



CONTINUING EDUCATION PROGRAM: FOCUS...

Imaging of the postoperative knee

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KEYWORDS

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Abstract On sagittal images after anterior cruciate ligament (ACL) reconstructions, the femoral tunnel aperture should be at the junction of the line drawn along the posterior femoral cortex and the line drawn along the roof of the intercondylar notch (Blumensaat line). The tibial tunnel aperture should be in the anterior portion of the second third, i.e. anterior aspect of the middle of the tibial epiphysis. An inaccurate placement of the femoral tunnel affects the graft isometry. A tibial tunnel too anteriorly placed results in intercondylar notch roof impingement. After meniscus surgery, first-line MRI is often sufficient to diagnose new tears; however, sometimes it is necessary to perform CT arthrography or MR arthrography. Surgical cartilage repair is evaluated based on articular congruity and on the appearance of the subchondral bone.

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Introduction

The increased use and improvement of knee surgery techniques has led to an increased number of indications for imaging. In routine practice, it has become increasingly frequent to come across MR images of knees that underwent previous surgery. Prior surgery is a crucial information because imaging protocol and interpretation need to be adapted.

Abbreviations: STGT, semitendinosus/gracilis tendons; BTB, bone-tendon-bone; ACL, anterior cruciate ligament; PCL, posterior cruciate ligament; PD, proton density; fs-PD-weighted, fat-suppressed proton density-weighted, equivalent in this text to fat-suppressed intermediate-weighted.

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This information is usually obtained during history taking. The surgery report is often not available. It is also important to obtain the images from previous examinations.

If, at time of assessment, it is not possible to know if the patient has had prior surgery, it is sometimes possible to visualize postoperative signs on MR images. Besides obvious signs of material migration or obvious morphologic changes, rounded or linear small fibrous areas in the infrapatellar fat are signs of trocar passage during arthroscopy. This type of sign is usually seen on both parts of the patellar tendon. Susceptibility artifacts generated by metallic particles, better visible on gradient echo sequences, are also signs of previous surgery. Knee surgery involves many areas and procedures.

The purpose of this review was to address surgical procedures of the anterior cruciate ligament, menisci and cartilage.

Anterior cruciate ligament reconstruction

Types of reconstruction

Today, ACL reconstruction uses tendon grafts (Table 1). Direct ligament sutures and grafting with synthetic materials are no longer performed. In most cases, an autograft from the patient himself is performed, rather than an allograft from a corpse donor. There are two types of tendon reconstruction: reconstruction with an autograft of the patellar tendon (bone-tendon-bone or BTB technique) and an autograft with semitendinosus/gracilis tendons (STGT technique). The BTB reconstruction uses the patellar tendon with its two bone fragments on each side (corresponding to the central third of the tendon), while the STGT technique uses the semitendinosus and gracilis tendons, with both tendons folded to form four strands.

On postoperative images, the BTB reconstruction is characterized by a defect on the central third of the patellar tendon, clearly visible during the first months after surgery and even later [1,2]. In the STGT reconstruction, tendons heal and no defects are, generally, visible later on [3].

Recently a new anatomic double-bundle reconstruction technique has been used (Fig. 1). This technique involves two femoral tunnels, or two tibial tunnels and two tendon grafts (STGT with each tendon folded to form two bundles of two strands each).

Table 1 Comparison between BTB and STGT reconstructions.

	BTB	STGT
Origin of the graft	Patellar tendon	Semitendinosus/ gracilis tendons
Constitution of the graft	Central third of the tendon with bone fragments on each side	Several intertwined tendon strands
Abnormality at the site of harvesting	Defect at the central third of the tendon, sometimes persisting	Almost none (regeneration of the tendon)

BTB and STGT are intra-articular reconstructions. Standard radiography ensures correct tunnel placement (Fig. 2) (Table 2) [4–6]. On sagittal images of ACL reconstructions, the aperture of the femoral tunnel should be located right in front of the junction of the line drawn along the posterior femoral cortex and the line drawn along the roof of the intercondylar notch (Bluemensaat line). The tibial tunnel aperture should be in the anterior portion of the second third, i.e. anterior aspect of the middle tibial epiphysis. An inaccurate placement of the femoral tunnel affects the graft isometry (Figs. 3 and 4). If the tibial tunnel is too anteriorly placed, it may cause an impingement against the roof of the intercondylar notch. Extra-articular reconstruction technique is possible, but has been much less widely performed.

MRI Protocol

A standard knee MRI protocol including fat-suppressed proton density (PD)-weighted sequences is usually performed. Non fat-suppressed T2- or PD-weighted sequences are useful

Table 2 Accurate tunnel placement and consequences in case of inaccurate placement.

	Femoral tunnel	Tibial tunnel
Sagittal view	Aperture at the junction of the posterior femoral cortex and the line along the roof of the intercondylar notch	Aperture on anterior aspect of the middle of the tibial epiphysis Parallel and posterior to the line along the roof of the intercondylar notch, in extension
Frontal view	Aperture in the superolateral part of the intercondylar notch Superolateral orientation	Aperture in projection of the tibial spine Inferomedial orientation
Accurate placement	Isometric reconstruction	No intercondylar notch roof impingement, anterior stabilization
Too anterior	Reconstruction too tight in flexion	Intercondylar notch roof impingement (in extension)
Too posterior	Reconstruction too tight in extension Risk of tear in the posterior femoral cortex	Reconstruction too vertical with reduced anterior stabilization

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