

# Psychological Factors Associated With Anterior Cruciate Ligament Reconstruction Recovery

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**Background:** Psychological factors may have underappreciated effects on surgical outcomes after anterior cruciate ligament (ACL) reconstruction; however, few studies have investigated the relationship between specific psychological factors, objective clinical data, and patient-oriented outcomes.

**Purpose:** Psychological factors are significantly associated with patient perceptions and functional outcomes after ACL reconstruction. The purpose of this study was to demonstrate relationships between self-esteem, health locus of control, and psychological distress with objective clinical outcomes, patient-oriented outcomes, and return to sport.

**Study Design:** Cross-sectional study; Level of evidence, 3.

**Methods:** Twenty-seven patients who were 6 to 24 months post-computer-assisted ACL reconstruction by a single surgeon consented to participate in the study (52% response rate). Participants had a 1-time visit with a physician consisting of: a physical examination, a single-leg hop test, KT-1000 arthrometer measurements, and survey completion. Psychological measures included the Multidimensional Health Locus of Control Scale, Rosenberg Self-Esteem Scale, and Brief Profile of Mood States. Outcome measures included the Tegner activity scale, International Knee Documentation Committee (IKDC) Subjective Knee Score, Knee injury and Osteoarthritis Outcome Score–Quality of Life subscale (KOOS-QOL), and Short Form–36 (SF-36). Patient charts were also reviewed for pertinent operative details.

**Results:** The mean age of patients ( $\pm$ SD) was  $25.7 \pm 8.4$  years, and the mean duration of time since surgery was  $16.5 \pm 5.9$  months. The majority (89%) of the patients identified themselves as athletes, and of these, 65% reported returning to sports at a competitive level. Sport returners were found to have higher levels of self-esteem ( $P = .002$ ) and higher reported KOOS-QOL scores ( $P = .02$ ). Self-esteem was significantly associated with IKDC scores ( $r = 0.46, P < .05$ ), KOOS-QOL scores ( $r = 0.45, P < .05$ ), and SF-36 subscales of general health ( $r = 0.45, P < .05$ ) and physical functioning ( $r = 0.42, P < .05$ ). Internal locus of control was significantly correlated with performance on single-leg hop test ( $r = 0.4, P < .05$ ). Objective knee stability measurements did not correlate with subjective outcomes.

**Conclusion:** Self-esteem levels and locus of control had significant relationships with functional test performance and validated outcome measures after ACL reconstruction. Sport returners had significantly higher self-esteem levels than those who did not return to sports, without observable differences in knee stability or time since surgery.

**Keywords:** anterior cruciate ligament; ACL; psychological; self-esteem; return to sport

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Despite stable anterior cruciate ligament (ACL) reconstructions, many athletes still never achieve their preinjury abilities or are unable to return to sport. Psychological aspects of recovery may account for this disparity in outcome.<sup>1,5,10,28</sup>

Orthopaedic research has primarily focused on optimizing the technical aspects of ACL reconstruction surgery that may yield superior outcomes. However, recovery and rehabilitation after ACL reconstruction are both physically and emotionally demanding, and psychological responses may have underestimated effects on patient outcomes.<sup>2</sup>

Return-to-sport rates among athletes have not been shown to be as impressive as one might expect. Ardern

et al<sup>4</sup> reported that 66% of athletes had not returned to competitive sport by 12 months after ACL reconstruction. A follow-up meta-analysis of 48 studies with 5770 patients revealed that only 44% of patients had returned to competitive sport after ACL reconstruction and that fear of reinjury was the primary reason for participation reduction.<sup>3</sup> The Multicenter Orthopaedic Outcomes Network (MOON) cohort reported similar return-to-play rates, with 63% to 69% of athletes returning to high school or college football; however, only 43% of these athletes reported returning to the same performance level.<sup>17</sup> Of the nonreturners in the MOON study, 50% cited fear of reinjury as a reason for not returning, and the authors suggested the possibility that psychological factors may play an underappreciated role in getting athletes back on the playing field. Another recent study found that only 31% of athletes returned to preinjury sport level at 12 months, and psychological responses were found to independently predict return to sport.<sup>2</sup>

