

Electronic Appendix

Search Strategy

We searched MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Trials for randomized trials comparing total knee arthroplasties performed with and without patellar resurfacing with use of the terms “patellar resurfacing,” “patellofemoral resurfacing,” “patellar non-resurfacing,” “patellar retention,” and “total knee arthroplasty.” (The last search was performed in November 2004.) References of retrieved articles were also screened. We set no language restrictions.

Detailed List of Data Extraction Items

All three investigators independently extracted the data and reached consensus on all extraction items. For each report, we recorded author names, journal title, year of publication, country of origin, calendar years of patient enrollment, patient eligibility and exclusion criteria, whether the mode of randomization was adequately described, whether blinding had been performed, and whether treatment allocation had been concealed. We gathered information on demographic characteristics as well as technical characteristics regarding the interventions (including the type of intervention and the types of prostheses used). Finally, for each of the compared arms, we recorded the number of patients and knees enrolled, randomized, and analyzed; the number of and reasons for postrandomization exclusions; and the duration of the follow-up period.

Subsequently, we recorded the number of patients who had undergone a secondary operation and the number of patients with postoperative anterior knee pain of any grade. We also kept information on the number of patients with different pain severity (mild pain or moderate/severe pain), respecting the classification in the individual trials. Finally, we recorded the average knee symptom and functionality assessment scores (i.e., the Knee Society score, The Hospital for Special Surgery score, or Bristol knee score, as applicable) and their corresponding standard deviations preoperatively and postoperatively as none of the trials reported the mean increase in the score scales after the arthroplasty.

Description of Fixed-Effects Versus Random-Effects Models and Heterogeneity Assessments

Individual effect sizes were synthesized across trials to derive an overall summary estimate with use of fixed-effects²⁶ and random-effects²⁷ models. Fixed-effects models assume that the observed differences between the results of the individual trials are due to chance alone, whereas random-effects models assume that there may be genuine diversity (heterogeneity) in the results of various studies and thus incorporate a between-study variance component into the calculations. When there is no observed between-study heterogeneity, fixed and random effects coincide. Otherwise, random effects usually yield more conservative results (wider confidence intervals). Especially for the outcome of reoperation, for which events were relatively rare, fixed-effects syntheses were preferable even in the presence of heterogeneity²⁸. The presence of between-study heterogeneity (diversity) across all studies was assessed with use of the chi-square-based Q statistic. As the Q statistic is relatively insensitive, heterogeneity is traditionally considered to be significant when $p < 0.10$ ^{25,26}. The extent of between-study diversity that is unlikely to be due to chance was estimated with use of the I² statistic²⁹. The possible value of I² ranges from 0% to 100%, and values $\geq 75\%$ imply very high heterogeneity.

The Method of Hedges for the Calculation of Standardized Mean Differences

The method of Hedges, used to calculate standardized mean differences (SMD_i) for knee scores between the two arms (indicated by indices 1 and 2) in the ith trial, is based on the formula:

$$SMD_i = \frac{m_{1i} - m_{2i}}{\sqrt{\left(\frac{(n_{1i} - 1)}{SD_{1i}^2} + \frac{(n_{2i} - 1)}{SD_{2i}^2}\right) \cdot \frac{1}{n_{1i} + n_{2i} - 2}}} \cdot \left(1 - \frac{3}{4(n_{1i} + n_{2i}) - 9}\right)$$

where m_{1i} and m_{2i} are the mean changes in the knee score, SD_{1i} and SD_{2i} are the corresponding standard deviations, and n_{1i} and n_{2i} are the sample sizes in the patellar resurfacing and non-resurfacing arms of trial i.

