

Patient Perception of Return to Sport Level Following ACL Reconstruction with BTB Autograft is 85% or Less Upon Initial Return Back to Sports

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ABSTRACT

Athletes undergoing anterior cruciate ligament reconstruction (ACLR) often aim to return to sport (RTS) at pre-injury levels. Our study examines perceived performance upon return to sport and return to occupation at one-year post ACLR in comparison to pre-injury levels. Patients were 15-43 years old, underwent primary ACLR with BTB-autograft (2016-2020), followed-up for at least one year, and completed pre- and post-operative surveys assessing athletic ability and perceived performance upon return to practice and competition. Knee pain during activity was evaluated alongside return to occupation when applicable. 85 patients met the inclusion criteria, revealing that patients averaged 4.9 weekly practice hours post-operatively compared to 8.6 hours pre-operatively. Cutting sport athletes returned to practice at 293.3 days (reporting 72.8% of their pre-injury level) and full competition at 315 days (82.7% of pre-injury level). Non-cutting athletes returned at 280.8 days (feeling 64.9% of pre-injury level) and competition at 311.7 days (reporting 85%). Out of 100 points (100 being most painful), patients ranked their knee pain as 10.8 for light jogging, 15.1 for high intensity jogging, and 16.4 with cutting moves. Return-to-work averaged 25.86 days for sedentary occupations (n=14), and 34.13 days for walking/standing occupational demands (n=8). Following ACLR using BTB autografts, patients return to cutting sports feeling less than 83% of their pre-injury level, while non-cutting sport patients feel less than 85% of their pre-injury level. Pre-injury perceived performance does not correlate with post-operative return to practice or competition. Sedentary occupations return to work sooner compared to those with consistent walking/standing occupational demands.

Introduction

Anterior cruciate ligament reconstruction stands as a pivotal intervention in the management of anterior cruciate ligament (ACL) tears, especially among athletes. However, despite considerable advancements in surgical techniques and rehabilitation protocols, the resumption of pre-injury performance levels upon return to activity remains an enduring challenge for numerous individuals. A comprehensive systematic review by Arden et al. underscores this issue, revealing that while 81% of ACLR patients successfully returned to some form of sporting activity, only 65% were able to attain their pre-injury functional levels, and a mere 55% were capable of resuming competitive sports endeavors [1]. Of particular concern is individuals who experience ACL tears within the age group of 13 to 25. This demographic's increased exposure to high levels of competition

and training increases their incidence of ACL injuries, especially while participating in sports that involve cutting and pivoting [2]. Consequently, the emphasis this group typically places on achieving pre-injury levels of activity causes them to face a significantly elevated risk of experiencing retears during the recovery and return-to-sport (RTS) phase [3]. This confluence of factors thus underscores a pressing need for further investigation into an individual's ability to regain their pre-injury performance levels following ACLR.

While prior research has extensively investigated the optimal return to-play (RTP) timeline, efficacy of diverse assessment measures, and the percentage of patients who successfully return to sport following ACLR surgery, a scarcity in the literature exists regarding patients' subjective perception of their activity

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level in relation to their pre-injury status. Consequently, the present study aims to address this gap by evaluating patients' perceived performance levels at the time they return to practice and competition, compared with their self-reported pre-injury activity levels. This investigation aims to provide clinicians with a deeper understanding of the timeline of the athletes return to practice and competition post ACLR by examining patients' self-perception of their activity level at various stages of rehabilitation compared to their pre-injury levels. We hypothesize that at one-year from ACLR, patients will perceive their performance to be less than 90% of their pre-injury level and individuals returning to sedentary occupations will return within 3 weeks of surgery.