Psychological factors have been significantly associated with various aspects of ACL reconstruction recovery. ACL injury has been associated with anxiety and pain response, mood disturbance, depression, and feelings of decreased athletic identity.<sup>6,15,19,22,35-37</sup> In addition, subjective feelings of function and symptoms were highly associated with patient satisfaction after ACL reconstruction.<sup>14</sup> Self-efficacy has been associated with Knee injury and Osteoarthritis Outcome Score (KOOS) results, rehabilitation adherence, return to sport, knee-related quality of life, and single-leg hop performance at 1 year.<sup>18,31,33,34</sup> Internal locus of control has been associated with self-efficacy, satisfaction with knee function, higher sport activity levels, and return to sport at 12 months.<sup>2,21,32</sup>

It is intuitive that psychological factors would play an important role in recovery after ACL reconstruction; however, few studies have sought to correlate psychological factors with objective clinical data, functional performance, and patient-oriented outcomes. In addition, no clinical study to date has explored self-esteem as it relates to ACL reconstruction recovery. The purpose of this study was to demonstrate relationships between self-esteem, health locus of control, and psychological distress with objective clinical outcomes, patient perceptions, and return to sport.

## METHODS

### Study Design

This research, which was a cross-sectional study of all consenting patients who met inclusion criteria between January 2009 and January 2011, was approved by our institutional review board.

### Patient Selection

Eligible patients were 14 to 40 years of age and were 6 to 24 months post-computer-assisted ACL reconstruction by a single surgeon (R.M.S.). Postsurgical timing was selected intentionally so that patients would safely be able to participate in functional testing and because this time frame

corresponds to the time when athletes are typically returning to athletic activity. All patients were contacted initially by phone to assess interest in participating in the study. Informed consent was signed by all participants (and/or their legal guardian if a minor) prior to participation.

### Study Protocol

Each patient had a single visit with an independent physician (M.A.C.). This visit consisted of 4 aspects: a standardized knee physical examination, KT-1000 arthrometer evaluation, functional testing with the single-leg hop test, and survey completion using online Survey Monkey software (Survey Monkey; <http://www.surveymonkey.com/>). Generally, each visit lasted between 40 and 60 minutes, with 20 to 25 minutes spent on survey completion.

During the physical examination, symptoms of pain and instability were assessed, and the patient was evaluated for incision integrity, tenderness, effusion, range of motion, ligamentous stability, strength, and neurovascular status. For data analysis, the anterior translation of the tibia on Lachman examination was defined as follows: 0 to 2 mm = 0, 3 to 5 mm = 1, 6 to 10 mm = 2, and >10 mm = 3. For the KT-1000 arthrometer measurement, both the injured and uninjured legs were each measured 3 times at 30 pounds of force, and the 3 trials were averaged for each side; the side-to-side difference was also calculated for analysis. During the single-leg hop test, patients were given 2 attempts each with both the injured and uninjured leg. The distances for each leg were averaged, and the mean distance of the injured leg was divided by the mean distance of the uninjured leg and this ratio was multiplied by 100%. Per previously described protocols,<sup>20</sup> a single-leg hop test of less than 85% of the uninjured leg was considered abnormal. In addition, immediately after performing this test, patients were asked, "How did that feel?" to gauge their subjective reaction to the test. Responses were recorded and later categorized into positive and negative reactions for data analysis.

Surveys were carefully chosen and converted to a digital online form using Survey Monkey. All surveys were completed by computer at the time of the office visit. Surveys that were included are summarized in Table 1.

