All-polyethylene tibial components are equal to metal-backed components: systematic review and meta-regression

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SURVEY

All-polyethylene Tibial Components are Equal to Metal-backed Components

Systematic Review and Meta-regression

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Abstract

Background Less than 1% of all primary TKAs are performed with an all-polyethylene tibial component, although recent studies indicate all-polyethylene tibial components are equal to or better than metal-backed ones.

Questions/purposes We asked whether the metal-backed tibial component was clinically superior to the all-polyethylene tibial component in primary TKAs regarding revision rates and clinical functioning, and which modifying variables affected the revision rate.

Methods We systematically reviewed the literature for clinical studies comparing all-polyethylene and metal-backed tibial components used in primary TKAs in terms of revision rates, clinical scores, and radiologic parameters including radiostereometric analysis (RSA). Meta-regression techniques were used to explore factors modifying the observed effect. Our search yielded 1557 unique references of which 26 articles were included, comprising more than 12,500 TKAs with 231 revisions for any reason.

Results Meta-analysis showed no differences between the all-polyethylene and metal-backed components except for higher migration of the metal-backed components. Meta-regression showed strong evidence that the all-polyethylene design has improved with time compared with the metal-backed design.

Conclusions The all-polyethylene components were equivalent to metal-backed components regarding revision rates and clinical scores. The all-polyethylene components had better fixation (RSA) than the metal-backed components. The belief that metal-backed components are better than all-polyethylene ones seems to be based on studies from earlier TKAs. This might no longer be true for modern TKAs.

Level of Evidence Level II, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

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Introduction

The all-polyethylene tibial component used in primary TKAs has regained interest. Although metal-backed tibial components are used in the majority of TKAs, the all-polyethylene component frequently is recommended [18]. Candidates for all-polyethylene tibial TKAs mainly are patients considered low demand, such as the elderly (older than 70 years) or patients with rheumatoid arthritis [25, 31]. Nonetheless, the all-polyethylene tibial component also has been recommended for younger patients [9, 36].

Advantages of metal-backed tibial components are intraoperative flexibility attributable to modularity, the possibility of late liner exchange in case of wear, and the feasibility of cementless application, which however applies to less than 3% of all components. Advantages of all-polyethylene tibial components are absence of locking mechanism failures and backside wear. Furthermore, all-polyethylene components are more cost-efficient and generally of thicker polyethylene (ie, higher yield strength of the polyethylene) with decreased bone resection [18]. Whether these properties lead to superior performance of one design is unclear.

According to the Australian Orthopaedic Association National Joint Replacement Registry [5], less than 1% of all primary TKAs are performed using an all-polyethylene tibial component. It seems, in daily practice, metal-backed tibial components are preferred, but is there evidence for such clinical practice?

To address this, we posed two research questions for this systematic review and meta-analysis: (1) Is the metal-backed tibial component clinically superior to the all-polyethylene tibial component in primary TKA regarding revision rates and clinical functioning (clinical scores ROM)? (2) Which modifying variables affect the revision rate using meta-regression and explain differences between studies?

Materials and Methods

The study protocol was approved by the institutional scientific review board. We designed and conducted this systematic review according to the Cochrane standard. The reporting is in accordance with the PRISMA guidelines [24] and Wright et al. [49].

Our search was designed to collect clinical studies that compared the outcome of the all-polyethylene and fixed-bearing metal-backed tibial components in primary TKAs. The search strategy was created in cooperation with an experienced medical librarian (JWS) to diminish the number of missed articles and therefore possible biased outcomes [48]. The search was without publication, language, or date restrictions. For articles published in languages other than English, German, Dutch, and French, we consulted a native speaker with a medical degree. PubMed, Embase, Web of Science, Cochrane, CINAHL, and Academic Search Premier databases were searched. Additionally, the journal databases for ScienceDirect and Wiley-Blackwell were searched. The search strategy consisted of the following components: "polyethylene" and related Mesh and free field terms, "arthroplasty" and related Mesh and free field terms, "knee replacement" and related Mesh and free field terms.

Two reviewers (KAN, WCV) independently selected the studies to be included in the review. Articles were selected in two steps: (1) both reviewers were blinded to all information except title and abstract, and (2) the full text of the article was screened for eligibility. In the first step, we excluded articles when it was apparent from either the title or the abstract that the study did not meet the following criteria: (1) The study had to be a comparative study. (2) The intervention(s) evaluated in the trials had to be all-polyethylene and metal-backed tibial components in primary (bicompartmental or tricompartmental) TKAs for end-stage osteoarthritis or rheumatoid arthritis and the results of both designs had to be reported separately. (3) The metal-backed tibial components needed to have a fixed-bearing design (modular or nonmodular). (4) Outcome measurement(s) in the studies had to be survival rates, clinical measurements, or functional measurements with minimal followup of 6 months. In the second step we excluded articles when it was apparent from the full text of the article that (1) the study did not meet the inclusion criteria for title and abstract, and (2) the population already had been reported in another included study (most informative version was included).

