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A Thirteen-Year Analysis of Facial Fractures among Professional Soccer Players

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Abstract

This study aims to identify the epidemiology and effects of facial fractures on return to play (RTP) in Major League Soccer (MLS) and the English Premier League (EPL). A total of 39 MLS players and 40 EPL players who sustained facial fractures from 2007 to 2019 were identified. Data on player demographics, the injury, and the impact of their injury on RTP were collected. Elbow-to-head was the most common mechanism of injury (20.3%). The most common fracture involved the nasal bone (48.3%). Most players (90%) RTP the same season. Players who sustained nasal fractures missed significantly fewer games ($p < 0.001$) than those who suffered other craniofacial fractures. Players treated surgically missed significantly more games (3.21 vs. 0.71, $p = 0.006$) and days (30.1 vs. 8.70, $p = 0.002$) than those managed nonoperatively. Significantly more EPL players who sustained facial fractures wore headgear upon RTP compared to MLS players (82% vs. 56%, p <0 .01). Most professional soccer players who sustain a facial fracture RTP the same season, but their recovery time can vary depending on the type of fracture, injury management, or injury severity. Our findings can help inform future craniofacial injury management as well as guidelines on player safety and fracture prevention.

Keywords
- facial fracture
- soccer
- sport injury
- fracture management
- return to play

Soccer is the most popular team sport played and followed worldwide. Common soccer injuries, such as fractures, ligament tears, as well as concussions, have been thoroughly studied.[1–8] Injuries sustained during games may result in prolonged recovery time, which may be detrimental to the player and team's performance, have long lasting effects on the player's career, and place an undue financial burden on the player and their club.[9]

Although musculoskeletal injuries sustained by professional soccer players have been well studied there is little in the literature examining facial fractures. Facial fractures account for approximately 50% of sports-related craniofacial injuries among European amateur soccer players[10] and are also associated with traumatic brain injury and concussions, a growing area of concern among sports-related injuries.[11,12] Serious facial bone injuries can require hospitalization and surgery and have long-term effects on quality of life.[13] While there are studies documenting the effects of craniofacial trauma among amateur soccer players, there has not been a long-term analysis conducted on facial fractures sustained

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in elite soccer leagues and the effect these injuries have on players' return to play (RTP).[14–17]

The goal of this study was to identify the epidemiology and effect of facial fracture injuries on professional soccer players from Major League Soccer (MLS) and the English Premier League (EPL) over a 13-year period.

Materials and Methods

Study Population

Professional soccer players from both the MLS and the EPL who suffered a craniofacial fracture between the 2007 and 2019 seasons (13 seasons, from 2007/2008 to 2019/2020) were identified. These two leagues were specifically chosen because the EPL is the most popular soccer league in the world in terms of viewership, and the MLS is the fastest growing professional sports league in the United States. Candidate players were found through publicly reported data, and each injury was cross-referenced by at least two independent media sources. MLS players were initially identified via a structured search on the league's official Web site, mlssoccer.com, in team press releases with detailed injury reports. EPL players were identified through a structured search of the league's official Web site, premierleague.com, or through national British media Web sites (Sky Sports, The Guardian, The Telegraph, The Daily Mail), with identical search terms as with MLS. The search terms used included "nose/nasal fracture," "jaw/mandible fracture," "zygoma/cheekbone fracture," "orbital fracture," "maxilla fracture," "sinus fracture," and "facial fracture." Players were also identified through a Google search using the terms "masked soccer player" OR "facemask soccer" OR "headgear soccer," as headgear/masks are commonly worn by players who have sustained a facial fracture. Players found through these searches were cross-referenced with injury reports to confirm facial fracture as the reason for wearing the face mask.

Measures Investigated

This study did not require approval from the University of California, Irvine's Institutional Review Board since data were collected from publicly accessible media outlets.

