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Systematic Review

The 50 Most-Cited Articles Regarding Hip Resurfacing

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ABSTRACT

Background: Hip resurfacing arthroplasty is an accepted treatment option for young patients presenting with osteoarthritis of the hip. The purpose of this review was to evaluate and identify the top 50 most-cited articles pertaining to hip resurfacing, to help clinicians identify influential articles and navigate the literature more effectively.

Material and methods: Clarivate Analytics Web of Science was used to identify all articles related to hip resurfacing. The screening was based on the number of citations for each article. The final list of articles was further reviewed, and further data including manuscript title, authors, total citation count, year of publication, journal, country of origin, and level of evidence were extracted.

Results: The most-cited publication was "Pseudotumors associated with metal-on-metal hip resurfacings", which was cited 704 times. The average total number of citations per publication was 203. The most prolific publication year was 2008 with 8 publications, and the most recent article was published in 2012. The journals with the most attributable publications were *Journal of Bone and Joint Surgery* and *Clinical and Orthopedic Related Research*.

Conclusions: This review provides a comprehensive analysis of the most-cited articles pertaining to hip resurfacing.

Level of evidence: III.

Introduction and background

Hip resurfacing arthroplasty was originally developed as an alternative surgery for young and active individuals requiring a hip replacement [1]. For hip resurfacing arthroplasty, the femoral head is not removed like it is in a traditional total hip arthroplasty (THA). Instead, it is resurfaced and capped with a metal component which then fits into an implanted metal acetabulum although newer synthetic materials are also used and under investigation. Potential advantages of hip resurfacing arthroplasty include lower rates of dislocation, better postoperative hip mobility, and a more normal gait, among others [2]. Of the several potential advantages, 2 are perhaps the most appealing to the younger patients: increased activity/performance and ease of revision [3]. For patients who may require a revision surgery due to excessive wear and subsequent failure of the femoral component, conversion to THA was found to be comparable to a primary total hip replacement [4]. Despite these advantages, hip resurfacing remains a controversial treatment option due to increase in metal ions in blood, development of pseudotumors from metal debris [5], increase in incidence of postoperative femoral neck fracture [6], and limited long-term results.

Evaluation of published literature was traditionally driven by review articles and surveys; however, bibliometric analyses have recently become an important statistical tool. Such an analysis is made to explore the qualities and characteristics of the published articles regarding a specific topic. The first of this kind was published in the *Journal of American Medical Association* in 1987 [7]. Bibliometric articles provide a cross-sectional analysis of a field of research and may assist in identification of the most impactful publications in the present literature. As the number of published articles or trends increase over time, bibliometric analyses assist in the investigation and evaluation of the level of scientific significance of the research available. Previous bibliometric analyses of

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THA and total knee arthroplasty have found that the most-cited articles originated in North America and Western Europe and focus on clinical outcomes (eg, postoperative thromboembolism) and surgical methods [8,9]. However, to our knowledge, there are no previous studies that have specifically analyzed the most influential articles related to hip resurfacing arthroplasty.

The authors sought to analyze the current most influential literature on hip resurfacing arthroplasty. The analysis will be in the form of a bibliometric review, focused on citation frequency. By doing so, we will be able to gauge the extent of already published research and help identify any trends that may be useful for future clinicians to argue for specific treatment options on an already controversial procedure. This paper is the first in the literature to review the most-cited literature in hip resurfacing arthroplasty.

Material and methods

Clarivate Analytics Web of Science, a global publisher-dependent citation database, was used to collect the data. A computerized literature search was performed using the following search query without filters: "(TS = (hip resurfacing)) OR TS = (resurfacing arthroplasty)". This yielded 3107 results which were subsequently sorted by the number of citations (high to low), and the 200 most-cited articles were exported to a spreadsheet for further analysis (Fig. 1). After an initial review by 2 authors (J.W. and A.A.S.), this search query was considered acceptable. The titles referring to hip resurfacing arthroplasty were included for the analysis. Articles were excluded if they pertained solely to THA, hip arthroplasty without an independent analysis of hip resurfacing, and arthroplasty of other joints. The abstract and full-text articles were reviewed if the inclusion criteria could not be assessed from the title. The top 50 full-text publications were assessed to determine the level of evidence (LOE) according to the Oxford Center for Evidence Based Medicine. The following guidelines were used to determine LOE:

1 = systematic reviews of randomized trials, or systematic reviews of inception cohort studies;

