

Rule Violations as a Cause of Injuries in Male Norwegian Professional Football

Are the Referees Doing Their Job?

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Background: Foul play is an important cause of injury in football. Reduction of foul play and adherence to the laws of the game may be possible interventions to reduce the rate of injuries.

Purpose: To evaluate how violations of the laws of the game contribute to injury and to investigate whether the decisions made by the referees are correct in high-risk situations.

Study Design: Prospective cohort study.

Methods: Videotapes and injury information were collected for 174 of 182 matches from the male Norwegian professional league during the 2000 season. Three Norwegian FIFA referees performed retrospective blinded evaluation of the 406 incidents.

Results: Less than one-third of the injuries identified on video and about 40% of the incidents with a high risk of injury resulted in a free kick being awarded. About 1 in 10 of these situations led to either a yellow or red card. The agreement between decisions made by the match referee and the expert referee panel was good, that is, their decisions agreed in 85% of the situations in which injury occurred.

Conclusions: There may be a need for an improvement of the laws of the game of football to protect players from dangerous play.

Keywords: football injuries; injury mechanisms; prevention; video recording

The speed, intensity, and aggressiveness of the game of football have increased over the past decades, especially at the professional level. The incidence of injury in modern top-level football matches is high,^{12,13} and the overall risk of injury to professional players is about 1000 times higher than for industrial occupations.¹² Furthermore, Drawer and Fuller showed that the risk associated with acute injuries is unacceptable when evaluated against work-based criteria.⁶ Football is a contact sport, and 42% to 74% of the acute injuries are considered a result of physical contact between players.^{3,7,10,13,20,21,23} Previous studies have shown that tackling is the primary mechanism of nearly half of the anterior cruciate ligament (ACL) injuries⁴ and most of the sprain injuries³ in both the ankle and knee.^{7,21}

Studies on prevention of football injuries are few,^{5,9,14,18,24-26} and one explanation for the paucity might be the lack of solid evidence about the risk factors and

mechanisms for football injuries at different levels of play. In several studies at lower levels, foul play has been proposed to be the most important cause of injury.^{8,20,21,23} Hawkins and Fuller^{10,11} showed that 15% to 29% of all injuries at the international and elite levels resulted from foul play, whereas the rest of the injuries occurred without a free kick being awarded by the referee. In all the nonfoul situations in which injury resulted, at least 60% still involved player-to-player contact, and it is not known whether referee performance was adequate in these cases. Since reduction of foul play and observance of the existing laws of the game have been proposed as possible interventions to reduce the rate of injuries,⁸ it is important to assess how the laws of the game are being applied by the referees in injury situations.

Thus, the aims of this study were primarily to evaluate how violations of the laws of the game contribute to injury in football and, secondarily, to investigate whether the decisions made by the referees were correct according to the laws of the game of football in situations with a high risk of injury.

METHODS

Videotapes and injury information were collected prospectively for the regular league matches during the 2000

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Norwegian professional football league (April through October). The regular league is a double round robin competition with home and away matches between 14 teams, resulting in a total of 182 matches.

The Norwegian Broadcasting Corporation and TV2 Norway secured a weekly delivery of DVC pro and Beta SP quality videocassettes from 174 of the 182 matches (96%). Regional production teams with one to three cameras were responsible for most of the recordings, although 20 matches were live broadcasts with six cameras, including two high-speed, slow-motion cameras. Of the 174 videotapes, 157 covered the match in full, whereas for 17 matches the tapes covered 73 minutes on average (range, 36 to 87 minutes). Thus, the total duration of the video recordings was 15,367 minutes (256 hours).

The videotapes were reviewed by one physician (TEA) and one expert on football match analysis (AT). All situations in which 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 were noted as an incident. This resulted in a total of 406 incidents that were transferred to a master videotape, including the play leading up to each of them. In 19 of the 406 incidents, two players went down on the pitch.

