Chapter 35
Selected Case Studies in the Treatment of the Multiple-Ligament-Injured Knee

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35.1 Introduction

This chapter in *The Multiple Ligament Injured Knee*: *A Practical Guide to Management*, *Second Edition*, presents selected cases in treatment of the multiple-ligament-injured knee that are representative of my practice. I have written this chapter in the first person to provide a more personal approach to presenting these topics. These selected cases represent real-life management examples in the treatment of difficult knee ligament instability problems. The format followed will be the same for each case study to provide consistency in the presentation and is outlined as follows: history, physical examination, imaging study findings, surgical timing, graft selection, surgical technique, postoperative rehabilitation program, and results. Details of the surgical technique will not be presented in this chapter since the surgical technique was performed as I have described in Chaps. 1, 20, and 22 in this textbook. The purpose of this case study chapter is for the reader to gain insight into management and treatment strategy decisions in these complex knee ligament injuries.

35.2 Case Study 1: Acute ACL–PCL and High-Grade Medial Side Injury with Entrapped Medial Capsule

This patient is a 17-year-old male American football player who sustained a right knee direct contact and twisting injury. The patient's right foot was stuck in the turf, and forced valgus, external rotation, and flexion forces were applied to the patient's knee resulting in a posterior tibiofemoral dislocation and pain and deformity of the right knee. The right lower extremity was splinted on the field, and the patient was transported from the scene of the accident to the community hospital where closed reduction of the dislocated knee was attempted. The patient was then transported to our facility. Dorsalis pedis pulses in the injured right lower extremity were 1/2 compared to 2/2 in the normal left lower extremity. Posterior tibial pulses were intact and symmetrical. Peroneal and tibial nerve functions for motor and sensation were intact and symmetrical to the uninvolved left lower extremity.

Physical examination of the knee revealed grade 3+ anterior–posterior laxity of the knee at 25° and 90° of knee flexion. The tibial step-offs were negative. There was grade 3+ laxity of the knee to valgus stress at 0° and 30° of knee flexion and a palpable defect in the medial retinaculum. The lateral and posterolateral ligament complex was stable to examination with varus stress at 30° and 0° of knee flexion, and the posterolateral drawer test was negative. The patient was able to perform a straight leg raise, and the patella femoral joint was stable with flexion and extension. There was medial skin indentation; however, the skin was intact with no lacerations. Postreduction X-rays revealed the tibia still displaced posterior and lateral to the distal femur.

Ankle–brachial index, arterial duplex, and CT angiogram were all normal, and there was no imaging study evidence of an intimal flap tear of the popliteal artery. There was no clinical evidence of venous insufficiency.

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Magnetic resonance imaging study revealed complete disruption of the ACL, PCL, and medial collateral ligament–medial capsular ligament complex. There was also peripheral detachment of the medial meniscus and the medial capsule entrapped within the medial compartment of the knee.

The assessment of this patient revealed a knee with complete disruption of the ACL and PCL with a high-grade medial side injury, medial meniscus avulsion, and the medial capsule entrapped within the medial compartment of the knee resulting in incomplete reduction. Dislocated knees with high-grade medial side injuries seem to be associated with a higher risk of stiffness and heterotopic ossification. My treatment strategy was to obtain reduction of the tibiofemoral joint by removing the entrapped medial capsule, thereby protecting the skin, and reduce the risk of arthrofibrosis and heterotopic ossification by doing a two-stage surgical procedure.

The patient was taken to surgery 2 days postinjury for stage 1 surgical procedure where open reduction of the tibiofemoral dislocation was performed. Primary repair of the medial meniscus and all medial side injured structures was performed using suture anchors and permanent number two suture. Medial side augmentation/reconstruction was performed using Achilles tendon allograft. Postoperatively, the patient was immobilized in a brace locked in full extension until the second-stage surgical procedure and remained non-weight-bearing on crutches. Stage 2 surgical procedure was performed 5 weeks after the stage 1 surgical procedure and consisted of an arthroscopic combined posterior and anterior cruciate ligament reconstruction using allograft tissue. A double-bundle PCL reconstruction was performed during this surgical procedure. Postoperatively, the patient was immobilized in a long leg brace locked in full extension and non-weight-bearing for approximately 5 weeks. The postoperative rehabilitation program that was followed is described in detail in Chap. 32 of this textbook.

