

Return to sports - a risky business? A systematic review with meta-analysis of risk factors for graft rupture following ACL reconstruction, Sports Medicine, Anna Cronström; anna.cronstrom@umu.se, Eva Tengman, Charlotte Häger, Umeå University

Online resource 4.

Table 1. Characteristics of the studies included in the meta-analysis

Article, year & country	Study design	Participants (n)	Graft type	Number of graft ruptures (n (%))	Time to graft rupture (mean months)	Age Mean (sd/range)	Activity level /sports participation	Risk factor(s)	Follow-up (mean/range, years)	RoB
Adults, adolescents and children pooled										
Akhtar et al. 2016 [1] United Kingdom	Retrospective	54 females, 129 males	Hamstring autograft, patella autograft	44 (24)	68	With graft rupture: 28 (16-51), Without graft rupture: 28 (15-57)	NR	Generalized joint laxity	NR	High
Akada et al. 2019 [2] Japan	Retrospective	220 females, 206 males	Hamstring	14 (3)	8.5	28.4	Tegner score: 7.0 at primary injury	Associated injuries	2	High
Allen et al. 2016 [3] USA	Retrospective	180 females	Hamstring autograft, patella autograft, allograft	11 (6)	24.8	19.6 (6.9)	Tegner score: 7.9 at primary injury	Playing soccer, RTS	5.7	Low
Annear et al. 2019 [4] Australia	Prospective	19 females, 23 males	Hamstring autograft	5 (12)	7 to 49	28.9 (10.6)	NR	Age, sex, associated injuries	10	High
Barrett et al. 2011 [5] USA	Retrospective	179 females, 238 males	Patella autograft, allograft Hamstrings autograft	63 (15)	NR	<25: 17.8 (12-25), >25: 39 (26-59)	<25: Post operative Tegner score 5.7, >25: 4.3	Age	5.2	High
Beischer et al. 2020 [6] Sweden	Retrospective	70 females, 89 males	Patella, hamstring, quadriceps autograft, allograft	10 (6)	NR	21 (4.4)	Tegner score >6 at primary injury	Age, sex, activity level	1.3 (after RTS)	Moderate

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Benner et al. 2016 [7] USA	Prospective	553 (females/male s NR)	Patella autograft	42 (8)	NR	With graft rupture: 18.6 (5.1), without graft rupture: 23.7 (9.4)	Activity score: 8.4	age	4.1	Moderate
Bodkin et al. 2021 [8] USA	Prospective	104 females, 88 males	Patella, hamstring	24 (13)	NR	21.2 (9.2)	Tegner score at primary injury: 8.6	Sex, RTS	2	Low
Bourke et al. 2012[9] Australia	Retrospective	241 females, 432 males	Hamstring autograft, patella autograft	75 (11)	60	29 (13-62)	NR	Age, sex, family history, RTS, associated injuries	16	Moderate
Christensen et al. 2015 [10] USA	Retrospective	28 females, 42 males	Hamstring autograft, patella autograft, allograft	35 (50)	12	21	NR	Tibial slope	6.9	Low
Cooper et al. 2018 [11] USA	Prospective	484 females, 661 males	Patella autograft, allograft	34 (3)	NR	26	NR	Age, sex	2	High
Csapo et al. 2021 [12] Austria	Retrospective	17 females, 13 males	Hamstring, quadriceps	5 (17)	29.4	21.6 (4.0)	Professional ski racers at primary injury	Sex	At least 2 years	High
Digiacoimo et al. 2018 [13] USA	Prospective	12 females, 16 males	Patella, semitendinosus, quadriceps	14 (50)	16.4	Graft rupture: 17.9 (4.0) No graft rupture: 18.7 (4.0)	Tegner score at primary injury Graft rupture: 8.6 No graft rupture: 8.0	Tibial slope	4	Moderate
Everhart et al. 2020 [14] USA	Prospective	205 females, 303 males	Hamstring autograft, allograft, hybrid graft	31 (6)	17.6	24 (8.2)	NR	Associated injuries	3.2	Low