Football Incident Analysis (FIA)

The incidents on the master videotape were analyzed using FIA by one of the authors (AT).² FIA is a video-based method allowing the playing events leading to incidents to be described using 19 variables such as related to playing position, action with the ball, movement direction and intensity, type of passes, attack type, tackling type, and foul play. The complete FIA results are reported separately.² The decision made by the referee for each incident was recorded from the video as no foul or a free kick for or against the exposed player, and whether the situation led to a yellow or a red card was also noted. Furthermore, ball possession was examined, and the exposed player was classified as being on the attack if his team had ball control and the necessary space and time for decisions with the ball, whereas the incident was classified as defensive if the opposing team was in possession of the ball. A *duel* was defined as an incident involving an opponent and was classified as heading, tackling, screening, running, or other (pushing, kicking, obstructing, stepping, or colliding). Heading, tackling, and screening duels were categorized into active and passive duels. *Passive duels* were defined as incidents in which the exposed player was challenged for ball possession by an opponent, whereas *active duels* were when the involved player was actively contesting ball possession. Tackling type was subdivided into *being tackled* (when the involved player was tackled by the opponent from the front, side, or behind) and *tackling* (when the involved player was tackling the opponent from the front, side, or behind).

Referee Expert Panel

Three Norwegian Fédération Internationale de Football Association (FIFA) referees with long experience in inter-

national football at the club and national team levels independently performed a retrospective blinded evaluation of the 406 incidents based on the master videotape. Blinding was accomplished by editing the video so that the decision of the match referee could not be seen. Their decisions were compared, and in 366 of the 406 incidents a majority agreement could be reached; that is, at least two of three in the referee panel agreed. The performance of the match referee was assessed by comparing his decision with the referee panel decision for these 366 incidents.

Injury Registration

Club medical staff, physiotherapists, and/or physicians, for all of the 14 first league clubs, prospectively recorded all acute injuries that occurred during regular league matches. An injury was recorded if the player was unable to participate in training or match play for at least 1 day following the incident.^{3,19}

All players (approximately 330) with an A-squad contract who participated in matches were covered by the injury registration. A specific injury questionnaire was used, and reports were collected on a monthly basis. The form included information on the date of the injury, in which match the injury occurred, and the approximate time during the match the injury occurred. Furthermore, the playing position and the injury location were registered, and injuries were classified as contusions, sprains, strains, fractures, or lacerations. Finally, each injury received a specific diagnosis using Orchard codes,²² and injury severity was classified according to the duration of absence. Injuries were classified as minor when the player could not fully participate in training or matches for 1 to 7 days, moderate if absent for 8 to 21 days, and serious if absent for more than 21 days. Detailed results from the injury registration are presented in a separate report by Andersen et al. (unpublished data, 2003).

Statistics

All analyses were performed using Statistical Package for the Social Sciences (SPSS). Kappa correlation coefficients were calculated to assess agreement between the decisions made by the match referee and the referee panel. Kappa values between 0.81 and 1.00 are generally interpreted as very good, 0.61 to 0.80 as good, 0.41 to 0.60 as moderate, 0.21 to 0.40 as fair, and less than 0.20 as poor.¹

RESULTS

Incidents and Injuries

During the 174 matches available for video analysis, 406 incidents were recorded and analyzed regarding the decision made by the referee. Of these, 52 incidents resulted in injuries. In the 18 cases that led to minor injuries, no foul was called in 13, a free kick for in 4 (one yellow card), and a free kick against in 1 case. In the 16 cases that led to moderate injuries, no foul was called in 9 and a free kick for

in 7 cases (four yellow cards, one red card). Of the 17 cases that led to a severe injury, no foul was called in 14, a free kick for in 3, and a free kick against in 1 (no yellow or red card). In 234 (58%) of the incidents, no foul was called by the referee, whereas 155 incidents (38%) led to a free kick for and 11 (3%) led to a free kick against the exposed player. In addition, 54 of the incidents that led to a free kick, all of them for the exposed player, also resulted in a yellow card (13% of the total number of incidents) and 2 in red cards (1%). In 6 of the incidents, the decision made by the referee could not be evaluated (2%). Of the 52 injuries seen on video, in 36 cases (69%) no foul was called, whereas 14 (27%) of the injury situations resulted in a free kick for and 2 (4%) in a free kick against the injured player. Five of the injury situations that led to a free kick also resulted in a yellow card (10% of the injury situations) and 1 in a red card (2%) (Fig. 1).

