No Effect of a Video-Based Awareness Program on the Rate of Soccer Injuries

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Background: The injury rate in soccer is high, and effective injury prevention methods are needed.

Purpose: To test the effect of a video-based awareness program on the incidence of acute injuries in soccer.

Study Design: Randomized control trial; Level of evidence, 1.

Methods: Participants were elite male soccer players from the top 2 divisions in Iceland. Fifteen of 20 teams completed the study: 7 intervention teams (127 players) and 8 control teams (144 players) chosen by random. Just before the start of the 2000 soccer season, the intervention teams were visited with an intervention program. The program included a 15-minute presentation with information on the injury risk of playing elite soccer, typical injuries, and their mechanisms. Then the players worked together in pairs and analyzed video sequences to develop preventive strategies. The 12 video sequences were selected from the previous Icelandic soccer season, representing 3 typical injury mechanisms that accounted for more than half of all incidents recorded. During the season, team physical therapists prospectively recorded all acute injuries, and coaches recorded training exposure on a special form. Injury incidence was compared between groups and between the 1999 and 2000 seasons for teams that participated in both seasons.

Results: No difference was observed in injury incidence between the intervention (6.6 ± 0.7 injuries per 1000 player hours) and control groups (6.6 ± 0.7 injuries per 1000 player hours). Furthermore, there was no difference in injury location or type.

Conclusion: The video-based injury awareness program showed no effect on injury rate.

Keywords: injury mechanisms; injury types; intervention; prevention; soccer

Soccer is one of the most widespread sports in the world,[33,50] but compared to many other sports, the injury incidence is high (13.0-34.8 injuries per 1000 match hours and 1.5-7.6 injuries per 1000 training hours).[3,15,22,24,28,37,44] In fact, injuries in soccer account for 30% to 56% of all sport-related injuries in some European countries.[15,32,34] Although this is partly due to the popularity of the sport, Drawer and Fuller[16] have concluded that injury risk among professional soccer players is unacceptable compared to work-based risk criteria used by the Health and Safety Executive in the United Kingdom. Studies have also shown that acute injuries represent 69% to 94% of all injuries in soccer, whereas 6% to 31% are overuse injuries.[3,20,37,43]

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To prevent some of the acute injuries occurring during soccer, it is necessary to identify the risk factors and mechanisms for injury, as well as the playing situations during which injuries occur. Several studies have examined 1 or more risk factors,[§] whereas injury mechanisms are poorly understood. Studies based on reports from players or team medical staff have not yielded information that can be readily used to develop preventive methods,[‖] probably because of the many player interactions possible, the complexity of the game, and the sudden onset of acute injuries. Therefore, considering our limited understanding of the causes of soccer injuries, it is not surprising that few trials have been conducted to test approaches to prevent injuries in soccer.[13,21,31,35,46,48]

Recently, in an attempt to provide a more precise description of the mechanisms of injury, our group[1,2,6] and others[27,29,45] have developed methods based on video analysis of injury situations. A new video-based method—football incident analysis (FIA)—combines soccer-specific and

[§]References 3, 5, 9-12, 14, 17-20, 23, 28, 30, 34, 37, 40, 43, 47, 49, 52.

[‖]References 3, 10, 11, 16, 17, 20, 27, 28, 30, 37, 38, 40, 43, 53.

medical information to describe injury incidents in soccer and the events leading up to them.[1] During the 1999 Icelandic soccer season, FIA was used to analyze videotapes from 52 elite matches, and some patterns were observed in the events leading to injury risk incidents during these games.[6] A program designed to increase awareness of the mechanisms of ACL injuries in alpine skiing and develop avoidance strategies has been shown to be effective in preventing injuries.[25] Increased awareness of the risk of injury, the injury patterns, and the injury mechanisms—whether intended or not—is often also a component in most of the intervention studies conducted.[7,21,39] It therefore seemed relevant to test the effect of improving the awareness of injury mechanisms alone, without including any specific exercises or training program to prevent injuries. Thus, we thought that a video-based awareness program could reduce the incidence of acute soccer injuries and set out to test this hypothesis in a randomized controlled trial.

MATERIALS AND METHODS

Before the start of the 2000 soccer season, 17 of 20 male soccer teams in the elite and first divisions accepted an invitation to participate in this study (9 from the elite and 8 from the first division). Of these 17 teams, 8 teams (4 elite and 4 first division) were randomly chosen to participate in the intervention group. The Icelandic soccer season lasts from mid-May to mid-September.