Methods

Patient Cohort

Upon receiving approval from the Institutional Review Board, we prospectively enrolled 318 patients who were scheduled to undergo primary ACLR between August 2016–October 2020 with a bone-patella tendon-bone (BTB) autograft by the senior author (**). All participating patients provided informed consent prior to surgery and their inclusion in the study. The study's inclusion criteria encompassed patients age (15–43) who had undergone primary ACLR, completed both preoperative and postoperative surveys, and maintained a follow-up period of no less than one year following the surgical intervention. Patients who exhibited incomplete survey responses or failed to meet the minimum one-year follow-up requirement were excluded from subsequent analyses. Patients were indicated for surgery with physical exam evidence of ACL insufficiency and with advanced imaging confirming an ACL tear. Ultimately, the final cohort consisted of 85 patients or 27% of the prospectively enrolled group.

Variables and Outcomes

Prior to surgery, patients were administered a comprehensive survey (Figure 1) inquiring about their occupation, primary sport, level of sport involvement, and the number of hours dedicated to practice per week. Subsequently, at the one-year post-operative mark, patients were provided with a parallel survey. This follow-up survey expanded its scope to inquire about pain levels experienced during various types of activities, and the duration until they were able to resume practice, engage in athletic competition, and return to work. Furthermore, this post-operative survey also inquired about their subjective evaluation of their performance level relative to their pre-injury state.

Statistical Analysis

Demographic characteristics including age, occupation, level of sports engagement, primary sport, practice hours, pain scores, and the duration until returning to work, were reported for the entire cohort using mean and standard deviation. Subsequently, the cohort was stratified into subgroups based on their primary sport classification, distinguishing between "cutting" and "non-cutting" sports as established in prior literature [4]. Within these sub cohorts, the duration from surgery until the resumption of practice and competition or work, as well as the subjective evaluation of performance level at the first practice or competition compared to pre-injury levels was calculated and reported using mean and standard deviation.

Page 1

Level Of Activity Questionnaire Reboot

Please complete the survey below. You may be asked to complete the same question more than once. This is by design, so please keep your answers consistent.

Thank you!

Please select the level of sport participation which describes you best, today.

☐ No activity
☐ Competitive non-sport-related activities
☐ Recreational competitive sport
☐ High School level
☐ College level
☐ National or professional level

How many seasons per year do you participate in the same recreational competitive sport?

☐ 1 season per year
☐ 2 seasons per year

How many seasons per year do you participate in the same sport in high school?

☐ 1 season per year
☐ 2 seasons per year
☐ I participate in more than one sport at my school

Level of Competition in High School

☐ Junior Varsity
☐ Varsity

How many sports do you participate in at your college?

☐ Just one sport
☐ More than one sport

Level of Competition in College

☐ Intramural
☐ Collegiate

Collegiate Division

☐ Division I
☐ Division II
☐ Division III

National Competition Level

☐ NBA
☐ O-League (NBA Development League)
☐ NHL
☐ AHL (American Hockey League)
☐ NFL
☐ MLS
☐ NASL (North American Soccer League)
☐ USL (United Soccer League)
☐ MLB
☐ MLB2

Minor League Baseball Division

☐ AAA
☐ AA
☐ Class A - Advanced
☐ Class A
☐ Class A Short season
☐ Rookie Advanced
☐ Rookie
☐ Rehabilitation Assignments

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What primary sport are you trying to return to?

☐ Basketball
☐ Hockey
☐ Football (American)
☐ Soccer (International Football)
☐ Baseball
☐ Lacrosse
☐ Field Hockey
☐ Skating
☐ Volleyball
☐ OTHER

Name the primary sport that you are trying to return to?

What secondary sport(s) are you trying to return to?

☐ Basketball
☐ Hockey
☐ Football (American)
☐ Soccer (International Football)
☐ Baseball
☐ Lacrosse
☐ Field Hockey
☐ Skating
☐ Volleyball
☐ OTHER

List any other secondary sports that you are trying to return to.

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SELF-ASSESSMENT

Using your pre-injury level of competition as your 100% performance target, select the percentage of that target to which you feel you are currently performing

0%100%

Place a mark on the scale above

What was the date that you felt you could return to (sport) for full inclusion practice (estimates are fine)?

