



# The Assessment of Quad to Quad and Hamstring to Quad Ratios in Patients Twelve to Twenty-Four Months Post Completion of a Supervised Anterior Cruciate Ligament Reconstruction Rehabilitation Program

Riley Anderson, Bennett Sikkink, Justin Grevengoed, Nick Adams, DPT, Rick Loutsch, DAT, ATC  
Athletic Training Program, Northwestern College



## Abstract

**Context:** The assessment of quadriceps to quadriceps (Q-Q) and hamstring to quadriceps (H-Q) ratios following anterior cruciate ligament (ACL) reconstruction is an important factor for returning to sport. Significant differences in these ratios can result in reinjury. **Objective:** The purpose of this study is to assess Q-Q and H-Q ratios in collegiate athletes who have undergone ACL reconstruction and have successfully completed a supervised physical therapy program in the last 12-24 months and compare the results to established normative return to play guidelines (Q-Q = 90% and H-Q = 60%). **Design:** Cross-sectional study. **Setting:** Midwest outpatient physical therapy clinic. **Patients or Other Participants:** Four collegiate athletes (2 females and 2 males; age range = 19-21). Inclusion criteria included a previous ACL reconstruction using a bone-patellar tendon-bone graft and completion of a supervised physical therapy program in the past 12-24 months. **Methods:** Isokinetic strength measurement and peak torque values of knee flexion and extension between injured and uninjured legs using the Humac Norm Isokinetic Dynamometer by CSMI. The Q-Q and H-Q ratios were calculated using raw data. **Main Outcome Measures:** Q-Q and H-Q Ratios **Results:** Subject 1: Q-Q = 97%, H-Q = 62%; Subject 2: Q-Q = 109%, H-Q = 65%; Subject 3: Q-Q = 110%, H-Q = 61%; Subject 4: Q-Q = 113%, H-Q = 77%. **Conclusions:** Results indicate that each of the subjects met return to play normative values. Due to the small number of participants, further research is needed to discover any true discrepancies.

## Introduction

Research suggests that muscle strength imbalances around the knee are often observed in athletes after ACL surgery.<sup>1</sup> Normative data for return to sport following ACL surgery has a Q-Q ratio of 90% and H-Q ratio of 60%.<sup>2,3</sup> The Humac Norm Isokinetic Dynamometer by CSMI has been proven to be an effective way to measure concentric and eccentric quadricep and hamstring peak torque.<sup>4</sup> Research has shown that muscle strength imbalances between the knee extensors and flexors can put athletes at greater risk for knee and hamstring injuries.<sup>1</sup> The ratio of hamstring-to-quadriceps torque production appears to be a key variable in the primary ACL injury risk model.<sup>5</sup> Studies have shown that nearly half of ACL patients go on to suffer a secondary ACL injury within the next five years.<sup>5</sup> By meeting the recommended return to play normative values, athletes decrease their risk of sustaining a secondary ACL injury.<sup>1,2,3</sup> The purpose of this study is to assess Q-Q and H-Q ratios in collegiate athletes who have undergone ACL reconstruction using the bone-patellar tendon-bone graft and have successfully completed a supervised physical therapy program in the last 12-24 months.

## Methods

### Study Design

A cross-sectional study design was used to assess and compare Q-Q and H-Q ratios in collegiate athletes 12-24 months after completing a supervised physical therapy program for ACL reconstruction. Only athletes that fit the inclusion criteria were included in the study. Data was collected from the Humac Norm Isokinetic Dynamometer by CSMI and then entered in an Excel spreadsheet.

### Participants

Four college athletes (2 males and 2 females; age range = 19-21) participated in this study. All participants were fall or winter sport athletes from wrestling (1), soccer (1), basketball (2).