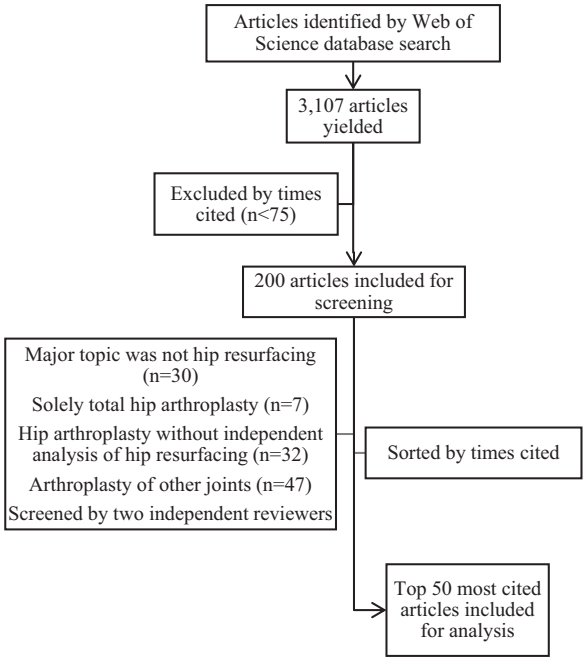

Figure 1. Search methodology.

2 = systematic reviews of cohort studies, inception cohort studies, cross-sectional studies, randomized trials, or observational studies with dramatic effect;
3 = cohort studies (primarily retrospective), epidemiological/observational study;
4 = case-control studies, low-impact cohort studies, animal trials;
5 = simulations, models, or mechanism-based reasoning.

The articles were simultaneously assigned to 1 or more of the following classifications: clinical outcomes, surgical techniques, anatomy/biomechanics/physiology, and corrosion/pseudotumors.

Among the studies that met the inclusion criteria, the following variables were recorded from the Web of Science database and analyzed: primary author, country of origin, number of citations, number of citations per year, year of publication, and publishing journal.

Results

The 50 publications analyzed in this study have been cited 10,162 times at the time this paper was written, averaging 203 citations per publication. The most-cited article in this study was cited 704 times, while the 50th (last) ranked publication in this study was cited 111 times (Table 1). The most recently published study included in this top 50 analysis was published in 2012, while the oldest publication included in our analysis was published in 1985. The most prolific publication year was 2008 with 8 publications, followed by 2009 with 7 publications, and the years 2006 and 2007 tied for third with 6 publications (Fig. 2). All but 3 of the studies included in this analysis were published between 2003 and 2012.

The most contributory author was Langton with 5 publications in the top 50. Three authors (Kwon, Hart, and Shimmin) each contributed 3 publications, the second most contributory authors in our study. An additional 3 authors (Treacy, De Haan, and Morlock) had contributions to 2 studies each. All other authors had a single attributed publication included in the analysis (Fig. 3).

The country which produced the most publications in the top 50 was England (n = 28). The country with the second most contributions was The United States (n = 15). Lastly, both Australia and Canada were tied for third with 5 publications each (Table 2). Nuffield Orthopaedic Centre was the institution that provided the most publications (n = 8), followed by The University of Oxford (n = 7). Both Melbourne Orthopaedic Group and University Hospital of North Tees contributed 5 publications each (Table 1).

Most publications in the analysis were published in the *Journal of Bone and Joint Surgery-British Volume* (n = 29). This was followed by *Journal of Bone and Joint Surgery-American Volume* (n = 7) and *Clinical and Orthopedic Related Research* (n = 6) (Fig. 4). In terms of LOE, the most common classification was level III (n = 43, 86%) (Fig. 5). Most articles published were classified as clinical outcomes with a total of 26 publications. This was followed by corrosion/pseudotumors with 19 publications, a unique classification specific to hip resurfacing. This classification evaluated concentrations of particular metal ions along with other markers of wear, degradation, and the development of pseudotumors as a consequence of hip resurfacing procedures. Surgical technique was a main focus of 5 of the publications, while an additional 4 focused on anatomy/biomechanics/physiology. Of note, 8 publications met criteria for multiple categories of classification. Such publications were assigned multiple classifications and included in the total count, once for each classification. No publications went unclassified at the end of the analysis as they all met criteria within our classification system (Fig. 6).

Table 1
Top 50 publications by total number of citations.

