



Off-Season Arthroscopic Partial Meniscectomy in National Collegiate Athletic Association Division I Football Players Has a Longer Return to Sport Time than In-Season Surgery

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Purpose: To report the outcomes of routine arthroscopic meniscectomy in National Collegiate Athletic Association (NCAA) Division I Football players. **Methods:** NCAA athletes who underwent arthroscopic meniscectomy over 5 years were included. Players who had incomplete data, previous knee surgery, ligamentous injury, and/or microfractures were excluded. Data collected were player position, timing of surgery, procedures performed, return to play (RTP) rate and time, and postoperative performance. Continuous variables were analyzed with Student *t*-tests or a one-way analysis of variance. **Results:** Thirty-six athletes (38 knees) who underwent arthroscopic partial meniscectomy (31 lateral, 7 medial) were included. The mean RTP time was 71 ± 39 days. The mean RTP time in athletes who underwent in-season surgery) was significantly shorter than the RTP in athletes who had off-season surgery (58 ± 41 days vs 85 ± 33 days, $P < .05$). The mean RTP in 29 athletes (31 knees) with lateral meniscectomy was similar to the 7 athletes (7 knees) who had medial meniscectomy (70 ± 36 vs 77 ± 56 , $P = .6803$). The mean RTP time was similar between football players who underwent isolated lateral meniscectomy and those who had lateral meniscectomy with chondroplasty (61 ± 36 days vs 75 ± 41 days, $P = .32$). Athletes played an average of 7.7 ± 4.9 games the season they returned; position category and anatomical compartment of the knee lesion had no bearing on number of games played ($P = .1864$ and $P = .425$). **Conclusions:** NCAA Division I football players who underwent arthroscopic partial meniscectomy RTP at approximately 2.5 months' postoperatively. Athletes who underwent off-season surgery had longer RTP time compared with those who underwent in-season surgery. RTP time and performance after surgery did not differ based on player position, anatomical location of the lesions, or chondroplasty at the time of meniscectomy. **Level of Evidence:** Level IV, therapeutic case series.

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Meniscal injuries have been described as potentially career-threatening injuries in elite athletes, as the menisci's biomechanical function includes load distribution, shock absorption, and joint stabilization.¹⁻⁵ A total of 2,460 knee ligament and meniscal tears and 3,009,205 athletic exposures were recorded by the National Collegiate Athletic Association (NCAA) Injury Surveillance System over a period of 10 years in collegiate football, with lateral and medial meniscus injuries accounting for 10.9% and 6.7% of injuries, respectively.⁶ Arthroscopic debridement or repair of the torn meniscal fibers remain the gold standard treatments in athletes with meniscal tears.⁷

Previous studies have reported the return to play (RTP) time and rate in football athletes undergoing knee arthroscopy, but the results are highly variable as the result of the different combinations of

intraoperative procedures performed within each study group.^{1,3,7-11} These procedures may involve the menisci, cartilage, and/or ligamentous structures of the knee.^{1,3,8,9} There are few studies reporting the outcomes of “routine knee arthroscopy” (partial meniscectomy with or without concomitant chondroplasty) in elite athletes, including American football players.

While it is common thinking in sports medicine that rehabilitation after routine knee arthroscopy can result in accelerated rehabilitation protocols, controversy still exists on the time to RTP following partial meniscectomy with or without chondroplasty in high-level athletes.^{12,13} In a systematic review of athletes who underwent various types of meniscal surgery, the mean time to RTP fell between the range of 4 to 9 weeks.¹⁰ A previous study showed no difference in RTP rate between National Football League (NFL) athletes who underwent lateral meniscectomy with versus without concomitant ligamentous procedures; however, differences in RTP time were not reported.¹ Kim et al.¹³ reported mean time to RTP of 54 days in a subgroup of young athletes who underwent meniscectomy; however, these athletes participated in various sports, and football was not included. More research is needed to accurately estimate the time to RTP in football athletes undergoing partial meniscectomy and to identify factors that are associated with faster or delayed RTP.

