Return to Sport and Performance After Anterior Cruciate Ligament Reconstruction in National Football League Linemen

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Background: Tears of the anterior cruciate ligament (ACL) are common in the National Football League (NFL). The impact of these injuries on the careers of NFL linemen is unknown.

Purpose: To define the percentage of NFL linemen who return to sport (RTS) after ACL reconstruction, the mean time to RTS, and the impact on performance compared with matched controls.

Study Design: Cohort study; Level of evidence, 3.

Methods: Data on NFL offensive and defensive linemen who sustained an ACL tear and underwent ACL reconstruction between 1980 and 2015 were analyzed. Players were identified through NFL team websites, publicly available injury reports, player profiles, and press releases. Demographics and mean in-game performance data preinjury and post–ACL reconstruction were recorded. A player was deemed to have returned to sport if he played in at least 1 NFL game after his ACL reconstruction. A healthy control group was selected to compare in-game performance data and was matched with the study group on several parameters.

Results: Overall, 73 NFL linemen met the inclusion criteria; 47 (64.3%) returned to play after ACL reconstruction (62.5% of offensive linemen, 65.9% of defensive linemen). All offensive linemen successfully returned to play the season after injury. No difference existed in number of seasons, total number of games played, mean number of games played, or mean number of games started per season when offensive linemen who RTS after ACL reconstruction were compared with matched controls (all $P > .05$). Among defensive linemen who RTS, most returned the season after injury (88.9%). There was no difference between defensive linemen who RTS after ACL reconstruction and matched controls in any performance metrics as an average over the remainder of their career (all $P > .05$). However, NFL defensive linemen who tore their ACL played fewer total seasons than matched controls ($P = .020$).

Conclusion: Overall, 64.3% of NFL offensive and defensive linemen who undergo ACL reconstruction returned to play. Linemen who RTS do so at a high level, with no difference in in-game performance or career duration when compared with matched controls.

Keywords: ACL; return to sport; NFL; linemen

Each year there are more than 200,000 anterior cruciate ligament (ACL) injuries in the United States; ACL reconstruction is undertaken for half of these injuries.[1,10] The risk of sustaining an ACL tear is significant for athletes who play high-level contact sports that require cutting and pivoting. In the National Football League (NFL), ACL injuries account for 2% of all injuries.[2] For these high-level athletes, the goal of treatment is to return the athlete to preinjury functional level within a reasonable time frame. The consensus among a majority of orthopaedic surgeons treating these athletes is that ACL reconstruction with a single-bundle bone–patellar tendon–bone autograft is the best treatment option to achieve that goal.[2,8]

Many studies report excellent functional outcomes after ACL reconstruction with high rates of return to sport (RTS) in competitive athletes.[7,9,12,17] In the NFL, more than 95% of quarterbacks and 79% of running backs and wide receivers return to play again at a high level after ACL reconstruction.[4,9] The most common NFL positions affected by ACL injuries are offensive and defensive linemen.[2,3] These athletes are particularly susceptible to sustaining an ACL tear due to the demands and risks of their position, such as twisting of the knee, getting pushed forcefully to the ground, and getting rolled up on from behind. However, there is a paucity of literature regarding ACL tears in NFL offensive and defensive linemen, the RTS time associated with their injuries, and their performance after RTS.

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The purpose of this study was to (1) determine the RTS rate in NFL offensive and defensive linemen after ACL reconstruction and (2) evaluate performance at the time of RTS by comparing the differences in performance before and after ACL reconstruction with matched controls. We hypothesized that there would be a high rate of RTS among NFL linemen after ACL reconstruction and that in-game performance after surgery would not differ from that of matched controls.

METHODS

Data on NFL offensive and defensive linemen who sustained an ACL tear and underwent an ACL reconstruction between 1980 and 2015 were collected for analysis. We wanted to maximize the number of linemen included in the study, so 1980 was chosen as the start point. Previous studies published on RTS after ACL reconstruction in professional athletes have gone as far back as 1975.[12] Players were identified through an extensive search of publicly available online information using the keywords "ACL OR Anterior Cruciate Ligament" AND "NFL OR National Football League." The same search was also performed for each year with "ACL OR Anterior Cruciate Ligament" and the name of the current 32 NFL teams as well as previous teams (eg, Houston Oilers, Baltimore Colts). As these data were publicly available, approval from the institutional review board was not required.

