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The Knee



A cross-sport comparison of performance-based outcomes of professional athletes following primary microfracture of the knee☆☆☆

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ABSTRACT

Background: The purpose of this study was to compare performance-based outcomes among professional athletes in four major North American sports following microfracture to treat symptomatic chondral defects of the knee.

Methods: Major League Baseball (MLB), National Basketball Association (NBA), National Football League (NFL), and National Hockey League (NHL) athletes who underwent primary unilateral microfracture of the knee were identified through a previously reported protocol based on public sources. Successful return-to-play was defined as returning for at least one professional regular season game after surgery. Regular season player statistics and sport-specific performance scores were compiled for each player. Each player served as his own control, with the season prior to surgery defined as baseline. Comparisons across sports were enabled by adjusting for expected season and career length differences between sports and by calculating percent changes in performance.

Results: One hundred thirty one professional athletes who underwent microfracture were included. One hundred three athletes (78.6%) successfully returned to play. The ratio of games started-to-games played before surgery was found to be a significant positive independent predictor of returning ($p = 0.002$). Compared with their preoperative season, basketball and baseball players demonstrated significantly decreased performance one season after surgery (-14.8% , $p = 0.029$ and -12.9% , $p = 0.002$, respectively) that was recoverable to baseline by postoperative seasons 2–3 for baseball players but not for basketball players (-9.7% , $p = 0.024$).

Conclusion: Knee microfracture surgery is associated with a high rate of return to the professional level. However, the impact of this procedure on postoperative performance varied significantly depending on sport.

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1. Introduction

Professional athletes are at an increased risk of sustaining a variety of orthopedic injuries due to the considerable physical demands associated with elite levels of play. While the general population may be concerned with returning to activities of daily living, the physical demands of elite-level sports are much higher. Injuries of the knee, particularly damage to the articular

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cartilage, are common in the elite athlete population [1] and are potentially career-threatening. As such, it is important for players, coaches, and team medical staff to be well aware of the potential career risks and benefits of surgical treatment for such injuries.

Articular cartilage injuries can be treated surgically with several different techniques including debridement/chondroplasty, marrow stimulation techniques (microfracture), osteochondral allograft/autograft transplantation, and autologous chondrocyte implantation [2]. Among these, microfracture, which involves the use of arthroscopic awls to make multiple holes into the subchondral bone beneath the chondral defect, is the most common [3]. This procedure produces local hemorrhage leading to the formation of a fibrin clot, which may promote differentiation and growth of chondral repair tissue into the defect [4,5].

Despite its frequent use, the durability of microfracture repairs has been questioned [6–8]. For example, in recreational athletes, microfracture surgery has been reported to lead to satisfactory short-term outcomes, but sub-optimal long-term results presumably from chronic cartilage degeneration. The professional athlete is exposed to far greater physical stress than a recreational competitor, warranting separate analyses and potential recommendations. In previous case series analyzing National Basketball Association (NBA) [9–11] and National Football League (NFL) [12–14] athletes, return-to-play (RTP) rates have been analyzed. However, as it currently stands the effect that knee microfracture has on return rates for Major League Baseball (MLB) and National Hockey League (NHL) athletes and on athletic performance compared with pre-injury levels for professional athletes in these four different sports has not been characterized. In addition, there is no consensus on whether certain sports portend worse outcomes following microfracture. It is reasonable to surmise that the varied physical demands from each professional sport may lead to different outcomes.

The purpose of this study was to perform a comparative assessment of performance-based outcomes among professional athletes in four major North American sports following microfracture to treat symptomatic chondral defects of the knee. We hypothesized professional athletes undergoing this procedure would be able to return to their previous level of sport and performance at a high rate after surgery.

2. Methods

2.1. Inclusion criteria

A well-established algorithmic protocol [15–20] based on public sources was utilized to create a database of MLB, NBA, NFL (American football, hereafter referred to as “football”), and NHL athletes who underwent microfracture of the knee. NewsBank® search engine was used to identify players from each sport who underwent surgery, using the search terms “[professional league] knee microfracture surgery”. Player name and date of surgery were recorded for players captured by this initial query. Next, each case was validated individually using player profiles, newspaper archives, press releases, and team injury reports using the more specific search terms “[player name] knee microfracture surgery”. Inclusion criteria for this study were MLB, NBA, NFL, and NHL athletes who reportedly underwent primary unilateral microfracture surgery to treat symptomatic chondral defects of the knee while on the active roster of a professional team and had a definitive date of surgery. For each case, two independent sources of record were cross-referenced to confirm that a microfracture procedure was performed as defined by the inclusion criteria. Newly drafted players who underwent microfracture prior to playing in any professional regular season games or rookie players who underwent season-ending or non-season-ending surgery were included only for RTP analysis. Players who reportedly underwent multiple microfracture procedures (revision and/or bilateral), had the procedure while in college or while on a minor league team, retired before surgery, did not yet have postoperative data available (e.g., underwent surgery too recently), or had conflicting reports from different sources were excluded.

2.2. Performance-based outcome measures

Demographic data was manually collected for each athlete, including date of birth, weight, height, date of professional regular season debut, position, date of most recent professional regular season game, and retirement date (when applicable). Successful RTP was defined as returning for at least one regular season game in a major professional league after surgery, excluding minor leagues. This definition was chosen in order to standardize comparisons and minimize potential confounders, given the greater physical demands and skill level required for major league-level play compared with other levels (e.g., minor or international leagues). Further, professional game participation data can be readily collected from public sources, whereas player data at other possible return points (e.g., first postoperative workout, practice, or scrimmage) is not consistently reported. Return time was defined as the number of days elapsed between reported date of surgery and date of first professional game played. The index season was defined as the professional regular season immediately before surgery (off-season surgeries) or the prior season (season-ending and non-season-ending surgeries). For season-ending and off-season surgeries, the season corresponding to a player's first professional game back was defined as postoperative season one. For non-season-ending surgeries, the professional season after the season in which surgery occurred was defined as postoperative season one. Regular season game statistics were compiled both pre- and post-surgery, including all-star appearances, games played, games started (except hockey, in which players rotate for each position), and performance score (PS). Two statistical time points were used after microfracture: postoperative season one and an average of postoperative seasons two and three. Each player served as his own control, with performance compared to the index (baseline) season.

Performance scores were calculated for each sport for players who successfully returned using previously established and refined scoring systems. For baseball, performance scores were calculated using accepted sabermetrics based on a player's role as a hitter or

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