The primary outcome measure was revision rate for any reason. Secondary outcomes included clinical and functional scores (ROM, The Knee Society Score™ [KSS], Hospital for Special Surgery score [HSS]), radiographic evaluations (femorotibial alignment, anterior tibial alignment, tibial slope), and radiostereometric analysis (RSA) (component fixation). We assumed clinically relevant reported differences between the two designs were 10° in ROM, 10 points on clinical scores, 5° or greater in femorotibial alignment, and greater than 3° in anterior tibial alignment and tibial slope [34].

Both reviewers independently extracted data concerning summary patient demographics (age, sex, weight, etiology); methods (design of study, number of TKAs, start of study, mean followup, date of publication, funding, country); interventions (type of arthroplasty, modularity, treatment of the PCL, use of cement, treatment for patella, stem or pegs [under tibial component], current availability of the arthroplasty); and outcomes (revision rates, ROM, clinical and functional scores, patient-reported outcomes, radiographic evaluation, migration measured using RSA). Disagreements in study selection and data extraction were resolved by consensus with a third reviewer (BGP) who acted as a referee.

The search yielded 1557 unique references. We screened 41 records because we excluded 1516 references after checking the title and abstract. We excluded 85% of these because the article described a noncomparative study.

Of the 41 articles screened, one was excluded because it was a proceeding of an included study and two other were proceedings without sufficient data for further analysis. Of the 38 articles for which the full text was assessed, 12 studies were excluded. Six studies were not included because another study of the same population was included, which was more informative and reported all necessary data from the excluded studies. One study was excluded because insufficient data were given for analysis; one was excluded because it included patients with indications other than osteoarthritis or rheumatoid arthritis; one was a letter to the editor; and three studies were reviews of included articles.

After exclusion, we were left with 26 articles comprising 2700 all-polyethylene and 9978 fixed-bearing metal-backed tibial components used in TKAs with 231 revisions for any reason [1–4, 6, 8, 9, 13, 16, 19, 21–23, 26–28, 30, 32, 33, 35, 37, 38, 41, 42, 44, 45].

Eleven studies were randomized controlled trials (RCT) and 15 were nonrandomized (Table 1). The mean followup ranged from 2 to 19 years. Twenty-four articles were in English, one was in French, and one was in Czech. Fifteen of the selected studies investigated prostheses that are still being used in TKAs. Eleven of the studies were performed in North America, 13 in Europe, and two in Asia. Nine of the 12 RCTs were industrially funded compared with three of the 15 nonrandomized studies. In all but two studies, a femoral component of identical geometry was used in the all-polyethylene and metal-backed groups. Of the metal-backed tibial components, 46% were modular. A patellar button was used in 16 studies. In 21 studies, the tibial components were fixed with cement.

To assess for publication bias, we constructed a funnel plot for studies reporting the primary outcome revision rate

Table 1. Details of the included studies

Study	Year of publication	RCT	Number of all-polyethylene	Number of metal-backed	Mean followup (years)	Age of patients (mean years)	% of female patients	% of patients with osteoarthritis
Robinson and Green [41]	2011	Yes	68	68	11.6	67	57	100
Bettinson et al. [9]	2009	Yes	262	304	NA	69	59	81
Shen et al. [44]	2009	No	34	34	5.9	61	59	71
Johnston et al. [23]	2009	Yes	207	202	2	70	52	95
Berend et al. [8]	2008	No	524	6024	NA	NA	60	100
Dojcinovic et al. [13]	2007	No	169	169	5.5	71	80	83
Gioe et al. [19]	2007	Yes	111	102	9.6	69	4	92
Muller et al. [27]	2006	Yes	21	19	2	74	53	93
Hyldahl et al. [22]	2005	Yes	20	20	2	72	85	NA
Hyldahl et al. [21]	2005	Yes	20	20	2	73	81	100
Ma et al. [26]	2005	No	58	68	19	59	NA	81
Bek et al. [6]	2005	No	122	62	16	NA	72	39
Pagnano et al. [33]	2004	Yes	80	80	NA	67	70	100
Norgren et al. [30]	2004	Yes	12	11	2	73	78	100
Najibi et al. [28]	2003	No	49	49	6	78	NA	100
O'Rourke et al. [32]	2002	No	31	145	6.4	68	59	93
Rodriguez et al. [42]	2001	No	130	113	5.5	70	61	91
Udomkiat et al. [45]	2001	No	48	48	3.2	71	58	100
Adalberth et al. [2]	2001	Yes	20	18	2	70	78	100
Adalberth et al. [1]	2000	Yes	17	17	2	71	65	100
Font-Rodriguez et al. [16]	1997	No	480	2149	NA	67	70	78
Régner et al. [38]	1997	No	87	57	6.8	61	82	32
Rand [37]	1993	No	61	129	10	62	60	64
Apel et al. [4]	1991	No	62	69	6.6	63	72	67
Albrektsson et al. [3]	1990	No	23	9	2	66	87	45
Railton et al. [35]	1990	No	48	55	2	65	83	75

RCT = randomized controlled trial; NA = not applicable.

for any reason. A trim and fill method was performed when there was asymmetry in the funnel plot to adjust for publication bias (missing studies) and estimate the overall effect size [14].