The standard error (SE_i) of SMD_i is given by the following formula:

$$SE_i = \sqrt{\left(\frac{n_{1i} + n_{2i}}{n_{1i} \cdot n_{2i}}\right) + \frac{SMD_i^2}{2(n_{1i} + n_{2i} - 3.94)}}$$

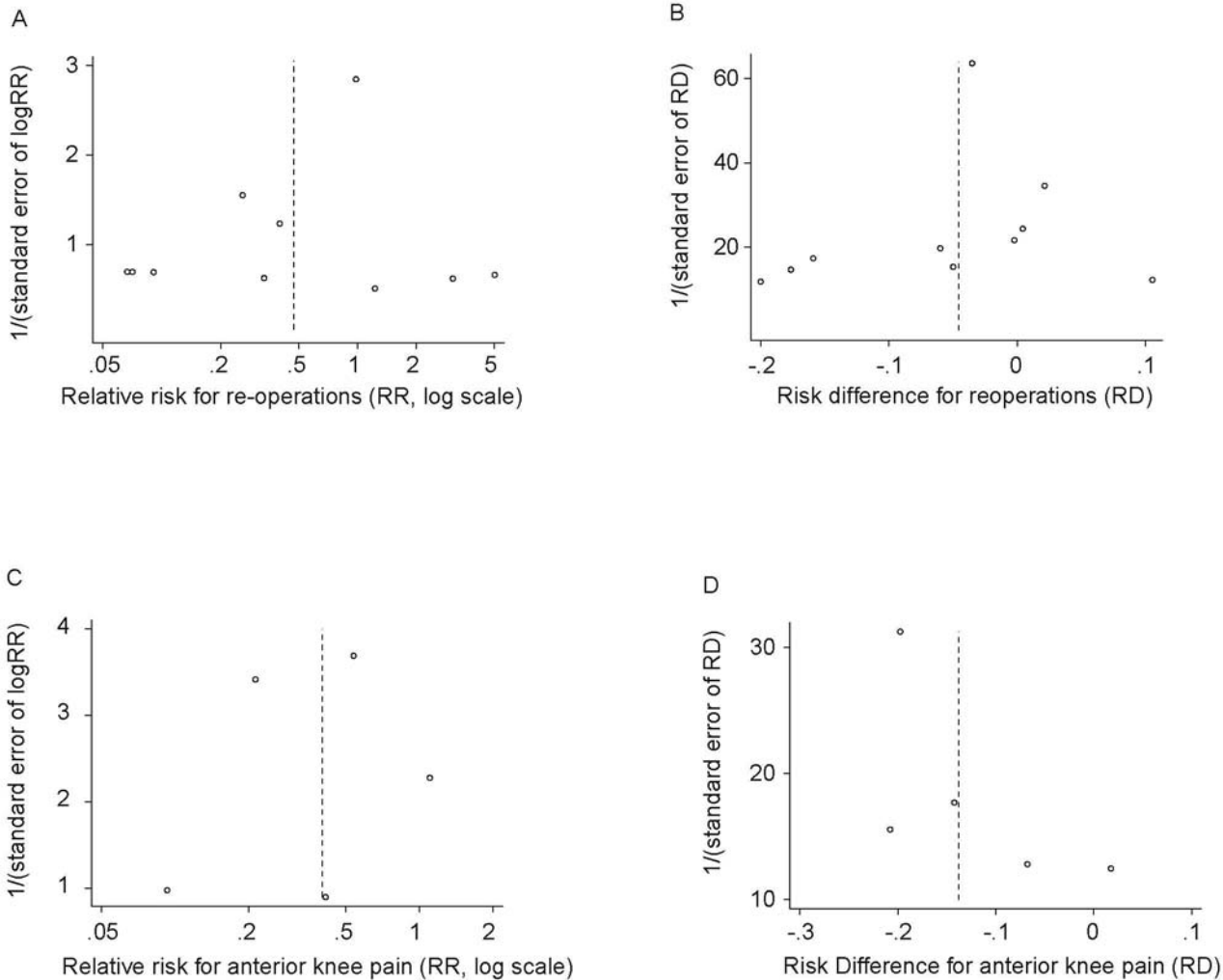


Fig. E-1

Inverted funnel plots for the outcomes of reoperation and postoperative anterior knee pain. In the inverted funnel plots, the effect size of each trial (logarithm of the relative risk [logRR] and risk difference [RD]) is plotted against its precision. In the absence of biases, the expected shape of the scatter points resembles a symmetric inverted funnel. Asymmetric funnel plots imply differential effects in smaller versus larger trials and may be suggestive of biases (particularly publication bias). There is no gross asymmetry in the funnel plots for the outcome of reoperation (panels A and B). There were fewer studies for the outcome of postoperative anterior knee pain (panels C and D), and there were no indications that there were any missing (unpublished) small and nonsignificant studies showing no effect. The mathematical detection of the asymmetries in the funnels plots (Begg-Mazumdar test) was not significant. The dotted lines pass through the summary effect size of the pertinent synthesis. RD = risk difference, and RR = relative risk.