### Patient-Oriented Outcomes

Patient demographics, injury characteristics, compliance with treatment, and whether patients had returned to sport were assessed using a self-designed series of questions (Patient Demographic and Information Sheet) (Appendix). Among the patients who identified themselves as athletes in the study, sport returners were considered to be those athletes who reported being successfully able to return to athletic activity after ACL reconstruction; sport nonreturners were considered to be those athletes who reported being unable to return to sports after ACL reconstruction. General health was assessed with the Short Form-36 (SF-36).<sup>26,27</sup> The Tegner activity scale was utilized to ascertain current and previous activity level.<sup>7,29</sup> Subjective knee function was assessed with a combination of the International Knee Documentation Committee

TABLE 1  
Survey Instruments<sup>a</sup>

| Variable  | Survey Instrument  |
|---|--|
| Demographics (patient characteristics, injury characteristics, return to sport, compliance) | Self-designed questionnaire  |
| General health  | Short Form-36 (SF-36)  |
| Activity level  | Tegner activity scale  |
| Subjective knee function  | International Knee Documentation Committee (IKDC) Subjective Knee Form   |
|   | Knee injury and Osteoarthritis Score—Quality of Life subscale (KOOS-QOL) |
| Psychological characteristics   | Multidimensional Health Locus of Control (MDHLC)                         |
|   | Brief Profile of Mood States (POMS)                                      |
|   | Rosenberg Self-Esteem Scale  |

<sup>a</sup>All survey items were converted to electronic format with Survey Monkey software for ease of administration.

(IKDC) Subjective Knee Form as well as the KOOS—Quality of Life subscale (KOOS-QOL).<sup>12,13,23</sup>

### Psychological Measures

Psychological characteristics were assessed as follows: locus of control with the Multidimensional Health Locus of Control (MDHLC),<sup>38,39</sup> psychological distress with the Brief Profile of Mood States (POMS) and additionally the Adolescent Profile of Mood States (APOMS) if participants were younger than 18 years,<sup>8,30</sup> and self-esteem with the Rosenberg Self-Esteem Scale.<sup>24</sup>

### Statistical Analysis

Statistical analysis was performed using Microsoft Excel software. Means and standard deviations were calculated for objective data of knee stability (intraoperative stability data, Lachman, KT-1000 arthrometer). Patient-oriented outcome measures and measures of general health were scored according to the measure's accepted scoring protocols, and means and standard deviations were calculated. The difference between preoperative Tegner activity level and postoperative activity level was calculated for each patient. Psychological data were also appropriately scored and compiled into a summary psychological profile, which included means and standard deviations.

Pearson correlations were then performed to evaluate relationships between the assessed psychological factors (self-esteem, locus of control, psychological distress) and patient-oriented outcomes, intraoperative stability data, physical examination findings (Lachman test), KT-1000 arthrometer measurements, and results of the single-leg hop test. Two-tailed *t* tests were used to compare psychological characteristics among sport returners and

nonreturners. In addition, a subgroup analysis was performed based on patients' recorded subjective responses to the single-leg hop test. Patients were grouped according to the type of response (positive or negative), and *t* tests were utilized to compare the psychological variables, outcome measures, knee stability, and single-leg hop test performance among the 2 groups. For all statistical tests, significance level was set at  $P < .05$  a priori.

### Chart Review

In addition to the patient visit, participant charts were reviewed for operative details, complications, and intraoperative stability data that was measured pre- and post-reconstruction for each patient with the assistance of computer navigation (Aesculap 2.0 Ortho Pilot Navigation System; B. Braun Aesculap). Intraoperative stability data included pre- and postreconstruction anterior translation, internal rotation, and external rotation measured at 30° of flexion.

### RESULTS

A total of 56 patients who fulfilled criteria for the study were identified; the patients were 6 to 24 months out from their ACL reconstruction. Four of these patients were excluded due to invalid or out-of-service contact numbers. Of the remaining 52 patients, 27 consented to participate in the study (52% response rate), 5 declined, and 20 were unable to be reached for scheduling despite multiple call attempts (minimum, 3; maximum, 5). One patient's data was excluded from the analysis, as this patient's responses represented significant outliers that inappropriately skewed results. Thus, 26 patients were included for data analysis.

