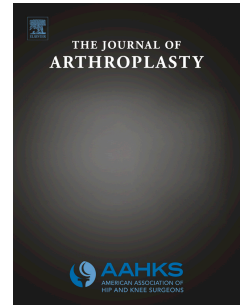


Accepted Manuscript

Patellar Resurfacing in Total Knee Arthroplasty. Systematic Review and Meta-Analysis

Umile Giuseppe Longo, Mauro Ciuffreda, Nicholas Mannering, Valerio D'Andrea, Matteo Cimmino, Vincenzo Denaro



PII: S0883-5403(17)30764-7

DOI: [10.1016/j.arth.2017.08.041](https://doi.org/10.1016/j.arth.2017.08.041)

Reference: YARTH 56071

To appear in: *The Journal of Arthroplasty*

Received Date: 26 June 2017

Revised Date: 2 August 2017

Accepted Date: 29 August 2017

Please cite this article as: Longo UG, Ciuffreda M, Mannering N, D'Andrea V, Cimmino M, Denaro V, Patellar Resurfacing in Total Knee Arthroplasty. Systematic Review and Meta-Analysis, *The Journal of Arthroplasty* (2017), doi: 10.1016/j.arth.2017.08.041.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Patellar Resurfacing in Total Knee Arthroplasty.

Systematic Review and Meta-Analysis

Umile Giuseppe Longo¹, Mauro Ciuffreda¹, Nicholas Mannering^{1,2}, Valerio D'Andrea¹, Matteo Cimmino¹, Vincenzo Denaro¹

¹ Department of Orthopaedic and Trauma Surgery, Campus Bio-Medico University, Via Alvaro del Portillo, 200, 00128 Trigoria, Rome, Italy

² University of Melbourne, Melbourne Medical School, Melbourne VIC 3010, Australia

Corresponding author:

Mauro Ciuffreda, MD,

Department of Orthopaedic and Trauma Surgery

Campus Bio-Medico University

Via Alvaro del Portillo, 200

00128 Trigoria, Rome, Italy

Phone: +3906225411613

Fax: +3906225411

E-mail: m.ciuffreda@unicampus.it

2 **Systematic Review and Meta-Analysis**

3

4 **Abstract**

5 **Background:** Patellar resurfacing in total knee arthroplasty remains controversial. The aim of this
6 study was to evaluate this technique through an analysis of comparative studies in current literature.

7 **Material and Methods:** We performed a comprehensive search of PubMed, Medline, Cochrane,
8 CINAHL, and Embase databases using various combinations of the keywords “Knee”,
9 “Replacement”, “Prosthesis”, “Patella”, “Resurfacing” and “Arthroplasty”. All articles relevant to
10 the subject were retrieved, and their bibliographies were hand searched for further references
11 relevant to primary patellar resurfacing in total knee arthroplasty. Only articles published in peer
12 reviewed journals were included in this systematic review.

13 **Results:** The percentage for a reoperation was 1% for the patellar resurfacing group (17/1636) and
14 6.9% for the non-resurfacing group (118/1699); (OR, 0.18; 95% CI, 0.11 to 0.29; $p < 0.00001$). The
15 patellar resurfacing group showed a significantly higher post-op KSS pain score, (OR, 1.52; 95%
16 CI, 0.68 to 2.35; $p = 0.004$), and post-op HSS score, (OR, 4.35; 95% CI, 3.21 to 5.49; $p < 0.00001$),
17 over the non-resurfacing group.

18 **Conclusion:** Based on the outcome scores of KSS (Pain), KSS (Function), and HSS post-op,
19 patellar resurfacing TKAs have performed better than non-resurfaced TKAs. The lower secondary
20 operation and revision rates for patellar resurfaced TKAs also demonstrates that this technique is
21 the more effective option. However, the full impact of patellar resurfacing still needs to be critically
22 evaluated by larger randomized controlled trials with long term follow up.

23 **Level of evidence:** Systematic review and meta-analysis (level III)

24 **Keywords:** Patellar resurfacing; Total knee arthroplasty; Meta-analysis; Systematic review,

25 Patellofemoral.

26

ACCEPTED MANUSCRIPT

28

29 Despite the excellent clinical success of total knee arthroplasty, there is no consensus in the
30 available literature on the best management of the patella in total knee Arthroplasty[1]. Current
31 options include resurfacing, and non-resurfacing with or without deafferentation (electrocautery
32 treatment) of the patella [2].

33 Anterior knee pain has been found in 6-25% of the patients after primary total knee arthroplasty
34 (TKA) with patellar retention and there is a great heterogeneity regarding the surgical options
35 between countries. According to different studies and registries carried out between 2014 and 2015,
36 in North America more than 90% of surgeons resurface the patella, 60% in Australia, 80% in
37 Denmark and 2% in Sweden and Norway [3]. Advocates of patellar resurfacing point out cost
38 effectiveness, lower number of reoperations and less anterior knee pain [4].

39 Despite these benefits, patellar resurfacing entails a greater risk of patellar fracture, dislocation,
40 implant failure, patellar tendon injury and patellar implant failure [5-7]. Studies also show that the
41 incidence of patello-femoral clunk in the patellar resurfaced group was significantly greater than the
42 non-resurfaced group[8]. Proponents of patellar retention sustain that patellar resurfacing offers no
43 advantages in functional outcomes, reoperation rate, or total healthcare cost and it is associated with
44 more complications [9].

45 On the other hand, non-resurfacing seems to be associated to a higher incidence of anterior knee
46 pain, readmission and further interventions, but it is also associated with more reoperations [6, 10].
47 Therefore, these results do not explain why a large proportion of TKAs in Europe, up to 95%,
48 employ a non-resurfacing technique [11]. Randomized trials have been performed, but no definitive
49 conclusions have been reached regarding which option is superior [12-19].

50 Therefore the aim of this meta-analysis was to cumulate data from a large number of randomized
51 controlled studies on patella resurfacing to establish the advantages and disadvantages of these

52 procedures with particular care to anterior knee pain, type of studies, follow up, revision and

53 reoperation rate, knee scores (KSS pain, function and total/ HSS).

54

ACCEPTED MANUSCRIPT

56 We performed a quantitative synthesis of all comparative studies to compare two technical
57 approaches to management of the patellar: patellar resurfacing and patellar non-resurfacing in terms
58 of revision and complications. according to the Preferred Reporting Items for Systematic Reviews
59 and Meta-Analyses (PRISMA) guidelines with a PRISMA checklist and algorithm [20, 21]. The
60 search algorithm according to the PRISMA guidelines is shown in Figure 1. A comprehensive
61 search of the PubMed, Medline, CINAHL, Cochrane, Embase, Ovid, and Google scholar databases
62 was performed using the following combinations of the keywords: “Knee”, “Replacement”,
63 “Prosthesis”, “Patella”, “Resurfacing” and “Arthroplasty”. We selected articles published from
64 inception of database to 2017. Three independent reviewers (U.G.L., M.C., and V.D.) separately
65 conducted the search. All journals were considered, and all relevant studies were analyzed. To
66 qualify for the study, articles had to be published in a peer-reviewed journal. All articles were
67 initially screened for relevance by title and abstract, excluding articles without an abstract, and
68 obtaining the full-text article if the abstract did not allow the investigators to assess the defined
69 inclusion and exclusion criteria. The three investigators (U.G.L., M.C., and V.D.) separately
70 reviewed the abstract of each publication and then performed a close reading of all papers and
71 extracted data, to minimize selection bias and errors. A cross-reference search of the selected
72 articles was also performed to obtain other relevant articles for the study. All comparative articles
73 reporting outcomes of patellar or not patellar resurfacing after total knee arthroplasty were taken
74 into account. The last search was performed on 31 March 2017.

75 According to the Oxford Centre of EBM, Level I-IV articles were found in the literature and
76 included in our study. Given the linguistic capabilities of the authors, articles in English, French,
77 Dutch, Spanish and Italian were included. Inclusion criteria were as follows: an appropriate
78 description of the surgical procedure; an adequate follow-up period; and at least one validated
79 outcome scores. Outcome parameters included anterior knee pain, revision rate and clinical scores.
80 Missing data pertinent to these parameters warranted exclusion from this systematic review.

81 Literature reviews, case reports, studies on animals, cadaver or in vitro investigations,
82 biomechanical reports, technical notes, letters to editors, and instructional courses were excluded.
83 We excluded articles with insufficient details of surgical intervention, follow-up, age of patients,
84 clinical examination, clinical postoperative outcomes, and statistical analysis.

85 Finally, to avoid bias, the selected articles, relative list of references, and the articles excluded from
86 the study were reviewed, assessed, and discussed by all the authors, and if there was disagreement
87 among investigators regarding the inclusion and exclusion criteria, the senior investigator (V.D.)
88 made the final decision. The following data were independently extracted by all the investigators:
89 demographics, second operations or revision, anterior knee pain, and clinical outcomes.

90 **Statistical Analysis**

91 Categorical variable data were reported as frequency with percentage. Continuous variable data
92 were reported as mean value, with the range between minimum and maximum values. In all studies,
93 $P < 0.05$ was considered statistically significant.

94 A meta-analysis was performed of all randomized comparative studies that investigated the two
95 approaches: resurfacing or not resurfacing the patella in case of total knee arthroplasty in terms of
96 KNEE SOCIETY SCORE (KSS), and HOSPITAL FOR SPECIAL SURGERY SCORE (HSS).
97 Review Manager (RevMan, version 5 for Windows; Cochrane Informatics and Knowledge
98 Management Department) was used to calculate the magnitude of treatment effect. I^2 was calculated
99 as a measure of heterogeneity for the main analysis. An I^2 value represents the percentage of total
100 variation across studies caused by heterogeneity rather than by chance. It was considered a low I^2
101 value to be 25% or lower and a high I^2 value to be 75% or higher.