Rank	Publication	Total citations	Citations/year of publication until 2021
1	Pandit, H., S. Glyn-Jones, P. McLardy-Smith, et al., *Pseudotumours associated with metal-on-metal hip resurfacings.* J Bone Joint Surg Br, 2008. **90**(7): p. 847-51.	704	54
2	Langton, D.J., S.S. Jameson, T.J. Joyce, et al., *Early failure of metal-on-metal bearings in hip resurfacing and large-diameter total hip replacement: A consequence of excess wear.* J Bone Joint Surg Br, 2010. **92**(1): p. 38-46	543	49
3	Daniel, J., P.B. Pynsent, and D.J. McMinn, *Metal-on-metal resurfacing of the hip in patients under the age of 55 years with osteoarthritis.* J Bone Joint Surg Br, 2004. **86**(2): p. 177-84.	540	32
4	Treacy, R.B., C.W. McBryde, and P.B. Pynsent, *Birmingham hip resurfacing arthroplasty. A minimum follow-up of 5 years.* J Bone Joint Surg Br, 2005. **87**(2): p. 167-70.	397	25
5	De Haan, R., C. Pattyn, H.S. Gill, et al., *Correlation between inclination of the acetabular component and metal ion levels in metal-on-metal hip resurfacing replacement.* J Bone Joint Surg Br, 2008. **90**(10): p. 1291-7.	383	29
6	Shimmin, A.J. and D. Back, *Femoral neck fractures following Birmingham hip resurfacing: a national review of 50 cases.* J Bone Joint Surg Br, 2005. **87**(4): p. 463-4.	360	23
7	Langton, D.J., S.S. Jameson, T.J. Joyce, et al., *Accelerating failure rate of the ASR total hip replacement.* J Bone Joint Surg Br, 2011. **93**(8): p. 1011-6.	287	29
8	Langton, D.J., T.J. Joyce, S.S. Jameson, et al., *Adverse reaction to metal debris following hip resurfacing: the influence of component type, orientation and volumetric wear.* J Bone Joint Surg Br, 2011. **93**(2): p. 164-71.	280	28
9	Grammatopoulos, G., H. Pandit, Y.M. Kwon, et al., *Hip resurfacings revised for inflammatory pseudotumour have a poor outcome.* J Bone Joint Surg Br, 2009. **91**(8): p. 1019-24.	276	23
10	Langton, D.J., S.S. Jameson, T.J. Joyce, et al., *The effect of component size and orientation on the concentrations of metal ions after resurfacing arthroplasty of the hip.* J Bone Joint Surg Br, 2008. **90**(9): p. 1143-51.	270	21
11	Schmalzried, T.P., D. Guttmann, M. Grecula, et al., *The relationship between the design, position, and articular wear of acetabular components inserted without cement and the development of pelvic osteolysis.* J Bone Joint Surg Am, 1994. **76**(5): p. 677-88.	241	9
12	Kwon, Y.M., S.J. Ostlere, P. McLardy-Smith, et al., *"Asymptomatic" pseudotumors after metal-on-metal hip resurfacing arthroplasty: prevalence and metal ion study.* J Arthroplasty, 2011. **26**(4): p. 511-8.	237	24
13	Garbuz, D.S., M. Tanzer, N.V. Greidanus, et al., *The John Charnley Award: Metal-on-metal hip resurfacing* versus *large-diameter head metal-on-metal total hip arthroplasty: a randomized clinical trial.* Clin Orthop Relat Res, 2010. **468**(2): p. 318-25.	237	22
14	Glyn-Jones, S., H. Pandit, Y.M. Kwon, et al., *Risk factors for inflammatory pseudotumour formation following hip resurfacing.* J Bone Joint Surg Br, 2009. **91**(12): p. 1566-74.	219	18
15	Pollard, T.C., R.P. Baker, S.J. Eastaugh-Waring, et al., *Treatment of the young active patient with osteoarthritis of the hip. A five- to 7-year comparison of hybrid total hip arthroplasty and metal-on-metal resurfacing.* J Bone Joint Surg Br, 2006. **88**(5): p. 592-600.	208	14
16	Clarke, M.T., P.T. Lee, A. Arora, et al., *Levels of metal ions after small- and large-diameter metal-on-metal hip arthroplasty.* J Bone Joint Surg Br, 2003. **85**(6): p. 913-7.	206	11
