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# Should the Patella Be Resurfaced During Primary Total Knee Arthroplasty? An Updated Meta-Analysis and Systematic Review

Nazanin Kermanshahi [a, *], Nicolaas C. Budhiparama, MD, PhD [b, c, d], Mahmood Shihab Wahhab, MD [e], Claudia Arias, MD [f], Weihua Xu, MD [g], Del Schutte, MD [h], Ping-Keung Chan, MD [i], Gwo-Chin Lee, MD [j], Javad Parvizi, MD [k]

[a] Arizona College of Osteopathic Medicine, Midwestern University, Glendale, Arizona
[b] Department of Orthopaedic and Traumatology, Universitas Airlangga, Surabaya, Indonesia
[c] Department of Orthopaedics, Leiden University Medical Center, Leiden, The Netherlands
[d] Nicolaas Institute of Constructive Orthopaedic Research & Education Foundation for Arthroplasty & Sports Medicine at Medistra Hospital, Jakarta, Indonesia
[e] Medical City Complex, Baghdad, Iraq
[f] Unidad de Rodilla, Edgardo Rebagliati Martins National Hospital, Jesús María, Peru
[g] Department of Orthopedics, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China
[h] East Cooper medical Center, Sullivans Island, South Carolina
[i] Department of Orthopaedics & Traumatology, Queen Mary Hospital, The University of Hong Kong, Pokfulam, Hong Kong
[j] Orthopaedic Surgery, Hospital for Special Surgery, New York, New York
[k] Orthopedics and Traumatology, Acibadem University, Istanbul, Turkey

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**Should the Patella be Resurfaced during Primary Total Knee Arthroplasty? An Updated Meta-analysis and Systematic Review**

**Response/Recommendation:** While the literature supports the notion that patellar resurfacing (PR) during total knee arthroplasty (TKA) results in fewer reoperations, patients who did not have patellar resurfacing demonstrate non-inferior clinical outcomes with better Knee Society Score (KSS) total and functional scores at various follow-up time points. Non-patellar resurfacing (NPR) was also associated with shorter operative times. These results must be evaluated cautiously, as they were reported across various follow-up intervals and included various implant designs. Selective PR appears justified, particularly in patients at risk of revision procedures.

**Level of Evidence:** Strong.

**Expert Vote:** Agree 83.4%, Disagree 14.6%, Abstain 2.0%.

## Rationale

The need to universally resurface the patella during primary total knee arthroplasty (TKA) remains controversial. In the past decade, there has been an increasing trend toward non-patellar resurfacing (NPR) in the United States, from 4.1% in 2012 to 10.3% in 2021 [1]. Globally, far fewer patellae are resurfaced, with only 35% of primary TKAs from registries outside the United States receiving a patellar component [2]. In 2023, an American Academy of Orthopaedic Surgeons Clinical Practice Guidelines strongly supported the lack of difference between PR and NPR in TKA [3]. Numerous articles compare patellar resurfacing (PR) to NPR, but most include small, single-institution prospective and retrospective studies, case series, and low-quality meta-analyses. Therefore, a meta-analysis of only randomized controlled trials assessing the effectiveness of patellar resurfacing, which compares various preoperative and postoperative outcomes and patient-reported outcomes, has been lacking.

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* Address correspondence to: Nazanin Kermanshahi, Arizona College of Osteopathic Medicine, Midwestern University, 19555 59th Ave, Glendale, AZ 85308.

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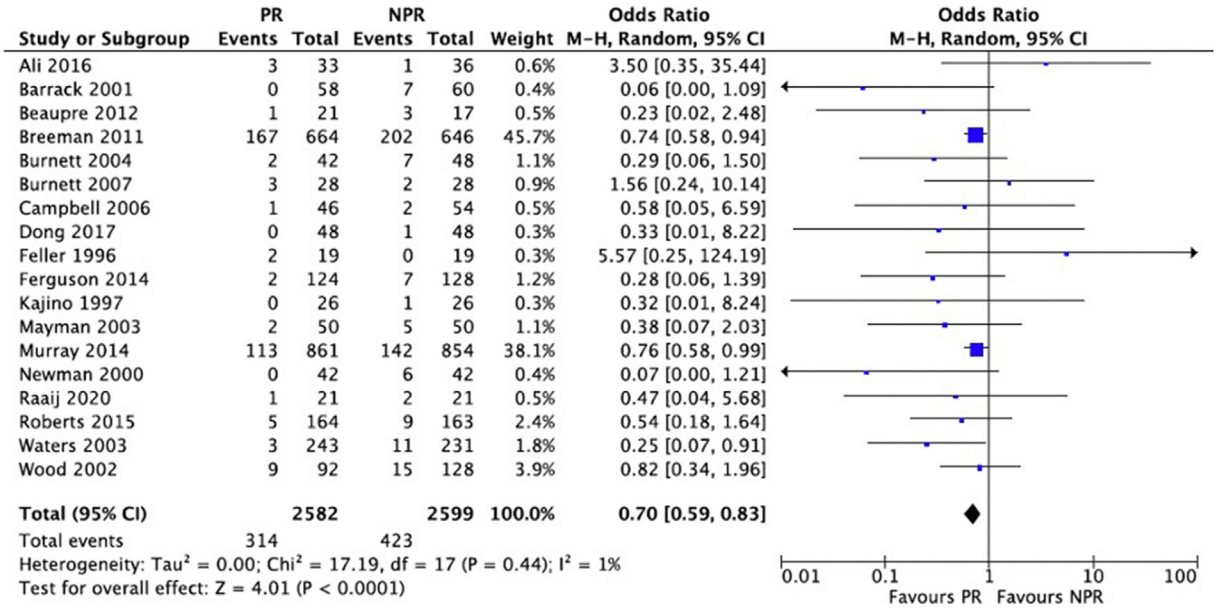