102

103 **Quality Assessment**

104 To assess the quality of the evidence in the included studies, and to evaluate the strength of
105 recommendation of the intervention that is proposed in the published article, the GRADE (Grading
106 of Recommendations Assessment, Development and Evaluation) was used. The GRADE is used to
107 establish the quality of the evidence through four factors: study design, study quality, consistency,

108 and directness. The combination of these four factors determines the quality of strength of
109 recommendation that is given through a qualitative assessment of the evidence: high quality,
110 moderate quality, low quality and very low quality.

111

ACCEPTED MANUSCRIPT

113 Studies:

114 1788 potential relevant publications were identified through database searching (Figure 1).
115 Additionally, 27 titles were identified from review of references. From these 1815 articles the
116 abstracts of 65 articles explicitly described an analysis of patellar resurfacing in total knee
117 arthroplasty. These full text papers were obtained for potential inclusion. After applying the
118 inclusion- and exclusion criteria (Figure 1) 35 publications were available for analysis and were
119 included in a quantitative synthesis/review. An additional 21 publications were also included in the
120 review for qualitative discussion.

121 Demographic Details

122 The 35 studies [5, 9, 12-16, 18, 19, 22-47] included in this systematic review reported on 5585 total
123 knee arthroplasties. 2359 surgeries were performed with patellar resurfacing and 2345 without. The
124 mean number of knees included in each study group was 74.2. The median duration of follow-up
125 was 59.1 ± 37.2 months.

126 Outcome Assessment127 *Anterior Knee Pain– Meta-analysis*

128 18 studies [5, 9, 12-14, 19, 25, 26, 29, 32-34, 37-40, 42, 46] reported if any anterior knee pain was
129 present at time of follow up. Out of 3313 operated knees 401 presented with anterior knee pain
130 (12.1%). The resurfaced group showed that 8% (128/1596) presented with anterior knee pain,
131 whereas the non-resurfaced group showed a higher percentage with 15.9% (273/1717). The results
132 showed that the rate of anterior knee pain was statistically significantly higher in the non-resurfaced
133 group than in the resurfaced group (OR, 0.44; 95% CI, 0.35 to 0.55; $p < 0.00001$) (Figure 2). There
134 was no strong evidence of publication bias for the epidemiological studies based on a visual
135 inspection of the funnel plot, although there is some asymmetry suggesting smaller studies with
136 negative associations might be under-represented in the literature (Figure 3).

138 In the 22 studies [5, 12-14, 16, 22, 24-27, 34, 35, 37-40, 42-47] that documented the revisions due
139 to patellar complications, there was an overall reoperation rate of 4% (135/3335). The resurfaced
140 TKAs showed a reoperation rate of 1% (17/1636) and whilst the non-resurfacing group had 6.9%
141 (118/1699) of the knees were revised. Only the reoperations related to the patella-femoral joint were
142 captured for this analysis, excluding reoperations for infection or other reasons not related to
143 patella-femoral joint. The reasons to revised the patella prosthesis are: persistent anterior knee pain
144 35% (6/17), patellar fracture 12% (2/17), patellar component loosening 41% (7/17), patellar
145 subluxation or maltracking 12% (2/17). The results showed that the rate of reoperation was
146 statistically significantly higher in the non-resurfaced group than in the resurfaced group (OR, 0.18;
147 95% CI, 0.11 to 0.29; $p < 0.00001$) (Figure 4). There was no strong evidence of publication bias for
148 the epidemiological studies based on a visual inspection of the funnel plot (Figure 5).

149

150 *Functional Scores – Meta-analysis*

151 16 studies [5, 9, 14, 19, 24, 26, 30, 31, 33-36, 39-42] reported on the mean and standard deviation
152 for the outcome of post operative KSS (Pain), totalling 1173 patients for the patellar resurfacing
153 group and 1132 patients for the non-resurfacing group (Figure 6). The patellar resurfacing group
154 showed a significantly higher KSS pain score, (OR, 1.52; 95% CI, 0.68 to 2.35; $p = 0.0004$),
155 compared to the non-resurfacing group.

156 14 studies [5, 9, 19, 24, 26, 30, 31, 33-36, 39, 40, 42] with mean and standard deviations for
157 postoperative KSS (Function) were available, totalling 1112 patients in the patellar resurfacing
158 group and 1082 patients in the non-resurfacing group (Figure 8). The patellar resurfacing group did
159 not show a significantly different KSS function score, (OR, 0.38; 95% CI, -1.48 to 2.24; $p = 0.69$),
160 over the non-resurfacing group.

161 5 studies [31, 43-45, 47] reported on the mean and standard deviations for the postoperative HSS
162 score, with 362 patients in the patellar resurfacing group and 193 patients in the non-resurfacing

163 group (Figure 10). The patellar resurfacing group was found to have a significantly higher post-op
164 HSS score, (OR, 4.35; 95% CI, 3.21 to 5.49; $p < 0.00001$).

165 Four studies [5, 14, 33, 34] reported on the mean and standard deviations for postoperative KSS
166 (Total), (OR, -0.09; 95% CI, -2.53 to 2.34; $p = 0.94$) with 233 patients in the patellar resurfacing
167 group and 227 patients in the non-resurfacing group (Figure 12). The patellar resurfacing group did
168 not show a significantly different postoperative KSS (total) outcome score, (OR, -0.09; 95% CI, -
169 2.53 to 2.34; $p = 0.94$), over the non-resurfacing group.

170 All postoperative scores analysed have showed no strong evidence of publication bias for the
171 epidemiological studies based on a visual inspection of the funnel plot except for postoperative HSS
172 score (Figure 7, 9, 11, 13).

173

174 **Quality Assessment**

175 The quality of the evidence of the included studies was found to be high (Figure 14). Our findings
176 are strengthened by the comprehensive search and broad clinical eligibility criteria. In the GRADE
177 system of rating quality of evidence for each outcome, randomized trials begin as high quality
178 evidence but may be rated down by one or more of five categories of limitations. The eligible trials
179 in our analysis had methodological limitations including lack of blinding of all relevant parties and
180 substantial loss to follow-up in some trials. Results were sometimes inconsistent across trials, and
181 most studies used surrogate end points; larger effects were typically reported for surrogates
182 compared with direct measures of function.

183 Concerns about publication bias arose from the limited number of small trials, and the inconsistent
184 reporting of outcomes across trials raises the possibility of selective reporting bias, although we did
185 not rate down the evidence for publication bias or selective reporting bias. The strength of inference
186 is therefore limited.

187

189 The most important finding of this systematic review and meta-analysis is that the patellar
190 resurfacing group had significantly better KSS pain ($p = 0.0004$) and post-operative HSS scores (p
191 < 0.00001) compared to the non-resurfacing group. Additionally, the patellar-resurfacing group
192 showed a lower reoperation rate ($p < 0.00001$) and postoperative anterior knee pain ($p < 0.00001$)
193 compared to non-resurfaced TKAs. Therefore, based on these endpoints alone, patellar resurfaced
194 TKAs were demonstrated to have performed better overall.

195 Our systematic review and meta-analysis of eligible comparative trials found 35 studies with a total
196 of 5585 knees. It was documented that the rate of revision surgery is lower following total knee
197 arthroplasty with patellar replacement than it is after total knee arthroplasty without patellar
198 replacement. The risk of anterior knee pain in the patellar resurfacing group was less than half that
199 of the non-resurfacing group. This is somewhat reflected in our meta-analysis, which shows that the
200 patellar resurfacing group had better overall KSS pain scores, (OR, 1.52; 95% CI, 0.68 to 2.35; p
201 $= 0.0004$), compared to the non-resurfacing group.

202 However, some studies pointed to the contrary. Both anterior knee pain and rate of revision was
203 found to be higher with patellar resurfaced TKAs in studies by Calvisi et al. 2009 [48] and Pakos et
204 al. 2005 [6]. The inability to include studies like these in the meta-analysis, due to incomplete mean
205 and standard deviation data, makes full interpretation of the results difficult. Whilst the data set is
206 limited, restrictions on the inclusion criteria for these analyses are necessary to make comparisons
207 valid.

208 It must be noted that performance outcomes are not the only driving force behind the decision to
209 resurface or not to resurface the patellar. In current practice the incidence of patellar resurfacing
210 during total knee arthroplasty (TKA) varies by geography. In the United States, for example, the
211 majority of knee replacements are tri-compartmental, whereas in Europe, TKA without patellar
212 resurfacing is more routine. An analysis of the Australian Orthopaedic Association National Joint
213 Replacement Registry showed in 134,799 TKAs a patellar resurfacing technique was employed in

214 43 per cent[49]. Conversely, the rate of patellar resurfacing in Europe is described significantly
215 lower, with 5% in Norway and 10% in Sweden [11].

216 Perhaps the reason for these discrepancies is that, at the moment, patellar resurfacing depends
217 essentially on the surgeon's preference. Current surveys in the Netherlands and the United
218 Kingdom show that about 50% of surgeons use patellar resurfacing in selective cases, whilst the
219 others never or always perform patellar replacement [11, 50]. The indications for selective patellar
220 resurfacing depended on patella-femoral cartilage status, patient age and patellar alignment, but
221 there is no evidence-based data for this approach [50, 51]. The moderate to high heterogeneity
222 found in our meta-analysis across the outcome scores of HSS post-op and for KSS Function (I^2 ,
223 97% and 52% respectively), also highlights that results vary quite significantly, potentially causing
224 relative individual bias towards a particular technique.

