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THE ORTHOPAEDIC FORUM

Public Perception Regarding Anterior Cruciate Ligament Reconstruction

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Background: Relatively little information exists regarding the public's perception of anterior cruciate ligament (ACL) injuries and their treatment. The objective of this study was to test the hypothesis that the public's understanding of ACL surgery may be incorrect with regard to various aspects of this procedure and to identify issues to emphasize in patient education.

Methods: This study utilized a forty-three-question survey designed to measure an individual's knowledge base and perception of ACL reconstruction with regard to the anatomy, function, indications, operative technique, risks, recovery time, and overall benefits of the procedure. Eligible individuals were between fifteen and sixty years of age. Study participants were recruited from an academic orthopaedic sports medicine clinic, a collegiate athletic training room, and various public venues.

Results: A total of 210 individuals (106 men and 104 women) with a mean age of thirty were surveyed. Educational level of the respondents varied widely. Twenty-seven percent of the respondents were employed in a health-care setting. Sixty-five percent of the respondents rated their ACL knowledge level as "little" or "none." Participants' self-perception of ACL knowledge was highly correlated with their survey scores on questions with a specific correct answer ($p < 0.001$). Almost one-third thought that surgical treatment involved repair of the torn ligament rather than reconstruction. Over half (56%) of the respondents preferred an autograft for ligament reconstruction, compared with 4% who preferred an allograft. The ability to return to sports after ACL surgery was the most important concern, followed by the risk of developing osteoarthritis.

Conclusions: There is wide variability in the lay public's knowledge level of ACL injuries; a substantial number of misguided perceptions were identified. Return to sports and risk for future osteoarthritis following ACL surgery appear to be the most important factors to the lay public. Focusing educational efforts on areas of knowledge deficits may be particularly important for patients of physicians who treat ACL injuries.

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The anterior cruciate ligament (ACL) functions as a major supporting ligament in the knee; it provides the greatest restriction of anterior displacement of the tibia relative to the femur¹, while also serving to limit tibial rotation and coronal plane angulation with the knee joint at full extension². The ACL is the most commonly disrupted ligament in the knee that requires surgical reconstruction after injury. An estimated 175,000 ACL reconstructions were performed in the United States in 2000³. The number of ACL reconstructions has dramatically increased over the past several decades, in large part because of increased exercise patterns that predispose individuals to ACL injuries, as well as the passage of Title IX and subsequent increased female participation in sports.

In addition to the immediate knee instability due to an ACL tear, patients are also at an increased risk of osteoarthritis from chronic instability, which occurs in 50% of patients within ten to twenty years following an ACL tear⁴. As a result of the important implications of ACL injury, extensive basic science and clinical research has examined diagnostic testing, indications for surgery, preoperative management, surgical techniques, postoperative management, and outcomes following treatment for this widespread injury.

Although the knowledge of clinicians and the scientific community regarding the ACL has greatly expanded, there has been scant data on the general public's understanding of ACL function, injury, reconstruction, and surgical outcome. Prior studies evaluating these factors relevant to a patient's selection of an ACL graft choice concluded that physician recommendation was the primary influence, with personal research (including medical web sites) also commonly utilized^{5,6}. However, to the best of our knowledge, there have been no studies documenting overall patient knowledge of ACL science or perceptions of treatment beyond those regarding graft selection.

The increase in ACL injuries in both the general public and professional athletic populations, combined with increased media coverage of athletic injuries, has cast a spotlight on ACL reconstructive surgery. Increased availability of electronic information has also allowed a greater transmission of medical information, although it is possible that this information is not expressed or interpreted correctly.

The purpose of this study was to gain insight into what the general public believes to be true about ACL injury and treatment, specifically in regard to the ligament's function, surgical reconstruction, and expected outcomes of treatment. We hypothesized that the public's perceptions regarding the indications, risks, benefits, and rehabilitation related to ACL reconstruction may be incomplete, despite the large number of ACL reconstructions performed in this country that often involve high-profile athletes. Potential misperceptions will not only negatively influence patient expectations regarding treatment but also hinder a patient's interaction with his or her treating physician. An objective assessment of the general public's knowledge base regarding this clinical condition will ultimately be beneficial in addressing patients' perceptions, concerns, and expectations prior to and following treatment for an ACL tear.