The demographic information of participants can be found in Table 2. There was equal representation of male and female participants, the mean age was 25.7 years (range, 15-40 years), and the mean time since surgery was 16.5 months (range, 6.4-24 months). Of all participants, 88.5% (23/26) identified themselves as athletes; 43.5% were adult athletes, 17.4% were college athletes, and 39.1% were high school athletes. Seventeen athletes (73.9%) considered themselves competitive athletes, 1 reported being an elite athlete (4.3%), and 5 reported being recreational athletes (21.7%). Athletes reported participating in a mean 4 sports (range, 1-12). More than half (65.2%, 15/23) of all athletes reported that they had returned to playing sports at a competitive level.

The most common mechanism of injury was sport activities (22/26, 81.5%), followed by traumatic injuries (3/26, 11.1%), and work-related injuries (1/26, 3.7%). Graft type was variable: 50% (13/26) of patients had hamstring autograft, 30.8% had patellar tendon autograft, 11.5% had allograft, and 7.7% had hamstring autograft with allograft augmentation.

There were no significant relationships observed between objective stability data and patient-oriented outcomes. However, Lachman test results correlated

TABLE 2  
Patient Demographics

| Variable                       | n (%) or Mean (Range) |
|--------------------------------|-----------------------|
| Male                           | 13 (50)               |
| Female                         | 13 (50)               |
| Mean age, y                    | 25.7 (15-40)          |
| Time since surgery, mo         | 16.5 (6.4-24)         |
| Athletes                       | 23 (88.5)             |
| Return to sport among athletes | 15 (65.2)             |

significantly with the KT-1000 measurement on the injured side ( $r = 0.48$ ,  $P < .05$ ) as well as the KT-1000 difference between the injured and uninjured side ( $r = 0.65$ ,  $P < .05$ ). Higher grades of anterior tibial translation on the Lachman test also negatively correlated with single-leg hop test performance ( $r = -0.62$ ,  $P < .05$ ). There were no significant correlations found between postoperative knee stability (as measured by KT-1000) and intraoperative stability data.

Significant moderate relationships between psychological variables and functional and patient-oriented outcomes were observed. Self-esteem was positively associated with outcome scores on the IKDC ( $r = 0.46$ ,  $P < .05$ ), KOOS-QOL ( $r = 0.45$ ,  $P < .05$ ), and SF-36 subscales of general health ( $r = 0.45$ ,  $P < .05$ ) and physical function ( $r = 0.42$ ,  $P < .05$ ). In addition, internal locus of control was found to significantly correlate with performance on the single-leg hop test ( $r = 0.4$ ,  $P < .05$ ).

Participants' subjective reactions to the single-leg hop test were also analyzed. Patients were categorized into 2 groups based on their recorded reaction to the test. The positive group was made up of participants that had posttest reactions of "good" or "fine." The negative group was made up of those who responded "awkward, weird, afraid, weak, or nervous." One patient declined to comment after performing the single-leg hop test and was not included in either of the groups. Between the positive subjective reaction group ( $n = 16$ ) and the negative subjective reaction group ( $n = 9$ ), there were no significant differences in knee objective stability data. However, patients with positive subjective reactions had significantly higher self-esteem and IKDC scores than patients with negative subjective reactions (Figure 1). Patients in the positive subjective reaction group also performed better on the single-leg hop test than patients with negative subjective reactions, and this finding approached significance (positive group, 92.4%; negative group, 78.4%;  $P = .066$ ).

Sport returners were found to have significantly higher self-esteem, higher KOOS-QOL scores, and lower differences in their reported pre- and postoperative Tegner activity scores when compared with nonreturners (Figure 2). There were no significant differences in objective knee stability measurements or the duration of time since surgery between returners and nonreturners.