17	Mahendra, G., H. Pandit, K. Kliskey, et al., *Necrotic and inflammatory changes in metal-on-metal resurfacing hip arthroplasties.* Acta Orthop, 2009. **80**(6): p. 653-9.	193	16
18	Morlock, M.M., N. Bishop, J. Zustin, et al., *Modes of implant failure after hip resurfacing: morphological and wear analysis of 267 retrieval specimens.* J Bone Joint Surg Am, 2008. **90 Suppl 3**: p. 89-95.	190	15
19	Langton, D.J., A.P. Sprowson, T.J. Joyce, et al., *Blood metal ion concentrations after hip resurfacing arthroplasty: a comparative study of articular surface replacement and Birmingham Hip Resurfacing arthroplasties.* J Bone Joint Surg Br, 2009. **91**(10): p. 1287-95.	189	16
20	Smith, A.J., P. Dieppe, P.W. Howard, et al., *Failure rates of metal-on-metal hip resurfacings: analysis of data from the National Joint Registry for England and Wales.* Lancet, 2012. **380**(9855): p. 1759-66.	188	21
21	Shimmin, A., P.E. Beaule, and P. Campbell, *Metal-on-metal hip resurfacing arthroplasty.* J Bone Joint Surg Am, 2008. **90**(3): p. 637-54.	186	14
22	Girard, J., M. Lavigne, P.A. Vendittoli, et al., *Biomechanical reconstruction of the hip: a randomised study comparing total hip resurfacing and total hip arthroplasty.* J Bone Joint Surg Br, 2006. **88**(6): p. 721-6	179	12
23	Campbell, P., P.E. Beaule, E. Ebramzadeh, et al., *The John Charnley Award: a study of implant failure in metal-on-metal surface arthroplasties.* Clin Orthop Relat Res, 2006. **453**: p. 35-46.	175	12
24	De Haan, R., P.A. Campbell, E.P. Su, et al., *Revision of metal-on-metal resurfacing arthroplasty of the hip: the influence of malpositioning of the components.* J Bone Joint Surg Br, 2008. **90**(9): p. 1158-63.	173	13
25	Vendittoli, P.A., S. Mottard, A.G. Roy, et al., *Chromium and cobalt ion release following the Durom high carbon content, forged metal-on-metal surface replacement of the hip.* J Bone Joint Surg Br, 2007. **89**(4): p. 441-8.	173	12
26	Steffen, R.T., H.P. Pandit, J. Palan, et al., *The 5-year results of the Birmingham Hip Resurfacing arthroplasty: an independent series.* J Bone Joint Surg Br, 2008. **90**(4): p. 436-41.	171	13
27	Kishida, Y., N. Sugano, T. Nishii, et al., *Preservation of the bone mineral density of the femur after surface replacement of the hip.* J Bone Joint Surg Br, 2004. **86**(2): p. 185-9.	170	10
28	Kwon, Y.M., S. Glyn-Jones, D.J. Simpson, et al., *Analysis of wear of retrieved metal-on-metal hip resurfacing implants revised due to pseudotumours.* J Bone Joint Surg Br, 2010. **92**(3): p. 356-61.	161	15
29	Marker, D.R., T.M. Seyler, R.H. Jinnah, et al., *Femoral neck fractures after metal-on-metal total hip resurfacing: a prospective cohort study.* J Arthroplasty, 2007. **22**(7 Suppl 3): p. 66-71.	156	11
30	Shimmin, A.J., J. Bare, and D.L. Back, *Complications associated with hip resurfacing arthroplasty.* Orthop Clin North Am, 2005. **36**(2): p. 187-93, ix.	153	10
31	Ziaee, H., J. Daniel, A.K. Datta, et al., *Transplacental transfer of cobalt and chromium in patients with metal-on-metal hip arthroplasty: a controlled study.* J Bone Joint Surg Br, 2007. **89**(3): p. 301-5.	148	11
32	Bell, R.S., J. Schatzker, V.L. Fornasier, et al., *A study of implant failure in the Wagner resurfacing arthroplasty.* J Bone Joint Surg Am, 1985. **67**(8): p. 1165-75.	148	4
33	Hart, A.J., S. Sabah, J. Henckel, et al., *The painful metal-on-metal hip resurfacing.* J Bone Joint Surg Br, 2009. **91**(6): p. 738-44.	146	12
34		146	10

