

# A Historical Perspective of Injuries in Professional Football

## Twenty-six Years of Game-Related Events

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A professional football franchise was studied consecutively from 1960 through 1985 for injuries incurred during regular-season games. A "significant" injury was defined as one requiring the player to miss at least two consecutive games (N = 331) and a "major" injury as one that caused the player to miss at least eight games or the equivalent time (N = 130). Significant injuries averaged 0.89 per game and major injuries 0.35 per game for the entire 26 years. Following a high injury rate prior to 1965, significant injury rates were episodic. Major injuries declined ( $r_s = -.68$ ;  $P < .01$ ). Since the team's first games on synthetic surfaces in 1968, there was no difference in the rates of significant injuries per game (0.57 vs 0.67) or major injuries per game (0.22 vs 0.33) between games played on grass or artificial turf, respectively. Since 1969 there has been a decline in major knee injuries ( $r_s = -.51$ ;  $P < .05$ ) and a decline in major injuries incurred during special-teams play ( $r_s = -.55$ ;  $P < .05$ ). The data indicate that this team suffered fewer injuries with the passing of time, primarily in injuries that caused a player to miss at least eight consecutive games. Observations of short duration do not lend themselves to current media perception that injury rates are higher and more serious today in professional football.

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INCREASED mass media attention has led to a heightened awareness of injury in high school, college, and professional football. Professional football has been played in the United States for almost 100 years, but few studies have investigated the incidence of injuries in professional football players. Ellsasser et al<sup>1</sup> and Ellsasser and Stein<sup>2</sup> reported

on hand and knee injuries but did not attempt to report on incidence. Shields and Zomar<sup>3</sup> reported on injury incidence in one professional football team during a six-year period from 1973 to 1978. A total of 2139 injuries occurred in 222 players during all preseason, regular-season, and play-off games. Most of the injuries (88.5%) required no physician follow-up, and players were able to return to the game or practice field. Two percent of all injuries required hospitalization, and slightly more than 1% required surgery. This is a rate of slightly more than four surgeries per year. Of-

fensive players had a 4% higher incidence of injuries than defensive players, and 15% of all injuries were to the knee.

The Stanford Research Institute<sup>4</sup> was commissioned to conduct three studies for the National Football League, but the total span of all three studies was also only six years, 1969 to 1974. A total of 4644 practice- and game-related injuries were analyzed according to type, circumstance, environment, equipment, playing surface, and field performance. Among many other observations, it was found that the highest incidence of injury was to the knee, and there was no statistical difference between the rates of injury causing two or more missed games on synthetic and natural surfaces.

In 1970 we reported on a comprehensive survey of injuries to our team from 1960 to 1969.<sup>5</sup> The findings indicated that chances of injury were higher if one played on special teams. We noted a relationship between some types of injury and hypermobility syndromes and contracture states.

Our experience with one professional football team extends over a continuous period of 28 years, 1960 to 1987. During this period, two leagues merged, and there have been many changes in equipment, rules, playing surfaces, training techniques, training personnel, coaching, medical screening and technological advances, and physical attributes of

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Table 1.—Summary of Variables, 1960-1985

No. of games	373
No. of significant injuries*	331
No. of major injuries†	130
Major injuries, % of total	39.3
Average No. of injuries per year	12.7
Average No. of major injuries per year	5.0
No. of significant injuries per game	0.89
No. of major injuries per game	0.35
Total No. of plays	55643
No. of plays per significant injury	168.1
No. of plays per major injury	428.0

\*Any injury that required a player to miss at least two consecutive regular season games.

†Any injury that required surgery or required a player to miss at least eight consecutive games or the equivalent time loss if near the end of the season.

players such as speed and lean body mass. Even the hash marks have been changed. The team physician has remained the same for the entire period, allowing for a continuous study of injuries.

We are reporting our analysis of regular-season, game-related injuries during a 26-year period. We chose to analyze only regular-season, game-related injuries for the following reasons: (1) During any game, exactly 11 players are on the field for each play for each team, although personnel may change from play to play ("situation substitution"). (2) All plays during a game are presumably performed at game intensity and with full contact. (3) The precise number of plays for each game has been consistently documented by the team and by photographic tape in earlier years and subsequently by videotape.

