Return to Play Rates in NFL Wide Receivers and Running Backs After ACL Reconstruction

An Updated Analysis

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Background: Anterior cruciate ligament (ACL) ruptures are potentially career-threatening injuries to National Football League (NFL) skill position players. A 2006 study showed a return-to-play (RTP) rate of 79% for NFL running backs (RBs) and wide receivers (WRs). Since then, a number of factors affecting RTP, including style of play as well as rules regarding hits to the head, have changed how defensive players tackle offensive ball carriers.

Purpose/Hypothesis: To determine whether the RTP rate for RBs and WRs in the NFL has changed since data were collected in the 2000s. Additionally, we evaluated player performance before and after ACL reconstruction (ACLR). We hypothesized that there will be a lower RTP rate than previously reported as well as a decrease in performance statistics after ACLR.

Study Design: Descriptive epidemiology study.

Methods: Publicly available NFL injury reports between the 2009-2010 and 2015-2016 seasons were utilized for RBs and WRs who underwent ACLR. Successful RTP was indicated by playing in at least 1 NFL game after reconstruction. Position-specific performance statistics from before and after reconstruction were gathered for these players, and the RTP players were compared against the players who did not RTP (dnRTP group). Pre- and postinjury performance measures were also compared against a matched control group of NFL RBs and WRs who had not sustained an ACL injury.

Results: Overall, 61.8% of players (64.5% of RBs, 60% of WRs) returned to play at a mean of 13.6 months. Prior to injury, the RTP group had played in significantly more career games and had significantly more rushes and receptions per game than the dnRTP group; however, there was no significant difference in performance after ACLR. The WR RTP group had significantly decreased performance in all measured categories when compared with the control group.

Conclusion: Our study found a lower RTP rate in RBs and WRs than previous studies conducted in the early 2000s. WRs who achieved RTP had decreased performance when compared with noninjured controls.

Keywords: ACL; anterior cruciate ligament; knee ligaments; football; return to play; NFL

Pivoting on a planted foot in American football places extreme demands on the ligaments stabilizing the joints of the lower extremity. The anterior cruciate ligament (ACL) is at particular risk because of the significant torque and forces placed across the knee during cutting, pivoting, and tackling. ACL ruptures comprise 2% of injuries in the National Football League (NFL), with offensive skill position players (eg, running backs [RBs] and wide receivers [WRs]) experiencing the highest frequency of injury.[2,7] The vast majority of players who sustain an ACL tear will undergo arthroscopically assisted single bundle bone-patellar tendon-bone reconstruction.[2,22]

Previous reports on professional athletes, including NFL players, have demonstrated return to play (RTP) at varying rates, based largely on player position.[9,10,19,21] One study reported a 92% RTP rate for NFL quarterbacks,[11] while another reported 64% for offensive and defensive linemen.[5,10] The most recent study of RTP in RBs and WRs,

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published in 2006, utilized data from the 5 seasons from 1998 to 2002 and found that 79% returned to play for at least 1 play in an NFL game after ACL reconstruction (ACLR).[3] The offensive game strategy has since changed.[6,12,20,25,29] As NFL offenses focus more on a passing strategy, both RBs and WRs have increased opportunities to touch the ball and be tackled, increasing their odds of sustaining an ACL injury.

Many rule changes have occurred with respect to player safety. Specifically, in 2009, the NFL instituted a rule change regarding hits to the head or neck area of defenseless receivers.[16,18] As more public attention has been drawn to head injuries, defensive players have been discouraged from making hits to the head. Penalties for an illegal hit to the head result in yards for the offense, a fine, and even a suspension. If forced to choose a high or a low hit, defensive players may consider a low hit in order to avoid these penalties. Additionally, there is no rule that protects the knees of offensive ball carriers while being tackled. This leaves offensive skill players vulnerable to unexpected and awkward tackles and hits to the legs. In addition to rule changes, new surgical techniques have emerged. Transtibial femoral tunnel drilling has fallen out of favor while a more anatomic tunnel placement technique is used that allows for improved rotational stability.[26] Changes in rehabilitation protocols have also been instituted with criteria-based guidelines predicated on progression-replacing, time-based protocols,[4] thus allowing more individualized programs for athletes that may be progressing faster than others. The NFL has evolved since the conclusion in 2002 of the last comparison study of RBs and WRs[3]; the players are bigger and faster than in the past, although the effect on ACL injury and RTP is unclear.[13,27]

The purpose of this study was to determine if the RTP rate for RBs and WRs has changed since prior data were collected. Additionally, we sought to determine whether there was a noticeable change in player performance after ACLR by comparing preinjury with postinjury statistics of players who sustained an ACL rupture.