Table 1 (*continued*)

Rank	Publication	Total citations	Citations/year of publication until 2021
	Ball, S.T., M.J. Le Duff, and H.C. Amstutz, *Early results of conversion of a failed femoral component in hip resurfacing arthroplasty.* J Bone Joint Surg Am, 2007. **89**(4): p. 735-41.		
35	Silva, M., K.H. Lee, C. Heisel, et al., *The biomechanical results of total hip resurfacing arthroplasty.* J Bone Joint Surg Am, 2004. **86**(1): p. 40-6.	144	8
36	Leslie, I.J., S. Williams, G. Isaac, et al., *High cup angle and microseparation increase the wear of hip surface replacements.* Clin Orthop Relat Res, 2009. **467**(9): p. 2259-65.	143	12
37	Mont, M.A., T.M. Seyler, P.S. Ragland, et al., *Gait analysis of patients with resurfacing hip arthroplasty compared with hip osteoarthritis and standard total hip arthroplasty.* J Arthroplasty, 2007. **22**(1): p. 100-8.	143	10
38	Little, C.P., A.L. Ruiz, I.J. Harding, et al., *Osteonecrosis in retrieved femoral heads after failed resurfacing arthroplasty of the hip.* J Bone Joint Surg Br, 2005. **87**(3): p. 320-3.	142	9
39	Hing, C.B., D.L. Back, M. Bailey, et al., *The results of primary Birmingham hip resurfacings at a mean of 5 years. An independent prospective review of the first 230 hips.* J Bone Joint Surg Br, 2007. **89**(11): p. 1431-8.	141	10
40	Ollivere, B., C. Darrah, T. Barker, et al., *Early clinical failure of the Birmingham metal-on-metal hip resurfacing is associated with metallosis and soft-tissue necrosis.* J Bone Joint Surg Br, 2009. **91**(8): p. 1025-30.	139	12
41	Back, D.L., D.A. Young, and A.J. Shimmin, *How do serum cobalt and chromium levels change after metal-on-metal hip resurfacing?* Clin Orthop Relat Res, 2005. **438**: p. 177-81.	137	9
42	Beaule, P.E., J.L. Lee, M.J. Le Duff, et al., *Orientation of the femoral component in surface arthroplasty of the hip. A biomechanical and clinical analysis.* J Bone Joint Surg Am, 2004. **86**(9): p. 2015-21.	134	8
43	Morlock, M.M., N. Bishop, W. Ruther, et al., *Biomechanical, morphological, and histological analysis of early failures in hip resurfacing arthroplasty.* Proc Inst Mech Eng H, 2006. **220**(2): p. 333-44.	133	9
44	McMinn, D., R. Treacy, K. Lin, et al., *Metal on metal surface replacement of the hip. Experience of the McMinn prothesis.* Clin Orthop Relat Res, 1996(329 Suppl): p. S89-98.	125	5
45	Hart, A.J., T. Hester, K. Sinclair, et al., *The association between metal ions from hip resurfacing and reduced T-cell counts.* J Bone Joint Surg Br, 2006. **88**(4): p. 449-54.	123	8
46	Kwon, Y.M., P. Thomas, B. Summer, et al., *Lymphocyte proliferation responses in patients with pseudotumors following metal-on-metal hip resurfacing arthroplasty.* J Orthop Res, 2010. **28**(4): p. 444-50.	121	11
47	Treacy, R.B., C.W. McBryde, E. Shears, et al., *Birmingham hip resurfacing: a minimum follow-up of 10 years.* J Bone Joint Surg Br, 2011. **93**(1): p. 27-33.	117	12
48	Hart, A.J., P. Buddhdev, P. Winship, et al., *Cup inclination angle of greater than 50 degrees increases whole blood concentrations of cobalt and chromium ions after metal-on-metal hip resurfacing.* Hip Int, 2008. **18**(3): p. 212-9.	117	9
49	Vail, T.P., C.A. Mina, J.D. Yergler, et al., *Metal-on-metal hip resurfacing compares favorably with THA at 2 years followup.* Clin Orthop Relat Res, 2006. **453**: p. 123-31.	117	8
50	Wimmer, M.A., A. Fischer, R. Buscher, et al., *Wear mechanisms in metal-on-metal bearings: the importance of tribochemical reaction layers.* J Orthop Res, 2010. **28**(4): p. 436-43.	111	10

The most-cited article in our analysis titled, "Pseudotumors associated with metal-on-metal hip resurfacings" (2008) by Pandit et al., described pseudotumors following hip resurfacings, soft-tissue masses that are neither malignant nor infectious [10]. The second most-cited publication, "Early failure of metal-on-metal bearings in hip resurfacing and large-diameter total hip replacement: A consequence of excess wear" (2010), was published by Langton et al., the most contributory author to the top 50 publications [11]. With 540 citations, the third most-cited publication in our study's analysis was the 2004 study of Daniel et al. [12], "Metal-on-metal resurfacing of the hip in patients under the age of 55 y with osteoarthritis".

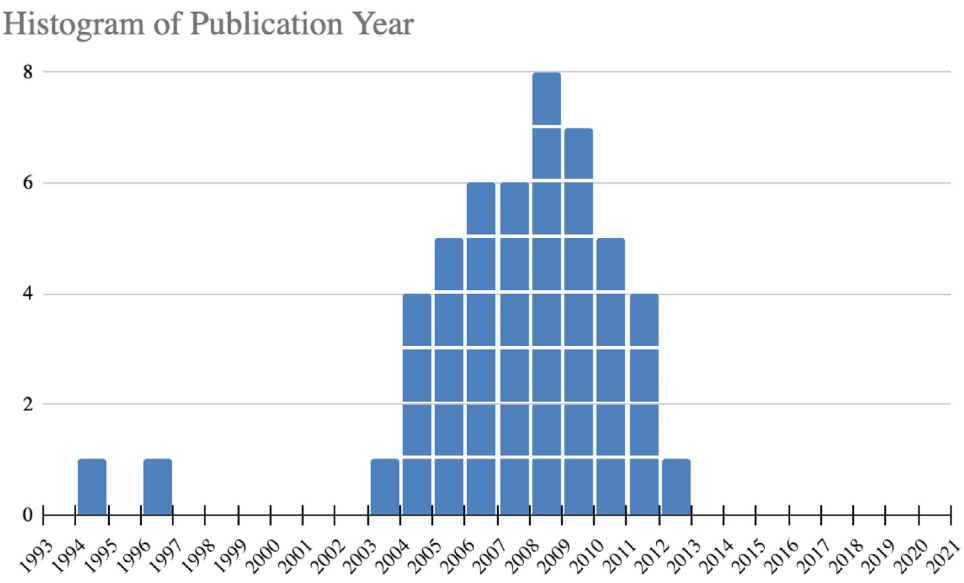

Figure 2. Publication year.

