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EVIDENCE-BASED ORTHOPAEDICS

Computer-Navigated and Manual Anterior Cruciate Ligament Reconstructions Were Similar in Function and Stability Outcomes

Hart R, Krejzla J, Sváb P, Kocis J, Stipčák V. Outcomes After Conventional versus Computer-Navigated Anterior Cruciate Ligament Reconstruction. *Arthroscopy*. 2008 May;24:569-78.

Question: In patients having anterior cruciate ligament (ACL) reconstruction, how does a computer-navigated system compare with a conventional system?

Design: Randomized (unclear allocation concealment), blinded (patients and outcome assessors) controlled trial with mean 28-month follow-up.

Setting: A hospital in Znojmo, Czech Republic.

Patients: 80 patients (mean age, 29 y; 80% men) who had arthroscopic confirmation of complete rupture of the ACL, objective anterolateral rotatory instability (a positive result on the Lachman and pivot-shift tests), and loss of stability prompting giving-way of the knee joint. Other inclusion criteria were no previous or simultaneous intra-articular surgical procedure, no cartilage deterioration or meniscal tear, and a normal contralateral knee. All patients completed the study.

Intervention: Patients were allocated to ACL reconstruction with the OrthoPilot navigation system (Braun-Aesculap, Tuttlingen, Germany) (n = 40) or with the

conventional manual targeting technique (n = 40). The OrthoPilot system used 3-dimensional infrared technology to navigate the surgical tools with an accuracy of up to 0.4 mm and maximal instrument deviation of up to 1.5 mm. The system allowed precise positioning of tunnels, calculation and definition of isometry, and projection of the intercondylar notch on a plateau to facilitate impingement avoidance. The surgical procedure that was followed was identical in both groups and performed by the same surgeon. All patients received the same physical and rehabilitation therapy for 3 months, at which point they could resume usual activities of daily living.

Main outcome measures: Anterior laxity of the knee (as measured by KT-1000 arthrometer [MEDmetric, San Diego, California]) was measured with use of the Lachman test, function was assessed with use of the Lysholm scale and the International Knee Documentation Committee (IKDC) rating system, and femoral and tibial tunnel position was evaluated radiographically.

Main results: The difference between the navigation-system group and the conventional group with regard to anterior laxity was not significant according to the results obtained with use of the passive Lachman test ($p < 0.15$) or the Lachman test with the examiner exerting maximum pull force ($p < 0.52$). During both tests, the normal knees were more stable than the repaired knees. The changes in Lysholm score and IKDC score did not differ between groups (Table). Anterior-posterior placement of the femoral tunnel was more accurate when done by the navigated system than by the conventional system: the a/t ratio in the navigation-system group was 25.5% compared with 27.5% in the conventional group ($p < 0.01$). The b/h ratio of tibial tunnel placement did not differ between navigated and conventional groups (27.3% vs 27.9%; $p < 0.48$).

Conclusions: In patients having ACL reconstruction, a computer-navigated system was not superior to a conventional system with regard to functional stability outcomes. Radiographic measurements of femoral tunnel placement showed more accuracy in the navigated group, whereas the accuracy of the tibial tunnel placement did not differ between the two groups.

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Computer-navigated system vs conventional system for ACL reconstruction			
Outcomes	Increase in score from baseline		P value
	Navigated system	Conventional system	
Lysholm score	33.9	32.9	<0.59
International Knee Documentation Committee score	35.2	31.8	<0.87

Commentary

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The advantage of computerized surgical navigation for anterior cruciate ligament reconstruction is that it assists the surgeon in selecting tunnel location in an accurate and reproducible manner. Anterior cruciate ligament graft failure is frequently due to tunnel malposition in either the femur or tibia, or both. There is no clear consensus on the most accurate location for the femoral tunnel, and this is a topic of ongoing study and research^{1,2}. Furthermore, it remains to be shown that a given surgeon can repeatedly place the femoral tunnel in the same location. More specifically, anatomical, as opposed to isometric (as used by the authors), graft position has been advocated recently^{3,4}.

In this randomized trial comparing traditional anterior cruciate ligament reconstruction with computer-assisted surgery, the rehabilitation protocol involved 6 weeks of daily mobilization of the knee joint from 10° to 90° with use of partial weight-bearing. A recent systematic review of the literature supported full weight-bearing with full range of motion immediately after surgery⁵.

The authors found no difference in laxity or functional outcome as evidenced by the Lysholm and IKDC scores. With use of radiographic measurement, they found that the femoral tunnel was more accurately placed in the navigated group. However, measurement of a 3-dimensionally located tunnel on a 2-dimensional radiograph is difficult. In addition, as mentioned above, ideal tunnel placement in both single and double-bundle anterior cruciate ligament reconstruction remains a topic of debate.

On the basis of the results of this randomized controlled trial, navigation is currently not indicated for routine primary anterior cruciate ligament reconstruction. However, as technological improvements in navigation are made and as we achieve a greater understanding of ideal graft position and tunnel location, the use of navigation may become more widespread in the future.

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