

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