This patient's postoperative Tegner, Lysholm, and Hospital for Special Surgery knee ligament rating scale scores 2 years post reconstruction were 5, 94/100, and 80/100, respectively. KT1000 arthrometer side-to-side difference values for the PCL screen, corrected posterior, and corrected anterior measurements were 1.0, 0.5, and 0.5 mm, respectively. The KT1000 side-to-side difference measurement at 30° of knee flexion was 1.0 mm. Telos stress radiographic side-to-side difference measurement at 90° of knee flexion with a posteriorly directed force applied to the tibial tubercle area to assess PCL reconstruction stability was 4.6 mm. The Lachman test was normal, pivot shift negative, tibial step-off normal, posterior drawer negative, valgus stress test symmetrical to the nonsurgical knee, and range of motion 0–110° of knee flexion (nonsurgical side range of motion 0–125°), with a stable extensor mechanism. Follow-up radiographs show no indication of heterotopic ossification or degenerative joint disease. The patient has achieved his preinjury level of function.

35.3 Case Study 2: Acute PCL, ACL, Medial and Lateral Side Injuries and Patellar Tendon Avulsion

This patient is a 40-year-old female who was riding her motorcycle when she was hit by a pickup truck. The patient was transported to a community hospital where a diagnosis of a left posterior knee dislocation with patellar tendon avulsion from the tibial tubercle insertion was made. The dislocation was reduced in the emergency room. Initial evaluation of the patient's knee revealed anterior and posterior laxity at 30° and 90° of knee flexion with no firm end point. There was varus and valgus laxity with no end point at 0°, 30°, and 90° of knee flexion. The patient was not able to perform a straight leg raise, and with hamstring contraction, the proximal tibia dislocated posterior to the distal femur. There was bruising on the skin of the proximal medial tibia. The peroneal and tibial nerve functions were intact with respect to sensory and motor functions. The dorsalis pedis and posterior tibial pulses were intact and symmetrical to the uninvolved right lower extremity. There were no other systemic or orthopaedic injuries. CT angiogram revealed the popliteal artery to be intact with no evidence of intimal flap tear. There was no clinical evidence of venous insufficiency. Reduction of the knee was maintained in plaster splints.

Plain radiographs demonstrated a reduced tibiofemoral joint and a patella displaced in a superior direction. There were no fractures. MRI demonstrated complete tears of the anterior and posterior cruciate ligaments and avulsion of the medial and lateral capsular structures from the proximal tibia which included the peripheral attachments of the medial and lateral menisci. Avulsion of the patellar tendon from the tibial tubercle insertion site was also identified on MRI. The patient was transferred to our facility for treatment.

This patient had a severe multiple-ligament left knee injury with extensor mechanism disruption that involved both cruciates, the medial and lateral side capsule and ligament structures, the medial and lateral menisci, and skin injury over the proximal medial tibia. The concerns with this patient are the severity and magnitude of the ligament injuries, the extensor mechanism disruption, the potential skin injury and compromise, and the risk of heterotopic ossification and arthrofibrosis. The decision was made to perform a single-stage open surgical procedure for repair and reconstruction of the involved structures within the first week following the patient's injury through a midline longitudinal skin incision. The severe capsular and extensor mechanism disruption required open and not arthroscopic surgery.

The posterior and anterior cruciate ligaments were reconstructed with Achilles tendon allograft tissue. The medial and lateral side meniscus, capsular, and ligament structures underwent primary repair with suture anchors, transosseous sutures, and allograft augmentation as needed. The patellar tendon avulsion received primary repair with number five suture through drill holes in the tibial tubercle area and tibialis anterior allograft augmentation. The patient was immobilized postoperatively in plaster splints in full extension with non-weight-bearing using crutches for approximately 4–5 weeks. Progressive range of motion, weight-bearing, and physical therapy were then initiated.