METHODS

A record of NFL injury reports between 2009-2010 and 2015-2016 seasons was compiled from publicly available data. The injuries were tracked during the preseason, regular season, playoffs, and offseason. Sources included official press releases, team websites, NFL.com, and pro-football-reference.com. The list was initially filtered for knee injuries. The list was further narrowed by position with players listed as RB or WR. Each remaining injury was then researched individually to determine if ACL injury and subsequent reconstruction occurred. Players with an ACL injury prior to the study period were excluded from the study group. If a player had not recorded any game statistics before the ACL injury that occurred during the study period, this player was counted in the RTP group but was not included in the analysis with the control players. Information concerning concomitant knee injuries was not readily available; as such, this was not recorded. A total of 76 players were identified with a primary ACL injury that met the inclusion criteria.

For each player, we determined if the player was successful in RTP after ACLR, where RTP was defined as playing in at least 1 NFL game after surgery. The most comparable prior study defined RTP as participating in at least 1 play.[3] However, other similar studies have also defined RTP as participating in at least 1 game.[5,15,21] We also recorded the time to RTP and calculated the mean time to RTP for each position group.

Performance statistics were gathered for each player, including career games played, percentage of games started, age at time of injury, and timing of injury. Furthermore, position-specific performance statistics were collected both before and after injury for RBs (yards per rush, rushes per game, and rushing touchdowns per season) and WRs (yards per reception, receptions per game, and receiving touchdowns per season). Post hoc analysis was carried out on these data using a paired t test for pre- versus postinjury RTP statistics. An unpaired t test was used to compare the preinjury statistics for players who achieved RTP versus those who did not achieve RTP. Players who did not have performance statistics before or after injury were excluded from the performance analysis. However, these players were still included in our RTP calculations.

A matched control group was identified for those players who returned to play; performance statistics were analyzed between these groups in an attempt to simulate their statistics if the player were not to sustain an injury. An algorithm was designed to identify matched controls for the RTP group. The control group was intentionally created to produce similar opportunities against similar opponents. This was achieved by identifying a player of the same position from the same team roster who had the same consecutive healthy seasons to match the injured player, such that both position groups were 1:1 with the control group. The healthy seasons included the 2 seasons preceding and the 2 seasons after the injury. The injury season was not included in the either group as some players were injured in the early part of the season and some were injured later in the season. If no player on the same team roster met inclusion criteria, a player was selected from a team roster in the same division in order to allow for exposure to similar opponents. A healthy season was defined as playing in a minimum of 12 games. A total of 4 years of performance data were collected for the injured and control players. The exclusion criteria for the control group included any history of ACL injury as well as any injury that resulted in the player missing more than 4 games during the study period. A thorough investigation was conducted to establish that no control player had an ACL injury before the study period. The performance data for the control players were gathered in a manner similar to that for the players in the study group. In total, 36 players comprised the control group. An unpaired t test was used to compare players in the RTP group with the matched control group for statistics before and after the injury season.

TABLE 1
Player Demographics and Performance Before Injury by Group[a]

	RTP (n = 47)	Did Not RTP (n = 29)	*P* Value
Demographics			
Age at time of injury	25.88 ± 2.81	25.61 ± 2.66	.6682
Timing of injury			
Preseason	9	11	
Regular season	28	14	
Playoffs	1	0	
Offseason	4	4	
Position			
Running back	20	11	
Wide receiver	27	18	
Performance[b]			
Career games played	72.16 ± 47.07	40.05 ± 45.94	**.0128**
Career games started (%)	40.80 ± 31.30	30.80 ± 32.6	.2445
Wide receivers			
Yards/reception	11.21 ± 8.3	8.77 ± 7.5	.1746
Receptions/game	2.29 ± 1.9	1.46 ± 1.6	**.04**
Receiving TDs/season	3.42 ± 3.1	1.82 ± 2.7	.2955
Running backs			
Yards/rush	4.46 ± 1.9	2.46 ± 2.4	**.0004**
Rushes/game	7.72 ± 6.8	2.16 ± 3.1	**.0002**
Rushing TDs/season	3.51 ± 4.5	0.58 ± 1.5	**.0019**

[a]Data are recorded as n or mean ± SD unless otherwise indicated. Bolded *P* values indicate statistically significant differences between groups ($P < .05$). RTP was defined as playing in at least 1 NFL game after ACL reconstruction. ACL, anterior cruciate ligament; RTP, return to play; TD, touchdown.