The quality of all included articles was appraised independently by two reviewers (KAN; WCV) using a checklist to evaluate reports of nonpharmacologic trials (CLEAR NPT) [10]. Quality items included adequate generation of allocation sequences, concealment of treatment allocation, details of the intervention administered to each available group, care providers' experience appropriate, all other treatments and care the same in each group, withdrawals and lost to followup the same in each group, patients' blinding adequate, care providers' blinding adequate, outcome assessors' blinding adequate, specific methods to avoid ascertainment bias, followup schedule the same in each group, and main outcomes analyzed according to intention-to-treat principle. Treatment compliance, which is an element of this checklist, was not assessed because this is not an issue for TKAs [10].

We tested heterogeneity between studies with the I^2 statistic. This test describes the variation across studies attributable to heterogeneity. Possible sources of heterogeneity were explored with meta-regression using the random-effects regression model, which has been used to study the effectiveness of the Bacillus Calmette-Guérin (BCG) vaccine against tuberculosis [11]. This model searches for modifying variables that affect the outcome of interest between studies and therefore can help resolve contradictory outcomes of different studies, as was the case with the BCG vaccine. The primary outcome we used in this study was revision rate. Other potential variables associated with revision rate of the tibial component design (eg, type of polyethylene, start study, type of study) served as covariates to the regression model. All data were combined for meta-analysis with the random-effects model according to the pooled Mantel-Haenszel test for risk differences (RDs) and the pooled standard error for mean differences (MDs).

All analyses were performed with the metafor package for R Version 2.13 (The R Project for Statistical Reporting, Institute for Statistics and Mathematics, WU Wirtschaftsuniversität Wien, Vienna, Austria) [47]. A sensitivity analysis was performed for study quality, patient characteristics, duration of followup, implant characteristics, and start of study.

Results

In our meta-analysis for the primary outcome, we found no difference in revision rates between the two tibial components. We estimated the revision rates for all-polyethylene and metal-backed components separately for 5 to 10 years' followup from eight studies. The revision rates were 0.975 (95% CI, 0.959–0.992) for the all-polyethylene component and 0.973 (95% CI, 0.959–0.988) for the metal-backed component. In a Forest plot of all studies reporting revision rates for any reason (Fig. 1), the risk difference was 0.00 (95% CI, −0.02, 0.01). In addition, no differences were found for revision rate for aseptic reasons, with a risk difference of 0.00 (95% CI, -0.01, 0.01) (Fig. 2).

Our meta-regression for the primary outcome showed an improvement in the all-polyethylene component with time compared with the metal-backed component (Fig. 3). This resulted from the random-effects regression model. This

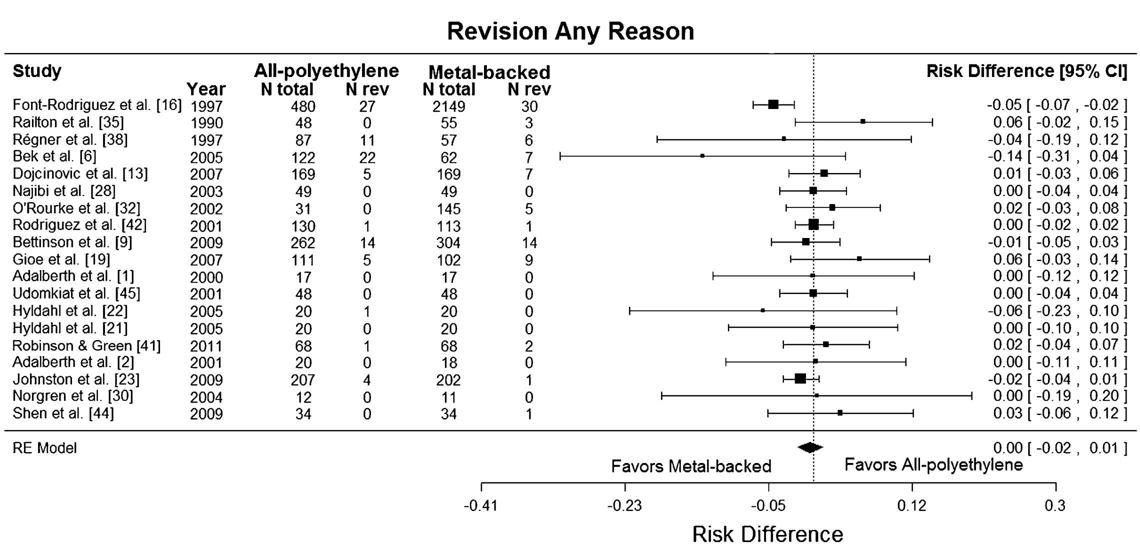

Fig. 1 The risk difference in revision rate for any reason between all-polyethylene and metal backed tibial components is shown. N rev = number revised; RE model = random effects model.