There was proximal medial skin breakdown in the postoperative period in the area of skin trauma that occurred during the accident. This was treated with dressing changes and antibiotics with complete healing. There was no infection, and skin grafting was not required. The patient developed arthrofibrosis resulting in a range of motion from 0° to 20° of knee flexion. At the fourth postoperative month, the patient underwent arthroscopic debridement and manipulation. This did not result in improved range of motion. At the eighth postoperative month, the patient underwent open debridement, lateral release, and manipulation. Postoperative wound healing was uneventful, and the patient was advanced in physical therapy and activity.

At postoperative year 2, the patient's involved left knee range of motion is 0–102° compared to 0–140° on the uninvolved right knee. The Hospital for Special Surgery, Lysholm, and Tegner knee ligament rating scale scores are 89/100, 93/100, and 3, respectively. The patient's preinjury Tegner score was also 3 indicating a return to preinjury level of function. KT1000 arthrometer side-to-side difference values for the PCL screen, corrected posterior, and corrected anterior measurements were 1.0, 1.0, and 0.0 mm, respectively. The KT1000 side-to-side difference measurements at 30° of knee flexion was 1.0 mm. Telos stress radiographic side-to-side difference measurement at 90° of knee flexion with a posteriorly directed force applied to the tibial tubercle area to assess PCL reconstruction stability was 2.5 mm. The Lachman test was negative, pivot shift negative, tibial step-off equal to the uninvolved side, posterior drawer negative, and valgus and varus stress tests symmetrical to the nonsurgical knee at 0° and 30° of knee flexion. The extensor mechanism is stable, and the patient has no extensor lag compared to the normal knee. Follow-up radiographs show no indication of heterotopic ossification or degenerative joint disease.

35.4 Case Study 3: Pediatric Combined PCL Posterolateral Instability

The patient is a 6-year-old female who was injured in a trampoline accident resulting in a posterior cruciate ligament tear of the left knee. The patient was initially seen at a community hospital and treated with long leg casting with the injured knee in extension for approximately 6 weeks. After cast removal, the patient was advanced in physical therapy and increasing activity. The patient went on to develop functional instability with activities such as running, pivoting, and twisting types of maneuvers. The patient was referred to me approximately 5 months after her initial injury for evaluation and treatment of a left knee posterior cruciate ligament tear with functional instability.

Physical examination revealed that the injured left knee, compared to the normal right knee, has negative tibial step-offs, a grade three posterior drawer, positive posterolateral drawer, negative posteromedial drawer, no valgus laxity at 0° and 30° of knee flexion, and varus laxity at 0° and 30° of knee flexion of approximately 10 mm of increased lateral joint line opening. The dial test was positive, with the left thigh–foot angle greater than 10° at 30° of knee flexion and increased at 90° compared to the normal lower extremity. The Lachman test and pivot shift tests were negative, and the extensor mechanism was stable. Range of motion was symmetrical to the uninvolved side. When having the patient run, pivot, and twist in the clinic, she would experience instability when twisting on the planted involved left foot causing her to fall. Plain radiographs revealed open distal femoral and proximal tibial growth plates that were symmetrical on both knees.

The diagnosis in this patient is chronic posterior cruciate ligament tear combined with posterolateral instability type B with resultant functional instability in a 7-year-old child with open growth plates. The decision was made to proceed with arthroscopic single-bundle transtibial posterior cruciate ligament reconstruction using fresh frozen looped semitendinosus allograft combined with posterolateral fibular-based figure-of-eight reconstruction using fresh frozen tibialis posterior allograft. The posterior cruciate ligament reconstruction femoral tunnel crossed the distal femoral physis, and the PCL tibial tunnel was positioned distal to the tibial physis. Cortical suspensory fixation with a polyethylene ligament fixation button was used on the femoral side, and a bioabsorbable interference screw and bicortical screw and spiked ligament washer were used on the tibial side fixation.