Public databases that were searched included Google.com, NFL.com, ESPN.com, CBSSports.com, and SBnation.com. Publicly available information such as injury reports, player profiles/biographies, and press releases on these websites were used to identify linemen who suffered an ACL tear. This included players who suffered ACL tears during in-season or preseason games, practices, and training camp. Linemen were included if their ACL tear was unilateral and reconstructed. Players who had suffered a meniscal tear, cartilage injury, medial collateral ligament injury, or lateral collateral ligament injury (but not both at the same time) were included in the study. Players who suffered multiple ACL tears were only included if they had sufficient data for their first ACL tear. Players were excluded from the study (1) if they had incomplete or unavailable data for the preinjury, postinjury, or injury years; (2) if they had multiligament injuries (combined ACL and posterior cruciate ligament injuries, or combined ACL and bicollateral ligament injuries); or (3) if they did not play at least 1 NFL season before their injury or if they had sustained their ACL tear within the previous 12 months, as these players did not have sufficient time to RTS. Furthermore, if players returned to football outside of the NFL (Canadian Football League, Europe), they were considered as not having RTS, as the purpose of this study was specifically to look at RTS in the NFL. We did not believe we could reliably determine if a player returned to play in Europe or Canada with publicly available information.

The data that were collected included demographic data and average in-game performance data preinjury and post–ACL reconstruction. A player was deemed to have RTS if he played in at least 1 NFL game after ACL reconstruction. Demographic data included position, league, age at injury, side of injury, body mass index (BMI), draft year, draft round, months from injury to RTS, total number of Pro Bowl appearances, total number of seasons played before and after the injury, and total number of games started before and after the injury. For defensive players, average in-game performance data collected and analyzed included sacks, tackles, assists, interceptions, interceptions returned for touchdowns, pass deflections, forced fumbles, fumble recoveries, and fumble recoveries for touchdowns. In-game performance variables were analyzed both as an average over the pre- and postinjury course of the players' careers as well as separately in each of the first 3 subsequent seasons after the player returned to the NFL after reconstruction.

A control group was selected to compare in-game performance data with the study group. The controls were matched to cases on all the following parameters: age, sex, BMI, position, draft year, draft round, number of Pro Bowl appearances prior to injury, and all measured performance variables prior to injury. For controls, an index year analogous to ACL reconstruction year in cases was designated as a matched reference year to compare pre– and post–ACL reconstruction data. The demographic and performance data were collected and analyzed in the same manner for both the controls and study participants.

Statistical Analysis

Statistical analysis was conducted in Stata version 13.1 (StataCorp LP). The level of significance was set at

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Ethical approval was not sought for the present study.

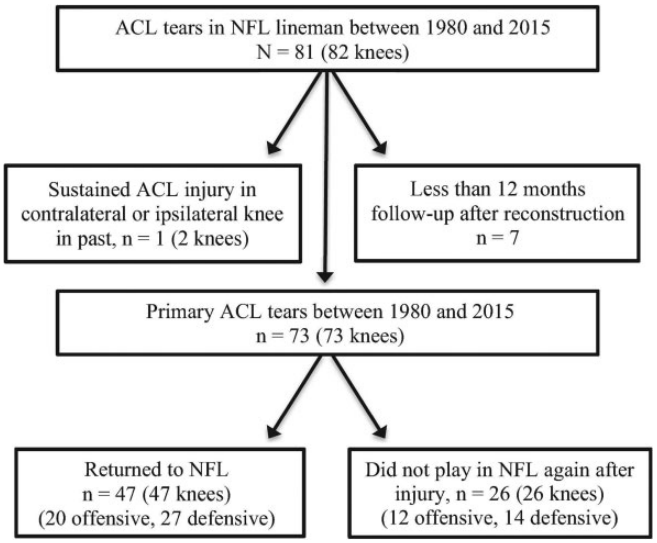

Figure 1. Selection of study participants. ACL, anterior cruciate ligament; NFL, National Football League.

