

Table E-1 Search Strategies Used to Identify the Eleven Included Systematic Reviews

Database: EBM Reviews - Cochrane Database of Systematic Reviews <1st Quarter 2006>

Search Strategy:

- 
- 1 anterior cruciate ligament.mp. (16)
  - 2 patellar tendon.mp. (8)
  - 3 hamstring.mp. (17)
  - 4 tendon graft.mp. (3)
  - 5 ligament surgery.mp. (3)
  - 6 reconstruction.mp. (86)
  - 7 or/4-6 (86)
  - 8 and/1-3 (2)
  - 9 7 and 8 (2)
  - 10 from 9 keep 1-2 (2)

Database: EMBASE <1996 to 2006 Week 21>

Search Strategy:

- 
- 1 exp anterior cruciate ligament/ (1973)
  - 2 anterior cruciate ligament.mp. (3995)
  - 3 exp ligament surgery/ (2428)
  - 4 ligament surgery.mp. (2484)
  - 5 exp patellar tendon/ (1213)
  - 6 patellar tendon.mp. (1210)
  - 7 exp hamstring/ (1345)
  - 8 hamstring.mp. (1539)
  - 9 exp tendon graft/ (1124)
  - 10 tendon graft.mp. (1218)
  - 11 or/1-2 (3995)
  - 12 or/3-4 (2484)
  - 13 or/5-6 (1556)
  - 14 or/7-8 (1539)
  - 15 or/9-10 (1218)
  - 16 12 or 15 (3109)
  - 17 11 and 13 and 14 and 16 (149)
  - 18 Meta Analysis/ (22456)
  - 19 (meta-anal: or metaanal:).mp. (26758)
  - 20 (quantitativ: review: or quantitativ: overview:).mp. (213)
  - 21 (systematic: review: or systematic: overview:).mp. (15901)
  - 22 exp "Systematic Review"/ (10075)
  - 23 (methodologic: review: or methodologic: overview:).mp. (84)
  - 24 (medline or medlars or embase or cochrane).mp. (18254)
  - 25 or/18-24 (47800)
  - 26 17 and 25 (9)
  - 27 from 26 keep 1-9 (9)

Database: Ovid MEDLINE(R) <1996 to May Week 3 2006>

Search Strategy:

- 
- 1 exp anterior cruciate ligament/ (3543)
  - 2 anterior cruciate ligament.mp. (3971)
  - 3 ligament surgery.mp. (112)
  - 4 patellar tendon.mp. (1275)
  - 5 hamstring.mp. (1004)
  - 6 tendon graft.mp. (405)
  - 7 Meta Analysis/ (4691)
  - 8 (meta-anal: or metaanal:).mp. (19258)
  - 9 (quantitativ: review: or quantitativ: overview:).mp. (224)
  - 10 (systematic: review: or systematic: overview:).mp. (8917)
  - 11 (methodologic: review: or methodologic: overview:).mp. (85)
  - 12 (medline or medlars or embase or cochrane).mp. (19569)

- 13 or/1-2 (3971)
- 14 or/3,6 (511)
- 15 and/4-5,13-14 (36)
- 16 or/8-12 (37937)
- 17 15 and 16 (4)
- 18 from 17 keep 1-4 (4)

PUBMED basic search

SEARCH STRATEGY

Anterior cruciate ligament AND patella AND hamstring ((meta-analysis [pt] OR meta-analysis [tw] OR metanalysis [tw]) OR ((review [pt] OR guideline [pt] OR consensus [ti] OR guideline\* [ti] OR literature [ti] OR overview [ti] OR review [ti]) AND ((Cochrane [tw] OR Medline [tw] OR CINAHL [tw] OR (National [tw] AND Library [tw])) OR (handsearch\* [tw] OR search\* [tw] OR searching [tw]) AND (hand [tw] OR manual [tw] OR electronic [tw] OR bibliographi\* [tw] OR database\* OR (Cochrane [tw] OR Medline [tw] OR CINAHL [tw] OR (National [tw] AND Library [tw]))))) OR ((synthesis [ti] OR overview [ti] OR review [ti] OR survey [ti]) AND (systematic [ti] OR critical [ti] OR methodologic [ti] OR quantitative [ti] OR qualitative [ti] OR literature [ti] OR evidence [ti] OR evidence-based [ti]))) BUTNOT (case\* [ti] OR report [ti] OR editorial [pt] OR comment [pt] OR letter [pt])