The posterolateral reconstruction was a fibular-based figure-of-eight reconstruction using a fresh frozen tibialis posterior allograft. The allograft was looped around the common biceps tendon at the fibular head and sewn there using permanent braided suture. The fibular collateral ligament component was passed medial to the iliotibial band, and the popliteofibular popliteus tendon component was passed medial to the common biceps tendon and the iliotibial band. The allograft limbs were crossed in a figure-of-eight fashion with the fibular collateral component being lateral to the popliteus tendon component. The graft limbs were sewn into their respective anatomic femoral insertion sites with number two braided permanent

sutures. The allograft was then sewn to the deep capsular layers for additional reinforcement, and a posterolateral capsular shift was also performed. Both the posterior cruciate ligament reconstruction and the posterolateral reconstruction procedures were protective of the growth plates.

At follow-up after five and one half years, postoperative examination reveals equal leg lengths, normal and symmetrical carrying angles, and normal gait during ambulation. Radiographs reveal open distal femoral and proximal tibial physes that are symmetrical to the normal knee with no malalignment and no evidence of growth arrest. Range of motion is 0–113° on the surgical left knee and 0–130° on the normal right knee. Side-to-side difference on KT1000 measurements on the PCL screen, corrected posterior, and corrected anterior measurements are 2.5, 3.5, and 0.0 mm, respectively. Side-to-side difference on the KT1000 anterior displacement measurement at 30° of knee flexion is 2.0 mm. Stress X-rays at 90° of knee flexion using the Telos device comparing the surgical knee to the normal knee reveal a negative 0.3-mm side-to-side difference.

Physical examination of the surgical left knee compared to the normal right knee reveals that the tibial step-offs are equal to the normal knee, the posterior drawer is negative, posteromedial and posterolateral drawer tests are negative, and the dial test is symmetrical at 30° and 90° of knee flexion. The Lachman test is negative, the pivot shift test is negative, and the surgical knee is stable to varus and valgus stress throughout the flexion extension arc. The Hospital for Special Surgery, Lysholm, and Tegner knee ligament rating scale scores are 90/100, 89/100, and 6, respectively. The patient's preinjury Tegner score was 7 indicating a return to nearly preinjury level of function.

35.5 Case Study 4: Fracture Dislocation

The patient is a 34-year-old man who fell from a height of approximately 50 ft and sustained a closed posterolateral fracture dislocation of the right knee. Initial evaluation revealed gross deformity and swelling of the right knee. Dorsalis pedis pulse in the involved extremity was diminished; however, the foot was adequately perfused. Sensory and motor exam of the right lower extremity was intact and symmetrical to the uninvolved left lower extremity. X-rays of the involved knee and lower extremity revealed a right comminuted medial tibial plateau fracture with articular surface comminution and a posterolateral dislocation of the tibia under the femur. The diagnosis is a right knee closed tibial plateau fracture dislocation. Closed fracture reduction was performed in the emergency department, and a well-padded long leg splint was applied. Post reduction, the dorsalis pedis pulse was restored and was symmetrical to the uninvolved lower extremity. Sensation and motor function remained intact and symmetrical to the uninvolved left lower extremity.

Open reduction and internal fixation of the right proximal tibia and tibial plateau fractures and meniscal and capsular repair were performed on postinjury day number 1. The patient was referred to me for evaluation and treatment of multiple-ligament instability of the right knee. Clinical examination, plain radiography, and MRI evaluation revealed a well-fixed and well-aligned proximal tibia fracture with reduced and aligned tibiofemoral and patellofemoral joints. There was anterior and posterior laxity at 30° and 90° of knee flexion and varus and valgus laxity at 0°and 30° of knee flexion with very soft end points. The clinical examination impression was posterior and anterior cruciate ligament instability, posterolateral instability type B, and posteromedial instability type B. These findings were confirmed with MRI examination.

