



Epidemiology and Outcomes of Achilles Tendon Ruptures in the National Football League

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Abstract

Background

The purpose of this study is to document the epidemiology of Achilles tendon ruptures in the NFL and to quantify the impact of these injuries upon player performance. Data on NFL Achilles tendon ruptures occurring between 1997 and 2002 was gathered. Power ratings for each player were calculated for the three seasons before and after the Achilles tendon injury. Statistical analysis was performed. Thirty-one Achilles tendon ruptures in NFL players between 1997 and 2002 were identified. Players generally took 9 to 12 months to return to play, and 32.3% of players never returned to play ($p=0.0006$). Offensively, there was a reduction in power ratings for wide receivers, running backs, and tight ends, respectively. Defensively, there was a reduction in power ratings

for linebackers, cornerbacks, and defensive tackles. 31% of NFL players who sustained an Achilles tendon rupture did not return to play in the NFL. On average, players had an over 50% reduction in their power ratings following such an injury.

Introduction

Twenty-five percent of all athletic injuries, irrespective of the specific sport or level of play, involve the foot and ankle.¹ By far, the most common of these injuries is the ankle sprain.² Achilles tendon ruptures represent a subset of athletic foot and ankle injuries that have potentially serious future implications regarding the ability of an athlete to return to play.

The past few decades have seen an increase in the total number of Achilles tendon ruptures, which, unlike other tendon ruptures, are very commonly associated with sport participation.^{3,4,5} This increase in incidence has been attributed to an increased participation in recreational sports by an increasingly sedentary population.⁴ However, elite athletes are at increased risk for rupture and tend to experience rupture earlier in life compared to non-elite athlete controls due to the increased demand to which they subject their tendons.⁶

Achilles tendon ruptures often occur during eccentric loading of the foot. Athletes who participate in sports requiring explosive acceleration, sudden changes in direction or maximal effort, such as American football, are at an increased risk for this injury.⁶ Because most Achilles tendon ruptures occur in previously asymptomatic patients and require extensive rehabilitation times even following operative repair, these injuries represent potentially sudden and career-altering injuries for professional athletes.⁷ Though previous studies have looked at the occurrence of Achilles tendon ruptures in elite athletes,^{5,6,8,9} very little is known about the

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epidemiology of Achilles tendon ruptures in American football, specifically the National Football League (NFL). Furthermore, regardless of the treatment method, to our knowledge, there are no publications evaluating the performance outcome of Achilles tendon ruptures in these players.

played in the 2000 season to serve as a control group. These individuals did not sustain an Achilles tendon injury during their season of play. This group was compared to the Achilles tendon rupture players who were running backs and wide receivers.

$OPR = \frac{PassYd}{20} + \frac{(RushYd + RecYd)}{10} + PassTD \times 4 + (RushTD + RecTD) \times 6 - Int$	
$DPR = Tackle + Int$	
PassYd = number of passing yards RushYd = number of rushing yards RecYd = number of receiving yards PassTD = number of passing touchdowns	RushTD = number of rushing touchdowns RecTD = number of receiving touchdowns Int = number of interceptions Tackle = number of tackles

Table 1: Formulas used to calculate the Offensive Power Rating (OPR) and Defensive Power Rating (DPR) for NFL players who suffered from Achilles tendon rupture.

The aim of our study was to document the epidemiology of Achilles tendon ruptures in the NFL and to quantify the impact of these injuries upon player performance.

Materials and Methods

A retrospective review of several online resources was conducted to identify all NFL players who sustained complete Achilles tendon rupture from 1997 through 2002 among all players on NFL rosters.¹⁰⁻¹⁶ For each player identified, data was gathered from game summaries, weekly injury reports, and player profiles. Recorded variables included player position, age at time of injury, side of injury, number of years in the league prior to the injury, the time of the season and quarter of the game in which the injury occurred, injury situation (practice versus game), playing surfaces, weather conditions at the time of injury, and games missed.

In addition, yearly performance statistics were collected for the players. For offensive players, this included passing, rushing, and receiving yards and touchdowns, as well as interceptions. A power ratings formula was used to calculate offensive ratings for the three seasons before and after injury (Table 1). For each defensive player, data on tackles and interceptions was collected. A power rating formula was created to compare performance levels pre- and post injury (Table 1).

Yearly performance data was also collected for uninjured running backs and wide receivers who

Statistical analysis for continuous data was performed using a paired two-tailed Student’s t-test and a two-sample test of probabilities was used for non-parametric data to look for any trends suggestive of a causal relationship between different variables and the injury. An alpha value of $\alpha = 0.05$ was considered significant. Furthermore, each player’s pre- and post-injury data was analyzed using a paired Student’s t-test to compare the effect of the injury upon the player’s performance.

