IN BRIEF

# Cemented Versus Cementless Total Knee Arthroplasty: Analysis of the Latest Literature Data

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## Abstract

The use of cementless total knee arthorplasty (TKA) has increased in recent years to the detriment of the use of cemented TKA. However, there is still no agreement on when to cement and in whom. A recent meta-analysis has shown that the cumulative survival at 12 years was 97% for the cementless implants and 89% for the cemented implants. Besides, no differences between the cemented and cementless TKAs were found in patient-reported results and revision rates. Another study showed noninferiority to cemented TKA. Its authors stated that cementles TKA can be utilized as an alternative mode of fixation in individuals opting for primary TKA. However, it was mentioned that additional long-run follow-up was required to confirm if cementless TKA can exhibit improved survivorship over cemented TKA. In individuals > 70 years of age, cementless TKA accomplished clinical scores equivalent to those of younger individuals at 2-year follow-up. Cementless TKA seemed to be a safe alternative for older individuals. Another meta-analysis has shown a substantial reduction in all-cause revisions and revisions for aseptic loosening when utilizing cementless fixation in high body mass index individuals when compared to the usage of cemented implants. In conclusion, clinical practice guidelines are required to ensure safe and efficacious usage of cementless fixation.

**Level of evidence:** III

**Keywords:** Cemented, Cementless, Comparison, Fixation, Total knee arthroplasty

## Introduction

Total knee arthroplasty (TKA) has been known as a definitive treatment for advanced knee osteoarthritis.[1,2] According to Roth et al the usage of uncemented TKA raised from 3.3% in 2017 to 17.1% in 2021, while cemented fixation diminished from 96.7% to 81.9%.[3] According to Agarwal et al, from 2015 to 2021, the usage of cementless TKA increased dramatically in all patient populations. However, there is still no agreement on when to cement and in whom. Clinical practice guidelines are required to ensure safe and efficacious usage of cementless fixation.[4]

In an attempt to clarify the current status of cementless TKA on December 8, 2024, a PubMed search was performed using the following keywords: "Cementless TKA 2024". Sixty-seven articles were found, of which the 9 providing the most information are analyzed in this article.

## Main body

The recent meta-analysis published by Chahidi et al disclosed the advantage of cementless fixation over cemented fixation in implant survivorship, with 0.6% and 2.6% of aseptic loosening in each cohort. The cumulative survival at 12 years was 97% for the cementless cohort and 89% for the cemented cohort. No differences between the cemented and cementless TKAs were found in patient-reported results and revision rates.[5]

Monarrez et al have found a comparable risk of periprosthetic joint infection and aseptic loosening in cementless and cemented TKA. Consequently they stated that with proper patient selection, cementless TKAs can be carried out with anticipation of low risks of infections and aseptic loosening.[6]

In a recent study of Miller et al using the same implant design, cementless TKA showed noninferiority to cemented TKA at a mean 5-year follow-up.[7]

In the analysis from the Canadian Joint Replacement Registry, Chen et al found no difference in revision risk between cemented and cementless TKAs. Besides, the

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reasons for revision were alike.[8]

In the study of Maniar et al, individuals > 70 years of age experiencing cementless TKA accomplished clinical scores equivalent to those of younger individuals at 2-year follow-up.[9]

Mosher et al have stated that cementless TKA yields enduring biologic fixation and successful long-run outcomes with improved operating room degree of effectiveness. Mosher et al stated that cementless TKA might be widely used in properly selected individuals, with intraoperative care taken to carry out accurate bone cuts to promote adequate bony contact and biologic fixation.[10]

A meta-analysis recently reported by Le et al showed a substantial reduction in all-cause revisions and revisions for aseptic loosening when utilizing uncemented fixation in high body mass index individuals when compared to the usage of cemented implants.[11]

The most important information from the publications analyzed in this article is shown in [Table 1].