Match Referee Decision for Duels

Of the 406 incidents, nearly all ($n = 381$) resulted from duels, mainly tackling duels ($n = 191$) and heading duels ($n = 82$). Of the 82 incidents (eight injuries) that resulted from heading duels, the exposed player was actively heading in all but 5. In 65% of the heading incidents (four injuries), no foul was called, whereas in 28% of the cases (three injuries), a free kick for and in 6% (one injury) a free kick against the exposed player was called (Table 1). In the heading duels that led to a free kick, a yellow card was also awarded in 1 case but none of the injury situations.

A total of 191 incidents (25 injuries) resulted from tackling duels, and of these 151 (79%) were passive duels in which the exposed player was being tackled (76% injuries) and 40 (21%) were active duels in which he was tackling (24% injuries). In 32% of the 151 passive tackling incidents (58% injuries), the referee called no foul, whereas a free kick was called in 68% of the cases (42% injuries) for the involved player (Table 2). Of the passive tackling incidents, a yellow card was also awarded in 30% of the cases (21% injuries) and a red card in 1 case.

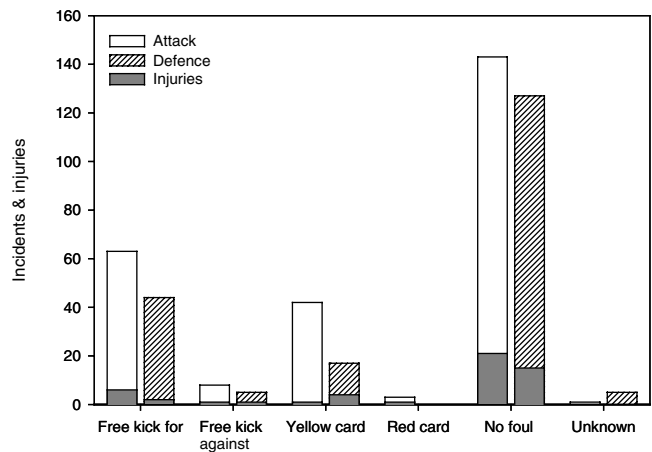


Figure 1. Number of incidents ($n = 425$) and injuries ($n = 52$) classified according to the playing phases and the referee's decision.

Expert Referee Panel

In 290 of the 366 incidents (39 of the 46 injuries), there was agreement between the match referee and the majority decision of the expert panel, that is, the cases where two out of three referees agreed ($\kappa = 0.65$). There was no indication that the rule interpretation of the match referee was stricter or more lenient than the referee panel was (Table 3). The expert panel decided on a free kick for the exposed player in 33 incidents (2 injuries) in which the match referee called no foul. However, the match referee awarded a yellow card in 22 incidents (1 injury) in which the expert panel did not.

When examining the tackling duels only, in 128 of 173 incidents (17 of the 21 injuries) there was agreement between the match referee and the expert panel ($\kappa = 0.60$). The match referee awarded a yellow card in 16 incidents (1 injury) in which the expert panel only gave a free kick for the exposed player. On the other hand, the expert panel awarded a free kick for the involved player in 15 inci-

TABLE 1
The Decision Made by the Match Referee for the Incidents ($N = 406$) and Injuries ($n = 52$) Related to the Types of Duels^a

	No foul	Free kick for	Free kick against	Unknown	Total	Yellow card ^b	Red card ^b
Heading duel	53 (4)	23 (3)	5 (1)	1 (—)	82 (8)	2 (—)	—
Tackling duel	78 (16)	106 (8)	5 (1)	2 (—)	191 (25)	47 (4)	1 (—)
Screening duels	7 (2)	1 (—)	—	—	8 (2)	1 (—)	—
Running duel	3 (—)	1 (—)	—	—	4 (—)	1	—
Other duel ^c	69 (9)	24 (3)	1 (—)	2 (—)	96 (12)	3 (1)	1 (1)
Not in duel	24 (5)	—	—	1 (—)	25 (5)	—	—
Total	234 (36)	155 (14)	11 (2)	6 (—)	406 (52)	54 (5)	2 (1)

^a The figures for injuries are shown in parentheses.