225 *Limitations:*

226 Some limitations of our systematic review should be acknowledged. First, broad inclusion criteria
227 were applied to analyze all available studies according to the Coleman methodology score. For
228 further detailed analysis only the excellent studies (CMS>85 points) were considered. Second, the
229 CMS is designed for tendinopathy and the requirement of a stronger influence of a long term follow
230 up is not considered. Third, in some trials, data on the prevalence of anterior knee pain, revision rate
231 and the various knee scores were incompletely reported or were not reported at all.

232 The designs and implantation technique for each of the participants in the studies that were
233 analyzed may have varied significantly. This is reflected in our heterogeneous cohort.
234 Heterogeneity may explain the finding that some studies showed associations between patellar
235 resurfaced TKAs and anterior knee pain, whilst others only found associations between higher
236 revision rates, with some finding neither. Previous meta-analysis that compared these two treatment
237 strategies [1, 6, 48, 52-55] also highlight these concerns.

238 Follow up times of the included studies also varied. There is evidence in current literature that the
239 majority of the complications appear in the long term follow up after 3 to 4 years[25]; however 12

240 of the analyzed studies showed a follow of only 3 years or less. This may underestimate the actual

241 rate of complications in either technique.

242 Importantly, none of these studies mentions the abilities and experience of the surgeon. Particularly

243 because resurfacing of the patellar involves greater operative time and attention, the experience of

244 the surgeon, including their biases, may be a determining factor in the decision to resurface or not to

245 resurface the patellar. In an effort to create a more homogenous cohort, studies that continue this

246 work should account for these individual surgeon factors in the methodology.

247 Other confounding factors may also play an important role when considering resurfacing of the

248 patellar; one study found differences when separating the cohort into those with preoperative

249 patella-femoral pain and those without preoperative patella-femoral pain – notably, only those with

250 preoperative pain had less crepitus after a resurfacing the patellar, yet those without pain had more

251 crepitus after resurfacing the patellar [8]. This potentially complicates the field, in which there must

252 be greater awareness of not only how the technique will perform in general, but also how the

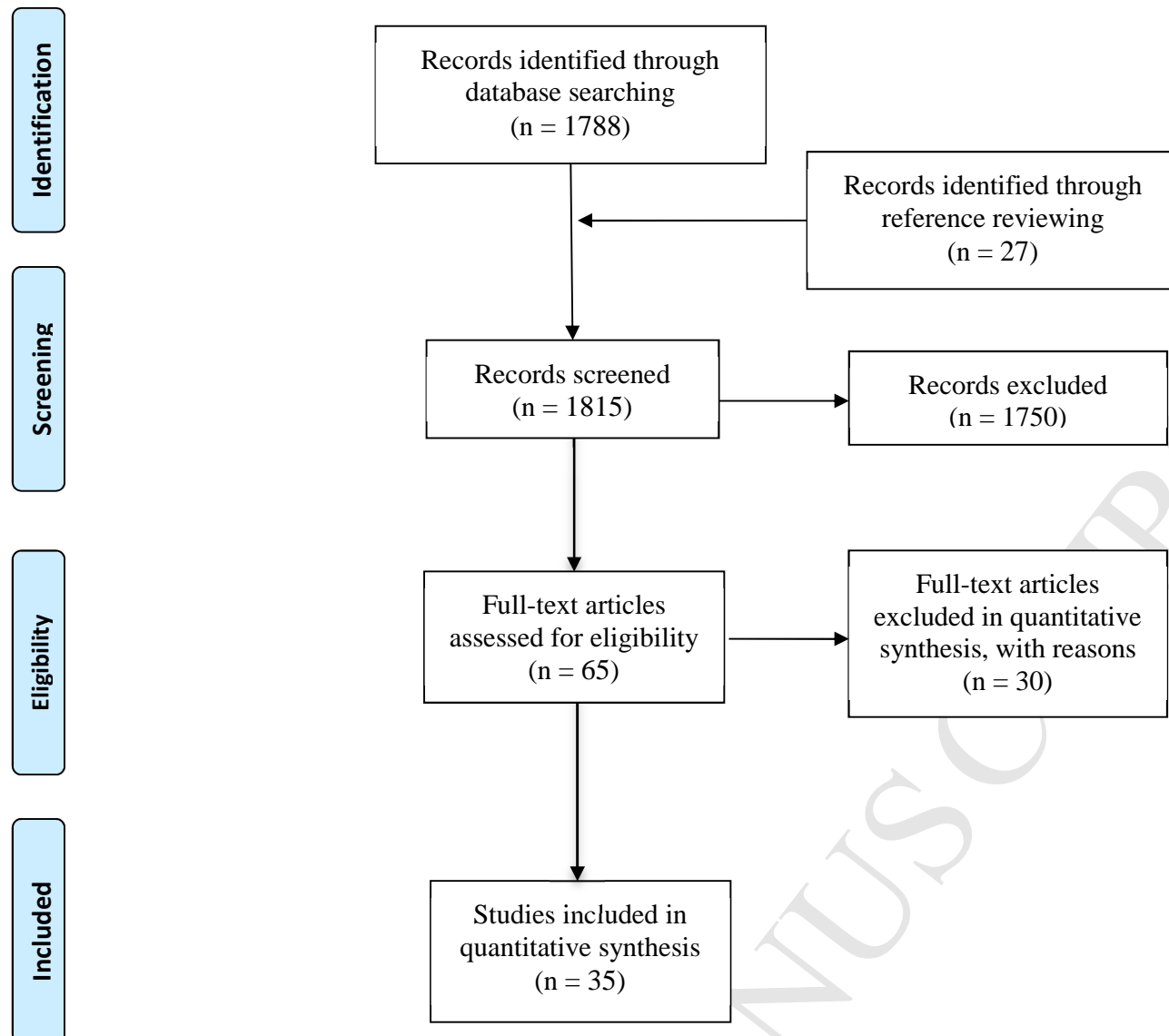
253 technique performs when applied to particular patient cohorts.

254

256 Our meta-analysis has identified that based on the outcome scores of KSS (Pain) and HSS post-
257 operatively, patellar resurfacing TKAs have performed better than non-resurfaced TKAs. The lower
258 anterior knee pain and reoperation rates for patellar resurfaced TKAs also points to this technique as
259 being the more effective option. However, standardized reporting of outcomes and follow up times
260 in more randomized controlled trials should be pursued for greater understanding of how the
261 patellar should be managed in these patients.

262

ACCEPTED MANUSCRIPT



265 Table 1. Demographics, re-operation, anterior knee pain and clinical outcome (KSS score)

Study	Type of study	N° knees enrolled	Knees reviewed	Lost at final FU (patients)	Mean FU (months)	Evaluation of outcome	Type	N° of knees (final FU)	AntKnee Pain	Re-operation	KSS mean score ± SD				
											Pre-op		Post-op		Total
											Pain	Function	Pain	Function	
Abraham et al. 1988 [22]	Prospective trial	111	100	11	60	Subjective symptoms, function, physical examination, radiographs	Resurfaced	47	-	1	-	-	-	-	-
							Non-resurfaced	53	-	2	-	-	-	-	-
Aunan et al. 2015 [9]	randomized, double-blind study	130	63	1	36	KOOS, Knee Society clinical rating system, Oxford knee score, visual analog scale (VAS).	Resurfaced	63	1	1	34 ± 18	65 ± 19	92 ± 9	83 ± 21	-
			Non-resurfaced				66	-		35 ± 15	69 ± 20	90 ± 14	83 ± 21	-	
Barrack et al. 1997 [23]	DB, prospective randomized study	121	58	3	30	Knee Society clinical scoring system, patient satisfaction questionnaire, radiographs	Resurfaced	58	4 (6.9%)	0	45.8	-	91.2	83.3	174.5
			Non-resurfaced				60	8 (13.3%)	6	47.4	-	89.3	81.3	170.9	
Barrack et al. 2001 [12]	DB, Prospective randomized trial	121	93	28	70.5	Knee Society clinical score, patient satisfaction questionnaire, radiographs	Resurfaced	47	9 (19.1%)	0	45.3	-	88.3	73.5	161.6
			Non-resurfaced				46	8 (17.4%)	7	43.6	-	88.5	80.7	169.1	
Bourne et al. 1995 [24]	Prospective randomized trial	100	100	-	24	Knee Society clinical rating, 30-seconds stair climbing, hamstring torques	Resurfaced	50	-	0	37 ± 15	41 ± 13	81 ± 15	67 ± 26	-
			Non-resurfaced				50	-	2	41 ± 14	44 ± 13	87 ± 8	76 ± 19	-	
Boyd et al. 1993 [25]	Retrospective	1197	686	252	78	Interview, examination, AKP	Resurfaced	396	1 (0.3%)	-	-	-	-	-	
			Non-resurfaced				495	51 (10.3%)	51	-	-	-	-	-	
Burnett et al. 2004 [26]	Prospective randomized clinical trial	100	42	10	129.6	KSS, VAS for AKP, functional tests	Resurfaced	42	13 (30.1%)	1	44.7 ± 19	40.8 ± 13.8	86.9 ± 12.8	58.7 ± 24.7	-