☐ Already answered this question in the previous questionnaire
☐ I have not yet
☐ Select a date

Select the date that you felt you could return to (sport) for full inclusion practice (estimates are fine)?

At the time of your first full inclusion practice, after injury, what percentage best describes your (sport) performance compared to your performance before your injury?

0%100%

Place a mark on the scale above

What date did you feel you could return to your pre-injury level of (sport) participation for full competition/game day (estimates are fine)?

☐ Already answered this question in the previous questionnaire
☐ I have not yet
☐ Select a date

Select the date that you felt you could return to your pre-injury level of (sport) participation for full competition/game day (estimates are fine)?

Note: If soccer season ended in May, but you were cleared for June, say June!

At the time of your first full competition/game day after injury, what percentage best describes your (sport) performance compared to your pre-injury performance?

0%100%

Place a mark on the scale above

How many hours per week, before injury, did you practice (sport) (estimates are fine)?

How many hours per week, currently, do you practice (sport) (estimates are fine)?

What was the reason that you did not return to your primary sport?

☐ Graduated High School
☐ Graduated College
☐ My time
☐ Other

Please elaborate on your reason.

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What was the date that you felt you could return to (sport, 2nd) for full inclusion practice (estimates are fine)?

☐ Already answered this question in the previous questionnaire
☐ I have not yet
☐ Select a date

Select the date that you felt you could return to (sport, 2nd) for full inclusion practice (estimates are fine)?

At the time of your first full inclusion practice, after injury, what percentage best describes your (sport, 2nd) performance compared to your performance before your injury?

0%100%

Place a mark on the scale above

How many hours per week, before injury, did you practice (sport, 2nd) (estimates are fine)?

How many hours per week, currently, do you practice (sport, 2nd) (estimates are fine)?

Figure 1: Level of Activity Questionnaire

To further assess the relationship between time to return to sport from injury and the perceived percent of pre-injury performance level, a Spearman’s rank correlation was calculated for both return to practice and return to competition. Spearman’s rank correlation is a non-parametric statistical method used to evaluate the strength and direction of associations between two variables. It allowed for investigation into whether there existed a consistent relationship between the duration of post-ACL surgery recovery and athletes’ perceptions of their performance level relative to their pre-injury status. The coefficient, denoted as "R", ranges from -1 to 1, where a positive "R" indicates a positive correlation, and a negative "R" signifies a negative correlation. Statistical significance was set at an alpha level of 0.05. All statistical analyses were performed using R version 4.2.2 (The R Foundation, Vienna, Austria).

Results
Demographic Variables

A total of 85 patients (38 male, 46 female, and 1 unspecified) were included in the cohort. According to the demographics displayed in table 1, the mean age at the time of surgery was

23.7 years. At the one-year post-operative mark, 42 (49%) patients were actively engaged in the workforce, 22 (26%) were enrolled in college, 3 (3.5%) were pursuing graduate studies, and 18 (21%) were in high school. Regarding their level of sports participation one year after surgery, 10 (12%) patients were participating at the collegiate level, 16 (19%) were involved in high school athletics, 14 (16%) were participating in recreational competitive sports, 16 (19%) were engaged in non-competitive sport-related activities (ie rock climbing), and one reported no activity. Among the various sports represented, the most prevalent were soccer (26%), skiing (16%), basketball (13%), and lacrosse (8.5%). In terms of sports categorization, 66 (78%) patients participated in cutting sports, while 19 (22%) were involved in non-cutting sports.

