Graft tensioning in anterior cruciate ligament reconstruction: a systematic review of randomized controlled trials

CRD summary
This generally well-conducted review concluded that underpowered, heterogeneous evidence showed a trend toward 80 Newtons being the most effective amount of tension to apply during knee anterior cruciate ligament reconstruction using hamstring-polyester graft sources. There was either no clear trend or no evidence for reconstruction using other graft types. These cautious conclusions are likely to be reliable.

Authors' objectives
To assess graft tensioning in knee anterior cruciate ligament reconstruction.

Searching
MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews were searched from 1966 to 1st July 2008. Search terms were reported. The ten journals related to orthopaedic sports medicine with the highest impact factor and proceedings of the seven most highly attended orthopaedic sports medicine conferences were handsearched from 1998 to 2007.

Study selection
Randomised controlled trials (RCTs) in patients with isolated unilateral anterior cruciate ligament insufficiency, undergoing anterior cruciate ligament reconstruction, were eligible for inclusion. No restrictions on the source of grafts were applied. A measured tensioning device had to be used during graft fixation. Trials were required to assess patients preoperatively and for a minimum of one year postoperatively and to use an objective knee ligament testing device for outcome assessment. The primary outcome was overall side-to-side differences in knee laxity. Secondary outcomes included quality of life or subjective questionnaire measures. Adverse events were also reported.

Included trials used an autogenous bone-patellar tendon-bone, a 5-strand autogenous semitendinosus-polyester graft and a 4-strand autogenous semitendinosus-gracilis-polyester graft. Both pre-conditioned and non pre-conditioned grafts were employed. All except one trial employed a custom-designed tensioner; the remaining trial used a commercially available tensiometer. During graft placement, knees were placed in full extension or 20 or 30 degrees of flexion. Tension applied differed in all trials and ranged from 20 to 147.1 Newtons (N). Mean patient ages ranged from 22 to 33 years where reported, and trials contained a slight majority of males.

Two reviewers independently selected the studies for inclusion in the review, and discrepancies were resolved by discussion and consultation with a third reviewer.

Assessment of study quality
Two blinded reviewers independently assessed the trials for validity using the Detsky index, which awards up to 20 points on 14 items related to the following criteria: randomisation, outcome measures, patient criteria, interventions, and statistics. Trials reporting negative outcomes have a maximum score of 21, with an additional point awarded for reporting of confidence intervals or post-hoc power calculations. Scores were standardised to a maximum of 100 and the percentage calculated. Seventy-five percent was regarded as the threshold for acceptable trial quality. Disagreements were resolved through consensus with a third independent reviewer.

Data extraction
Data extraction was carried out by one reviewer.

Methods of synthesis
The studies were combined in a narrative synthesis grouped by outcomes.
Results of the review
Five randomised controlled trials (RCTs) were included in the review (n=248 patients). Sample sizes ranged from 38 to 70. Standardised Detsky scores ranged from 38.1 to 80 with a mean of 61.3; only two studies were considered to be of acceptable quality. Duration of follow-up ranged from 12 to 30 months.

Two RCTs reported a statistically significant difference in final postoperative knee laxity between treatment groups. One found that there was a significant decrease (p<0.05) in the 90 N group (2.2 +/- 1.6 mm) compared with the 45 N group (3.0 +/- 2.2 mm). The second study found a significant decrease (p < 0.05) in the 80 N group (0.6 +/- 1.7 mm) compared with the 20 N group (2.2 +/- 1.4 mm). There were no other statistically significant differences in the primary outcome, or in any of the secondary outcomes. The other three studies reported no significant differences between treatments.

Authors’ conclusions
There is a trend which suggests that 80 N of tension was the most effective amount of tension to apply during anterior cruciate ligament reconstruction using hamstring-polyester graft sources. There was no clear trend for reconstruction using semitendinosus-gracilis or patellar tendon graft sources. There was no randomised evidence relating to 4-strand semitendinosus-gracilis autografts without polyester augmentation. These conclusions were limited by lack of power in the included trials, and by heterogeneity between them.

CRD commentary
The review question and the inclusion criteria were clear. The authors searched a number of databases and other sources, including attempts to locate unpublished studies. This reduced the chances that some relevant studies were excluded, or that publication bias was introduced. The authors used methods designed to reduce bias and error in the selection of studies and the assessment of validity, but not in the extraction of data. The validity assessment used appropriate criteria, was properly reported, and was used to inform the synthesis. The decision to employ a narrative synthesis was appropriate given the clinical heterogeneity of the included trials. Details of these trials were reported. The authors’ conclusions accurately reflect the limited evidence of this generally well-conducted review, and are likely to be reliable.

Implications of the review for practice and research
The authors did not state any implications for practice or further research.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.