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Fleming et al. 2013 [15] USA	Prospective RCT	48 females, 42 males	Patella autograft, hamstring autograft	6 (7)	NR	Low tension: 24 (2.7) High tension: 23 (2.1)	Tegner score at primary injury Low tension: 7.6 High tension: 7.6	Age, sex, associated injuries, activity level	3	Moderate
Fältström et al. 2016 [16] Sweden	Retrospective	8 986 females, 11 838 males	Hamstring autograft	702 (3)	NR	Graft rupture: 21.9 (7.3) No graft rupture: 27 (9.9)	Soccer, other contact ball sports, other sport/recreation, other (causes of injury)	Timing of surgery, KOOS score	0.5-8.6	Low
Fältström et al. 2021 [17] Sweden	Prospective	117 females	NR	21 (18)	NR	20 (2)	All soccer players	Hop performance	2	Moderate
Gifstad et al. 2014 [18] Norway	Retrospective	19 031 females, 26 371 males	Patella autograft, hamstring autograft, allograft, other grafts	1198 (3)	NR	Patella autograft: 29 (13-71) Hamstring autograft: 26 (7-90)	93% injured during sport participation	Age, sex, playing soccer, associated injuries	3	Low
Goshima et al. 2014 [19] Japan	Retrospective	160 females, 73 males	NR	12 (5)	NR	21 (14-51)	Tegner score: 7 (Time point NR)	Family history	2	High
Grassi et al. 2020 [20] Italy	Retrospective	58 females, 186 males	Hamstring autograft	8 (3)	44	30.7 (10.6)	Tegner score ≥7: 44% <7: 56%	Age, sex, BMI, smoking status, timing of surgery, activity level	10	Low
Grassi et al. 2019 [21] Italy	Retrospective	18 females, 68 males	Hamstring autograft	43 (50)	NR	Graft rupture: 21.8 (q1-q3: 18.7-26.7)	NR	Tibial slope, femoral condyle ratio	3	Low

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						Controls: 23.3 (q1- q3: 19.6- 23.2)				
Gupta et al. 2020 [22] India	Retrospective	26 females, 314 males	Patella, hamstring	8 (2)	25.5	26 (5.5)	Tegner score at primary injury Graft rupture: 9.1 No graft rupture: NR	Age, sex	10	High
t 2018 [23] Switzerland	Prospective	186 females, 195 males	LARS	30 (8)	NR	33 (12)	Tegner score at primary injury: Graft rupture: 6, controls: 5	Age, sex, BMI, smoking status, activity level	2.5	Low
Henle et al. 2018 [24] Switzerland	Prospective	47 females, 51 males	LARS	11 (11)	NR	31.5 (9.8)	Tegner score at primary injury: 5	Age, Sex, activity level	2	Low
Ifran et al. 2020 [25] Singapore	Retrospective	153 females, 598 males	Hamstring autograft, allograft, patella autograft, allograft	44 (6)	32	23 (14-60)	NR	Age, sex, BMI	2-7	Low
Jaeger et al. 2018 [26] Germany	Retrospective	41 females, 85 males	Patella autograft, hamstring autograft	57 (45)	NR	Graft rupture: 26.6 (18-46) No graft rupture: 31.9 (18-68)	NR	Tibial slope	NR	Low
Kaeding et al. 2017 [27] USA	Prospective	1129 females, 1368 males	Patella autograft, hamstring	112 (4)	NR	26.9 (11.4)	Marx score at primary injury: 11.3	Age, sex, BMI, smoking status,	2	Low

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			autograft, allograft					associated injuries, playing soccer, activity level		
Kajetanek et al. 2017 [28] France	Retrospective	160 females, 227 males	Hamstring autograft	20 (5)	25	28.6 (13- 58)	Tegner score at primary injury: 5.2	Age, sex, tibial slope, Activity level	2.2	Moderate
Kamien et al. 2013 [29] USA	Retrospective	98 (females, males NR)	Hamstring	15 (15)	NR	Range. 12- 52	Tegner score (time point NR): Graft rupture: 5.5 No graft rupture: 4.8	Age, sex	2	High
Kim et al. 2020 [30] South Korea	Retrospective	19 females, 101 males	NR	31 (26)	NR	Graft rupture: 29.3 (8.3) No graft ruptures: 31.1 (7.9)	Pre-operative Tegner score: 3	Age, sex, BMI, tibial slope, Associated injuries	4.1	Low
King et al. 2020 [31] Ireland	Prospective	364 females, 1068 males	Patella autograft, hamstring autograft	39 (3)	21.4	24.4 (7.3)	Pre-operative Marx score: 10.9	Age, sex, associated injuries, contact/non- contact injury, activity level	2.4	Low
King et al. 2021 [32] Ireland	Prospective	88 males	Patella, hamstring	31 (35)	19.8	18 - 35	All played multidirectional field sport at primary injury	Hop performance , knee strength, Psychological readiness to RTS	2	High
Krismer et al. 2017 [33] Switzerland	Retrospective	109 females, 155 males	LARS	25 (9)	7.1	30.8 (12.2)	Tegner score at primary injury: 7	Age, sex, BMI, activity level,	2	Moderate