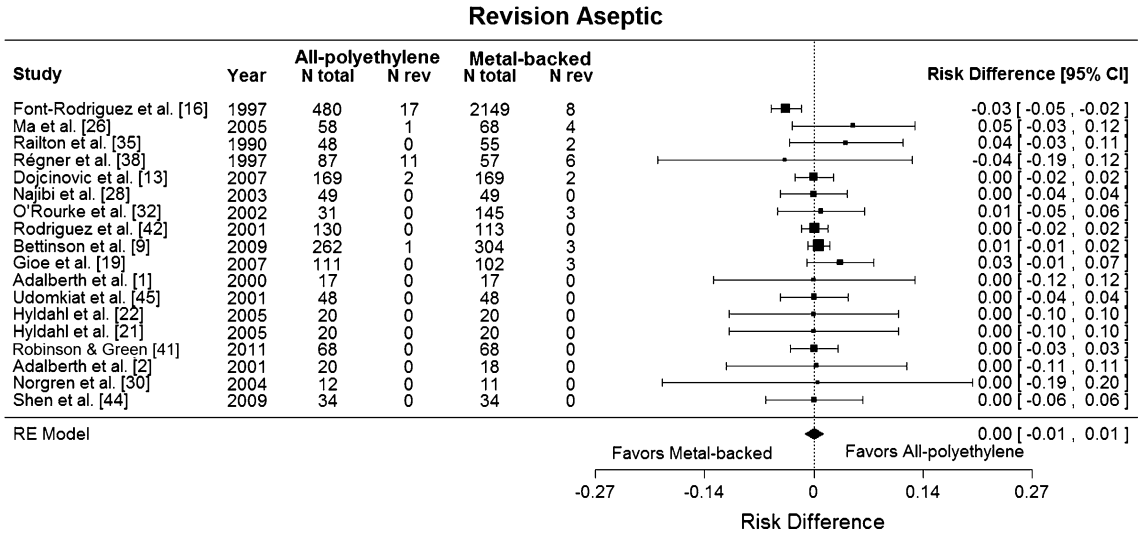

Fig. 2 The risk difference in revision rate for aseptic loosening between all-polyethylene and metal-backed tibial components is shown N rev = number revised; RE model = random effects model.

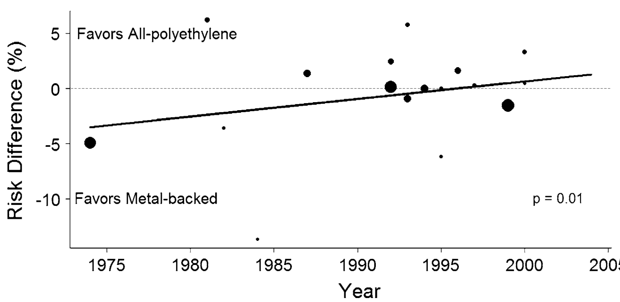

Fig. 3 The significant influence of the start date of the study on the primary outcome is shown. More recent studies favor the all-polyethylene over the metal-backed components.

Table 2. Influence of study characteristics on the primary outcome revision rate

Variable	Coefficient*	Lower limit	Upper limit	p value
Age (years)	−0.1	−0.48	0.45	0.95
Sex	0.01	−0.17	0.06	0.33
Rheumatoid arthritis	0.01	−0.23	0.07	0.30
Weight (kg)	−0.02	−0.24	0.28	0.86
Mean followup (years)	0.04	−0.05	0.12	0.78
Start of study†	0.16	0.04	0.28	0.0012
Publication year	0.08	−0.22	0.28	0.60

* A positive coefficient favors all-polyethylene components; a negative coefficient favors metal-backed components; †when corrected for study type (randomization): 0.24 (95% CI, 0.07–0.40), p = 0.0045.

model was used to investigate the heterogeneity across studies ($I^2 = 28.99\%$). Potentially associated variables of this heterogeneity were explored for our primary outcome revision rate. These analyses showed the factor that modified the RD and the MD is the start of study. The test for residual heterogeneity was p = 0.5, indicating this was the best-fitting model. The start of the study was related to revision rates in favor of the all-polyethylene tibial component (Table 2). More recent studies were in favor of the all-polyethylene component compared with earlier studies (Fig. 3). In studies in which the all-polyethylene component was the first one used and in time was replaced by the metal-backed component, the survival was in favor of the metal-backed tibial component (Table 3). In addition, the type of the study (randomized trial or observational study) did not affect the outcome of interest (Table 3).

In our meta-analysis of the secondary outcomes, we found no differences in clinical and functional outcomes between components. The mean (± SD) ROM was 106° (± 19.7°) for the all-polyethylene components and 106° (± 21.7°) for the metal-backed components. The mean clinical KSS was 85 (± 12.0) points for the all-polyethylene components and 84 (± 13.9) points for the metal-backed components (Fig. 4). The mean functional KSS was 76 (± 18.9) points for the all-polyethylene components and 76 (± 19.5) points for the metal-backed components (Fig. 5). The HSS was 87 (± 9.2) points for the all-polyethylene components and 85 (± 9.5) points for the metal-backed components (Fig. 6). Other clinical outcomes, functional outcomes, and patient-reported outcomes were not reported or were reported too infrequently for meta-analysis.

