

Arthroscopic Reconstruction of the Posterior Cruciate Ligament by Using a Quadriceps Tendon Autograft: A Minimum 5-Year Follow-up

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Purpose: We prospectively assessed 22 consecutively treated patients to determine the effectiveness and safety of arthroscopically assisted posterior cruciate ligament (PCL) reconstruction by using a quadriceps tendon autograft. **Methods:** Twenty-two patients with isolated PCL injury who underwent PCL reconstruction with a quadriceps tendon autograft were enrolled in the prospective study. The average follow-up period was 66 months (range, 60-76). Follow-up included Lysholm knee scores, Tegner activity scores, International Knee Documentation Committee (IKDC) score, thigh muscle assessment, and radiographic assessment. **Results:** The mean preoperative Lysholm score for 22 knees was 67 (range, 50 to 75), and the mean postoperative Lysholm score was 89 (range, 75 to 98). Nineteen of 22 patients (86%) displayed good or excellent results in the final assessment. The mean preoperative Tegner score for 22 knees was 3 (range, 2 to 5), whereas the mean postoperative Tegner score was 6 (range, 3 to 9). There were statistically significant improvements in Lysholm score ($P = .009$), Tegner score ($P = .039$), postoperative KT-1000 arthrometer (MEDmetric, San Diego, CA) scores ($P = .006$), final IKDC rating ($P = .035$), and thigh atrophy and muscle strength ($P < .05$) when compared with preoperative data. Regarding IKDC final rating, 82% of the patients (18 of 22) were assessed as normal or nearly normal (grade A or B). **Conclusions:** After follow-up for more than 60 months, the analytical results showed patients achieved satisfactory function after PCL reconstruction by using a quadriceps tendon–patellar bone autograft. This study suggests that a quadriceps tendon autograft is sufficiently large and strong and can achieve good ligament function after reconstruction. **Level of Evidence:** Level IV, therapeutic study. **Key Words:** Arthroscopy—Posterior cruciate ligament—Quadriceps tendon autograft.

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The authors report no conflict of interest.

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The posterior cruciate ligament (PCL) is the primary restraint against straight posterior translation of the tibia at all positions of the knee.^{1,2} Early studies on the natural history of PCL injury found that conservative treatment achieved satisfactory function outcomes.^{3,4} However, patients with grade 3 (the tibial plateau displaced posterior to the femoral condyle between 10 and 15 mm) or 4 (posterior displacement more than 15 mm) PCL injuries are at high risk of functional disability because of recurrent pain, instability, and knee degeneration.⁵⁻⁷ Currently, early surgical reconstruction of the knee with grade 3 or 4 PCL injury is generally recommended.^{8,9}

Failure of reconstruction has a number of causes, including insufficiently strong substitute choice. Both an autograft (patellar tendon, quadriceps tendon, and

hamstring tendon) and allograft (Achilles' tendon and patellar tendon) are frequently used. However, the optimum graft choice remains controversial. Based on the availability of tissue and surgical simplicity, a quadriceps tendon–patella bone autograft were used in this series for arthroscopic reconstruction of the isolated PCL. This study prospectively evaluated 22 patients treated consecutively to determine patient outcome efficacy and complication potential of arthroscopically assisted PCL reconstruction by using quadriceps tendon–patella bone autografts. The authors hypothesized that a quadriceps tendon–patella bone autograft is a safe, effective, and acceptable choice for PCL reconstruction, affording good ligament reconstruction with satisfactory clinical results.

METHODS

From August 1997 through January 1999, 22 consecutive patients (17 men and 5 women) underwent PCL reconstruction with a quadriceps tendon–patella bone autograft at our institution and were enrolled in this prospective study. The average age at surgery was 27 years (range, 18 to 49). The average time from injury to surgery was 5 months (range, 3 to 14). The average follow-up period was 66 months (range, 60 to 76). The mechanism of injury was sports related in 3 cases (14%), whereas 17 cases (78%) were injured in motorcycle accidents and 2 cases (8%) suffered falls. Cases of associated ligament injury, chondral damage, previous meniscectomy (excision > one-third meniscus), malposition of tibia and femoral tunnels, abnormal preoperative radiographs, or abnormal contralateral knee joints were excluded. All of the PCL ruptures diagnosed were confirmed by precise physical examination, magnetic resonance imaging, and arthroscopic examination. The physical examination comprised posterior sagging sign, posterior drawer test, reverse pivot shift test, varus angulation test, the dial (external rotation thigh-foot angle) test, and posterolateral drawer test. A posterior drawer examination was performed on all knees in neutral rotation and graded 1, 2, 3, and 4. The knees were graded as follows: less than 5 mm of posterior tibial displacement, grade 1; 6 to 10 mm of posterior tibial displacement, grade 2; 11 to 15 mm of posterior tibial displacement, grade 3; and posterior displacement of >15 mm, grade 4.^{5,6} Surgical indication was functional disability of the knee because of pain and instability resulting from PCL injury with failure of 3 months of conservative treatment. The conservative treatment included a vigorous quadriceps strengthen-

ing program begun as the patient's symptoms allow, closed-chain exercise including squats and leg press, and hamstring strengthening started 6 weeks after injury. All patients were grade 3 or grade 4 on the posterior drawer test. The knees were examined for posteromedial lesion and/or posterolateral rotatory instability. No subject had medial collateral ligament injury, posterolateral rotatory instability, a positive dial (external rotation thigh-foot angle) test, or a positive extension varus recurvatum test. All the arthroscopic procedures for PCL reconstruction were performed by the same surgeon using the same surgical technique.

Surgical Technique

After adequate anesthetization, a complete physical examination and a diagnostic arthroscopy was performed to evaluate the condition of the relevant anatomic structures and identify the extent of ligament tear and associated injuries.

Arthroscopy Portals

Standard anterolateral and anteromedial portals are used for arthroscopy, and a posteromedial portal was created under direct arthroscopic vision and used for PCL tibial tunnel preparation.

Graft Harvest and Preparation

A midline incision approximately 7-cm long was made from the midpatella and extended proximally to harvest the quadriceps tendon graft. The proximal portion of the patella therefore was prepared with a bone plug with dimensions of width 10 mm, length 25 mm, and depth 8 mm. Subsequently, a horizontal cleavage plane was created parallel to the most superior leaf of the quadriceps tendon to an 8-cm length of the tendon from the top of the patella. The quadriceps tendon–patellar bone construct was fashioned to the desired size by using 1 No. 5 Ethibond (Somerville, NJ) suture through the bone plug, plus 2 No. 5 Ethibond sutures affixed to the tendon end in a running baseball whipstitch fashion.⁹

Tunnel Preparation

The single-bundle reconstruction was intended to reproduce the anterolateral component of the PCL. The posterior tibial tunnel opening should exit the posterior tibia within the PCL footprint near the distolateral fibers. The transtibial PCL tunnel is drilled from the anteromedial aspect of the proximal tibia 1 cm below the tibial tubercle to exit posteriorly at

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