

APPENDIX 1
Modified Coleman Methodology Score^a

Section	Number or Factor	Score	Criteria
<i>Part A</i>			
Only one score to be given for each section			
Study size: number of patients	>60	10	
	41-60	7	
	20-40	4	
	<20, not stated	0	
Mean follow-up, y	>10	5	
No. of different treatment procedures included in each reported outcome. More than 1 method may be assessed, but separate outcomes should be reported	1 procedure	10	Surgical methods and/or nonoperative treatment methods
	More than 1 method but >90% of subjects undergoing the 1 procedure	7	
	Not stated, unclear, or <90% of subjects undergoing the 1 procedure	0	
Type of study	Prospective cohort study/randomized controlled trial	15	
	Retrospective cohort study	0	
Diagnostic certainty	In all	5	Arthroscopy
	In >80%	3	Arthroscopy or clinical examination for both knees
	In <80%	0	
Description of treatment given	Adequate (technique stated and necessary details of that type of procedure given)	5	Adequate description of surgical method or nonoperative treatment
	Fair (technique only stated without elaboration)	3	
	Inadequate, not stated, or unclear	0	
<i>Part B</i>			
Scores could be given for each option in each of the 3 sections			
Outcome criteria	Outcome measures clearly defined	4	Radiologic classification and standing position
	Reported either interrater or intrarater reliability	3	
	Use of outcome criteria that has reported good reliability	3	Kellgren and Lawrence
Procedure for assessing outcomes	Subjects recruited (results not taken from surgeons' files)	5	Radiologic assessment performed
	Investigator independent of surgeon/therapist	4	Radiologist independent of the authors of the study
	Written assessment	3	Use of questionnaires for evaluation of osteoarthritis
	Completion of assessment by subjects themselves with minimal investigator assistance	3	Western Ontario and McMaster Universities Index of Osteoarthritis, Knee Injury and Osteoarthritis Outcome Score, Tegner/return-to-sport questionnaire
Description of subject selection process	Selection criteria reported and unbiased	5	Inclusion criteria
	Recruitment rate reported >80%	5	Radiologic assessment
	Recruitment rate reported <80%	3	Radiologic assessment
	Eligible subjects not included in the study satisfactorily accounted for, or 100% recruitment	5	Dropout analysis
Total score		90	

^a The modified Coleman methodology score criteria used on the studies reporting knee osteoarthritis after ACL injury.

APPENDIX 2
 Characteristics of Studies Included in the Systematic Review, Listed Chronologically^a

Study	No. of Subjects Included	Description of Included Subjects	Additional Injuries and/or Re-injuries at Injury and Follow-up	Follow-up, y	Initial Treatment of ACL Tear	No. of Subjects Radiologically Assessed (%)	Radiologic Classification
Hanypsiak et al ³¹ (2008)	54	Mean age at follow-up: 39 years; male: 31, female: 13	Articular cartilage injury at injury: 25; meniscal lesions at injury: 50; partial meniscectomies: 21; meniscal sutures: 9; contralateral injuries at follow-up: 10; meniscal reoperation: 7; revision: 3; other reoperations: 5	12.7	Patellar tendon or hamstring tendon graft in all	44/54 (82)	Rosenberg method: JSN of 2 mm or more and Kellgren and Lawrence; weightbearing posteroanterior 45° flexion, lateral and skyline view
Kessler et al ⁴³ (2008)	124	Mean age at injury: 30.7 (12.5-54) years; male: 68, female: 41; Tegner at injury for ACL reconstructed/nonoperatively treated: 5.4/5.9; Tegner at follow-up for ACL reconstructed/nonoperatively treated: 5.3/4.9	Exclusions due to additional injuries in menisci or other ligaments or cartilage injuries: 27	11.1	BPTB graft with extra-articular screw fixation on tibia and femur: 60; nonoperative treatment: 49	109/124 (88)	Kellgren and Lawrence; cutoff value: 2; weightbearing anteroposterior extended position, lateral and skyline view described by Rosenberg for the injured leg only
Lebel et al ⁴⁵ 2008	154	Mean age at surgery: 28.8 (16-59) years; male: 76, female: 22	Medial/lateral/bilateral meniscectomies before surgery: 11/6/3; contralateral ACL injury: 19; meniscal lesion at follow-up: 55; medial/lateral meniscectomies at follow-up: 24/15; ACL graft ruptures/revisions: 9/4; meniscectomies at follow-up: 9; contralateral ACL injury during follow-up: 14	10	BPTB autograft	98/154 (64)	IKDC; weightbearing, posteroanterior, lateral, Merchant view
Nakata et al ⁵⁸ (2008)	123	Mean age at surgery: 20.9 years; male: 26, female: 35; 82% sports injured; activity level at injury/follow-up: 61/16% highly competitive; 39/28% well-trained, frequently sporting; 20/43% sporting sometimes; 3/13% nonsporting	Medial meniscal injuries at surgery: 10 (sutures, 3; meniscectomies, 7); lateral meniscal injuries at surgery: 16 (sutures, 7; meniscectomies, 9); articular cartilage lesions at surgery: 10; MCL at surgery: 2; 3 revisions during follow-up excluded; reinjuries not reported	10	Fresh-frozen tendon allograft without bone plugs	61/123 (49)	JSN 2 mm or more, subchondral bone sclerosis or osteophyte formation; posteroanterior weightbearing, lateral, and skyline view
Neuman et al ⁶⁰ (2008)	100	Mean age at injury/follow-up: 26/42 years; male: 58, female: 42; Tegner at injury: 7; Tegner at follow-up: 4	Meniscectomies at injury/follow-up: 25/29; ACL reconstructions during follow-up: 22	15.7	Nonoperative treatment	79/100 (79)	OARSI atlas, cutoff corresponding to Kellgren and Lawrence grade 2; weightbearing anteroposterior in 20° of flexion