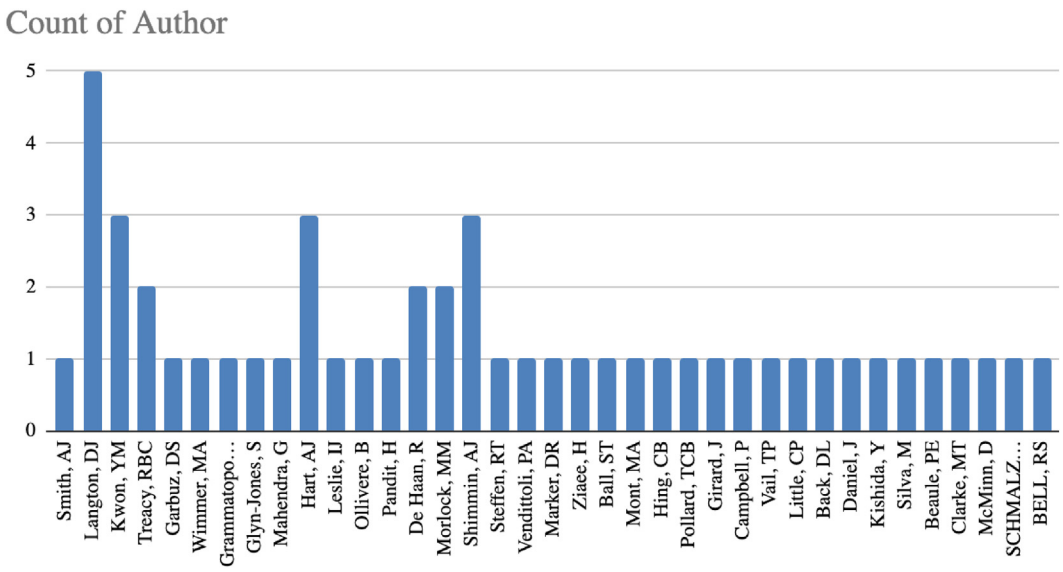

Figure 3. Author count.

Discussion

In young, high-demand patients with evidence of arthritic hip disease, the best surgical procedure remains under discussion. Hip resurfacing arthroplasty was developed as a solution, preserving more femoral bone stock and more closely mimicking the patient's normal natural anatomy [13]. By performing a bibliometric review on "Hip Resurfacing", we identified the most influential publications on the topic. Although this approach makes it difficult to ascertain publication quality, it is a measure of influence of the publication [14]. This analysis provides surgeons and clinicians who will consider hip resurfacing in their practice a tool to quickly identify the top articles cited, instead of having to sort through the vast amount of literature. The publications analyzed in our study have amassed well over 10,000 citations already despite most of them having been published within the last 15 years. Although the first publication in our study was published in 1985, most highly cited articles were published more recently in the late 2000s.

Although more evidence may be warranted comparing traditional THA to hip resurfacing, previous studies show promise. Oxblom et al. published a 2019 cohort study showing better self-reported hip function scores with HR than with THA, primarily in scores of functions of daily living (90% vs 84%, respectively) and sport and recreation (77% vs 68%, respectively) [15]. One study evaluating HR vs THA in patients younger than 35 y showed excellent functional outcomes with both procedures and no statistical difference between patient-reported outcomes when comparing the 2 [16]. Another study demonstrated no differences in short-term outcomes when comparing the Oxford, the Western Ontario and McMaster Universities Osteoarthritis Index, and Harris Hip Scores, as well as the activity scores of young patients with HR vs a THA [17].

This bibliometric analysis has shown that the majority of the most influential literature has evaluated either clinical outcomes (62%) or wear/metal debris (32%). Although there are theoretical advantages to HR and short-term to midterm outcomes are promising, many of the most-cited publications aim to discuss postoperative complications. In fact, the 2 most-cited publications in our study focused on common complications associated with metal-on-metal hip resurfacing arthroplasty, pseudotumors, and wear/metal debris. These trends highlight the controversy that currently exists with the use of hip resurfacing implants: lack of long-term clinical outcomes and postoperative complications.