Table 1: Patient characteristics and post-operative sport and work participation

Characteristic	N	N=85 ¹
Age at time of surgery (years)	85	23.7 (7.4)
Occupation at one year after surgery	85	
College		22 (26%)
Graduate School		3 (3.5%)
High School		18 (21%)
Work		42 (49%)
Level of Sports Participation at one year after surgery	85	
College level		10 (12%)
Competitive non-sport-related activities		16 (19%)
High School level		16 (19%)
No activity		1 (1.2%)
Recreational competitive sport		14 (16%)
Primary Sport at one year after surgery		
Basketball		11 (13%)
Boxing		1 (1.2%)
Cheerleading		1 (1.2%)
Cross Country		1 (1.2%)
Dance		1 (1.2%)
Football (American)		3 (3.5%)
Golf		1 (1.2%)
Hockey		3 (3.5%)
Lacrosse		10 (12%)
MMA		1 (1.2%)
None		1 (1.2%)
Quidditch		1 (1.2%)
Rock Climbing		1 (1.2%)
Running		5 (5.9%)
Skiing		14 (16%)
Soccer (International Football)		22 (26%)
Softball		1 (1.2%)
Tennis		3 (3.5%)
Ultimate Frisbee		1 (1.2%)
Volleyball		3 (3.5%)

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Profession	37	N=37 ¹
Analyst		2 (5.4%)
Attorney		1 (2.7%)
Business		3 (8.1%)
Carpenter		1 (2.7%)
Consultant		2 (5.4%)
Designer		1 (2.7%)
Engineer		2 (5.4%)
Finance		4 (11%)
Manager		2 (5.4%)
Painter		1 (2.7%)
Physician		2 (5.4%)
Pro Football		1 (2.7%)
Psychologist		1 (2.7%)
PT aide		1 (2.7%)
Real estate		2 (5.4%)
Research		6 (16%)
Retail		1 (2.7%)
Sales		1 (2.7%)
Scientist		1 (2.7%)
Teacher		2 (5.4%)
Job Activity Level	37	N=37 ¹
Sedentary		26 (70%)
Consistent Walking/Standing		9 (24%)
Heavy Labor		2 (5.4%)

¹Mean (SD); n (%)

Outcome Measures

Before injury, patients averaged 8.6 hours of practice per week. Pre-operatively, this reduced to 1.7 hours per week, and at one-year post-operation, patients averaged 4.9 hours of practice per week (Table 2 & Figure 2). When patients were asked to rank their pain levels in the front of the knee during different activities on a scale of 0 to 100 at one-year post-operation, the average pain score was 10.8 for light to moderate intensity jogging, 15.1 for high-intensity sprinting, and 16.4 during side-to-side agility movements such as cutting (Table 3 & Figure 3). Regarding the time taken to return to practice and competition, as well as the perceived level of performance compared to the pre-injury level, the cohort participating in cutting sports returned to practice at an average of 293.3 days and returned to competition at 315 days (Table 4). Upon returning to practice, they reported feeling 72.8% back to their pre-injury level and 82.7% upon returning to the game (Table 4). In contrast, the cohort participating in non-cutting sports returned to practice at an average of 280.8 days and returned to competition at 311.7 days (Table 4). Upon returning to practice, they reported feeling 64.9% back to their pre-injury level, increasing to 85% upon returning to competitive play (Table 4). The subgroup of patients returning to work after surgery (n=37) was comprised of sedentary (n=26), consistent walking/standing (n=9), and heavy labor occupation types (n=2) (Table 1). The patients who completed the 1-year return to work follow up survey (n=22) exhibited a return-to-work average of 25.86 days for sedentary occupations (n=14),

compared to 34.13 days for those with consistent walking/standing occupational demands (n=8) (Table 4 & Figure 4). The remaining patients (n=15) were returning to both work and sport, in which they only completed the return to sport follow up survey. Additionally, the Spearman's Rank correlation test found no significant relationship between the time taken to return to practice or competition and the percentage of perceived pre-injury performance (Table 4, Figure 5, Figure 6).