The purpose of this study was to report the outcomes of routine arthroscopic meniscectomy in NCAA Division I football players. We hypothesized that NCAA Division I football athletes would RTP at high rates following noncruciate arthroscopy of the knee, with the mean time to RTP falling into previously reported timelines in the athletic population.

Methods

Study Design

Included were NCAA Division I football players at a single institution who underwent arthroscopic meniscectomy with or without chondroplasty over a 5-year period. Athletes were excluded if they had previous knee surgery on the operative side, injury to any of the cruciate or collateral ligaments of the knee, or if the primary indication for knee arthroscopy was symptomatic cartilage defect requiring microfracture and/or advanced cartilage restoration surgery rather than meniscus injury. This study was approved by the Institutional Review Board of the University of Southern California (protocol #HS1500063).

Variables collected for each player included player position, age, timing of surgery (in season vs off-season), intraoperative findings, procedures performed, RTP time, and number of games played in the season the player returned to football activity. Players injured in-season were injured during fall camp or early

during the season. Intraoperative findings were categorized based on the anatomic location within the knee joint: lateral compartment, medial compartment, patellofemoral compartment, and multicompartamental. Multicompartamental lesions involved at least 3 compartments. Player positions were grouped as non-skill positions (offensive and defensive line, tight end, punter) and skill positions (running back, wide receiver, defensive back, linebacker, quarterback) based on a previous analysis.¹⁴ RTP time was defined as the number of days that elapsed between an athlete’s surgery and the day that the athlete fully participated in football practice or game without any physical restrictions. The number of games played in the season the player returned to football activity was obtained by publicly available sources, and it was determined based on the number of games played during the remaining season (for athletes who returned during the same season that they had surgery) or games played during the following season. NCAA Division I Football players typically play 10 to 13 games in a season.

Surgical Technique and Rehabilitation

All patients underwent arthroscopic partial meniscectomy under general anesthesia. If chondral damage was observed intraoperatively, this was addressed with chondroplasty. Postoperatively, weight-bearing as tolerated on the operated lower extremity was recommended with the use of crutches in athletes who underwent partial meniscectomy with or without chondroplasty.

Statistical Analysis

Continuous outcome variables were analyzed using unpaired Student *t* tests or a one-way analysis of variance. A simple linear regression was performed to compare RTP time and number of games played in the season in which the player returned to football activities. Statistical significance was defined as $P < .05$. Statistical analysis was performed using STATA/IC 14.0 (Stata Statistical Software: Release 14; StataCorp LP, 2015, College Station, TX).

Results

A total of 36 NCAA Division I athletes (38 knees) who underwent arthroscopic partial meniscectomy with or without chondroplasty were analyzed. The mean athlete age was 20 ± 2.4 (range: 18-22) years. One-half (18/36, 50%) of players were non-skill players and 50% (18/36 players) were skill players. Fifty-three percent (20/38 procedures) of arthroscopic partial meniscectomies were performed during the season in which they player was injured (in-season procedures), whereas 47% (18/38 procedures) of surgeries were performed during the off-season. Lateral partial meniscectomy was performed in 31 knees (31/38

Table 1. Anatomic Location of Lesions and Meniscectomy Performed Based on Player Position

Player Position	Partial Meniscectomy		Lateral Compartment (N = 27)	Medial Compartment (N = 3)	Multiple (≥3) Compartments (N = 8)
	Lateral (N = 31)	Medial (N = 7)			
Non-skill					
Defensive lineman	1	4	2	2	2
Offensive lineman	7	0	0	0	0
Tight end	2	1	0	0	1
Punter	1	1	1	1	1
Skill					
Linebacker	8	1	6	0	3
Running back	7	0	6	0	1
Defensive back	3	0	3	0	1
Wide receiver	2	0	2	0	0
Quarterback	1	0	0	0	1

procedures, 81.5%). Of the lateral partial meniscectomies, isolated lateral partial meniscectomy was performed in 20 cases (20/31 procedures, 65%), whereas lateral partial meniscectomy with chondroplasty was performed in 11 cases (11/31 procedures, 35%). Partial medial meniscectomy was performed in 7 knees (7/38 procedures, 18.5%) and chondroplasty was performed in all cases (7/7 procedures, 100%).

