

Anterior Cruciate Ligament Injury and Reconstruction Among University Students

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The consequences of athletic injuries extend beyond the musculoskeletal system. Depression, anger, and tension have been observed in athletes with athletic injuries. It was hypothesized that among student athletes, the psychological impact of injury may be seen as a drop in academic performance. Thirty-eight students who had an anterior cruciate ligament injury and subsequent reconstruction were evaluated retrospectively by academic transcript and questionnaire to measure their academic performance before their injury, in the semester of their injury, and in the semester after their surgery. The patients were compared with randomly selected undergraduate control subjects. To evaluate any effect of the timing of the surgery on academic performance, the patients were separated into two groups, according to the timing of their reconstruction: those who had surgery during the academic semester, and those who elected to wait for a school break. There was a significant drop in grade

point average of 0.3 grade points during the semester of injury among all injured students. Compared with those who had surgery during a break, the students who had surgery during the semester received more frequently the grade of failure (6% versus 0%) or incomplete (33% versus 9%). These students also missed more school days (10.5 days versus 1.5 days) and examinations (2.2 examinations versus 0.1 examinations). Only 47% of students who had surgery during the semester were satisfied with their decision for surgical timing, compared with 96% satisfied with the timing during an academic break. Acute anterior cruciate ligament rupture, and surgical reconstruction during an academic semester, have a significant academic effect in university students.

Anterior cruciate ligament rupture requiring reconstruction is a common injury that occurs approximately 50,000 times a year in the United States. Smith et al^{8,9} showed that athletic injury in students can result in objective signs of depression, anger, and tension that can remain present for 1 month after injury. The significance of this injury in patients' lives may be underestimated. The effect of athletic injury on students' academic performance is unknown but it may be an important consideration when selecting the optimal time for surgical reconstruction.

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The timing of anterior cruciate ligament reconstruction remains controversial. Several authors recommend delaying surgery for patients who are high school or university students to accommodate academic or personal priorities.^{1,6,7} Mental preparation of the patient and accommodation of school, work, family, and social schedules have been considered important in perioperative planning.⁵ Shelbourne and Foulk⁴ observed improved psychologic attitude in the athlete during a delay of at least 3 weeks from injury until reconstruction. Johnson et al¹ also reported that a delay in the surgical procedure until a convenient time (such as a school break) improves preparedness of the patient for surgery.

Although there may be a tendency toward delaying surgery in the university student until a semester break, there are no reports on the academic consequences of performing surgery during the semester rather than during an academic break. The purpose of this study was to determine the effect of anterior cruciate ligament injury and subsequent timing of reconstruction on measurable variables of academic performance among university students.

MATERIALS AND METHODS

Eighty-three undergraduate and graduate students with anterior cruciate ligament tears who underwent reconstructive surgery during a 4 year period at the authors' institution were included in the study. Arthroscopically assisted anterior cruciate ligament reconstruction using either central infrapatellar tendon autograft, hamstring autograft, or patellar tendon allograft, was performed by one of three surgeons. A standard rehabilitation protocol was used regardless of the timing of surgery. The 83 students were sent a questionnaire that addressed the academic impact of their injury and surgery and also were sent a transcript release form. Forty-eight patients returned the questionnaire and transcripts were obtained for those 48 students. Ten patients who were first semester students with no academic baseline were excluded; the remaining 38 patients made up the study population. A randomly selected convenience sample comprising sophomore, junior, and senior under-

graduate students from the authors' university was selected to serve as a control group. The control subjects' transcripts were selected using social security numbers instead of names to blind the reviewers and the transcripts were obtained directly from the university registrar.

Data collected from the surgical group included the baseline (preinjury) grade point average (A = 4.0), the grade point average earned in the semester of the injury, and the grade point average earned in the semester of surgery. If the operation took place during an intersemester academic break, the grade point average of the semester after surgery was used. Changes in grade point average, comparing the injury and surgery semesters with the baseline grade point average were calculated. The number of courses failed and the amount of incomplete courses also were tabulated. In addition, information was obtained on the number of missed examinations and missed school days. For the control group, the change in grade point average was calculated as the difference between that earned in the most recent semester compared with the average of all other previous semesters. The surgical group additionally was divided to include those students who had their surgery during the semester (semester group), and those who elected to defer surgery until a school break (break group). Each patient chose the timing of his or her surgery in consultation with the surgeon; the students were not assigned randomly to a treatment group. A questionnaire that asked all patients to indicate whether they were satisfied with their chosen time for surgery was sent at least 1 year after surgery. Two tailed Students' t tests were performed for all means, and chi squared testing was performed for all proportions.

RESULTS

Demographics

The study population had an average age of 22 years (range, 20–30 years). All patients were undergraduate or graduate students at the time of their surgery (31 undergraduate, seven graduate). There were 15 students who elected to have their surgery during the academic year (semester group). Twenty-three chose to defer surgery until an academic break (break group). The average time between injury and surgery was 2 months

TABLE 1. Academic Effect of Timing of Anterior Cruciate Ligament Reconstruction

Parameters	Semester	Break	Statistical Comparison (p)
Number of students	15	23	
Percentage with grades of failure	6	0	p = 0.01
Percentage with grades of incomplete	33	9	p = 0.05
Number of missed examinations	2.2	0.1	p = 0.001
Number of missed school days	10.5	1.2	p = 0.001
Change in grade point average	0.03	0.12	NS
Percentage of satisfaction with timing	47	96	p = 0.001

NS = not significant.