Table 2: Practice hours per week at various follow up points

Timepoint	N	Practice hours per week
Pre-Injury	85	8.6 (6.9)
Pre-op	85	1.7 (4.3)
Post-op	85	4.9 (6.3)

¹Mean (SD)

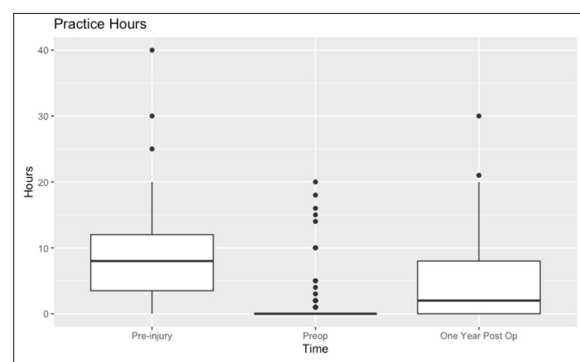


Figure 2: Practice hours before injury, before surgery and one year after surgery

Table 3: Pain scores at one year follow up after surgery while performing various activities

Characteristic	N	One year follow up
Pain level in front of knee while straight line jogging at light to moderate intensity for long duration	85	10.8 (18.8)
Pain level in front of knee while sprinting at high intensity for a short duration	85	15.1 (21.4)
Pain level in front of knee while performing side to side agility movements such as cutting	85	16.4 (22.3)

¹Mean (SD)

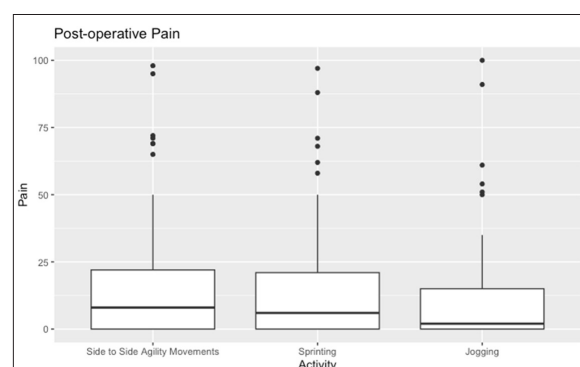


Figure 3: Pain scores at one year follow up after surgery while performing various activities.

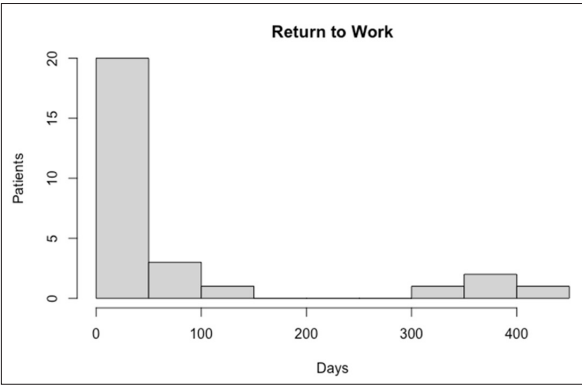


Figure 4: Return to Work (n = 42)

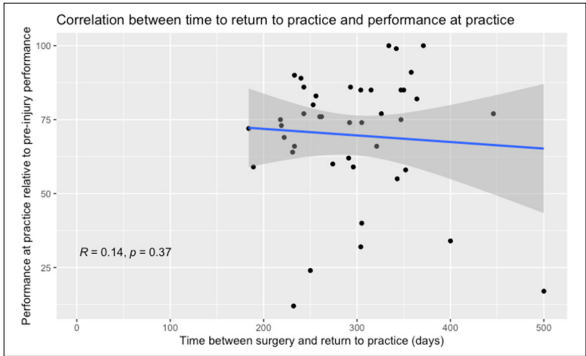


Figure 5: Correlation between time to return to practice and performance at practice relative to pre-injury performance

Table 4: Return to practice, competition, and work duration

Characteristic	n	Cutting, n=66 ¹	N	Non-cutting, N=19 ¹
Practice				
Time between surgery and return to practice (days)	35	293.3 (58.2)	7	311.7 (105.0)
Performance at first practice relative to preinjury performance	41	72.8 (20.7)	7	64.9 (23.2)
Competition				
Time between surgery and return to competition (days)	25	315.6 (61.6)	4	280.8 (58.4)
Performance at first competition	32	82.7 (14.6)	4	85.0 (11.1)
Work	n	Consistent Walking/Standing n=8 ¹	N	Sedentary N=14 ¹
Return to work duration (days)	8	34.13 (16.21)	14	25.86 (19.08)
Activity	0.14	0.37		
Competition	0.064	0.74		
¹ Mean (SD)				

