

Performance and Return to Sport After Thumb Ulnar Collateral Ligament Surgery in National Football League Players

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Abstract

Background: Acute ruptures of the ulnar collateral ligament (UCL) of the thumb are common injuries in sports. Surgical repair of complete tears has yielded excellent results in elite athletes. **Methods:** National Football League (NFL) players who underwent thumb UCL surgery and matched controls were identified. Demographic and performance data were collected. Performance scores were calculated using a standardized scoring system. Return to sport (RTS) in the NFL was defined as playing in at least 1 NFL game after thumb UCL surgery. Comparisons between case and control groups and preoperative and postoperative time points were made using paired-samples Student *t* tests. **Results:** Twenty-three players were identified (mean age: 28.8 ± 3.4 years and mean experience in the NFL: 5.9 ± 3.4 years). Twenty-two players (95.7%) were able to return to sport in the NFL at an average of 132.2 ± 126.1 days. The overall 1-year NFL career survival rate of players undergoing thumb UCL surgery was 87.0%. There was not a statistically significant decrease in games per season and career length for any position following surgery. No positions had a significant difference in postoperative performance when compared with preoperative performance, and there was no significant performance difference postoperatively when compared with matched controls. **Conclusions:** There is a high rate of RTS in the NFL following thumb UCL surgery. Players who underwent thumb UCL surgery played in a similar number of games per season and had similar career lengths in the NFL as controls. No position group had any significant postoperative performance score differences when compared with postindex matched controls.

Keywords: thumb, UCL, ulnar collateral ligament, NFL, return to sport

Introduction

Acute ruptures of the ulnar collateral ligament (UCL) of the thumb are common injuries in sports.^{12,20} The incidence is likely to rise secondary to an increase in athletic participation, with complete injuries to the thumb UCL occurring at a high frequency in elite athletes.^{11,13} The mechanism of injury typically involves hyperabduction or hyperextension of the thumb metacarpophalangeal (MCP) joint.^{8,10,16}

Incomplete injuries or sprains with a stable thumb MCP joint have historically been treated nonoperatively with cast immobilization.¹⁰ However, complete tears of the thumb UCL treated nonoperatively have resulted in pain, instability, decreased pinch strength, and eventually symptomatic osteoarthritis.¹⁷ Surgical repair of complete tears and those with a Stener lesion has yielded excellent results in over 90% of patients with a return to sport (RTS) rate ranging from 96% to 100% in elite-level athletes.^{5-7,17,19,20}

In the National Football League (NFL), various orthopedic injuries and surgical procedures such as patella tendon

repair and Achilles tendon repair have been shown to have a negative effect on postoperative performance, RTS, and length of career.^{2,14} Given these negative outcomes and the increasing revenue and popularity of the NFL, it is important to understand surgical outcomes in this patient population.

The purpose of this study was to determine: (1) RTS rate in NFL players following thumb UCL surgery; (2) postoperative career length and games per season; (3) preoperative and postoperative performance; and (4) postoperative performance compared with control players matched by position, age, years of experience, and performance. The authors hypothesized that NFL players who underwent thumb UCL surgery would have: (1) a greater than 90% RTS rate; (2) no

