Comparison of stability and functional outcomes in anterior cruciate ligament reconstruction: anatomical vs. non-anatomical femoral tunnel

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Despite improvement in our understanding of anatomy and in the techniques available for anterior cruciate ligament (ACL) reconstruction, some patients with an apparently stable knee reconstruction in the anterior direction, occasionally report rotational instability, a feeling of giving way, and/or develop degenerative joint disease. The findings of several biomechanical studies support placing the femoral tunnel at an anatomic tunnel position to achieve anterior and rotational knee stability after ACL reconstruction. However, no firm consensus has been reached regarding the merits and demerits of ACL reconstruction using an anatomical femoral tunnel versus a high femoral tunnel (11 o'clock). The purpose of this prospective study was to compare intra-operative stability and clinical outcomes of ACL reconstruction between anatomical and non-anatomical femoral tunnel.

Fifty-eight patients that underwent ACL reconstruction (29 in the anatomical femoral tunnel group and 29 in non-anatomical femoral tunnel group) were followed up for a minimum of 2 years. The average time from injury to reconstruction in the anatomical femoral tunnel group was 3.7 months (range, 0.1-37.0 months), and patients were followed for an average of 27.5 months (range, 24.0-36.0 months). These patients included 23 men and 6 women and had an average age at the surgery of 29.9 years (range, 18-45 years). The average time from injury to reconstruction in the high femoral tunnel group patients was 3.5 months (range, 0.1-35.5 months), patients were followed on average for 28.8 months (range, 24.0-37.0 months), and there were 25 men and 4 women with an average age at the surgery of 33.1 years (range, 18-64 years). Meniscectomy was performed in nine cases in the anatomical femoral tunnel group and in ten cases in the high femoral tunnel group. Time from injury to surgery, age at surgery, gender, follow-up period, and frequency of meniscectomy were not significantly different in the two groups ($p>0.05$). A computer navigation system (OrthoPilot, B. Braun-Aesculap, Tuttlingen, Germany) was used for stability testing at 0°, 30°, 60°, and 90° of knee flexion. Anterior translations were determined under 100N of anterior load on the proximal tibia using a spring scale before reconstruction and again after complete graft fixation, and were recorded by the navigation system. Internal and external rotations of the tibia before reconstruction and after complete graft fixation were determined under 10N·m of torque using a torque wrench. The two groups were compared with respect to anterior translations, and internal and external rotations before and after reconstructions. Patients were evaluated preoperatively and at two years postoperatively. Clinical results were evaluated using Lysholm knee scores[1], Tegner activity scores[2], and using Lachman and pivot shift tests. Radiological stabilities were evaluated based on an instrumented laxity test using a Telos® device (Telos stress device; Austin & Associate, Polston, USA) at 30° of knee flexion with 20 lbs of anterior load applied to the proximal tibia. Differences between the anterior translations of reconstructed and normal sides were used to determine degree of laxity.

Anterior translations were significantly improved after both reconstructions as compared with the ACL deficient conditions at all flexion angles ($p<0.05$). However, anterior translations after reconstruction were not significantly different in the two groups from 0° to 90° of knee flexion. Anterior translation after reconstruction at 30° of knee flexion was 5.3 ± 1.7 mm in the anatomical tunnel group and 6.2 ± 1.8 mm in the high tunnel group ($p=0.076$). Tibial external and internal rotations improved significantly in both groups after reconstruction, and although no significant inter-group difference was found between tibial external rotations at all flexion angles, tibial internal rotations were better in the anatomical tunnel group at 0° and 30° of knee flexion, but not at the other selected angles (60° and 90°). Tibial internal rotations, after reconstruction at 0° and 30° of knee

flexion, were 10.3° and 14.4° in the anatomical tunnel group and 12.0° and 16.4° in the high tunnel group, respectively, and these values were significantly different (p=0.037 and 0.020, respectively). Furthermore, Lachman and pivot shift test stability results and radiological stability data obtained at final follow-up were not significantly different in the two groups.

The anatomical femoral tunnel group showed better internal rotational stability during ACL reconstruction than the high femoral tunnel group. However, no significant differences were observed between the two groups in terms of clinical outcomes or stabilities.

References

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