Intervention Program

During April and early May, just before the start of the season, the teams in the intervention group were visited individually with an intervention program based on a 2-hour workshop with players and coaches. The workshop started with a 15-minute presentation, which included information about the study, the injury risks associated with playing elite soccer (injury incidence, severity, common injury types), and typical injury mechanisms. Then, the players worked together in pairs (if necessary, in groups of 3) to analyze 12 video sequences, each showing an incident from the previous Icelandic soccer season. These video sequences had been edited to show the injury situation as well as the entire play leading up to the incident (ie, from the start of the attack that eventually leads to the incident).

The video sequences were selected to represent 3 previously documented categories of injury mechanisms (4 video sequences in each category): (1) breakdown attacks: attacks in which the attacking player appeared to be fully focused on the ball while he was tackled from the side or from the front; (2) defensive tackles: the defending player engaging in a tackling duel in a situation with low ball control (eg, after inadequate first touch on the ball), with his attention focused on the ball; and (3) heading duels: player attention focused on the ball, seemingly unaware of the position of the opponent or teammates. The 3 groups of mechanisms were selected based on a systematic analysis (FIA)[1] of 95 incidents from the 1999 Icelandic soccer season,[6] in which these categories were shown to account for 57% of all incidents (breakdown attacks, 24%; defensive tackles, 20%; heading duels, 13%). For a more detailed description of the categories, see Arnason et al.[6]

A process of guided discovery as described by Ettlinger et al[25] was used to increase player awareness of injuries and their mechanisms. The players were asked to review the 12 incidents on video. Each incident (including slow motion and from several views, if available) was observed 3 times. They could also replay the incidents. Each pair of players completed a standardized form in writing. In this, they were asked to describe the playing situation leading to each incident, the cause(s) of each incident, and the strategies whereby the incident could be prevented (open-ended questions). They were encouraged to discuss each incident between themselves. Their responses have been categorized and are shown in Table 1. After the players had completed and returned their forms, the results were briefly discussed in the whole group, and all of the teams came to the same conclusion: poor attention and insufficient first touch of the ball was the main reason for most of these incidents. A total of 155 players from the 8 intervention teams participated in the program (16-28 players per team; mean = 19.4). The teams in the control group were not provided with any information on the content of the intervention program, the injury risk in soccer, common injury types, or injury mechanisms.

Injury Registration

During the 2000 season, the team physical therapists prospectively recorded all acute injuries, and the coaches recorded training exposure on special forms. The forms were collected by 1 of the authors (AA) on a monthly basis. Match exposure was obtained from official records.[5] Acute injuries were defined as injuries with a sudden onset resulting from trauma (eg, tackling, kicking, or sprinting).[5] An injury was recorded if it occurred during a soccer match or team training session and the player was unable to participate in match play or regular training for at least 1 day after the incident. The player was defined as injured until he was able to play a match or fully comply with all instructions given by the coach, including sprinting, turning, shooting, and playing soccer at full tempo.[3-6,36] The injury severity was classified in 3 categories according to the duration of absence: mild (1-7 days), moderate (8-21 days), and severe (more than 21 days).[1,5] An identical injury registration was carried out in a separate nonintervention cohort study during the 1999 season,[5] and the results from this study were used to compare injury rates between the 1999 and 2000 seasons for teams that participated in both studies.

Two of the 17 teams (1 from the intervention group and 1 from the control group) did not follow up the injury registration and had to be excluded from the study. Thus, the results are based on the remaining 15 teams: 7 in the intervention group (127 players) and 8 in the control group (144 players).

TABLE 1
Injury Prevention Measures Proposed by 155 Players From the 8 Teams in the Intervention Group That Participated in the Workshops[a]

Classification of Incidents	Injury Prevention Proposals	n	%
Breakdown attacks	Improve first touch on the ball by the exposed player	104	28
	Pass the ball sooner	90	24
	Opponent must play fair or improve timing	66	17
	Improve attention of the exposed player	46	12
	Not possible to avoid incident	19	5
	Other	45	12
	Not answered	8	2
	Total	378	100
Defensive tackles	Opponent must play fair or improve first touch on the ball	173	51
	Improve attention of the exposed player	32	9
	Refrain from tackling in this type of situation	30	9
	Improve communication between players	20	6
	Improve attention of the opposing player	7	2
	Not possible to avoid incident	7	2
	Other	52	15
	Not answered	16	5
	Total	337	100
Heading duels	Improve attention of the exposed player	98	25
	Improve attention of the opponent player	80	20
	Not possible to avoid incident	40	10
	Lower elbows	36	9
	Improve communication between players	22	6
	The exposed player must protect himself better	21	5
	Better timing of the exposed player	14	4
	Other	56	14
	Not answered	24	6
	Total	391	100