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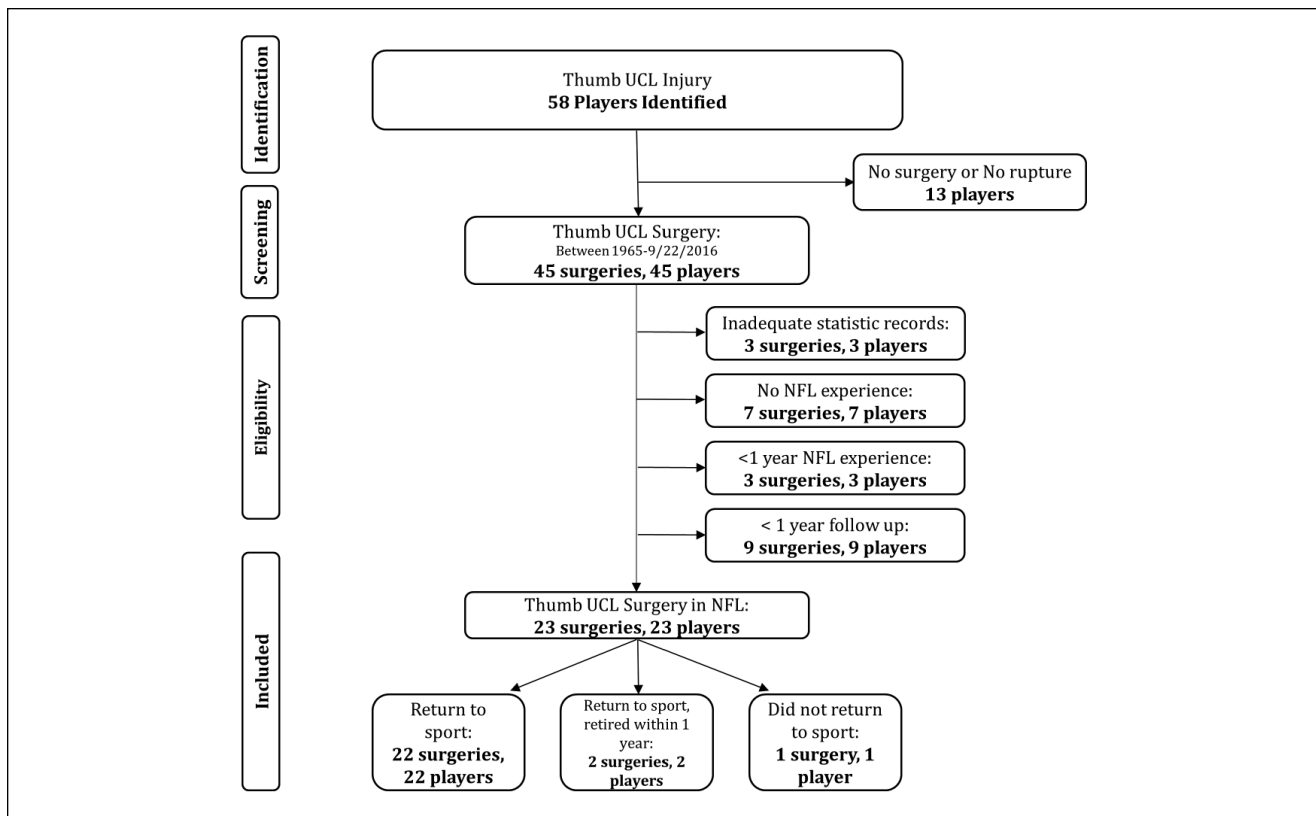


Figure 1. Flowchart illustrating application of exclusion criteria. Note. UCL = ulnar collateral ligament.

significant difference in postoperative career lengths and games per season compared with matched controls; (3) no significant difference in postoperative performance compared with preoperative performance; and (4) no significant performance difference postoperatively when compared with matched controls.

Materials and Methods

Players in the NFL who sustained a thumb UCL tear and underwent surgery were evaluated (Figure 1). These players were identified through NFL team websites, publicly available Internet-based injury reports, player profiles and biographies, and press releases. The search was manually conducted. Searches were performed for all NFL teams and players. Players who underwent thumb UCL surgery from 1965 to September 2016 were identified. It was unable to determine reliably whether the players underwent thumb UCL repair or reconstruction.

All players identified were included in this study as it related to RTS rate. A player was deemed to have RTS if he played in any single NFL game after surgery. A player was not deemed to have RTS if he did not play in any NFL game after surgical treatment. Inclusion criteria were any NFL athlete on

an active roster or listed on injured reserve in the NFL prior to thumb UCL surgery. Players were included if they were found to have thumb UCL surgery as reported by at least 2 separate sources. Athletes who were injured before completing their first NFL regular season were excluded. Players who sustained a thumb UCL tear and underwent thumb UCL surgery in the 2015-2016 season were excluded from analysis because they had less than 1 year to RTS. In addition, online reports that were conflicting, incomplete, or did not have a date of surgery were also excluded from the study ($n = 0$).

Demographic variables including a player's age, position, prior professional experience, and date of injury were recorded. Players were categorized by their positions: quarterback "QB," running back "RB," tight end "TE," wide receiver "WR," offensive lineman "OL," defensive lineman "DL," linebacker "LB," defensive back "DB," kicker "K," or punter "P." Fullbacks were considered as RBs. Performance statistics were collected from profootballreference.com for each player identified before and after thumb UCL surgery. Statistics were collected for regular season NFL games only with preseason and playoff games excluded.