Based on prior studies performed by our group,¹⁷ power ratings have a test-retest probability of 0.825. A test-retest probability of greater than 0.75 suggests that there is an excellent agreement beyond chance that the power ratings are reliable. Concurrent criterion-oriented validity testing using a two-sided t-test revealed that players who were not selected to the Pro-Bowl (a post-season All-Star game for the National Football League) during the years of our study had a power rating average of 76.2. Meanwhile, players who were selected to the Pro-Bowl had a mean power rating of 198.1. This difference was statistically significant ($p < 0.0001$) and demonstrates that power ratings correlate with overall performance in the League as demonstrated by Pro-Bowl selections.

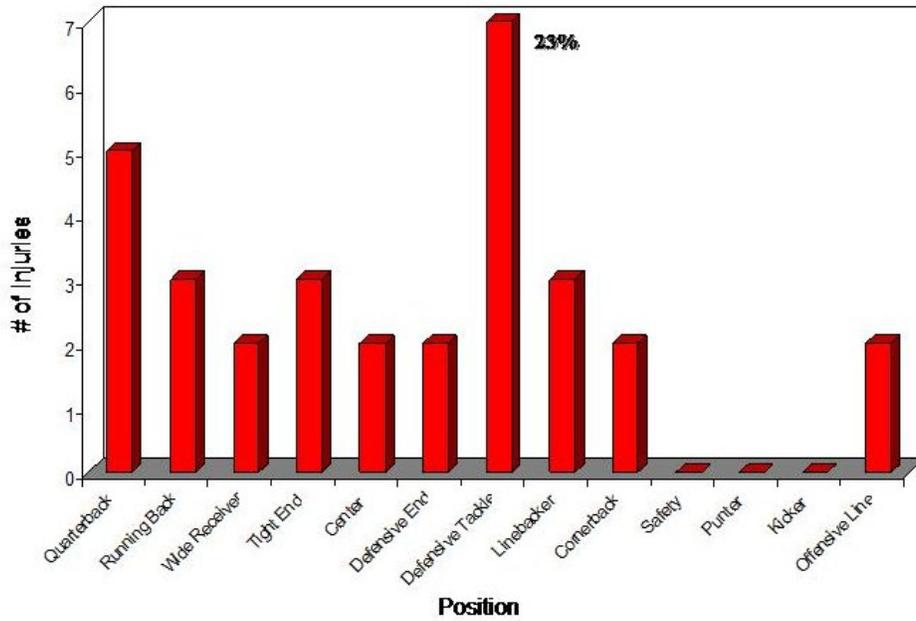


Figure 1: Number of Achilles Tendon Injuries sustained in the National Football League, by player position.

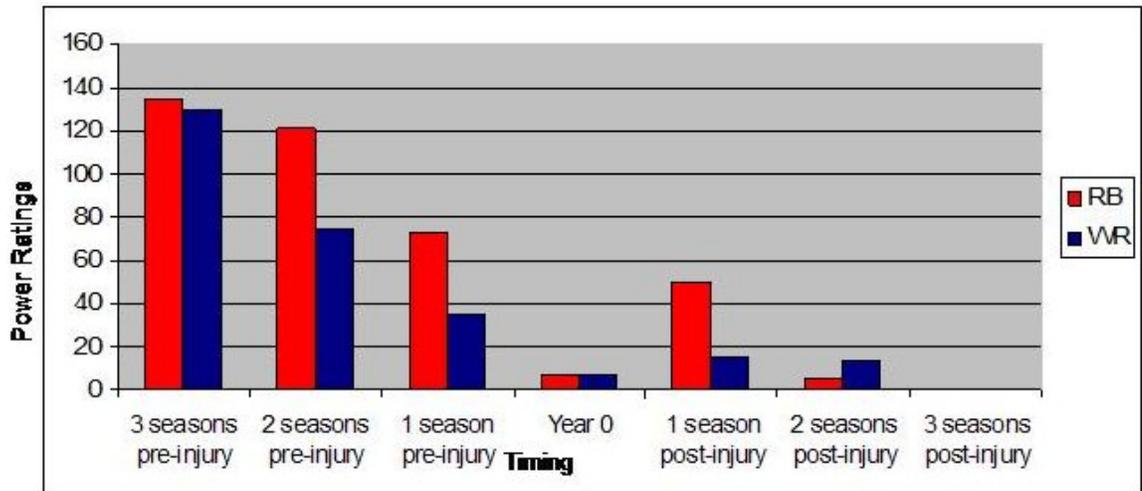


Figure 2: Power ratings of running-backs (RB) and wide receivers (WR) who had sustained an Achilles tendon rupture, in the three years prior to and the three years following the injury.

