Journal of Dental Sciences 21 (2026) 88–95

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-jds.com

Original Article

Multi-institutional observational study on the relationship between oral infection focus and surgical site infection in artificial arthroplasty and the clinical significance of tooth extraction: An analysis using propensity score matching

Ryoji Kitamura [a,b], Sakiko Soutome [c*], Naohisa Wada [d], Daisuke Akita [e], Takumi Hasegawa [f], Narihiro Hirahara [g], Yuichiro Imai [h], Hideto Imura [i], Yuki Hokita [j], Shinichiro Kato [k], Yuka Kojima [l], Yuji Kusafuka [m], Kousuke Matsumoto [n], Yumiko Matsusue [o], Hirokazu Nakahara [p], Kanae Niimi [q], Yu Ohashi [r], Mitsunobu Otsuru [s], Satoshi Rokutanda [t], Hironori Sakai [u], Yuki Sakamoto [v], Makoto Shimanishi [w], Yoshiko Yamamura [x], Akira Tachibana [y], Hideyuki Takano [z], Hiroshi Tsurumaki [aa], Fumihiko Uchida [ab], Nobuhiro Ueda [ac], Koichiro Ueki [ad], Toshiro Yamamoto [ae], Madoka Funahara [af], Masahiro Umeda [ag,ah], Nagato Natsume [ag,ah]

[a] *Department of Dental and Oral Surgery, Kyushu Rosai Hospital, Fukuoka, Japan*
[b] *Section of Oral and Maxillofacial Oncology, Division of Maxillofacial Diagnostic and Surgical Sciences, Faculty of Dental Science, Kyushu University, Fukuoka, Japan*
[c] *Department of Oral Health, Nagasaki University Graduate School of Biomedical Sciences, Nagasaki, Japan*
[d] *Department of General Dentistry, Faculty of Dental Science, Kyushu University, Fukuoka, Japan*
[e] *Department of Dentistry and Oral Surgery, Okaya City Hospital, Nagano, Japan*
[f] *Department of Oral and Maxillofacial Surgery, Kobe University Graduate School of Medicine, Hyogo, Japan*
[g] *Department of Oral and Maxillofacial Surgery, Kagoshima City Hospital, Kagoshima, Japan*

* Corresponding author. Department of Oral Health, Nagasaki University Graduate School of Biomedical Sciences 1-7-1, Sakamoto, Nagasaki, 852-8588, Japan.
E-mail address: sakiko@nagasaki-u.ac.jp (S. Soutome).

https://doi.org/10.1016/j.jds.2025.07.022
1991-7902/© 2026 Association for Dental Sciences of the Republic of China. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