[b]Performance in this table includes in-game statistics for the injury season and the 2 previous seasons.

RESULTS

Of the 76 players studied, 47 (61.8%) achieved RTP and 29 (38.2%) did not. 64.5% of RBs sucessfully returned compared with 60% of WRs. There were 6 RTP players without preinjury statistics to report, so they were omitted from the performance analyses. Additionally, 5 players sustained repeat ACL tears and were therefore included in only the preinjury RTP group for their primary injury and were excluded from further statistical analysis.

A comparison of the players who achieved successful RTP and the players who did not is shown in Table 1. Significantly more players who achieved RTP had more career games than those who did not reach RTP. There was no statistical difference in career games started. Time to RTP was not significantly different between the RB and WR groups at an average of 13.6 months (14.43 ± 9.6 vs 12.67 ± 2.8 months; $P = .4065$), although the RB group took almost 14.5 months to achieve RTP, almost 2 months longer than the WR group (Figure 1). This difference was the result of 1 RB taking 47 months to achieve RTP. The median RTP time for RBs was 12 months.

Results of the performance analysis for the RTP players (before vs after injury and compared with matched controls) are shown in Table 2. Before injury, WRs in the RTP group had significantly more receptions per game than those who did not achieve RTP. Similarly, the RBs who achieved RTP had significantly more yards per rush, rushes per game, and touchdowns per season than those who did not. Additionally, for each of the 3 performance categories, the WR RTP group had significantly decreased performance after ACLR when compared with preinjury performance.

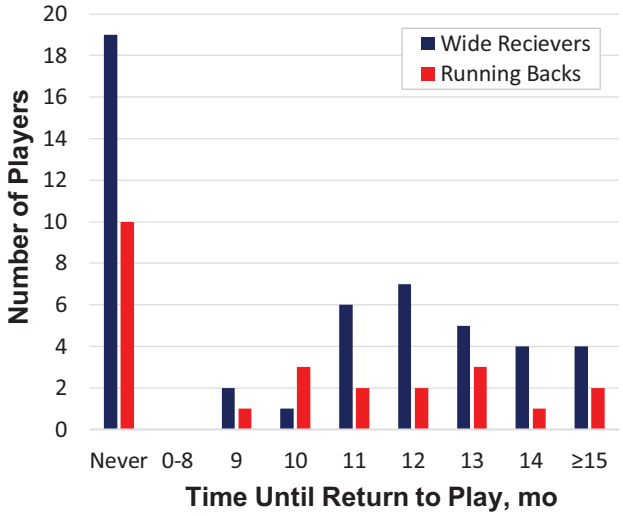

Figure 1. Months to return to play for wide receivers and running backs.

When compared with the control group, the WR RTP group had significantly fewer receptions per game, yards per reception, and receiving touchdowns per season. When evaluating RBs, there was no difference in yards per rush, rushes per game, or rushing touchdowns per season in RTP group compared with the control group. There was no significant difference in preinjury performance between the RTP and control groups. This demonstrates a valid comparison between the injury and control groups.

DISCUSSION

The primary goal of this study was to determine whether the RTP rate for NFL skill position players from 2009-2016 had changed since prior data were collected from the 1998-2002 seasons.[3] Our study showed a lower RTP rate of 62% compared with earlier reports of 79% and 74%.[3,21] One factor that may have contributed to the difference in RTP was the advancement and availability of the internet. As the internet has become more accessible, much of the sporting media coverage is readily available and consumed online. Our finding is similar with the 59.2% RTP rate reported for RBs and WRs in the 2013-2015 seasons, although this was a smaller sample size than the current study.[8] Previous studies have referenced a premade NFL injury database constructed for research purposes; however, our data collection was unique, as each team roster was searched to identify injured players.[15] Additionally, we used true performance measures to provide a more realistic impact of ACL injury

TABLE 2
Performance Before ACL Injury and After Reconstruction[a]