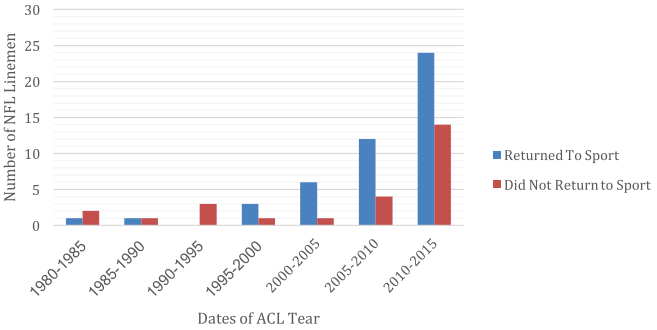

Figure 2. ACL tears in NFL Linemen since 1980. ACL, anterior cruciate ligament; NFL, National Football League.

$P < .05$. Demographic characteristics were compared between cases and controls using a Student t test (for continuous variables) or a Fisher exact test (for categorical variables). Player statistics were then compared between cases and controls using linear regression (for continuous variables) or Poisson regression with robust error variance (for categorical variables) during the 3 years before and 3 years after injury.[18] For these regressions, the player statistic was the dependent variable, while independent variables included case-versus-control status, before-versus-after-injury status, and an interaction term for the interaction between case-versus-control status and before-versus-after-injury status. Because each player was included up to 6 times in each regression, the model included adjustment for clustering around each specific player. The coefficient of the interaction term from this regression was interpreted as the specific impact of the injury on the player statistic. Because multiple comparisons were made during the player statistics analysis section, the Bonferroni adjustment was used to lower the P value required to achieve statistical significance. The Fisher exact test was used to test for association of year of injury (before 2005 vs 2005 and after) and RTS. The year 2005 was chosen so that there were relatively equal numbers of athletes in each group.

TABLE 1
Comparison of Demographic Characteristics Between Injured Offensive Linemen and Control Offensive Players[a]

	Control Players (n = 20)	Injured Players (n = 20)	*P* Value
Age, y, mean ± SD	25.0 ± 2.1	26.3 ± 2.6	.105
BMI, kg/m^2, mean ± SD	37.8 ± 2.3	37.4 ± 1.9	.532
Side of injury, n (%)			—
Left	—	9 (45.0)	
Right	—	11 (55.0)	
Position, n (%)			.714
Center	4 (20.0)	5 (25.0)	
Guard	6 (30.0)	8 (40.0)	
Tackle	10 (50.0)	7 (35.0)	
League, n (%)			>.999
NFC	11 (55.0)	11 (55.0)	
AFC	9 (45.0)	9 (45.0)	
Total seasons, mean ± SD	8.2 ± 1.6	7.7 ± 6.6	.442
Currently playing, n (%)			.741
No	14 (70.0)	12 (60.0)	
Yes	6 (30.0)	8 (40.0)	
Played the season after injury, n (%)			>.999
No	0 (0.0)	0 (0.0)	
Yes	20 (100.0)	20 (100.0)	
Months until return, mean ± SD	—	10.7 ± 1.5	—

[a]AFC, American Football Conference; BMI, body mass index; NFC, National Football Conference.

RESULTS

Eighty-one offensive and defensive NFL linemen who tore their ACL and underwent reconstruction between 1980 and 2015 were identified; of these, 73 linemen met the inclusion criteria (Figure 1). Of the 73 linemen who met the inclusion criteria, 47 (64.3%) RTS again in the NFL after ACL reconstruction (Figure 2). These 47 were included in the performance analysis and compared to matched controls. Year of injury (before 2005 vs 2005 and after) was not associated with RTS among all players ($P = .084$), among offensive players ($P = .062$), or among defensive players ($P = .706$).