			48					<i>Non-resurfaced</i>	48	11 (23%)	3	43.4 ± 16.7	42.4 ± 14.4	85 ± 13.5	59.5 ± 25.3	-
Burnett et al. 2007 [13]	Prospective randomized clinical trial (bilateral)	64	56	8	110	Knee Society Clinical Rating Score (KSCRS), questionnaire (non validated)		<i>Resurfaced</i>	28	4 (16.5%)	1	48	38	83	63	146
								<i>Non-resurfaced</i>	28	5 (17.3%)	2	50	40	83	65	148
Cameron et al. 1982 [27]	Retrospective	77	14	0	12	British rating system, radiographs		<i>Resurfaced</i>	14	-	1	-	-	-	-	-
			63					<i>Non-resurfaced</i>	63	11 (17.5%)	1	-	-	-	-	-
Campbell et al. 2006 [14]	Randomized prospective trial	100	46	0	120	KSS, WOMAC		<i>Resurfaced</i>	30	14 (47%)	1	36.0 ± 14.9	-	71.8 ± 14.2	-	137.6 ± 37.7
			54					<i>Non-resurfaced</i>	28	12 (43%)	2	39.9 ± 17.4	-	74.9 ± 14.0	-	135.5 ± 31.8
Enis et al. 1990 [28]	Retrospective (bilateral)	50	25	5	40	Radiographs, examination, phone interviews		<i>Resurfaced</i>	20	-	-	-	-	-	-	-
			25	5				<i>Non-resurfaced</i>	20	-	-	-	-	-	-	-
Garneti et al. 2008 [5]	Retrospective study	142	76	0	33 (non-res)	AKP, patellar apprehension, knee instability, ability to kneel, return to preop. function level, KSS, Eurocol score		<i>Resurfaced</i>	76	5 (6.6%)	0	-	-	89 ± 10.62	72 ± 25.01	161 ± 33.07
			66	-	18 (res)			<i>Non-resurfaced</i>	66	18 (27.3%)	9	-	-	81 ± 26.30	75 ± 28.55	156 ± 52.70
Gildone et al. 2005 [29]	A prospective, randomised clinical trial	56	28	-	25.4	KSS, patella-related activities		<i>Resurfaced</i>	28	0	-	-	-	-	86.7	178.3
			28					<i>Non-resurfaced</i>	28	6	-	-	-	-	85.5	178.0
Joo et al. 2013 [30]	Level III, therapeutic study	49	23	0	28.8	KSS, WOMAC, Anterior Knee Pain Scale		<i>Resurfaced</i>	23	-	-	43.07 ± 13.08	34.81 ± 10.05	66.12 ± 14.16	54.58 ± 13.78	-
			26					<i>Non-resurfaced</i>	26	-	-	45.25 ± 9.46	38.75 ± 7.20	69.4 ± 13.29	61 ± 11.77	-
Kim et al. 2014 [31]	Retrospective matched-pairs case-control. Level of evidence IV	373	69	281 knees excluded	104.4	ROM, Kellgren and Lawrence scale, WOMAC, KSS, HSS		<i>Resurfaced</i>	69	-	-	36.6 ± 17.5	46.0 ± 21.6	98.3 ± 8.8	88.6 ± 10.2	-
			23					<i>Non-resurfaced</i>	23	-	-	37.6 ± 21.1	42.9 ± 14.9	91.5 ± 7.6	86.5 ± 13.6	-
Levai et al.	Retrospective	73	39	2	60	Clinical information		<i>Resurfaced</i>	39	2 (5%)	-	-	-	-	-	-

1983 [32]			32			n sheet, Radiographs	<i>Non-resurfaced</i>	32	9 (28%)	2	-	-	-	-	-
Li et al. 2012 [33]	Retrospective Study	130	59	-	112.8	AKP, KSS, patient satisfaction, revision rate and radiographic findings	<i>Resurfaced</i>	59	3 (5.1%)	-	22.1 ± 6.5	-	47.6 ± 8.2	83.4 ± 16.7	91.6 ± 10.1
			71				<i>Non-resurfaced</i>	71	10 (14.1%)	-	24.3 ± 6.9	-	46.9 ± 7.5	82.2 ± 17.5	92.1 ± 11.4
Liu et al. 2011 [34]	Prospective randomized trial	144	74	12	84	KSS, anterior knee pain rate, radiographs	<i>Resurfaced</i>	68	10 (14.7%)	0	23.5 ± 7.2	-	46.7 ± 7.4	83.8 ± 16.3	91.4 ± 10.2
			70				<i>Non-resurfaced</i>	64	8 (12.5%)	0	21.1 ± 8.5	-	46.0 ± 8.6	80.2 ± 18.1	91.5 ± 9.4
Mayman et al. 2003 [16]	Randomized clinical trial	100	50	0	120	Knee Society Scores, Patient-Determined Subjective Questionnaires	<i>Resurfaced</i>	50	-	1	-	-	-	-	146.8
			50				<i>Non-resurfaced</i>	50	-	5	-	-	-	-	156.5
Myles et al. 2006 [35]	Prospective randomized trial	50	25	8	24	American Knee Society Clinical Rating System, WOMAC, Motion Analysis	<i>Resurfaced</i>	18	-	0	40.7 ± 11.4	53.8 ± 13.5	83.2 ± 14.8	63.6 ± 17.6	146.8
			25				<i>Non-resurfaced</i>	24	-	0	41.9 ± 10.8	62.2 ± 12.1	83.4 ± 16.1	79.2 ± 18.3	162.6
Ogon et al. 2002 [36]	Retrospective	65	44	0	139.2	KSS, Knee Society Roentgenographic Evaluation System	<i>Resurfaced</i>	44	-	-	-	-	85.3 ± 12.9	70.3 ± 23.4	-
			21				<i>Non-resurfaced</i>	21	-	-	-	-	82.7 ± 16.2	71.7 ± 22.4	-
Park et al. 2010 [37]	Retrospective	71	38	10	149 (res)/140.7 (non-res)	AKSS, HSS Score, Bristol patellar score, Lonnerpat.-fem. score, radiographs	<i>Resurfaced</i>	36	1 (2.8%)	0	50.5 ± 16.2	39.8 ± 17.5	93.5	77.5	-
			33				<i>Non-resurfaced</i>	25	0%	0	53.7 ± 15.9	46.3 ± 15.3	95.0	60.0	-
Patel et al. 2011 [38]	Prospective trial (bilateral)	130	65	10	90 (res)/54 (non-res)	American Knee Society Clinical Rating System, radiographs	<i>Resurfaced</i>	60	2	0	44	40	88	80	168
			65				<i>Non-resurfaced</i>	60	6	4	46	42	76	68	144
Roberts et al. 2015 [39]	Prospective, randomized, double-blinded study	350	178	23	93.6	KS Score, KS Function Score, KS Stair Sub-score, Active Passive ROM	<i>Resurfaced</i>	164	10 (6.4%)	0	-	-	88.0 ± 9.0	65.6 ± 28.0	-
			172				<i>Non-resurfaced</i>	163	9 (5.6%)	9	-	-	86.6 ± 11.9	59.8 ± 26.3	-

Schroeder-Boersch et al. 1998 [18]	Prospective randomized study	40	20	-	24	Knee Society Score, radiographs	<i>Resurfaced</i>	20	-	-	-	-	82.6	80.0	-
			20				<i>Non-resurfaced</i>	20	-	-	-	-	65.7	69.5	-
Smith et al. 2008 [40]	Prospective randomized trial	181	87	22	52.44	The Knee Society clinical rating system, knee pain scale, knee diagram	<i>Resurfaced</i>	73	22 (30.1)	0	39.7 ± 18.9	51.9 ± 17.1	92.0 ± 12.0	60.0 ± 30.0	152.0
			94				<i>Non-resurfaced</i>	86	18 (20.9%)	0	39.0 ± 13.8	51.7 ± 16.4	93.0 ± 11.0	70.0 ± 46.0	163.0
Van Hemert et al. 2008 [41]	Retrospective study	53	31	0	16.7	KSS, Dynaport Knee test, Minimod Gait test	<i>Resurfaced</i>	31	-	-	42.7 ± 12.5	-	83.1 ± 13.5	-	-
			22				<i>Non-resurfaced</i>	22	-	-	50.5 ± 13.8	-	85.0 ± 14.0	-	-
Waters et al. 2003 [19]	Prospective randomized study	514	474 at final FU	40	63.6	Knee Society rating system, Brit. Orthopaedic Association patient-satisfaction score	<i>Resurfaced</i>	243	13 (5.3%)	-	44.1 ± 13.1	-	91.4 ± 5.93	75.8 ± 20.94	-
							<i>Non-resurfaced</i>	231	58 (25.1%)	-	43.1 ± 13.0	-	88.5 ± 10.23	73.2 ± 23.21	-
Wood et al. 2002 [42]	DB Prospective randomized trial	240	92	20	48	Knee Society clinical rating system, AKP, stair climbing test, radiographics	<i>Resurfaced</i>	92	15 (16%)	9	57.4 ± 14.0	51.3 ± 13.5	87.0 ± 10.0	70.0 ± 32.5	-
			128				<i>Non-resurfaced</i>	128	39 (31%)	11	55.7 ± 16.6	51.6 ± 16.4	86.5 ± 11.0	65.0 ± 28.5	-

266

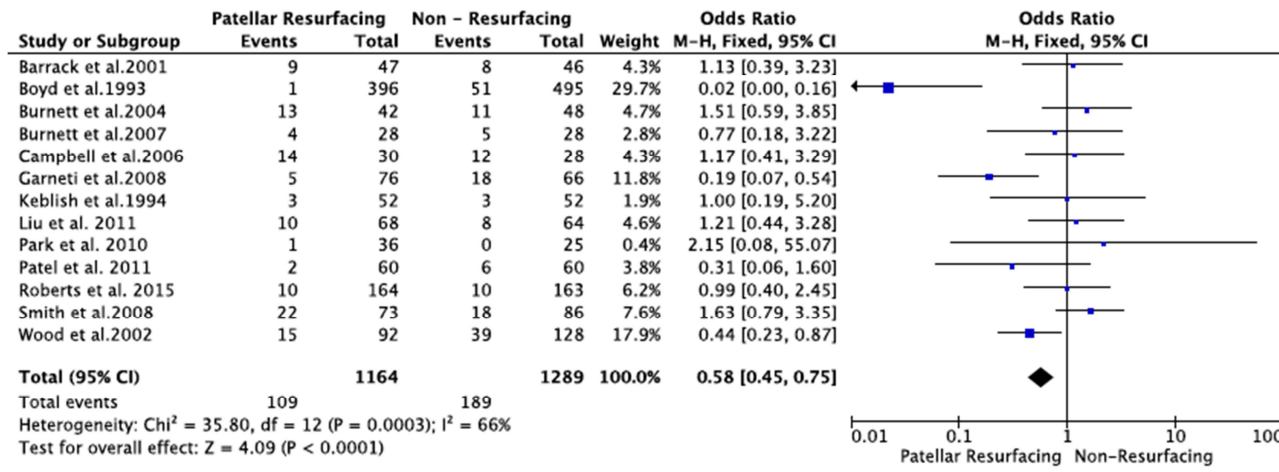
267

268 **Table 2. Demographics, re-operation, anterior knee pain and clinical outcome (HSS score)**