The treatment decision was to enable the fractures to completely heal and confirm that normal lower extremity alignment was achieved with fracture fixation and healing and that no osteotomy would be required. When complete fracture healing was achieved and normal lower extremity alignment confirmed, the internal fixation hardware was removed approximately 7 months after open reduction internal fixation of the fracture. The patient underwent right knee combined PCL, ACL, posterolateral, and posteromedial reconstruction approximately 9 months postinjury after complete wound healing from the hardware removal surgical procedure.

The knee ligament reconstructions were performed using fresh frozen allograft tissue all from the same tissue bank. The double-bundle arthroscopic PCL reconstruction was performed with an Achilles tendon allograft for the anterolateral bundle and a tibialis anterior allograft for the posteromedial bundle. The arthroscopic ACL reconstruction utilized a tibialis anterior allograft. The posterolateral reconstruction was performed with a fibular head-based figure-of-eight semitendinosus allograft combined with a posterolateral capsular shift and peroneal nerve neurolysis. The medial posteromedial reconstruction was performed with tibialis posterior allograft combined with a posteromedial capsular shift procedure. Postoperatively, the patient was immobilized in a long leg brace locked in full extension and non-weight-bearing for approximately 5 weeks. The postoperative rehabilitation program that was followed is described in detail in Chap. 32 of this textbook.

This patient's postoperative Tegner, Lysholm, and Hospital for Special Surgery knee ligament rating scale scores 3 years post reconstruction were 3, 70/100, and 75/100, respectively. KT1000 arthrometer side-to-side difference values for the PCL screen, corrected posterior, and corrected anterior measurements were 0.0, 0.5, and −0.5 mm, respectively. The KT1000

side-to-side difference measurement at 30° of knee flexion was 2.0 mm. Telos stress radiographic side-to-side difference measurement at 90° of knee flexion with a posteriorly directed force applied to the tibial tubercle area to assess PCL reconstruction stability was −1.0 mm indicating that the surgical knee was tighter than the nonsurgical knee. The Lachman test was normal, pivot shift negative, tibial step-off equal to the uninvolved knee, posterior drawer negative, posterolateral and posteromedial drawer negative, anterolateral and anterior medial drawer negative, dial test right equals left at 30° and 90° of knee flexion, varus and valgus stress tests symmetrical to the nonsurgical knee at 0° and 30° of knee flexion, and range of motion 0–122° of knee flexion (nonsurgical side range of motion 0–130°), with a stable extensor mechanism. Follow-up radiographs show no indication of heterotopic ossification or degenerative joint disease. The patient has achieved his preinjury level of function with respect to work and recreational sports; however, he does have a slight limp, some exertional pain, and some impairment with stair climbing and squatting.

35.6 Case Study 5: Bilateral Knee Dislocations with Vascular Injury

The patient is a 17-year-old female involved in a motor vehicle accident who sustained a closed head injury, right PCL-based multiple-ligament knee injury, and a left knee dislocation with popliteal artery rupture and peroneal nerve injury. The left knee dislocation was reduced in the emergency department; however, the patient had diminished dorsalis pedis and posterior tibial pulses on the left lower extremity compared to the right lower extremity even after the reduction. An emergent arteriogram was obtained which identified a left popliteal artery segmental occlusion at the tibial plateau. The right multiple-ligament-injured knee had intact neurological and vascular examination, and the right lower extremity was immobilized in full extension in a brace. The right knee also had an angiogram performed that was a normal study. The patient was taken to the operating room for emergent left popliteal artery repair with saphenous vein patch angioplasty by the vascular surgeons. Upon completion of the vascular repair, the left knee joint posterior capsule that was torn at the time of the dislocation was repaired by the orthopaedic surgery team. The knee was placed in an immobilizer locked in full extension postoperatively. The patient's popliteal artery repair healed uneventfully.