A control group was selected. Controls were matched to study cases based on position, age (± 1 year), years of

experience (± 1 year), and performance data prior to the surgery date. Each control was given an index date (relative to career length) which matched the case player's surgery date to compare postoperative or postindex performance. For example, if a player sustained a thumb UCL tear and underwent thumb UCL surgery 3 years into his career, the control's index date was 3 years into his career.

Player statistics for cases preoperative and postoperative and controls preindex and postindex were collected and aggregated. Each statistical category was divided by games played to account for discrepancies in the number of games played per season. A player's performance score was then calculated by using a previously published and standardized scoring system based on metrics important to the player's specific position.^{3,18} Statistics per game were used to calculate each performance score per game.

All players were included in RTS, games per season, and career length analyses. A Kaplan-Meier survivorship curve with "retirement" as the endpoint was constructed postoperative for cases and postindex for controls. Positions without previously defined performance scores (punters, kickers, and OL) were excluded from performance score analysis. Comparisons between case and control groups and preoperative and postoperative time points were made using paired-samples Student *t* tests (<http://in-silico.net/tools/statistics/ttest>) using *P* value less than .05.

Results

Twenty-three thumb UCL surgeries in 23 players were analyzed (Table 1). The mean age was 28.8 ± 3.4 years, and the mean experience in the NFL was 5.9 ± 3.4 years at the time of surgery. Surgery occurred less than 1 week following injury in 18 players (78.3%), less than 1 month following injury in 1 player (4.3%), and the remaining 4 players (17.4%) waited until the offseason to undergo surgery. The QB position ($n = 6$) represented the largest proportion of players who underwent thumb UCL surgery (26.1%). Five of the 6 QBs underwent thumb UCL surgery in their dominant hand (83.3%). Twenty-two of 23 players (95.7%) were able to return to sport in the NFL at an average of 132.2 ± 126.1 days. One player did not return to sport after he failed a medical physical following thumb UCL surgery and was subsequently released by the team. It is unknown whether the thumb was the cause of the failed physical. Thirteen players (59.1%) returned within the same season as their injury.

Nine players (40.9%) returned to sport in less than 6 weeks. An additional 4 players (18.2%) returned between 6 and 12 weeks, and the remaining 9 players (40.9%) returned at greater than 12 weeks. Of the 9 players who return to sport after 12 weeks, 7 (77.8%) were out of season when they were expected to return. Two players (1 WR and 1 LB) underwent surgery after a prolonged period (average of 167

Table 1. Number of Surgeries With RTS Data by Position.

Position	n	RTS (n)	RTS (%)	Days to RTS (mean \pm SD)
QB	6	6	100.0	168.8 \pm 140.9
RB	4	4	100.0	230.0 \pm 139.6
WR	5	4	80.0	80.0 \pm 89.6
DB	3	3	100.0	108.0 \pm 159.4
LB	2	2	100.0	93.0 \pm 123.0
DL	1	1	100.0	6.0
OL	2	2	100.0	70.0 \pm 21.2
Total	23	22	95.7	132.2 \pm 126.1

Note. RTS = return to sport; QB = quarterback; RB = running back; WR = wide receiver; DB = defensive back; LB = linebacker; DL = defensive lineman; OL = offensive lineman.

days) of playing with a thumb UCL injury. These two players underwent surgery in the offseason and had an average RTS time of 197 days. The average RTS for players who returned within the same season as their surgery was 34.8 days (38.4 days for skill positions and 30.7 days for non-skill positions).

The overall 1-year NFL career survival rate of players undergoing thumb UCL surgery was 87.0%. Players in the control group (4.1 ± 2.5 years) were not in the NFL significantly longer ($P = .627$) than players who underwent thumb UCL surgery (3.8 ± 2.6 years) (Table 2). Players in the control group (11.1 ± 4.0 games per season) played in a similar number of games per season postindex as players who underwent thumb UCL surgery (11.0 ± 3.7) ($P = .888$).