Since these criteria were not met for practice sessions on a year-to-year basis, especially in the first decade, it is difficult to compare preseason injuries in this manner, since exposure rates varied considerably because of varied practice sessions. For example, large numbers of players changed daily, especially during preseason, thus constantly altering the number of players who are exposed to injury during practice. Additionally, type, length, and intensity of practices change during the course of the preseason depending on many factors (eg, teaching practices). Preseason squads are so different in composition and so large in numbers and the training period so demanding in a short period of time that it is difficult to study the injury rates accurately. Regular-season practices are generally more structured and focus on noncontact teaching and strategy. Our purpose, therefore, is limited to providing a perspective on regular-season, game-related injuries from 1960 to 1985, wherein a strict evaluation of the circumstances of injury during game play and the reporting mechanism were available and accurate.

Table 2.—Number of Injuries by Year\*

Year	Significant injuries	Major injuries	Injuries per Game	Major Injuries per Game
1960	22	3	1.57	0.21
1961	20	5	1.43	0.36
1962	26	5	1.89	0.36
1963	21	7	1.50	0.50
1964	28	9	2.00	0.64
1965	10	9	0.71	0.64
1966	14	8	1.00	0.57
1967	16	10	1.14	0.71
1968	9	5	0.64	0.36
1969	6	5	0.43	0.36
1970	9	7	0.64	0.50
1971	8	4	0.57	0.29
1972	10	6	0.71	0.43
1973	8	4	0.57	0.29
1974	11	3	0.79	0.21
1975	11	3	0.79	0.21
1976	14	5	1.00	0.36
1977†	10	3	0.71	0.21
1978‡	11	6	0.69	0.37
1979	6	2	0.37	0.12
1980	12	3	0.75	0.19
1981	12	4	0.75	0.25
1982§	2	2	0.22	0.22
1983	13	3	0.81	0.19
1984	15	5	0.94	0.31
1985	7	4	0.44	0.25

\*A significant injury is one causing the player to miss two or more consecutive games. A major injury is one requiring surgery or causing the player to miss eight or more consecutive games or the equivalent loss of time if near the end of the season. All major injuries are also classified as injuries. Injuries per game are the number of injuries divided by the total number of regular season games. Major injuries per game are the number of major injuries divided by the number of games.

†Marks the beginning of the comprehensive predraft physical examinations of prospective draft choices.

‡The season increased from 14 to 16 games.

§This was a strike-shortened season, with only nine regular season games.

||This was the first season that the team began playing home games on synthetic turf.

## METHODS

A retrospective examination was performed of injuries in regular-season games in one team since its inception in 1960 through 1985. Originally called the Titans, the team was renamed the New York Jets in 1963. Data were compiled from year-end trainers' reports, as well as the team physician's records and examination results, and sometimes from films of injuries.

### Injury Definitions

The standard American Medical Association nomenclature was used for distinguishing types of musculoskeletal injury.<sup>6</sup> We developed and used a classification that differentiates injuries on the basis of game time lost.

Most injuries are minor, for they do not require the player to miss two consecutive games. Minor injuries are not the subject of this report, although they are the most numerous as reported by others.<sup>14</sup> We are reporting on the more serious injuries.

**Significant Injury.**—A "significant" injury caused the player to miss at least

two consecutive regular-season games. We chose this definition because a deconditioning effect is apparent after missing two or more weeks, and the injury may have an impact on the team's performance. There is some position dependence associated with this definition, since an injury that would keep out a player in a speed and agility position, such as running back, may not keep out a player who does not rely as much on speed, such as a lineman. Therefore, each position's performance demands can impact on the amount of game time lost. Examples of significant injuries include first- and second-degree sprains and strains, contusions, mild concussions, and fractures and subluxations to areas that can be braced, stabilized, or padded to allow pain-tolerated play at a satisfactory level.

**Major Injury.**—A "major" injury required the player to miss at least eight or more consecutive games or required surgery that led to the player's missing eight or more consecutive games. This definition was used because treatment always required extended rehabilita-

tion as well as position-specific reconditioning. These injuries required roster change so that a substitute could be made available to the squad for the injured player. If an injury occurred during the last eight games, or with fewer than two games remaining in the regular season, the judgment and experience of the team physician were utilized to determine the classification of the injury. Major injuries include third-degree sprains and strains, serious fractures, a few contusions leading to myositis ossificans, and career-ending injuries to the spine and more often the knee.