Materials and Methods

This study was approved by the Washington University Human Studies Committee prior to commencement. A forty-three-item questionnaire (see Appendix) was created that sought to investigate various aspects of ACL science, injury, treatment, complications, rehabilitation, and outcome. In addition, several items were designed to determine the respondents' demographic information, educational level, exposure to ACL injury, prior surgical history, and activity level. Our respondents had a wide range of educational and occupational backgrounds. Therefore, to facilitate comprehension, the questionnaire was written at the sixth-grade reading level^{7,8}.

The survey was designed with commonly accepted principles of item generation, item reduction, questionnaire format, and pretesting⁹. Item generation identified reasonable questions for inclusion in the survey. Item reduction was used to select a subset of the initially generated items to be included in the survey. Based on these items, a survey of thirty-seven questions was prepared in a predominantly multiple-choice format. The pilot questionnaire was then pretested⁹ in a total of twenty-seven subjects with a mean age of forty-two years (range, twenty-one to eighty years). On average, the questionnaire took six minutes and thirty seconds to complete, with a range of five minutes to eleven minutes and thirty seconds. All of the questions were answered. No subject felt that the questionnaire was biased or offensive in any way. Several grammatical and content-related changes were made based on the comments of the responders. Finally, a pilot study was conducted in which the survey was completed by ten volunteers with various degrees of medical knowledge so that the questions could be refined. The survey did not undergo reliability and validity testing since it was designed as an informative survey rather than a precise patient measure. Furthermore, the input of expert orthopaedic surgeons corroborated face validity (the overall reasonableness and sensibility of an index¹⁰) and content validity (appropriate selection and aggregation of components qualitatively¹⁰). We did not test for criterion validity (how accurate an instrument is with respect to a reference standard¹¹) or construct validity (how well an index describes the construct it is intended to assess¹²) because of the lack of standard measures for comparison.

Questions were constructed with use of a predominantly multiple-choice format. Some items required the respondents to complete a Likert scale dealing with various degrees of activity level, with anchors ranging from "less than one time in a month" to "four or more times in a week"; some questions required a "yes" or "no" response; and some questions asked the respondent to circle the appropriate response on a scale of 1 to 10. Three questions dealt with demographic data. Two questions inquired about educational background and work history. One question required the respondents to specify their highest level performing various running, cutting, decelerating, and pivoting activities in their healthiest and most active state over the past year based on the Marx Activity Rating Scale¹³. Six questions asked the respondents about any prior injury or surgical history, as well as exposure to ACL surgery from their immediate family. Seven questions dealt with ACL science such as basic anatomy and biomechanics. Nine items inquired about ACL treatment, including the indications and general techniques of ACL surgery. Three questions dealt with postoperative complications of ACL reconstruction. Seven questions involved topics of rehabilitation following treatment of an ACL tear, such as the need for casting and timing of return to sports. Five questions dealt with topics pertaining to treatment outcomes, including the risk of a retear. Of the forty-three questions, twenty-seven were considered factual and to have a single correct answer based on the currently accepted orthopaedic literature (e.g., "To what two structures does the ACL attach?"). The remaining sixteen questions did not have only one correct answer; they involved either personal information unique to the individual or sought to determine the respondent's opinion about various ACL-related issues.

A total of 210 respondents completed the survey. The majority (65%) of these participants were recruited from the senior author's (M.J.M.) orthopaedic practice after being seen for a problem unrelated to the knee. The remaining participants were recruited from the undergraduate campus of Washington University (25%) and from the general public (10%). Each participant completed the questionnaire in private without assistance from any of the coauthors

TABLE I Correlation of Self-Rated Knowledge About the ACL with Performance on the Survey*

Self-Rated Knowledge	Number of Respondents	Percent Correct (Mean ± SD)
None	36	37% ± 15%
Little	100	49% ± 13%
Moderate	56	58% ± 10%
Considerable/extensive	17	64% ± 11%

*ACL = anterior cruciate ligament and SD = standard deviation.

or their assistants. Each volunteer was given a \$5.00 gift certificate for his or her participation.

