Antibiotic Prophylaxis for Dental Procedures following Total Joint Arthroplasty: A Systematic Review and Meta-Analysis

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INTRODUCTION:

Periprosthetic joint infection (PJI) is a severe complication following total joint arthroplasty (TJA), associated with significant morbidity, mortality, and healthcare costs. While early and delayed PJIs are often linked to intraoperative contamination, late infections are typically attributed to hematogenous spread from distant sources. Dental procedures, which can induce transient bacteremia, have historically been considered a potential source of such infections. For decades, orthopedic surgeons and dentists have debated the necessity of antibiotic prophylaxis (AP) before dental procedures in patients with joint replacements. Despite earlier recommendations supporting universal prophylaxis, recent clinical guidelines from organizations including the American Academy of Orthopaedic Surgeons (AAOS) and the American Dental Association (ADA) have increasingly questioned the benefit of routine AP in this context, citing limited and inconsistent evidence. This systematic review and meta-analysis was conducted to provide an updated synthesis of the literature and clarify the relationship between dental AP and PJI risk in patients with hip or knee arthroplasties.

METHODS:

A comprehensive literature search was conducted across PubMed, Embase, and Cochrane databases from January 1980 to February 2025, following PRISMA guidelines. Studies were included if they evaluated adult patients with total hip or knee arthroplasty who underwent dental procedures, compared cohorts receiving and not receiving AP, and reported PJI as an outcome. The methodological quality of the included studies was assessed using the Newcastle-Ottawa Scale. Four retrospective cohort studies, encompassing 157,466 patients, met inclusion criteria. A random-effects meta-analysis was performed using the Hartung-Knapp adjustment to account for between-study variability and the small number of studies.

RESULTS:

Across all studies, the incidence of PJI following dental procedures was low, ranging from 0.07% to 0.3% in patients who received AP and 0.07% to 0.18% in those who did not. No individual study reported a statistically significant difference in PJI rates between prophylaxis and non-prophylaxis groups. The pooled odds ratio for PJI among patients receiving AP compared to those who did not was 1.12 (95% CI: 0.66–1.92), indicating a slight, nonsignificant increase in infection odds in the AP group. Heterogeneity among studies was negligible ($I^2 = 0\%$), suggesting consistency in findings. Several studies identified patient-specific factors—such as obesity (BMI > 30), revision arthroplasty, congestive heart failure, and diabetes with end-organ damage—as stronger predictors of PJI risk than dental exposure or prophylaxis status.l p

DISCUSSION AND CONCLUSION:

This meta-analysis provides the most robust synthesis to date of available evidence regarding dental AP in TJA patients. Despite longstanding concerns about dental-induced bacteremia leading to late PJIs, the data do not support a significant protective benefit of prophylactic antibiotics prior to dental procedures in patients with primary hip or knee arthroplasty. The findings align with recent AAOS and ADA clinical guidelines, which no longer recommend routine prophylaxis for all TJA patients undergoing dental work. These results also underscore the importance of antibiotic stewardship, as indiscriminate use of antibiotics contributes to resistance, adverse events (including C. difficile infections), and unnecessary healthcare spending. Given that nearly 60 million dollars are spent annually in the U.S. on dental AP for arthroplasty patients, and that the incidence of PJI remains extremely low, a more targeted approach may be both clinically and economically prudent.

Routine antibiotic prophylaxis prior to dental procedures does not reduce the risk of periprosthetic joint infection in patients with primary total hip or knee arthroplasty. Given the low infection rates, potential harms of antibiotic overuse, and substantial healthcare costs, current evidence supports limiting prophylaxis to high-risk populations, such as those undergoing revision arthroplasty or with significant comorbidities. These findings should inform future clinical guidelines and support efforts toward rational antibiotic use in orthopedic and dental practice.

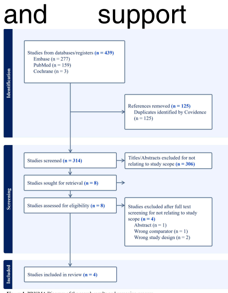
Identification
Studies from databases/registers (n = 439)
Embase (n = 277)
PubMed (n = 159)
Cochrane (n = 3)
References removed (n = 125)
Duplicates identified by Covidence (n = 125)
Screening
Studies screened (n = 314)
Titles/Abstracts excluded for not relating to study scope (n = 306)
Studies sought for retrieval (n = 8)
Studies assessed for eligibility (n = 8)
Studies excluded after full text screening for not relating to study scope (n = 4)
Abstract (n = 1)
Wrong comparator (n = 1)
Wrong study design (n = 2)
Included
Studies included in review (n = 4)

Figure 1. PRISMA Diagram of the search results and screening process.