^b All of the yellow and red cards also resulted in free kicks for the exposed player.

^c Other duels: pushing, kicking, obstructing, stepping, and colliding.

TABLE 2
The Decision Made by the Match Referee for the Incidents ($n = 191$) and Injuries ($n = 25$) Resulting From Active or Passive Tackling Duels^a

	No foul	Free kick for	Free kick against	Unknown	Total	Yellow card ^b	Red card ^b
Passive tackling duels							
From the front	14 (3)	36 (4)	—	—	50 (7)	17 (2)	—
From the side	33 (8)	53 (4)	—	—	86 (12)	23 (2)	—
From behind	1 (—)	14 (—)	—	—	15 (—)	6 (—)	1 (—)
Active tackling duels							
From the front	9 (—)	2 (—)	3 (—)	2 (—)	16 (—)	—	—
From the side	21 (5)	1 (—)	2 (1)	—	24 (6)	1 (—)	—
From behind	—	—	—	—	—	—	—
Total	78 (16)	106 (8)	5 (1)	2 (—)	191 (25)	47 (4)	1 (—)

^a The figures for injuries are shown in parentheses. An *active* tackling duel is when the exposed player was being tackled; a *passive* tackling duel is when the player was tackling.

^b All of the yellow and red cards also resulted in free kicks for the exposed player.

TABLE 3
The Decision Made by the Match Referee Versus the Majority Decision Made by the Expert Referee Panel (incidents where two of three referees agreed) for 366 Incidents (including 46 injuries) Observed on Video^a

Referee panel decision	Match referee decision				
	No foul	Free kick	Free kick against	Yellow card	Red card
No foul	179 (32)	7 (2)	1 (—)	2 (—)	—
Free kick for	33 (2)	80 (5)	3 (1)	20 (1)	—
Free kick against	1 (—)	—	3 (—)	—	—
Yellow card	2 (—)	7 (1)	—	27 (2)	—
Red card	—	—	—	—	1 (—)

^a In 40 cases (including 6 injuries), no majority decision could be reached by the referee panel. The figures for injuries are shown in paren-

dents (2 injuries) and a yellow card in 2 incidents in which the match referee called no foul.

In 59 of 73 heading duels (four of seven injuries), there was agreement between the match referee and the expert panel ($\kappa = 0.62$). The expert panel deemed 7 incidents to be a free kick for the exposed player when the match referee called no foul, whereas the match referee awarded a yellow card in 1 incident for which the expert panel only deemed it a free kick.

DISCUSSION

One main finding of this study was that less than one-third of the injuries identified on video and about 40% of the incidents with a high risk of injury resulted in a free kick being awarded by the referee. Furthermore, about 1 in 10 of the situations led to either a yellow or a red card. The second main finding was that the agreement between decisions made by the match referee and the expert referee panel was good; that is, their decisions agreed in 85% of the situations in which injury occurred.

Methodological Considerations

When interpreting the findings of the present study, there are some methodological issues that need to be addressed. First, although we have used the judgment of the members of the expert panel as the gold standard to assess match referee performance, we cannot be sure that their decisions were correct. In most cases, they had only one camera view available, and the view angle of the match referee may have been different from the members of the referee panel in many of the situations. This means that the referee panel may have observed rule violations that the match referee was unable to see and vice versa. However, in contrast to the match referee, they had access to as many slow-motion replays as they needed, and this suggests that their decisions may have been correct in most cases. They were also chosen because of their background as FIFA referees with long international experience from the club and national team levels, and they are all at present referees. All the recordings were edited to blind the panel to the decision made by the match referee, but since the panel members were performing referees, they did lead some of the matches during the 2000 season. Thus, they may have

been able to recognize some of the incidents. The referee panel reviewed the incidents independently, and 15% of the incidents had to be excluded from the analysis, in most cases because the recording of the situation was poor from a referee perspective and could not be evaluated by two of the referees.