Overall, 62.5% of offensive linemen RTS in the NFL. All offensive linemen who successfully RTS played the season after injury and returned at a mean (±SD) of 10.7 ± 1.5 months after ACL reconstruction (Table 1).

Table 2 shows the results of the analysis of player statistics. Because 6 comparisons were performed as part of the career statistics analysis, the Bonferroni adjustment required lowering of the P value required for statistical significance to $P < .008$. Similarly, because 6 comparisons were performed as part of the seasonal statistics analysis, the Bonferroni adjustment required lowering of the P value

TABLE 2
Association of Offensive Linemen Statistics With Injury to the Anterior Cruciate Ligament[a]

	Control Players (Mean)			Injured Players (Mean)			Effect of Injury[a]		
	Before	After	Difference	Before	After	Difference	Coefficient	95% CI	*P* Value
Career statistics									
Total number of Pro Bowls	0.10	0.40	0.30	0.95	0.40	−0.55	−0.85	−1.80 to 0.10	.079
Total number of seasons	4.00	4.20	0.20	4.40	3.25	−1.15	−1.35	−4.04 to 1.34	.316
Total number of games played	56.50	56.70	0.20	55.80	39.15	−16.65	−16.85	−54.40 to 20.70	.370
Total number of games started	47.30	49.75	2.45	48.00	32.95	−15.05	−17.50	−51.54 to 16.55	.305
Mean number of games played per season	14.18	13.78	−0.40	15.06	11.20	−3.86	−3.46	−13.15 to 6.25	.477
Mean number of games started per season	12.40	12.58	0.18	10.41	8.89	−1.52	−1.70	−5.27 to 1.89	.343
Number of games played per season[b]									
First year after injury	13.90	14.20	0.30	13.50	12.20	−1.30	−1.60	−4.7 to 1.7	.349
Second year after injury	13.90	13.80	−0.10	13.50	12.70	−0.80	−0.70	−3.3 to 2.0	.621
Third year after injury	13.90	13.10	−0.80	13.50	15.20	1.70	2.50	−0.4 to 5.5	.089
Number of games started per season[b]									
First year after injury	12.00	13.10	1.10	12.40	10.00	−2.40	−3.50	−7.7 to 0.7	.101
Second year after injury	12.00	12.90	0.90	12.40	10.30	−2.10	−3.00	−7.1 to 1.1	.148
Third year after injury	12.00	11.30	−0.70	12.40	13.90	1.50	2.20	−3.1 to 7.5	.402

[a]A statistically significant positive coefficient indicates that injury leads to an increase in player statistics after the injury, while a statistically significant negative coefficient indicates that injury leads to a decrease in player statistics after the injury. For career statistics, the Bonferroni adjustment for performance of 6 unique tests required lowering of the *P* value representing statistical significance to $P < .008$. Similarly, for seasonal statistics, the Bonferroni adjustment for performance of 6 unique tests required lowering of the *P* value representing statistical significance to $P < .008$.

[b]Each year after the injury was compared with the average for the 3 years before injury.

required for statistical significance to $P < .008$. For both the career statistics and the seasonal statistics analyses, there was no statistically significant effect of the injury on player performance ($P > .008$ for each).

Overall, 65.9% of NFL defensive linemen returned to play in the NFL after ACL reconstruction. A majority of those who did RTS played the season after injury (88.9%) at a mean of 11.3 ± 2.9 months after ACL reconstruction. All demographics between injured defensive linemen and matched defensive linemen controls did not differ except for total number of seasons played (Table 3). NFL defensive linemen who tore their ACL played fewer total seasons than their matched controls (7.2 ± 3.0 vs 9.2 ± 3.0, $P = .020$).

Table 4 shows the results of the analysis of player statistics. Because 6 comparisons were performed as part of this analysis, the Bonferroni adjustment required lowering of the *P* value required for statistical significance to $P < .002$. For no case was there a statistically significant effect of the injury on the player statistic ($P > .002$ for each).