Table E-2 Oxman and Guyatt Index and QUOROM Statement Weblink

1. Were the search methods used to find evidence stated?
2. Was the search for evidence reasonably comprehensive?
3. Were the criteria for deciding which studies to include in the overview reported?
4. Was bias in the selection of studies avoided?
5. Were the criteria used for assessing the validity of the included studies reported?
6. Was the validity of all studies referred to in the text assessed with use of appropriate criteria?
7. Were the methods used to combine the findings of the relevant studies reported?
8. Were the findings of the relevant studies combined appropriately relative to the primary question the overview addresses?
9. Were the conclusions made by the author(s) supported by the data and/or analysis reported in the overview?
Question 10 summarizes the previous ones and, specifically, asks to rate the scientific quality of the review from 1 (being extensively flawed) to 3 (carrying major flaws) to 5 (carrying minor flaws) to 7 (minimally flawed). The developers of the index specify that if the “partially/can’t tell” answer is used one or more times in questions 2, 4, 6, or 8, then a review is likely to have minor flaws at best and it is difficult to rule out major flaws (i.e., a score of $\leq 4$ ). If the “no” option is used on questions 2, 4, 6, or 8, the review is likely to have major flaws (i.e., a score of $\leq 3$ ).

QUOROM statement: <http://www.consort-statement.org/QUOROM.pdf>

Table E-3 Compliance of Included Systematic Reviews with the QUOROM Index

QUOROM Item	Systematic Review										
	Biau et al. <sup>31</sup>	Dauty et al. <sup>28</sup>	Forster et al. <sup>27</sup>	Freedman et al. <sup>23</sup>	Goldblatt et al. <sup>30</sup>	Herrington et al. <sup>29</sup>	Prodromos et al. <sup>26</sup>	Schultz et al. <sup>22</sup>	Spindler et al. <sup>24</sup>	Thompson et al. <sup>25</sup>	Yunes et al. <sup>21</sup>
Identifying title	+	-	+	+	+	+	+	-	+	-	+
Abstract											
Structured Abstract	+	-	+	+	+	+	+	-	+	-	+
Objectives in Abstract	+	-	+	+	+	+	+	+	-	+	+
Data sources in Abstract	+	-	+	+	+	-	-	-	-	-	-
Review methods in Abstract	+	-	-	-	-	-	-	-	-	-	-
Results in Abstract	+	+	+	+	+	+	+	-	-	-	+
Conclusion in Abstract	+	+	+	+	+	+	+	+	+	+	+
Introduction	+	+	+	+	+	+	+	+	+	+	+
Methods											
Searches in Methods	+	+	+	+	+	+	+	+	+	+	+
Selection in Methods	+	+	+	+	+	+	+	-	+	+	+
Validity assessment in Methods	+	-	-	-	+	+	-	-	+	-	-
Data abstraction in Methods	+	-	-	+	+	-	-	-	-	-	-
Study characteristics in Methods	+	+	-	+	+	-	-	-	+	+	+
Quantitative data synthesis in Methods	+	-	+	-	+	-	-	-	-	-	+
Results											
Trial flow in Results	+	-	-	-	-	-	-	-	-	-	-
Study characteristics in Results	+	+	+	+	+	+	+	-	-	+	+
Quantitative data synthesis in Results	+	+	+	+	+	+	+	-	+	+	+
Discussion	+	+	+	+	+	+	+	+	+	+	+
QUOROM total	18	9	13	14	16	12	11	5	10	9	13