As mentioned previously, 1 additional patient participated in the study; however, those data were excluded as this patient represented a substantial outlier. The

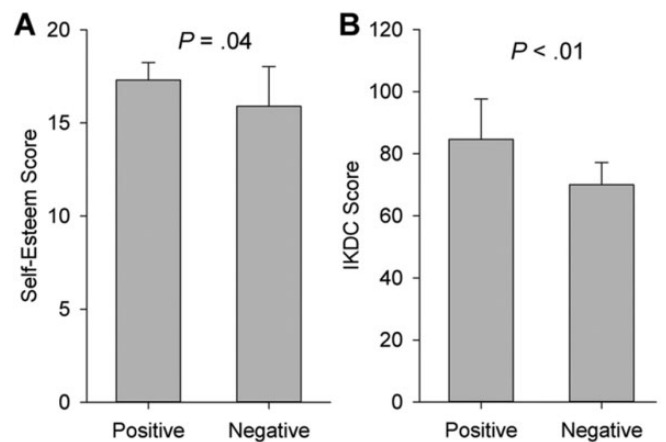


Figure 1. Differences in (A) self-esteem and (B) International Knee Documentation Committee (IKDC) scores between patients with positive versus negative subjective reactions to the single-leg hop test. Error bars represent standard deviations.

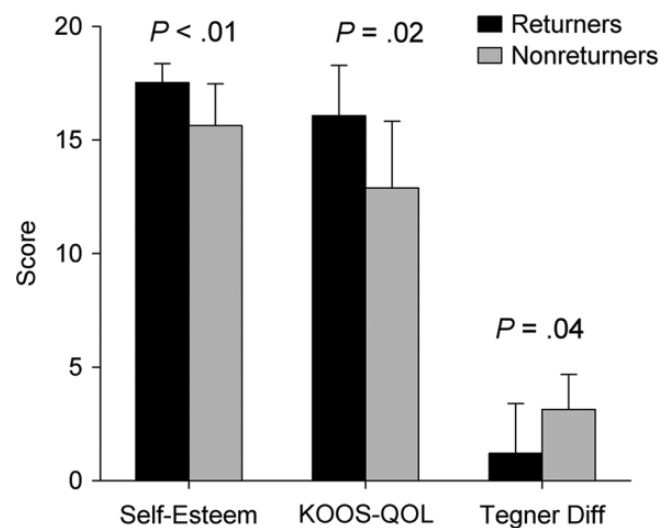
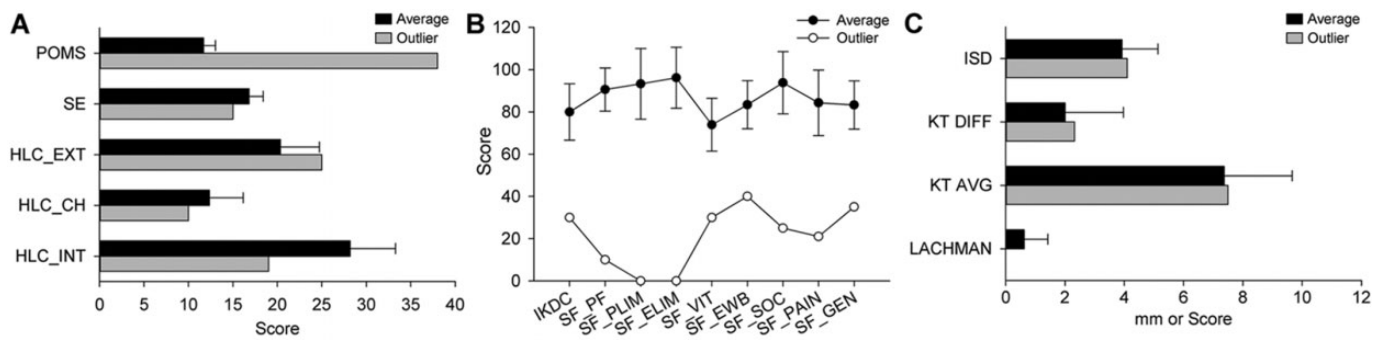