[h] Department of Oral and Maxillofacial Surgery, Kyoto Oral Health Care Center, Rakuwakai Otowa Hospital, Kyoto, Japan
[i] Department of Oral and Maxillofacial Surgery, Nagasaki University Graduate School of Biomedical Sciences, Nagasaki, Japan
[j] Division of Clinical Engineering, Kagoshima University Hospital, Kagoshima, Japan
[k] Department of Oral and Maxillofacial Surgery, Nagoya City University West Medical Center, Aichi, Japan
[l] Department of Oral and Maxillofacial Surgery, Kansai Medical University, Osaka, Japan
[m] Department of Oral and Maxillofacial Surgery, Shinonoi General Hospital, Nagano, Japan
[n] Department of Oral and Maxillofacial Surgery, Japan Community Health Care Organization, Kobe Central Hospital, Hyogo, Japan
[o] Department of Oral and Maxillofacial Surgery, Takita Hospital, Nara, Japan
[p] Department of Oral Pathology, Faculty of Dentistry, Asahi University, Gifu, Japan
[q] Patient Support Center, Niigata University Medical and Dental Hospital, Niigata, Japan
[r] Division of Oral and Maxillofacial Surgery, Department of Reconstructive Oral and Maxillofacial Surgery, School of Dentistry, Iwate Medical University, Iwate, Japan
[s] Department of Oral and Maxillofacial Surgery of Dentistry, Kanagawa Dental University, Kanagawa, Japan
[t] Department of Oral and Maxillofacial Surgery, Juko Memorial Nagasaki Hospital, Nagasaki, Japan
[u] Department of Dentistry and Oral Surgery, Shinshu University School of Medicine, Nagano, Japan
[v] Department of Oral and Maxillofacial Surgery, Kansai Medical University Medical Center, Osaka, Japan
[w] Department of Oral and Maxillofacial Surgery, Oji General Hospital, Hokkaido, Japan
[x] Department of Oral and Maxillofacial Surgery, Faculty of Medicine, Juntendo University, Tokyo, Japan
[y] Department of Oral and Maxillofacial Surgery, Kakogawa Central City Hospital, Hyogo, Japan
[z] Department of Oral Management Center, Tokushima University Hospital, Tokushima, Japan
[aa] Department of Dentistry and Oral Surgery, Niigata Central Hospital, Niigata, Japan
[ab] Department of Oral and Maxillofacial Surgery, Institute of Clinical Medicine, Faculty of Medicine, University of Tsukuba, Ibaraki, Japan
[ac] Department of Oral and Maxillofacial Surgery, Nara Medical University, Nara, Japan
[ad] Department of Oral and Maxillofacial Surgery, Division of Medicine, Interdisciplinary Graduate School, University of Yamanashi, Yamanashi, Japan
[ae] Department of Dental Medicine, Kyoto Prefectural University of Medicine, Kyoto, Japan
[af] School of Oral Health Sciences, Faculty of Dentistry, Kyushu Dental University, Fukuoka, Japan
[ag] Division of Research and Treatment for Oral and Maxillofacial Congenital Anomalies, School of Dentistry, Aichi Gakuin University, Aichi, Japan
[ah] The Japanese Society of Oral Care, Aichi, Japan

Received 10 July 2025; Final revision received 22 July 2025
Available online 9 August 2025

KEYWORDS
Arthroplasty;
Oral infection;
Propensity score matching;
Surgical site infection;
Tooth extraction

Abstract *Background/purpose:* Surgical site infection (SSI) is a serious complication of artificial arthroplasty. Its relationship with dental infections and the necessity of preoperative dental screening remains debated. This study examined the relationship between oral condition and risk of SSI, along with preoperative tooth extraction effect, in patients undergoing artificial arthroplasty.
Materials and methods: Patients undergoing artificial hip or knee arthroplasty between April 2018 and September 2021 were retrospectively examined for age, sex, surgical site, surgical procedure, surgical time, preoperative hemoglobin level, white blood cell count, albumin level, creatinine level, remaining teeth, apical lesions $\geq$3 mm, periodontal pockets $\geq$4 mm, root fractures, residual roots, local infection symptoms in the oral cavity, preoperative or postoperative tooth extraction, and SSI occurrence. Tooth extraction effects on SSI incidence were analyzed using propensity score matching.
Results: The study included 3950 patients from 30 facilities. SSI occurred in 79 patients (2.0 %). Multivariate analysis identified surgery time and oral infection symptoms as significant risk factors. SSI occurred in 75 of 3793 patients without preoperative tooth extraction (2.0 %) and in 4 of 157 patients with tooth extraction (2.6 %), with no significant difference. However, in 292 propensity-matched patients, SSI incidences were 2.7 % and 6.2 % with and without preoperative extraction, respectively, indicating that preoperative infectious tooth removal may

reduce SSI risk. Conversely, SSI occurred in three of seven patients (42.9 %) with tooth extraction within 60 days post-surgery, highlighting its risks.
Conclusion: Oral infections increase SSI risk after artificial arthroplasty. Preoperative tooth extraction is recommended to reduce this risk.
© 2026 Association for Dental Sciences of the Republic of China. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Introduction