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								associated injuries		
Krosshaug et al. 2016 [34] Norway	Prospective	59 females	NR	4 (7)	NR	Graft rupture: 22.7 (3.8) including n=8 with C-ACL injury) No graft rupture: 23.6 (4.1)	Premier league handball players	Knee abduction	1-7	Low
Kyrtsis et al. 2016 [35] Qatar	Prospective	158 males	Patella, hamstring	26 (16)	3.5 (after RTS)	Graft rupture: 22 (5) No graft rupture: 21 (4)	Professional athletes	Age, playing soccer, hop performance, muscle strength	2.5 (after RTS)	Low
Laboute et al. 2010 [36] France	Retrospective	64 females, 234 males	Patella autograft, hamstring autograft	26 (9)	Patella autograft : 21.8 Hamstring autograft : 22	Graft rupture: 24 (6) No graft rupture: 26 (7.7)	All athletes playing at regional level or higher	Age, sex, contact/non contact injury	3.5	High
Larson et al. 2017 [37] USA	Prospective	102 females, 81 males	Patella autograft, hamstring autograft, allograft	13 (7)	NR	26.9 (12-62)	Tegner score at primary injury: 6.5	Sex, general joint laxity	6	High
Lee et al. 2021 [38] South Korea	Retrospective	26 females, 72 males	Hamstring	5 (5)	NR	Adolescents: 17.4 (1.3), adults: 32.3 (4.9)		Age	2.3	Low
Leys et al. 2012 [39] Australia	Prospective	85 females, 95 males	Patella autograft,	22 (12)	NR	24.5 (13-52)	81% participated in moderate-to-	Age, sex	15	High

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			hamstring autograft				strenuous activity at primary injury			
Lord et al. 2020 [40] Sweden	Retrospective	2684 females 3346 males	Hamstring autograft, patella autograft	146 (2)	NR	28.3 (10.7)	NR	Age, Sex, associated injuries,	2	Low
Magnussen et al. 2012 [41] USA	Retrospective	120 females, 136 males	Hamstring autograft	18 (7)	12	25 (10.5)	NR	Age, sex	1.2	High
Maletis et al. 2015 [42] USA	Retrospective	6277 females, 11159 males	Patella autograft, hamstring autograft, allograft	416 (2)	17	27.2 (IR: 18.7-37.7)	NR	Age, sex, BMI	2.4	Low
Mardani-Kivi et al. 2019 [43] Iran	Retrospective	179 females, 836 males	Hamstring autograft	33 (3)	NR	34 (8.9)	Sport inactivity – regular sport activity (Time point NA)	Age, sex, BMI, Family history	6.5	High
McPherson et al. 2019 [44] Australia	Prospective	118 females, 211 males	Patella, hamstring, quadriceps, synthetic graft	34 (10)	NR	25.3 (8.7)	Sports participation at primary injury	Sex, psychological readiness to RTS	2	Low
Mohtadi et al. 2016 [45] Canada	Prospective	147 females, 183 males	Patella, hamstring	17 (5)	18.3	28.5 (9.8)	Tegner Score ≥ 5 at primary injury	Sex	2	Low
Okoroha et al. 2019 [46] USA	Retrospective	130 males	NR	23 (18)	NR	25.3 (3.2)	NFL players	Age	NR	Low
Paterno et al. 2012 [47] USA	Prospective	42 females, 21 males	NR	4 (6)	NR	16.3 (2.9)	IKDC level 1-2	Sex	1	Moderate
Pfeiffer et al. 2018 [48] USA	Retrospective	38 females, 47 males	NR	49 (6)	NR	29.1 (9.7)	NR	Femoral condyle ratio	4.4	Moderate

