

ORIGINAL ARTICLE

Knee Flexor Strength and Endurance Profiles After Ipsilateral Hamstring Tendons Anterior Cruciate Ligament Reconstruction



Giampietro L. Vairo, PhD, ATC

From the Athletic Training and Sports Medicine Research Laboratory, Department of Kinesiology, College of Health and Human Development, The Pennsylvania State University, University Park, PA; and Sports Medicine Clinical Research Agenda, Penn State Hershey Bone and Joint Institute – State College, State College, PA.

Abstract

Objectives: To profile knee flexor strength and endurance responses to ipsilateral hamstring tendon autograft anterior cruciate ligament reconstruction in patients, and to describe knee flexor strength and endurance as predictors of subjective outcomes. The hypothesis was that the involved leg would demonstrate deficits compared with uninvolved and matched legs.

Design: Retrospective cohort.

Setting: Controlled laboratory.

Participants: Women (n=15; mean age, 20.47±1.96y; height, 1.69±0.08m; weight, 68.51±12.64kg), who were a mean ± SD of 25.93±11.25 months postsurgery, were matched to 15 sex-matched controls (mean age, 20.93±1.22y; height, 1.65±0.06m; weight, 66.52±10.69kg).

Interventions: Not applicable.

Main Outcome Measures: Concentric peak flexor moment over the entire isokinetic joint range of motion, peak flexor moment at 105° of joint flexion, and knee flexor total work, normalized to body mass, and subjective questionnaire scores for the involved leg.

Results: Significantly lesser peak flexor moment over the entire isokinetic joint range of motion ($P=.034$) and total work ($P=.048$) existed for the involved leg (.959±.186Nm/kg; 21.933±5.881J/kg) compared with the matched leg (1.108±.134Nm/kg; 27.431±6.499J/kg). Significantly lesser peak flexor moment at 105° of joint flexion ($P=.002$) existed between the involved (.221±.116Nm/kg) and uninvolved (.40±.234Nm/kg) and matched (.475±.183Nm/kg) legs. Significantly greater strength deficits ($P\leq.001$) existed at peak flexor moment at 105° of joint flexion compared with peak flexor moment over the entire isokinetic joint range of motion for side (53.83%±38.8%; 9.87%±10.77%) and group (77.61%±44.14%; 18.09%±11.73%) differences. Peak flexor moment at 105° of joint flexion was a significant predictor of subjective pain ($P=.007$), symptoms ($P=.006$), function ($P=.011$), and sports ($P=.022$) outcomes.

Conclusions: Knee flexor strength and endurance deficits suggest susceptibility to reinjury, and strength in a deep joint angle predicts subjective outcomes.

Archives of Physical Medicine and Rehabilitation 2014;95:552-61

© 2014 by the American Congress of Rehabilitation Medicine

Recent reports¹⁻³ have communicated an increased use of the ipsilateral hamstring tendon (HT) autograft as a primary tissue for anterior cruciate ligament (ACL) reconstruction, with some authors⁴ advocating that it be considered the criterion standard. Despite this, apprehension to ipsilateral HT harvest remains because of clinical concern for hindering the agonistic function

of the associated musculature to the native ACL or intra-articular autograft.⁵ The hamstrings are suggested to significantly contribute to maintaining knee stability.⁶⁻⁸ Thus, improving knee flexor strength and endurance is important for improving functional performance after ACL injury and reconstruction.⁹ Consequently, knee flexor strength¹⁰⁻¹² and endurance¹³ deficits have been reported in associated physically active patients. This has been clinically indicated by isokinetic measures of peak flexor moment over the entire isokinetic joint range of motion and knee flexor total work at slow and fast

Supported by the Pennsylvania Athletic Trainers' Society Inc., Supported Research Grant.

No commercial party having a direct financial interest in the results of the research supporting this article has conferred or will confer a benefit on the authors or on any organization with which the authors are associated.

angular velocities, respectively. Such decrements have been revealed with unilateral pre- and postoperative¹³ and bilateral postsurgical^{11,12} assessments approximately 2 years after ACL reconstruction. A greater extent of deficiencies has also been observed when comparing the involved leg with a healthy matched control.^{11,12}

Conversely, it has been proposed that most¹⁴ prior research studies have demonstrated that related strength^{6,15-18} and endurance⁶ recover to satisfactory levels approximately 2 years after surgery, as determined from unilateral pre- and postoperative¹⁵ and bilateral postsurgical^{6,16-18} measures. These results, however, may be limited by the conventional seated testing method used in these studies. This technique may not replicate orientation of the lower extremity in a functional position representative of standing tasks and evaluates muscular strength and endurance over a limited 90°¹⁹ to 100°²⁰ range of motion (ROM). This yields less clinically applicable measures of such isokinetic indices,²¹ considering the knee may undergo a functional ROM of approximately 110° with squatting and stair-climbing²² or 118° during sprinting activities.²³ Subsequently, the seated testing position lengthens the hamstrings to yield a mechanical advantage for generating a knee flexor moment.^{24,25} Hence, a large proportion of corresponding experiments may underrepresent the incidence of resultant postoperative knee flexor strength and endurance insufficiencies. Thus, various authors^{19,21,26} have attempted to address this by conducting isokinetic measures in similar patients using a prone position, which better approximates orientation of the lower extremity during functional tasks when standing.^{24,25}