TABLE E-1 Review of the Published Mean Clinical Scores in the Eligible Trials

First Author (Year of Publication)	Score Used*	Patellar Resurfacing†		Patellar Nonresurfacing†	
		Preoperative	Postoperative	Preoperative	Postoperative
Mayman (2003)‡	KSS	86.9	146.8	87.4	156.5
Bourne (1995)‡	KSS	86.9	147.7	87.4	163.7
Waters (2003) – osteoarthritis	KSS	KS=44.1, FS=NR	KS=91.4, FS=NR	KS=43.1, FS=NR	KS=88.5, FS=NR
Waters (2003) – rheumatoid arthritis	KSS	KS=33.0, FS=NR	KS=85.8, FS=NR	KS=41.4, FS=NR	KS=84.2, FS=NR
Kordelle (2003)	KSS	68.2	152.3	73.6	135.0
Wood (2002)	KSS	KS=57.4, FS=51.3	KS=87.0, FS=70.0	KS=55.7, FS=51.6	KS=86.5, FS=65.0
Barrack (2001)§	KSS	87.4	161.6	89.6	169.1
Barrack (1997)§	KSS	88.0	174.5	91.4	170.9
Newman (2000)	BKS	50.2	90.3	51.3	78.1
Waikukul (2000)	NR	NR	NR	NR	NR
Schroeder-Boersch (1998)	KSS	NR	KS=82.6, FS=80.0	NR	KS=65.7, FS=69.5
Feller (1996)	HSSS	63.8	85.7	61.6	88.6
Partio (1995)	KSS	KS=34.3, FS=45.6	KS=92.5, FS=77.1	KS=33.8, FS=46.2	KS=90.5, FS=78.1

*KSS = Knee Society Score, BKS = Bristol knee score, NR = not reported, HSSS = Hospital for Special Surgery knee score.

†KS = knee score component of KSS, FS = function score component of KSS, NR= not reported. Scores are presented as mean values. Postoperative scores refer to the maximal follow-up of each study. Especially for the KSS, some trials reported the knee and function components of the KSS separately. ‡Reports on the same patients. Mayman et al. (2003) presented outcomes after ten years of follow-up, whereas Bourne et al. (1995) presented outcomes after two years of follow-up. §Reports on the same patients. Barrack et al. (2001) presented outcomes after 5.9 years of follow-up, whereas Barrack et al. (1997) presented outcomes after 2.5 years of follow-up.

TABLE E-2 Main Analysis and Subgroup Analyses for Reoperation and Postoperative Anterior Knee Pain

