# Performance Outcomes of Anterior Cruciate Ligament Reconstruction in the National Basketball Association

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**Purpose:** The purpose of this study was to determine the rate of return to play and to quantify the effect on the basketball player's performance after surgical reconstruction of the anterior cruciate ligament (ACL). **Methods:** Surgical injuries involving the ACL were queried for a 10-year period (1993-1994 season through 2004-2005 season) from the database maintained by the National Basketball Association (NBA). Standard statistical categories and player efficiency rating (PER), a measure that accounts for positive and negative playing statistics, were calculated to determine the impact of the injury on player performance relative to a matched comparison group. Over the study period, 31 NBA players had 32 ACL reconstructions. Two patients were excluded because of multiple ACL injuries, one was excluded because he never participated in league play, and another was the result of nonathletic activity. **Results:** Of the 27 players in the study group, 6 (22%) did not return to NBA competition. Of the 21 players (78%) who did return to play, 4 (15%) had an increase in the preinjury PER, 5 (19%) remained within 1 point of the preinjury PER, and the PER decreased by more than 1 point after return to play in 12 (44%). Although decreases occurred in most of the statistical categories for players returning from ACL surgery, the number of games played, field goal percentage, and number of turnovers per game were the only categories with a statistically significant decrease. Players in the comparison group had a statistically significant increase in the PER over their careers, whereas the study group had a marked, though not statistically significant, increase in the PER in the season after reconstruction. **Conclusions:** After ACL reconstruction in 27 basketball players, 22% did not return to a sanctioned NBA game. For those returning to play, performance decreased by more than 1 PER point in 44% of the patients, although the changes were not statistically significant relative to the comparison group. **Level of Evidence:** Level IV, therapeutic case series. **Key Words:** ACL—Anterior cruciate ligament—Knee injury—Return to play—Basketball.

Basketball is a sport that places significant demands on the knee, requiring running, jumping, and cutting movements that can put the players at risk for anterior cruciate ligament (ACL) injuries. In a National Basketball Association (NBA) injury study, the knee was the most common site of trauma, representing 13.8% of all reportable injuries and resulting in the greatest amount of time lost per injury.[1] In the Women's NBA the incidence of ACL injury in white-European-American players and nonwhite-European-American (black/African American, Hispanic, and Asian) players is 0.45 and 0.07 per 1,000 athletic exposures, respectively.[2] According to the National Collegiate Athletic Association Injury Surveillance System, the overall incidence of ACL injury was 0.08 in collegiate men's basketball and 0.28 in women's college basketball per 1,000 athlete exposures.[3] A study of Canadian college basketball players found a remarkable injury incidence of 45% over a 2-year pe-

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riod, with knee injuries as the leading cause of prolonged inability to play.[4] The overall percentage of NBA players sustaining an ACL injury between 1996 and 2002 was 0.8%. However, the effect of this injury on athletic performance in this population has not been evaluated.[5]

Despite a high rate of successful outcomes in the general population, few reports in the literature have focused on the postoperative function of elite athletes.[6,7] A National Football League (NFL) study of combine players found a statistically significant decrease in rejections for medical reasons for patients with an ACL reconstruction, suggesting that the function of these athletes improved over the study's 13-year period, without focusing on game performance outcomes.[8] In an NFL study of running backs and wide receivers after ACL reconstruction, 21% of the players never returned to participation in an NFL game and those who did exhibited a statistically significant decrease in performance ratings by one third when compared with a cohort group.[6] A study of collegiate athletes found a decreased participation rate in elite-level athletics after college in the reconstructed patients.[7] Another NFL study showed a constant number of ACL injuries per year in the league over a 9-year period.[9] On the basis of these studies of NFL and collegiate athletes, the rate of return to sports participation after reconstruction is diminished in elite athletes and sport-specific performance may deteriorate. Although the effect on NFL players has been examined, the ability to return after reconstruction and the effect on future performance for injured NBA players are unclear.

The purpose of this study was to determine the proportion of players undergoing ACL reconstruction who returned to play in the NBA and quantify the effect on statistical performance. Our hypothesis was that the elite athletes of the NBA would have a high rate of return to play in the NBA. For those players who did return to league competition, we also hypothesized that there would be a statistically significant decrease in playing performance.

## METHODS

The National Basketball Athletic Trainers Association maintains a database of all injuries and illnesses occurring in NBA players that (1) required physician referral and/or prescription medication, (2) resulted in a practice or game being missed, or (3) caused emergency care to be rendered to the athlete. These records are based on a standardized, league-wide injury-reporting instrument that is completed by each team's athletic trainer. The primary information collected includes the player's identification number, when and where the injury occurred, the specific injury, and the date, activity at the time of injury, and mechanism of the injury.

The records of athletes who sustained an ACL injury that required surgery during the 1994-1995 season to 2005-2006 season (excluding the strike-shortened 1998-1999 season) were queried from the database. The database only identifies whether the injury required surgery; it does not track the surgical technique or graft source.

### Player Efficiency Rating

Subjects were analyzed before injury and after reconstruction by use of individual game performance statistics and were matched to a comparison group to identify differences in the player efficiency rating (PER).[10] Game performance statistics including the number of games played, minutes per game, points per game, field goal percentage, 3-point field goal percentage, free throw percentage, rebounds per game, assists per game, steals per game, blocks per game, turnovers per game, and personal fouls were recorded for each player.[10] Calculated by summing positive performance measures (e.g., points, rebounds, and steals) and subtracting negative measures (e.g., turnovers and fouls), the PER is an objective and standardized method of assessing a player's performance and is used by coaches and front office administrators in making player personnel decisions.[9] The PER allows for comparisons of player performance across different seasons. The league average PER is adjusted each year to a value of 15. To minimize the effect of team or playing time variables, the PER is adjusted to a per-minute basis and allocations are made for team pace and playing style to represent a player's overall team contribution.[10]

### Statistical Analysis

A comparison group was matched for each ACL-injured player who returned to the NBA by use of an independent database.[11] The database makes comparison-group matches based on demographic factors (e.g., height, weight, age, and years of NBA experience), offensive productivity, and defensive statistics relative to the injured player's productivity in the years before surgery. Two comparison-group players who had no history of significant time lost because of injury during the study period were randomly selected for each injured player.