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Appendix 2 (continued)

Study	No. of Subjects Included	Description of Included Subjects	Additional Injuries and/or Re-injuries at Injury and Follow-up	Follow-up, y	Initial Treatment of ACL Tear	No. of Subjects Radiologically Assessed (%)	Radiologic Classification
van der Hart et al ⁸⁸ (2008)	44	Mean age at surgery: 30.5 years; male: 17, female: 11; Tegner at surgery: 6.8; Tegner at follow-up: 6	Medial meniscal injury: 13; lateral meniscal injury: 7; both medial and lateral meniscal injury: 7; chondral injuries: 4; arthroscopies during follow-up: 6	10.3	BPTB autograft	28/44 (64)	Kellgren and Lawrence and Fairbank sign; weightbearing anteroposterior 30° flexion
Cohen et al ¹³ (2007)	82	Mean age at surgery: 27 years; male: 47, female: 15; activity level: not reported	Partial meniscectomies at surgery: 41; reinjuries: not reported	11.2	Patellar tendon autograft	62/82 (75)	Fairbank (cutoff grade 2); anteroposterior weightbearing; posteroanterior with 45° flexion; Merchant view, lateral with 30° flexion
Meunier et al ⁸³ (2007)	100	Mean age at surgery: 22 years; male: 33, female: 11; mean age at injury nonsurgically treated: 21 years (male: 35, female: 21); Tegner score at preinjury: 9; Tegner score at follow-up: 5.5	Meniscal tears at injury: 54; MCL tears at injury: 52 (32 repaired); surgically treated: 3 ACL revisions, 5 later meniscal tears; nonsurgically treated: 3 later ACL reconstructions, 18 later meniscal tears	15	Surgery: 41 (10 patients with multiple sutures with no augmentation; 31 patients with augmentation); nonsurgery: 52 (36 never operated; 16 later operated)	93/100 (93)	Ahlbäck and Fairbank (cutoff grade 2); standing radiographs of both knees in extension and in 30° flexion
Pinczewski et al ⁶⁷ (2007)	180	Hamstrings tendon group: median age at surgery: 24 years (male: 47, female: 43); patellar tendon group: median age at surgery: 25 years (male: 48, female: 42); activity level preinjury: all level 1 or 2; activity level at follow-up in patellar tendon group: 45% level 1 or 2; hamstrings tendon group: 57% level 1 or 2	Medial meniscal tears at surgery: hamstrings tendon group, 20, and for patellar tendon group, 18; lateral meniscal tears at surgery for hamstrings tendon group, 43, and for patellar tendon group, 34; meniscal sutures: 17; minimal meniscal resections: 15; ACL graft ruptures at 10 years: 19 (excluded from analyses); contralateral ACL injury: 29 (excluded from radiologic assessment); additional meniscectomies at follow-up: 13	10	Hamstring tendon: 90 patients; patellar tendon: 90 patients	Hamstring tendon group: 69/90 (76); patellar tendon group: 59/90 (65)	IKDC (cutoff grade C); weightbearing anteroposterior, 30° flexion posteroanterior, lateral and Merchant view
Drogset et al ¹⁹ (2006)	150	Mean age at surgery: 29 years; Tegner at preinjury: 6.3; Tegner at follow-up: 5.3	Excluded revisions; 30% of the patients had meniscal tears	16	Acute primary repair; acute repair with ligament augmentation device; acute repair with augmentation with an autologous BPTB graft	85/150 (56)	Ahlbäck (cutoff grade 1); standing radiographs of both knees at 45° flexion and with a 30° angulation of the beam

