Concomitant ACL Reconstruction And Infratubercle Anterior Closing Wedge High Tibial Osteotomy

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Background

In patients with a primary anterior cruciate ligament (ACL) injury and an ACL-reconstructed knee, increased posterior tibial slope (PTS) has been identified as one of the most important risks factors for recurrent injury to the reconstructed ACL. Knowledge of the relationship between PTS and forces experienced by the ACL graft has shown that increased slope correlates with increased forces on the ACL. Anterior tibial closing wedge osteotomy (ACWO) can be performed in combination with or in a staged manner with revision ACL reconstruction to reduce PTS and reduce the forces seen by the ACL graft.

Description

Patients with a secondary ACL injury require a thorough history and physical examination to determine the causes of graft failure. In considering anatomic contributions, coronal morphology and PTS can be measured on full-length AP and lateral tibial radiographs. For patients with a PTS greater than 12°, ACWO is considered and discussed.

In concurrent ACL revision reconstruction, the procedure begins with diagnostic arthroscopy followed by débridement of the remnant graft. Any meniscal pathology is addressed via all-inside or inside-out repair technique, depending on the injury pattern. Attention is then turned to ACL reconstruction. A notchplasty, if indicated, is performed, followed by drilling the femoral tunnel via an inside-out technique. The tibial tunnel is then drilled, and the ACL graft is passed, fixed to the femoral side, but not yet fixed to the tibia. Next, the osteotomy is performed. After re-draping the extremity and removing the post, an anterior approach is made to the proximal tibia, subperiosteally elevating the anterior compartment musculature off the tibia. Large medial and lateral flaps are created in line with the planned osteotomy site to ensure adequate visualization medially and laterally for osteotomy completion. After the proximal tibia is adequately exposed, a guide pin is placed just inferior to the tibial tubercle, aimed to the posterior cruciate ligament insertion flare of the posterior tibia, and confirmed via multiplanar fluoroscopy. A second guide pin is then placed at a predetermined distance distal to the first pin to create the corrective angle for the osteotomy, aiming for both to end at the same posterior cortex. The osteotomy is begun with the use of an oscillating saw and completed with the use of an osteotome. After the osteotomy is completed, the osteotomy site is compressed via extension of the leg, after which an anterior-to-posterior lag screw is placed to provide compression. A fixed-angle laterally based plate is then applied for additional fixation. The tibial side of the ACL graft is then fixed in place with an ABOS button. The wounds are then irrigated and closed in a layered fashion.

Alternatives

In patients with recurrent ACL tears, nonsurgical treatment is an alternative. Nonsurgical treatment may be pursued based on a patient's activity level, potential osteoarthritis, age, and goals. In addition, revision ACL reconstruction alone may be performed with no attempt at slope correction, with knowledge of the increased risk of graft failure but faster recovery time. A third option is a staged approach, in which the osteotomy is performed and heals, after which revision ACL reconstruction is performed. Other surgical options include lateral extra-articular stabilization procedures. In patients with combined coronal and sagittal plane deformities, multiplanar osteotomy may be considered to alter increased PTS and varus/valgus malalignment.

Rationale

In patients with isolated increased PTS who undergo an anterior closing wedge osteotomy, the osteotomy is identified by its relationship to the tibial tubercle. With supratubercle osteotomies, altering patellar height is possible, which may lead to changes in patellar tracking. With transtubercle osteotomies, the tubercle must be osteotomized and then refixed to perform the osteotomy, which results in a second osteotomy that requires healing. With infratubercle osteotomy, the risks of changing patellar height and avoiding an osteotomy of the tubercle itself are avoided. In addition, this osteotomy is distal to the tibial tunnel, allowing for concurrent ACWO and ACL reconstruction.

Expected Outcomes

For patients undergoing combined ACWO and ACL reconstruction, studies have reported successful protection of the ACL graft and osteotomy healing. In a study of nine patients, 100% demonstrated healing of the osteotomy site, with the graft present at 2-year follow-up and improved Lysholm Knee Scale scores. In another retrospective study, five patients were followed for a mean of 36 months. This study reported increased knee stability, decreased anterior tibial laxity, and improved Lysholm Knee Scale scores. Biomechanically, ACWO resulted in a decrease in anterior tibial translation in 10 cadaver model knees. In addition, in patients who undergo revision ACL reconstruction and have increased PTS but do not undergo PTS management, an elevated risk for the graft remains.

Tips

Important tips include the following: (1) Flexion of the knee during osteotomy decreases the risk of injury to the neurovascular bundle. (2) Leaving the posterior tibial cortex intact increases osteotomy stability and decreases the risk of nonunion. (3) After the osteotomy is completed, slow closure of the anterior gap via extension of the leg helps maintain correction until fixation with the use of a lag screw. (4) Using an osteotome for completion of osteotomy decreases the risk of thermal necrosis from an oscillating saw and provides more control with incremental movements. (5) If a meniscal root or meniscal root–equivalent injury is fixed with an osseous tunnel, the sutures can be passed under and tied to the plate for fixation.