Additionally, for each individual year up to 3 years before and after injury, there was no difference between injured defensive linemen and matched controls for any performance metric (Table 5).

TABLE 3
Comparison of Baseline Characteristics Between Injured Defensive Linemen and Control Defensive Players[a]

	Control Players (n = 27)	Injured Players (n = 27)	*P* Value
Age, y, mean ± SD	26.4 ± 3.2	25.6 ± 3.1	.349
BMI, kg/m^2, mean ± SD	35.7 ± 3.5	35.2 ± 3.5	.815
Side of injury, n (%)			—
Left	—	11 (40.7)	
Right	—	16 (59.3)	
Position, n (%)			>.999
Defensive tackle	13 (48.2)	13 (48.2)	
Defensive end	14 (51.9)	14 (51.9)	
League, n (%)			>.999
NFC	16 (59.3)	15 (55.6)	
AFC	11 (40.7)	12 (44.4)	
Total seasons, mean ± SD	**9.2 ± 3.0**	**7.2 ± 3.0**	**.020**
Currently playing, n (%)			.577
No	15 (55.6)	18 (66.7)	
Yes	12 (44.4)	9 (33.3)	
Played the season after injury, n, (%)			.236
No	0.0 (0.0)	3 (11.1)	
Yes	27 (100.0)	24 (88.9)	
Months until return, mean ± SD	—	11.3 ± 2.9	—

[a]Boldfaced entries indicate statistical significance. AFC, American Football Conference; BMI, body mass index; NFC, National Football Conference.

DISCUSSION

ACL tears are common injuries among both offensive and defensive NFL linemen. The results from this study demonstrate that 64.3% of linemen who suffer an ACL tear and undergo reconstruction return to play in the NFL. Linemen who returned to play in the NFL did not have a decline in

TABLE 4
Association of Career Defensive Linemen Statistics With Injury to the Anterior Cruciate Ligament