Figure 2. Sport returners versus nonreturners. Differences in self-esteem, Knee injury and Osteoarthritis Outcome Score–Quality of Life subscale (KOOS-QOL), and pre- and postoperative Tegner activity score between athletes who were able to return to sports and those who were not. Tegner Diff, difference between pre- and postoperative reported Tegner activity level. Error bars represent standard deviations.

comparison between this outlier data and the study aggregate data, however, is interesting to observe and can be seen in Figure 3. This patient had a very high level of psychological distress and more external locus of control compared with other participants, and he/she reported drastically lower scores on all subjective outcome measures. However, in terms of objective knee stability, this patient measured right at the group average on all dimensions.



**Figure 3.** Outlier data not included in general analysis compared with average from the study population. (A) Outlier had a substantially different psychological profile high in psychological distress. (B) Representation of the dichotomy of responses between outlier and study population on selected subjective measures. (C) Comparison of outlier knee stability with study population. HLC\_CH, chance locus of control; HLC\_EXT, external locus of control; HLC\_INT, internal locus of control; ISD, intraoperative stability data; KT AVG, KT-1000 arthrometer average of injured leg; KT DIFF, KT-1000 arthrometer difference between legs; POMS, Profile of Mood States; SE, self-esteem; SF\_ELIM, SF-36 emotional limitations subscale; SF\_EWB, SF-36 emotional well-being subscale; SF\_GEN, SF-36 general health subscale; SF\_PF, SF-36 physical function subscale; SF\_PAIN, SF-36 pain subscale; SF\_PLIM, SF-36 physical limitations subscale; SF\_SOC, SF-36 social functioning subscale; SF\_VIT, SF-36 vitality subscale. Error bars represent standard deviations for cohort data.

**DISCUSSION**

This study suggests that psychological factors may have underappreciated effects on surgical outcomes after ACL reconstruction and is the first clinical study to evaluate the psychological construct of self-esteem as it relates to ACL recovery. The main results were that self-esteem and internal locus of control had significant relationships with functional test performance, as measured by the single-leg hop test, as well as validated measures of patient-reported knee outcomes (IKDC, SF-36, and KOOS-QOL). In addition, patients who returned to sports had significantly higher self-esteem levels than those who did not return to sports, without observable differences in knee stability or duration of time since surgery.

The relationship between psychological responses, knee stability, and patient-oriented outcome has yet to be fully elucidated and is quite complex. The cause and effect relationship between the two is likely interrelated and multidirectional. Certainly, an unstable reconstruction could be a source of negative psychological reactions that could confound rehabilitation. Likewise, a stable knee may generate positive feelings and outcomes. The question that remains to be answered is to what degree can psychological responses mediate outcome? In other words, how much can a person's psychological makeup interfere with recovery, or alternatively, compensate for a suboptimal surgical outcome? This question is particularly salient when observing the clear discrepancy in the outlier data demonstrating objective measurements of knee stability with very low outcome scores reported. Large numbers of patients would be needed to distinguish the effects of subtle psychological or stability differences.

Psychological factors may be influencing functional performance. In our study, having a higher internal locus of control was associated with better performance on the single-leg hop test, and patients who had positive subjective reactions to performing the test had higher self-esteem,

higher IKDC scores, and better performances compared with the negative subjective group. Recording subjective responses to the single-leg hop test has not been previously described; however, this provided us with valuable information about how patient outlook may influence performance in the absence of stability differences. If patients feel that they have control over their actions and abilities or are more confident, these traits may be very positive in the rehabilitative period to drive motivation and favorable outcomes.