Telephone contact was made with the public relations departments of each rival team to assess the type of playing surface used during each game. The trainer's reports recorded where each injury occurred and under what circumstances. The team first played a game on a synthetic surface (turf) in 1968. Therefore, injuries occurring on turf and grass were examined beginning with that season.

### Assumptions and Statistics

In this study, injuries were treated statistically as if they were separate and unrelated events. The same player could have repeated significant injuries, but we had none with two major injuries. Certain players appear to be more prone to injury, but we did not attempt to address this question. Thus, repeated injuries in the same player were treated as separate events.

In 1978 the season increased from 14 to 16 games, and in 1982 the season was shortened to nine games due to a strike. For this reason, we have tried to adjust for exposure by expressing injuries as events per game, as well as by examining injuries on offense, defense, and special teams, by plays. Roster size per game changed from 33 in 1960 to 45 in 1985, reflecting an increase in the number of "specialty players."

Spearman rank correlations ( $r_s$ ), which do not require linearity of the data over time, were computed to examine injury trends with time.<sup>7</sup> A paired  $t$  test was used to examine differences in injuries between surfaces. The Friedman test was used to compare injuries incurred on offense, defense, and special teams, and a  $\chi^2$  test was used for the differences in injury rates between time periods.<sup>8</sup> For these analyses, the sampling unit was the play rather than the game or the individual.

### RESULTS

The descriptive data for the 26-year period are shown in Table 1. During this period 373 regular-season games were

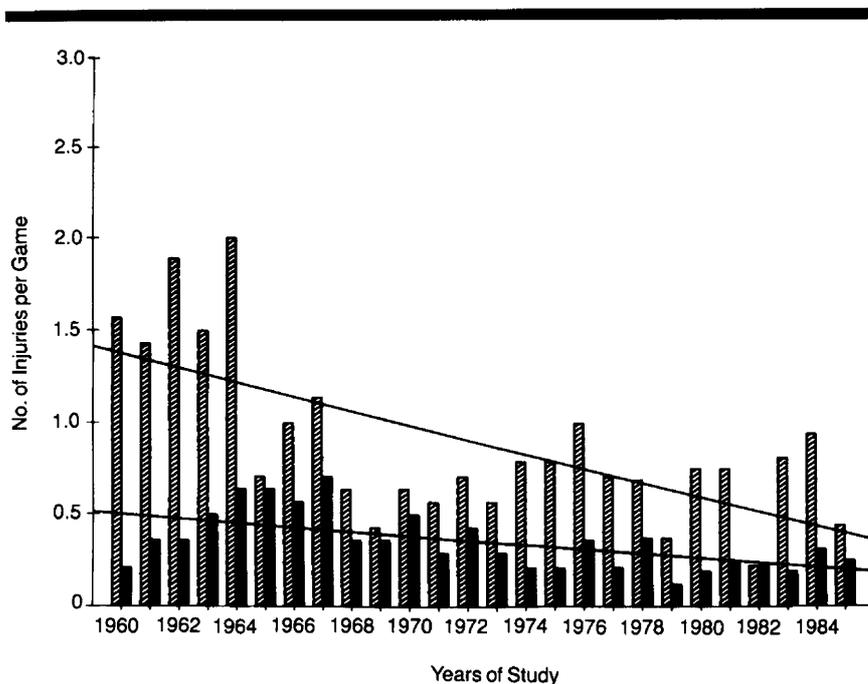


Fig 1.—Total number of injuries per game from 1960 to 1985 is plotted along ordinate vs years of study along abscissa. For entire 26-year period, significant injuries per game (two or more games missed [slashed bars]) have declined significantly in number ( $r_s = -.51$ ;  $P < .01$ ), as have major (eight or more games missed [solid bars]) injuries per game ( $r_s = -.56$ ;  $P < .01$ ). Least squares regression lines are drawn for reference. See text for details.