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Appendix 2 (continued)

Study	No. of Subjects Included	Description of Included Subjects	Additional Injuries and/or Re-injuries at Injury and Follow-up	Follow-up, y	Initial Treatment of ACL Tear	No. of Subjects Radiologically Assessed (%)	Radiologic Classification
Salmon et al ⁷⁵ (2006)	67	Mean age at injury: 27 years; male: 20, female: 47; activity level at preinjury: all participated in level 1 or 2; follow-up: 47% participated in level 1 and 2	Meniscectomies at surgery: 25; meniscus sutured at surgery: 7; meniscal excisions before surgery: 3; later meniscectomies: 6; ACL graft ruptured (excluded): 9	13	Endoscopic patellar tendon autograft	43/67 (64)	IKDC (cutoff grade C); weightbearing, bilaterally posterior-anterior, 30°, anteroposterior, lateral, and skyline views (cutoff grade 2); weightbearing; anteroposterior and lateral radiographs of both knees
Seon et al ⁷⁹ (2006)	70	Mean age at follow-up: 30.4 years; male: 55, female: 3; activity level at preinjury: 88% injured in pivoting sports; follow-up: 14% participated in pivoting sports	Meniscectomies at surgery: 33	11.2	Patellar tendon autograft with a single-incision arthroscopic-assisted reconstruction technique	58/70 (83)	Kellgren and Lawrence (cutoff grade 2); weightbearing; anteroposterior and lateral radiographs of both knees
Selmi et al ⁷⁸ (2006)	89	Mean age at injury/reconstruction/follow-up: 22/25/42 years; male: 79, female: 10; activity level: not reported	Meniscectomies at surgery: 59; meniscus sutured at surgery: 12; later meniscectomies: 9; high tibial valgus osteotomies after surgery: 7	17	Open procedure combining an intra-articular reconstruction with a BPTB graft, associated with an extra-articular tenodesis as described by Lemaire	89/148 (60)	IKDC (cutoff grade C); weightbearing anteroposterior and lateral in single-leg stance bilaterally, 45° flexion view in 2-leg stance (Rosenberg)
Yamaguchi et al ⁸⁴ (2006)	45	Mean age at surgery: 24.8 (15-43) years; male: 18, female: 8; Tegner at injury: 7; Tegner at follow-up: 4	Meniscectomies before ACL reconstruction: 2; ACL suture before inclusion: 1; medial meniscectomies at surgery: 15; lateral meniscectomies at surgery: 1; bilateral meniscectomies at surgery: 2; MCL: 2; medial meniscectomies at follow-up: 5; lateral meniscectomies at follow-up: 4; bilateral meniscectomies at follow-up: 1; contralateral ACL injuries at follow-up: 6	24	Intra- and extra-articular reconstruction with iliotibial tract	26/45 (58)	IKDC; weightbearing with 45° of flexion
Hart et al ⁸⁴ (2005)	40	Mean age at follow-up: 27.8 years; male: 21, female: 10; Tegner at follow-up: 6	Meniscectomies at surgery: 16	10	BPTB reconstruction	31/40 (77.5)	Ahlbäck (cutoff grade 2); weightbearing anteroposterior, lateral, and skyline views
Hertel et al ⁸⁶ (2005)	150	Mean age at follow-up: 42.2 years; male: 56, female: 39; Tegner at preinjury: 6.8; Tegner at follow-up: 6	Partial medial/lateral/both meniscectomies at surgery: 21/17/5; medial/lateral/both meniscus sutured at surgery: 17/2/1; later meniscectomies: 6	10.7	BPTB reconstruction with a press-fit fixation	67/150 (44.5)	IKDC (cutoff grade C); weightbearing anteroposterior with extended knee