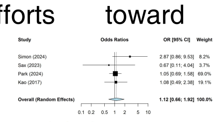
Study
Odds Ratios
OR [95% CI]
Weight
Simon (2024)
2.87 [0.86; 9.53]
8.2%
Sax (2023)
0.67 [0.11; 4.04]
3.7%
Park (2024)
1.05 [0.69; 1.58]
69.0%
Kao (2017)
1.08 [0.49; 2.38]
19.1%
Overall (Random Effects)
1.12 [0.66; 1.92]
100.0%
0.1 0.2 0.5 1 2 5 10
Heterogeneity: $I^2 = 0\%$, $\tau^2 < 0.0001$, $\chi^2_3 = 2.78$ ($p = 0.43$)
Test for overall effect: $t_3 = 0.70$ ($p = 0.54$)

Figure 2. Forest Plot depicting risk of periprosthetic joint infection after dental procedures with antibiotics vs without antibiotics

Table 1. Study design characteristics

Author (Year)	Journal	Location	Study population	Follow-up	Matching / Limitations
Simon et al. (2024)	The Journal of Arthroplasty	Boston, MA, USA	Patients at New England Baptist Hospital	2-3 years	Groups were not matched 1:1. No confirmation of whether patients took antibiotics.
Sax et al. (2023)	Orthopedics	Baltimore, MD, USA	National, all-payer database (PearlDiver)	90 days, 1 year	All groups were matched for age, sex, Charlson comorbidity index, tobacco use, alcohol abuse, and obesity. This study only investigated total knee arthroplasty.
Park et al. (2024)	Clinical Orthopedics and Related Research	South Korea	National, HIRA database	2 years	Dental procedure cohort patients were propensity score matched. Did not include patients who had PJI within 1 year of index surgery.
Kao et al. (2017)	Infection control and hospital epidemiology	Taiwan	National, NHIRD database	2 years	All groups were matched by index date, age, sex, and propensity score of antibiotic prophylaxis. Did not examine influence of BMI, smoking, alcohol, or dietary habits.

Table 2. Patient demographics

	N	Age	Female (%)	Obesity (%)	Charlson Comorbidity Index	Smoker (%)	Diabetes (%)	TKA (%) THA (%)	Primary Revision
Simon et al. (2024)	8023 / 2871	60.4 / 59.4*	56.2 / 59.4	49.5 / 50.4	28.8 / 34.5**	4.4 / 6.4	12.6 / 11.4	54.5 / 54.9 45.5 / 45.1	96.2 / 97.7 3.8 / 2.3
Sax et al. (2023)	496 /496	63 / 63	62.7 / 62.7	57.1 / 57.1	4.8 / 4.8***	35.3 /35.3	47.4 / 47.4	100 / 100 0 / 0	100 / 100 0 / 0
Park et al. (2024)	66277 / 66277	71 / 71	86 /85	NR	2.5 / 2.5	NR	NR	100 / 100 0 / 0	97 / 97 3 / 3
Kao et al. (2017)	6513 /6513	50.2 / 50.2	37.4 / 37.4	NR	1.5 / 1.4	NR	22.4 / 19.5	NR	NR

Antibiotic Prophylaxis / No Antibiotic Prophylaxis, N = number of patients, PJI = Periprosthetic joint infection, NR = Not reported
* % of patients age > 65, ** ASA used instead of CCI, *** CCI > 3,

Table 3. Study result summary

	PJI w/ Antibiotics	PJI w/o Antibiotics	Statistical Results	Results Summary
Simon et al. (2024)	24 (0.3%)	3 (0.1%)	Antibiotic prophylaxis OR = 2.6, p = 0.1	Routine antibiotics prior to dental procedure do not affect risk of late-presenting PJI. Revision arthroplasty and BMI >30 were risk factors for PJI.
Sax et al. (2023)	NR	NR	Antibiotic prophylaxis OR= 0.67, p = 0.99	No difference in odds of PJI with or without antibiotic prophylaxis at all timepoints
Park et al. (2024)	46 (0.07%)	44 (0.07%)	Antibiotic prophylaxis HR = 0.73 p = 0.17	Prophylactic antibiotics did not affect PJI occurrence.
Kao et al. (2017)	13 (0.2%)	12 (0.18%)	Antibiotic Prophylaxis HR = 1.03, p = 0.94	The risk of PJI is not increased following dental procedure and is unaffected by antibiotic prophylaxis. CHF and diabetes with end organ damage are independent risk factors for PJI following dental procedures.

N events (%); NR = Not reported