Player demographics, facial fracture information, fracture management, and RTP (games/days missed) were collected and highlighted in ►**Tables 1–4**. Supplementary data concerning player injuries and RTP were found via Web pages (transfermarkt.com, us.soccerway.com), player/team social media pages (Facebook and Instagram), team homepages, TV channel Web sites (Sky Sports, NBC sports), as well as media reports/tabloids (The Daily Mail, The Guardian, The Sun).

Each player's experience at the time of injury was defined as the number of years since their senior team debut; amateur/junior team experiences were not considered. Specific facial fracture diagnoses were noted. The mechanism of injury (hand to face, knee to face, foot to face, elbow to face, shoulder to face, torso to face, ball to face) was found in accordance with previous sports injury mechanism analyses.[18,19] If the fracture site, injury mechanism, injury event (practice vs. game), or management (operative vs. nonoperative) could not be identified within publicly available reports/press releases, it was designated as unspecified.

RTP was calculated as the number of league games or days missed until participation in the next league game. Participation was defined by a player being fit to either play in the match or at the minimum, be on the list of reserves ("on the bench"). To standardize the analysis, concurring competitions, such as domestic cups or European competitions, were not included. Facial fractures which prevented players from RTP in a league game during the same season were classified as "season-ending."

Table 1 Comparison of MLS and Premier League injured player demographics

Variable	MLS ($n = 39$)	Premier ($n = 40$)	p-Value
Games missed, *n*	2.30 ± 3.05	1.03 ± 2.22	**0.011**[b]
Total facial fractures, *n*	45	45	–
Facial fracture type, *n* (%)			–
Nasal	16 (36)	25 (56)	
Zygoma	7 (16)	12 (27)	
Orbital	6 (13)	3 (7)	
Maxilla	3 (7)	0 (0)	
Mandible	3 (7)	3 (7)	
Frontal sinus	2 (4)	0 (0)	
Skull	0 (0)	2 (4)	
Unspecified	8 (18)	0 (0)	
Mechanism of injury			
Hand-to-face	2 (5)	5 (13)	
Knee-to-face	0 (0)	1 (3)	
Foot-to-face	5 (13)	6 (15)	
Elbow-to-face	7 (18)	9 (23)	
Head-to-face	5 (13)	6 (15)	
Shoulder-to-face	1 (3)	1 (3)	
Torso-to-face	1 (3)	0 (0)	
Ball-to-face	1 (3)	0 (0)	
Unspecified	17 (44)	12 (30)	
Concussion status, *n* (%)			0.136[a]
Yes	6 (15)	2 (5)	
No	33 (85)	38 (95)	
Mask status, *n* (%)			$<$ **0.01**[a]
Yes	14 (56)	32 (82)	
No	11 (44)	7 (18)	

Abbreviation: MLS, Major League Soccer.
Note: Values expressed as mean $\pm$ standard deviation unless otherwise indicated.
[a]Pearson's chi-square test (one-tailed).
[b]Mann–Whitney *U* test.

Table 2 Comparison of injured players who returned to play versus season/career-enders

Variable	Returned for ≥ 1 game ($n = 70$)	Did not RTP following injury ($n = 9$)
Age, y	27.3 ± 3.55	27.67 ± 4.44
Height, m	1.83 ± 0.07	1.82 ± 0.07
Weight, kg	78.7 ± 7.14	77.9 ± 6.92
BMI, kg/m^2	23.5 ± 1.59	23.4 ± 1.14
Experience, y	8.58 ± 3.91	7.55 ± 4.88
Facial fractures, *n*	80	10
Facial fracture type, *n* (%)		
Nasal	38 (48)	3 (30)
Zygoma	19 (24)	0
Orbital	8 (10)	1 (10)
Maxilla	2 (2)	1 (10)
Mandible	6 (8)	0
Frontal sinus	2 (2)	0
Skull	1 (1)	1 (10)
Unspecified	4 (5)	4 (40)
Mechanism of injury		
Hand-to-face	7 (10)	0 (0)
Knee-to-face	1 (1)	0 (0)
Foot-to-face	10 (14)	1 (11)
Elbow-to-face	14 (20)	2 (22)
Head-to-face	9 (13)	2 (22)
Shoulder-to-face	2 (3)	0 (0)
Torso-to-face	1 (1)	0 ()
Ball-to-face	0 (0)	1 (11)
Unspecified	26 (37)	3 (33)
Position, *n* (%)		
Defender	31 (44)	4 (44)
Forward	20 (29)	3 (33)
Midfielder	14 (20)	2 (22)
Goalkeeper	5 (7)	0 (0)
Concussion status, *n* (%)		
Yes	6 (8)	2 (22)
No	66 (92)	7 (78)
Mask status, *n* (%)		
Yes	46 (64)	N/A
No	18 (36)	N/A
Games missed prior to RTP	1.69 ± 2.81	N/A
Days missed prior to RTP	15.96 ± 20.2	N/A