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Pinczewski et al. 2007 [49] Australia	Prospective	85 females 95 males	Patella autograft, hamstring autograft	19 (11)	Patella autografts: 63 Hamstring autografts: 50	25 (13-42)	Pivoting, cutting or side-stepping sports at primary injury	Age, sex	10	High
Poston et al. 2020 [50] USA	Prospective	32 females, 17 males	Hamstring autograft, allograft, patella autograft, allograft	7 (14)	<24	16.5 (3.0)	Pivoting or cutting sport at primary injury	Age, sex, knee abduction	2	Low
Rahardja et al. 2020 [51] New Zealand	Prospective	3111 females, 4291 males	NR	285 (4)	NR	29.1 (10.9)	NR	Age, sex, timing of surgery, associated injuries	1.9	Low
Riff et al. 2017 [52] USA	Retrospective	929 females, 1296 males	Patella autograft, allograft, hamstring autograft, allograft	40 (2)	54	29.3 (15.1)	NR	Age, sex	15.7	High
Rosenstiel et al. 2019 [53] France	Retrospective	22 females, 48 males	Hamstring autograft	4 (6)	23.9	23.2 (15-37)	Tegner score: 9.3 at primary injury	Sex	3.9	Low
Runer et al. 2020 [54] Austria	Prospective	345 females, 530 males	Quadriceps autograft, hamstring autograft	38 (4)	NR	30.8 (12.4)	Tegner score: 6 at primary injury	Age, sex, activity level	2	Low
Salmon et al. 2005 [55] Australia	Prospective	289 females, 383 males	Patella autograft, hamstring autograft	39 (6)	20	28 (14-62)	IKDC level 1-4 at primary injury	Sex, family history, contact vs non-contact mechanism RTS,	5	Low

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								associated injuries		
Salmon et al. 2006 [56] Australia	Prospective	20 females, 47 males	Patella autograft	9 (13)	77.3	27 (NR)	Pivoting, cutting or side-stepping sports at primary injury	Sex, associated injuries	13	Low
Salmon et al. 2018 [57] Australia	Prospective	74 females, 105 males	Hamstring autograft	37 (21)	NR	25.8	Strenuous, moderate or light activity at follow-up	Age, sex, family history	19.7	Low
Sanders et al. 2017 [58] USA	Retrospective	535 females, 820 males	Patella autograft, hamstring autograft, allograft	72 (5)	58.8	26.6 (9.9)	NR	sex	10	Low
Sandon et al. 2020 [59] Sweden	Retrospective	252 females, 432 males	Patella autograft, hamstring autograft, allograft	34 (5)	NR	23.5 (7.6)	Soccer players	RTS	10	High
Sauer et al. 2019 [60] Denmark	Retrospective	34 females, 86 males	Hamstring	60 (50)	NR	22.5 (10-51)	NR	Tibial slope	4	Low
Schlumberger et al. 2017 [61] Germany	Retrospective	916 females, 1551 males	Hamstring, quadriceps	73 (3)	NR	32.4 (12.2)	NR	Sex	5	Moderate
Shelbourne et al. 2009 [62] USA	Prospective	552 females, 863 males	Patella autograft	61 (4)	19.2	21.6 (3.6)	Tegner score: > 7 at primary injury	Age, sex, timing of RTS	5	High
Singhal et al. 2007 [63] USA	Retrospective	31 females, 38 males	Tibialis allograft	16 (23)	22	31.7 (19-69)	NR	Age	4.5	High
Sousa et al. 2017 [64] USA	Prospective	131 females, 92 males	Patella autograft, allograft,	10 (4)	44	22 (12-59)	Tegner score: >6.5 at primary injury	Sex, timing of RTS	4	Low