[a]The players worked in pairs (N = 72 groups) and analyzed 12 incidents from the previous season in 3 categories (see "Materials and Methods" for details; 4 incidents from each category): (1) breakdown attacks, (2) defensive tackles, and (3) heading duels. The number of responses reported represents the total number within each category (multiple responses were possible), and the percentage is expressed in relation to the total number of responses.

TABLE 2
Total Exposure, Number of Acute Injuries, and Incidence of Injuries Among the Teams in the Intervention and Control Groups During the 2000 Season

	Exposure, h			Injuries, n			Incidence (injuries per 1000 h)		
	Total	Match	Training	Total	Match	Training	Total	Match	Training
Intervention (n = 7)	14 310	2470	11 840	94	62	32	6.6 ± 0.7	25.1 ± 3.2	2.7 ± 0.5
Control (n = 8)	14 617	2844	11 773	96	74	22	6.6 ± 0.7	26.0 ± 3.0	1.9 ± 0.4
Total (n = 15)	28 927	5314	23 613	190	136	54	6.6 ± 0.5	25.6 ± 2.2	2.3 ± 0.3

Statistical Methods

Z tests were used to compare ratios (number of injuries per hours of exposure) between intervention and control groups and within groups between the 1999 and 2000 competitive seasons. Because of few injuries to some body parts, injury location was recoded to 5 groups (thigh, knee, lower leg, ankle, and other) before the statistical analysis was performed. A χ^2 test was used to test for differences in injury distribution between the intervention and control groups. A χ^2 test was also used to test for differences between groups in injury severity. Linear regression was used to test the slope for monthly injury incidence corrected for group during the season. This test was also done separately per group. Standard error was used to describe the variation in injury incidence, which has been reported as the number of injuries per 1000 hours of player exposure.

RESULTS

Throughout the study period (mid-May to mid-September), 190 acute injuries occurred among 103 (38%)

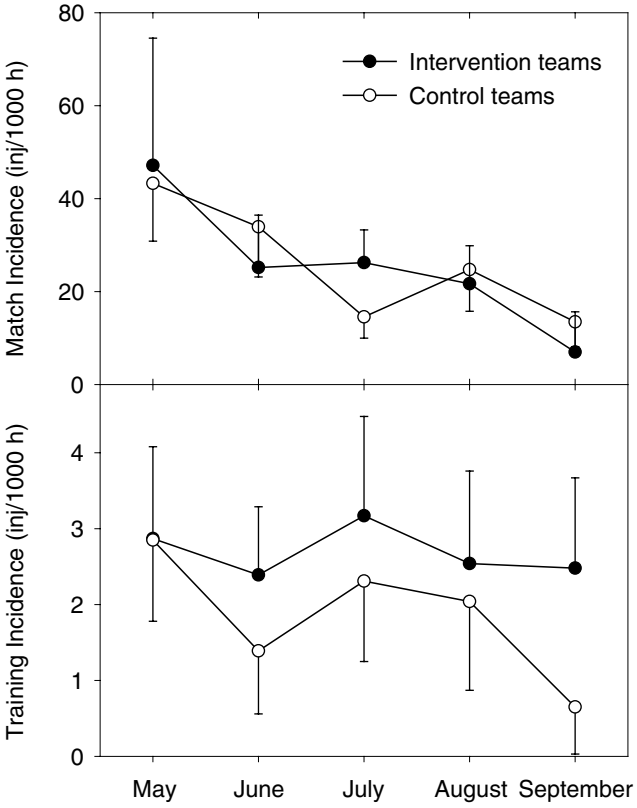

Figure 1. Monthly incidence of acute injuries during matches (top panel) and training (lower panel) in the intervention group (n = 7) and control group (n = 8) during the 2000 season. Error bars indicate the team SEM. inj, injuries.