The right knee ligament injuries were disruption of the posterior cruciate and anterior cruciate ligaments and the medial side structures diagnosed by physical examination, plain radiography, and MRI study. The left knee ligament injuries were disruption of the posterior and anterior cruciate ligaments and the lateral and posterolateral structures. The vascular surgeons preferred a 6-week minimum time frame from left lower extremity arterial repair until subsequent left knee surgery that would require manipulation of the left knee or instrumentation in the posterior aspect of the left knee as would be done with posterior cruciate ligament reconstruction. The treatment decision was to proceed with staged reconstruction performing the right knee surgery on postinjury day 22 and the left knee surgery approximately 10 weeks postinjury and popliteal artery repair. This enabled the patient to recover from her closed head injury and for the vascular repair to heal adequately.

The right knee ligament reconstruction consisted of an arthroscopic single-bundle posterior cruciate ligament reconstruction using an Achilles tendon allograft, an arthroscopic single-bundle anterior cruciate ligament reconstruction using an Achilles tendon allograft, and a medial posteromedial reconstruction using an Achilles tendon allograft. The left knee ligament reconstruction consisted of an arthroscopic single-bundle posterior cruciate ligament reconstruction using an Achilles tendon allograft, an arthroscopic single-bundle anterior cruciate ligament reconstruction using an Achilles tendon allograft, a fibular collateral ligament and popliteus tendon primary repair, a lateral posterolateral reconstruction using an Achilles tendon allograft combined with a posterolateral capsular shift, and a peroneal nerve neurolysis. The details of the surgical procedure are similar to the techniques described in Chap. 20 of this textbook. Postoperatively, the patient was immobilized in a long leg brace locked in full extension and non-weight-bearing for approximately 5 weeks. Careful follow-up was performed after each surgical segment to evaluate for heterotopic ossification and arthrofibrosis so that appropriate intervention could be initiated as necessary. The postoperative rehabilitation program is discussed in both Chaps. 20 and 32 of this textbook.

Eight years post right and left knee multiple knee ligament reconstructions, this patient's postoperative Tegner score was level 4 (preinjury level 6). Postoperative Lysholm score was 90/100, and the Hospital for Special Surgery knee ligament rating scale score was 96/100 on the left and 94/100 on the right. KT1000 arthrometer side-to-side difference values for the PCL screen, corrected posterior, and corrected anterior measurements were 2.0, 2.0, and 0.5 mm, respectively. The KT1000 side-to-side difference measurement at 30° of knee flexion was 0.0 mm. Telos stress radiographic side-to-side difference measurement at 90° of knee flexion with a posteriorly directed force applied to the tibial tubercle area to assess PCL reconstruction stability was 2.3 mm. The Lachman test was normal, pivot shift tests negative, tibial step-offs equal in both knees, posterior drawer negative in both knees, posterolateral and posteromedial drawer tests

negative, anterolateral and anterior medial drawer tests negative, dial test right equals left at 30° and 90° of knee flexion, varus and valgus stress tests stable and symmetrical at 0° and 30° of knee flexion, and range of motion 0–126° of knee flexion on the right and 0–132° of knee flexion on the left, with stable extensor mechanisms. Follow-up radiographs show no indication of heterotopic ossification or degenerative joint disease. The patient has achieved her preinjury level of function with respect to work; however, she does have some exertional pain and some impairment with stair climbing and squatting.

35.7 Case Study 6: Chronic PCL, ACL, Posterolateral, Posteromedial Instabilities After Left Knee Dislocation

The patient is a 19-year-old male college student who is a competitive wrestler. The patient sustained a planted left foot severe external rotation twisting mechanism of injury to his left knee resulting in a posterolateral tibiofemoral knee dislocation. The patient was initially seen in an outside hospital emergency department where closed reduction of the tibiofemoral knee dislocation was performed. Neurological and vascular examination of the involved left lower extremity was normal and symmetrical to the uninvolved right lower extremity. Imaging studies revealed no abnormality of the popliteal vessels or the common peroneal nerve. MRI study at the time of injury revealed posterior cruciate and anterior cruciate ligament tears, medial collateral ligament and medial capsule tears, medial patellofemoral ligament tears, fibular collateral ligament tear, and lateral and posterolateral capsular sprains. The patient was treated with immobilization followed by progressive increase in activity level. The patient was referred to me 4 months after his index injury for functional instability of his left knee with pivoting and twisting activities, walking on uneven ground, and other activities of daily living. The patient was not able to participate in sports or other physically demanding activities. Also of note, the patient had a prior ACL reconstruction on the uninvolved right knee.