**Table 1. Relevant information on cementless total knee arthroplasty (TKA)**

| AUTHORS [REFERENCE] | YEAR | METHODS | RESULTS | CONCLUSIONS |
|---|---|---|---|---|
| Roth et al [3] | 2024 | *A retrospective data review was performed on the Michigan Arthroplasty Registry Collaborative Quality Initiative database of TKA individuals from 2017 to 2021 at 6 hospitals.<br><br>* Individuals were divided into two cohorts: uncemented and cemented. All patient demographics and 90-day postoperative events were collected and analyzed. | * Of the 18,749 primary TKAs analyzed 89.7% were cemented, 9.7% cementless, and 0.7% hybrid or reverse hybrid.<br><br>*Cementless individuals were younger, men, heavier, current smokers, and diabetics than cemented individuals. They also had a shorter LOS and were on fewer preoperative medications.<br><br>*The rate of cementless TKA increased from 3.3% to 17.1%, while the rate of cemented TKA fell from 96.2% to 81.9%.<br><br>*The readmission rate was higher in cemented TKAs (4%) than in cementless TKAs (2.6%). | * There were no substantial differences in short-run complications between groups. |
| Agarwal et al [4] | 2024 | *This study investigated the trend of utilizing cementless TKA based on a national database.<br><br>*The individuals experiencing cementless TKA between 2015 and 2021 were retrospectively extracted from the PearlDiver (Mariner dataset) Database.<br><br>*The annual percentage of cementless TKA was calculated utilizing the following formula: annual number of cementless TKA/annual number of TKA.<br><br>*The trend of the number of individuals experiencing cementless TKA was created according to a compounded annual growth rate (CAGR) calculation of annual percentages.<br><br>*Patient age, comorbidity, region, insurance type, etc., were also investigated. | *Of the 574,848 individuals who received TKA, 546,731 (95%) experienced cemented fixation and 28,117 (5%) experienced cementless fixation.<br><br>*From 2015 to 2021, the use of cementless TKA substantially increased by 242% from 3 to 9% CAGR: + 20%).<br><br>*From 2015 to 2021, a CAGR greater than 15% for all age groups, sex, and certain comorbidities (osteoporosis, diabetes mellitus, tobacco use, underweight (BMI < 18.5), rheumatoid arthritis) was observed.<br><br>*Patients experiencing TKA with chronic kidney disease, prior fragility fractures, and dementia showed a CAGR of + 9%-13% from 2015 to 2021. | *The use of cementless TKA exhibited a dramatic increase in all patient populations.<br><br>*However, there is still no consensus on when to cement and in whom.<br><br>*Clinical practice guidelines are required to ensure safe and effective usage of cementless fixation. |
| Chahidi et al [5] | 2024 | *This systematic review and meta-analysis compared cemented and cementless posterior-stabilized implants. | *The study revealed the advantage of cementless fixation over cemented fixation in implant survivorship, with 0.6% and 2.6% of aseptic loosening in each cohort.<br><br>*The cumulative survival at 12 years was 97.4% for the cementless cohort and 89.2% for the cemented cohort.<br><br>*No differences between the cemented and cementless TKAs were found in patient-reported outcomes, revision rates, or radiolucent line development. | *These authors observed comparable rates for cemented and cementless posterior-stabilized TKAs over a medium-run follow-up period. |