Results:

Epidemiology of Injuries

Thirty-one Achilles tendon ruptures (16 left, 15 right) were identified in twenty-eight NFL players between 1997 and 2002. The average age of the players at the time of injury was 29 (range 23 – 36), which is older than the average age of all players in the NFL (26.5 years).¹⁸ On average, players had been in the league for six years (range 0 – 14 years) before the injury was sustained, possibly suggesting that Achilles tendon rupture is an injury of veteran NFL players. 54.8% (n=17) of injuries occurred in offensive players. 45.2% (n=14) were defensive players. 48.4% of injuries occurred in skilled positions (running backs, wide receivers, quarterbacks, and corner backs) (Figure 1). The cumulative incidence of Achilles tendon injuries per game in the NFL was 0.93% from 1997-2002. The incidence of this injury per player per game was 0.015%.

Timing of Injuries

35.4% (n=11) ruptures occurred during the preseason, five of which were in game situations. 64.5% (n=20) of ruptures occurred during games in the regular season (p=0.02). No player was injured during practice sessions in the regular season. During games, 30% of these in-season injuries occurred in the first quarter, while an additional 40% occurred during the second quarter (p=0.51). There was an equal distribution of injuries throughout the months of the season. 32.3% (n=10) of these players did not return to the National Football League (p=0.0006). Of those who did return, players returned to play at mean eleven months after the date of injury.

Game day situations

Weather conditions were not a significant variable for these injuries. The average temperature at the time of injury was 69.7 degrees Fahrenheit, with five injuries occurring in indoor stadiums, nine injuries each in sunny and rainy weather, and seven injuries in cloudy conditions. Eleven (52.3%) injuries occurred on grass, while 10 (47.7%) occurred on artificial surfaces.

Games Played

On average, in the three years preceding the injury, these players played in 11.67 games per year. During the year of the injury, the players, on average, played 4 games prior to sustaining the injury. In the

three years following their return to play, these players averaged 6.17 games per season.

Power Ratings per Season and Game, time to return to play

Power ratings in the three years prior to the injury and the three years following the return to play were calculated according to the offensive and defensive formulas detailed earlier. Offensively, quarterbacks had a power rating averaging 108 in the three seasons prior to their injuries. In the three seasons following their return, they averaged a power rating of 62. There was a net decrease in power ratings of 42.6% (p=0.12). Per season, wide receivers, running backs, and tight ends, also witnessed a decrease in their power ratings by 88% (p=0.11), 83% (p=0.07), and 78% (p=0.07), respectively (Table 1). Defensively, linebackers experienced the greatest drop in power ratings, followed by cornerbacks, defensive tackles, and defensive ends. The average decrease was 95% (p=0.09), 87% (p=0.03), 64% (p=0.01), and 55% (p=0.03), respectively. When evaluating power ratings per game played, offensively, running backs had the most significant drop in power ratings, by 83% (p=0.04). They were followed by wide receivers, tight ends, and quarterbacks, whose power ratings percent decrease was 77% (p=0.09), 73% (p=0.02), and 50% (p=0.06), respectively (Table 2). Finally, percent decrease in power ratings per game dropped in the same order as power ratings per season for the defensive players.

Discussion

Foot and ankle injuries can account for up to one-quarter of all athletic injuries.¹ Achilles tendon injuries, according to our study, occur infrequently in professional American football players, with a cumulative incidence of only 0.93% per NFL game. The incidence of this injury per player per game is 0.015%.

Although not common, our study suggests that these Achilles tendon ruptures can be career-altering injuries. Nearly thirty six percent (35.7%, p=0.0006) of players who sustained this injury never returned to play in the NFL. Of those players who did return, they had an over 50% reduction in their performance, as demonstrated by their power ratings. Specifically, there was a reduction of 88%, 83%, and 78% for wide receivers, running backs, and tight ends, respectively. Defensively, there was a 95%, 87%, and 64% reduction in power rating for linebackers, cornerbacks, and defensive tackles.