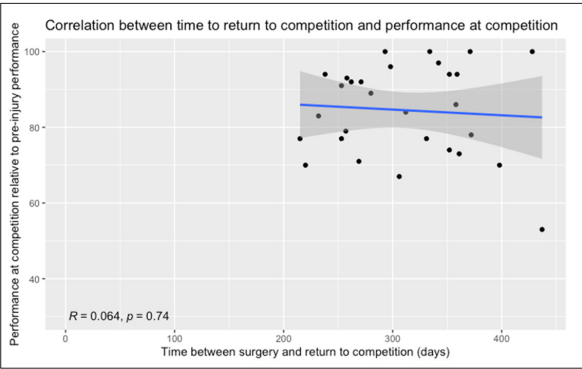


Figure 6: Correlation between time to return to competition and performance at competition relative to pre-injury performance

Discussion

The observed findings confirm our hypothesis that although practice hours decreased after ACLR, 1-year is a reliable benchmark for reduced anterior knee pain, and while perceived performance levels were high at 83.9%, they were still less than 90% at the return to competition. This study addresses the patient’s subjective outcome scores during their transition to practice and competition at 1-year post ACLR in comparison to baseline pre-injury perceived performance. The current research functions to investigate the role of the post operative

rehabilitation timeline in conjunction with patient reported outcomes on the return to practice and competition.

Returning to sport, and often competition, after an ACLR can seem daunting to an athlete considering their immediate post operative state. Athletes typically undergo surgical intervention with the intention of returning to their sport quickly, and often expect to achieve their pre-injury performance levels at the time of their return. During the transition back to sport, patients are challenged not just physically, but mentally as they recognize the difficulty in achieving these performance goals [5]. A common assumption held by the predominant number of ACLR patients is that they will be able to make a full recovery and perform at pre-injury levels within 1-year post op [5,6,7]. Although the present study identifies the 1-year mark as a reasonable indicator of minimal symptoms and a reasonable timeline for the return to practice/competition, it does not further correlate the time interval with the perceived performance levels. It is easy for patients to interconnect these conclusions and expect that their 1-year performance levels will correspond identically with their pre-injury performance level, but deeper evaluation reveals the independence in these achievements. Addressing these patient presumptions can benefit the long-term success of the repair even with athletic demands such as running, sprinting, and agility maneuvers like cutting. Graft

type selection is paramount to the success of the athlete's return to sport and requires deliberate assessment and evaluation. There has been extensive support favoring both hamstring and BTB autografts for successful ACLR but the determination of graft type for the purpose of returning to sport is widely debated [2,3,8,9,10]. Laboute et al. revealed a 3.5% reduction of graft failure following ACL reconstructions consisting of BTB autografts as opposed to hamstring autografts. Likewise, after 1-year, BTB grafts have demonstrated less anterior knee pain occurrences at rest in comparison to hamstring grafts following ACLR [11]. Supplemental findings suggest that 65% of patients regardless of graft type [12] and 83% exclusively with BTB autografts returned to sport at pre-injury performance levels [2].

Gauging return to sport readiness is complex because of its multifaceted nature with different sports and levels of competition placing various demands on each athlete. As medical research accumulates, readiness qualifications are incorporating improved strength testing parameters to refine guidelines for the various types of athletes [13]. Appropriate objective testing includes multiple hop tests, quadricep/hamstring strength tests, and skill specific measures (i.e. running, sprinting, cutting, pivoting) [7,8,12-14]. Although not crucial to physical knee function, obtaining pain perception levels prior to functional scores contributes insight into readiness and aids in functional score comprehension [15]. Discerned a negative association between knee pain and both patient-reported knee function as well as quantitative task performance measures at 1-year post ACLR [14]. Similarly, the current data depicts low knee pain at 1-year for various performance-based skills (jogging, sprinting, cutting). Return to practice and competition commenced well before the 1-year mark, alluding to successful rehabilitation outcomes, and supporting current return to play literature. Although no direct association was currently evaluated between pain and function, the implicit findings align with previous studies posing a direct negative correlation [11-13]. Based on these individualized outcomes, readiness can be predicted with greater confidence.