Table 1 shows the distribution of anatomic location of the intra-articular lesions and meniscectomies performed based on player position. In most cases, structural abnormalities were observed at the lateral compartment (24/38, 63%), followed by medial compartment lesions (7/38, 18%), patellofemoral compartment lesions (4/11%), and multi-compartmental lesions (3/38, 8%).

All athletes were able to RTP at a mean of 71 ± 39 days (range: 19-181; Fig 1). Athletes who underwent in-season surgery had significantly shorter RTP versus off-season knee arthroscopy (59 ± 41 days, range: 19-181 days vs 85 ± 33 days, range: 22-144 days, $P = .041$). The mean time to return following lateral meniscectomy (29 athletes, 31 knees) was similar to those (7 athletes, 7 knees) who had medial meniscectomy (70 ± 36 , range: 19-144 vs 77 ± 56 , range: 19-181, $P = .68$). The mean RTP time was similar between football players who underwent isolated lateral meniscectomy and those who had lateral meniscectomy combined with chondroplasty (61 ± 36 days; range: 19-114 vs 75 ± 41 days, range: 19-181, $P = .32$). RTP time did not differ based on the anatomic compartment that the lesions were observed intraoperatively ($P = .46$, Table 2). RTP time in non-skill players was similar to skill players (73.0 ± 44 days; range: 19-181 days vs 70 ± 39 days, range: 19-144 days, $P = .82$, Table 3).

The mean number of games played in the season the player returned to football activity was 7.4 ± 4.4 games (range: 0-14 games). Four players returned to full participation in football activity but did not appear in any games for factors unrelated to their injury. There

was no difference in games played in the season the player returned to football activity by position category or anatomical compartment of intra-articular knee lesions ($P = .19$, $P = .43$, Table 2 and Table 3).

Discussion

This study showed that NCAA Division I players who underwent off-season or in-season arthroscopic meniscectomy successfully returned to the preinjury level of sport at approximately 10 weeks post-operatively. There was a significantly shorter RTP time in athletes who underwent surgery during the season. Most players underwent lateral meniscectomy and only 7 of 36 athletes underwent medial partial meniscectomy. There was no statistically significant difference in the RTP time between athletes who had lateral versus medial partial meniscectomy (72 days vs 91 days, $P = .46$). RTP time and post-return player performance did not differ based on player position (skill position vs non-skill position players), and the anatomic compartment that the lesions were observed intraoperatively. The mean number of games played in the season the player returned to football activity was 7.4 games.

There was a statistical difference in the mean RTP time between players who had an in-season (20 knees) versus off-season (18 knees) procedure (59 days vs 85 days, $P = .04$). This may be attributed to athletes who undergo surgery during the season may be "rushed" to RTP faster than those who have off-season surgery. Our results confirm this hypothesis, given that the mean time to RTP in athletes who had off season surgery was 2.5 weeks longer than in those who underwent an in-season knee arthroscopy. We did not alter the rehabilitation protocol based on the timing of surgery relative to the season but these findings warrant future investigation.

Previous literature on the RTP rate and time in athletes undergoing arthroscopic meniscectomy is limited by mixed populations (type of sport and/or level of competition of the athletes) and variability of the