**Figure 1.** Reoperation rate. PR, patellar resurfacing; NPR, nonpatellar resurfacing; CI, confidence interval.

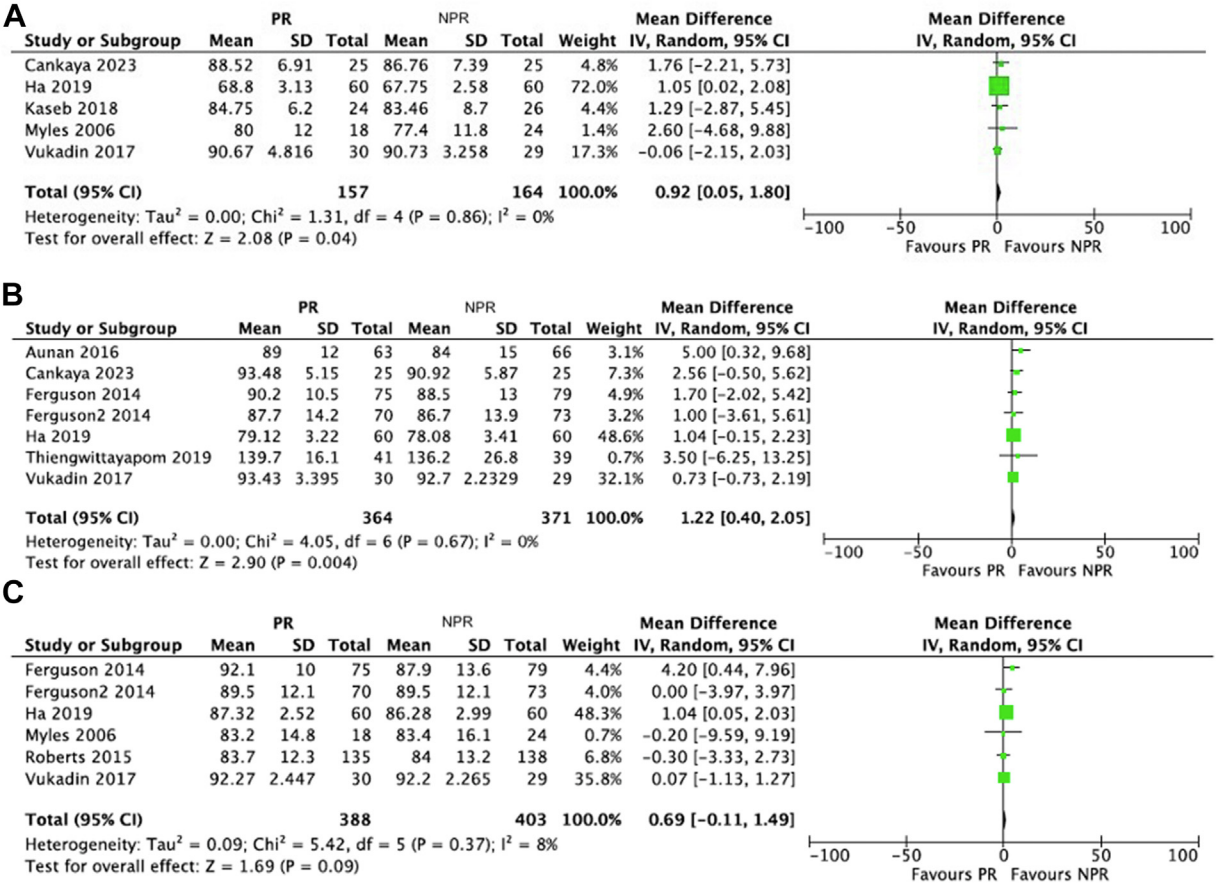


**Figure 2.** (a) KSS total at < 1-year follow-up, (b) KSS total at one year follow-up, (c) KSS total at 2-year follow-up, (d) KSS total at 3-year follow-up, (e) KSS total at 4-year follow-up, (f) KSS total at 5-year follow-up, and (g) KSS total at 10-year of follow-up. PR, patellar resurfacing; NPR, nonpatellar resurfacing; CI, confidence interval; KSS, Knee Society Score.