Table E-4 Compliance of Included Systematic Reviews with the Oxman and Guyatt Index

Questions	Systematic Review*											
	Biau et al. <sup>31</sup>	Dauty et al. <sup>28</sup>	Forster et al. <sup>27</sup>	Freedman et al. <sup>23</sup>	Goldblatt et al. <sup>30</sup>	Herrington et al. <sup>29</sup>	Prodromos et al. <sup>26</sup>	Schultz et al. <sup>22</sup>	Spindler et al. <sup>24</sup>	Thompson et al. <sup>25</sup>	Yunes et al. <sup>21</sup>	
1. Were the search methods used to find evidence stated?	+	+	+	+	+	+	+	+	+	+	+	+
2. Was the search for evidence reasonably comprehensive?	+	+	+	+	+	+	-	-	-	+	+	+
3. Were the criteria for deciding which studies to include in the overview reported?	+	+	+	+	+	+	O	O	+	+	+	+
4. Was bias in the selection of studies avoided?	+	+	-	-	-	-	-	-	-	-	-	-
5. Were the criteria used for assessing the validity of the included studies reported?	+	+	-	-	-	+	-	-	+	-	-	-
6. Was the validity of all studies referred to in the text assessed using appropriate criteria?	+	+	+	-	-	+	-	O	-	O	-	-
7. Were the methods used to combine the findings of the relevant studies reported?	+	+	+	+	+	-	+	-	+	+	+	+
8. Were the findings of the relevant studies combined appropriately relative to the primary question the overview addresses?	+	+	+	+	+	+	-	+	+	O	+	+
9. Were the conclusions made by the author(s) supported by the data and/or analysis reported in the overview?	+	+	+	+	+	+	O	+	+	O	+	+
Oxman and Guyatt Index†	7	6	3	2	2	2	1	1	2	2	3	3

\*O = partially done or not mentioned. †Ranging from 1 to 7 for extensive to minimal flaws, respectively (see text).

Table E-5 Primary Studies Included in the Systematic Reviews

	Systematic Review*										
	Biau et al. (2006)	Prodromos et al. (2005)	Thompson et al. (2005)	Goldblatt et al. (2005)	Herrington et al. (2005)	Dauty et al. (2005)	Spindler et al. (2004)	Forster et al. (2005)	Freedman et al. (2003)	Schultz et al. (2002)	Yunes et al. (2001)
Date of Last Literature Search in systematic review ( <i>day/month/year</i> )	14/03/05	NA	16/05/01	??/04/03	??/01/03	??/12/02	31/12/03	NA	??/05/00	NA	??/05/97
Arvidsson (1981)						+					
Fried (1985)						+					
Engebretsen (1990)									+		
Marder (1991)	+			+	+			+	+	+	+
O'Brien (1991)		+									
Aglietti (1992)									+		
Rosenberg (1992)						+					
Sgaglione (1992)									+		
Buss (1993)		+							+		
Otero and Hutcheson (1993)									+		
Aglietti (2-year follow-up) (1994)	+			+	+			+		+	+
Bach (1994)									+		
Karlson (1994)									+		
Schierl (1994)						+					
Bach (1995)		+									
Aglietti (1996)									+		
Arciero (1996)		+							+		
Grondveldt (1996)									+		
Howell (1996)									+		
Maeda (1996)		+							+		
Novak (1996)						+					
O'Neill (1996)							+		+	+	+
Aglietti (5-year follow-up) (1997)	+								+		
Callaway (1997)	+										
Feagin (1997)		+									
Heier (1997)		+							+		
Shelbourne (1997)						+					
Sgaglione (1997)		+							+		
Shelton (1997)									+		
Yasuda (1997)		+							+		
Tan (1997)		+									
Bach a (1998)									+		
Bach b (1998)		+							+		
Kleipool (1998)									+		
Meystre (1998)		+									
Muneta (1998)				+					+		
Nebelung (1998)		+							+		
Osteras (1998)						+					
Otto (1998)									+		
Plancher (1998)		+									