(range, 1 week–1 year). The mean followup was 31 months (range, 12–58 months). Although the timing of the surgery was left up to the student, there was no detectable tendency for students with better grades to choose one option over the other.

Academic Effect of the Injury; Changes in the Semester of Injury Compared With Baseline

In the semester of injury, there was a statistically significant decrease in the mean grade point average of the study group (down 0.09 grade points from baseline) as compared with the mean grade point average of the control group (up 0.21 grade points from baseline) ($p = 0.04$). This results in a net change in grade point average of 0.30 grade points in the semester in which the anterior cruciate ligament injury occurred. Three of 39 students received a grade of failure in the semester of their injury, compared with 0 of 39 control subjects ($p = 0.07$).

Academic Effect of the Timing of the Surgery; Changes in the Semester of, or After, Surgery Between Semester and Break Groups

There was a statistically significant difference in the proportion of students in the semester group who received a failing grade in the semester of their surgery (6%) as compared with the proportion receiving a failing grade in the break group (0%) ($p = 0.01$). There was also a statistically significant dif-

ference in the proportion of patients in the semester group who received an incomplete in the semester of their surgery (33%) as compared with the proportion receiving incomplete grades in the break group (9%) ($p = 0.05$). There was a statistically significant increase in the mean number of missed examinations for patients in the semester group in the semester of surgery (2.2 examinations), as compared with the number of missed examinations by patients in the break group (0.1 examinations) ($p = 0.001$). For students in the semester group, there was a statistically significant difference in the number of school days missed in the semester of surgery (10.5 days) as compared with the number of school days missed by students in the break group (1.2 days) ($p = 0.001$). Change in grade point average in the semester of the surgery was not statistically significant between students in the semester group (up 0.03 grade points) and those in the break group (up 0.11 grade points). In response to the question regarding satisfaction, only 47% of patients in the semester group indicated that they would make the same choice again (to have the surgery during the semester), compared with 96% of the patients in the break group who were satisfied with the timing.

DISCUSSION

The optimal time to perform reconstructive anterior cruciate ligament surgery depends on

multiple factors. The range of motion of the knee and the presence of ligamentous or meniscal injuries⁵ are important considerations. A delay for a minimum of 3 weeks from the time of acute anterior cruciate ligament injury has been shown to have several advantages, including decreased incidence of arthrofibrosis,⁷ earlier recovery of quadriceps strength,¹⁰ and earlier return to sport specific rehabilitation.⁴ The current study supports the decision to delay surgery on other grounds, suggesting that deferring the operation may have social and occupational benefits and may improve patient satisfaction. As Shelbourne and Patel⁵ observed, mental preparation and accommodation of school and work schedules should be considered before undertaking anterior cruciate ligament surgery. This study buttresses that argument.

Beyond the issue of timing, one must recognize that the injury itself, and not necessarily its treatment, had an adverse effect on the patient; that is, the largest drop in grade point average was found in the semester of injury, regardless of the timing of surgery. Treating surgeons must be aware of this impact, and they in turn should make their patients aware of this phenomenon. Referring the patient to meet with an academic or psychological counselor may be warranted. This caveat probably applies to other athletic injuries as well. Smith et al⁸ showed that severe athletic injury results in elevations of tension, depression, and anger that can last for 1 month. Although this study examined only one injury whose severity, complexity, and treatment requirements are unique, it probably is best to anticipate and preempt similar problems with other athletic injuries.

Meeuwisse and Fowler³ reported that the injury rate among intercollegiate athletes is 38% for male and 32% for female participants. If even only 1/3 of such injuries are associated with adjustment problems, 10% of all intercollegiate athletes are at risk. The high frequency of athletic injury, coupled with findings such as those of this study (which may be viewed as tangible effects of

the emotional impact of injury), suggest that psychological adjustment to injury is an important public health issue in this population.

The current study was neither prospective nor randomized, features that are necessary to issue a definitive statement on the effects of timing surgery. Because many surgeons think that the correct time to perform surgery is after the appropriate delay, it is perhaps unethical to perform the retrospective study described above in a prospective manner, with students randomly assigned to a semester or break group. It may be instructive, however, prospectively to study the effect of preemptive psychological interventions among those students who elect to have surgery during the academic year.

In this study, furthermore, other metrics of the outcome of surgery were not assessed; perhaps the patients in the semester group had more academic difficulties but achieved a more stable knee in return. One ineluctable conclusion, though, is that anterior cruciate ligament injury has ramifications that extend beyond mere knee function. As a sports medicine surgeon, one must not only diagnose and treat the ligamentous lesion, but also must attend to all of the patient's concerns, some of which may transcend the problems with the musculoskeletal system. Traditionally, the measure of success of anterior cruciate ligament reconstruction is the enduring elimination of instability. Yet, as Meakins and Barkun² reported, patient centered outcomes will play an important role in measuring the success in medical and surgical treatment in the future. To attain excellent outcomes, surgeons must become increasingly aware of historically peripheral issues, such as short term function at school and psychological adjustment to injury.

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