Surgical site infections (SSI), including prosthetic joint infections, are severe complications following primary artificial arthroplasty.[1–4] Care providers often optimize modifiable risk factors such as obesity, smoking, and diabetes, before surgery to minimize the risk of SSI post-surgery. Transient bacteremia following routine dental procedures or active dental infections is a potential source of hematogenous seeding, increasing SSI risk.[5–8]The primary bacterial causes of periprosthetic joint infections include coagulase-negative Staphylococcus (30—43 %), *Staphylococcus aureus* (12—23 %), mixed bacteria (10—11 %), Streptococcus species (9—10 %), Gram-negative rods (3—6%), Enterococcus species (3—7%), and anaerobes (2—4%). Approximately 11 % of periprosthetic joint infections are culture-negative, while oral bacteria account for 6—13 % of periprosthetic joint infections.[9]

Active dental infections during artificial arthroplasty or in the acute postoperative period are believed to increase the risk of SSI. Surgeons usually recommend preoperative dental screening.[5–8,10] In Japan, this practice has become common, though some oppose it owing to social and potential side effects.[11–13] However, detailed investigations into oral conditions remain scarce, with many studies reporting premature conclusions. Herein, we report the results of a multicenter collaborative study conducted in Japan to investigate the relationship between oral infection and SSI, as well as the effect of extraction of infectious teeth before surgery.

Materials and methods

This study was conducted in accordance with the Declaration of Helsinki and the Ethical Guidelines for Medical and Biological Research Involving Human Subjects of the Ministry of Health, Labor, and Welfare of Japan, with permission from the institutional review board of each hospital. The study protocol was registered with the University Hospital Medical Information Network (UMIN) (UMIN000044895, 21 July 2021).

A consecutive series of patients undergoing primary total hip arthroplasty (THA), bipolar hip arthroplasty, unicompartmental knee arthroplasty (UKA), or total knee arthroplasty (TKA) from April 1, 2018, to September 31, 2022, were reviewed retrospectively. This study included all participants who underwent primary artificial arthroplasty of the hip or knee during the study period and had details of preoperative dental evaluation available in their medical records. Participants were excluded from the study if they had less than 90 days of follow-up or were undergoing secondary surgery.

For each procedure matching the inclusion criteria, we recorded the patient's age, sex, date of surgery, type of surgery, preoperative dental notes (number of teeth, apical lesion >3 mm, alveolar bone loss >1/2, periodontal pocket >4 mm, root fracture, tooth stump, and local infection symptoms such as gingival swelling, pain, or pus discharge), tooth extraction (if any), postoperative orthopedic notes including date of complication (if any) and date of last follow-up, preoperative laboratory values (leukocyte, hemoglobin, albumin, and creatinine levels), operation time, and medical history. Additional relevant medical history included a diagnosis of diabetes mellitus or use of immunosuppressive medications at the time of surgery, as these would likely confound an infectious complication if the patient experienced delayed wound healing, cellulitis, wound infection, or SSI. SSI were defined according to the Musculoskeletal Infection Society criteria.[14]

Statistical analysis was performed using SPSS version 26.0 (IBM Japan, Ltd., Tokyo, Japan) statistical software. Each variable related to SSI was analyzed using a chi-square test for categorical variables and one-way ANOVA for continuous data to identify significant differences. Variables with significant differences were identified and examined using multivariate logistic regression analysis. Local infection and radiographic findings were incorporated as covariates and examined using propensity score matching.

Results

A total of 3950 patients were recruited from 30 hospitals in Japan (Table 1). Patient characteristics are summarized in Table 2. There were 877 men and 3073 women, with an average age of 70.3 years. The surgical site involved the knee in 1862 patients and the hip in 2088 patients; THA or TKA was performed in 3706 patients, while UKA or TKA was performed in 244 patients. Oral and panoramic radiographic findings included apical lesions >3 mm, alveolar bone loss >1/2, periodontal pocket >4 mm, root fracture, tooth stump, and oral infection (such as swelling of the gingiva, fistula, pain, and pus discharge) in 782, 1,201, 2,543, 246, 745, and 545 patients, respectively.

SSI occurred in 79 patients (2.0 %). Univariate analysis showed that longer operation time, lower serum albumin level, and local infection symptoms in the oral cavity were

Table 1 Research participating hospitals.