Tibone (1998)						+					
Webb (1998)									+		
Carter and Edinger (1999)					+						
Corry (1999)			+	+					+	+	+
Howell (1999)		+									
Jomha (1999)									+		
Hamada (2000)		+									
Marumo (2000)		+									
Noojin (2000)		+									
Patel (2000)		+							+		
Shelbourne (2000)		+									
Anderson (2001)	+				+		+			+	
Aune (2001)	+			+	+		+	+			
Beard (2001)	+				+					+	
Cooley (2001)		+									
Erikson a (2001)					+						
Erikson b (2001)	+	+	+	+	+		+	+		+	
Goradia (2001)		+									
O'Neill (2001)	+	+									
Pantano (2001)							+				
Ropke (2001)	+										
Webster (2001)				+	+						
Barrett (2002)		+		+							
Beynon (2002)	+	+					+				
Scranton (2002)		+									
Shaieb (2002)	+	+		+	+		+	+			
Ejerhed (2003)	+			+	+		+				
Feller Webster (2003)	+	+			+		+	+			
Gobbi (2003)		+									
Jansson (2003)	+			+	+		+				
Aglietti (2004)	+										
Hantes (2004)	+										
Williams (2004)		+									
Fabbriciani (2005)		+									
Harilainen (2005)		+									
Hill (2005)		+									
Ibrahim (2005)	+										
Laxdal (2005)	+										
Prodromos (2005)		+									
Total	19	35	2	11	13	9	9	6	29	7	4

\*NA = not applicable.

Table E-6 Authors' Recommendation on Using Patellar Tendon or Hamstring Grafts for Anterior Cruciate Ligament Reconstruction on the Basis of the Outcomes of Stability, Anterior Knee Pain, and Range of Motion