Statistical Analysis

Data were analyzed with use of SAS software (version 9.3); *p* values less than 0.05 were considered significant. Chi-square tests were used to compare categorical variables, while Spearman correlation coefficients were used to assess the relationship between two continuous or ordered categorical variables. Depending on the distribution of the variable, a *t* test or the Wilcoxon test was used to test hypotheses about the equality of means across groups.

Results

A total of 210 individuals (106 men and 104 women) with a mean age of thirty years (range, fifteen to fifty-six years) were surveyed. The racial breakdown of the survey participants was 74% Caucasian, 14% African-American, 8% Asian, and 3% Hispanic. The group was well educated: 11% held graduate or professional degrees, 39% had college degrees, 35% had some college education, 9% had finished high school, and 7% had some high school education. Over one-quarter of the individuals

(27%) were employed in a health-care setting. The activity level of the participants, as assessed by the Marx Activity Rating Scale, varied widely (Fig. 1).

Sixty-five percent of the respondents rated their ACL knowledge level as “little” or “none.” Correspondingly, only 51% of the factual questions were answered correctly. The respondents’ self-perception of ACL knowledge was highly correlated with their scores on the survey ($p < 0.001$) (Table I). There was a positive correlation between activity level and the number of correct answers ($p < 0.0001$), but a negative correlation between age and the number of correct answers ($p = 0.003$). There was no relationship between the percentage of correct answers and sex, educational level, or employment in a health-care setting. Sixteen survey participants admitted to having a history of a torn ACL. For those indicating that they had experienced an ACL tear, the number of correct answers was 14.9 ± 4.1 . For the 194 participants who had never had an ACL tear, the number of correct answers was 14.7 ± 4.3 ($p = 0.823$).

Overall understanding of ACL anatomy and function was fair. Only 34% knew that the ACL is attached to bone at both ends. However, 75% knew that the key purpose of the ACL is to provide knee stability; 84% understood that a twisting injury with a planted foot was the most likely cause of an ACL injury. About one-half (51%) believed that the most difficult movement with an injured ACL was changing direction while running, although 76% thought that a cutting sport, such as soccer, would be more difficult with an injured ACL compared with in-line activities. Only 30% of the survey participants knew that there was a difference in risk for ACL injury between men and women, with a trend toward women knowing more frequently than men ($p = 0.080$). However, the survey did not specifically ask whether women or men were more likely to injure their ACL.

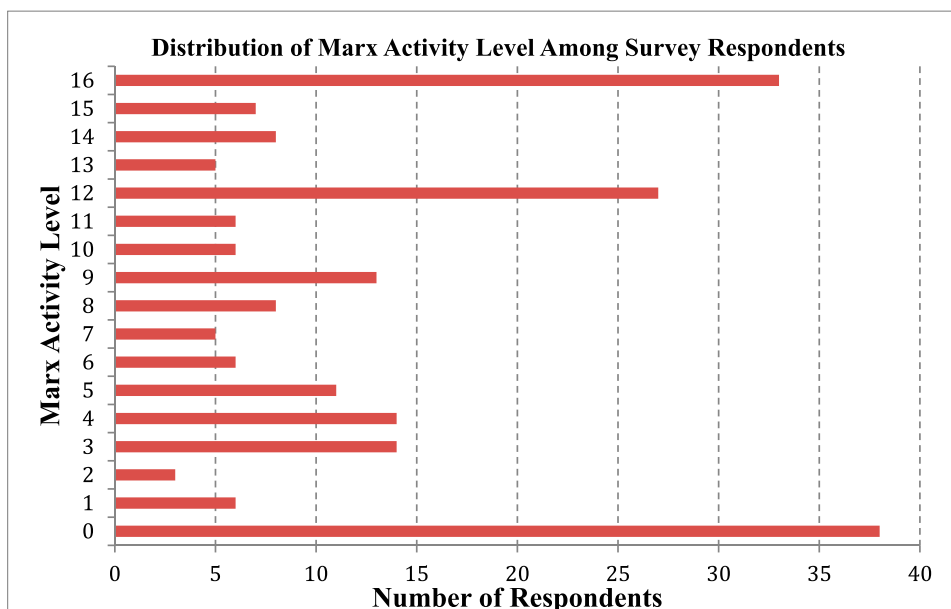


Fig. 1

Distribution of the scores on the Marx Activity Rating Scale among survey respondents.