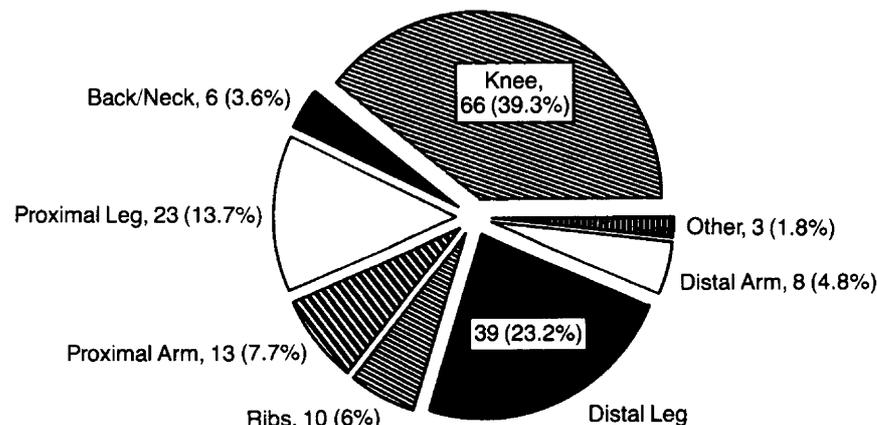


Fig 2.—Pie chart demonstrating site of all significant injuries from 1969 to 1985. Number of injuries to each site and percentage of total are also indicated. Distal leg is comprised of area below knee; proximal leg is thigh and hip; distal arm, area below elbow; and proximal arm, area from elbow to shoulder.

played. A total of 474 different regular-squad players appeared in at least one game, and significant (two or more games' lost time) or major (eight or more games' lost time) injury occurred 331 times. There were 130 major injuries resulting in surgery or in missing eight or more consecutive games.

In 26 years there was a total of 55 643

plays (including offensive, defensive, and special teams), so that the overall incidence of significant or major injury was 0.0059 per play. This becomes 0.89 injuries per game, or 167.9 plays per injury. The average number of game-related significant injuries per year was 12.7 and major injuries 5.0 for the entire 26-year period.

## Injuries per Year

Table 2 shows the number of injuries for each year. For the entire 26 years there was a decline in both the number of significant injuries per game ( $r_s = -.56$ ;  $P < .01$ ) and major injuries per game ( $r_s = -.56$ ;  $P < .01$ ). Figure 1 demonstrates the injury rates during the 26 years and shows a high initial injury rate that results in a decline of significant injuries with time. If the initial high injury rates of 1960 through 1964 are omitted, it can be shown that the number of significant injuries per game was episodic with time ( $r_s = -.68$ ;  $P < .01$ ).

## Playing Surface

The team began playing its first games on synthetic surfaces (turf) in 1968 on some road games and played 177 games on grass and 84 on turf from 1968 to 1985. There was no decline in the number of significant injuries per game with time on turf ( $r_s = .09$ ; NS) or on grass ( $r_s = -.04$ ; NS). There was no change in the number of major injuries per game on turf ( $r_s = .37$ , NS), and there was a decline in the number of major injuries per game on grass ( $r_s = -.79$ ;  $P < .01$ ). The number of significant injuries per game was  $0.70 \pm 0.38$  on turf and  $0.59 \pm 0.26$  (mean  $\pm$  SD) on grass. The number of major injuries per game was  $0.36 \pm 0.29$  on turf and  $0.23 \pm 0.16$  on grass. Using the year as the unit of association to compare turf with grass injuries, the mean difference (turf minus grass) was  $0.11 \pm 0.49$  significant injuries and  $0.13 \pm 0.38$  major injuries per game. Neither mean difference differed from zero. A large deviation<sup>9</sup> is  $0.8 \times$  SD, which in our case amounts to 0.4 significant injuries and 0.3 major injuries per game. Our power to detect what Cohen<sup>9</sup> calls a large deviation from zero is 90% (using a two-tailed significance of .05). Therefore, we found no statistically meaningful differences between grass- and turf-related injuries since 1968.

## Injuries by Site

From 1969 to 1985 we were able to break down the injuries by site (Fig 2). The knee suffered the most significant injuries (39.3%), with the distal leg (foot, ankle, shin, and calf) accounting for an additional 23.2%. All leg injuries accounted for 76.2% of all significant injuries.

The location of major injuries (Fig 3) also shows a clear preponderance of injuries to the knee (58.0%). Once again, the distal leg is second with 15.9% of the major injuries.