	Control Players (Mean)			Injured Players (Mean)			Effect of Injury[a]		
	Before	After	Difference	Before	After	Difference	Coefficient	95% CI	*P* Value
Pro Bowl games	1.0	0.7	0.3	0.5	0.3	0.2	0.1	−0.6 to 0.9	.711
Years played	4.9	4.3	0.6	3.7	3.3	0.4	0.7	−2.6 to 2.7	.955
Games started	55.2	49.4	5.8	34.7	25.3	9.4	−3.7	−38.8 to 31.4	.833
Games played	69.8	59.3	10.5	51.7	37.1	14.6	−4.2	44.3 to 36.0	.835
Mean number of starts per year	9.5	10.2	−0.7	7.2	6.0	1.2	−1.8	−5.6 to 2.0	.337
Mean number of games per year	14.1	12.7	1.4	11.9	9.3	2.6	−1.4	−5.3 to 2.4	.476
Sacks									
Total number	23.78	16.98	6.8	14.94	8.70	6.24	−0.56	−13.28 to 14.39	.936
Mean per year	4.57	3.86	0.71	3.15	2.19	0.96	−0.24	−2.06 to 1.58	.793
Mean per game	0.32	0.29	0.03	0.26	0.19	0.07	−0.03	−0.15 to 0.08	.535
Tackles									
Total number	157.12	116.52	40.6	95.45	64.47	30.98	9.62	−89.13 to 108.37	.845
Mean per year	28.40	24.18	4.22	20.47	16.23	4.24	−0.02	−9.74 to 9.70	.997
Mean per game	1.91	1.75	0.16	1.72	1.38	0.34	−0.17	−0.83 to 0.48	.603
Assists									
Total number	48.71	46.79	1.92	34.81	29.09	5.72	−3.81	−44.56 to 36.93	.851
Mean per year	8.58	9.75	−1.17	9.50	6.15	3.35	−4.54	−11.39 to 2.32	.190
Mean per game	0.58	0.69	−0.11	1.23	0.55	0.68	−0.79	−2.23 to 0.65	.277
Interceptions									
Total number	0.72	0.48	0.24	0.42	0.29	0.13	0.12	−0.61 to 0.84	.750
Mean per year	0.22	0.14	0.08	0.11	0.04	0.07	0.01	−0.24 to 0.26	.932
Mean per game	0.02	0.05	−0.03	0.01	0.01	0	−0.04	−0.12 to 0.05	.388
Interceptions returned for touchdowns									
Total number	0.24	0.12	0.12	0.04	0.04	0	0.12	−0.12 to 0.36	.325
Mean per year	0.07	0.03	0.04	0.04	0.01	0.03	0.01	−0.11 to 0.13	.859
Mean per game	0.007	0.002	0.005	0.004	0.001	0.003	0.001	−0.011 to 0.014	.815
Pass deflections									
Total number	7.00	6.125	0.875	4.04	4.00	0.04	0.83	−4.88 to 6.55	.771
Mean per year	1.54	1.46	0.08	1.17	1.15	0.02	0.07	−0.71 to 0.86	.849
Mean per game	0.10	0.10	0	0.11	0.12	−0.01	0.01	−0.06 to 0.09	.760
Forced fumbles									
Total number	5.81	3.92	1.89	2.74	2.35	0.39	1.49	−2.68 to 5.66	.475
Mean per year	0.94	0.91	0.03	0.61	0.40	0.21	−0.18	−0.73 to 0.38	.529
Mean per game	0.06	0.06	0	0.04	0.03	0.01	−0.01	−0.04 to 0.03	.758
Fumble recoveries									
Total number	3.89	2.15	1.74	1.88	1.73	0.15	1.59	−1.00 to 4.17	.223
Mean per year	0.62	0.43	0.19	0.39	0.53	−0.14	0.32	−0.05 to 0.71	.087
Mean per game	0.04	0.05	-0.01	0.04	0.11	−0.07	0.07	−0.09 to 0.23	.374
Fumble recoveries for touchdowns									
Total number	0.37	0.15	0.22	0.12	0.04	0.08	0.15	−0.15 to 0.44	.324
Mean per year	0.06	0.03	0.03	0.06	0.01	0.05	−0.03	−0.20 to 0.06	.543
Mean per game	0.004	0.002	0.002	0.014	0.001	0.013	−0.012	−0.038 to 0.014	.014

[a]A statistically significant positive coefficient indicates that injury leads to an increase in player statistics after the injury, while a statistically significant negative coefficient indicates that injury leads to a decrease in player statistics after the injury. The Bonferroni adjustment for performance of 33 unique tests required lowering of the *P* value representing statistical significance to $P < .002$.

performance compared with matched controls. Our hypothesis that NFL linemen would RTS at a high rate was refuted, as linemen returned at a lower rate compared with other players in the NFL who undergo ACL reconstruction. However, our hypothesis that in-game performance after surgery would not differ from that of matched controls was confirmed, as there was no difference in performance between linemen who underwent ACL reconstruction and matched controls.

In professional athletes, the RTS rate has been reported as high as 97% in the National Hockey League (NHL), 86% in the National Basketball Association (NBA), and 77% in Major League Soccer (MLS).[6,7,12] In the NFL, however, there are many different positions, each of which requires a unique skill set and places a different amount of stress on the knee. As a result, it is important to analyze the impact of ACL reconstruction on each position.

NFL offensive and defensive linemen RTS after ACL reconstruction at a significantly lower rate than other positions in the NFL. After ACL reconstruction, NFL running backs and wide receivers have been reported to return to play at a rate of 79%, while almost all quarterbacks (92%)

TABLE 5
Association of Yearly Defensive Linemen Statistics With Injury to the Anterior Cruciate Ligament