Return to sport has been a marker of surgical success after ACL reconstruction, particularly in high-level athletes. However, fear of reinjury is the most commonly cited reason among athletes for not returning to sport after ACL reconstruction.<sup>3,17</sup> This is significant because this fear may be independent of surgical technique or knee stability. Fear is a patient perception or feeling, not a surgical outcome. Defining surgical success based on return to sport cannot be reasonably done without consideration of individual psychological differences.

In a study of 100 ACL reconstruction patients, Gobbi and Francisco<sup>11</sup> found that more than 90% of patients had less than 3 mm of side-to-side difference using arthrometer measurements; however, sport returners had higher psychovitality and subjective outcome scores when compared with nonreturners. Our study showed similar results with no differences in knee stability between returners and nonreturners, but returners were found to have significantly higher self-esteem and subjective outcome scores. Another recent study showed that psychological readiness to return to sport, patient expectations, and locus of control predicted returning to sport by 12 months.<sup>2</sup> It is reasonable to conclude that psychological factors may play a critical role with regard to return to sport. More in-depth research is needed to properly characterize this relationship; however, perhaps psychological interventions aimed at increasing self-esteem, locus of control, self-efficacy, or confidence could help improve return-to-sport percentages.

The effectiveness of psychological interventions for behavioral change has been studied extensively in various domains, and health-coaching has helped increase activity levels and outcomes in patients with illness and injury.<sup>9</sup> Specifically within the domain of sports injuries and ACL reconstructions, interventions are currently being employed to help improve outlook and outcomes for injured athletes.<sup>16,25,40</sup>

There are several limitations to this study. First, there was a relatively small sample size. Because of the defined inclusion criteria of time since surgery, only a limited number of patients were eligible to participate. Response rate within this group was moderate, with 52% agreeing to participate. However, if the study included more patients, results may have been stronger and there may have been more variety among psychological dimensions, which may be important to tease out subtle relationships. Selection bias of the participants may also skew results as the patients who declined participation or were unable to be reached may have had significantly different outcomes than those who participated. As mentioned, there was a relative homogeneity of psychological profiles among the study population, particularly with regard to psychological distress. Because of this, it was necessary to exclude 1 interesting patient from the analysis who had average knee stability but markedly elevated psychological distress and very low outcome scores, which inappropriately skewed results. Patient perceptions of surgical outcomes may be significantly influenced by an individual's psychological state, but a much larger sample population would be required to obtain ranges of psychological variables that could be used to detect small differences in outcomes. In addition, survey responses were self-reported and may not truly be representative of patient feelings and function. The possibility of fatigue bias during survey completion cannot be ruled out either. This study was also performed at a single postoperative time point, and preinjury or preoperative survey data were not available for response comparison; nor were data from other time points during recovery, which may have made the findings stronger and more generalizable. Lastly, while the subjective outcome measures used in this study have been validated for ACL reconstruction patients, the psychological measures utilized have not been validated for use with either ACL patients or within the field orthopaedic surgery in general. Each has been well-established and validated within the social science and/or medical literature, but use with this specific patient population has not been reliably described.

Despite the limitations inherent to the study design, the results suggest that there is complex interplay between the physical and mental aspects of recovery after ACL reconstruction. This study identified psychological factors that may be instrumental for patient success, optimal recovery, and return to sport. Self-esteem and internal locus of control had significant relationships with functional and subjective outcomes, and sport returners were found to have higher self-esteem than nonreturners regardless of knee stability or time since surgery. While patients with ACL tears often have similar anatomic injuries, each patient is unique in his or her emotional constitution and ability to

adjust to setbacks. Taking into account individual psychological responses to injury and recovery may be an important next step in improving surgical outcomes after ACL reconstruction. Future prospective studies are needed to determine whether psychological outcomes can predict return to sport.