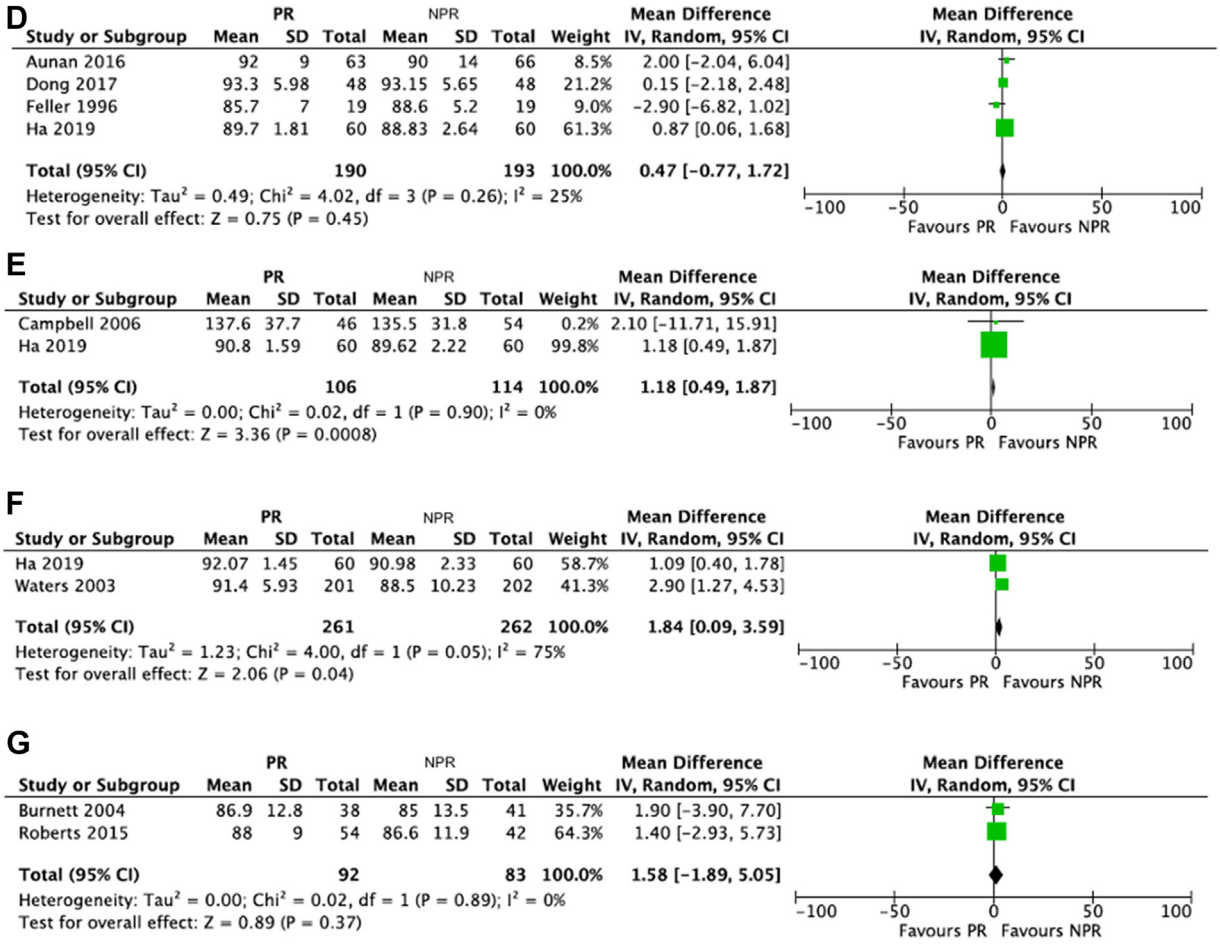


**Figure 2.** (*continued*).

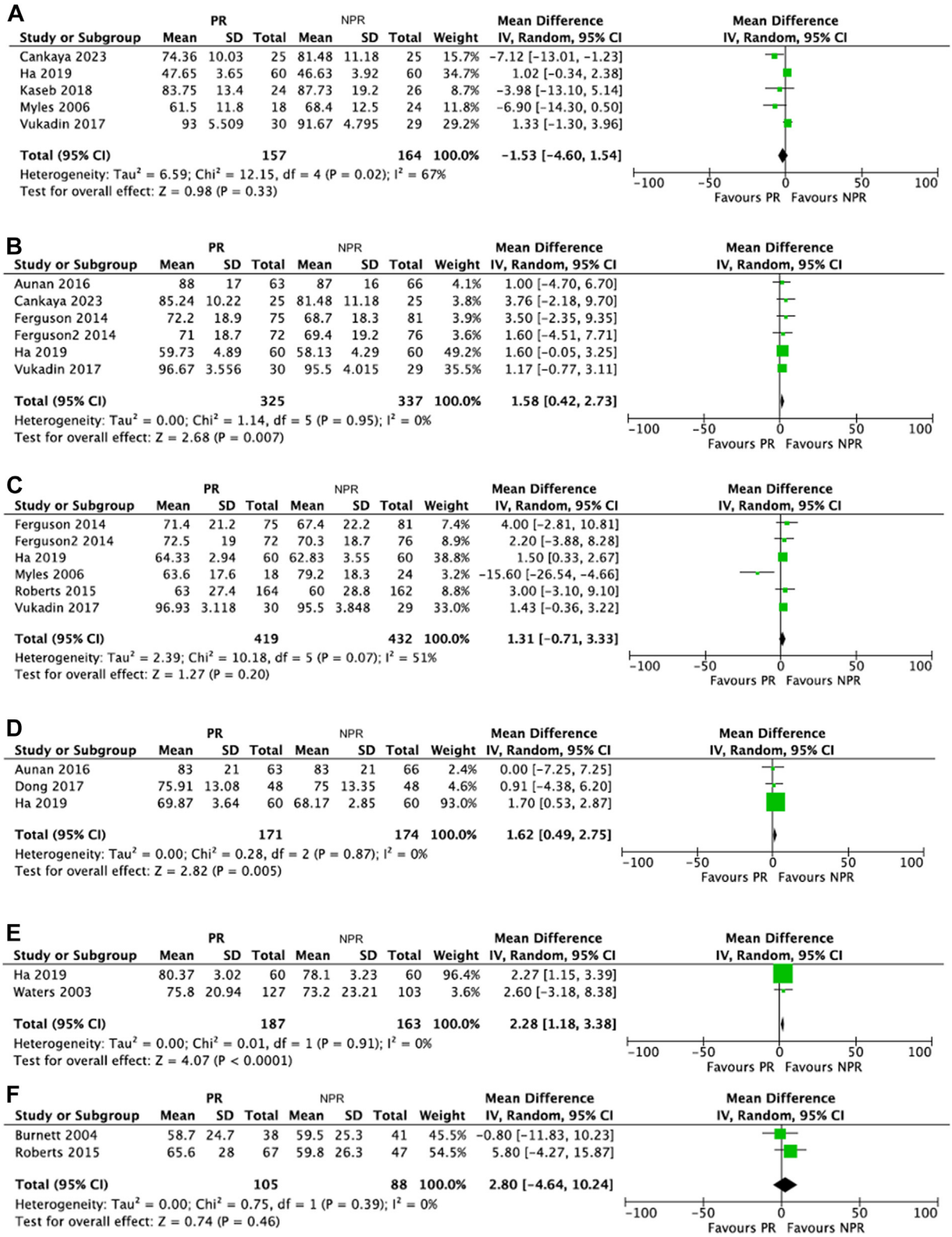


**Figure 3.** (a) KSS function at <1-year follow-up, (b) KSS function at 1-year follow-up, (c) KSS function at 2-year follow-up, (d) KSS function at 3-year follow-up, (e) KSS function at 5-year follow-up, and (f) KSS function at 10-year follow-up. PR, patellar resurfacing; NPR, nonpatellar resurfacing; CI, confidence interval; KSS, Knee Society Score.

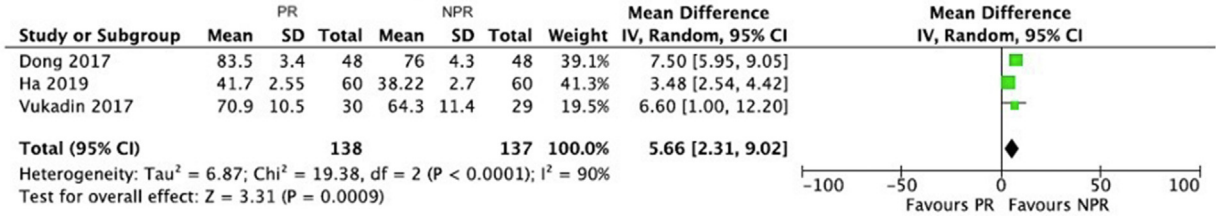


**Figure 4.** Operation time. CI, confidence interval.

From the initial 2,021 articles retrieved from the databases, 28 randomized controlled trials were included in the meta-analysis [4–30]. When analyzing 18 articles, PR was associated with fewer reoperations when comparing 2,582 PRs to 2,599 NPRs (odds ratio [OR] = 0.70, 95% confidence interval [CI]: 0.59 to 0.83, $P < 0.0001$, Figure 1) [4,6,7,9–12,15,16,18,21,22,24–26,29–31]. However, the study of six articles at 1-year follow-up revealed that both the Knee Society Score (KSS) total and the KSS function scores significantly favored