Patellar versus hamstring tendons in anterior cruciate ligament reconstruction: a meta-analysis
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Authors' objectives
To compare the outcome of anterior cruciate ligament (ACL) reconstruction when using patellar tendon (PAT) to that when using hamstring tendons.

Searching
MEDLINE was searched from 1980 to May 1997 for studies published in English using the following subject headings and textwords: 'anterior cruciate ligament', 'surgery', 'reconstruction' and 'human'. In addition, manual searches of the reference lists of identified papers, and current research and unpublished literature were conducted.

Study selection
Study designs of evaluations included in the review
The authors stated that all controlled studies comparing STG with PAT for ACL reconstruction were included. The inclusion criteria required that the patients be followed-up post-operatively, according to the examiner's protocol, for a minimum of two years. Studies that met the inclusion criteria were subsequently excluded if there were discrepancies in the methods or results sections. In addition, studies were excluded if they did not provide adequate post-surgical data, such as laxity or subjective evaluation.

Specific interventions included in the review
All controlled studies comparing semitendinosus and gracilis tendon (STG) with PAT for ACL reconstruction were included.

The surgical and post-operative techniques were different in each of the studies. In one study, the PAT procedure was performed using both single and double incision techniques; in both cases, the bone-tendon-bone graft was secured using an interference screw in the femur and tibia.

Participants included in the review
The authors do not state any disease or participant-based inclusion or exclusion criteria.

Data on participant gender were provided for 3 of the 4 included studies: the proportion of male participants ranged from 53 to 65% for the PAT groups and 52 to 74% for the STG groups. The same 3 studies reported the participants' age: this ranged from 14 to 56 years and 13 to 56 years in the PAT and STG groups, respectively.

No further participant details, e.g. injury and concomitant disease states, were reported.

Outcomes assessed in the review
The authors stated that, for a study to be included, data must be provided to assess the subjective and objective post-operative condition of the graft and the patient. Studies also had to include an assessment of the ability to return to a pre-injury level of activity.

The outcome criteria assessed were performance level, KT arthrometer measurements, Lachman scores, pivot shift results, range of motion (ROM) studies, complications, and failures.

How were decisions on the relevance of primary studies made?
The abstracts of retrieved articles were reviewed and assessed for relevance. The authors do not state how many of the reviewers performed the selection.
Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction. Data were extracted on the following categories: the country and year of publication; the numbers of patients enrolled and evaluated for each procedure; method of treatment assignment; patient gender and age range for each procedure; details of the PAT procedure; details of the STG procedure; details of the post-operative technique; results and/or outcomes, i.e. performance level, KT arthrometer measurements, Lachman scores, pivot shift results, ROM studies, complications, and failures.

Methods of synthesis
How were the studies combined?
The relative risks (RRs) and their 95% confidence intervals (CIs) were calculated for each trial and outcome of interest. These were compared for patients undergoing the PAT and STG procedures. A Q statistic was calculated for each outcome to check whether the RRs were constant across trials, and subsequently could be pooled. For each outcome with a constant RR, the pooled RR estimates were obtained using a fixed-effect model (see Other Publications of Related interest no.1). If the RR was not constant, the pooled effect estimate not calculated. The absolute risk difference was also estimated (see Other Publications of Related Interest nos.1-2).

How were differences between studies investigated?
The Q statistic was used to check for between-trial heterogeneity in RR estimates. Where the P value for the Q statistic was less than 0.10, indicating heterogeneity, the study reports were examined for possible explanations.

Results of the review
The authors state that 4 studies involving a total of 424 patients were identified and included in the review. However, from the data presented, it appears that a total of 445 patients were enrolled in the included studies; of these, 411 were evaluated and 393 were available for complete follow-up evaluation of all tests.

There were significant differences between PAT and STG reconstructions.

Using the PAT graft versus the STG graft, the pooled risk ratio for return to a pre-injury level of activity following ACL replacement was 1.18 (95% CI: 1.04, 1.34, P=0.01); the absolute risk difference was 11%.

PAT patients had a greater chance of obtaining a statistically stable knee, based on KT arthrometer data when using a force equivalent to 20 lbs.

The RR of 0.81 (95% CI: 0.38, 1.72, P=0.59) for the Lachman scores suggested that PAT graft was less likely to be unstable than STG, but the CIs were too wide to make a definitive statement.

The RR estimate of 0.63 (95% CI: 0.39, 1.01, P=0.05) for pivot shift also suggested that PAT patients were less likely than STG patients to have a positive shift (defined as greater than zero). This difference was significant.

The RR estimates for loss of ROM extension could not be pooled because of significant heterogeneity between the studies. Following the exclusion of one study, the RR estimates for the remaining homogeneous studies were pooled; the results showed no significant difference between PAT and STG patients (RR 1.21, 95% CI: 0.68, 2.13). There was no significant difference between PAT and STG patients for loss of ROM flexion (P=0.31).

There was no statistically-significant difference in the number of complications or failures between the two techniques: the risk ratio and pooled risk ratio were 1.04 (95% CI: 0.59, 1.83, P=0.89) and 0.63 (95% CI: 0.23, 1.73, P=0.37), respectively.
Authors' conclusions
Both the PAT and STG techniques, as performed in the late 1980s and early 1990s, yielded good results. However, PAT reconstruction led to higher post-operative activity levels and greater static stability than hamstring reconstruction; this result was statistically significant, based on this meta-analysis.

CRD commentary
The review question was clear and concise, whereas the inclusion and exclusion criteria used were broad and poorly defined; in particular, the characteristics of the participants and the specific outcome measures.

Only one database was searched, using a search strategy that appeared crude; it is unlikely that all available studies in the field were completely retrieved. This was compounded by restricting the included articles to those published in English. Though the authors state that a manual search of current research and unpublished literature was undertaken, the sources searched were not identified.

The authors do not describe any method of assessing the validity of the included studies. The particular methodological problems posed by the surgical trials were discussed, but there was insufficient detail of the primary studies to assess the extent and relevance of possible bias.

Details of the methodological design and individual procedures (both surgical and post-operative) used in the primary studies were reported. The authors discussed the methodological problems raised by surgical trials, and the specific problems of inconsistency in outcome measurements within the field of orthopaedics. There were concerns about the general applicability of the findings since only limited data were reported on the participants' characteristics, there were few studies, and the total number of participants was small.

Studies were combined in a methodologically rigorous manner, which included appropriate heterogeneity testing. The pooled effect estimates were clearly presented in graphic and tabular format. The main review findings were summarised concisely in the text, and the authors' conclusions follow broadly from these findings as reported. However, only two of the outcome measures reported showed statistically-significant differences between the surgical techniques, and the results were derived from only four relatively small studies. The authors' conclusions in favour of PAT should, therefore, be treated with some caution.

Implications of the review for practice and research
Practice: The authors state that, based on this review, elite or professional athletes who require the greatest opportunity for return to full function would be more likely to benefit from the PAT technique than from the STG technique, because of the 18% greater chance of returning to the previous level. A surgical technique that is more likely to return the patient to pre-injury level of activity would have a distinct advantage in this and other high-performance populations. This difference in outcomes is both statistically significant and clinically relevant in the athletic population.

Research: The authors state that specific complications relating to the individual techniques could not be compared in this review because the studies did not include the same information. Two important, potentially relevant complications are quadriceps weakness and anterior knee pain from the PAT harvest site, and hamstring strength recovery from the STG harvest site. Since the patient may be highly aware of these subjective outcomes, they may influence the rate of recovery. Future studies should include these outcomes, and also include a standardised subjective assessment of how the patients feel and how they would describe the outcome.

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Record Status
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