In our analysis, we found that the most-cited article pertaining to hip resurfacing was "Pseudotumors associated with metal-on-metal hip resurfacings" by Pandit et al. which sought to describe the presence of pseudotumors following a hip resurfacing procedure [10]. They noted an incidence of 1% for development of pseudotumor that occurred at 5 years. All occurred in women, and presentations were variable: most commonly hip discomfort [10]. The second most-cited article, "Early failure of metal-on-metal bearings in hip resurfacing and large-diameter total hip replacement: A consequence of excess wear", by Langton et al. was a retrospective review which analyzed 660 patients who underwent a hip resurfacing procedure, evaluating for an association with metal debris failure. Seventeen patients (3.4%) were found to require a revision due to a complication caused by metal debris. Their data showed

Table 2
Contributing institutions.

Name of institution	Country of origin	Number of articles
Nuffield Orthopaedic Centre	England	8
University of Oxford	England	7
Melbourne Orthopaedic Group	Australia	5
University Hospital of North Tees	England	5
Newcastle University	England	4

Multiple institutions may be attributed to a single publication. Only institutions with 4 or more contributions are included.

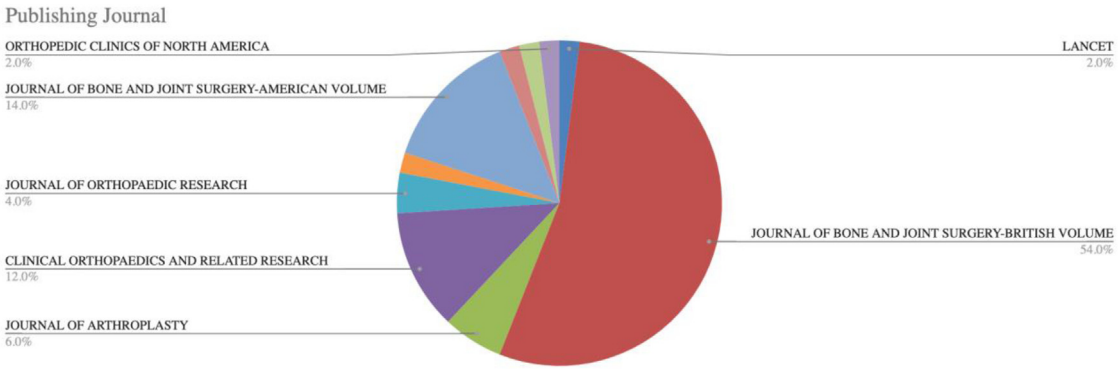

Figure 4. Journal of publications.

that these revision-required patients had statistically significant smaller components, significantly higher acetabular component anteversion, and significantly higher concentrations of blood and joint chromium and cobalt ions than asymptomatic individuals ($P < .001$) [11]. Ultimately, adequate acetabular implant positioning and component size may reduce early failures in these implants.

Many studies evaluated the effect of implant position and size in regard to failure and metal ion concentrations. Langton et al. noted significantly higher concentrations of cobalt and chromium ions in the blood in smaller femoral components (≤51 mm) than in larger components (≥53 mm) ($P < .01$) [18]. De Haan et al. described a significantly higher level of metal ions in patients with steeply inclined components (>55 abduction angles) [19]. They noted steeper inclined components with smaller size components give rise to higher serum metal ion levels, which contribute to greater risk of edge loading [19].

Other studies evaluating clinical outcomes and survivorship have shown satisfactory early to midterm outcomes. The fourth most-cited publication, a 5-year follow-up of consecutive Birmingham hip arthroplasties performed, described a survival of 98% in men younger than 65 years and women younger than 60 years with normal bone stock, with 99% for aseptic revisions only [20]. Fisher et al. assessed return to physical activity following hip resurfacing in men and women with a mean age at surgery of 54 years and found 87% of patients returned to sporting activity postoperatively with an improvement in Oxford hip scores from 43.4 to 17.7 after surgery [21]. Macpherson and Breusch performed a review article and found promising short-term survivorship ranging from 93% to 99% at follow-up of up to 8 years after metal-on-metal hip resurfacing [22]. Two publications identified in our "top 50 most cited" list focused on another postoperative complication: femoral neck fractures. Shimmin and Back reported an incidence of femoral neck fractures of 1.46% after a Birmingham implant was placed [6]. The relative risk of fracture in women was 1.94 times more than that in men ($P < .01$), and significant varus malalignment of the femoral component and notching of the femoral neck were seen in 85% of cases [6]. Marker et al. reported an absolute risk of femoral neck fracture at 2.5% [23]. An incidence of 17% was observed during the first 69 resurfacing procedures, followed by an incidence of 0.4% in the remaining 481 resurfacing procedures. A higher incidence was also seen in women and obese patients [23].

The journals most commonly represented are *Journal of Bone and Joint Surgery* and *Clinical Orthopedics and Related Research*, 2 of the highest rated orthopedic journals in terms of impact factor [24]. Most articles were graded with an LOE of III at 43 (86%), whereas only 1 article (2%) achieved level I (Fig. 5). This demonstrates the lack in high-quality level I/II evidence on this topic currently being cited in the literature.