There were no differences in radiographic femorotibial alignment, anterior tibial alignment, and tibial slope

Table 3. Meta-regression for revision rates

Variable	Risk difference*	Lower limit	Upper limit	p value
Modular				
Yes	0.8	−0.9	2.5	0.38
No	−3.1	−9.3	3.1	0.33
Mixed	−2.6	−4.6	−0.5	0.015
Posterior stabilized				
Yes	1.1	−1.1	3.3	0.35
No	0.1	−2.8	3.0	0.95
Mixed	−2.15	−4.1	−0.19	0.03
Fixation (all-polyethylene)				
Cemented	−0.3	−2.0	1.4	0.71
Cementless	3.8	−4.1	12	0.35
Stem (all-polyethylene)				
Yes	−0.3	−2.1	1.4	0.70
No	4.0	−3.2	11	0.28
Mixed	−1.6	−5.6	2.3	0.42
Availability				
Available	0.5	−1.1	2.2	0.54
Historical	0.7	−2.0	3.4	0.60
Type of study†				
RCT	0.2	−2.7	2.3	0.88
Observational	−0.4	−2.4	1.6	0.69
All-polyethylene historical prosthesis‡				
Yes	−4.2	−6.5	−1.8	0.0006
No	0.1	−1.2	1.1	0.93

* A positive coefficient favors all-polyethylene components; a negative coefficient favors metal-backed components; †effect of study type corrected for start of study = 0.22 (95% CI, −0.6, −5.1), p = 0.12; ‡the all-polyethylene was the former prosthesis and in time was substituted with the metal-backed; RCT = randomized controlled trial.

between the two types of components (Table 4). The all-polyethylene components had better fixation compared with the metal-backed components because the maximum total point motion (MTPM) for cemented tibial components measured using RSA showed a mean difference of −0.29 (95% CI, −0.29, −0.21) favoring the all-polyethylene component (Fig. 7). This accounts for a mean MTPM of 0.6 (± 0.2) for the all-polyethylene components and 0.89 (± 1.3) for the metal-backed components.

There was publication bias in the literature because there was asymmetry of the funnel plot (Fig. 8). Therefore, we performed a trim and fill method [14] (Fig. 9). Here, the asymmetric outlying part of the funnel plot was trimmed off and the number of studies in this asymmetric part was estimated. These studies were used to estimate the true center of the funnel. This estimate showed little change, which indicated the influence of the publication bias was small.

Overall, RCTs were better reported than nonrandomized studies and more recent studies were of better quality. Seven of the 12 RCTs reported an adequate generation of allocation sequences. Six RCTs reported concealment of treatment allocation. No study reported patient blinding, and only one reported assessor blinding. No study used specific methods to limit the risk of bias when outcome assessors could not be blinded. None of the study quality items scored on the CLEAR NPT checklist had an effect on the outcome (Table 5).

Six studies did not report or did not adequately report revision rates of both designs separately for our meta-analysis. Moreover, clinical and functional scores were reported even less frequently. In one study, the cointerventions were not comparable between groups.

Discussion

Less than 1% of all primary TKAs are performed with an all-polyethylene tibial component, however recent studies indicate all-polyethylene tibial components are equal or better than metal-backed ones. In this systematic review and meta-analysis, we asked two research questions: (1) Is the metal-backed tibial component clinically superior to the all-polyethylene tibial component in primary TKAs regarding revision rates and clinical function (clinical scores, ROM)? (2) Which modifying variables affect the revision rate using meta-regression and explain differences between studies?

The results of the meta-analyses indicated that there were no clinically relevant differences in revision rates, clinical function, or radiographic variables. We did find a more recent start of study was related to revision rates in favor of the all-polyethylene tibial component. This can be explained partly by the historical introduction of the metal-backed component. Most of the first TKAs used an all-polyethylene component. These total condylar prostheses were newly introduced early on (1970) when surgical techniques, surgical instruments, and TKAs were being developed [40]. Furthermore, only a few sizes of prostheses existed, and the surgical instruments had limited clinical evaluation and little development [20]. When the metal-backed prosthesis became the preferred prosthesis, the TKA had evolved (surgical technique and instrumentation) and it is plausible this led to more reliable results. In seven of the 15 nonrandomized studies the newly developed metal-backed component replaced the former all-polyethylene component [4, 6, 16, 26, 35, 37, 38]. The results of these studies favored the metal-backed component (Table 3). The other possible explanation for improvement of the results of the all-polyethylene component with time could be enhanced performance of the polyethylene.