Despite such assessment modifications, related studies consist of considerable limitations that include measuring absolute rather than relative indices,^{19,21,26} such as that normalized to body mass, and evaluating measures over a restricted ROM.¹⁹ Absolute isokinetic indices yield greater interparticipant variability, which lessens the reliability of such measures and limits the validity of comparative outcomes among related literature.^{27,28} Furthermore, assessing isokinetic strength and endurance through constrained joint ROM diminishes the applicability of captured data to functional tasks, such as athletic endeavors.^{19,29} Therefore, the primary aim of this research study was to profile isokinetic concentric knee flexor strength and endurance, normalized to body mass, responses to ipsilateral HT autograft ACL reconstruction in physically active patients approximately 2 years after surgery using a prone position over an ROM representative of functional athletic tasks. It was hypothesized that the involved leg would display knee flexor strength and endurance deficits compared with the contralateral uninvolved leg^{19,26} and healthy matched control leg,¹² and that greater deficiencies would be revealed when compared with the matched leg.¹² It was also hypothesized that knee flexor strength deficiencies would be greater at a deep joint angle, defined as 105° of flexion.³⁰ A secondary aim was to describe knee flexor

strength and endurance as predictors of self-reported outcomes for the involved leg.

Methods

Participants

The sample size was based on the primary aim of this study and was determined using the 50°/s isokinetic concentric peak flexor moment over the entire isokinetic joint range of motion data of Hiemstra et al.¹² For a 1-way analysis of variance (ANOVA) with an alpha of .05, a minimum of 13 patients and 13 controls was sufficient to detect statistically significant differences in peak flexor moment over the entire isokinetic joint range of motion among the involved, uninvolved, and matched legs with 80% power.

Correspondence was distributed to 27 patients that met the qualifications for potential enrollment via primary analysis of medical records. Seventeen patients expressed interest in potentially participating; 2 of these participants were excluded. One man was excluded because he had fractured his contralateral fibula approximately a year prior, and 1 woman was excluded for not being physically active. Subsequently, 15 physically active women 18 to 35 years of age who underwent arthroscopic ipsilateral semitendinosus and gracilis tendon autograft reconstruction within 3 months of ACL injury and 12 to 36 months prior to this study were consecutively enrolled.⁶ Patients possessed no other ligamentous sprains greater than grade I or meniscal lesions requiring greater than one third debridement in the involved knee and followed a standardized prescribed postoperative physical rehabilitation protocol. The basis of rehabilitation was specific to the HT procedure, which intended to restore knee ROM, muscular strength and endurance, and joint functionality. The protocol was supervised by a licensed athletic trainer or physical therapist 2 to 3 times per week for 12 weeks and included supplemental home exercises. After this, patients were prescribed a standardized 12-week program that was completed independently. A gradual return to full participation in preinjury activities was permitted at 6 to 9 months postsurgery on surgeon approval. Patients self-reported no history of traumatic injury to the hip or ankle of the involved leg and also had no account of traumatic injury to the contralateral leg or spine. Fifteen healthy control participants matched by sex, approximate age, height, mass, reciprocal ponderal index, and physical activity level self-reported no history of traumatic injury to either leg or the spine. Reciprocal ponderal index is an anthropometric measure providing a global index for body composition and reflects the quotient of height divided by the cubed root of the mass. Physically active was delineated as participants being in compliance with the United States Centers for Disease Control and Prevention exercise guidelines for adults³¹ over a 6-month period before enrolling in this study and gauged with the reliable³² and valid³³ Minnesota Leisure Time Physical Activity Questionnaire.

Prior to enrollment, all participants underwent a standard orthopedic clinical evaluation by a licensed athletic trainer. Bilateral comparisons were used for this examination. No signs of knee joint effusion, edema, hamstring tendinopathy, or Baker cyst were observed. Manual capsuloligamentous assessments were determined to be normative to nearly normative per the International Knee Documentation Committee Knee Evaluation Form.³⁴ Each qualified participant completed an institutional review board approved, written informed consent form before data

List of abbreviations:

ACL	anterior cruciate ligament
ANOVA	analysis of variance
CI	confidence interval
HT	hamstring tendon
KOOS	Knee Injury and Osteoarthritis Outcome Score
ROM	range of motion

Download English Version:

<https://daneshyari.com/en/article/6149776>

Download Persian Version:

<https://daneshyari.com/article/6149776>

[Daneshyari.com](https://daneshyari.com)