It should also be noted that the style of football and the tradition of referring and adherence to the existing rules may differ between Norwegian football and other countries or international tournaments. Therefore, the results from this study on Norwegian professional football may not necessarily be generalized to other levels of play or female football.

Foul Play

The results of this study show slightly more rule violations compared with findings by Hawkins and Fuller from the 1994 World Cup finals, English professional league matches,¹⁰ and the 1996 European championship.¹¹ Studies at lower levels of adult and youth football also found slightly less foul play decisions in situations in which injury occurred.^{15,17}

Nearly all injuries (90%) and incidents (94%) occurred in duels and resulted from player-to-player contact. Half of them were tackling duels, and in two-thirds of the tackling duels the injured player was being tackled, most often from the side. In about 60% of these injuries, no foul was called by the referee (see Tables 1 and 2). The most common mechanism of injury in football is direct contact between opponent players,¹⁵ and in previous studies based on player or coach reports, 44% to 74% of the injuries are considered to be the result of physical contact between players.^{3,7,20,21}

Studies based on video analysis have found similar results,^{11,12} and in nonfoul incidents from which injury resulted, more than 60% resulted from player-to-player contact.¹¹ Hawkins and Fuller¹¹ found that the main mechanisms leading to these player-to-player contact injuries among professional football players were being tackled, tackling, and heading. Furthermore, the same authors highlighted the high numbers of injuries arising from player-to-player contact in nonfoul situations.^{10,11}

Tackling and running were found to be the main mechanisms of injury among low-level adult and youth players in a Danish study.²¹ The figures in this study correspond well with the findings in a recent study by Andersen et al. (unpublished data, 2000) and underline the importance of referees paying close attention to player-to-player contact situations during match play—in particular, tackling and heading duels.

Referee Performance

The correlation between the majority decision of the expert panel of referees and the match referee was good. In 89% of the 203 incidents for which a consensus decision was reached by the referee panel (three out of three), the agree-

ment with the decision made by the match referee was very good¹ ($\kappa = 0.80$, data not shown). To our knowledge, no previous study has assessed the performance of the match referee in injury-related situations in football. This study from the male Norwegian professional league shows that overall, the judgments of the match referees are according to the existing interpretation of the laws of the game and that there was no bias toward too strict or too lenient refereeing by the match referee.

Implications

Over the past years, attention has been directed toward fair play from both FIFA and the United European Football Association, and fair play is also part of the Champions League concept. Law 12 of the *Laws of the Game* describes how fouls and misconducts are penalized, as well as which offences are cautionable (yellow card) or should lead to being sent off (red card).¹⁶ Nevertheless, injuries in football have long been linked to contesting ball possession, and FIFA has therefore looked at rules and rule enforcement by the referees to prevent dangerous play.

The present and other studies show that of the injuries and incidents with a potential for causing an injury from player-to-player contact, a foul is awarded by the referee in 15% to 40% of the cases.^{3,7,10-12,20,21} Perhaps an assessment should be made, as previously suggested in two different studies,^{8,11} to ascertain whether changes or improvements to the existing laws of the game could reduce the numbers of injuries in football. This focus on injury prevention is important and may help to reduce aggressive behavior from players, trainers, and spectators. However, the game of football is highly competitive, and at the top professional level, the glory and the financial benefits of winning are considerable. It may therefore be tempting for players to make use of all means—including aggressive tackling and intentional fouls—to be able to win the game. This development needs to be taken seriously, and the approach to require the referees to be stricter in their implementation of the existing laws of the game does not seem to be enough. The present study shows that compared with the referee panel, Norwegian football referees are not lenient in their interpretation of the rules.