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			hamstring autograft, allograft							
Su et al. 2020 [65] USA	Retrospective	59 females, 64 males	NR	46 (37)	NR	21.2 (6.8)	NR	Tibial slope	NR	High
Tagesson et al. 2016 [66] Sweden	Prospective	8 females, 11 males	Hamstring	3 (16)	24-48	Graft rupture: 21.3 (4) No graft rupture: 21.7 (4.4)	Tegner score: 7 at primary injury ²⁴⁻	Age, sex, KOOS score	5	Moderate
Thompson et al. 2015 [67] Australia	Prospective	44 females, 46 men	Patella autograft	6 (7)	84	25 (15-42)	Pivoting, cutting or side-stepping sports at primary injury	Age, sex, family history	20	Low
Van Eck et al. 2012 [68] USA	Prospective	103 females, 103 males	Hamstring allograft, tibialis allograft	27 (13)	11 (9)	24 (10)	NR	Age, sex, BMI, associated injuries	2.5	Low
Vincent et al. 2017 [69] China	Retrospective	3 females, 39 males	Patella	9 (21)	NR	Graft rupture: 22.8 (3.6) No graft rupture: 21.4 (4.4)	NR	Number of physical therapy visits	5	Low
Wasserstein et al. 2013 [70] USA	Retrospective	4708 females, 8259 males	Allograft, autograft	336 (3)	35	29.5 (10.5)	NR	Age, sex	5.2	Low
Webb et al. 2013 [71] Australia	Prospective	90 females, 91 males	Hamstring autograft	31 (17)	66	26	NR	Sex, tibial slope	15	High
Welling et al. 2020 [72] Netherlands	Prospective	20 females, 44 males	Patella autograft, allograft,	8 (13)	NR	27.7 (8.8)	Amateur team ball sports	RTS	2.1	High

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			hamstring autograft							
Webster et al. 2014 [73] Australia	Retrospective	191 females, 370 males	Autograft	25 (4)	20	28.5 (9.9)	NR	Age, sex, family history, RTS, associated injuries, contact/non-contact injury	4.8	Moderate
Webster et al. 2019 [74] Australia	Prospective	129 females, 200 males	Hamstring	50 (15)	33	17.2 (2)	NR	Hop performance	5	High
Webster et al. 2021 [75] Australia	Retrospective	253 females, 405 males	Hamstring	43 (7)	NR	26 (9)	Marx activity score 8.9 - 9.8 at follow-up	Sex	2	High
Wright et al. 2007 [76] USA	Prospective	110 females, 125 males	Patella autograft, allograft, hamstring autograft, allograft	7 (3)	NR	24 (11-54)	NR	Sex	2	High
Yabroudi et al. 2016 [77] USA	Retrospective	139 females, 112 males	Autograft, allograft	21 (8)	NR	26.1 (9.9)	58% competitive level at primary injury	Age, sex, BMI, RTS, timing of surgery	3.4	High
<i>Adults</i>										
Borton et al. 2018 [78] United Kingdom	Retrospective	76 females, 203 males	Hamstring autograft	11 (4)	15	31 (IQR: 23-42)	NR	Sex	4	High
Filbay et al. 2017 [79] Sweden	Prospective	32 females, 86 males	Patella autograft, hamstring autograft	5 (4)	NR	26 (5)	Moderate-high activity level (non professional) at primary injury	Age, BMI, smoking, activity level, number of physical therapy	5	Low

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								visits, associated injuries		
Lee et al. 2018 [80] South Korea	Retrospective	12 females, 116 males	Autograft, allograft	64 (50)	48.5	31 (18-60)	NR	Tibial slope	3.1	High
Lee et al. 2017 [81] South Korea	Prospective	19 females, 61 males	Hamstring autograft, tibialis allograft	4 (5)	12	34.4 (9.8)	NR	Sex	2.5	High
Pullen et al. 2016 [82] USA	Retrospective	2735 females, 13601 males	NR	587 (4)	16.6	28.9 (7.6)	94% active duty military	Age, sex, BMI, smoking, associated injuries	7	Low
Shelbourne et al. 1998 [83] USA	Prospective	234 women, 480 men	Patella	19 (3)	NR	24.3	Noyes score: 99.7% > 12 at primary injury	Sex	NR	Moderate
Tulloch et al. 2019 [84] Australia	Retrospective	23 females, 32 males	LARS	17 (30)	46.8	36 (19-58)	Cincinatti score at primary injury: 70	sex	7.8	Low
<i>Children/Adolescents</i>										
Bayomy et al. 2019 [85] USA	Retrospective	18 girls, 41 boys	Hamstring autograft, allograft	6 (10)	NR	12.5 (6.8-16)	NR	Sex	2.8	Low
Bram et al. 2020 [86] USA	Retrospective	237 girls, 213 boys	NR	56 (12)	NR	14.9 (2.2)	89% played sport at primary injury	Sex, family history	4.3	High
Britt et al. 2020 [87] USA	Retrospective	71 girls	Hamstring, patella autograft	8 (11)	<24	15.4 (1.3)	Soccer players	RTS, associated injuries	3.4	Moderate
Cruz et al. 2017 [88] USA	Retrospective	24 girls, 79 boys	Allograft, autograft, hybrid	11 (11)	23	12.1 (6.3-15.7)	NR	Age, sex, BMI, associated injuries	1.8	Low