Study	Type of study	N° knees enrolled	Knees reviewed	Lost at final FU (patients)	Mean FU	Evaluation of outcome	Type	N° of knees (final FU)	AntKnee Pain	Re-operation	HSS	
											Pre-op:	Post-op:
Badhe et al. 2001 [43]	Retrospective	170	99	-	36	HSS score, Patellar score, radiographs	<i>Resurfaced</i>	99	-	2	61.8 ± 10.3	87.6 ± 5.8
			71				<i>Non-resurfaced</i>	71	-	10	63.7 ± 9.8	76.8 ± 5.6
Feller et al. 1996 [44]	Prospective randomized trial	40	38	2	36	HSS score, Patellar score	<i>Resurfaced</i>	19	-	0	63.8 ± 10.1	85.7 ± 7.0
							<i>Non-resurfaced</i>	19	-	0	61.6 ± 10.5	88.6 ± 5.2
Ikejiani et al. 2000 [45]	Information collected prospectively, reviewed retroactively	185	45	0	24	ROM, pain assessment, HSS score	<i>Resurfaced</i>	140	-	0	54.8 ± 12.7	89.1 ± 9.5
			140				<i>Non-resurfaced</i>	45	-	0	56.0 ± 13.4	91 ± 7.4
Kajino et al. 1997 [15]	Prospective randomized study	70	26	9	79.2	HSS Knee Score, radiographs	<i>Resurfaced</i>	26	-	-	48	81
			26				<i>Non-resurfaced</i>	26	-	1	47	80
Keblish et al. 1994 [46]	Prospective study (bilateral)	118	52	4	62.9	Modified HSS knee score, Knee Society radiological evaluation system	<i>Resurfaced</i>	52	3 (5.8%)	0	-	90.1
			52				<i>Non-resurfaced</i>	52	3 (5.8%)	0	-	89.2
Kim et al. 2014 [31]	Retrospective matched-pairs case-control. Level of evidence IV	373	69	281 knees excluded	104.4	ROM, Kellgren and Lawrence scale, WOMAC, KSS, HSS	<i>Resurfaced</i>	69	-	-	41.6 ± 11	93.3 ± 7.8
			23				<i>Non-resurfaced</i>	23	-	-	44.5 ± 10.3	89.1 ± 9.2
Park et al. 2010 [37]	Retrospective	71	38	10	145	AKSS, HSS Score, Bristol patellar score, Lonnerpat.-fem. score, radiographs	<i>Resurfaced</i>	36	1 (2.8%)	0	61.1	87.0
			33				<i>Non-resurfaced</i>	25	0%	0	65.3	83.0
Shoji et al. 1989 [47]	Prospective study	70	35	0	32.4	HSS knee score	<i>Resurfaced</i>	35	-	0	49.9 ± 8.9	85.5 ± 4.8
			35				<i>Non-resurfaced</i>	35	-	0	48.6 ± 5.4	85.6 ± 5.3
OVERALL From table 1 and 2.	TOTAL	5304				TOTAL	<i>Resurfaced</i>	2359		18 (0.8%)		
	MEAN	151.5			66.3		<i>Non-res:</i>	2345		127 (5.4%)		
	SD	204.1			40.4							

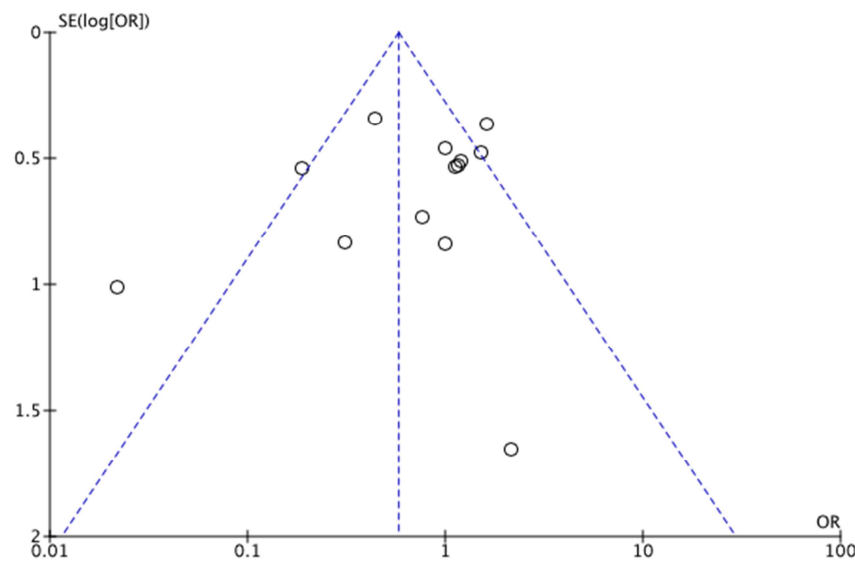
269

270 **Figure 2.** Forest plot: Patellar Resurfacing vs Non-resurfacing TKAs, postoperative anterior Knee -
 271 Pain.



272

273 **Figure 3.** Funnel plot for evaluation of publication bias (Patellar Resurfacing vs Non-resurfacing
 274 TKAs, postoperative anterior Knee – Pain)

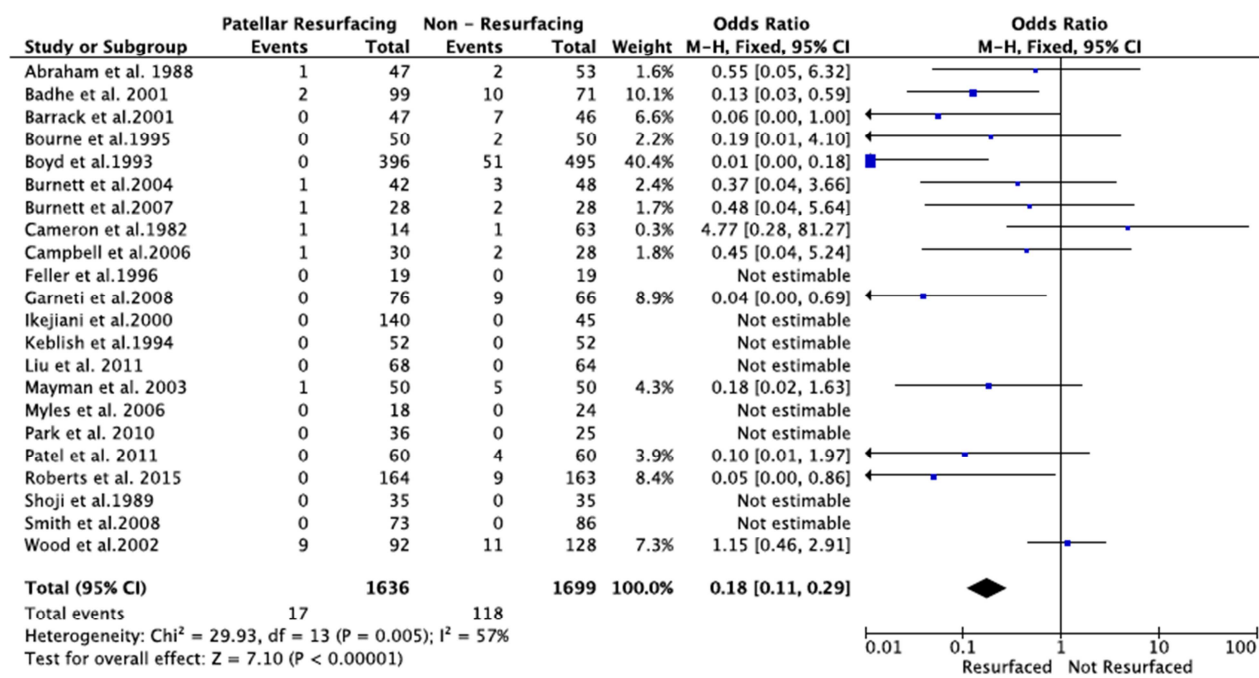


275

276

277 **Figure 4.** Forest plot: Patellar Resurfacing vs Non-resurfacing TKAs, reoperation.

