

ACL deficient knee: the effect of extraarticular and intraarticular reconstructions on pivot shift phenomenon: clinical assessment using navigation

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Introduction: Anterior cruciate ligament (ACL) reconstruction is one of the most performed surgical procedure in the world with a rate of success ranging from 70 to 94 per cent, depending on the criteria used to evaluate outcomes. Among the stability test used to evaluate the results of the reconstruction the pivot shift is considered the most reliable as it strongly correlates with satisfaction of the patient, giving way episodes and activity level.

Addition of a lateral tenodesis to current techniques of intraarticular reconstruction with hamstrings has been recommended by some authors to improve knee laxity control, particularly internal rotation, to be used in selected cases of severe rotational instability. Navigation has been previously used to evaluate the anteroposterior and rotatory instability in ACL deficient and reconstructed knee at various degree of flexion. However the effect of various surgical procedures on the pivot shift phenomenon is not completely understood due to the lack of an objective way to measure the knee stability in dynamic conditions, such as those provided by the pivot shift.

The purpose of this paper is to present the preliminary results of the effect of intra-articular and extra-articular reconstructions on the pivot shift phenomenon as evaluated by navigation using a new software designed to specifically measure rotation and anterior displacement of the knee that occur carrying out the pivot shift test.

Methods: Twenty patients underwent anatomic single bundle ACL reconstruction with doubled semitendinosus and gracilis tendons with addition of extraarticular reconstruction (Coker/Arnold modification of the Mc Intosh lateral tenodesis). The navigator (Ortho-Pilot, BBraun, Tuttlingen, Germany), equipped with a software designed to evaluate the pivot shift, was used to measure knee kinematics in response to Lachman test, maximum internal-external rotation at 30° of flexion and pivot-shift test. Two sequential reconstruction protocols were used to assess the contribution of the extra-articular tenodesis and intra-articular anatomic single bundle reconstruction to restrain tibial translations and coupled axial rotation occurring with the manually performed clinical laxity tests. In group A the intraarticular reconstruction was fixed first and then the lateral tenodesis was fixed; in group B the lateral tenodesis was performed and fixed before the intra-articular reconstruction. Measurements were performed before the reconstruction, after the first part was fixed and after the second part was fixed in each protocol. All the tests were performed with manual maximum force by the same operator.

Results: The anterior translation of the tibial at 30° of flexion (Lachman test) was significantly reduced only by the intra-articular reconstruction with no additional effect of the lateral tenodesis.

Both procedures significantly reduced rotation of the tibia at 30° of flexion but the extra-articular reconstruction was significantly more effective than intra-articular reconstruction. In dynamic conditions (Pivot Shift test) both procedures have the same effect in reducing anterior displacement and internal rotation of the tibia, with no significant difference between them, regardless of the type of procedure performed first.

Conclusions: This study shows that measurements of stability significantly differ in static and dynamic conditions and confirm the need to use a reliable method to objectively evaluate and measure the pivot shift phenomenon: as Lord Kelvin stated "What is measured, it can be improved"

The extra-articular reconstruction has no effect in reducing the anterior displacement of the tibia at 30° of flexion (Lachman test) but it is more effective than intraarticular reconstruction in reducing tibial rotation. Intraarticular and extraarticular reconstructions are synergic in controlling the pivot shift phenomenon.