Hospital	Prefecture	Research Collaborator
Nagasaki University Hospital	Nagasaki	Sakiko Soutome
University of Tsukuba Hospital	Ibaraki	Fumihiko Uchida
Kagoshima University Hospital	Kagoshima	Taihei Yamaguchi
Kyoto Prefectural University Hospital	Kyoto	Toshiro Yamamoto
Niigata Central Hospital	Niigata	Hiroshi Tsurumaki
Juko Memorial Nagasaki Hospital	Nagasaki	Satoshi Rokutanda
Nagoya City University Hospital	Aichi	Shin-ichiro Kato
Kyushu Rousai Hospital	Fukuoka	Ryoji Kitamura
Kyushu University Hospital	Fukuoka	Naohisa Wada
Japanese Redcross Nagasaki Genbaku Hospital	Nagasaki	Mitsunobu Oturu
Shinonoi General Hospital	Nagano	Yuji Kusafuka
Kansai Medical University	Osaka	Yuka Kojima
Tokushima University Hospital	Tokushima	Hideyuki Takano
Juntendo University Hospital	Tokyo	Mitsuyo Shinohara
Mansai Medical University Medical Center	Osaka	Yuki Sakamoto
Kobe University Hospital	Hyogo	Takumi Hasegawa
Takita Hospital	Nara	Yumiko Matsusue
Yamanashi University Hospital	Yamanashi	Koichiro Ueki
Kobe Central Hospital	Hyogo	Kousuke Matsumoto
Oji General Hospital	Hokkaido	Makoto Shimanishi
Kagoshima City Hospital	Kagoshima	Narihiro Hirahara
Iwate Medical University Hospital	Iwate	Yu Ohashi
Osaka Metropolitan University Hospital	Osaka	Hirokazu Nakahara
Aichi Gakuin University Hospital	Aichi	Hideto Imura
Kakogawa Central City Hospital	Hyogo	Shinsho Tachibana
Okaya City Hospital	Nagano	Daisuke Akita
Nara Medical University Hospital	Nara	Nobuhiro Ueda
Rakuwakai Otowa Hospital	Kyoto	Yuichiro Imai
Shinshu University Hospital	Nagano	Hironori Sakai
Niigata University Hospital	Niigata	Kanae Niimi

Table 2 Patient characteristics.

Variable		Number of patients/mean ± SD
Sex	Male	877
	Female	3073
Age		70.3 ± 11.1
Operation site	Knee	1862
	Hip	2088
Operation method	BHA/UKA	244
	THA/TKA	3706
Operation time	minutes	118 ± 61.5
Leukocytes	$10^3/\mu L$	6.08 ± 1.76
Hemoglobin	g/dL	12.9 ± 1.66
Albumin	g/dL	4.07 ± 0.460
Creatinine	mg/dL	0.833 ± 0.963
Number of teeth		20.1 ± 8.26
Apical lesion >3 mm	(−)	3057
	(+)	782
Alveolar bone loss >1/2	(−)	2644
	(+)	1201
Periodontal pocket >4 mm	(−)	1236
	(+)	2543
Root fracture	(−)	3650
	(+)	246

(*continued on next page*)

Table 2 (*continued*)

Variable		Number of patients/mean ± SD
Tooth stump	(−)	3163
	(+)	745
Local infection symptom in the oral cavity	(−)	3365
	(+)	545
Tooth extraction before surgery	(−)	3793
	(+)	157

Abbreviations: BHA: bipolar hip arthroplasty, UKA: unicompartmental knee arthroplasty, THA: total hip arthroplasty, TKA: total knee arthroplasty, SD: standard deviation.

Table 3 Factors related to the incidence of SSI (univariate analysis).