In 34% of the incidents that led to either a free kick for or against the exposed player, a yellow (54 cases) or a red card (2 cases) was also given. However, it should be noted that during the 2000 competitive season in which this video analysis was performed, a total of 468 yellow and 24 red cards were awarded during the 182 regular league matches (personal communication, E. Reimert, Norwegian Football Association). This means that only about 10% of the yellow and red cards that were awarded during the season were given in high-risk injury situations detected during our video analysis. This indicates that player cautions and expulsions are primarily used for other rule violations than those associated with a high injury risk. This is perhaps not surprising since according to the *Laws of the Game*, a player should be cautioned and shown the yellow

card for the following offences: unsporting behavior, showing dissent, persistently infringing the laws of the game, delaying the restart of play, failing to respect the required distance when starting play, and entering or leaving the field of play without permission.¹⁶ This means that none of the seven offences that may lead to a yellow card is explicitly related to injury risk. The *Laws of the Game* also state that a player should be sent off and shown the red card for any of the following offences: serious foul play, violent conduct, spitting, deliberately handling the ball to deny a goal or goal-scoring opportunity, using abusive language or gestures, or receiving a second yellow card in the same match.¹⁶ Thus, the only direct mention of potentially injury-related offences is serious foul play, which should be penalized with a red card. In other words, it is clearly evident that according to the *Laws of the Game*, yellow and red cards are primarily awarded for other reasons than to protect players from injury, although it is frequently claimed that the rules of football are written to protect the players from injuries and incidents with a high risk of injury.¹⁰ When examining the results of the present study, which shows that a red card was given for only two injury-related offences during the entire season, this becomes even clearer.

These findings indicate that there is a need for more specific information about the injury mechanisms in tackling duels and heading duels, including the mechanisms for specific injury types such as head injuries and knee and ankle ligament injuries. This information could be used to amend the laws of the game to penalize behavior known to cause injuries, in the same way that FIFA introduced a new rule before the 1998 World Cup. Tackles from behind were classified as serious foul play and would lead to an immediate red card and expulsion from the game. We are convinced that the rules could be further improved to protect players against dangerous play, but at present we are limited by lack of specific information on the mechanisms for even the most common injury types.

It is questionable, however, whether the penalties awarded are sufficient to have a deterrent effect—even if more specific rules to prevent players from dangerous play were put in place and the rule interpretation by referees were perfect. Some national leagues have introduced postgame video review, strict fines, and disqualifications from future games for intentional, serious foul play, and we think this is an important measure to prevent violent conduct. However, it may be that the existing penalty system is too steeply graded. It seems that a free kick or yellow card has no deterrent effect since as a rule they have no bearing on the result of the game (unless it is a penalty kick or the second yellow card in the same game). In contrast, a red card should have a clear deterrent effect, but as shown in the present study, it is not being used to prevent injuries. In many—if not most—cases, a red card may have a direct bearing on the result of the game, and therefore the referee may hesitate to expel players, especially early in the game. We would argue that there is a need for an

intermediate disciplinary sanction, sufficiently strict to affect player behavior significantly but not so strict that it would rarely be used.

In lower level regional adult divisions and youth football divisions in Denmark, cautionable offences where a yellow card is shown automatically also lead to a 10-minute temporary expulsion from the game. This rule was originally introduced to reduce the workload and the cost of administration connected to the previous system in which yellow cards, when receiving two or three, led to suspension from forthcoming matches. A 10-minute suspension introduced at all levels of football, similar to the existing rules of other sports such as ice hockey, basketball, lacrosse, and team handball, could possibly contribute to reduce aggressiveness in matches, if used for specific fouls associated with a high risk of injury. Whether a 10-minute expulsion should replace the yellow card or come in addition to the existing disciplinary sanctions, or whether the suspension period should be shorter or longer, needs to be discussed further. However, through a 10-minute expulsion the player(s) and the team(s) will have to expiate the sanction immediately, which may influence the actual match both by “cooling down” the players and at the same time also giving the fair-playing team an advantage that could even have an impact on the result of the match. We would argue that such a change in the laws of football could contribute to a safer but still as entertaining and spectacular sport.

CONCLUSION

In this study, we found that less than one-third of the injuries seen on video and about 40% of the incidents with a high risk of injury resulted in a free kick awarded by the referee. Only about 1 in 10 of the free kicks given for the exposed player resulted in either a yellow or a red card. Second, there was a good correlation between the decision of the match referee and the referee panel, and the match referee was neither too lenient nor too strict in his rule interpretation. There may be a need for an improvement of the laws of the game to protect players from dangerous play.

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