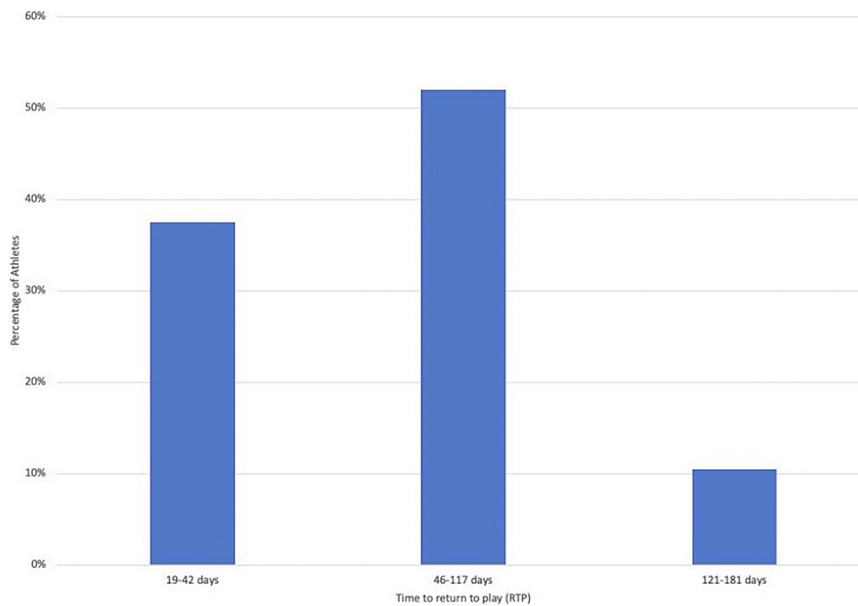


Fig 1. Time to RTP (in days) following arthroscopic partial meniscectomy in NCAA Division 1 football players. The time to RTP groupings were determined based on the range of RTP values determined for athletes from this study, as well as to provide a range to demonstrate early (<1 month-1.5 months) versus delayed RTP (4-6 months). (NCAA, National Collegiate Athletic Association; RTP, return to play.)

intraoperative procedures performed.^{1,10} Aune et al.¹ reported the outcomes of partial lateral meniscectomy in a group of NFL players and found similar RTP rates between athletes who had isolated partial lateral meniscectomy versus partial lateral meniscectomy and concomitant procedures (anterior cruciate ligament reconstruction, chondral debridement, microfracture, meniscal repair, loose body removal, and others). The overall rate of RTP in this study was 61% and the mean time to RTP was 8.5 months.¹ The mean RTP time in our cohort was significantly shorter (10 weeks), likely because we excluded athletes who underwent concomitant procedures that require extensive rehabilitation, such as cruciate ligament reconstruction, meniscal repair or microfracture. Lee et al.¹⁰ reported that most athletes returned to sports within 7 to 9 weeks following meniscal repair, and that RTP rate was as high as 89.9%. This last study, however, was not specific to football players and included meniscal repairs in addition to meniscectomy.¹⁰

Additional studies¹³ have reported the outcomes of arthroscopic meniscectomy in athletes without the presence of accompanying ligamentous injury. Kim et al.¹³ examined the RTP rate and time in a mixed

group of 56 athletes between the ages of 13 and 67 years. Most of the patients in this study underwent lateral meniscectomy.¹³ Kim et al.¹³ reported mean time to RTP of 54 days in the subgroup of athletes who were younger than 30 years old. The RTP reported in this last study was significantly shorter than the 2.5 months (73 days) RTP time found in our group of NCAA Division I athletes with a mean age of 20 (range: 18-22) years.¹³ The mean time to RTP in the older subgroup (>30 years) of patients in the study of Kim et al.¹³ was 89 days, which was longer compared with ours (73 days) possibly due to the age difference and the urgency to RTP.

The mean number of games played during the season in which the athletes returned to football after arthroscopic partial meniscectomy was 7. Aune et al.¹ reported that NFL players who had partial meniscectomy played an average of 27.5 games over a little more than 2 seasons. Due to fundamental differences in the training and competition schedules followed by football players competing in the NCAA Division I category compared with those competing in the NFL, any comparison of the postoperative athletic performance based on the numbers of games played between the 2 study

Table 2. Time to Return to Play and Number of Games Played Upon Return to Football Activity by Compartment

	Lateral Compartment	Medial Compartment	Patellofemoral Compartment	Multiple (≥ 3) Compartments	<i>P</i> Value
Number of knee arthroscopy cases (%)	27 (71.05%)	8 (21.05%)	0 (0%)	3 (7.9%)	
RTP time, d, mean \pm SD	66 \pm 32	100 \pm 51	—	44 \pm 33	.46
Games played, mean \pm SD	7.3 \pm 4.9	8 \pm 6.1	—	10 \pm 2.0	.43

RTP, return to play; SD, standard deviation.