Abbreviations: BMI, body mass index; N/A, not available; RTP, return to play.
Note: Values expressed as mean ± standard deviation unless otherwise indicated.

Statistical Analysis

Averages and standard deviations were calculated for continuous variables, while proportions/percentages were determined for categorical variables. Comparisons of player demographics and RTP were determined with unpaired two-sample Student's *t*-tests, while Mann–Whitney *U* tests were used for nonnormally distributed continuous variables. Pearson's chi-square tests of independence were performed to identify differences in distributions of concussion and headgear status for MLS and EPL players. A *p*-value of < 0.05 represented a statistically significant difference.

Results

The search strategy identified 79 professional soccer players, including 40 from the EPL and 39 from the MLS, who sustained various facial fractures over 13-year period. These 79 players sustained 90 facial fractures. The most common facial fractures included nasal (45.6%), zygomatic (21.1%), and orbital (10.0%). A comprehensive breakdown of fracture types can be found in ►**Table 1**. Only eight (10.1%) of the fractures were associated with a concussion. The most common mechanism of injury among those reported included elbow-to-face (36%), foot-to-face (22%), and head-to-face (22%).

Seventy (88.6%) of the players RTP after their injuries, while nine (11.4%) did not. There was no statistically significant difference in player demographics or experience between these two groups. In addition, facial fracture type, mechanism of injury, player positions, and concussion status were varied and did not significantly differ between the two groups (►**Table 2**). On average, players returning from a facial fracture missed 1.69 games and 15.96 days prior to RTP in their next league game. MLS players who returned to play were sidelined for a statistically significant longer amount of time (2.30 ± 3.05 games) compared to EPL players who returned after injury (1.03 ± 2.22 games; $p = 0.011$).

Players who suffered a nasal fracture RTP in a significantly shorter timeframe (3.63 ± 8.63 days) compared to zygomatic (29.2 ± 26.2 days; $p < 0.001$), orbital (27.5 ± 12.3 days; $p < 0.001$), and mandibular (35.3 ± 25.2 days; $p < 0.001$) fractures. No significant differences were observed between the zygomatic, orbital, and mandibular fracture RTP times (►**Table 3**). The 61 players who suffered a single fracture RTP significantly faster, missing 14.0 ± 20.4 days compared to the nine players with multiple concurrent fractures who RTP after missing 35.9 ± 28.1 days ($p = 0.024$).

The most facial fractures were suffered by defenders (44.3%), followed by forwards (29.1%) and midfielders (20.3%). There were no statistically significant differences between player position and RTP in games and days postinjury.

Of the identified players for which data was available, 31 (44.3%) were treated surgically while 39 (55.7%) were managed nonoperatively. Age, body mass index, and professional playing experience demonstrated no statistically significant difference between the two cohorts (►**Table 4**). Players who underwent surgery had a statistically significant longer time

Table 3 Comparison of return to play (in days) among single fracture types

	Nose ($n = 37$, RTP = 3.63 ± 8.63)	Zygoma ($n = 13$, RTP = 29.2 ± 26.2)	Orbit ($n = 5$, RTP = 27.5 ± 12.3)	Mandible ($n = 4$, RTP = 35.3 ± 25.2)
Nose ($n = 37$, RTP = 3.63 ± 8.63)	–	< **0.001**	< **0.001**	< **0.001**
Zygoma ($n = 13$, RTP = 29.2 ± 26.2)	< **0.001**	–	0.70	0.393
Orbit ($n = 5$, RTP = 27.5 ± 12.3)	< **0.001**	0.70	–	0.857
Mandible ($n = 4$, RTP = 35.3 ± 25.2)	< **0.001**	0.393	0.857	–

Abbreviation: RTP, return to play.
Note: Values expressed as mean ± standard deviation (in days) unless otherwise indicated. Mann–Whitney *U* test.