Along with pain and function scores, rehabilitation and recovery timelines are critical factors to address for the return to practice or competition, especially as the topic is widely debated. Our study determined RTS to be more than 9 months post ACLR in all samples, which endorses lower reinjury rates leading to higher perceived performance levels at 1-year. An accelerated return to sport program entails 6 months of rehabilitation as compared to 9-12 months [12]. Despite persuasive advantages of an expedited timeline, such as decreased disability and increased quality of life, a frequently used timeline now suggests a minimum of 9 months before returning to sport [7,8,12,13,16-18]. In contrast to RTS at 6 months, patients returning between 9 and 12 months demonstrate greater than 90% quadricep strength symmetry and report superior functional scores [7,8,12,13,17,18]. The current study reproduces the traditional consensus, establishing the return to practice average to be 9.5 months post ACLR, and the return to competition average to be 10.5 months across all sports. A conservative recovery timeline consequently accounts for reduced reinjury rates. Waldron et al. observed that every month added to the recovery program, succeeding the 6-month accelerated minimum, demonstrated a 51% reduction of reinjury rate only up until the 9-month benchmark [12]. 9-month RTS

protocols and meeting all testing requirements promotes long term benefits, exemplified by decreased re-rupture rates [17]. Reinjury, and therefore failure to perform at pre-injury levels are feasibly due to unsubstantial graft integration and healing [12,13]. Retear prevention warrants adequate attention because increased reinjury contributes to decreased RTS performance scores.

Despite the existence of a preliminary timeline, the return to sport progression remains a highly individualized process guided by personal milestones [12,19,20]. Athletes' return to sport performance levels after ACLR are eminently dependent on collective psychological factors. Major components of mental status include confidence, self-efficacy, and fear of reinjury, which form a rational foundation for predicting readiness [1,13,14,17,21]. Arderm et al. reports that 28% of patients did not return to sport following ACLR because they lacked confidence in the knee, 24% feared injury, and 22% described inadequate knee function [1]. Once knee function exceeds all functional testing benchmarks, performance confidence requires individualized monitoring to continue to pass activity milestones. Awareness of mental stressors creates opportunity for early tracking and intervention such as cognitive behavioral strategies, goal setting, and motivation sessions [1]. These tactics are consistently incorporated into personalized health coaching to aid the mental recovery following ACLR.

The positive association previously established between favorable psychological health and quicker return to sport can be further broken down to shed light on factors mediating the relationship. With fear of reinjury as one of the leading hinderances preventing the transition back to sport, full rather than expedited recovery and rehabilitation timelines can promote psychological ease and encourage optimal performance [21]. Rapid return to play protocols may not allocate substantial time to achieve psychological readiness. Therefore, improper psychological healing can streamline negative implications on objective activity performance and patient perceived performance. The psychological status of ACLR patients may provide additional rationale for the relationship observed in the present study, which aligns high perceived performance outcomes with extended rehabilitation duration.