There were no significant ($P > .05$) differences in demographic, performance, and games per season data between cases and matched controls presurgery and preindex (Tables 3 and 4) and in postoperative performance scores compared with preoperative scores (Figure 2). There was not a statistically significant ($P > .05$) decrease in games per season for any position following surgery (Table 5). No positions had a significant difference ($P > .05$) in postoperative performance when compared with preoperative performance, and there was no significant performance difference postoperatively when compared with matched controls (Figure 2).

Discussion

The purpose of this study was to determine: (1) RTS rate in NFL players following thumb UCL surgery; (2) postoperative career length and games per season; (3) preoperative and postoperative performance; and (4) postoperative performance compared with control players matched by position, age, years of experience, and performance. The study hypotheses were confirmed with a 95.7% RTS rate and similar postoperative career length and games per season postoperatively. No positions had a significant difference ($P > .05$) in postoperative performance when compared with preoperative performance, and there was no significant

Table 2. Games per Season and Career Lengths Postsurgery and Postindex for Cases and Controls.

Position	n	Games/season (mean ± SD)			Career length (mean ± SD)		
		Cases	Controls	P value	Cases	Controls	P value
QB	6	7.8 ± 3.1	8.8 ± 4.8	.601	5.3 ± 1.8	5.7 ± 2.3	.760
RB	4	11.7 ± 4.0	11.3 ± 3.7	.893	1.6 ± 0.5	3.8 ± 2.0	.135
WR	4	13.4 ± 2.5	12.8 ± 2.1	.647	4.9 ± 2.9	3.8 ± 2.9	.179
DB	3	12.0 ± 3.1	13.2 ± 2.5	.573	3.6 ± 3.5	3.1 ± 2.5	.566
LB	2	11.4 ± 1.3	14.7 ± 1.6	.031*	2.7 ± 0.9	5.7 ± 1.9	.374
DL	1	13.9	11.3		8.1	2.1	
OL	2	10.7 ± 7.5	7.5 ± 6.4	.802	0.5 ± 0.2	1.0 ± 0	.205
Overall	22	11.0 ± 3.7	11.1 ± 4.0	.888	3.8 ± 2.6	4.1 ± 2.5	.627

Note. QB = quarterback; RB = running back; WR = wide receiver; DB = defensive back; LB = linebacker; DL = defensive lineman; OL = offensive lineman.

Table 3. Preoperative and Preindex Performance Scores for Cases and Matched Controls.

Position	n	Performance score ± SD		
		Cases	Controls	P value
QB	6	10.2 ± 5.4	11.0 ± 5.1	.555
RB	4	6.8 ± 5.4	8.0 ± 4.0	.477
WR	4	5.9 ± 4.5	6.7 ± 4.1	.612
DB	3	4.0 ± 2.1	3.7 ± 2.1	.174
LB	2	6.7 ± 1.8	7.0 ± 0.5	.830
DL	1	7.2	5.3	

Note. QB = quarterback; RB = running back; WR = wide receiver; DB = defensive back; LB = linebacker; DL = defensive lineman.

performance difference postoperatively when compared with matched controls.

Previous studies demonstrated an RTS rate ranging from 96% to 100% for players who underwent thumb UCL surgery in elite-level athletes including collegiate and professional football.^{5,19,20} The RTS rate from these prior studies is similar to the results of the present study (RTS rate of 95.7%). Werner et al demonstrated an average RTS of 38.5 days in collegiate football players with skill position players returning at an average of 49 days and non-skill position players returning at 28 days on average.²⁰ This is similar to the present study in which the average time to RTS for players who returned within the same season as their surgery was 34.8 days. The same pattern was observed in our study in which non-skill positions (OLs, DLs, LBs, and DBs) returned faster than skill position players (QBs, RBs, and WRs) at 38.4 and 30.7 days, respectively.

The faster RTS in non-skill positions is likely due to the ability of these players to return while still wearing a thumb spica cast. Skill positions requiring manual dexterity and fine motor movement of the hands for throwing and catching are unable to return with a playing cast. Werner et al defined RTS as return to practice or return to game, whereas the present study defined RTS as playing in at least 1 regu-

Table 4. Mean Games per Season for Cases and Controls Presurgery and Preindex.

