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The majority of athletes fail to return to play following anterior cruciate ligament reconstruction due to reasons other than the operated knee

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Abstract

Purpose The purpose of this study is to evaluate the reasons why athletes do not return to play (RTP) following anterior cruciate ligament (ACL) reconstruction from a large single-centre database.

Methods The institutional ACL registry was screened for patients that had undergone a primary ACLR and had RTP status reported at 24-month follow-up. The reasons that patients were unable to RTP at 24 months were evaluated. The ACL-Return to Sport Index (ACL-RSI) was evaluated at baseline and 24-month follow-up to evaluate psychological ability to RTP.

Results At 2 years, 1140 patients returned to play, and 222 had not returned to play. The most common reasons athletes were unable to return was fear of reinjury (27.5%), lack of confidence in performance on return (19.4%) and external life factors (16.6%), i.e. work commitments and family reasons. Other reasons for athletes not returning to play were residual knee pain (10%) and subsequent injury (5%). The ACL-RSI score was significantly lower at diagnosis (40.3 vs. 49.3; $p=0.003$) and 2 years (41.8 vs. 78.7; $p<0.0001$) in athletes who did not return to play vs. those that did RTP.

Conclusion The majority of patients that report they have not returned to play do so due to external life and psychological factors associated with their injury, including fear of reinjury and lack of confidence in performance. A small minority of patients were unable to return due to residual knee symptoms or reinjury. Pre-operative psychological assessment and intervention may identify those less likely to RTP and provide an opportunity for targeted interventions to further improve RTP outcomes.

Level of evidence III.

Keywords ACL · Reconstruction · Sport · Return to play · Pyschological

Introduction

Anterior cruciate ligament (ACL) ruptures are a relatively common knee injury amongst athletes and can have a detrimental impact on an athletes ability to maintain involvement in their desired activities. ACL injuries can often lead to sustained periods of absence from sport, a return to play at a reduced level or failure of return to sport altogether [22]. Return to play (RTP) is considered an important outcome measure and an indication for ACL reconstruction (ACLR) [5, 6, 8, 19, 29]. RTP may potentially be considered to be the primary determinant of success following surgery for demanding patient cohorts, particularly the young athlete. RTP at the same or higher level as prior to injury is the ultimate goal following ACLR. ACLR is widely considered as the gold-standard treatment for an ACL injury with the aim of returning functional capacity to the knee and preventing further tissue injury [10, 28]. ACLR aims to allow a patient to return to previous levels of activity and prevent further joint injury (damage and degeneration to the joint). Great emphasis has been placed on identifying the optimal method of ACLR and rehabilitation [17]. While this is certainly important, often other factors that can affect return to play are overlooked, most notably the patient's psychological make up.

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The recent literature has explored the idea that psychological factors may be an important aspect varying rates of return to play [7, 13, 15, 21, 25]. Fear of reinjury has been suggested to be a common cause of failing to return [1, 16, 31]. Evidence suggests that both physical and psychological factors are important prognostic factors, but it has been shown that these two factors do not always correlate [24]. Also, little evidence addresses external life factors as an important non-modifiable factor that can affect RTP rates. While the literature appears to be moving away from solely addressing functional knee outcomes, there is no consensus regarding optimal multidisciplinary rehabilitation.

The reasons for athletes not returning to play following ACLR have not yet been fully quantified and are likely complex and multifactorial. Therefore, the purpose of this study was to evaluate the reasons why athletes did not RTP following an ACLR. The hypothesis was that the majority of athletes who report that they have not returned to play would cite reasons other than the condition of their knee.

Materials and methods

The data were collected in a prospectively collected institutional database. All data were stored on the Sports Surgery Clinic IRB-approved ACL registry (25AFM010). Consent was gained prior to surgery ahead of inclusion in the registry. Data recorded included the mechanism of injury, type and level of sporting involvement and patient demographics. Intra-operative data were recorded by the operating surgeon and database coordinator. All data recorded were based on operations performed by two surgeons (R.M. and M.J.) between 2014 and 2016. Included were all those whose RTP status was known at minimum 2-year follow-up following primary ACLR.