**Table 1. Continued**

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| Monarrez et al [6] | 2024 | *These authors compared the survivorship and revision rate of cementless (N=8,890) versus cemented (N=215,460) TKA prostheses performed from October 1, 2015 to October 31, 2020.<br><br>*Revision surgery for PJI and aseptic loosening were identified with diagnosis and associated procedural codes at 90 days, 1 year, and 2 years and then compared between cohorts.<br><br>*A propensity matched-analysis was carried out for age, sex, Charlson Comorbidity Index (CCI) > 3, alcohol abuse, tobacco use, obesity, and diabetes. | *Cementless TKA was associated with similar revisions rates due to PJIs at 90 days (OR, 1.04), 1 year (OR, 0.93), and 2 years (OR, 0.87) in comparison to the cemented TKA cohort.<br><br>*The OR of revision due to aseptic loosening was similar as well at 90 days (OR, 0.67), 1 year (OR, 1.09), and 2 years (OR, 1.00). | *This study found a comparable risk of PJI and aseptic loosening in cementless and cemented TKA when controlling for several comorbidities, such as tobacco, diabetes, and alcohol.<br><br>*The conclusion was that with adequate patient selection, cementless TKAs can be carried out with expectation of low risks of infections and aseptic loosenings. |
| Miller et al [7] | 2024 | *These authors evaluated the mid-run clinical results of cementless TKA utilizing a highly porous tibial baseplate compared with its cemented counterpart of the same system.<br><br>*They performed a retrospective case-control study of 400 individuals experiencing primary TKA that included 200 individuals with cementless components matched for age and BMI to 200 individuals with cemented implants of the same implant design with a 5-year follow-up.<br><br>*They assessed clinical outcomes, adverse events, revisions, and overall survivorship between the cohorts. | *There was no statistical difference in age (64.3 vs. 64.3), BMI (34 vs. 33.1), preoperative Knee Society Score (KSS) function (41 vs. 32.3), and preoperative KSS (39.2 vs. 38.3) between the cementless and cemented cohorts, respectively.<br><br>*The cementless cohort had seven revisions, while the cemented cohort had nine revisions. The cementless cohort had one revision due to aseptic loosening versus five in the cemented group.<br><br>*Postoperative 5-year KSS knee scores were 92.84 versus 91.75 and function scores were 81.81 versus 69.65 in the cementless and cemented cohorts, respectively.<br><br>*The cementless cohort had survivorship of 96.5% for all-cause revision compared with 95.5% in the cemented cohort at 5-year follow-up.<br><br>*Cementless TKA utilizing a highly porous tibial baseplate showed excellent mid-run outcomes with one case of aseptic loosening at 5-year follow-up and with similar Knee Society outcome scores and survivorship compared with the cemented cohort. | *Cementless TKA showed noninferiority to cemented TKA. Therefore, cementless TKA could be utilized as an alternative mode of fixation in individuals opting for primary TKA.<br><br>*However, additional long-term follow-up was required to confirm if cementless TKA can demonstrate improved survivorship over cemented TKA. |
| Chen et al [8] | 2024 | *Using the Canadian Joint Replacement Registry (CJRR), these authors sought to investigate cementless versus cemented fixation in modern primary TKA and define whether there is an overall difference in revision by fixation; carry out a subanalysis of the most-frequently utilized cementless TKA brand in Canada; and identify the causes of revision.<br><br>*The CJRR data was utilized to analyze TKA designs with cemented and cementless versions.<br><br>*Revision risk was reported as all-cause cumulative percent revision (CPR).<br><br>*Causes of revision were analyzed. Cox proportional hazards models were utilized to report adjusted hazard ratios (HR) controlling for age, sex, patella resurfacing, and bearing constraints.<br><br>*The study included 202,880 primary TKAs carried out between 2012 and 2021. Of those, 9,163 (4.5%) were cementless. | *The CPR at 8 years was 4.49% for cementless and 3.14% for cemented implants. After adjusting for confounders, these authors did not detect a difference in revision risk overall (HR 0.87).<br><br>*However, the most commonly utilized cementless TKA brand demonstrated a CPR of 1.95% compared to 2.19% for its cemented version at 4 years.<br><br>*Furthermore, they detected a substantially lower revision risk compared to its cemented version after adjusting for confounders (HR 0.66).<br><br>*The four most common causes of revision in both cohorts were infection, instability, aseptic loosening, and pain of unknown origin. | *Utilizing CJRR data adjusted for confounding factors, no difference in revision risk was found between cemented and cementless implants overall.<br><br>*However, for the most common brand of cementless TKA utilized in Canada, there was a lower risk of revision than its corresponding cemented version. The causes of revision were similar. |

**Table 1. Continued**

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| Maniar et al [9] | 2024 | *These authors studied whether age affected survivorship and results of cementless TKA. Utilizing their prospectively collected institutional database, they retrospectively reviewed all individuals experiencing primary cementless TKAs at a tertiary care institute.<br><br>*They identified 347 TKA, which were divided into 3 cohorts based on age at the time of surgery. Cohort A was ≤ 60 years, cohort B was 60 to ≤ 70 years, and cohort C was > 70 years.<br><br>*They compared clinical results (Knee Society Clinical Rating System [KSCRS], Western Ontario and McMaster University Osteoarthritis Index [WOMAC], and Veterans Rand 12 Item Health Survey [VR-12]) and survivorship between the cohorts. | *At final follow-up, range of motion, KSCRS, WOMAC, and VR-12 physical score were similar. The VR-12 Mental score was higher in cohort B and cohort C than in cohort A.<br><br>*Compared to preoperative scores, the change in KSCRS, WOMAC, and VR-12 physical and mental scores was comparable at the final follow-up.<br><br>*No individual experienced revision for aseptic loosening. | *There were no cases of revision surgery for aseptic loosening in this study cohort of 347 cementless TKAs.<br><br>*The conclusion was that individuals > 70 years of age experiencing cementless TKA can accomplish clinical scores equivalent to those of younger individuals at short-run (2-year) follow-up.<br><br>*Although these authors stated that longer-run survivorship was still required, based on early data, cementless TKA seems to be a safe option for older individuals. |
| Mosher et al [10] | 2024 | *A symposium evaluated the history of cementless TKA, the recent resurgence, and appropriate patient selection, as well as the historical and modern-generation results of each implant (tibia, femur, and patella).<br><br>*Besides, surgical technique pearls to assist in dependable, reproducible results were detailed. | *Historically, cemented fixation has been the gold standard for TKA.<br><br>*However, cementless fixation is increasing in prevalence in the United States and globally, with equivalent or improved outcomes shown in adequately selected individuals. | *Cementless TKA rendered enduring biologic fixation and successful long-run outcomes with improved operating room efficiency.<br><br>*Therefore, cementless TKA might be broadly used in adequately selected individuals, with intraoperative care taken to carry out precise bone cuts to promote adequate bony contact and biologic fixation. |
| Le et al [11] | 2024 | *This systematic review and meta-analysis (level 1 of evidence) presented the existing evidence to establish if cementless TKA had a lower rate of aseptic loosening in high BMI individuals when compared to cemented TKA procedures. | *The pooled OR for all-cause revisions was 0.17 in favor of cementless implants.<br><br>*The pooled OR for aseptic loosening was 0.15 in favor of cementless implants. | *The meta-analysis showed a substantial decrease in all-cause revisions and revisions for aseptic loosening when utilizing cementless fixation in high BMI individuals when compared to the usage of cemented implants. |