Physical examination of the involved left knee compared to the right knee upon presentation to my clinic demonstrated range of motion of 0–140° in each knee. There was no effusion, the skin is in good condition, the extensor mechanism is intact, and the neurological and vascular examinations were normal and symmetrical to the uninvolved side. The Lachman test and pivot shift tests were positive. The anterolateral and anteromedial drawer tests were positive. The tibial step-offs were negative at 90° of knee flexion, and the posterior drawer, posterolateral drawer, and posteromedial drawer tests were positive. There was valgus laxity at 0° and 30° of knee flexion. The knee is stable to varus stress. The dial test was positive at 30° and 90° of knee flexion. Gait is normal with no valgus or varus thrust. Preoperative KT1000 side-to-side difference measurements on the PCL screen, corrected posterior, and corrected anterior measurements were 10.0, 10.0, and 1.5 mm, respectively. The KT1000 side-to-side difference measurement at 30° of knee flexion was 1.0 mm. Telos stress radiographic side-to-side difference measurement at 90° of knee flexion with a posteriorly directed force applied to the tibial tubercle area to assess PCL stability was 11.7 mm. This patient's preoperative Tegner, Lysholm, and Hospital for Special Surgery knee ligament rating scale scores were 3, 80/100, and 37/100, respectively, and the IKDC score is 61.

The patient's diagnosis was chronic posterior and anterior cruciate ligament instability, lateral posterolateral instability type A, and medial posteromedial instability type B. The patient has a functionally unstable knee with his desired level of activity. Plain radiographs show a well-reduced, well-aligned tibiofemoral joint with some calcification near the fibular collateral ligament and popliteus femoral insertion sites.

Six months after the patient's left knee dislocation surgical reconstruction of his knee ligaments was performed for chronic functional instability using fresh frozen allograft tissue all from the same tissue bank. The double-bundle arthroscopic PCL reconstruction was an Achilles tendon allograft for the anterolateral bundle and a tibialis anterior allograft for the posteromedial bundle. The arthroscopic ACL reconstruction utilized Achilles tendon allograft. The lateral posterolateral reconstruction was performed with a fibular head-based figure-of-eight semitendinosus allograft combined with a posterolateral capsular shift and peroneal nerve neurolysis. The medial posteromedial reconstruction was performed with semitendinosus allograft combined with a posteromedial capsular shift procedure. Postoperatively, the patient was immobilized in a long leg brace locked in full extension and non-weight-bearing for approximately 5 weeks. The postoperative rehabilitation program is described in detail in Chap. 32 of this textbook.

This patient's postoperative Tegner, Lysholm, and Hospital for Special Surgery knee ligament rating scale scores 1 year post reconstruction were 5, 94/100, and 86/100, respectively. The IKDC score is 77. KT1000 arthrometer side-to-side difference values for the PCL screen, corrected posterior, and corrected anterior measurements were 2.0, 4.5, and −1.5 mm, respectively. The KT1000 side-to-side difference measurement at 30° of knee flexion was −6.0 mm (the patient had a prior ACL reconstruction on the right knee). Telos stress radiographic side-to-side difference measurement at 90° of knee flexion with a posteriorly directed force applied to the tibial tubercle area to assess PCL reconstruction stability was 3.0 mm. The Lachman test was normal, pivot shift negative, tibial step-off equal to the uninvolved knee, posterior drawer negative,

posterolateral and posteromedial drawer negative, anterolateral and anterior medial drawer negative, dial test right equals left at 30° and 90° of knee flexion, varus and valgus stress tests negative and symmetrical to the nonsurgical knee at 0° and 30° of knee flexion, and range of motion 0–121° of knee flexion (nonsurgical side range of motion 0–140°), with a stable extensor mechanism. Follow-up radiographs show no indication of heterotopic ossification or degenerative joint disease. The patient has achieved his non-competitive sports preinjury level of function with respect to work and recreational sports; however, he has chosen not to return to competitive wrestling.