Position	Games/season (mean ± SD)		
	Cases presurgery	Controls preindex	P value
QB	8.7 ± 3.4	9.2 ± 3.3	.417
RB	12.3 ± 1.2	13.4 ± 1.7	.458
WR	15.2 ± 0.8	14.3 ± 1.7	.169
DB	12.0 ± 3.5	15.7 ± 0.5	.233
LB	13.8 ± 2.8	14.1 ± 0.9	.848
DL	11.5	14.5	
OL	14.5 ± 1.1	13.4 ± 2.7	.509

Note. QB = quarterback; RB = running back; WR = wide receiver; DB = defensive back; LB = linebacker; DL = defensive lineman; OL = offensive lineman.

lar season game.²⁰ This difference could explain the faster RTS. It is also possible that the small sample sizes (beta error) favored injuries at the beginning of the season (Werner et al) versus the end of the season in the present study.

A separate investigation by Werner et al investigated thumb UCL injuries and subsequent repairs in NFL athletes from a single team.¹⁹ All players who sustained a thumb UCL tear requiring surgery were treated with taping and splinting during the season and then treated with thumb UCL repair in the offseason. All players returned to sport the following season. This differs from the current study in which only 17.4% of players waited until the offseason for surgery. However, both studies demonstrated a high RTS rate following surgery, regardless of timing.

Of the 9 players who return to sport after 12 weeks, 77.8% were out of season when they were expected to return. Therefore, the RTS time is likely higher than it would have been if the players were not in the offseason. This is also exaggerated by the relatively short NFL season compared with other sports.

The offensive skill positions represented the largest proportion of players who underwent thumb UCL surgery

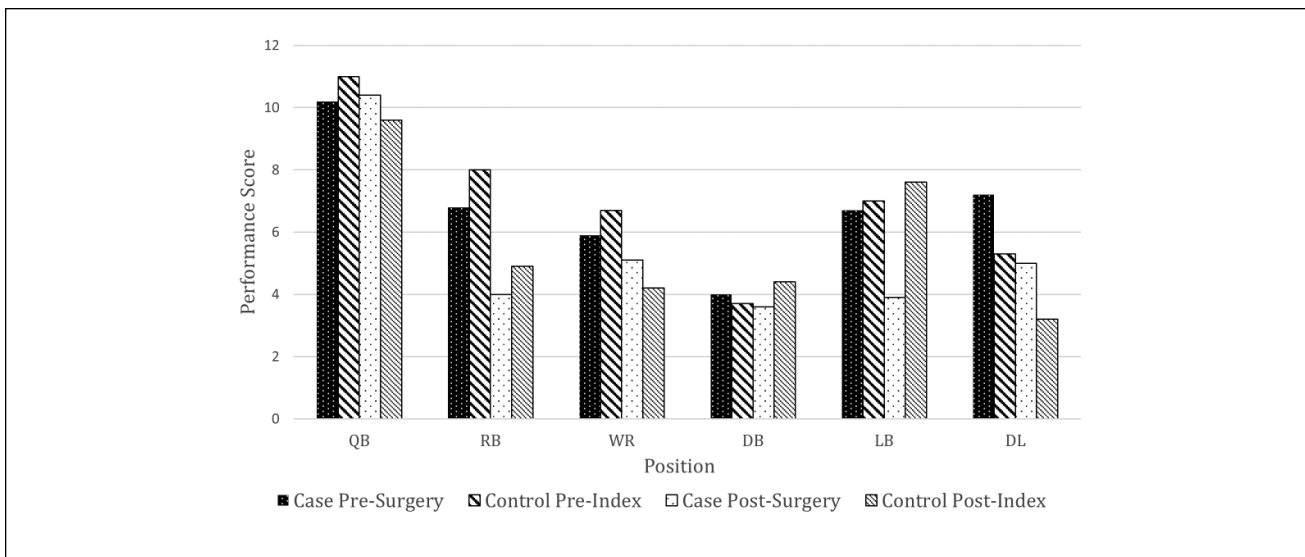


Figure 2. Performance scores by position before and after surgery compared with controls preindex and postindex. Note. QB = quarterback; RB = running back; WR = wide receiver; DB = defensive back; LB = linebacker; DL = defensive lineman.

Table 5. Mean Games per Season Presurgery and Postsurgery for Cases.