TABLE II Relative Importance of Concerns About ACL Surgery*

Specific Concern	Score (Mean ± SD)
Ability to return to previous level of sports/activity	8.4 ± 2.3
Risk of developing osteoarthritis	7.3 ± 2.4
Pain immediately after surgery	6.3 ± 2.8
Cost	6.2 ± 3.1
Scars	4.2 ± 2.7

*Patients used a rating scale from 1 to 10, with 10 being the highest level of concern. ACL = anterior cruciate ligament and SD = standard deviation.

Participant understanding of the treatment for ACL tears was fair. Approximately one-half (52%) of respondents knew that a torn ACL would not heal without surgery. Only 27% thought that it was necessary to have surgery for a torn ACL, although one-third (33%) thought that a torn ACL requires surgery for the ability to walk. A similar percentage (32%) thought that surgery involved actual repair of the torn ligament. Over one-half of the respondents (56%) preferred an autograft for reconstruction compared with 4% who preferred an allograft. In terms of graft choice, 51% did not have an opinion as to which autograft would be preferable; 19% preferred a hamstring autograft, 15% preferred a bone-patellar tendon-bone autograft, and 15% had no preference. Twenty percent thought that an allograft would permit faster return to sports, while 36% felt that an autograft would not allow a faster return; 44% did not know. Eighty-two percent thought that a brace was required after ACL reconstruction.

Public knowledge regarding the outcome following ACL reconstruction was not very extensive. Seventy-seven percent of participants knew that recurrent instability was a risk after ACL reconstruction. Forty-five percent thought that the risk of infection is greater than 10%. Forty-two percent thought that the risk of rearing the ACL is 25%, while 29% of the respondents thought the risk of re-rupture is 50%. Only 37% knew that surgery does not decrease the risk of osteoarthritis. Eighty-two percent thought that a brace is required to prevent surgical failure. The ability to return to sports was the most important concern with ACL surgery, followed by the risk of developing osteoarthritis (Table II). Patients were least concerned with the size of the scars from the surgery.

Discussion

To our knowledge, this is the first study that assesses the perception of ACL injury and its treatment from a segment of the population. In general, there is wide variability in the lay public's knowledge level of this condition, and a substantial number of misguided perceptions have been identified. Nevertheless, respondents had reasonable insight into how much they know (or do not know) about the ACL. Return to sports and risk for future osteoarthritis following ACL injury appear to be important

factors to the lay public. Focusing educational efforts on areas of knowledge deficits may be particularly important for patients of physicians and other health-care professionals who treat ACL injuries.

In this study population, participants preferred an autograft rather than an allograft and cared most about return to sports and the risk for future osteoarthritis after ACL reconstruction. It is unclear what factors are responsible for these preferences, although they are clearly relevant outcome measures. Only a minority of individuals is aware of the sex-based differences associated with the risk for ACL injury; however, the risk of reinjury after ACL reconstruction is perceived to be quite high. These are two areas that should be discussed with patients. The lack of awareness about the sex-based difference in ACL tear risk is surprising, although women appeared to be more aware of the difference than men. Even so, the majority of both men and women either thought there was no difference or did not know enough to have an opinion. Female athletes have a greater risk than male athletes for rupturing the ACL¹⁴, and they are more likely to rupture the contralateral ACL after reconstruction¹⁵. Although large cohorts of patients have no sex-based difference in risk of recurrent ACL tears^{14,16,17}, female soccer players have a higher risk of ACL reinjury compared with their male counterparts¹⁸. Thus, women may gain the most benefit from education to guide their expectations following ACL reconstruction.