	Control Players (Mean)			Injured Players (Mean)			Effect of Injury[a]		
	Before	After	Difference	Before	After	Difference	Coefficient	95% CI	*P* Value
Games played per season[b]									
First year after injury	13.85	13.5	0.35	10.13	9.96	0.17	0.18	−3.56 to 3.93	.922
Seconf year after injury	13.85	12.77	1.08	10.13	14.62	−4.49	−0.53	−4.34 to 3.29	.783
Third year after injury	13.85	14.00	-0.15	10.13	8.59	1.54	−1.69	−6.50 to 3.19	.484
Starts per season[b]									
First year after injury	11.14	11.92	−0.78	7.47	7.08	0.39	−1.18	−5.46 to 310	.583
Second year after injury	11.14	10.82	0.32	7.47	5.14	2.33	−2.01	−6.88 to 2.85	.411
Third year after injury	11.14	10.78	0.36	7.47	2.88	4.59	−4.23	−8.85 to 0.38	.072
Interceptions per season[b]									
First year after injury	0.22	0.12	0.1	0.29	0.04	0.25	−0.14	−0.66 to 0.37	.577
Second year after injury	0.22	0.14	0.08	0.29	0.00	0.29	—	—	—
Third year after injury	0.22	0.06	0.16	0.29	0.07	0.22	−0.06	−0.59 to 0.46	.809
Interceptions for touchdowns per season[b]									
First year after injury	0.05	0.00	0.05	0.00	0.00	0	—	—	—
Second year after injury	0.05	0.00	0.05	0.00	0.00	0	—	—	—
Third year after injury	0.05	0.06	-0.01	0.00	0.00	0	—	—	—
Pass deflections per season[b]									
First year after injury	1.73	1.35	0.38	0.83	0.92	−0.09	0.48	−0.40 to 1.35	.277
Second year after injury	1.73	1.10	0.63	0.83	0.63	0.2	0.44	−0.79 to 1.69	.476
Third year after injury	1.73	1.47	0.26	0.83	0.40	0.43	−0.16	−1.54 to 1.21	.814
Forced fumbles per season[b]									
First year after injury	1.08	1.46	−0.38	0.46	0.25	0.21	−0.60	−1.39 to 0.20	.138
Second year after injury	1.08	0.91	0.17	0.46	0.46	0	0.06	−0.74 to 0.85	.890
Third year after injury	1.08	1.06	0.02	0.46	0.25	0.21	−0.19	−1.06 to 0.67	.659
Fumble recoveries per season[b]									
First year after injury	0.84	0.31	0.53	0.46	0.46	0	0.54	0.08 to 1.00	.021
Second year after injury	0.84	0.68	0.16	0.46	0.50	−0.04	0.20	−0.32 to 0.73	.439
Third year after injury	0.84	0.67	0.17	0.46	0.19	0.27	−0.09	−0.71 to 0.53	.766
Fumble recoveries for touchdowns per season[b]									
First year after injury	0.09	0.04	0.05	0.03	0.04	−0.01	0.07	−0.09 to 0.22	.383
Second year after injury	0.09	0.05	0.04	0.03	0.05	−0.02	0.07	−0.10 to 0.24	.423
Third year after injury	0.09	0.00	0.09	0.03	0.00	0.03	—	—	—
Sacks per season[b]									
First year after injury	4.77	4.77	0	3.19	2.38	0.81	−0.81	−2.85 to 1.22	.426
Second year after injury	4.77	4.34	0.43	3.19	2.26	0.93	−0.49	−3.02 to 2.03	.694
Third year after injury	4.77	4.36	0.41	3.19	1.06	2.13	−1.72	−3.96 to 0.51	.128
Tackles per season[b]									
First year after injury	29.53	27.07	2.46	17.12	15.75	1.37	1.08	−7.42 to 9.58	.800
Second year after injury	29.53	21.14	8.39	17.12	14.30	2.82	5.57	−6.32 to 17.46	.351
Third year after injury	29.53	22.59	6.94	17.12	8.47	8.65	−1.71	−13.76 to 10.33	.766
Assists per season[b]									
First year after injury	13.85	13.50	0.35	10.12	9.96	0.16	0.18	−3.56 to 3.93	.922
Second year after injury	13.85	12.77	1.08	10.12	8.52	1.6	−0.53	−4.34 to 3.29	.783
Third year after injury	13.85	14.00	−0.15	10.12	8.89	1.23	−1.69	−6.50 to 3.12	.484

[a]A statistically significant positive coefficient indicates that injury leads to an increase in player statistics after the injury, while a statistically significant negative coefficient indicates that injury leads to a decrease in player statistics after the injury. The Bonferroni adjustment for performance of 28 unique tests required lowering of the *P* value representing statistical significance to $P < .002$.