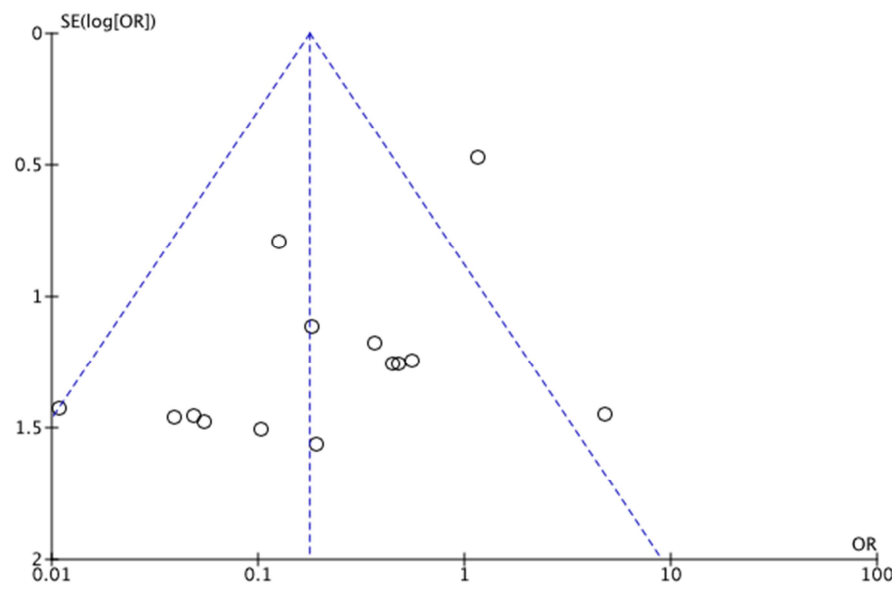
278



279

280

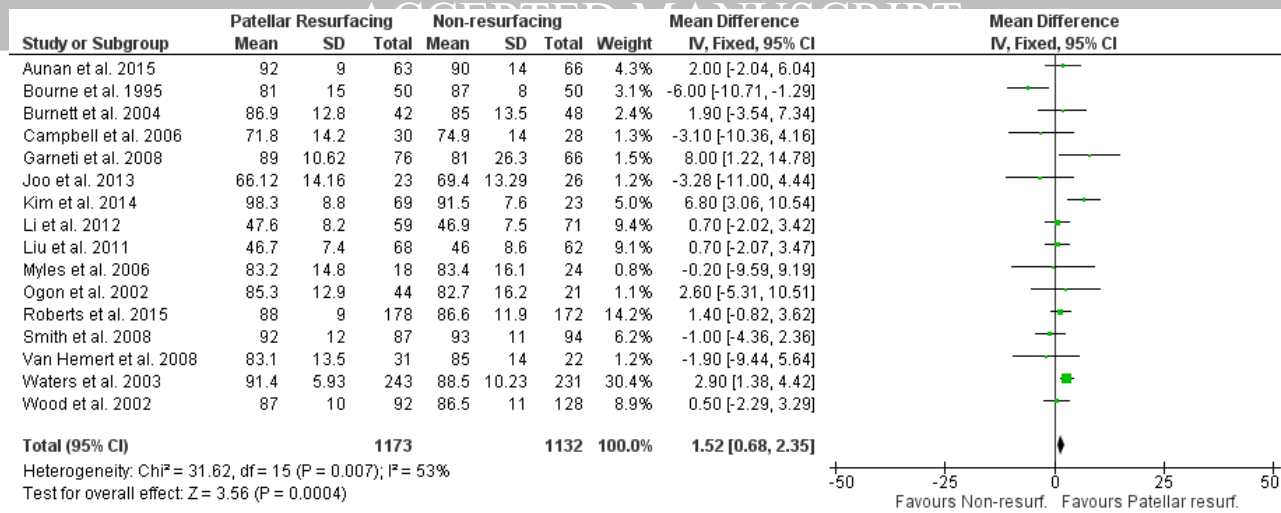
281 **Figure 5.** Funnel plot for evaluation of publication (Patellar Resurfacing vs Non-resurfacing TKAs,
 282 outcome: Post-op KSS Pain).



283

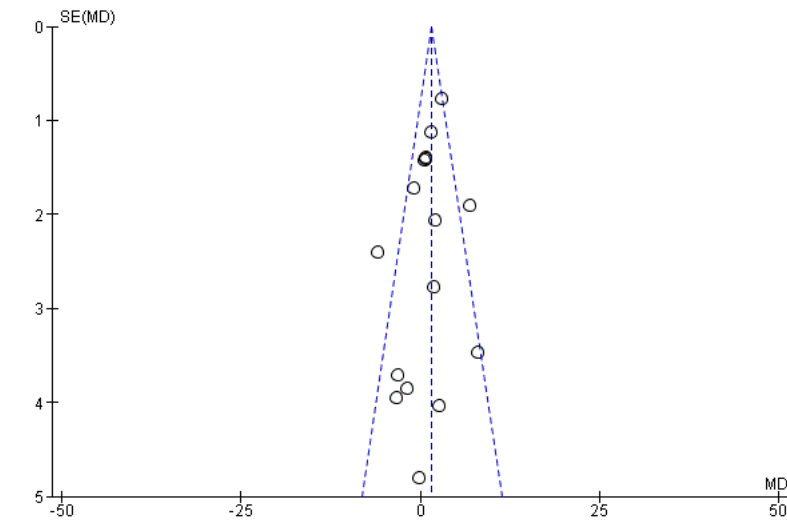
284

285 **Figure 6.** Forest plot: Patellar Resurfacing vs Non-resurfacing TKAs, outcome: Post-op KSS Pain.



286

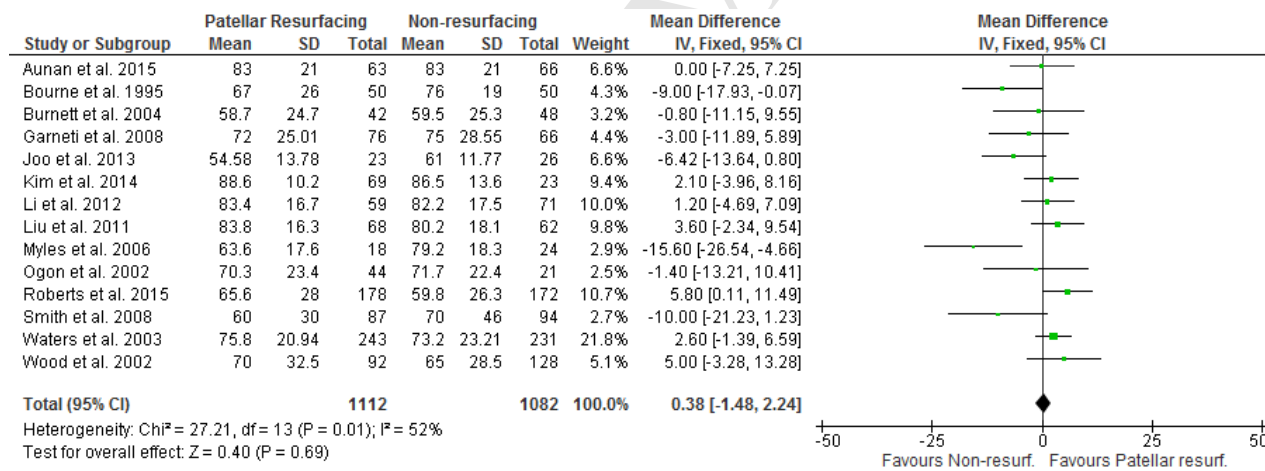
287 **Figure 7.** Funnel plot for evaluation of publication (Patellar Resurfacing vs Non-resurfacing TKAs,
288 outcome: Post-op KSS Pain).



289

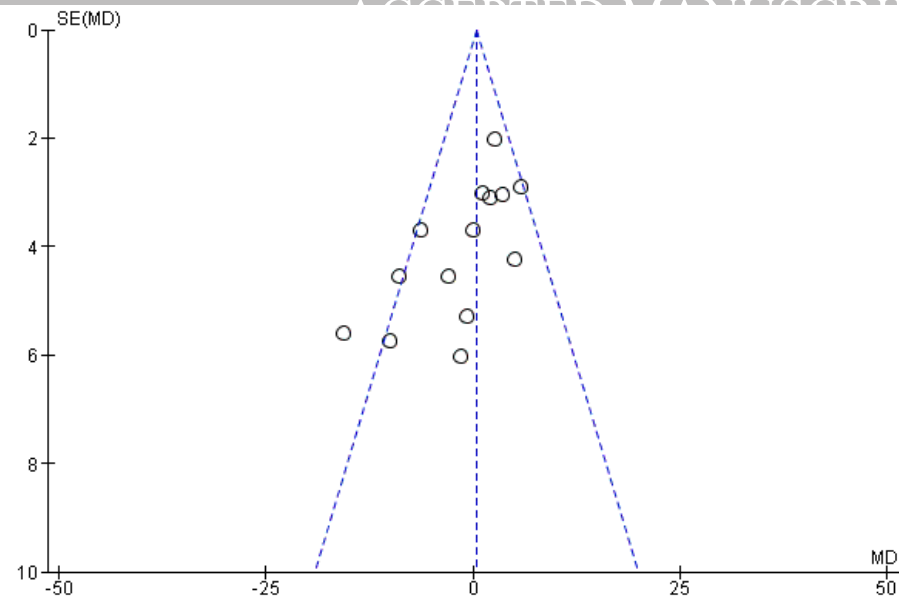
290

291 **Figure 8.** Forest plot: Patellar Resurfacing vs Non-resurfacing TKAs, outcome: Post-op KSS
292 Function.



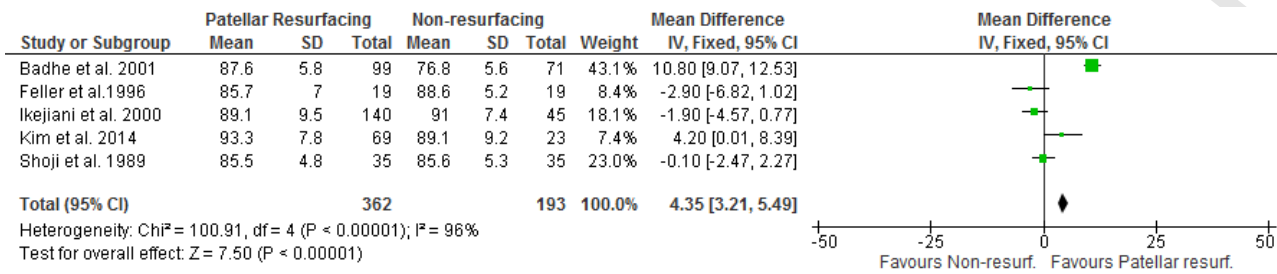
293

294 **Figure 9.** Funnel plot for evaluation of publication (Patellar Resurfacing vs Non-resurfacing TKAs,
295 outcome: Post-op KSS Function).