Self-awareness of knowledge deficits is important. Hopefully, patients who know less about the topic will pay more attention to discussions with their health-care providers and invest more effort to investigate their injury and its treatment. Inquiry into a patient's self-assessed level of knowledge in the clinic prior to discussing surgery is important. Patients with a lower level of perceived knowledge may benefit from greater access to appropriate literature and a more detailed discussion of the injury and its treatment options. Fortunately, based on the results of this study, younger and more active individuals who are more likely to sustain an ACL injury have a greater knowledge base about the ACL. Providers should be aware that older and less active patients with ACL tears may have less overall knowledge concerning this injury; they should be offered access to appropriate educational materials and may benefit from a more thorough review in clinic. Based on the twenty-seven factual questions, the sixteen participants who had been previously diagnosed with an ACL tear did not exhibit an improved understanding of the ACL. This could be attributed to multiple factors, including an absence of self-education regarding the ACL, poor retention of prior discussions pertaining to the ACL with a health-care provider, or the desire to pursue non-operative treatment.

Although two previous studies have shown physician recommendation to be the strongest factor in patient selection of graft in ACL reconstruction^{5,6}, the modern practice of patient-oriented care with active patient participation^{19,20} puts increasing emphasis on patient preferences. In our study, over half of the respondents preferred an autograft to an allograft. Furthermore, participants had relatively little concern about the size of

incisions. Given the potential drawbacks of allografts, including higher cost, risk of disease transmission, and a higher failure rate in active athletes, these findings suggest that an allograft may be optimal for limited indications.


Respondents were not well educated about the outcomes of ACL reconstruction. The risk of recurrent instability is perceived to be very high, and many seem to think that surgery decreases the risk of developing osteoarthritis. Surgeons should explain that ACL reconstruction has been proven to restore knee stability but does not appear to decrease the risk of developing osteoarthritis. This is particularly important given the two leading concerns that individuals appear to have regarding outcomes after ACL reconstruction: return to sports and risk for osteoarthritis. Return to sports is a relatively achievable goal and has been proven in sports such as football and soccer^{18,21}. However, identifying and treating factors that lead to later osteoarthritis after ACL reconstruction requires ongoing research. Surgeons should explain to patients that the ACL typically does not heal without surgery, although surgery may not be necessary in all cases. Patients should be educated on the risks of recurrent instability and postoperative infection, both of which are lower than most participants perceived. Furthermore, surgeons should be proactive about explaining to patients that despite the fact that ACL reconstruction is effective in restoring knee stability, it has not been shown to reduce the risk of developing osteoarthritis. Finally, women should be educated about their increased risk for contralateral ACL rupture after ACL reconstruction.

A limitation of our study is that it is a survey of relatively well-educated individuals from one geographic location (a medium-sized city in the central United States). The reliability of certain measures may be less for socioeconomically disadvantaged groups (those with less income or lower levels of education) or individuals whose impairments (such as poor sight or hearing) limit their ability to respond adequately to certain types of survey forms or questions²². We did not assess the participants' income or level of intelligence. However, all of the volunteers who completed the survey had the ability to read, write, and comprehend written material at or beyond

the sixth-grade level. Secondly, the questions in this study were not validated. There was a high percentage of "don't know" responses, which likely represents the honest limitations of participant knowledge, but may also reflect a weakness inherent in the study design. Finally, we did not survey patients from the senior author's orthopaedic practice who had sustained an ACL tear or had previously undergone ACL reconstruction. This selection bias was intentional in an attempt to identify baseline information as opposed to an assessment of knowledge based on Internet research or word of mouth as might occur in patients who had been told or suspected that they had an ACL tear.

In conclusion, patient education is important during the evaluation and treatment of any injury. Overall knowledge regarding ACL injury is limited in the general population, but individuals appear to have good awareness of their relative level of knowledge. People are most concerned about return to sport and the risk of osteoarthritis after ACL reconstruction. More study is needed to better characterize patient understanding of ACL injury and treatment across diverse populations in order to guide not only physician-patient discussions, but also to stimulate future ACL injury-related research.

Appendix

 The survey instrument used in this study is available with the online version of this article as a data supplement at jbjs.org. ■

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