NPR (mean difference [MD] = 1.22, 98% CI: 0.40 to 2.05, $P = 0.004$, Figure 2 and MD = 1.58, 95% CI: 0.42 to 2.73, $P = 0.007$, Figure 3, respectively) [5,10,13,17,27,28]. There were two articles that revealed a similar trend at 5-year follow-up (MD = 1.84, 95% CI: 0.09 to 3.59, $P = 0.04$ and MD = 2.28, 95% CI: 1.18 to 3.38, $P < 0.0001$, respectively) [17,29]. Other follow-up intervals, less than one year [13,17,19,23,28], three years [5,15–17], and 10 years [26,31], demonstrated inconsistent results when comparing the KSS function to the KSS total scores. NPR was associated with shorter operative times (MD = 5.7 minutes, 95% CI: 2.31 to 9.0 minutes, $P = 0.0009$, Figure 4) [15,17,28]. Clinical outcomes such as anterior knee pain (OR = 0.60, 95% CI: 0.33 to 1.07, $P = 0.69$, Figure 5) [6,7,12,15,17,20,24,26,27,29–31], visual analog scale pain score (MD = −0.15, 95% CI: −0.34 to 0.04, $P = 0.13$, Figure 6) [4,14,19,20,23,28], and patient satisfaction (OR = 1.51, 95% CI: 0.78 to 2.92, $P = 0.22$, Figure 7) [4,6,15,17,20,21,29–31] were not significantly different between the two groups.