35.8 Case Study 7: 17-Year Follow-Up of Chronic PCL, ACL, Posterolateral, Posteromedial Instabilities

This patient is a 36-year-old woman who injured her right knee when her right foot struck a stationary object while snow sledding. At the time of impact, the right knee sustained forced valgus, flexion, and external rotation of the tibia with respect to the femur. The patient's dorsalis pedis and posterior tibial pulses were intact and symmetrical to the uninvolved extremity, and motor and sensory neurologic functions of the involved extremity were intact and symmetrical to the uninvolved lower extremity at the time of presentation. The skin was in good condition with no open wounds. Physical examination of the involved right knee compared to the normal left knee demonstrated range of motion of 10–90° in the injured knee and 0–120° in the normal knee. The extensor mechanism was intact. The Lachman test and pivot shift tests were positive. The anterolateral and anteromedial drawer tests were positive. The tibial step-offs were negative at 90° of knee flexion, and the posterior drawer, posterolateral drawer, and posteromedial drawer tests were positive. There was valgus laxity at 0° and 30° of knee flexion. The knee was stable to varus stress. The dial test was positive at 30° and 90° of knee flexion. Plain radiographs demonstrated a well-reduced, well-aligned tibiofemoral joint. MRI imaging demonstrated posterior and anterior cruciate ligament tears as well as medial and lateral side injuries. The diagnosis was posterior and anterior cruciate ligament instability, lateral posterolateral instability type A, and medial posteromedial instability type B. The patient was initially treated with splinting in extension followed by progressive range of motion. Surgical treatment consisting of single-bundle PCL reconstruction with Achilles tendon allograft, ACL reconstruction using bone patellar tendon bone autograft, posterolateral reconstruction using biceps femoris tendon transfer, and medial side reconstruction using a posteromedial capsular shift was performed approximately 10 weeks postinjury. Postoperatively, the patient was immobilized in a long leg brace locked in full extension and non-weight-bearing for approximately 5 weeks followed by progressive range of motion and weight-bearing. The postoperative rehabilitation program that was followed is described in detail in Chap. 32 of this textbook.

This patient's postoperative Tegner, Lysholm, and Hospital for Special Surgery knee ligament rating scale scores 17 years post reconstruction were 3, 83/100, and 86/100, respectively. The IKDC score is 64. KT1000 arthrometer side-to-side difference values for the PCL screen, corrected posterior, and corrected anterior measurements were 2.0, 3.0, and 1.0 mm, respectively. The KT1000 side-to-side difference measurement at 30° of knee flexion is 3.0 mm. Telos stress radiographic side-to-side difference measurement at 90° of knee flexion with a posteriorly directed force applied to the tibial tubercle area to assess PCL reconstruction stability was −2.2 mm indicating that the PCL reconstruction side has less posterior tibial translation than the uninvolved knee. The Lachman test was negative, pivot shift negative, tibial step-offs equal to the uninvolved knee, posterior drawer negative, posterolateral and posteromedial drawer negative, anterolateral and anterior medial drawer negative, dial test right equals left at 30° and 90° of knee flexion, varus and valgus stress tests negative and symmetrical to the nonsurgical knee at 0° and 30° of knee flexion, and range of motion 0–110° of knee flexion (nonsurgical side range of motion 0–122°), with a stable extensor mechanism. Follow-up radiographs show progressive degenerative joint disease.

The patient's Tegner preinjury level of function was level 5, and at 17 years postoperative follow-up, it is level 3. The patient walks with a slight limp, does have some knee pain with exercise, and is slightly impaired with stair climbing and squatting. Her knee is very stable with all activities, and there are no locking or giving way episodes. The patient's decreased Tegner level of function may be due to the degenerative changes in her knee, as well as being 17 years older than at the time of injury.