Table 4 Comparison of injured players who were treated operatively versus nonoperatively

Variable	Operative cohort ($n = 31$)	Nonoperative cohort ($n = 39$)	*p*-Value[a]
Age, y	27.7 ± 3.42	27.2 ± 3.52	0.2863
Height, m	1.82 ± 0.07	1.84 ± 0.08	0.2305
Weight, kg	77.5 ± 7.56	79.5 ± 6.87	0.1700
BMI, kg/m^2	23.4 ± 1.77	23.6 ± 1.42	0.3253
Experience, y	8.90 ± 4.05	8.54 ± 3.83	0.2953
Facial fractures, *n*	36	45	–
Facial fracture type, *n* (%)			
Nasal	12 (34)	25 (57)	
Zygoma	10 (29)	8 (19)	
Orbital	2 (5)	5 (11)	
Maxilla	2 (5)	0 (0)	
Mandible	4 (11)	2 (5)	
Frontal sinus	0 (0)	1 (2)	
Skull	1 (3)		
Unspecified	5 (13)	2 (5)	
Games missed, *n*	3.21 ± 3.62	0.714 ± 1.34	**0.006**[b]
RTP, d	30.1 ± 28.4	8.70 ± 12.42	**0.002**[b]

Abbreviations: BMI, body mass index; RTP, return to play.
Note: Values expressed as mean ± standard deviation unless otherwise indicated.
[a]Unpaired two-sample Student's *t*-test (one-tailed).
[b]Mann–Whitney *U* test.

out prior to RTP (3.21 ± 3.62 games/30.1 ± 28.4 days) compared to those who were managed nonoperatively (0.71 ± 1.34 games/8.70 ± 12.42 days; Games: $p = 0.006$, Days: $p = 0.002$). Among the players who did RTP, 64% did so with the use of a face mask. There was a statistically significant difference between the proportion of MLS players (56%) versus EPL players (82%) who wore a face mask upon RTP ($p < 0.01$).

Discussion

Although there are a few studies investigating the incidence and prevention of facial fractures, mostly focused on recreational play, the impact of these fractures on a professional player's RTP has not been discussed. To our knowledge, this is the first study to examine the impact of facial fractures on a players' RTP among major professional soccer leagues. Soccer was found to be the most common sport associated with craniofacial fractures in a literature review from 2000 to 2018 concerning sports-related facial injuries.[20] Injuries to professional soccer players are associated with both increasing financial costs as well as added health risks, including concussions and traumatic brain injury, and therefore it is important to characterize the consequences of these injuries to players' health and ability to participate in future games.

A 2019 study of players in the German Bundesliga from 2009 to 2016 found that nasal bone fractures were the most common fracture among players,[17] which is consistent with our findings that the most frequent site of facial fracture among MLS and EPL players was found to be the nasal bone

(45.6%). The literature surrounding facial fractures in recreational players appears to be more nuanced, however, with the incidence of zygomatic fractures outweighing that of nasal fractures in a recent literature review of facial fractures.[15,21] Nevertheless, Secanho et al concede the true number of nasal fractures in their study was most likely undercharacterized as nasal fractures often have no symptoms and are missed in evaluations of recreational players.