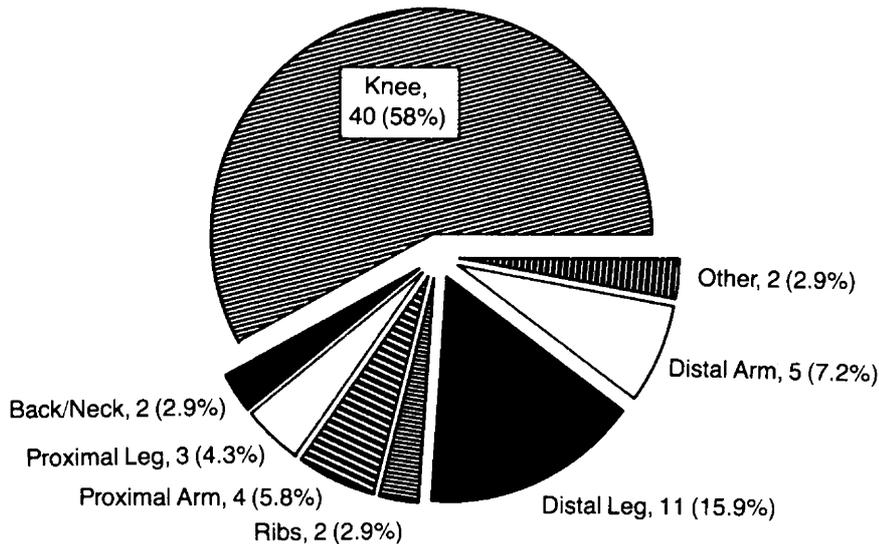


Fig 3.—Pie chart demonstrating site of all major injuries from 1969 to 1985. Distal leg is comprised of area below knee; proximal leg is thigh and hip; distal arm, area below elbow; and proximal arm, area from elbow to shoulder.

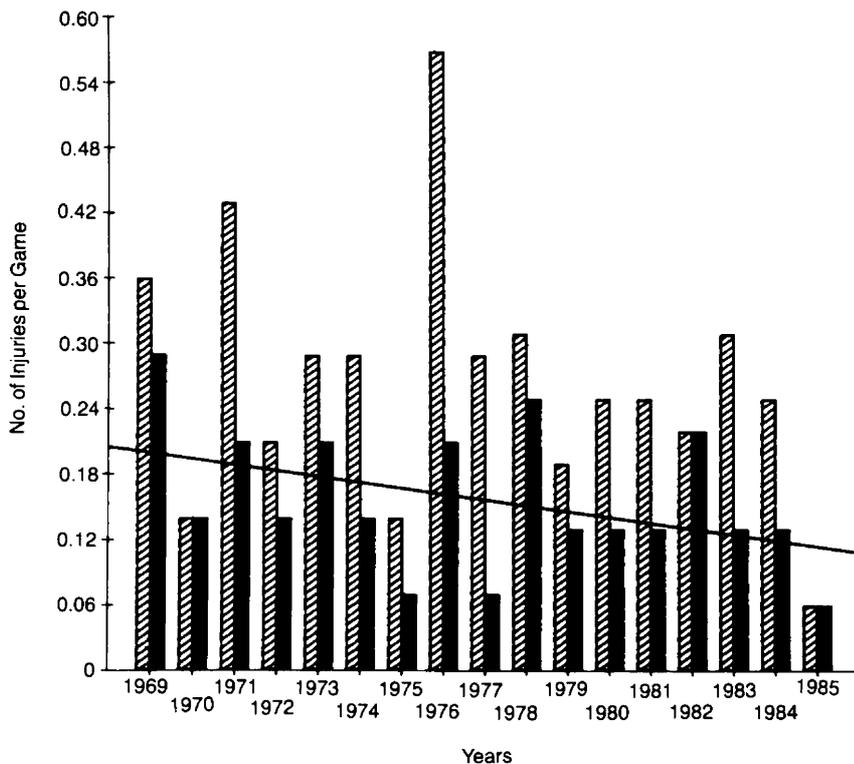


Fig 4.—Number of significant (two or more games missed [slashed bars]) and major (eight or more games missed [solid bars]) knee injuries from 1969 to 1985. Least squares regression line is drawn in for major knee injuries, which declined significantly from 1969 to 1985 ( $r_s = -.51$ ;  $P < .05$ ). Number of significant injuries has not changed.