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Appendix 2 (continued)

Study	No. of Subjects Included	Description of Included Subjects	Additional Injuries and/or Re-injuries at Injury and Follow-up	Follow-up, y	Initial Treatment of ACL Tear	No. of Subjects Radiologically Assessed (%)	Radiologic Classification
Strand et al ⁸⁶ (2005)	140	Mean age at injury/follow-up: 29/47 years; Tegner at preinjury: 5.2; Tegner at follow-up: 3.75	Preservation of meniscus at surgery: 28; meniscectomies/partial meniscectomies at surgery: 4/2; MCL sutures at surgery: 90; excluded revisions Meniscal surgery in 26 of the patients with radiographs	15-23	Bunnell suture in 16; U-suture in 63 (primary open repair without augmentation) 62% surgically treated, mostly with autologous patellar tendon graft (65%)	61/140 (43.5)	IKDC (cutoff grade C); weightbearing, anteroposterior in 2 projections
Lohmander et al ⁴⁷ (2004)	103	Mean age at follow-up: 31 years; activity level at preinjury: all female soccer players; follow-up: 8% soccer players	Meniscal surgery in 26 of the patients with radiographs	12	62% surgically treated, mostly with autologous patellar tendon graft (65%)	67/103 (65)	OARSI; weightbearing anteroposterior of both knees at 15° of flexion; axial view of patellofemoral joint in 40° flexion
Murray and Macnicol ⁵⁵ (2004)	24	Mean age at surgery/follow-up: 28.4/41.8 years; male: 17, female: 1; Tegner at follow-up: 4.7	Revisions of ACL: 5; later partial medial meniscectomies: 5	13.3	Leeds-Keio polyester ligament ACL surgery, open technique	18/24 (75)	IKDC (cutoff grade C); weightbearing anteroposterior, 30° of flexion, beam angle 10° to the horizontal
von Porat et al ⁹⁰ (2004)	205	Mean years at follow-up: 38 years; activity level at preinjury: all male soccer players; follow-up: 8% were still soccer players	Meniscal tears at injury: 59	14	65/154 (42%) treated without surgery; 89/154 (58%) reconstructed with patellar tendon graft in most of the subjects	122/205 (59.5)	OARSI; weightbearing, both legs, posteroanterior, 15° of flexion
Wu et al ⁹³ (2002)	103	Mean age at surgery/follow-up: 24/34 years; male: 36, female: 27; Tegner at preinjury: 7.3; Tegner at follow-up: 6.4	Preoperative meniscus surgery: 17; complete/partial meniscectomies at surgery: 9/38; meniscus sutured at surgery: 22; later partial medial meniscectomies: 3; revisions ACL: 2	10.4	Autologous BPTB reconstruction	63/103 (61)	Fairbank; posteroanterior and lateral radiographs
Fink et al ²² (2001)	113	Mean age at injury for surgically treated: 33.6 years; nonsurgically treated: 32.3 years; male: 37, female: 9; activity level at preinjury for surgically treated: 22% level 1; nonsurgically treated: 26% level 1	Meniscus injured at surgery: 23 (surgical) and 11 (nonsurgical); MCL injured at surgery: 7 (surgical) and 3 (nonsurgical); later meniscal tears: 7 (surgical) and 4 (nonsurgical)	11.5	BPTB graft, open technique with medial parapatellar arthrotomy	71/113 (63)	Fairbank sign, modified (cutoff grade 2); weightbearing anteroposterior 30° of flexion and lateral view
Segawa et al ⁷⁷ (2001)	107	Mean age at injury/follow-up: 22.8/34.9 years; male: 28, female: 42; Tegner at preinjury: 5.7; Tegner at follow-up: 4.5	Meniscectomies at inclusion: 55; untreated meniscal injuries: 10	11.6	Nonsurgically treated	70/107 (65.5)	Kellgren and Lawrence (cutoff grade 2); weightbearing anteroposterior and lateral radiographs of both knees

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Appendix 2 (continued)