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**APPENDIX**  
**Patient Demographic and Information Sheet**

**ACL Study Demographic & Information Sheet**

ID Number: \_\_\_\_\_

Today's Date: \_\_\_\_\_

1. Date of Birth: \_\_\_\_\_
2. Sex: *circle*                      Male                      Female
3. Age: \_\_\_\_\_
4. Surgery Date: \_\_\_\_\_
5. How did you injure your knee? *please circle*

|              |                    |
|--------------|--------------------|
| Sports       | Traumatic Accident |
| Work-Related | Other _____        |

6. What is your Race? *please circle*

|                        |                 |
|------------------------|-----------------|
| White                  | Hispanic        |
| Black/African-American | Native American |
| Asian/Pacific Islander | Other _____     |

7. What is the highest education level you have completed? *please circle*

|                             |                            |
|-----------------------------|----------------------------|
| Less than high school       | Some college               |
| Current high school student | College Graduate           |
| High school graduate        | Postgraduate School/Degree |

8. Do you participate in athletic activities? *please circle*

|     |    |
|-----|----|
| Yes | No |
|-----|----|

*If yes, please go onto questions 8-10. If no, skip to question 11.*

9. At what level do you participate in athletic activities? *please circle*

|             |         |
|-------------|---------|
| Youth       | College |
| High School | Adult   |

10. What kind of athlete are you? *please circle*

|                      |                     |               |
|----------------------|---------------------|---------------|
| Recreational Athlete | Competitive Athlete | Elite Athlete |
|----------------------|---------------------|---------------|

11. What sports do you participate in? *please circle all that apply*

|              |                        |                   |
|--------------|------------------------|-------------------|
| Baseball     | Hiking                 | Skiing - Downhill |
| Basketball   | Horseback Riding       | Snow Boarding     |
| Bowling      | Ice Hockey             | Soccer            |
| Boxing       | Karate                 | Squash            |
| Cheerleading | Lacrosse               | Swimming          |
| Cycling      | Mountain Biking        | Tennis            |
| Crew         | Rock Climbing          | Track and Field   |
| Dancing      | Rugby                  | Volleyball        |
| Fencing      | Running                | Water Polo        |
| Field Hockey | Sailing                | Weight Lifting    |
| Golf         | Skateboarding          | Wrestling         |
| Gymnastics   | Skiing - Cross Country | Yoga              |
| Other _____  |                        |                   |



APPENDIX (continued)

12. At this point in your rehabilitation, have you started playing your sport(s) again at a competitive level?

|     |    |
|-----|----|
| Yes | No |
|-----|----|

13. How tall are you? \_\_\_\_\_ ft \_\_\_\_\_ inches

14. How much do you weigh \_\_\_\_\_ lbs

15. Do you smoke? *Circle* Yes No

16. What medical problems do you have?

|                             |                                    |
|-----------------------------|------------------------------------|
| None                        | Overweight                         |
| Heart disease               | Cancer                             |
| High blood pressure         | Depression                         |
| Asthma or pulmonary disease | Osteoarthritis                     |
| Diabetes                    | Rheumatoid arthritis               |
| Ulcer or stomach disease    | Back pain                          |
| Bowel Disease               | Lyme disease                       |
| Kidney disease              | Alcoholism                         |
| Liver disease               | Other medical problem: <i>list</i> |
| Anemia or blood disease     | _____                              |

17. Concerning your knee rehabilitation, check the box that matches your agreement to each of the following statements?

|  | All of the time | Most of the time | A good bit of the time | Some of the time | A little of the time | None of the time |
|--|-----------------|------------------|------------------------|------------------|----------------------|------------------|
| a. I attend my scheduled doctor visits       |                 |                  |                        |                  |                      |                  |
| b. I follow my doctor's instructions         |                 |                  |                        |                  |                      |                  |
| c. I attend my physical therapy appointments |                 |                  |                        |                  |                      |                  |
| d. I do my home exercises as directed        |                 |                  |                        |                  |                      |                  |
| e. I am upset that I injured my knee         |                 |                  |                        |                  |                      |                  |
| f. I feel relieved that I injured my knee    |                 |                  |                        |                  |                      |                  |