Table 3.—Injury per Play on Offense, Defense, and Special Teams, 1960-1968 vs 1969-1985\*

	1960-1968	1969-1985	Significance
<b>Significant Injuries (≥2 Games Missed)</b>			
Offense	1:165 (48:7862)	1:348 (45:15 595)	<.001
Defense	1:261 (31:8069)	1:378 (42:15 839)	NS
Special teams	1:68 (26:1733)	1:705 (9:6344)	<.001
<b>Major Injuries (≥8 Games Missed)</b>			
Offense	1:360 (22:7888)	1:579 (27:15 613)	NS
Defense	1:368 (22:8078)	1:496 (32:15 849)	NS
Special teams	1:103 (17:1742)	1:635 (10:6343)	<.001

\*A comparison of injuries from a first report<sup>6</sup> covering the years 1960 to 1968 with those from the more recent era of 1969 to 1985. The ratio indicates the number of injuries per play; the number of injuries and plays is indicated within the parentheses. There have been declines in the rates of significant injuries (those that required a player to miss at least two consecutive regular season games) on offense and special teams and declines in major injuries (those that required surgery or required a player to miss at least eight consecutive games or the equivalent time loss if near the end of the season) on special teams.

Figure 4 demonstrates the number of significant and major injuries to the knee on a per-game basis from 1969 through 1985. The number of significant injuries showed no trend with time ( $r_s = -.27$ ; NS), but the number of major injuries declined during this time period ( $r_s = -.51$ ;  $P < .05$ ).

### Injuries by Position

Our previous study<sup>5</sup> (from 1960 to 1968) compared the number of injuries per play on offense, defense, and special teams. We have made a similar comparison for the years 1969 to 1985. The results of this comparison are shown in Table 3. Overall, there have been fewer injuries per play from 1969 to 1985 than there were from 1960 to 1968. Perhaps the most striking difference between these two eras was the change in injury rates on special teams. From 1969 to 1985, the major injury rate did not differ among offensive, defensive, and special-team plays ( $P = .5$ ) but was much higher on special-team plays from 1960 to 1968. There has continued to be a decline in major injuries per play on special teams from 1969 to 1985 ( $r_s = -.55$ ;  $P < .05$ ). There were fewer significant injuries per play during special-team play from 1969 to 1985 than there were on offensive and defensive plays ( $P = .04$ ).

### COMMENT

During one 26-year period, we have seen a decline in game-related significant and major injuries to one professional football team. If the first five years of study (1960 through 1964) are omitted, significant injuries showed no trend with time, while major injuries (eight or more games missed) have declined in number.

To our knowledge, no other team physician has had the opportunity to study closely injury in any professional sport for a period spanning more than one fourth of a century. Although injury rates are empirically believed to be high in professional football and, as reported

by the press, "violently and brutally higher," there is no basis for this statement. Indeed, we believe our data demonstrate no increase in the frequency or substance of injury in professional football. From the creation of this team in 1960, the team has averaged less than one significant injury per game and five major injuries per season, with periodic, episodic highs and lows. We have often said that there was one major injury per year per every eight players on the squad in the earlier years of study, and we are impressed by the relative constancy of this rate over the duration of this study. These values are similar to the number of major injuries evident in the data of Shields and Zomar,<sup>3</sup> which we computed to be slightly more than four injuries per year that required surgery.

To qualify as a reportable event, an injury had to be more severe in our study than in other previous studies. The Stanford Research Institute recorded an injury if a player could not complete a game or a practice, missed two or more consecutive practices, missed one game, or suffered a fracture or dislocation that required support.<sup>4</sup> The National Athletic Injury/Illness Reporting System considers an injury to be reportable if it requires a player to miss two participation days beyond the day of onset.<sup>10</sup> We do not deny the importance of these injuries, but we chose to use a more stringent criterion because our experience indicates that this definition recognizes the varying performance demands that may allow participation at one position but not another and addresses the deconditioning process that is likely to be significant after missing two games of regular-season play, but not one game. Moreover, players differ in their ability to play with pain, thus making the one-game injury more subject to individual variation than two or more games, where coaches are likely to substitute players.