Whether to resurface the patella or not may not be a binary decision. Surgical technique, patellofemoral factors, and knee joint stability can all affect impact results. Patellar resurfacing can be performed using various patellar components and implant designs, which could affect the outcome of surgery. An anatomic patellar component allows a more normal kinematic pattern with a mobile-bearing posterior stabilized (PS) TKA compared to a fixed-bearing PS TKA. However, subjects who have a domed patella can achieve similar kinematics regardless of the TKA design [32,33]. Furthermore, an NPR TKA patella reduces cartilage thickness, particularly with an anatomical design, possibly necessitating conversion to patellar resurfacing [34]. Although patellofemoral contact stresses do not significantly change after NPR TKA, they significantly increase after PR with both dome-

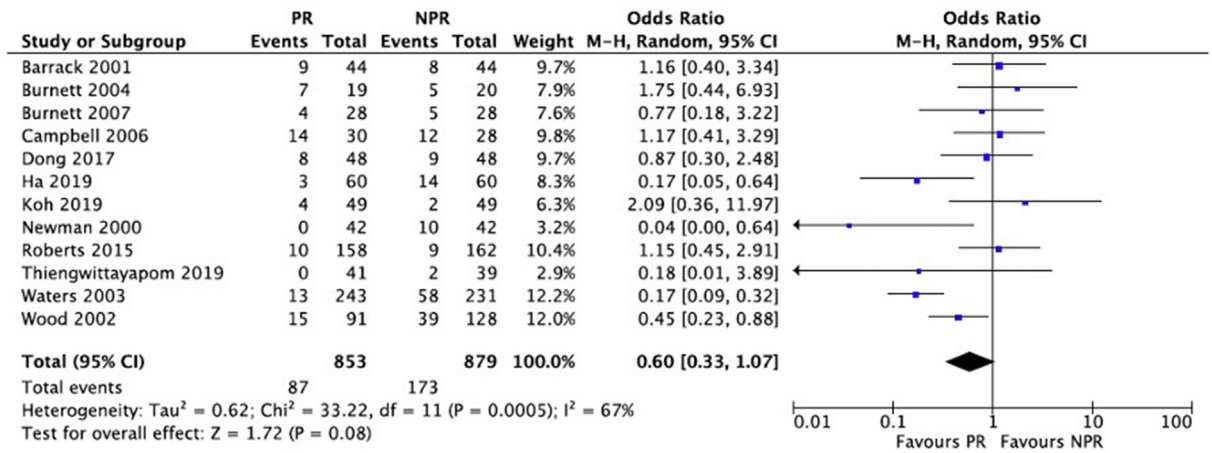


**Figure 5.** Anterior knee pain. PR, patellar resurfacing; NPR, nonpatellar resurfacing; CI, confidence interval.

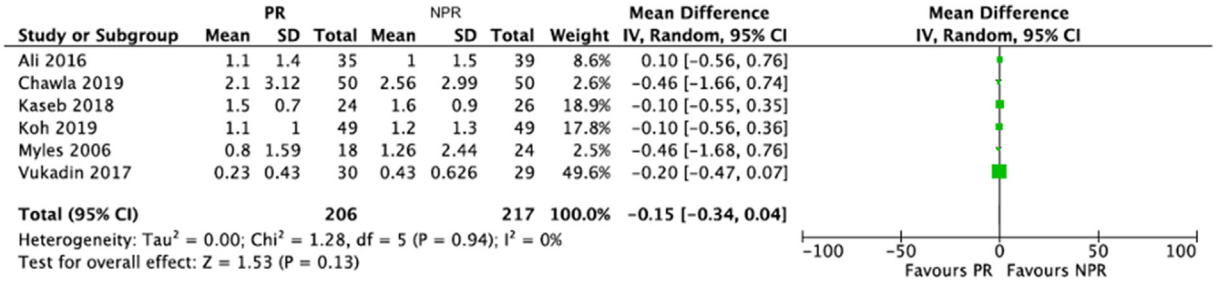


**Figure 6.** Visual analog scale pain score. PR, patellar resurfacing; NPR, nonpatellar resurfacing; CI, confidence interval.

shaped and conforming components [33]. Also, PR reduces the rate of revision surgery in both minimally stabilized and PS TKA, while minimally stabilized knees with PR have the lowest rate of revision [35]. Previous studies have shown that lateral facetectomy and patellar denervation can also influence outcomes for an unsurfaced patella [36,37].