Variable		Number of patients/mean ± SD		*P*-value
		SSI (−)	SSI (+)	
Sex	Male	853	24	0.099
	Female	3018	55	
Age		70.3 ± 11.1	70.6 ± 12.5	
Operation site	Knee	1829	33	0.364
	Hip	2042	46	
Operation method	BHA/UKA	242	2	0.237
	THA/TKA	3629	77	
Operation time	minutes	117 ± 60.4	157 ± 92.8	<0.001
Leukocytes	$10^3/\mu L$	6.07 ± 1.74	6.35 ± 2.09	0.855
Hemoglobin	g/dL	12.9 ± 1.65	12.6 ± 2.06	0.173
Albumin	g/dL	4.08 ± 0.456	3.95 ± 0.592	0.015
Creatinine	mg/dL	0.832 ± 0.960	0.928 ± 1.09	0.378
Number of teeth		20.2 ± 8.23	19.2 ± 9.44	0.296
Apical lesion >3 mm	(−)	2994	63	0.775
	(+)	768	14	
Alveolar bone loss >1/2	(−)	2594	50	0.617
	(+)	1175	26	
Periodontal pocket >4 mm	(−)	1213	23	0.626
	(+)	2489	54	
Root fracture	(−)	3578	72	0.815
	(+)	241	5	
Tooth stump	(−)	3100	63	1.000
	(+)	730	15	
Local infection symptom in the oral cavity	(−)	3319	46	<0.001
	(+)	512	33	

Abbreviations: BHA: bipolar hip arthroplasty, UKA: unicompartmental knee arthroplasty, THA: total hip arthroplasty, TKA: total knee arthroplasty, SSI: surgical site infection, SD: standard deviation.

significantly correlated with the incidence of SSI (Table 3). When multivariate analysis was performed using factors that were significant in the univariate analysis as covariates, the two factors of operation time (odds ratio [OR]: 1.007, 95 % confidence interval [95%CI]: 1.005−1.010, *P*-value: <0.001) and local infection symptoms (OR: 4.748, 95%CI: 2.987−7.548, *P*-value: <0.001) were significantly associated with SSI incidence (Table 4).

The relationship between tooth extraction and the incidence of SSI was examined. SSI occurred in 4 of 157 patients (2.6 %) who underwent preoperative tooth extraction. This incidence was higher compared to 75 of 3973 patients (2.0 %) who did not undergo preoperative tooth extraction, demonstrating no significant difference (OR: 1.296, 95%CI: 0.468−3.589, *P*-value: 0.555). However, significant differences in the background factors between patients in the extraction and non-extraction groups suggest that tooth extraction is a risk factor for SSI development. Patients undergoing preoperative tooth extraction had significantly higher rates of apical lesions, alveolar bone resorption, periodontal pockets, root fracture, tooth stump, and oral infection symptoms, and had significantly fewer teeth, suggesting poor oral hygiene compared to those who did not undergo tooth extraction. Therefore, propensity score matching was performed using dental findings as covariates (Table 5). The 292 matched cases had

Table 4 Factors related to the incidence of SSI (multivariate analysis).

Variable		OR	95 % CI	*P*-value
Operation time	minutes	1.007	1.005–1.010	<0.001
Albumin	g/dL	0.685	0.438–1.070	0.097
Local infection symptom in the oral cavity	(+)/(−)	4.748	2.987–7.548	<0.001

Abbreviations: OR: odds ratio, 95 % CI: 95 % confidence interval.

Table 5 Background factors of the original 3950 patients and 292 patients matched using propensity score methods.

Variable		Before propensity score matcing			After propensity score matcing		
		Extraction (−)	Extraction (+)	*P*-value	Extraction (−)	Extraction (+)	*P*-value
Number of teeth		20.2 ± 8.3	18.8 ± 7.9	0.035	18.7 ± 8.0	18.6 ± 7.8	0.911
Apical lesion >3 mm	(−)	2973	84	<0.001	81	81	1.000
	(+)	712	70		65	65	
Alveolar bone loss>1/2	(−)	2579	65	<0.001	60	63	0.813
	(+)	1112	89		86	83	
Periodontal pocket>4 mm	(−)	1220	16	<0.001	17	16	1.000
	(+)	2406	137		129	130	
Root fracture	(−)	3519	131	<0.001	126	122	0.624
	(+)	220	26		20	24	
Tooth stump	(−)	3078	85	<0.001	81	82	1.000
	(+)	673	72		65	64	
Local infection symptom in the oral cavity	(−)	3351	14	<0.001	14	14	1.000
	(+)	405	140		132	132	

Excluding cases with no dental findings noted.

similar dental backgrounds for both the extraction and non-extraction cases. As a result, the SSI incidence rate for patients who underwent or did not undergo preoperative tooth extraction was 2.8 % or 6.2 %, respectively; hence, although no significant difference was observed (OR: 0.429, 95%CI: 0.129–1.425, *P*-value:0.256), extraction of infectious teeth may prevent the onset of SSI (Fig. 1).