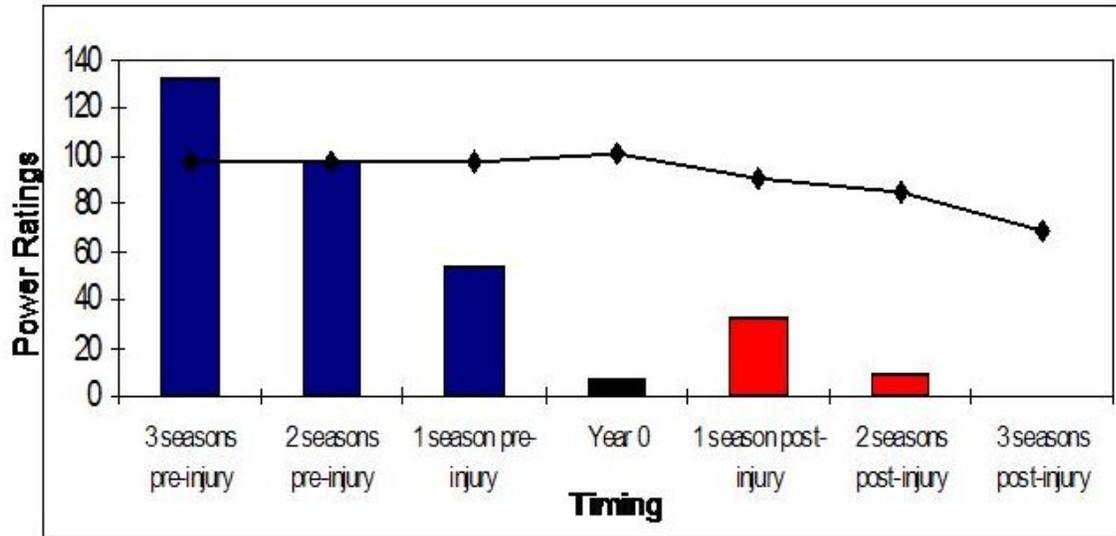


Figure 3: Average power ratings of running-backs (RB) and wide receivers (WR) who had sustained an Achilles tendon rupture, in the three years prior to and the three years following the injury, compared to the control RB and WR.

When evaluating the performance levels for wide receivers and running backs, there is a steady decline in the power ratings in the immediate three years prior to the injury (Figure 2). Though such a decline is likely multifactorial in nature, such a performance decline may be attributable to a prodromal period prior to rupturing of the tendon. In such cases, there may be an opportunity to intervene in these individuals with therapeutic modalities that could change the natural history of the Achilles pathologies.

When comparing the power ratings for the control group (wide receivers and running backs from the 2000 NFL season) to the wide receivers and running backs who had sustained an Achilles tendon rupture, the injured players had performed at average power ratings that were less than the control group 1 year prior to the injury. Following the injury, these players were never able to attain the control group's level of play (Figure 3). When evaluating the injured patient's per game power ratings three years before and after the injury, there was a decrease of 71% in the performance levels. In the control group, through the same period of time, there was an increase in performance by 5.1%. Once again, both sets of data suggest that there may be a prodromal period of symptoms in the players who are prone to rupture their Achilles tendons.

Similar to another study by our group, this

paper makes use of the novel approach of using game performance levels, as an outcome measure to assess patients' functions following an Achilles tendon rupture.¹⁷ Even though the power ratings formula cannot account for certain valuable intangible qualities of players, such as leadership and toughness, and cannot account for factors that may have negatively influenced power ratings, such as being traded to another team, being released from the team for reasons other than injury, or simply increased player age, our group has still shown power ratings to be reliable and valid measures of player performance, with high test-retest probability.¹⁷

There are some notable limitations to our study. Firstly, since we used publicly available data obtained from the Internet, we were only able to identify certain players who sustained an Achilles tendon rupture, that were reported on the Internet. Access to the complete official NFL injury database would have allowed us to define the complete number of NFL players who suffered from the same injury during this time period. Secondly, we were limited by the information available on the Internet to assess the player's function. Again, access to the NFL injury database would have allowed us to evaluate other pertinent variables such as body mass index, show wear, range of motion, and treatment methods (surgical versus non surgical), which could potentially influence the outcomes of these patients. Despite its limitations, we believe this study sheds

light on valuable epidemiologic data for Achilles tendon ruptures among NFL players.

In summary, 31% of NFL players who sustain an Achilles tendon rupture will not return to play in the NFL. On average, players who return to play may see an over 50% reduction in their power ratings following such an injury. Finally, a prodromal period may exist during which different therapeutic modalities may be able to alter the natural history of Achilles tendon pathologies. Future studies with the cooperation of the National Football League and their official injury database are needed to fully evaluate the impact of Achilles injuries in this at-risk population.

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