As part of the ACL registry, patients are followed up at three months, six months, nine months, 1 year and at least 2 years post-operatively. Patients reported whether they had returned to play, what level of play they had returned at, what sport they had returned to and, if they had not returned, the reason for not returning. As part of this study we assessed the Anterior Cruciate Ligament Return to Sport After Injury (ACL-RSI) score. For the purpose of this study, ACL-RSI was assessed at diagnosis and 24 months post-operatively. Subsequent injuries were also recorded.

Surgical technique

All surgeries were performed by one of two dedicated knee surgeons using equivalent arthroscopic and surgical techniques with either an ipsilateral patella tendon or hamstring autograft. Femoral tunnel drilling was performed via the anteromedial portal technique, and tunnel positions were aimed to be placed within the original ligament footprints concentrating mainly on reproducing the anteromedial bundle position. A standard bone-patellar tendon (BPTB) harvest was performed utilising the middle third of the tendon with bone blocks secured with metal interference screws (Softsilk, Smith and Nephew). The gracilis and semitendinosus hamstrings (HS) were harvested for a 4- or 5-strand hamstring graft aiming for a minimum size of 8 mm. An Endobutton (Smith and Nephew) fixation was used for femoral fixation with biosure (Smith and Nephew) interference screw in the tibial tunnel. Co-existing intra-articular meniscal and chondral pathology was addressed through routine arthroscopic techniques and treated accordingly.

Rehabilitation

A standardised institutional ACL program was used for all patients following surgery with rehabilitation carried out with their local physiotherapist. Immediate post-operative weight bearing was encouraged, as tolerated. Patients progressed with a standard restoration of motion, gait and a simple closed chain lower limb-strengthening program. Advanced power and plyometric development followed as strength and symptoms allowed, and eventual progression into straight line running, change of direction and return to sport rehabilitation when appropriate. Subjects were physically assessed at the 3-, 6- and 9-month stages so as to monitor their progress. This was carried out within the unit using isokinetic and force plate strength and power tests as well as a two- and three-dimensional biomechanical analyses to assess their progress and provide feedback throughout the rehabilitation process. RTP prior to 6 months post-surgery was discouraged. Clearance from the operating surgeon and encouragement to fully complete the rehabilitation process were recommended before RTP.

Statistical analysis

Statistical analysis was performed using SPSS version 22.0 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.) A power analysis was performed based on the ACL-RSI score as primary endpoint, which revealed that a minimum of 126 would be required in the DNR groups, respectively, to detect a difference in the ACL-RSI score with a power of 0.8 and an alpha of 0.05. Fisher's exact or Chi-squared test was used to analyse categorical variables. The independent or paired *t* test for normally distributed variables or the nonparametric Mann–Whitney *U* test or Wilcoxon signed-rank test was performed to compare continuous variables. A p value of < 0.05 was considered to be statistically significant.

Table 1 Demographics

	RTP	DNRTP	*p* value
N	1140	222	
Age, yrs	23.6 ± 7.0	27.2 ± 7.5	< 0.0001
Male/female (%)	76/24	69/31	0.0269
Dominant side	58.9%	62%	(n.s)
BPTB autograft (%)	79.4%	82%	(n.s)
Hamstring autograft (%)	20.6%	18%	
Concomitant injuries			
PCL injury %	0.5%	0%	(n.s)
MCL injury %	4.1%	4.5%	(n.s)
LCL injury %	2.5%	2.4%	(n.s)
Medial meniscal tear %	22.4%	31%	0.0053
Lateral meniscal tear %	38%	38.7%	(n.s)
Chondral pathology %	28.6%	38.70%	0.0026
Injury mechanism			
Contact to knee, *n* (%)	20.1%	16.7%	(n.s)
Contact (other than to knee), *n* (%)	15.2%	17.1%	
Non-contact, *n* (%)	64.7%	66.2%	

RTP returned to play, *DNRTP* did not return to play, *yrs* years, *n* number, *mo* months, *N/A* not applicable, *BPTB* bone-patellar tendon bone, *PCL* posterior cruciate ligament, *MCL* medial collateral ligament, *LCL* lateral collateral ligament, *n.s* not significant

Table 2 Targeted level of return to play

	RTP	DNRTP	*p* value
Same level	826/1140 (72.4%)	184/222 (82.9%)	
Higher level	292/1140 (25.6%)	26/222 (11.7%)	
Lower level	6/1140 (0.5%)	7/222 (3.2%)	< 0.0001
No sport	3/1140 (0.25%)	1/222 (0.5%)	
Other sport	13/1140 (1%)	4/222 (1.8%)	