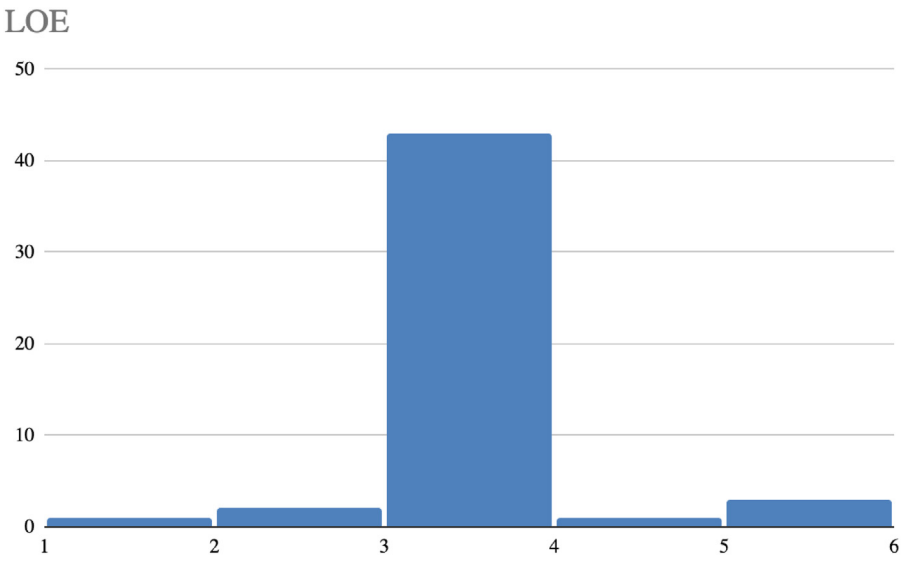

Figure 5. Level of evidence.

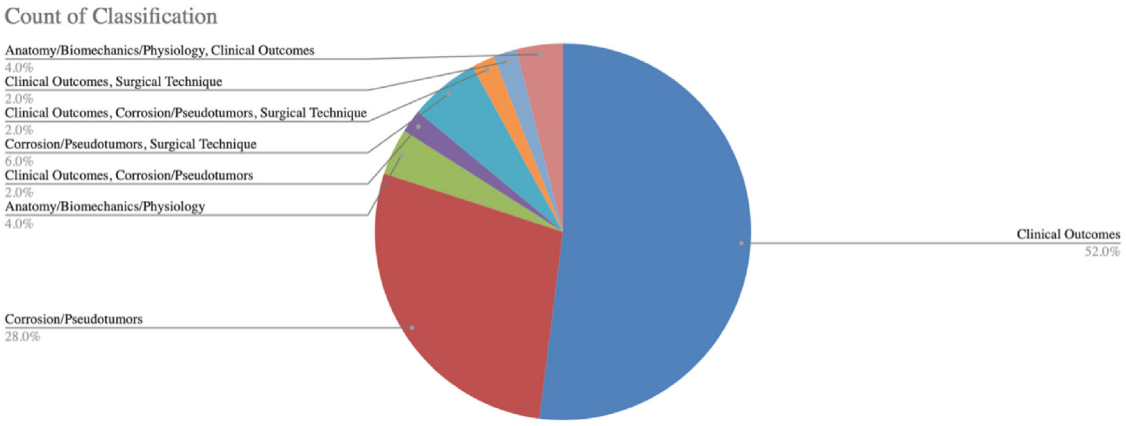

Figure 6. Publication classifications.

There are inherent limitations present in this bibliometric review. Hip resurfacing is not a commonly performed procedure; therefore, there are lower amounts of citations to these publications than for other major orthopedic topics. Second, articles may have been missed in our search criteria as we only included and evaluated peer-reviewed articles. Citations occurring in other non–peer-reviewed literature were not included, which may underreport the influence of publications. Lastly, older publications may be viewed as having greater importance given they have had a longer opportunity to be cited.

Our analysis attempted to alleviate some of these limitations. The LOE was provided for all studies, giving the reader an opportunity to see the overall quality of top-cited articles. Second, we included a citation density which breaks down how many times the article is cited per year.

Conclusions

This study highlights the 50 most-cited publications regarding hip resurfacing arthroplasty, which have accumulated over 10,000 citations. Most of the literature on the topic were regarding clinical outcome studies (62%), and all but 3 of the most influential publications were published between 2003 and 2012. The United Kingdom was the most contributory country followed by the United States of America, Australia, and Canada. This bibliometric review can help navigate providers to the most influential articles on hip resurfacing in the current literature.

Conflicts of interest

The authors declare there are no conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2022.06.008.

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