Position	Games/season (mean ± SD)		P value
	Presurgery	Postsurgery	
QB	8.7 ± 3.4	7.8 ± 0.5	.506
RB	12.3 ± 1.2	11.7 ± 4.0	.808
WR	15.2 ± 0.8	13.4 ± 2.5	.174
DB	12.0 ± 3.5	12.0 ± 3.1	.988
LB	13.8 ± 2.8	11.4 ± 1.3	.568
DL	11.5	13.9	
OL	14.5 ± 1.1	10.7 ± 7.5	.553

Note. QB = quarterback; RB = running back; WR = wide receiver; DB = defensive back; LB = linebacker; DL = defensive lineman; OL = offensive lineman.

(n = 15, 65.2%). This is similar to previous studies in which 50% to 55.6% of players undergoing thumb UCL repair were offensive skill players.^{19,20} The authors hypothesize that the increased incidence of thumb UCL tears within these position groups is likely due to the large amount of stress placed on the thumb UCL carrying, catching, or throwing the football in which the thumb MCP joint is extended and abducted. On the contrary, defensive players are relying less on thumb positioning during tackling and are therefore less likely to place their thumb in a vulnerable position.

The difference between prior studies and the current study is that the previous investigations did not look at performance scores for specific position groups and did not compare the outcomes of thumb UCL surgery against

matched controls. By using controls that were age-, NFL experience-, and performance-matched, the current study was able to improve performance data comparisons for case players against controls at the same junction of their career. By simply comparing a player with himself, rapid improvements (or regressions) in performance that are prevalent among similar players in the league may otherwise not be accounted for.

Prior studies have also failed to comment on performance and RTS differences between position groups following thumb UCL repair. There was no significant difference in performance between cases and matched controls preoperatively and preindex. The DB and QB groups had similar performance scores postoperatively as did their corresponding controls postindex.

Similarly, RBs and WRs performance decreased postoperatively as did their controls postindex. This indicates that thumb UCL surgery may not have a significant influence on the development and performance of these players after they returned to sport.

The QB position had the second longest RTS time of all position groups at 168 days. However, involvement of the dominant (83.3%) or nondominant throwing arm does not appear to affect RTS rate. The increased RTS time is likely due to reliance on thumb MCP joint motion for gripping and throwing the football. Further studies are needed to assess the biomechanical effect of thumb UCL surgery on throwing mechanics in football players.

There are limitations to this study. The use of publicly available data to identify players who underwent thumb UCL surgery is prone to selection, reporting, and observer bias. However, this method of data acquisition has been

used in multiple previous studies.^{1,4,9,15,18} In addition, the use of public data limits the ability to obtain the severity of the injury. In this study, career length was not adjusted for “time missed” for players who underwent thumb UCL surgery. Their time in the league was in fact longer than reported; however, their seasons spent playing (ie, career length) after surgery is accurate. Inherent to this type of study, there are multiple unknown confounding variables such as no direct physical contact or medical records access to corroborate diagnosis. In addition, the extent of the injury or presence of Stener lesion was unable to determine. It was also unable to determine reliably whether the patient had a repair or a reconstruction of the thumb UCL. Other limitations include the absence of patient-reported outcomes, incomplete follow-up and career length for players still in the NFL, and inability to compare OL or specialists with performance scoring. The authors were unable to compare nonoperative treatment with thumb UCL repair. Also, the small number of players in the study and position groups increases the risk of beta error in the present study.

In conclusion, there is a high rate of RTS in the NFL following thumb UCL surgery. Players who underwent thumb UCL surgery played in a similar number of games per season and had similar career lengths in the NFL as controls. No position group had any significant postoperative performance score differences when compared with postindex matched controls.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

This article does not contain any studies with human or animal subjects.

Statement of Informed Consent

Informed consent was not obtained.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: KRS, RAJ, RN, SRL, DML declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. PCM has the following disclosures: Speaker’s Bureau/Paid Presentation by company/supplier (Verice); research support from company/supplier (DePuy, A Johnson & Johnson Company; Arthrex); Medical/Orthopaedic Publications editorial/governing board (*Journal of Knee Surgery*; Orthobullets.com). JDH has the following disclosures: AAOS: Board or committee member; American Orthopaedic Society for Sports Medicine: Board or committee member; Arthroscopy: Editorial or governing board; Arthroscopy Association of North America: Board or com-

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