Also, potential complications resulting from resurfacing, such as fracture, asymmetric resurfacing, overstuffing of the patello-femoral compartment, and avascular necrosis of the patella, should be considered along with the diversity in patient demographics. Some studies have favored routine resurfacing in selected groups, including women, patients who had inflammatory arthritis or obesity, and those who find stair climbing imperative [38]. However, no official guidelines are established [39,40]. These factors may indicate that the decision to resurface the patella should be made selectively based on intraoperative findings, the surgeon's philosophy, and the patient's demands.

## CRediT authorship contribution statement

**Nazanin Kermanshahi:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Nicolaas C. Budhiparama:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization. **Mahmood Shihab Wahhab:** Writing – review & editing, Visualization, Validation, Supervision. **Claudia Arias:** Writing – review & editing, Validation, Supervision, Methodology. **Weihua Xu:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Del Schutte:** Writing – review & editing, Visualization, Supervision, Methodology, Investigation, Conceptualization. **Ping-Keung Chan:** Writing – review & editing, Visualization, Supervision, Methodology, Investigation. **Gwo-Chin Lee:** Writing – review & editing, Visualization, Supervision, Methodology, Investigation, Conceptualization. **Javad Parvizi:** Writing – review & editing, Visualization, Validation, Methodology, Investigation, Conceptualization.

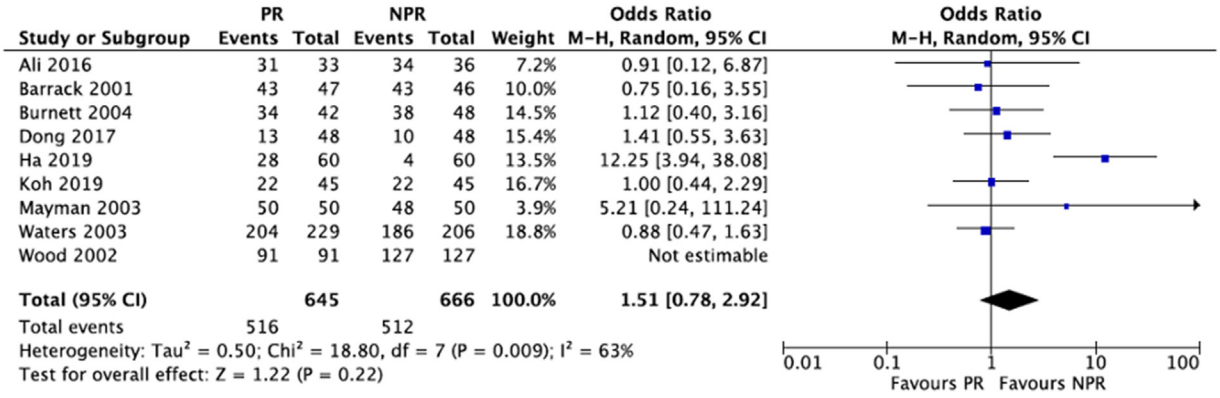


**Figure 7.** Patient satisfaction rate. PR, patellar resurfacing; NPR, nonpatellar resurfacing; CI, confidence interval.

## References


[1] Hegde V, Stambough JB, Levine BR, Springer BD. Highlights of the 2022 American joint replacement registry annual report. Arthroplast Today 2023;21:101137. https://doi.org/10.1016/j.artd.2023.101137.

[2] Fraser JF, Spangehl MJ. International rates of patellar resurfacing in primary total knee arthroplasty, 2004-2014. J Arthroplasty 2017;32:83–6. https://doi.org/10.1016/j.arth.2016.06.010.

[3] American Academy of Orthopaedic Surgeons on the Surgical Management of Osteoarthritis of the Knee Clinical Practice guideline. https://wwwAaosOrg/Smoak2cpgOrg2022. [Accessed 30 June 2024].

[4] Ali A, Lindstrand A, Nilsdotter A, Sundberg M. Similar patient-reported outcomes and performance after total knee arthroplasty with or without patellar resurfacing: a randomized study of 74 patients with 6 years of follow-up. Acta Orthop 2016;87:274–9. https://doi.org/10.3109/17453674.2016.1170548.

[5] Aunan E, Næss G, Clarke-Jenssen J, Sandvik L, Kibsgard TJ. Patellar resurfacing in total knee arthroplasty: functional outcome differs with different outcome scores. Acta Orthop 2016;87:158–64. https://doi.org/10.3109/17453674.2015.1111075.

[6] Barrack RL, Bertot AJ, Wolfe MW, Waldman DA, Myers L. Patellar resurfacing in total knee arthroplasty A prospective, randomized, double-blind study with five to seven years of follow-up. J Bone Joint Surg Am 2001;83:1376–81.