The initial five years of the franchise represented a period with extremely

Table 4.—Some Improvements in the Game Since 1960

Reporting of injuries
Profiling of performance demands and players
Rules changes
Education of sports medicine team
All-season conditioning and monitoring of injured players
Improved equipment
Coaching techniques at all levels of the game
Referee education and more officials
Biomechanical studies of injury
Improved techniques for specific early diagnosis and appropriate treatment, eg, arthrography and arthroscopy
Rehabilitation techniques
Bracing for specific purposes with new materials
Appropriate emergency care and transport
Computerization and modern photographic techniques for recall and analysis
Predraft physical examinations

high injury rates. Possible explanations for this phenomenon are that the team was initially comprised of some players who could not make other teams due to prior injury or lack of size or talent. Perhaps they suffered more injuries as a result. Also, there may have been a learning curve associated with the team physician's diagnosis and more effective treatment of injury with the passage of time.

Since 1965, significant injuries allowed no predictable pattern and averaged 0.7 injuries per game for this team. This translates into a rate of 0.00042 injuries per player exposure if one considers that there are 11 players from the team on the field for each play and an average of 149 plays per game.

Unlike the total number of injuries, there continued to be a decline in the number of major injuries per game. Since 1969 there was also a decline in major knee injuries per game, while the number of significant knee injuries per game did not change (Fig 4). There are several possible explanations for this observation.

Injuries that once required arthroscopy and a much longer recuperative period were frequently treated arthroscopically by the team physician beginning in 1975, so that diagnosis was more accurate, morbidity was decreased, and players could return faster. Experience in advanced methods of rehabilitating the injured athlete may have decreased time loss due to injury. Stabilization of the unstable knee joint by triaxial bracing,<sup>11</sup> starting in 1969, allowed faster return to competition at positions that could play with the brace and may have decreased the chance of another major injury. However, we do not believe that prophylactic knee bracing has been conclusively shown to decrease the rate of knee injuries.

A predraft screening of all potential

draft choices, originally conceived by the Institute of Sports Medicine and Athletic Trauma and instituted by the medical team and scouts in 1977, decreased the likelihood of drafting a player with a history of or vulnerability to serious injury. Finally, there has been a continuous evolution of year-round training techniques and knowledge, and this may have decreased the likelihood of serious injury.

Our study did not include surgical procedures performed during the off-season for injuries that did not cause the player to miss two or more consecutive games. These elective surgical procedures corrected residual pathology that may have occurred in college or during the season but did not prevent players from competing. Deimpingement of ankle and acromial spurs and the surgical correction of hallux rigidus or shoulder dislocation are examples of such cases. Players could function with these conditions and did not lose playing time in any case by a major injury of the affected part.

Since 1969, there have actually been fewer significant injuries per play on special teams compared with offensive and defensive plays (Table 3). This differs from our previous report, which found a higher incidence of major and significant injuries on special teams prior to 1969.<sup>5</sup> Special teams represent a better trained and more thoroughly coached unit than in the early years of the franchise. Starting offensive and defensive players have had diminished responsibility on special teams as time progressed, whereas players in the 1960s frequently played on special teams as well as regularly on offense or defense, since squads were much smaller. The current report also found no difference among offensive, defensive, and special-team plays with regard to the number of major injuries per play, but during this time period there was a reduction in the number of major injuries per play on special teams ( $r_s = -.55$ ;  $P < .05$ ). It seems likely, therefore, that changes have been made in the game that make it less likely for a player to sustain a serious injury on special-team play. Rule changes, such as prohibiting blocking below the waist, may be responsible for part of this decline.

Since changes in the game occurred during the entire 26 years, we chose to make our comparison of playing surface on a paired basis by year. Since 1968, when the team first began playing some of its games on turf, there has been no difference in the rates of significant injuries per game or major injuries per game on either surface. We actually ob-

served more injuries on grass than on turf, but that was due to the fact that more games were played on grass. The Stanford Research Institute study also found no difference in serious injury between surfaces.<sup>4</sup> It may appear that there are now more injuries on turf simply because more games are now played on artificial surfaces. Therefore, consideration of the number of exposures to each surface is critical before either surface is deemed more injurious.

The relationship between type of playing surface and contact vs noncontact injuries was not within the scope of this study. The advent of multiple camera placements for filming games may make it appear that noncontact injuries are more frequent today than they were in the past. However, we recall many severely damaged knee joints in the 1960s and early 1970s that occurred on grass without contact, caused by cleated foot fixation or bad grass conditions.