	RTP Group (n = 36)			Control Group (n = 36)			
	Before	After	*P* Value[b]	Before	After	*P* Value[c]	*P* Value[d]
Wide receivers							
Yards/reception	12.71 ± 6.31	9.92 ± 6.08	**.0143**	13.11 ± 3.01	12.88 ± 2.22	**.0068**	.7112
Receptions/game	2.86 ± 1.18	1.95 ± 1.80	**.0013**	3.27 ± 1.58	3.70 ± 1.52	**.0001**	.2834
Receiving TDs/season	3.71 ± 3.17	2.12 ± 3.36	**.0011**	4.07 ± 3.45	3.98 ± 2.25	**.0043**	.6353
Running backs							
Yards/rush	4.45 ± 0.81	3.42 ± 1.32	**.0044**	4.41 ± 1.28	3.89 ± 0.76	.1334	.7826
Rushes/game	8.43 ± 6.75	6.78 ± 6.16	.2851	9.24 ± 5.85	9.23 ± 6.12	.1742	.3785
Rushing TDs/season	4.59 ± 4.95	2.36 ± 3.62	.0702	4.21 ± 4.22	4.19 ± 4.3	.1217	.9565

[a]Data are recorded as mean ± SD. For each combination of matched players, the "before" data include 2 seasons preceding the injury and the injury season and the "after" data include 2 seasons the injury season. Bolded *P* values indicate statistically significant between-group differences ($P < .05$). ACL, anterior cruciate ligament; RTP, return to play; TD, touchdown.
[b]For comparison of player performance before versus after injury.
[c]For comparison of the postinjury performance of the RTP group versus the "postinjury" performance of the control group.
[d]For comparison of the preinjury performance of the RTP group versus the "preinjury" performance of the control.

on player performance. Carey et al[3] used surrogate measures including power ratings to measure injury impact on performance. We feel that for the general population interested in sports, as well as the players and other staff in the NFL, the classical way of reporting statistics is the most common way to discuss a player's performance. Using a power rating system allows for a uniform scale to compare performance, but ultimately, it is neither standardized nor commonly used and therefore not as useful in discussing performance as true performance measures are. There are certainly other efficiency measures; however, these were outside the scope of this study.

As the internet has become the main outlet for sports reporting and viewing, it is possible that there were missed injuries in prior studies in which much of the data were available largely (or solely) in print. The football rule against the chop block may have lowered the incidence of ACL injuries among defensive players, but no such protection exists for RBs and WRs.[1] Beginning in 2009, the NFL began to implement rules pertaining to the safety of the head and neck area of defenseless receivers.[16,18] There is no explicit rule about hitting a ball carrier around the knee. Since 2009, the focus has been on protecting the brain; due to this, if a defensive player hits an offensive player, he has to choose between a penalty, a fine, and possible suspension for an illegal hit to the head compared with a lower hit to the body or legs of the receiver or runner. The size and speed of players has changed over time with faster and larger players, although the significance of this evolution is unclear.[17] Our RTP rate is much lower than what most team physicians report. In a study that reported that the RB position was at the highest risk of ACL tear, 90% of team physicians responded in a survey that "90 to 100%" of players return to the NFL, and it is possible that they are using that number when counseling coaches, agents, and players about RTP.[2]

There was a significant difference in the number of career games played between the RTP and non-RTP groups. The percentage of career games started was higher in favor of the RTP group, but not significantly. This may be attributable to better players being able to return and overcome an ACL injury. Another influencing factor involves the so-called "franchise" players. If the franchise or star player is injured, the organization is more likely to keep this player under contract during the recovery period than a player who is perceived as less valuable to a team's success. A previous report showed a correlation between early draft pick status and the ability to achieve RTP after ACLR.[30] When compared with the group that did not RTP, the preinjury statistics of the RTP group of both RBs and WRs showed increased production. This was possibly attributable to a combination of greater skill as well as more opportunity. Prior studies showed that early round draft picks and more talented players tend to return after ACL injury.[8,19,21,23,30]

Our data supported a later RTP at approximately 12-14 months compared with a previously reported time of 9-12 months for RBs and WRs.[3] In the RTP group, no player was able to complete RTP in less than 9 months. This represents a change in treatment since 2002, as 65% of team physicians at that time allowed return to full activity at 6 months after reconstruction.[2] The reasoning for this finding is unclear as the standard surgical treatment has not changed. One contributing factor may be the timing of the injury. For example, if a player is injured in September at the start of the season, he will not be ready to RTP during the current season, which concludes in February. Thus, despite this player's being ready to play, the league season has not commenced and RTP is prolonged.