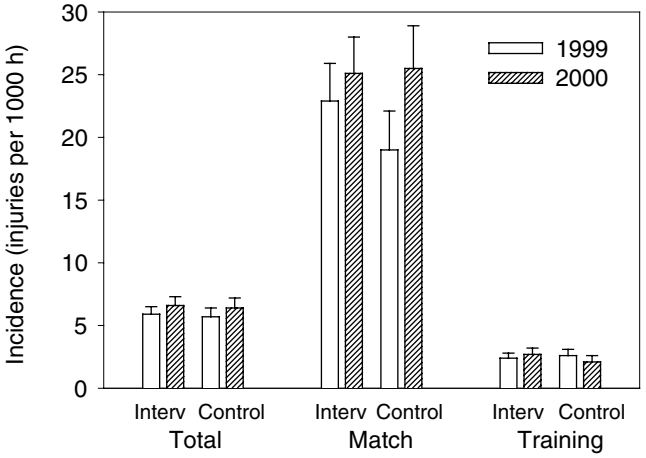

Figure 2. Incidence of acute injuries in the intervention and control groups during the intervention season (2000) as well as the previous season (1999). These data are based on the 7 teams in the intervention group and the 6 teams in the control group that participated in the elite league or first division during both seasons. Interv, intervention.

of the 271 players that were included in the study. Of these injuries, 136 (72%) occurred during matches and 54 (28%) during training. The incidence of acute injuries was 25.6 ± 2.2 injuries per 1000 player hours during matches and 2.3 ± 0.3 injuries per 1000 player hours during training (Table 2), or 1 injury per 1.2 matches and 19.7 training sessions.

No difference was observed in total injury incidence (injuries per 1000 hours) between the intervention and control groups (Z test, $P = 1.0$) nor was there any difference in match ($P = .8$) or training incidence ($P = .2$) (Table 2). Power calculations showed that there was an 80% probability at the 5% significance level of detecting a difference of ≥2.7 in total injury incidence between the intervention and control groups, assuming a control group injury rate of 6.6 injures per 1000 hours of exposure, that is, a 41% difference. The monthly injury incidence during matches gradually decreased during the season (B = –6.6 ± 2.5, $P = .01$, controlled for group), whereas no such trend was seen for injuries during training (Figure 1).

There was no significant difference in the injury distribution related to body part between the intervention and control groups (Table 3; χ^2: $P = .50$ for all injuries, $P = .60$ for match injuries, and $P = .08$ for training injuries). Also, we observed no difference in injury severity between groups (Table 4; χ^2: $P = .21$ for all injuries, $P = .20$ for match injuries, and $P = .90$ for training injuries). Thigh injuries were the most common (29%), followed by injuries to the knee (15%), ankle (15%), lower leg (9%), and groin (7%).

No difference was found in total injury incidence between the 1999 and 2000 soccer seasons within the 7 intervention teams (Z test, $P = .50$) or 6 control teams ($P = .42$) that participated in studies during both seasons (Figure 2).

DISCUSSION

The main finding of the present study was that no difference was observed in injury incidence between an intervention group, which participated in a video-based program designed to improve awareness of the mechanisms for injuries in soccer, and a similar control group.

There are at least 3 potential explanations for the failure of the program to reduce injury rates in the intervention group. First, it may be that the playing situations we used were not representative. Second, the players may have misinterpreted the injury mechanisms from the videos, or the prevention strategies they developed were ineffective. Third, the players may have been unable to change their skills and behavior—even if the videos were representative, the players did interpret the mechanisms correctly and were able to develop appropriate preventive strategies.

When addressing the first question—whether the playing situations used were representative—it is important to keep in mind that from a kinetic and biomechanical point of view, soccer is a complicated sport. It is characterized by short sprints, rapid acceleration or deceleration, turning, jumping, kicking, tackling, and many complex actions with or without the ball.[8,51] Through the years, the game has

TABLE 3
Location of Acute Injuries in the Intervention (n = 7) and Control Groups (n = 8) During the 2000 Season[a]