[b]Each year after the injury was compared with the average for the 3 years before injury.

returned to play.[4,9] This disparity may be due to differing physical demands inherent to the position and the differences in physical profiles of the players. Linemen are drafted and selected for their position for many reasons, including their strength, endurance, agility, and size. Today, the average NFL offensive lineman weighs over 310 pounds, which produces increased strain on the knee during normal daily activities.[11] Previous studies have demonstrated that increased BMI is associated with lower patient-reported outcomes as well as lower activity levels after ACL reconstruction in weekend warriors.[14-16] NFL linemen are not immune to this association between BMI and ACL outcomes and may be at increased risk for even worse outcomes due to the physical demands of their

position. This may contribute to why defensive linemen who did RTS had a shorter career compared with the matched controls despite having no decline in performance. Several other factors may also play a role, including contract-related issues, concerns regarding their knee, other injuries, or a personal decision. In contrast to more skilled players, who are more commonly household names used to promote a team and have higher salaries, linemen may be seen as more expendable members of a team; thus they may be more likely to be left off the roster or off the playing field. Future studies are warranted to further investigate this finding.

Interestingly, despite the lower overall RTS rate among NFL linemen, those linemen who returned did so at a high level. Most linemen who RTS were able to return the season after injury, with 88.9% of defensive linemen and 100% of offensive linemen returning the season after surgery. These athletes returned at a high level, with no statistically significant difference regarding in-game performance parameters from preinjury to postsurgery compared with matched controls. This is similar to findings in NFL quarterbacks, who also did not show a decline regarding in-game performance after ACL reconstruction.[9] NFL wide receivers and running backs, however, typically require increased time before returning to competition. Carey et al[4] found that 31% of running backs and wide receivers require 12 to 15 months before returning to competition. When they did return, in contrast to NFL linemen, running backs and wide receivers had a decline of one-third in performance on return.[4] This delay in return as well as decline in performance may be due to a heightened concern of reinjury by the athlete and physician as well as due to the intense physical demands on the knee required by these skilled offensive players.[5] Additionally, running backs and wide receivers depend on speed, agility, and cutting, while linemen require more strength, which leads to different demands on the knee and may influence performance after ACL reconstruction.

Limitations

While this study is the first to report outcomes in NFL linemen after ACL reconstruction, it does have limitations. We specifically analyzed RTS after ACL reconstruction, which is the current gold standard for treatment of ACL tears in the NFL. However, several previous NFL athletes have been able to RTS with nonoperative treatment and have had successful careers. The success of nonoperative treatment is beyond the scope of this article, but it must be recognized as a treatment option. While the study methodology has been previously utilized in several studies that looked at RTS in professional athletes, there is the possibility that some NFL linemen who underwent ACL reconstruction were missed during the search.[6,7,9,12,13] As a result, our sampling is biased to the most recent years of the study period, with 40% of our athletes still playing. We recognize this is a limitation of the study that may bias the RTS rates; however, we believe that our results are the best approximation of RTS in NFL linemen based on publicly available data. Additionally, no information on the surgeon who performed the procedure, surgical technique, graft choice, rehabilitation protocols, clinical outcome scores, patient satisfaction, and so on, was available and therefore could not be compared. Players may also have had concomitant knee injuries such as meniscal tear or cartilage injury not identified in the search, which may have influenced return to play. Finally, this information is on NFL linemen and cannot be extrapolated to high school– or college-level athletes.

CONCLUSION

Less than two-thirds (64.3%) of NFL offensive and defensive linemen who undergo ACL reconstruction return to play in the NFL after surgery. The linemen who do return to play do so at a high level, with no difference regarding in-game performance or career duration when compared with matched controls.

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