WRs in the RTP group, compared with their preinjury statistics, had a significant decrease in all measured categories. For RBs, there was a trend toward decreased production, but this did not reach statistical significance. This could be attributed to some of the RBs being statistical outliers with notably higher averages, allowing the overall averages to be comparable with control group players. The design of the control group was intentional. As there is usually only

1 RB on the field at a time, this may appear inequitable; however, the preinjury RTP group statistics and the control preinjury statistics are not significantly different, making this a valid comparison. Many teams have transitioned to using multiple RBs throughout a game.[11,14,28] These results are applicable only to players with successful RTP.

There are a number of limitations to this study. It is a retrospective review of publicly available data; thus, we may not have known the full extent of the injury or the presence of concomitant injuries. For example, players may have had meniscal, cartilage, or other bony or soft tissue injuries that were not reported, which could have affected their RTP rate. ACL injuries with articular damage, or those that need partial or total medial and/or lateral meniscectomies, fare worse subjectively and on objective measures.[24] The means of identifying injured players was challenging. The media coverage was disproportionate, as more is reported on injured star players. However, players who were on only the preseason roster and players who spent time on the practice squad likely did not garner the same amount of media attention and detailed reporting as some of the high-profile players.

Despite demonstrating a statistically valid control group, the principle of having a control group is based off of a specific intervention. Our control group was more of a measuring stick in that sense, as there was no true intervention. It served as a group with similar opportunities as the injured group to compare performance over time. For the WRs, it was not a perfectly equal comparison, as there are up to 4 or 5 WRs on the field at a given time. Reasons for not returning to play are not fully known; however, reasons may include decreased ability, a team having moved on to another uninjured player, age, or other personal reasons. Information was generally not available about the specific surgical technique employed in each scenario, though among surveyed team physicians, up to 97% report bone–patellar tendon–bone as the graft of choice.[9] Additionally, clinical follow-up and rehabilitation protocols were unknown. This study was limited to NFL RBs and WRs and may not be applicable to other position groups.

CONCLUSION

Our study found that approximately 62% of NFL RBs and WRs achieved successful RTP. On average, these players took 12-14 months to RTP, which is longer than what was previously reported. WRs with successful RTP demonstrated decreased performance when compared with the control group. RBs had an insignificant drop in production after ACL reconstruction. This updated information may be helpful to competitive athletes as well as team physicians who care for and counsel athletes about potential RTP. It may also be helpful for NFL general managers, owners, scouts, and coaches in evaluating players with a history of ACL injury.