Systematic Review	Conclusion	Stability	Anterior Knee Pain	Range of Motion*	Total QUOROM Score	Total Oxman and Guyatt Score
Biau <sup>31</sup>	The morbidity rate associated with hamstring autografts was lower than that associated with patellar tendon autografts. The evidence that patellar tendon autografts offer better stability was weak. The poor quality of the studies that were evaluated called into question the robustness of the analyses.	Patellar tendon	Hamstring	NA	18	7
Dauty <sup>28</sup>	After discussing different bias in prospective randomized and comparative studies, the anterior cruciate ligament reconstruction with patellar tendon graft had a knee-extensor deficit for several months. The hamstring surgical procedure is associated with a less important knee extensor deficit (from 6% to 19%, as compared with 8% to 21%). Knee sprain and intra-articular surgery are associated with a long-lasting knee-extensor deficit. Anterior cruciate ligament reconstruction with use of hamstrings graft is associated with a knee-flexor deficit over a period of several months. The patellar tendon surgical procedure is associated with a less important knee-flexor deficit (from 1% to 15%, as compared with 5% to 17%). With regard to isokinetic parameters, no difference between the two surgical procedures (patellar tendon graft or hamstring graft) was shown after more than twenty-four months postoperatively.	Outcome not described	Outcome not described	Flexion: patellar tendon. Extension: hamstring	10	6
Forster <sup>27</sup>	Overall, there was a greater chance of extension loss ( $p = 0.007$ ) and a trend toward increased patellofemoral joint pain ( $p = 0.09$ ) with a patellar tendon graft. With a four-strand hamstring graft, there was a greater loss of hamstring power ( $p = 0.008$ ) and a trend toward an increased chance of a pivot shift $>1$ ( $p = 0.12$ ). There was no difference between the two groups in terms of Lachman testing, chance of returning to the same level of sport, clinical knee scores, graft ruptures, or other complications.	Inconclusive	Inconclusive	Hamstring	13	3
Freedman <sup>23</sup>	Patellar tendon autografts were associated with a significantly lower rate of graft failure and resulted in better static knee stability and increased patient satisfaction in comparison with hamstring tendon autografts. However, patellar tendon autograft reconstructions were associated with an increased rate of anterior knee pain.	Patellar tendon	Hamstring	Inconclusive	14	2
Goldblatt <sup>30</sup>	The data presented in this meta-analysis showed that the prevalence of instability was not significantly different between the bone-patellar tendon-bone grafts and the hamstring tendon grafts. However, the use of bone-patellar tendon-bone grafts was more likely to result in reconstructions that were associated with normal results on the Lachman test, normal results on the pivot-shift test, KT-1000 manual-maximum side-to-side differences of $<3$ mm, and fewer outcomes associated with substantial loss of flexion. In contrast, hamstring tendon grafts were associated with a reduced prevalence of patellofemoral crepitance, kneeling pain, and extension loss. The choice of graft by the patient and the surgeon must be individualized. The results of this meta-analysis can aid in this decision by clarifying the risks and benefits of each surgical approach.	Inconclusive	Hamstring	Flexion: patellar tendon. Extension: hamstring	16	2
Herrington <sup>29</sup>	The results of the thirteen studies that were included in this review suggested that there was no significant evidence indicating that one type of graft is superior. Both the patellar tendon grafts and the hamstring tendon grafts appeared to improve patients' performance, and therefore both types of grafts would be good choices for reconstruction of the anterior cruciate ligament.	Inconclusive	Inconclusive	Inconclusive	12	2
Prodromos <sup>26</sup>	The recent literature suggests that reconstruction of the anterior cruciate ligament with use of a four-strand hamstring grafts produces higher stability rates than does reconstruction with a bone-patellar tendon-bone graft, that the stability rates associated with four-strand hamstring grafts are fixation-dependent, that aperture fixation offers no stability advantage, and that the	Hamstring	Hamstring	Hamstring	11	1



	use of an EndoButton with second-generation tibial fixation produces consistently high stability rates.					
Schultz <sup>22</sup>	A review of prospective, randomized trials and a large controlled retrospective study suggested that, if fixation is controlled, the results associated with the two types of grafts are similar, with the possible exception of when the grafts are used for high-demand athletes, in whom patellar tendon grafts may be associated with a slight disadvantage. Large-scale prospective, randomized studies involving careful data collection and control are needed in order to better define graft performance in vivo.	Inconclusive	Inconclusive	Inconclusive	5	1
Spindler <sup>24</sup>	Increased kneeling pain in the patellar tendon group was consistently observed in the studies that were evaluated. Subjective differences in terms of anterior knee pain or return-to-activity level were not consistently observed in these studies. With the numbers available, failure rates were not significantly different between the groups. These findings suggest that graft type may not be the primary determinant of successful outcomes after anterior cruciate ligament surgery.	Inconclusive	Hamstring (kneeling)	Inconclusive	10	2
Thompson <sup>25</sup>	The risk of development of a range-of-motion extension deficit of >3° two years after surgery was 62% higher for patients who had undergone a patellar tendon procedure than for those who had undergone a hamstring graft procedure, and the risk of having an abnormal International Knee Documentation Committee score was 9% higher in the former group than in the latter group. There were no significant functional differences between the two groups. The authors also concluded that studies based on “high-quality randomized trials” are insufficient alone; clinicians should evaluate results of meta-analyses in order to determine whether data from individual studies were properly combined.	Inconclusive	Hamstring	Hamstring	9	2
Yunes <sup>21</sup>	Although both techniques, as performed in the late 1980s and early 1990s, yielded good results, patellar tendon reconstruction led to higher postoperative activity levels and greater static stability than hamstring reconstruction. This finding is significant on the basis of this meta-analysis.	Patellar tendon	Inconclusive	Inconclusive	13	3

\*NA = not applicable.