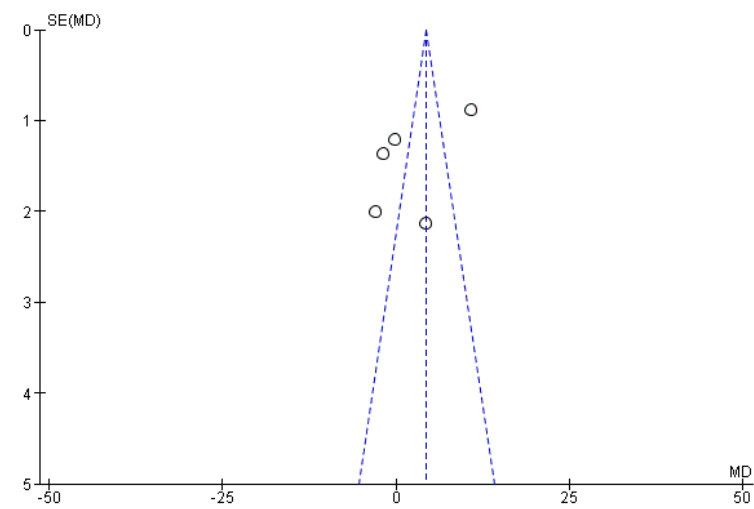
296

297 **Figure 10.** Forest plot: Patellar Resurfacing vs Non-resurfacing TKAs, outcome: HSS Post-op.



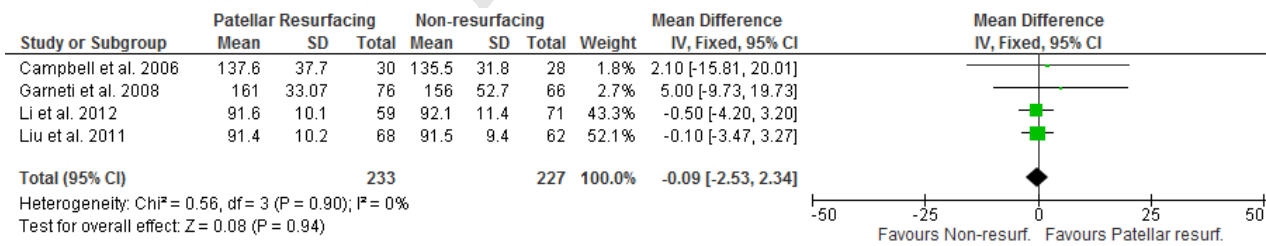
298

299 **Figure 11.** Funnel plot for evaluation of publication (Patellar Resurfacing vs Non-resurfacing
300 TKAs, outcome: HSS Post-op).



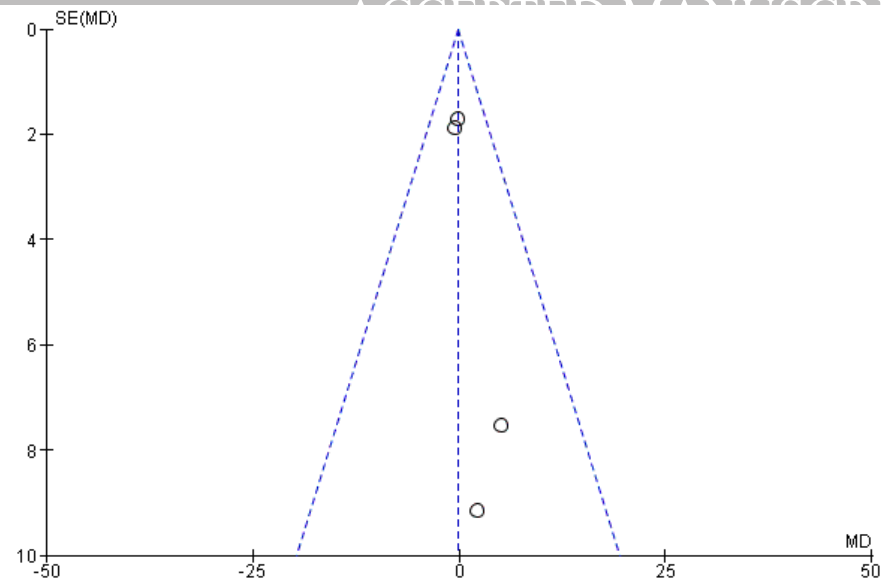
301

302 **Figure 12.** Forest plot: Patellar Resurfacing vs Non-resurfacing TKAs, outcome: Post-op KSS
303 Total.



304

305 **Figure 13.** Funnel plot for evaluation of publication (Patellar Resurfacing vs Non-resurfacing
306 TKAs, outcome: Post-op KSS Total).



307

308 **Figure 14.** GRADE, Summary of Findings.

No of studies	Study design	Quality assessment					No of patients		Effect		Quality	Importance
		Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Patellar resurfacing	Non Patellar resurfacing	Relative (95% CI)	Absolute (95% CI)		
Anterior Knee Pain												
18	randomised trials	not serious	not serious	not serious	not serious	none	128/1596 (8.0%)	273/1717 (15.9%)	OR 0.44 (0.35 to 0.55)	82 fewer per 1,000 (from 65 fewer to 97 fewer)	⊕⊕⊕⊕ HIGH	
Re-Operation												
22	randomised trials	not serious	not serious	not serious	not serious	none	17/1636 (1.0%)	118/1699 (6.9%)	OR 0.18 (0.11 to 0.29)	56 fewer per 1,000 (from 48 fewer to 61 fewer)	⊕⊕⊕⊕ HIGH	
KSS pain												
16	randomised trials	not serious	not serious	not serious	not serious	none	1173	1132	-	mean 1.52 higher (0.68 higher to 2.35 higher)	⊕⊕⊕⊕ HIGH	
KSS Function												
14	randomised trials	not serious	not serious	not serious	not serious	none	1112	1082	-	mean 0.38 higher (1.48 lower to 2.24 higher)	⊕⊕⊕⊕ HIGH	
HSS												
5	randomised trials	not serious	not serious	not serious	not serious	none	362	193	-	mean 4.35 higher (3.21 higher to 5.49 higher)	⊕⊕⊕⊕ HIGH	
KSS total												

309

310

311

312

313

315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369

1. Meneghini RM. Should the patella be resurfaced in primary total knee arthroplasty? An evidence-based analysis. *The Journal of arthroplasty* 23(7 Suppl): 11, 2008
2. Gupta S, Augustine A, Horey L, Meek RM, Hullin MG, Mohammed A. Electrocautery of the patellar rim in primary total knee replacement: beneficial or unnecessary? *The Journal of bone and joint surgery British volume* 92(9): 1259, 2010
3. Ali A, Lindstrand A, Nilsson A, Sundberg M. Similar patient-reported outcomes and performance after total knee arthroplasty with or without patellar resurfacing. *Acta orthopaedica* 87(3): 274, 2016
4. Maffulli N, Longo UG, Gougoulas N, Caine D, Denaro V. Sport injuries: a review of outcomes. *British medical bulletin* 97: 47, 2011
5. Garneti N, Mahadeva D, Khalil A, McLaren CA. Patellar resurfacing versus no resurfacing in Scorpio total knee arthroplasty. *The journal of knee surgery* 21(2): 97, 2008
6. Pakos EE, Ntzani EE, Trikalinos TA. Patellar resurfacing in total knee arthroplasty. A meta-analysis. *The Journal of bone and joint surgery American volume* 87(7): 1438, 2005
7. Meding JB, Fish MD, Berend ME, Ritter MA, Keating EM. Predicting patellar failure after total knee arthroplasty. *Clinical orthopaedics and related research* 466(11): 2769, 2008
8. Khan A, Pradhan N. Results of total knee replacement with/without resurfacing of the patella. *Acta Ortopedica Brasileira* 20(5): 300, 2012
9. Aunan E, Næss G, Clarke-Jenssen J, Sandvik L, Kibsgård TJ. Patellar resurfacing in total knee arthroplasty: functional outcome differs with different outcome scores. *Acta orthopaedica* 87(2): 158, 2016
10. Parvizi J, Rapuri VR, Saleh KJ, Kuskowski MA, Sharkey PF, Mont MA. Failure to resurface the patella during total knee arthroplasty may result in more knee pain and secondary surgery. *Clinical orthopaedics and related research* 438: 191, 2005
11. van Jonbergen HP, Barnaart AF, Verheyen CC. A dutch survey on circumpatellar electrocautery in total knee arthroplasty. *Open Orthop J* 4: 201, 2010
12. Barrack RL, Bertot AJ, Wolfe MW, Waldman DA, Milicic M, Myers L. Patellar resurfacing in total knee arthroplasty. A prospective, randomized, double-blind study with five to seven years of follow-up. *The Journal of bone and joint surgery American volume* 83-A(9): 1376, 2001
13. Burnett RS, Boone JL, McCarthy KP, Rosenzweig S, Barrack RL. A prospective randomized clinical trial of patellar resurfacing and nonresurfacing in bilateral TKA. *Clinical orthopaedics and related research* 464: 65, 2007
14. Campbell DG, Duncan WW, Ashworth M, Mintz A, Stirling J, Wakefield L, Stevenson TM. Patellar resurfacing in total knee replacement: a ten-year randomised prospective trial. *The Journal of bone and joint surgery British volume* 88(6): 734, 2006
15. Kajino A, Yoshino S, Kameyama S, Kohda M, Nagashima S. Comparison of the results of bilateral total knee arthroplasty with and without patellar replacement for rheumatoid arthritis. A follow-up note. *The Journal of bone and joint surgery American volume* 79(4): 570, 1997
16. Mayman D, Bourne RB, Rorabeck CH, Vaz M, Kramer J. Resurfacing versus not resurfacing the patella in total knee arthroplasty: 8- to 10-year results. *The Journal of arthroplasty* 18(5): 541, 2003
17. Newman JH, Ackroyd CE, Shah NA, Karachalios T. Should the patella be resurfaced during total knee replacement? *The Knee* 7 17, 2000
18. Schroeder-Boersch H, Scheller G, Fischer J, Jani L. Advantages of patellar resurfacing in total knee arthroplasty. Two-year results of a prospective randomized study. *Archives of orthopaedic and trauma surgery* 117(1-2): 73, 1998
19. Waters TS, Bentley G. Patellar resurfacing in total knee arthroplasty. A prospective, randomized study. *The Journal of bone and joint surgery American volume* 85-A(2): 212, 2003
20. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JP, Clarke M, Devereaux PJ, Kleijnen J, Moher D. The PRISMA statement for reporting systematic reviews and meta-