Study	No. of Subjects Included	Description of Included Subjects	Additional Injuries and/or Re-injuries at Injury and Follow-up	Follow-up, y	Initial Treatment of ACL Tear	No. of Subjects Radiologically Assessed (%)	Radiologic Classification
Maletius and Messner ⁴⁹ (1999)	60	Mean age at injury/follow-up: 28/48 years; male: 48, female: 12; Tegner at preinjury: 7; Tegner at follow-up: 5	Meniscal injuries at surgery: 25; MCL injuries at surgery: 46; posterior oblique ligament at surgery: 18; partial meniscectomies at follow-up: 14; meniscal injuries at follow-up: 32	20	Acute nonaugmented repair in 83%	54/60 (90)	Fairbank and Ahlbäck (cutoff grade 2); weightbearing, lateral projection, anteroposterior, knee flexed to 20°
Meystre et al ⁵⁴ (1998)	30	Mean age at surgery: 26.3 years; male: 14, female: 13; activity level: 24 injured by pivoting sports; follow-up: 81.5% on the same level as preinjury	Presurgery medial meniscectomies: 3; presurgery ACL sutures: 3; presurgery ACL reconstructions: 3; meniscal or chondral injured at surgery: 63%; chondral lesions at surgery: 11; osteoarthritis at surgery: 2; later meniscectomies: 5	10	Looped semitendinosus tendon, reinforced by an extra-articular anterolateral procedure	26/30 (87)	IKDC (cutoff grade C); weightbearing anteroposterior radiographs of knees in 30° of flexion
Pritchard et al ⁶⁸ (1995)	79	Mean age at follow-up: 33.4 years; male: 47, female: 15; Tegner at follow-up: 5.1	Meniscectomies at surgery: 33; meniscal sutures at surgery: 17	11.2	Freeze-dried fascia lata allografts and an additional lateral extra-articular reconstruction	40/79 (50.5)	IKDC (cutoff grade C); weightbearing 45° flexion; anteroposterior, lateral, and infrapatellar view
Neyret et al ⁶¹ (1993)	43	Mean age at injury/surgery / follow-up: 23/28/53 years; were male soccer players; follow-up: no patients in pivoting sports	All meniscal injuries	27	Nonoperated	43/43 (100)	0-3 scale (cutoff grade 2); weightbearing, anteroposterior of 1 knee
O'Brien ⁶³ (1993)	328	Mean age at injury/follow-up: 18/39 years; male: 242, female: 86; multicenter study; activity level: not reported		20	No surgery: 12%; meniscectomy: 27%; intra-articular ACL reconstruction: 6%; intra-articular reconstruction and meniscectomy: 35%; extra-articular reconstruction: 2%; extra-articular reconstruction and meniscectomy: 18%	328/328 (100)	Fairbank (no cutoff); weightbearing anteroposterior radiographs, bilaterally

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Appendix 2 (continued)

Study	No. of Subjects Included	Description of Included Subjects	Additional Injuries and/or Reinjuries at Injury and Follow-up	Follow-up, y	Initial Treatment of ACL Tear	No. of Subjects Radiologically Assessed (%)	Radiologic Classification
Reid et al ⁶⁹ (1992)	46	Mean age at surgery: 22 years; male: 27, female: 5; Tegner at follow-up: 5	Presurgery partial meniscectomies: 12; intact menisci at follow-up: 2	11	Ellison technique of extra-articular transfer of the iliotibial band, without advancement of the biceps tendon	32/46 (69.5)	Fairbank sign (cutoff grade 2); weightbearing anteroposterior of both knees
McDaniel and Dameron ⁵⁰ (1983)	77	Mean age at injury/follow-up: 19.4/33 years; male: 41, female: 8; activity level: not clearly reported, but 36 participated in different strenuous sports at follow-up	Meniscectomies at 14-year follow-up: 45; both menisci intact: 8	14	Nonoperated (5 patients had reconstruction at 14-year follow-up)	45/77 (58)	JSN, osteophytes; weightbearing anteroposterior of both knees
Noyes et al ⁶² (1983)	39	Subgroup of 39 followed up more than 10 years after ACL injury; subject characteristics not specified for the subgroup; activity level at preinjury: 67% football and basketball players; follow-up: 35% participated in high-level sports	No reported meniscal injuries for the subgroup separately	11.2	Nonoperated	39/39 (100)	No specified atlas

⁶⁹BPTB, bone-patellar tendon-bone; IKDC, International Knee Documentation Committee; JSN, joint space narrowing; MCL, medial collateral ligament; OARSI, Osteoarthritis Research Society International.