RTP return to play, *DNRTP* did not return to play

Table 3 Return to play

	n (%)
Return to play	1140 (83.7%)
Return to play at same/higher level	747 (65.5%)
Mean time to return to play (mo)	11.1 ± 5.1

n number, *mo* months

Table 4 Reasons for not returning to play

	n (%)*
Operated knee (138)	
Pain	22 (10%)
Fear of reinjury	61 (27.5%)
Confidence in performance	43 (19.4%)
Other	12 (5.4%)
Other than operated knee (84)	
Other injury	11 (4.9%)
Work commitments	29 (13%)
Family reasons	8 (3.6%)
Other	36 (16.2%)

DNRTP did not return to play, *n* number

*All percentages of total DNRTP (*n* = 222)

Results

Demographics (Table 1)

There were 1431 ACLR performed by the two surgeons during the study period, with 1362 patients who met the inclusion/exclusion criteria. Overall, 1140 (83.7%) patients had returned to play. Of these, 76% were male and 24% were female. The mean patient age was 23.6 ± 7.0. The dominant knee was injured in 671 (58.9%) patients. A BPTB graft was used in 905 (79.4%) of patients and a HT graft in 235 (20.6%) of patients. Additionally, 222 (16.3%) patients had not returned to play. Of these, 69% were male and 31% were female. The mean patient age was 27.2 ± 7.5 years of age. The dominant knee was injured in 138 (62%) patients. A BPTB graft was used in 182 (82%) of patients and a HT graft in 40 (18%) of patients.

Targeted level of return to play (Table 2)

Of those who RTP, 25.6% had targeted to RTP at a higher level than previous, 72.4% at the same level and 0.5% intended to return at a lower level. 0.3% intended to return to no sport and 1% stated that they would change sport on anticipated return. Of those who did not RTP, 11.7% had intended to RTP at a higher level, 82.9% at the same level and 3.2% at a lower level. One patient stated that they would not return to sport and 1.8% reported that they would return to another sport. There was a significant difference in the targeted level of RTP between the two groups ($p < 0.0001$).

Returned to play (Table 3)

Overall, 83.7% of patients returned to play. The mean time from surgery to RTP was 11.1 ± 5.1 months. Of these, 57.3% returned to play at the same level, 8.2% at a higher level and 34.6% returned at a lower level. Overall, 61 patients had a second ACL rupture, 23 with an ipsilateral ACL ruptures, and 38 with a contra-lateral ACL rupture.

Did not return to play (Table 4)

Overall, 16.3% (222/1362) of patients had not returned to play at two years follow-up. 62.2% (138/222) had not returned due to reasons related to the operated knee. 27.5% (61/222) reported 'fear of reinjury' as the prime reason, 10% (22/222) stated 'pain' as the reason, 19.4% (43/222) reported 'confidence in performance' as the reason and 'other' reasons were reported by 5.4% (12/222). In contrast, 37.8% (84/222) reported that they had not returned for reasons other than the operated knee. Of these, 13% (29/222) stated that 'work commitments' was their reason for not returning, 4.9% (11/222) stated 'other injury', 3.6% (8/222) reported 'family reasons', and 16.2% (36/222) stated 'other' as their reason for not returning. One patient suffered an contralateral ACL rupture, and no patient had a re-rupture.

ACL-RSI (Table 5)

ACL-RSI data at diagnosis and 24-month follow-up were available in 581 patients (43%). Of the patients that did RTP, the ACL-RSI scores were 49.3 ± 26.3 at baseline and 78.7 ± 20.2 at 24-month follow-up in 491 of these patients. Of the patients that did not RTP the ACL-RSI scores were 40.3 ± 26. At diagnosis and 41.8 ± 25.6 at 24-month follow-up in 90 of these patients. There was a significant difference in the ACL-RSI score between the groups at both timepoints. Figures are summarised in Table 5.

Discussion

The most important finding of this study was that, following ACLR, of the patients that fail to RTP, the majority are due to external life factors and psychological factors associated with their injury, including fear of reinjury and confidence in performance. A smaller proportion of athletes did not return due to residual knee symptoms.