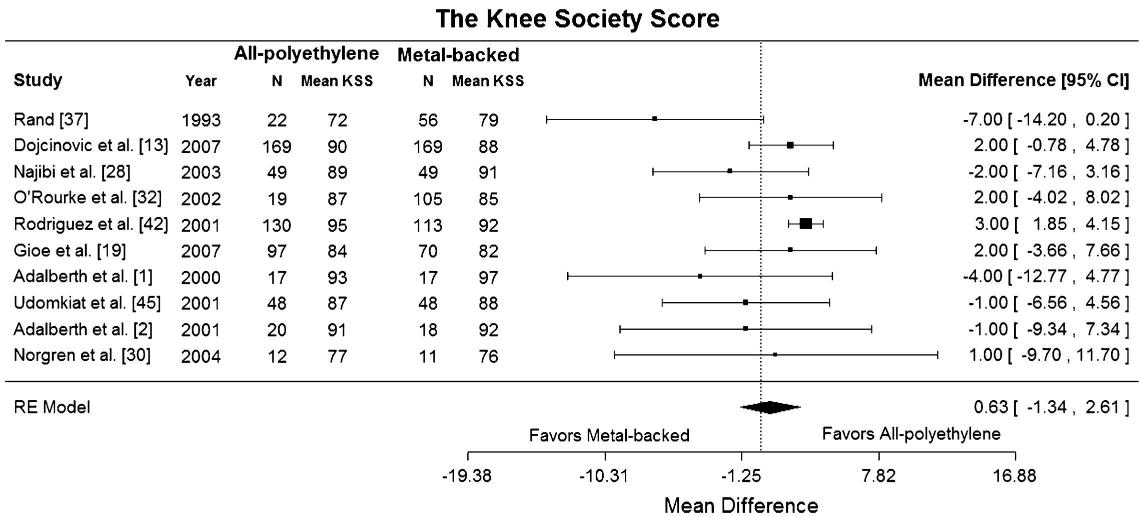

Fig. 4 The mean difference in KSS between all-polyethylene and metal-backed tibial components is shown. The mean difference of 0.63 in favor of the all-polyethylene is not significant and not clinically relevant. KSS = The Knee Society Score; RE Model = random effects model.

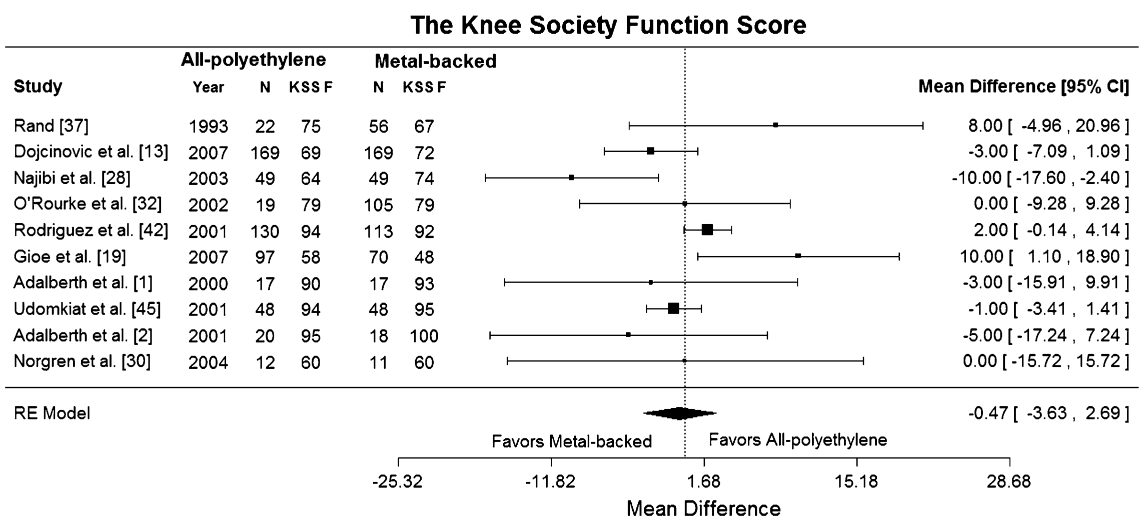

Fig. 5 The mean difference in the KSS Function between all-polyethylene and metal-backed tibial components is shown. KSS F = The Knee Society Function Score; RE Model = random effects model.

Unfortunately, the type of polyethylene was not reported in such a manner that we could analyze this as a potential modifying factor on the outcome.

RSA outcomes of included studies showed superior results for the all-polyethylene component in terms of migration expressed in MTPM [29, 46]. This is the three-dimensional motion of the prosthetic marker, which moves the most and indicates the magnitude of the motion. Our results indicated that the all-polyethylene component has a lower MTPM and therefore the risk of revision for aseptic loosening is less in comparison with the metal-backed component [43].

High levels of quality of the included studies in a meta-analysis are preferable. In our study, there was variable quality of the included studies. However, results of the meta-regression indicated the quality of the studies did not influence our outcomes. Another limitation is that the funnel plot indicated there was publication bias because there was asymmetry. Using the trim and fill method we showed that there was no change in the center of the risk difference and therefore the influence of publication bias was small.