Table 3. Time to Return to Play and Games Played Upon Return to Football Activity by Player Position

	Non-skill Positions (N = 19)	Skill Positions (N = 19)	P Value
RTP time, d, mean \pm SD	73 \pm 44	70 \pm 38	.82
Games played, mean \pm SD	9.1 \pm 4.6	6.8 \pm 4.9	.19

NOTE. Non-skill positions = offensive and defensive lineman, tight end, punter; skill positions = linebacker, running back, defensive back, wide receiver, and quarterback.

RTP, return to play; SD, standard deviation.

populations would be irrelevant.¹ Lastly, we did not find a correlation between the time to RTP and numbers of games played after return in this group of NCAA Division I football players who underwent arthroscopic meniscectomy.

We found no differences in the number of games played based on player position or anatomic location of the lesions during surgery. In addition, 63% the football players in our study had structural lesions (meniscal tear with or without chondral damage) isolated in the lateral compartment of the knee joint. We found no difference in the RTP time between players who underwent isolated lateral meniscectomy and those who had lateral meniscectomy combined with chondroplasty (61 vs 75 days), suggesting that chondroplasty is unlikely to prolong the postoperative recovery of the athletes.

We found no difference in the RTP rate following arthroscopic partial meniscectomy between skill-position players (linebacker, running back, defensive back, wide receiver, quarterback) and non-skill position players (defensive lineman, offensive lineman, tight end, punter) who competed in the NCAA Division I category (mean RTP of 73 days and 70 days, $P = .82$). According to the study of Aune et al.¹ in NFL players, skill position was the single greatest measured predictor of the ability to RTP among the athletes who underwent lateral meniscectomy (69 players). Specifically, skill-position players were 4 times less likely to RTP compared with the non-skill position athletes.¹ The authors attributed this result to the greater frequency of cutting and agility movements involved in the skill positions in American football compared with non-skill positions that make the postoperative recovery challenging.¹

Previous studies on this topic included athletes who underwent multiple procedures and/or athletes participating in various sports,^{1,2,13} but our inclusion criteria were limited to high-level football players who underwent arthroscopic partial meniscectomy with or without concomitant chondroplasty. More research is necessary to establish more accurate estimates of the

RTP time following arthroscopic meniscectomy in athletes. Future studies should examine the differences in RTP time based on diagnosis and intraoperative procedures performed in athletes undergoing arthroscopic surgery to facilitate preoperative counseling in athletes and help to determine the optimal timing for surgical intervention relative to the athletic season.

Limitations

Our study was limited by several factors, mainly related to the inclusion of only high-level football athletes who underwent routine arthroscopic knee surgery to address uncomplicated meniscal tears, and who did not undergo major concomitant procedures and/or advanced (such as ACL reconstruction or meniscal repair) cartilage restoration surgery. This was a retrospective review of prospectively collected data; however, there is always a risk of missed or inaccurately reported information that may have impacted the validity of these results. This current study was limited by the small population size (36 athletes), which was likely responsible for the failure to detect differences in RTP rate and time based on player position and other data points analyzed. We were unable to perform analysis of the RTP rate and time based on the individual player position due to the limited number of athletes in each category, as shown in Table 1. Thus, we limited our comparison between skill-position and non-skill position athletes based on a previously published paper.¹ The number of games played over 1 season following the athletes' RTP after surgery was the only metric used to assess the postoperative performance of the included players, which is unlikely to represent their overall status of health during the postoperative period. Lastly, we did not report the length of career in these athletes, although literature has shown that meniscectomy poses a threat to the athlete's career.^{3,4,14} Longer follow-up would be necessary to determine the long-term effect of arthroscopic partial meniscectomy in NCAA Division I football players.

Conclusions

NCAA Division I football players who underwent arthroscopic partial meniscectomy RTP at approximately 2.5 months postoperatively. Athletes who underwent off-season surgery had longer RTP time compared with those who underwent in-season surgery. RTP time and performance after surgery did not differ based on player position, anatomical location of the lesions, or chondroplasty at the time of meniscectomy.

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