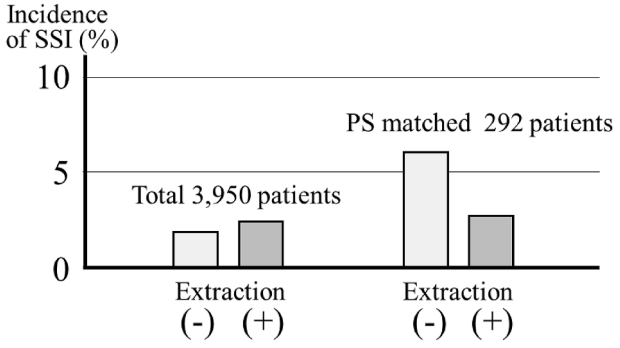

Figure 1 Relationship between preoperative tooth extraction and surgical site infection (SSI) development. Frequency of SSI development in all cases did not decrease even with preoperative tooth extraction but the incidence was lower in patients underwent preoperative tooth extraction when dental background factors were propensity score matched. SSI, surgical site infection, PS, propensity score.

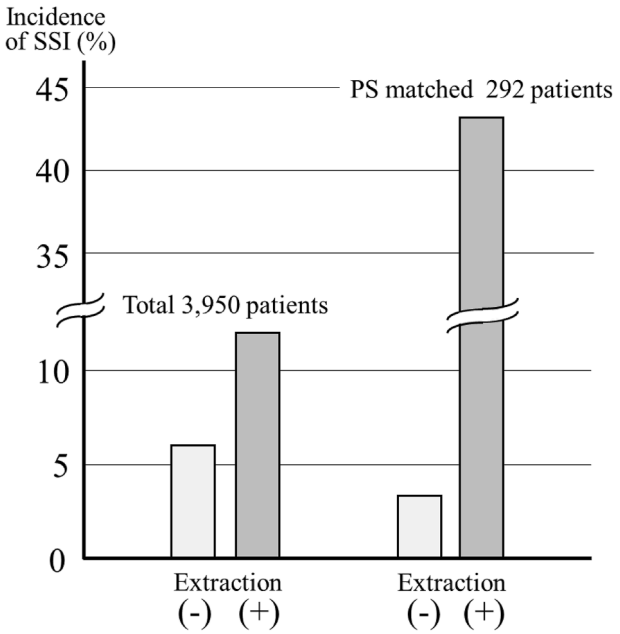

Figure 2 Relationship between postoperative tooth extraction and surgical site infection (SSI) development. Patients underwent tooth extraction within 2 months of surgery had a significantly higher SSI incidence in analysis of all cases and after propensity score matching. SSI, surgical site infection, PS, propensity score.

Conversely, 25 patients had their teeth extracted within 2 months of surgery, and SSI occurred in 3 of them (12.0 %). This was significantly higher than the SSI incidence rate (1.9 %) in patients who did not undergo tooth extraction within 2 months of surgery (OR: 6.906, 95%CI: 2.024—23.567, *P*-value: 0.013). When we examined the 292 cases that were matched using propensity score matching, SSI occurred in 3 of the 7 patients (42.9 %) who underwent tooth extraction within 60 days of surgery and in 10 of the 285 (3.5 %) who did not, indicating that tooth extraction after surgery significantly increased the risk of developing SSI (OR: 20.625, 95%CI: 4.063—104.689, *P*-value: 0.002) (Fig. 2).