To search for all available evidence, we included all comparative studies, including nonrandomized studies, so that we could perform a meta-analysis based on more observations and strengthen the outcomes. Other strengths of our study are the large number of patients and revisions and no restrictions in the search on publication, language,

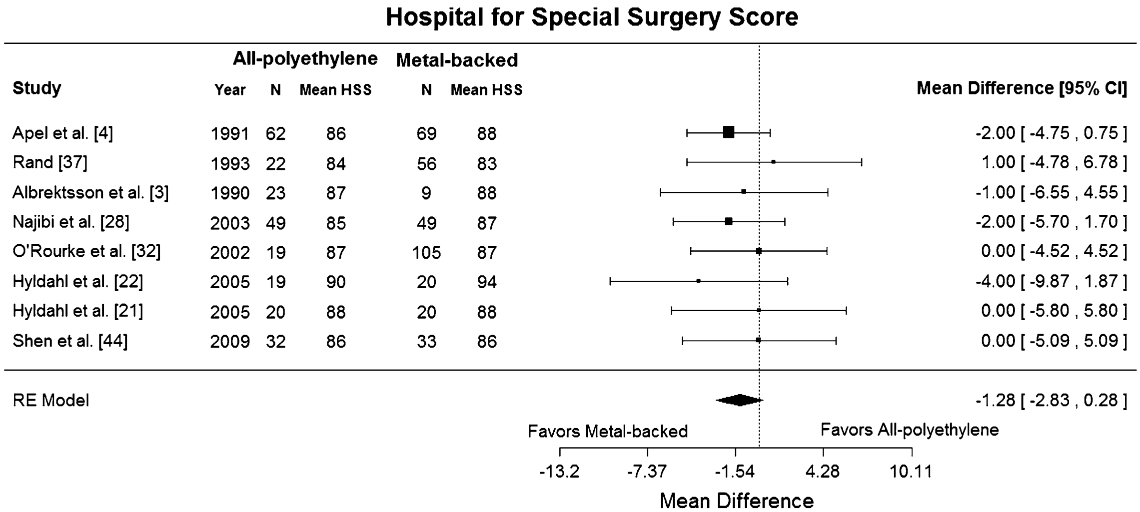

Fig. 6 The mean difference in the Hospital for Special Surgery score between all-polyethylene and metal-backed tibial components is shown. HSS = Hospital for Special Surgery; RE Model = random effects model.

Table 4. Difference in radiographic alignment between the all-polyethylene and metal-backed tibial components

Variable	Mean difference* (°)	Lower limit	Upper limit	p value
Femorotibial alignment	0.25	−0.63	1.13	0.58
Anterior tibial alignment	−0.15	−0.69	0.38	0.58
Tibial slope	0.34	−0.25	0.93	0.26

* A positive coefficient favors all-polyethylene components; a negative coefficient favors metal-backed component.

and date. We included an article in Czech, an article in French, two articles from Asia, and articles published from 1990 to 2011. Our results therefore represent the worldwide experience with both designs during more than two decades.

Forster [17] performed a meta-analysis comparing all-polyethylene and metal-backed tibial components, only including survival studies. Of the studies we analyzed, 55% were published after Forster's meta-analysis. Forster [17] showed metal backing of the tibial component did not improve the survival of primary TKAs compared with TKAs

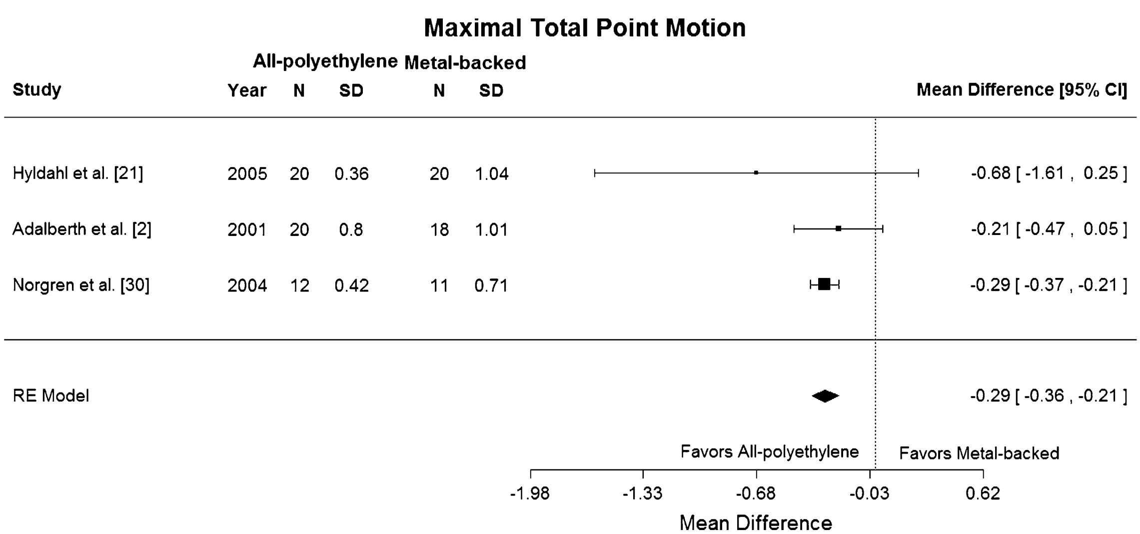

Fig. 7 The forest plot of the MTPM measured using RSA is shown. The MTPM is significantly in favor of the all-polyethylene design. MTPM = maximum total point motion; RSA = radiostereometric analysis.