The lower extremity was responsible for 76% of all significant injuries and 78% of all major injuries. The knee was the site more frequently injured, with 39% of all significant injuries and 58% of all major injuries. Other studies of injury in nonprofessional<sup>10,12-15</sup> and professional<sup>4,5,16</sup> football also underscore the high rate of injury to the lower extremity and particularly the knee. Preseason profiles have selected against many such candidates in the last decade.

This study offers a perspective on injury history during a 26-year period of one professional team. The game of professional football has experienced extensive change and can be expected to undergo further change (Table 4). Similarly, selection, coaching experience, conditioning, profiling, rules, and the skills of athletes will change, as will our ability to diagnose, treat, and heal injury more efficiently. It seems that we cannot expect the disappearance of injury in professional football, considering the forces involved. But by constant attention to the nature of the game and its performance demands and by monitoring the pathology of injury rates, as in other sports at all ages, we should be able to establish standards as to what we can expect under constant medical surveillance.

## CONCLUSIONS

1. Following an initial higher rate of significant injuries (two or more games missed) during the first five years of study (1960 through 1964), injury rates have not changed significantly and averaged 0.7 per game.

2. The rate of major injuries (eight or more games missed) has declined signifi-

cantly ( $r_s = -.56$ ;  $P < .01$ ) from 1960 to 1985.

3. Rates of injury on turf and grass did not differ significantly when corrected for games played on each surface.

4. The lower extremity, particularly the knee suffered the most injuries of any site on this team. However, the rate of major injuries to the knee declined from 1969 to 1985.

5. The high rates of major injury on special-teams play noted during the first nine years have shown a significant decline from 1969 to 1985 ( $P = .04$ ).

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## References

1. Ellsasser JC, Reynolds FC, Omohundro JR: The nonoperative treatment of collateral ligament injuries of the knee in professional football players. *J Bone Joint Surg Am* 1974;56A:1185-1190.
2. Ellsasser JC, Stein AH: Management of hand injuries in a professional football team. *Am J Sports Med* 1979;7:178-182.
3. Shields CL, Zomar VD: Analysis of professional football injuries. *Contemp Orthop* 1982;4:90-95.
4. *National Football League 1974 Injury Study*. Menlo Park, Calif, Stanford Research Institute, 1975.
5. Nicholas JA: *A Review of Professional Football Injuries in Relation to Position*. National Academy of Science Symposium, Committee on Skeletal Systems report, Division of Medicine, Science. St Louis, National Research Council Workshop on Football Injuries, 1970.
6. *Standard Nomenclature of Athletic Injuries*. Chicago, American Medical Association, 1963.
7. Colton T: *Statistics in Medicine*. Boston, Little Brown & Co Inc, 1974, pp 223-224.
8. Norusis MJ: *SPSS/PC+ for the IBM PC/XT/AT*. Chicago, SPSS Inc, 1986, pp B190-B191.
9. Cohen J: *Statistical Power Analysis for the Behavioral Sciences*. New York, Academic Press Inc, 1964.
10. Alles WF, Powell JW, Buckley W, et al: The National Athletic Injury/Illness Reporting System three-year findings of high school and college football injuries. *J Orthopaed Sports Phys Ther* 1979;1:103-108.
11. Nicholas JA: Bracing the anterior cruciate ligament deficient knee using the Lenox Hill Derotation brace. *Clin Orthoped Related Res* 1983;172:137-142.
12. Blyth CS, Mueller FO: Football injury survey: Part 1—When and where players get hurt. *Phys Sports Med* 1974;2:45-52.
13. Olson CO: The Spokane study: High school football injuries. *Phys Sports Med* 1979;7:75-82.
14. Pritchett JW: High cost of high school football injuries. *Am J Sports Med* 1979;7:197-199.
15. Canale ST, Cantler ED, Sisk TD, et al: A chronicle of injuries of an American intercollegiate football team. *Am J Sports Med* 1981;9:384-389.
16. Grippo N: *NFL Injury Study 1969-1972: Final Project Report*, SRI-MSD 1961. Menlo Park, Calif, Stanford Research Institute, 1973.