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Ellis et al. 2012 [89] USA	Retrospective	56 girls, 34 boys	Patella autograft, allograft	9 (10)	9	16 (14-18)	All participated in high school athletics at primary injury	Sex	4-11	Low
Engelman et al. 2014 [90] USA	Retrospective	33 girls, 40 boys,	Hamstring allograft, autograft	15 (21)	NR	15 (11.2-18.7)	NR	Sex	2.7 - 4.2	High
Fones et al. 2020 [91] USA	Retrospective	46 girls, 28 boys	Hamstring allograft, autograft, Patella autograft	8 (11)	NR	15.9 (1.5)	Athletes	Sex, RTS, associated injuries	4	Moderate
Ghosh et al. 2020 [92] Australia	Prospective	32 girls, 68 boys	Hamstring allograft	12 (12)	11	14 (8-16)	NR	Sex, family history	2	High
Grassi et al. 2020 [93] Italy	Prospective	30 girls, 64 boys	Hamstring	8 (9)	NR	15.7 (1.5)	34% Tegner activity level >7 at primary injury	Tibial slope	>2	Low
Graziano et al. 2017 [94] USA	Prospective	12 girls, 30 boys	Hamstring autograft	4 (10)	13.7	12 (10-15)	All participated in sports at primary injury (level 1-3)	Sex	NR	High
Heath et al. 2019 [95] Australia	Retrospective	82 girls. 166 boys	Hamstring allograft	51 (21)	17.5	14.6 (8-17.9)	> 86% participated in sports at primary injury	Age, sex, family history, Growth plate status	4.5	Low
Ho et al. 2018 [96] USA	Retrospective	264 girls, 297 boys	Patella autograft, allograft, hamstring autograft, allograft, hybrid	54 (10)	13.6	15.4 (5-19)	NR	Age, sex, growth plate status	1	Low

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Larson et al 2016 [97] USA	Prospective	16 girls, 13 boys	Hamstring autograft, tibialis allograft	5 (17)	NR	13.9 (9-16)	All participated in cutting/pivoting sports at primary injury	Age, sex	4	Low
Mitchell et al. 2021 [98] USA	Retrospective	83 females, 70 males	Patella, quadriceps, hamstring	39 (25)	NR	14.2 (9.3 – 19)	NR	Tibial slope	3.5	Low
Morgan et al. 2016 [99] Australia	Prospective	104 girls, 138 boys	Patella autograft, hamstring autograft	27 (19)	51	13-18	> 91% participated in sports at primary injury	Age, sex, family history, associated injuries, RTS	16.5	Low
Perkins et al. 2019 [100] USA	Retrospective	197 females, 157 males	Hamstring autograft	50 (14)	16	15.3 (10-19)	NR	Age, sex, BMI, associated injuries	2	Low
Ranade et al. 2018 [101] USA	Retrospective	83 (sex NR)	Hamstring	11 (13)	32	12.3 (6.3-15.9)	NR	Age	4	High
Rauck et al. 2021 [102] USA	Retrospective	38 females, 15 males	Patella	4 (8)	15	16.6 (1.3)	All high school athletes	Sex	3.8	High
Schmale et al. 2014 [103] USA	Retrospective	23 females, 6 males	Hamstring autograft, tibialis allograft	4 (14)	39	14 (1.0)	Tegner score: 8 at primary injury	Sex	4	High
Wall et al. 2017 [104] USA	Retrospective	4 girls, 23 boys	Hamstring	3 (11)	26	11 (8-15)	NR	sex	3.6	Low
Webster et al. 2021 [105] Australia	Prospective	56 females, 73 males	Patella, quadriceps, hamstring	20 (16)	29	17 (1.9)	91% participated in cutting and pivoting sports	Sex	3.4	Low

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USA = United States of America, RoB = risk of bias, NR = not reported, RTS = return to sport, KOOS = Knee injury and Osteoarthritis Outcome Score, LARS = Ligament Advanced Reinforcement System, BMI = Body Mass Index, NFL = National Football League, IKDC = International Knee Documentation Committee subjective knee form, RoB = risk of bias

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