Distinguishing the extent to which physical and mental factors contribute to the observed perceived performance outcomes is constructive for optimal treatment plans and individual RTS guidelines [12,19,20]. The positive association previously established between favorable psychological health and quicker return to sport can be further broken down to shed light on factors mediating the relationship. Rapid return to play protocols may not allocate substantial time to achieve psychological readiness. Therefore, improper psychological healing can have negative implications on objective activity performance and patient perceived performance. The psychological status of ACLR patients may provide additional rationale for the relationship observed in the present study, which aligns high perceived performance outcomes with extended rehabilitation duration. The present findings evaluated at 1 year post ACLR, suggest the patients had substantial recovery time to possess full knee functionality and biological healing, however, the patient reported performance scores were not identical to the pre-injury scores at this time [7,12]. The current study did not investigate

possible psychological components, but as previously mentioned, mental barriers can inhibit full restoration of skills and performance, which contextualizes the inadequate perceived scores [12-14,17,19,20,22]. These suspected mental barriers may also help explain the measured decrease in the number of hours practiced per week by athletes one year following ACLR and contribute to the lack of confidence in performance levels upon return to competition, but more in-depth research is needed to evaluate these variables.

Clinical Applications

From a clinical standpoint, after following a standard 9-12-month physical ACLR rehabilitation protocol and fulfilling objective functional testing, the perceived performance levels in athletes are considerably close to reported pre-injury levels. Hence, it is reasonable to assume that the remainder of achievable improvement in perceived performance will not stem from increased physical function related to the knee, but from increased mental satisfaction regarding the recovery. Dedicating time during the rehabilitation to address mental challenges can mitigate unrealistic expectations and anxieties regarding the patient's recovery of performance level and contextualize performance levels at the 1-year mark. Addressing the mental state of patients could be achieved throughout the standard 9-12-month physical rehabilitation protocol through dedicated time with sports psychologists or targeted conversations with their care team. Alternatively, there is risk that after one year, the maximal perceived performance levels have been met and persist at unsatisfactory levels compared to pre-injury perceived sport performance.

Literature concerning return to work numbers following ACLR is sparse, yet valuable in clinical settings. The current study establishes a preliminary foundation for return-to-work protocols that differ between sedentary and non-sedentary occupations. Less actively demanding jobs report an earlier resumption compared to higher walking and labor occupations. Although prior research is limited, our data suggests a shorter sick leave compared to previous findings reporting averages ranging from 68 to 74 days, but furthers the conclusion stating that sedentary jobs return to work sooner than physically active jobs [24-26]. While the present study acknowledges the small sample, the results offer insight to both providers and patients on anticipated leave time away from their occupation.

Limitations

The sample size of 85 represents a clear limitation in the external validity of this study. Only 27% of the prospectively enrolled patients were included in this study largely due to a loss of follow up at the 1-year mark. Patients in this study were only followed until a maximum of 500 days post-surgery, which introduces some bias into the results from loss to follow up. Due to the limited sample size, subdividing the data based on specific sport would have produced inadequate results, but warrants further evaluation. Some patients included were returning to both work and sport, but only completed the return to sport survey at the 1-year follow up, which exposes a limitation and decreases the sample for returning to work results. Future research must be conducted with a longer duration to further assess the relationship between an athlete's perceived performance and their clinical function following ACLR. Another limitation to this study

is that psychological factors were not directly addressed and cannot formally explain the discrepancy between the perceived performance at one year post ACLR. Future research should target the mental state of athletes as they progress through their ACLR to fully characterize this relationship. Additionally, to quantitatively compare performance pre- and post-injury, game statistics could be measured in athletes to objectively quantify performance after the return to competition. Our investigation also used handheld dynamometer (HHD) strength testing rather than isokinetic strength devices. While isokinetic strength testing is considered the gold standard, HHD has been shown to be quite comparable to this and considered a reasonable alternative [23]. We additionally had multiple evaluators of strength and while our methods (using a computerized device against a fixed point of resistance) were meant to remove variance, there may be some subtle changes between evaluators such as amount of verbal encouragement during testing that could possibly influence output.

Conclusion

Following ACLR using BTB autografts, patients return to cutting sports feeling less than 83% of their pre-injury level, while non-cutting sport patients feel less than 85% of their pre-injury level. Pre-injury perceived performance does not correlate with post-operative return to practice or competition. Sedentary occupations return to work sooner compared to those with consistent walking/standing occupational demands.

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