Bone-patellar tendon-bone autografts versus hamstring autografts for reconstruction of anterior cruciate ligament: meta-analysis

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CRD summary
This generally well-conducted review concluded that morbidity was lower for hamstring autografts than for patellar tendon autografts, and that the evidence that patellar tendon grafts offer better stability was weak. However, measures of stability in favour of patellar tendon autografts were statistically significant at the 5% level, and deeming them to be weak may be understating the evidence in this area.

Authors' objectives
To compare bone-patellar tendon-bone autografts with hamstring autografts for reconstruction of the anterior cruciate ligament.

Searching
MEDLINE, WebSPIRS, the Science Citation Index, Current Contents, and the Cochrane Central Register of Controlled Trials were searched up to March 2005 without language restrictions. The search terms were stated as being available online, but these could not be found (04/12/2006). The reference lists of identified studies were checked for additional relevant studies. The authors of the trials were contacted for additional unpublished data and to identify further studies. Main and specialist orthopaedic journals and relevant organisations were also contacted for further studies.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) and quasi-randomised trials with a mean follow-up of more than 1 year were eligible for inclusion. The mean duration of follow-up was 36 months (range: 12 to 102).

Specific interventions included in the review
Studies of hamstring autograft reconstruction without augmentation compared with bone-patellar tendon-bone autograft reconstruction were eligible for inclusion. Patients undergoing hamstring autograft reconstruction received a two-, three- or four-strand hamstring autograft. All control participants received a patellar tendon autograft.

Participants included in the review
Studies of patients undergoing reconstruction of the anterior cruciate ligament were eligible for inclusion. Where reported, the mean age ranged from 22 to 31 years and the male-to-female ratio ranged from 1.1 to men only.

Outcomes assessed in the review
The studies had to have at least one primary outcome related to stability (instrumented measurement of knee laxity, Lachman test or pivot shift test) and morbidity (anterior knee pain, kneeling test, loss of extension or graft failure) to be included in the review.

How were decisions on the relevance of primary studies made?
The authors did not state how the studies were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors used a 5-point scale to assess the quality of the studies. The quality scale considered the randomisation procedure, withdrawal or drop-out rate, comparability of the cointerventions, whether the assessment was independent, and whether an intention-to-treat analysis was undertaken. Studies scoring 2 or less were considered poor quality; studies scoring 3 or 4 were considered fair quality; studies scoring 5 were considered good quality.

Two reviewers independently evaluated study quality, with any disagreements being resolved through consensus or
consultation with the other authors.

**Data extraction**
Two authors independently extracted the data, with any disagreements being resolved through consensus or consultation with the other authors. The results for the instrumented measurement of knee laxity, the Lachman test, the pivot shift test and the kneeling test, along with the number of patients with anterior knee pain, loss of extension or graft failure, were extracted for each study.

**Methods of synthesis**

*How were the studies combined?*
A random-effects meta-analysis was used to calculate pooled relative risks (RRs) for binary outcomes and weighted mean differences (WMDs) for continuous outcomes.

*How were differences between studies investigated?*
The chi-squared test was used to investigate statistical heterogeneity. The effects of study quality (score less than 3 versus at least 3), randomisation status (randomised versus quasi-randomised), and the number of strands used in the hamstring tendon group (less than 4 versus 4), were investigated using subgroup analyses.

**Results of the review**
Twenty-four publications of 18 cohorts were included in the review (n=1,512). When data in studies overlapped they were merged, resulting in 18 merged studies.

Nine studies were considered fair quality (four scored 4 and five scored 3) and nine were considered poor quality (six scored 2 and three scored 1).

**Stability.**
The difference in laxity between the operated side and the contralateral side, assessed using instrumented measurement of knee laxity, was statistically significantly greater after hamstring autografts compared with patellar tendon autografts at a low force of 89 newtons (WMD 0.36, 95% confidence interval, CI: 0.01, 0.71, P=0.04) and maximal manual force (WMD 0.70, 95% CI: 0.02, 1.39, P=0.04). The Lachman test also showed a statistically significant difference in favour of patellar tendon autografts (RR 1.22, 95% CI: 1.01, 1.47, P=0.04).

**Morbidity.**
There were statistically significant differences in favour of hamstring autografts in relation to anterior knee pain (RR 0.57, 95% CI: 0.44, 0.74, P<0.0001), loss of extension (RR 0.52, 95% CI: 0.34, 0.80, P=0.003) and the kneeling test (RR 0.26, 95% CI: 0.14, 0.48, P<0.0001), but not graft failure (RR 1.33, 95% CI: 0.73, 2.44, P=0.35).

**Subgroup analyses.**
There was no statistically significant difference in the pivot test or anterior knee pain between treatment and control when only results of studies using 4-strand hamstring autografts were analysed, or when studies were analysed according to quality.

There was no statistically significant heterogeneity between studies in any of the analyses.

**Authors' conclusions**
Morbidity was lower for hamstring autografts than for patellar tendon autografts. The evidence that patellar tendon autografts offer better stability was weak.
CRD commentary
The authors addressed a clear review question with well-defined inclusion criteria. Several relevant sources were searched and unpublished data were sought. The search was conducted without language restrictions, thereby reducing the potential for language bias. Attempts were made to reduce error and bias during the data extraction and quality assessment processes, however it was unclear whether similar attempts were made to reduce selection bias.

Relevant measures of effect were calculated. The lack of statistical heterogeneity between the studies indicates that pooling was appropriate. Appropriate subgroup analyses were conducted to investigate clinical heterogeneity and study quality. The authors’ conclusions seem to favour hamstring autografts. However, it should be kept in mind that although the measures of stability in favour of patellar tendon autografts did not show such highly statistically significant P-values as morbidity in favour of hamstring autografts, they were still statistically significant at the 5% level; deeming them to be weak may be understating the evidence in this area.

Implications of the review for practice and research
Practice: The authors stated that the lower incidence of anterior knee symptoms and extension deficits in patients with hamstring autografts, compared with patellar tendon autografts, should be taken into account when advising patients of certain ethnic origins and religions or patients who do sports.

Research: The authors stated that the methodological quality of surgical trials needs to be improved.

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