	No. of Studies (No. of Knees)	Relative Risk (95% Confidence Interval)		pHet* (I ² [%])	Risk Difference (95% Confidence Interval)		pHet* (I ² [%])
		Random Effects	Fixed Effects		Random Effects	Fixed Effects	
<i>Reoperations</i>							
Overall	10 (1223)	0.46 (0.21-1.01)	0.48 (0.30 to 0.75)	0.12 (36)	-4.3 (-8.6 to -0.001)	-4.6 (-7.3 to -1.9)	<0.01 (60)
Follow-up							
<5 years	8 (708)	0.95 (0.51 to 1.76)	0.80 (0.46 to 1.39)	0.55 (0)	-0.9 (-4.2 to 2.3)	-1.5 (-4.0 to 1.8)	0.16 (33)
≥5 years	4 (733)	0.23 (0.09 to 0.56)	0.19 (0.08 to 0.46)	0.57 (0)	-9.3 (-16.5 to -2.0)	-6.7 (-9.8 to -3.6)	0.03 (68)
Year of publication							
≥2000	7 (1050)	0.35 (0.14 to 0.84)	0.41 (0.25 to 0.67)	0.09 (46)	-7.0 (-12.2 to -1.9)	-5.7 (-8.7 to -2.7)	0.02 (59)
<2000	5 (391)	1.01 (0.24 to 4.23)	1.01 (0.31 to 3.23)	0.53 (0)	-0.2 (-3.4 to 3.0)	0.0 (-3.2 to 3.2)	0.38 (6)
Blinding specifically reported							
Yes	4 (882)	0.43 (0.16 to 1.15)	0.51 (0.30 to 0.86)	0.08 (55)	-5.1(-10.1 to -0.1)	-4.3 (-7.5 to -1.0)	0.16 (42)
No	6 (341)	0.53 (0.12 to 2.37)	0.40 (0.16 to 1.00)	0.21 (30)	-3.9 (-11.5 to 3.7)	-5.3 (-10.3 to -0.4)	<0.01 (73)
Allocation concealment specifically reported							
Yes	4 (417)	0.46 (0.08 to 2.61)	0.60 (0.34 to 1.06)	0.04 (64)	-6.2 (-18.1 to 6.0)	-5.6 (-11.6 to -0.4)	<0.01 (74)
No	6 (806)	0.35 (0.15 to 0.81)	0.33 (0.15 to 0.72)	0.65 (0)	-2.8 (-6.8 to 1.1)	-4.0 (-6.7 to -1.4)	0.09 (48)
Indication for total knee arthroplasty†							
Osteoarthritis	9 (993)	0.39 (0.16 to 0.92)	0.44 (0.28 to 0.70)	0.09 (42)	-6.0 (-10.9 to -1.1)	-6.1 (-9.4 to -2.8)	0.03 (52)
Rheumatoid arthritis also	2 (160)	1.59 (0.14 to 18.6)	1.70 (0.17 to 16.6)	0.52 (0)	0.1 (-3.4 to 5.1)	0.1 (-3.1 to 5.7)	0.62 (0)
<i>Postoperative anterior knee pain</i>							
Overall	5 (927)	0.40 (0.19 to 0.85)	0.36 (0.26 to 0.51)	0.01 (70)	-13.8 (-21.2 to -6.4)	-15.8 (-20.4 to -11.1)	0.08 (52)
Follow-up							
<5 years	4 (478)	0.48 (0.30 to 0.76)	0.44 (0.28 to 0.69)	0.43 (0)	-12.2 (-18.7 to -5.6)	-12.9 (-19.3 to -6.5)	0.31 (16)
≥5 years	2 (567)	0.47 (0.09 to 2.34)	0.32 (0.20 to 0.50)	<0.01 (90)	-10.3 (-31.2 to 10.7)	-16.2 (-22.1 to -10.3)	0.01 (84)
Year of publication							
≥2000	4 (832)	0.47 (0.22-1.02)	0.39 (0.28 to 0.55)	0.01 (73)	-11.7 (-20.9 to -2.6)	-15.2 (-20.2 to -10.2)	0.05 (61)
<2000	2 (213)	0.27 (0.05 to 1.38)	0.27 (0.11 to 0.70)	0.13 (57)	-13.2 (-27.3 to 0.8)	-12.8 (-20.0 to -4.6)	0.09 (65)
Blinding specifically reported							
Yes	3 (785)	0.48 (0.20 to 1.14)	0.39 (0.28 to 0.55)	<0.01 (82)	-12.7 (-23.6 to -1.8)	-15.7 (-20.9 to -10.5)	0.04 (69)
No	2 (142)	0.18 (0.04 to 0.81)	0.16 (0.04 to 0.65)	0.31 (2)	-14.5 (-28.2 to -0.8)	-16.2 (-26.0 to -5.4)	0.16 (49)
Allocation concealment specifically reported							
Yes	2 (311)	0.71 (0.36 to 1.40)	0.65 (0.42 to 1.02)	0.16 (48)	-7.2 (-22.8 to 8.3)	-9.4 (-18.4 to -0.3)	0.10 (63)
No	3 (616)	0.21 (0.12 to 0.36)	0.20 (0.12 to 0.34)	0.61 (0)	-17.9 (-24.5 to -11.3)	-18.9 (-24.3 to -13.6)	0.28 (23)

*pHet = p value for heterogeneity, I² = percentage of between-study variance ascribed to heterogeneity and not to chance. †Partio et al. (1995) did not report separate counts per indication for total knee arthroplasty. Waters et al. (2003) gave separate counts for patients operated on for osteoarthritis and patients operated on for rheumatoid arthritis.