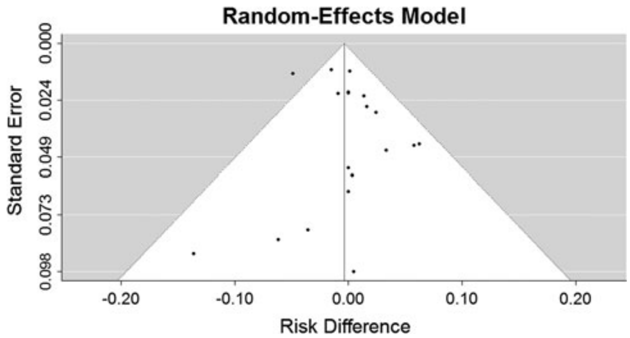

Fig. 8 A funnel plot of the included studies shows there is publication bias, because there is an appearance of missing studies in the upper left corner.

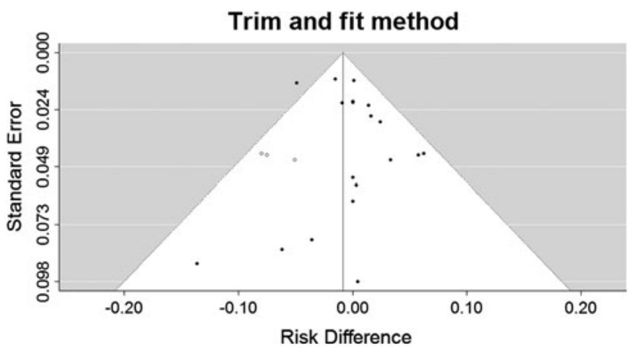

Fig. 9 The plot shows the 'trim and fill method'. The solid circles are the original data. The open circles on the upper left side are the 'missing' studies, when symmetry is assumed. This figure shows these studies have no effect on the center of the risk difference; therefore, publication bias has little impact on the pooled treatment effect.

Table 5. Effect of study quality items of the checklist (CLEAR NPT) on the outcome

Quality item*	Coefficient†	Lower limit	Upper limit	p value
Concealment of allocation generation				
Yes	−0.8	−3.6	2.1	0.59
No	−0.4	−2.6	1.7	0.68
Concealment of treatment allocation				
Yes	−1.1	−4.1	2.0	0.49
No	−0.4	−2.4	1.5	0.67

* Only two of the items were estimated because all other items reported were too limited for analysis; †a positive coefficient favors all-polyethylene components; a negative coefficient favors metal-backed components.

that used all-polyethylene tibial components. Moreover, that study found better survival of nonstabilized all-polyethylene tibial components. In contrast, our study did not find an effect of the treatment of the PCL on the outcome (Table 3).

There are contradicting results in the outcome of TKAs using the Anatomic Graduated Component (AGC), which is an all-polyethylene component. Several articles have been published of one observational cohort that reported higher revision rates for the all-polyethylene tibial components compared with metal-backed components [7, 15, 39]. The authors suggest the inferior results could be attributable to the low conformity of the AGC design. In contrast to these results, three RCTs using RSA to compare all-polyethylene and metal-backed tibial components of the TKAs using identical AGC prostheses found no differences in continuous migration of both components [2, 21, 22], which is prognostic for future aseptic loosening [43].

In contrast to our results, the Australian Orthopaedic Association National Joint Replacement Registry suggested a small difference in survival rates in favor of metal-backed components [5]. It is notable the metal-backed tibial component is used in greater than 99% of all cases, which makes a clear comparison more difficult.

The all-polyethylene tibial component frequently is recommended for use in patients with low demands, such as elderly patients and patients with rheumatoid arthritis [25, 31]. One of the included studies reported the all-polyethylene component was used for such patients [32]. We showed that none of the parameters for low-demand status (age, rheumatoid arthritis, weight) influenced the outcome of the comparison. Therefore, the all-polyethylene component could be an option for all patients with an indication for TKA as previously reported [12, 31, 36]. When there is a need for modular stems or augmentations, there is an indication for metal backing of the tibia since this cannot be added to the all-polyethylene tibial component. However, this can be identified during preoperative planning.

Our meta-analysis comprising more than 12,500 TKAs and 231 revisions did not show evidence for clinical superiority of the metal-backed tibial component. Moreover, more recent studies indicate improved results for the all-polyethylene tibial component. Thus, TKA using the all-polyethylene tibial component is an effective, safe treatment for end-stage osteoarthritis of the knee. Our results support more frequent use of the all-polyethylene tibial component in primary TKAs. Therefore, we should reconsider the use of this component design.

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