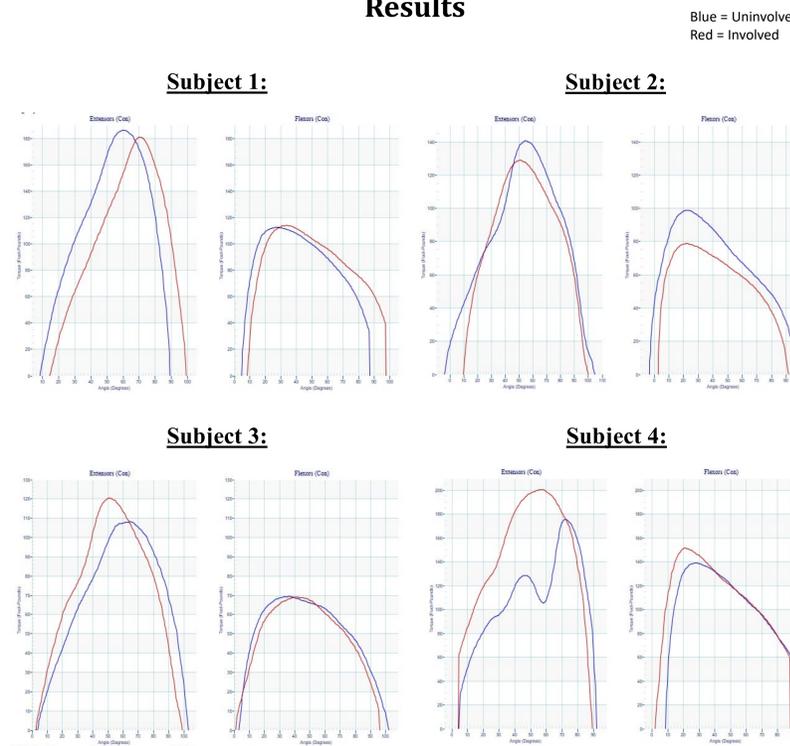
### Instruments

Isokinetic strength and peak torque between legs were gathered using a Humac Norm Isokinetic Dynamometer by CSMI.

### Procedures

Participants were allowed a 5-minute warm-up on a stationary bike prior to beginning the test. Each participant was then secured into the Humac Norm Isokinetic Dynamometer properly under the supervision of a trained physical therapist. Once the test began, the participants were allowed 4 trial reps and 5 recorded reps at 60 degrees per second, then 4 trial reps and 15 recorded reps at 180 degrees per second. Between measurements, a 1-minute break was given. This procedure was used to assess the uninjured leg first, then involved leg afterwards. The data collected was used to calculate the results.

## Results



Subject #	Gender	Months Post-Rehab	Q-Q	H-Q
1	M	24	97%	62%
2	F	15	109%	65%
3	F	18	110%	61%
4	M	12	113%	77%

Table 1: Subject results after Q-Q and H-Q calculations.



## Discussion

The results of this study show that our subjects continue to meet recommended return to play criteria 12-24 months after completing physical therapy for a bone-patellar tendon-bone graft surgery of the ACL. All four subjects exceeded the recommended 90% Q-Q ratio and 60% H-Q ratio.<sup>2,3</sup> All four subjects have returned to sport without further injuries to their knees or hamstrings. This is consistent with the current research that shows that athletes who meet the 90% Q-Q ratio and 60% H-Q ratio have a significantly lower chance of secondary injury following ACL rehab. This further shows the importance of muscle strength in the quadriceps and hamstrings following ACL reconstruction. The results of this study demonstrate athletes are able to maintain adequate Q-Q and H-Q ratios 12-24 months following clearance from a supervised post ACL reconstruction physical therapy program. Further research should be done including more subjects of various grafts, gender, sport, and time since being cleared to return to play to further validate the results of this study.

## Conclusions

This study uses isokinetic measures to calculate Q-Q and H-Q ratios in collegiate athletes 12-24 months out of a supervised physical therapy program following ACL reconstruction using a bone-patellar tendon-bone autograft. Results were used to compare subjects' measures to the recommended return to play normative values. The findings demonstrate that each of the subjects met the recommended return to play ratios. Due to the small number of participants, further research is needed to discover any true discrepancies.

## Sources

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