[7] Burnett RSJ, Boone JL, McCarthy KP, Rosenzweig S, Barrack RL. A prospective randomized clinical trial of patellar resurfacing and nonresurfacing in bilateral TKA. Clin Orthop Relat Res 2007;464:65–72. https://doi.org/10.1097/BLO.0b013e31812f783b. Lippincott Williams and Wilkins.

[8] Burnett RSJ, Boone JL, Rosenzweig SD, Steger-May K, Barrack RL. Patellar resurfacing compared with nonresurfacing in total knee arthroplasty: a concise follow-up of a randomized trial. J Bone Joint Surg 2009;91:2562–7. https://doi.org/10.2106/JBJS.H.00109.

[9] Beaupre L, Secretan C, Johnston D, Lavoie G. A randomized controlled trial comparing patellar retention versus patellar resurfacing in primary total knee arthroplasty: 5-10 year follow-up. BMC Res Notes 2012;5:273. https://doi.org/10.1186/1756-0500-5-273.

[10] Ferguson KB, Bailey O, Anthony I, James PJ, Stother IG, M JGB. A prospective randomised study comparing rotating platform and fixed bearing total knee arthroplasty in a cruciate substituting design - outcomes at two year follow-up. Knee 2014;21:151–5. https://doi.org/10.1016/j.knee.2013.09.007.

[11] Breeman S, Campbell M, Dakin H, Fiddian N, Fitzpatrick R, Grant A, et al. Patellar resurfacing in total knee replacement: five-year clinical and economic results of a large randomized controlled trial. J Bone Joint Surg 2011;93:1473–81. https://doi.org/10.2106/JBJS.J.00725.

[12] Campbell DG, Duncan WW, Ashworth M, Mintz A, Stirling J, Wakefield L, et al. Patellar resurfacing in total knee replacement a ten-year randomised prospective trial. J Bone Joint Surg 2006;88:734–9. https://doi.org/10.1302/0301-620X.88B6.

[13] Cankaya D, Inci F, Bilekli AB, Karakus D, Kahve Y, Erdem Y. Patellar resurfacing in total knee arthroplasty leads to better isokinetic performance. J Orthop Sci 2023;28:195–9. https://doi.org/10.1016/j.jos.2021.10.004.

[14] Chawla L, Bandekar SM, Dixit V, P A, Krishnamoorthi A, Mummigatti S. Functional outcome of patellar resurfacing vs non resurfacing in Total Knee Arthoplasty in elderly: a prospective five year follow-up study. J Arthrosc Joint Surg 2019;6:65–9. https://doi.org/10.1016/j.jajs.2018.09.006.

[15] Dong Y, Li T, Zheng Z, Xiang S, Weng X. Adding patella resurfacing after circumpatellar electrocautery did not improve the clinical outcome in bilateral total knee arthroplasty in Chinese population: a prospective randomized study. J Arthroplasty 2018;33:1057–61. https://doi.org/10.1016/j.arth.2017.10.039.

[16] Feller JA, Bartlett RJ, Lang DM. Patellar resurfacing versus retention in total knee arthroplasty. J Bone Joint Surg 1996;78:226–8.

[17] Ha C, Wang B, Li W, Sun K, Wang D, Li Q. Resurfacing versus not-resurfacing the patella in one-stage bilateral total knee arthroplasty: a prospective randomized clinical trial. Int Orthop 2019;43:2519–27. https://doi.org/10.1007/s00264-019-04361-7.

[18] 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. J Bone Joint Surg Am 1997;79:570–4.

[19] Kaseb MH, Tahmasebi MN, Mortazavi J, Sobhan MR, Nabian MH. Comparison of clinical results between patellar resurfacing and non-resurfacing in total knee arthroplasty: a short term. Evaluation 2018;124:124–9.

[20] Koh IJ, Kim MS, Sohn S, Song KY, Choi NY, In Y. Patients undergoing total knee arthroplasty using a contemporary patella-friendly implant are unaware of any differences due to patellar resurfacing. Knee Surg Sports Traumatol Arthrosc 2019;27:1156–64. https://doi.org/10.1007/s00167-018-5120-2.

[21] 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. J Arthroplasty 2003;18:541–5. https://doi.org/10.1016/S0883-5403(03)00150-5.

[22] Murray DW, MacLennan GS, Breeman S, Dakin HA, Johnston L, Campbell MK, et al. A randomised controlled trial of the clinical effectiveness and cost-effectiveness of different knee prostheses: the Knee Arthroplasty Trial (KAT). Health Technol Assess 2014;18:1–235. https://doi.org/10.3310/hta18190.

[23] Myles CM, Rowe PJ, Nutton RW, Burnett R. The effect of patella resurfacing in total knee arthroplasty on functional range of movement measured by flexible electrogoniometry. Clin BioMech 2006;21:733–9. https://doi.org/10.1016/j.clinbiomech.2006.02.008.

[24] Newman JH, Ackroyd CE, Shah NA, Karachalios T. Should the patella be resurfaced during total knee replacement? Knee 2000;7:17–23.