LOS = length of stay; BMI = body mass index; PJI = periprosthetic joint infection; OR = odds ratio



## Conclusion

The use of cementless TKA has increased in recent years to the detriment of the use of cemented TKA. However, there is still no agreement on when to cement and in whom. Clinical practice guidelines are required to ensure safe and efficacious usage of cementless fixation.

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## References

1. Poursalehian M, Ebrahimzadeh MH, Javadzade E, Mortazavi SJ. Recent trends and hotspots in knee arthroplasty: a bibliometric analysis and visualization study of the last five-year publications. Arch Bone Jt Surg. 2023; 11(9):545-555. doi: 10.22038/ABJS.2023.70791.331.
2. Razzaghof M, Mortazavi SJ, Moharrami A, Noori A, Tabatabaei Irani P. The effect of intramedullary vs extramedullary tibial guides on the alignment of lower extremity and functional outcomes following total knee arthroplasty: a randomized clinical trial. Arch Bone Jt Surg. 2023; 11(7):441-447. doi: 10.22038/ABJS.2022.60061.2960.
3. Roth S, DeClercq MG, Sacchetti M, Keeley J, Karadsheh M, Runner R. Uncemented total knee arthroplasty is on the rise. A report of patient demographics and short-term outcomes

from the Michigan Arthroplasty Registry Collaborative Quality Initiative. Arthroplast Today. 2024; 29:101499. doi: 10.1016/j.artd.2024.101499.

4. Agarwal AR, Kuyl EV, Gu A, et al. Trend of using cementless total knee arthroplasty: a nationwide analysis from 2015 to 2021. Arthroplasty. 2024; 6(1):24. doi: 10.1186/s42836-024-00241-7.
5. Chahidi E, Martinov S, Simion F, et al. Survivorship and complications of cementless compared to cemented posterior-stabilized total knee arthroplasties: a systematic review and meta-analysis. SICOT J. 2024; 10:22. doi: 10.1051/sicotj/2024017.
6. Monarrez R, Dubin J, Bains SS, et al. Cemented is not superior to cementless total knee arthroplasty for complications: a propensity score matched analysis. Eur J Orthop Surg Traumatol. 2024; 34(4):1825-1830. doi: 10.1007/s00590-024-03847-4.
7. Miller AJ, Nadar AC, Granade CM, Smith LS, Yakkanti MR, Malkani AL. Cementless versus cemented total knee arthroplasty using the same implant design: a mean 5-year follow-up study. J Knee Surg. 2024; 37(10):724-729. doi: 10.1055/s-0044-1785192.
8. Chen AG, Sogbein OA, McCalden RW, Bohm ER, Lanting BA. Survivorship of modern cementless total knee arthroplasty: analysis from the Canadian Joint Replacement Registry. J Arthroplasty. 2024:S0883-5403(24)00808-8. doi: 10.1016/j.arth.2024.08.003.
9. Maniar AR, Howard JL, Somerville LE, Lanting BA, Vasarhelyi EM. Cementless total knee arthroplasty: does age affect survivorship and outcomes? J Arthroplasty. 2024; 39(8S1):S95-S99. doi: 10.1016/j.arth.2024.04.027.
10. Mosher ZA, Bolognesi MP, Malkani AL, Meneghini RM, Oni JK, Fricka KB. Cementless total knee arthroplasty: a resurgence-who, when, where, and how? J Arthroplasty. 2024; 39(9S2):S45-S53. doi: 10.1016/j.arth.2024.02.078.
11. Le GT, van Duren BH, Ilo K, Berber R, Matar HE, Bloch BV. Cementless TKA use as an alternative to cemented TKA in high BMI patients: A systematic review and meta-analysis. J Exp Orthop. 2024; 11(3):e12067. doi: 10.1002/jeo2.12067.