The main mechanism of injury was found to be elbow-to-face contact (36%), with head-to-face and foot-to-face contact closely following (22%). These contact points are supported by previous findings that elbow-to-face and head-to-face contact are the two most common mechanisms of facial injury among soccer players.[8,21,22] In 2006, the International Football Association Board introduced a rule which penalizes a player with a red card for an intentional elbow to an opposing player's face. While this rule may have decreased the incidence of maxillofacial injuries in soccer,[8] our findings suggest that there may be an opportunity for further enforcement. The incorporation of video assistant referee (VAR) in elite worldwide soccer leagues has led to a decrease in the number of fouls and yellow cards in games, as players are aware they can be punished for fouls that the referee might not spot in real-time.[22] VAR may be considered to better identify elbow-to-face contact in games and be used to retroactively discipline players during a game in which elbow-to-face contact was intentionally performed.

Most players who sustained a facial fracture were able to RTP the same season (88.6%). There were no significant differences in player age, experience, mechanism of injury, or facial fracture type between the RTP and non-RTP cohorts. Overall, the 70 players who were able to return missed on average 1.69 games and 15.96 days. These findings are in accordance with prior investigations on facial fractures among soccer players wherein the median absence following a facial fracture was found to be between 16 and 19 days.[2,17]

We found that soccer players who suffered an isolated nasal fracture RTP significantly sooner than those who suffered an isolated zygomatic, orbital, or mandibular fracture. Our findings are in line with both Schiffner et al and Larsson et al, who found RTP among European professional soccer players after nasal fracture to be less than 10 days, whereas RTP for zygomatic, mandibular, or orbital fractures was greater than 20 days.[2,17] While our comparison of facial fracture subtypes is limited by a small sample size, players generally recovered the quickest following nasal fractures. In addition, players who sustained multiple concurrent facial fractures returned to competition significantly longer than those who endured a single facial fracture, likely owing to the need for more complex medical management.

Past literature has found that defenders and forwards are exposed to the most player-to-player contact, but there is conflicting evidence as to whether any association exists between player position and injury types/rates.[23–28] We found no significant differences in facial fracture type between the various soccer positions but did identify intriguing trends—defenders RTP 14.97 days postinjury, midfielders RTP 11.4 days after injury, while forwards RTP after 22.3 days. We postulate this may be because forwards are more likely to use their head as a means of scoring or assisting and are predisposed to more severe craniofacial fractures. Although our findings do not elicit a "most dangerous" player position, they do suggest that with a larger sample size, this undesirable title might be given to the forward position.

Players who required surgical intervention missed significantly more games and days when compared to players who were treated nonoperatively. It is possible that players who underwent operative repair endured more severe fractures, as a higher proportion of nasal fractures did not require surgical intervention. However, we did not find any significant differences in the distribution of fractures between surgically and nonsurgically treated patients. Data from other professional contact sports are consistent with this finding, such as in the management of craniofacial injuries among professional basketball players.[29] Most players (56%) did not undergo surgery, which is contrary to findings from past studies on the management of sports-related maxillofacial fractures.[15,30] However, the subjects in those studies were mostly amateur sports players, and Secanho et al admit that amateur games played without yellow/red cards are often played more violently, possibly leading to more severe fractures. We postulate that because professional athletes are financially dependent on their performance, they are more committed to returning to competitive play sooner than amateur athletes and may opt for nonoperative management when plausible.

Protective headgear was worn by most players upon RTP (72%) for whom data was available. Interestingly, we found that EPL players were significantly more likely to wear headgear upon RTP compared to MLS players. This finding may be a consequence of our fracture incident search methodology as our study was limited to publicly available reports of facial fractures in sports media. Nevertheless, this difference is still important given the documented inconsistent use of facial protection by soccer players. Many athletes, including soccer players, do not use headgear (goggles, mask) in competitive games or only use it during an initial recovery phase because it reportedly causes considerable facial discomfort.[31,32] Mouthguards are also underutilized among professional soccer players and could be used to minimize mandibular injuries.[33,34] The prevention of facial fractures, and especially refractures which require longer recovery periods than primary fractures, is imperative.[2] Our observed deviation in headgear usage between the MLS and EPL ultimately illustrates the need for a standardized facial protection protocol in worldwide soccer.