REFERENCES

1. Baker HP, Varelas A, Shi K, Terry MA, Tjong VK. The NFL's chop-block rule change: does it prevent knee injuries in defensive players? *Orthop J Sports Med*. 2018;6(4):2325967118768446.
2. Bradley JP, Klimkiewicz JJ, Rytel MJ, Powell JW. Anterior cruciate ligament injuries in the National Football League: epidemiology and current treatment trends among team physicians. *Arthroscopy*. 2002; 18(5):502-509.
3. Carey JL, Huffman GR, Parekh SG, Sennett BJ. Outcomes of anterior cruciate ligament injuries to running backs and wide receivers in the National Football League. *Am J Sports Med*. 2006;34(12):1911-1917.
4. Cavanaugh JT, Powers M. ACL rehabilitation progression: where are we now? *Curr Rev Musculoskelet Med*. 2017;10(3):289-296.
5. Cinque ME, Hannon CP, Bohl DD, et al. Return to sport and performance after anterior cruciate ligament reconstruction in National Football League linemen. *Orthop J Sports Med*. 2017;5(6): 2325967117711681.
6. Clary J. Passing league: explaining the NFL's aerial evolution. Accessed April 25, 2020. https://bleacherreport.com/articles/729496-nfl-has-the-nfl-really-turned-into-a-pass-first-league
7. Dodson CC, Secrist ES, Bhat SB, Woods DP, Deluca PF. Anterior cruciate ligament injuries in National Football League athletes from 2010 to 2013: a descriptive epidemiology study. *Orthop J Sports Med*. 2016;4(3):2325967116631949.
8. Eisenstein ED, Rawicki NL, Rensing NJ, Kusnezov NA, Lanzi JT. Variables affecting return to play after anterior cruciate ligament injury in the National Football League. *Orthop J Sports Med*. 2016;4(10): 2325967116670117.
9. Erickson BJ, Harris JD, Fillingham YA, et al. Anterior cruciate ligament reconstruction practice patterns by NFL and NCAA football team physicians. *Arthroscopy*. 2014;30(6):731-738.
10. Erickson BJ, Harris JD, Heninger JR, et al. Performance and return-to-sport after ACL reconstruction in NFL quarterbacks. *Orthopedics*. 2014;37(8): e728-e734.
11. Football Outsiders. NFL snap counts. Accessed April 23, 2020. https://www.footballoutsiders.com/stats/nfl/snap-counts?year=2019&team=ALL&week=ALL&position=RB&op=Submit&form_build_id=form-aMxgz2p5UiCqZXuR6wLkEVVeNM-B9X9VRFl2k6a76U&form_id=fo_stats_snap_counts_form
12. Hermsmeyer J. For a passing league, the NFL still doesn't pass enough. Accessed April 25, 2020. https://fivethirtyeight.com/features/for-a-passing-league-the-nfl-still-doesnt-pass-enough/
13. Kelly R. How NFL players have evolved. Accessed June 4, 2020. https://www.stadiumtalk.com/s/evolution-nfl-football-players-7aa420a72ca24a40
14. Lineups. 2019-2020 Running back (RB) touches. Accessed April 27, 2020. https://www.lineups.com/nfl/player-stats/running-back-rb-touches
15. Mai HT, Alvarez AP, Freshman RD, et al. The NFL Orthopaedic Surgery Outcomes Database (NO-SOD): the effect of common orthopaedic procedures on football careers. *Am J Sports Med*. 2016;44(9): 2255-2262.
16. NFL Operations. 2019 NFL rulebook. Accessed April 23, 2020. https://operations.nfl.com/the-rules/2019-nfl-rulebook/#penalty-summary
17. NFL Operations. Evolution of the NFL player. Accessed April 23, 2020. https://operations.nfl.com/the-players/evolution-of-the-nfl-player/
18. NFL Operations. Health and safety rule changes. Accessed April 23, 2020. https://operations.nfl.com/football-ops/nfl-ops-honoring-the-game/health-safety-rules-changes/
19. Okoroha KR, Kadri O, Keller RA, et al. Return to play after revision anterior cruciate ligament reconstruction in National Football League players. *Orthop J Sports Med*. 2017;5(4):2325967117698788.
20. Powell-Morse A. Evolution of the NFL offense: an analysis of the last 80 years. Accessed April 25, 2020. https://www.besttickets.com/blog/evolution-of-nfl-offense/
21. Read CR, Aune KT, Cain EL Jr, Fleisig GS. Return to play and decreased performance after anterior cruciate ligament reconstruction in National Football League defensive players. *Am J Sports Med*. 2017;45(8):1815-1821.
22. Schrock JB, Carver TJ, Kraeutler MJ, McCarty EC. Evolving treatment patterns of NFL players by orthopaedic team physicians over the past decade, 2008-2016. *Sports Health*. 2018;10(5):453-461.

23. Shah VM, Andrews JR, Fleisig GS, McMichael CS, Lemak LJ. Return to play after anterior cruciate ligament reconstruction in National Football League athletes. *Am J Sports Med*. 2010;38(11):2233-2239.
24. Shelbourne KD, Gray T.Results of anterior cruciate ligament reconstruction based on meniscus and articular cartilage status at the time of surgery. Five- to fifteen-year evaluations. *Am J Sports Med*. 2000; 28(4):446-452.
25. Sphigel B, Pennington B. How offense took over the N.F.L. Accessed April 25, 2020. https://www.nytimes.com/2019/01/19/sports/nfl-offense-records.html
26. Tompkins M, Milewski MD, Brockmeier SF, et al. Anatomic femoral tunnel drilling in anterior cruciate ligament reconstruction: use of an accessory medial portal versus traditional transtibial drilling. *Am J Sports Med*. 2012;40(6):1313-1321.
27. Veltman N. NFL players: height and weight over time. Accessed May 30, 2020. https://noahveltman.com/nflplayers/
28. Wong M. Analyzing the efficiency of using multiple running backs in the NFL. Accessed April 23, 2020. https://bleacherreport.com/articles/123587-utilizing-multiple-rbs-the-current-trend-in-nfl-examining-the-efficiency
29. Wyche S. Passing league: explaining the NFL's aerial evolution. Accessed April 25, 2020. http://www.nfl.com/news/story/09000d5d82a44e69/article/passing-league-explaining-the-nfls-aerial-evolution
30. Yang J, Hodax JD, Machan JT, et al. National Football League skilled and unskilled positions vary in opportunity and yield in return to play after an anterior cruciate ligament injury. *Orthop J Sports Med*. 2017; 5(9):2325967117729334.