	Total				Match				Training			
	Intervention		Control		Intervention		Control		Intervention		Control	
	n	%	n	%	n	%	n	%	n	%	n	%
Head	3	3.2	7	7.3	3	4.8	7	9.5	0	0.0	0	0.0
Neck	1	1.1	0	0.0	1	1.6	0	0.0	0	0.0	0	0.0
Back (lumbar/thoracic)	7	7.4	2	2.1	5	8.1	2	2.7	2	6.3	0	0.0
Shoulder	4	4.3	3	3.1	2	3.2	3	4.1	2	6.3	0	0.0
Arm	1	1.1	1	1.0	0	0.0	1	1.4	1	3.1	0	0.0
Hand	0	0.0	2	2.1	0	0.0	0	0.0	0	0.0	2	9.1
Chest	1	1.1	2	2.1	0	0.0	2	2.7	1	3.1	0	0.0
Abdomen	1	1.1	0	0.0	1	1.6	0	0.0	0	0.0	0	0.0
Groin	7	7.4	6	6.3	5	8.1	3	4.1	2	6.3	3	13.6
Hip/pelvis	1	1.1	2	2.1	1	1.6	2	2.7	0	0.0	0	0.0
Thigh	26	27.7	30	31.3	16	25.8	22	29.7	10	31.3	8	36.4
Knee	17	18.1	12	12.5	8	12.9	11	14.9	9	28.1	1	4.5
Lower leg	6	6.4	11	11.5	5	8.1	11	14.9	1	3.1	0	0.0
Ankle	13	13.8	16	16.7	10	16.1	9	12.2	3	9.4	7	31.8
Foot	6	6.4	2	2.1	5	8.1	1	1.4	1	3.1	1	4.5
Total	94	100	96	100	62	100	74	100	32	100	22	100

[a]The number of injuries occurred during matches and training are shown, as well as the total number of injuries.

TABLE 4
Injury Severity by Location of Acute Injuries in the Intervention and Control Groups During the 2000 Season

	Minor				Moderate				Severe			
	Intervention		Control		Intervention		Control		Intervention		Control	
	n	%	n	%	n	%	n	%	n	%	n	%
Head	3	7.5	7	13.2	0	0.0	0	0.0	0	0.0	0	0.0
Neck	0	0.0	0	0.0	0	0.0	0	0.0	1	5.3	0	0.0
Back (lumbar/thoracic)	5	12.5	2	3.8	1	2.9	0	0.0	1	5.3	0	0.0
Shoulder	0	0.0	3	5.7	3	8.6	0	0.0	1	5.3	0	0.0
Arm	0	0.0	1	1.9	1	2.9	0	0.0	0	0.0	0	0.0
Hand	0	0.0	2	3.8	0	0.0	0	0.0	0	0.0	0	0.0
Chest	0	0.0	1	1.9	1	2.9	1	3.7	0	0.0	0	0.0
Abdomen	1	2.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Groin	4	10.0	1	1.9	3	8.6	3	11.1	0	0.0	2	12.5
Hip/pelvis	1	2.5	1	1.9	0	0.0	1	3.7	0	0.0	0	0.0
Thigh	11	27.5	9	17.0	9	25.7	11	40.7	6	31.6	10	62.5
Knee	6	15.0	8	15.1	6	17.1	3	11.1	5	26.3	1	6.3
Lower leg	1	2.5	8	15.1	4	11.4	3	11.1	1	5.3	0	0.0
Ankle	6	15.0	10	18.9	5	14.2	4	14.8	2	10.5	2	12.5
Foot	2	5.0	0	0.0	2	5.7	1	3.7	2	10.5	1	6.3
Total	40	100	53	100	35	100	27	100	19	100	16	100

developed and become faster, with higher intensity and more aggressive play than in the past.[50] Consequently, the injury mechanisms in soccer are complex as well.[1,2,6] In the present study, we decided to base the intervention on the 3 injury mechanisms that were found to be responsible for more than half of all injury incidents during the Icelandic soccer season the year before. We did not focus on a specific injury type, such as ankle or knee sprains, but on situations with a high risk for any type of injury. Preventing injury through increased player awareness may be more difficult in soccer than in sports in which fewer and more specific mechanisms are found, such as for ACL injuries in skiing[25] or team handball[39] or ankle sprains in volleyball.[7]