Around 10% of facial fractures incidents were associated with a concurrent concussion. Although seemingly not a significant percentage, the true number of concussions associated with facial fractures is likely higher. In a study done investigating the 2014 World Cup Tournament, 86% of players with 3 or more concussion signs after a collision continued playing, whereas in a retrospective study of the French Soccer League, 53% of concussed players returned to play during the same game.[35,36] A recent study comparing concussion management in the EPL and MLS showed significant

differences between the RTP time for soccer players in both leagues.[6] This lack of a standardized concussion management protocol in professional soccer is a major reason why many concussions go undiagnosed or are not treated properly. Additionally, previous studies have established an association between facial fractures and brain injuries, including both neurologic injuries and concussions.[37–40] It is well known that the long-term consequences of concussions can include postconcussive syndrome as well as chronic traumatic encephalopathy, leading to neurocognitive impairment if not properly treated.[41,42] This data supports the need for onsite providers to follow a standardized concussion management protocol following a head collision. If a player shows clinical symptoms of a facial fracture, players should also be assessed for a concurrent neurologic injury.

We acknowledge limitations in our investigation. While each player injury was verified by at least two separate media sources, we acknowledge that a retrospective search of publicly available records may have confounded our study results. Despite an extremely rigorous data-gathering protocol, injury data for some players was unavailable, especially surrounding concussions. It is very possible that our search methodology also failed to identify all incidences of facial fractures over the 13-year period.

In addition, to standardize our analysis, we solely judged a player's RTP through league games, which all players participated. Of note, several players were fit for competition prior to the next domestic league game they played, through UEFA/CONCACAF cup competitions or international games. Conversely, many players were also not selected to their national team and played for EPL/MLS teams who were not included in midweek cup competitions (i.e., Champions League, FA cup). Nonetheless, this may marginally exaggerate the true number of days players missed until they were fit to RTP in any competitive game while underestimating the true number of games missed for a longer injury. In addition, the MLS calendar is generally more compact with fewer outside competitions (domestic cups/European competitions), so injured MLS players are more likely to miss MLS league games. This may explain in part why MLS players missed significantly more league games compared to EPL players upon RTP.

Our findings offer insight into common craniofacial fractures that occur among professional soccer players which may guide facial trauma surgeons in identifying, treating, and preventing such injuries. An initial on-field assessment should be aimed toward critical findings that must not be missed including presence of a sunken eye globe, depression of the zygomatic arch, or gross facial asymmetry which suggests a more complex or multifacial fracture.[43,44] A thorough neurologic examination is critical with a focus on evaluating for concussion, which was demonstrated in approximately 10% of the players in our data set. Although not present among our cohort, the presence of unilateral persistent rhinorrhea may suggest damage to the skull base resulting in cerebrospinal fluid leak. These findings indicate that more urgent surgical intervention may be necessary. Ultimately, operative versus nonoperative management depends on imaging findings and patient symptoms, the details of which are beyond the scope of this study. Players should be educated on the high risks of refracture, especially professional athletes who are eager to RTP. Our data show inconsistencies in the use of face masks/guards following craniofacial fractures. Theoretically, these masks can serve as a physical guard to dissipate impact forces to the surrounding facial structures. However, there is limited high-quality research assessing the true benefit of such protective equipment in the postoperative period.[45]

Conclusion

The majority of MLS and EPL soccer players who sustained a facial fracture RTP the same season, although their recovery time varied. Players who suffered a nasal fracture as well as those who solely suffered a single fracture had the shortest injury layoff. Players who did not undergo surgical management of their fracture missed less games postinjury. We hope that our findings can help inform future craniofacial injury management as well as guidelines on player safety and fracture prevention.

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Conflict of Interest
None declared.

Authors' Contributions
K.K., P.R., and A.H. acquired and analyzed data, drafted the manuscript, and granted final approval for the manuscript to be submitted for publication. A.P. and L.S. contributed to the interpretation of the data, drafting of the manuscript, and granted final approval for the manuscript submission.

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