ACCEPTED MANUSCRIPT

370 analyses of studies that evaluate healthcare interventions: explanation and elaboration. *Bmj*
371 339: b2700, 2009

372 21. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for
373 systematic reviews and meta-analyses: the PRISMA statement. *Bmj* 339: b2535, 2009

374 22. Abraham W, Buchanan JR, Daubert H, Greer RB, 3rd, Keefer J. Should the patella be
375 resurfaced in total knee arthroplasty? Efficacy of patellar resurfacing. *Clinical orthopaedics*
376 *and related research* (236): 128, 1988

377 23. Barrack RL, Wolfe MW, Waldman DA, Milicic M, Bertot AJ, Myers L. Resurfacing of the
378 patella in total knee arthroplasty. A prospective, randomized, double-blind study. *The Journal*
379 *of bone and joint surgery American volume* 79(8): 1121, 1997

380 24. Bourne RB, Rorabeck CH, Vaz M, Kramer J, Hardie R, Robertson D. Resurfacing versus not
381 resurfacing the patella during total knee replacement. *Clinical orthopaedics and related*
382 *research* (321): 156, 1995

383 25. Boyd AD, Jr., Ewald FC, Thomas WH, Poss R, Sledge CB. Long-term complications after total
384 knee arthroplasty with or without resurfacing of the patella. *The Journal of bone and joint*
385 *surgery American volume* 75(5): 674, 1993

386 26. Burnett RS, Haydon CM, Rorabeck CH, Bourne RB. Patella resurfacing versus
387 nonresurfacing in total knee arthroplasty: results of a randomized controlled clinical trial at a
388 minimum of 10 years' followup. *Clinical orthopaedics and related research* (428): 12, 2004

389 27. Cameron HU, Fedorkow DM. The patella in total knee arthroplasty. *Clinical orthopaedics*
390 *and related research* (165): 197, 1982

391 28. Enis JE, Gardner R, Robledo MA, Latta L, Smith R. Comparison of patellar resurfacing
392 versus nonresurfacing in bilateral total knee arthroplasty. *Clinical orthopaedics and related*
393 *research* (260): 38, 1990

394 29. Gildone A, Manfredini M, Biscione R, Faccini R. Patella resurfacing in posterior stabilised
395 total knee arthroplasty: a follow-up study in 56 patients. *Acta orthopaedica Belgica* 71(4):
396 445, 2005

397 30. Joo J-H, Lee S-C, Ahn N-K, Ahn H-S, Jung K-A. Patellar resurfacing versus no resurfacing in
398 two-stage revision of infected total knee arthroplasty. *The Knee* 20: 451, 2013

399 31. Kim S, Lee S, Ro D, Cho Y, Lee Y, Chung K, Lee M. Comparison of patellar resurfacing versus
400 preservation in high flexion total knee arthroplasty. *Knee Surgery, Sports Traumatology,*
401 *Arthroscopy* 23(6): 1782, 2015

402 32. Levai JP, McLeod HC, Freeman MA. Why not resurface the patella? *The Journal of bone and*
403 *joint surgery British volume* 65(4): 448, 1983

404 33. Li B, Bai L, Fu Y, Wang G, He M, Wang J. Comparison of clinical outcomes between patellar
405 resurfacing and nonresurfacing in total knee arthroplasty: retrospective study of 130 cases.
406 *The Journal Of International Medical Research* 40(5): 1794, 2012

407 34. Liu ZT, Fu PL, Wu HS, Zhu Y. Patellar reshaping versus resurfacing in total knee
408 arthroplasty - Results of a randomized prospective trial at a minimum of 7years' follow-up.
409 *The Knee*, 2011

410 35. Myles CM, Rowe PJ, Nutton RW, Burnett R. The effect of patella resurfacing in total knee
411 arthroplasty on functional range of movement measured by flexible electrogoniometry. *Clin*
412 *Biomech (Bristol, Avon)* 21(7): 733, 2006

413 36. Ogon M, Hartig F, Bach C, Nogler M, Steingruber I, Biedermann R. Patella resurfacing: no
414 benefit for the long-term outcome of total knee arthroplasty. A 10- to 16.3-year follow-up.
415 *Archives of orthopaedic and trauma surgery* 122(4): 229, 2002

416 37. Park SJ, Jung YB, Jeong HJ, Shin HK, Jung HJ, Lim JJ, Yoon JW, Kim E. Long-term results of
417 primary total knee arthroplasty with and without patellar resurfacing. *Acta Med Okayama*
418 64(5): 331, 2010

419 38. Patel K, Raut V. Patella in total knee arthroplasty: to resurface or not to--a cohort study of
420 staged bilateral total knee arthroplasty. *International orthopaedics* 35(3): 349, 2011

421 39. Roberts DW, Hayes TD, Tate CT, Lesko JP. Selective Patellar Resurfacing in Total Knee
422 Arthroplasty: A Prospective, Randomized, Double-Blind Study. *The Journal of arthroplasty* 30:
423 216, 2015

- 424 40. Smith AJ, Wood DJ, Li MG. Total knee replacement with and without patellar resurfacing: a
425 prospective, randomised trial using the profix total knee system. *The Journal of bone and joint*
426 *surgery British volume* 90(1): 43, 2008
- 427 41. van Hemert WL, Senden R, Grimm B, Kester AD, van der Linde MJ, Heyligers IC. Patella
428 retention versus replacement in total knee arthroplasty; functional and clinimetric aspects.
429 *Archives of orthopaedic and trauma surgery* 129(2): 259, 2009
- 430 42. Wood DJ, Smith AJ, Collopy D, White B, Brankov B, Bulsara MK. PATELLAR RESURFACING
431 IN TOTAL KNEE ARTHROPLASTY. *Journal of Bone & Joint Surgery, American Volume* 84(2):
432 187, 2002
- 433 43. Badhe N, Dewnany G, Livesley PJ. Should the patella be replaced in total knee
434 replacement? *International orthopaedics* 25(2): 97, 2001
- 435 44. Feller JA, Bartlett RJ, Lang DM. Patellar resurfacing versus retention in total knee
436 arthroplasty. *The Journal of bone and joint surgery British volume* 78(2): 226, 1996
- 437 45. Ikejiani CE, Leighton R, Petrie DP. Comparison of patellar resurfacing versus
438 nonresurfacing in total knee arthroplasty. *Canadian journal of surgery* 43(1): 35, 2000
- 439 46. Keblish PA, Varma AK, Greenwald AS. Patellar resurfacing or retention in total knee
440 arthroplasty. A prospective study of patients with bilateral replacements. *The Journal of bone*
441 *and joint surgery British volume* 76(6): 930, 1994
- 442 47. Shoji H, Yoshino S, Kajino A. Patellar replacement in bilateral total knee arthroplasty. A
443 study of patients who had rheumatoid arthritis and no gross deformity of the patella. *The*
444 *Journal of bone and joint surgery American volume* 71(6): 853, 1989
- 445 48. Calvisi V, Camillieri G, Lupporelli S. Resurfacing versus nonresurfacing the patella in total
446 knee arthroplasty: a critical appraisal of the available evidence. *Archives of orthopaedic and*
447 *trauma surgery* 129(9): 1261, 2009
- 448 49. Clements WJ, Miller L, Whitehouse SL, Graves SE, Ryan P, Crawford RW. Early outcomes of
449 patella resurfacing in total knee arthroplasty. *Acta orthopaedica* 81(1): 108, 2010
- 450 50. Phillips AM, Goddard NJ, Tomlinson JE. Current techniques in total knee replacement:
451 results of a national survey. *Ann R Coll Surg Engl* 78(6): 515, 1996
- 452 51. Rodriguez-Merchan EC, Gomez-Cardero P. The outerbridge classification predicts the need
453 for patellar resurfacing in TKA. *Clinical orthopaedics and related research* 468(5): 1254, 2010
- 454 52. Fu Y, Wang G, Fu Q. Patellar resurfacing in total knee arthroplasty for osteoarthritis: a
455 meta-analysis. *Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA,*
456 2011
- 457 53. He JY, Jiang LS, Dai LY. Is patellar resurfacing superior than nonresurfacing in total knee
458 arthroplasty? A meta-analysis of randomized trials. *The Knee* 18(3): 137, 2011
- 459 54. Li S, Chen Y, Su W, Zhao J, He S, Luo X. Systematic review of patellar resurfacing in total
460 knee arthroplasty. *International orthopaedics* 35(3): 305, 2011
- 461 55. Swan JD, Stoney JD, Lim K, Dowsey MM, Choong PF. The need for patellar resurfacing in
462 total knee arthroplasty: a literature review. *ANZ J Surg* 80(4): 223, 2010
- 463
464