[25] Raaij TMV, Meij EV, Vries AJD, Raay JJAMV. Patellar resurfacing does not improve clinical outcome in patients with symptomatic tricompartmental knee OsteoarthritisAn RCT study of 40 patients receiving primary cruciate retaining total knee arthroplasty. J Knee Surg 2021;34:1503–9. https://doi.org/10.1055/s-0040-1710369.

[26] Roberts DW, Hayes TD, Tate CT, Lesko JP. Selective patellar resurfacing in total knee arthroplasty: a prospective, randomized, double-blind study. J Arthroplasty 2015;30:216–22. https://doi.org/10.1016/j.arth.2014.09.012.

[27] Thiengwittayaporn S, Srungboonmee K, Chiamtrakool B. Resurfacing in a posterior-stabilized total knee arthroplasty reduces patellar crepitus complication: a randomized, controlled trial. J Arthroplasty 2019;34:1969–74. https://doi.org/10.1016/j.arth.2019.04.050.

[28] Vukadin OB, Blagojević ZB, Baščarević ZL, Slavković NS, Stevanović V, Vukomanović BD. The importance of patellar resurfacing in total knee arthroplasty for symptomatic valgus degenerative deformity. Acta Chir Orthop Traumatol Cech 2017;84:30–4.

[29] Waters TS, Bentley G. Patellar resurfacing in total knee arthroplasty A prospective, randomized study. J Bone Joint Surg Am 2003;85:212–7.

[30] Wood DJ, Smith AJ, Collopy D, White B, Brankov B, Bulsara MK. Incorporated patellar resurfacing in total knee arthroplasty a prospective, randomized trial. Copyright © 2002 BY the journal of bone and joint surgery J Bone Joint Surg Am 2002;84:187–93.

[31] Burnett RS, Haydon CM, Rorabeck CH, Bourne RB. Patella resurfacing versus nonresurfacing in total knee arthroplasty: results of a randomized controlled clinical trial at a minimum of 10 years' follow-up. Clin Orthop Relat Res 2004;428:12–25. https://doi.org/10.1097/01.blo.0000148594.05443.a3. Lippincott Williams and Wilkins.

[32] Smith LA, LaCour MT, Dennis DA, Komistek RD. Anatomic vs dome patella: is there a difference between fixed- vs mobile-bearing posterior-stabilized total knee arthroplasties? J Arthroplasty 2021;36:3773–80. https://doi.org/10.1016/j.arth.2021.07.006.

[33] Yu Z, Cai H, Liu Z. Factors that impact the patellofemoral contact stress in the TKA: a review. Arthroplasty 2023;5:44. https://doi.org/10.1186/s42836-023-00197-0.

[34] Sato D, Inoue M, Sasaki T, Uchida J, Onodera T, Kondo E, et al. No patella resurfacing total knee arthroplasty leads to reduction in the thickness of patellar cartilage to less than half within 5 years: a quantitative longitudinal evaluation using MRI. J Exp Orthop 2021;8:107. https://doi.org/10.1186/s40634-021-00425-z.

[35] Coory JA, Tan KG, Whitehouse SL, Hatton A, Graves SE, Crawford RW. The outcome of total knee arthroplasty with and without patellar resurfacing up to 17 Years: a report from the Australian orthopaedic association national joint replacement registry. J Arthroplasty 2020;35:132–8. https://doi.org/10.1016/j.arth.2019.08.007.

[36] Budhiparama NC, Hidayat H, Novito K, Utomo DN, Lumban-Gaol I, Nelissen RGHH. Does circumferential patellar denervation result in decreased knee pain and improved patient-reported outcomes in patients undergoing nonresurfaced, simultaneous bilateral TKA? Clin Orthop Relat Res 2020;478:2020–33. https://doi.org/10.1097/CORR.0000000000001035.

[37] Wang Y, Feng W, Zang J, Gao H. Effect of patellar denervation on anterior knee pain and knee function in total knee arthroplasty without patellar resurfacing: a meta-analysis of randomized controlled trials. Orthop Surg 2020;12:1859–69. https://doi.org/10.1111/os.12815.

[38] Benazzo F, Perticarini L, Jannelli E, Ivone A, Ghiara M, Rossi SMP. Controversy: supporting patellar resurfacing in total knee arthroplasty – do it. EFORT Open Rev 2020;5:785–92. https://doi.org/10.1302/2058-5241.5.190075.

[39] Vertullo CJ, Graves SE, Cuthbert AR, Lewis PL. The effect of surgeon preference for selective patellar resurfacing on revision risk in total knee replacement: an instrumental variable analysis of 136,116 procedures from the Australian orthopaedic association national joint replacement registry. J Bone Jt Surg Am Vol 2019;101:1261–70. https://doi.org/10.2106/JBJS.18.01350.

[40] Schindler OS. The controversy of patellar resurfacing in total knee arthroplasty: ibisne in medio tutissimus? Knee Surg Sports Traumatol Arthrosc 2012;20:1227–44. https://doi.org/10.1007/s00167-012-1985-7.