Second, it may be questioned whether the players were able to assess the injury mechanisms correctly and develop appropriate prevention strategies from the video session they participated in. Active player participation in the workshop was ensured by having the players work in pairs and requiring them to complete questionnaires for each video sequence, and they did show a positive attitude. Moreover, as shown in Table 1, their responses to the questionnaire were largely the same as our description from the formal FIA method.[1] Based on the FIA results, the main emphasis of the preventive measures proposed by the players was expected to be on player attention in duels and the quality of the first touch of the ball. For a player to be aware of the positions and actions of the players in his vicinity is obviously important to perform well. We suggest that player attention is also essential to avoid injury—by being more aware of potential duels with opponents, to avoid collisions with teammates, or by knowing where to pass the ball before being tackled by an opponent. The quality of the first touch of the ball depends on many factors, such as the technique of the exposed player, the quality of the pass that the player receives, the playing situation, and field and weather conditions. Player technique is probably the most important of these factors and can influence both the first touch on the ball and passing skills. The 2 factors—player attention and technique—are probably also correlated, in such a way that players with insufficient ball technique often have to focus their attention on receiving the ball, not having time to assess the playing situation or the actions of other players. Players with insufficient techniques also tend to pass the ball too far from themselves, often having to tackle an opponent to regain ball control.

However, even if the players did appear to interpret the main injury mechanisms correctly and seemed to suggest appropriate preventive strategies, we observed no effect on injury rates. It is possible that the program has the potential to prevent specific injury types (eg, head injuries), but considering the small number of injuries in each subgroup, it is not possible to test this hypothesis. Nevertheless, although the power of the study was sufficient to detect clinically significant effects, there was no difference between the intervention and control groups or between the teams within each group during the 1999 and 2000 seasons. The third potential explanation for this is that the players were unable to change their behavior on the pitch. Although the players may have recognized the preventive strategies, it can be difficult to follow the guidelines during games—when the requirements are high and they often only have a split second to consider the playing situation. It is also possible that 1 session is not enough to affect player attitudes or behavior, especially because ball-handling skills are difficult to change. Although most of the coaches participated in the workshops, we do not know if they actively emphasized injury prevention strategies in training. However, because player behavior and skill level cannot be readily assessed, we do not know whether the workshop was sufficient to produce any significant changes. All we know is that injury rates were not affected. It is possible that a more comprehensive program over a longer period of time and with greater coach involvement could produce an effect on player awareness, behavior, and injury risk.

Nevertheless, when conducting an injury intervention study, one concern is that injury rates are influenced by changes in player behavior resulting from the players just being made aware that injuries occur—especially if the intervention is based on specific training programs that include information on typical injury types and their mechanisms—or even if the intervention program just provides clues to the mechanisms of injury. Ettlinger et al[25] have shown positive results on the risk of ACL injuries from an intervention study based on the principle of guided discovery, with the specific goal of teaching skiers to recognize vulnerable knee positions and avoidance techniques. Examples of studies that have shown impressive effects on injury rates based on specific exercise programs include the studies of Tropp et al[48] and Bahr et al[7] on ankle injuries in soccer and volleyball and Caraffa et al[13] and Myklebust et al[39] on ACL injuries in soccer and team handball. In addition to the specific training program, the prevention programs to a certain extent also served to draw attention to the risk of injury and dangerous playing situations. In these and similar studies using various forms of balance training or other exercises, it is possible that the effect on injury rates was not an effect on ankle or knee proprioception directly but that the effect resulted from changes in player behavior, for example, avoidance of specific situations players recognize from the training program or reduced risk-taking behavior in general. This effect should not be confused with a placebo effect, which could result from just conducting an injury registration in the control group. One important lesson from the present study is therefore that a specific program designed to increase player awareness of injuries and their mechanisms alone did not affect injury rates.

A secondary finding in the present study was that injury incidence during matches gradually decreased throughout the competitive season. One potential explanation for this decrease in injury incidence could be that the players were not well prepared enough before the competitive season started—physically, technically, and/or mentally. However, most of the teams had trained intensively for at least 6 to 7 months during the preseason period and participated in many training matches before the competition season started. Moreover, in a previous study we did not find preseason player fitness to be a significant risk factor for injuries during the competitive season in this player population.[5] Another reason could be that when the competitive season started, most of the teams changed their playing surface from artificial turf or gravel to natural grass. Some authors have indicated that changes in playing ground can increase injury risk, at least under certain weather conditions.[3,26,41,42] A third hypothesis is that some players with a particularly high risk of injury suffered severe injuries early in the season, leaving those who were less likely to be injured in the population at risk.

CONCLUSION

No significant effect was observed on the incidence of injuries among elite soccer players from a video-based program designed to improve their awareness of injury mechanisms.

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