This study showed an overall high rate of RTP, similar to previous studies [2, 27]. Of those who did not return to play (DNRTP), the vast majority of patients reported reasons other than knee symptoms. Psychological factors including 'fear of reinjury' and 'confidence in performance' accounted for almost half of those who DNRTP. In this study, fear of reinjury was found to be the single most important cause of failure to RTP. The rate of those who DNRTP due to fear of reinjury was similar to figures of 20–50% seen in the literature [3, 11, 16, 18, 30]. Cupal and Brewer, and others, have demonstrated that by using psychological interventions such as relaxation, modelling and imagery techniques, underlying fear of reinjury anxieties can be addressed and enhanced recovery may be achieved [9, 26]. This is further supported by Maddison et al. who found that pre-injury 'modelling' with a patient who has completed ACLR rehabilitation showed earlier functional outcomes at six weeks post-operatively [20]. It is evident that fear of reinjury affects the rate of RTP, but it is effect on performance in those who do RTP is still unknown [23]. This study highlights the need to address these psychological components in both the 'prehabilitation' and rehabilitation protocols so as to optimise patient outcomes. Psychological intervention may play a crucial role in RTP following ACLR.

Social factors, including work and family commitments, are another important cause of failure to RTP [18]. While it is technically not considered to be a 'non-modifiable' risk factor, it may be considered an uncontrollable factor. Based on this study, more patients fail to return due to social factors than residual knee pain. Social factors may become more prominent in injuries such as ACL ruptures where recovery times are prolonged. We suggest that longer recovery times may provide sufficient time for social factors to become more prominent in the life of the patient, while sporting involvement may become less relevant during this latent time period. Age was shown to be a significant factor for those who DNRTP, with older patients more commonly failing to return. As patients progress through adulthood, social factors including family and career may become more significant and result in reduced motivation for return to recreational play. Time constraints may impact on both postoperative rehabilitation and motivation to RTP.

In this cohort, patients with a longer delay to surgery were less likely to RTP. Deciphering the precise cause is difficult, however, those who DNRTP had a statistically significantly higher rate of chondral pathology and medial meniscal tears which may be a factor. While it may be that those who had meniscal and chondral injury were less likely to return due to concomitant injury and the associated symptoms, it has been previously noted that delayed surgery can lead to increased chondral and meniscal pathology [4, 12, 14]. Furthermore, these patients may lack the same motivation as those who seek early intervention which may result in delayed recovery and less desire to RTP. Delayed time to intervention may flag those who are less likely to RTP when initially seen based on the functional and psychological reasons mentioned above.

This study showed that in those who did not return, ACL-RSI scores were lower from initial diagnosis when compared to those who did return. Identifying athletes with lower

Table 5 ACL-RSI scores

	RTP	DNRTP	*p* value
Baseline	49.3 ± 26.3	40.3 ± 26	0.003
24 months	78.7 ± 20.2	41.8 ± 25.6	< 0.0001

RTP returned to play; *DNRTP* did not return to play

scores at diagnosis could allow an opportunity to counsel them appropriately regarding the rehabilitation process and possibly focus more on the psychological side of recovery in order to maximise their likelihood of returning to play. Reduced confidence in a person's own ability to recover and low motivation could also explain the delay to surgery found in the DNRTP group. This may also be a factor in the reduced rates of RTP. The important role of both psychological and physiological components in RTP following ACLR is clear.

There was a 95% response rate with regard to these RTP data; however, the ACL-RSI was completed by less than 50% at 2 years. While these data were prospectively collected, they were retrospectively analysed. Although 2 years can be considered sufficient time for RTP following ACLR by most surgeons, some patients may RTP at a later stage which would not be gathered at this current follow-up.

Conclusion

The majority of patients that report they have not returned to play do so due to external life and psychological factors associated with their injury, including fear of reinjury and lack of confidence in performance. A small minority of patients were unable to return due to residual knee symptoms or reinjury. Pre-operative psychological assessment and intervention may identify those less likely to RTP and provide an opportunity for targeted interventions to further improve RTP outcomes. These results highlight the importance of assessing a patients psychological state and psychosocial situation when considering their likelihood of returning to play following operative intervention, allowing the opportunity for pre- and post-operative intervention that will allow for improved outcomes.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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