Discussion

Oral hygiene has recently emerged as a critical aspect of health management,[15] reflecting the growing recognition of its close relationship with overall health. Barriers to dental care, including those faced by older individuals, economically disadvantaged people, ethnic minorities, individuals with disabilities, and patients receiving home care when seeking dental treatment have further highlighted this issue. Resident oral bacteria are implicated in the onset and exacerbation of various systemic diseases such as diabetes, cerebrovascular disorders, low birth weight, preterm birth, and chronic rheumatoid arthritis.[16] Additionally, oral bacteria have been identified as a potential cause of SSI following heart valve replacement and arthroplasties.[17,18] However, high-level studies reporting a relationship between oral bacteria and SSI in arthroplasties remain lacking. Therefore, we conducted this large-scale retrospective study to address this issue.

Poor dental hygiene is a potential risk factor for infection during artificial arthroplasty. Thus, it is common practice to perform dental clearance before surgery, and teeth that may become the source of infection are extracted.[5—8,10] In recent years, a relationship between oral infections and SSIs around artificial joints has been reported. Sonn et al.[13] retrospectively examined 2457 cases of THA and TKA. Dental evaluation was performed preoperatively in 1944 patients (79.1 %); of these, 223 (11.5 %) underwent tooth extraction. Prosthetic joint infection occurred in 1.51 % of cases, but the complication rate was higher in patients who had teeth extracted, patients with diabetes, and patients on immunosuppressive drugs. Therefore, it was concluded that dental clearance was not necessary and that preoperative tooth extraction may be an unnecessary step. However, a significant bias existed between patients who had their teeth extracted preoperatively and those who did not, such as the poor oral condition of the former. In their study, they concluded that preoperative tooth extraction and dental screening were unnecessary because SSI were more common in patients who had their teeth extracted without examining the differences in these oral conditions; nevertheless, we do not agree with their conclusions. Lampley et al.[19] found no difference in the incidence of SSI between 355 patients who underwent arthroplasty after dental clearance and 161 patients who underwent surgery without dental clearance and stated that the perceived need for routine preoperative dental screening for all patients after hip and knee arthroplasty should be reassessed. Frey et al.[12] conducted a systematic review of eight articles[7,13,19—24] and reported the lack of evidence to support the usefulness of preoperative dental screening. However, none of these eight studies were randomized controlled trials, and given the aforementioned bias between patient groups, we believe that it is impossible to conclude that dental screening is not useful.

We collected data from many cases (3950 cases from 30 facilities). First, we examined the relationship between oral findings and SSI and found that prolonged surgery time and local infection symptoms in the oral cavity, such as pain, swelling, and pus discharge, were significantly associated with the development of SSI. We also examined the association of SSI with tooth extraction. The incidence of SSI in patients who underwent tooth extraction prior to arthroplasty was 2.6 %, which was slightly higher than the 2.0 % in patients who did not undergo tooth extraction, although no significant difference was found. This result was the same as that reported by Sonn et al.[13] However, when the oral findings of the extraction and non-extraction groups were examined after propensity score matching, although no significant difference was observed, the incidence of SSI in the extraction group was 2.8 % and that in the non-extraction group was 6.2 %, showing that the incidence was lower in the extraction group. This indicates that dental infection foci are a risk factor for the development of SSI after artificial arthroplasty and that it is necessary to perform dental screening before surgery and extract teeth with symptoms of infection. In addition, as SSI incidence is significantly higher when the infectious tooth is extracted within 60 days of surgery, the infectious tooth should be extracted preoperatively, not postoperatively.

This study has some limitations. First, although we conducted multivariate and propensity score matching analyses in this retrospective study, unknown bias could be present, and the generalizability of the results remains unclear. Furthermore, because the number of patients who underwent tooth extraction was small, no significant difference was noted in the effectiveness of preoperative tooth extraction. However, owing to the ethical issues involved in randomizing tooth extraction or non-tooth extraction, it would be difficult to conduct randomized controlled trials in the future. We intend to conduct further research on this topic using larger sample sizes.

In conclusion, a total of 3950 patients who underwent artificial hip or knee arthroplasty at 30 hospitals were retrospectively investigated. The risk of developing SSI was significantly higher in patients with teeth exhibiting local infection symptoms. Additionally, when the patients' dental background factors were matched and analyzed using propensity score matching, the risk of SSI decreased when teeth that could be a source of infection were extracted preoperatively, but increased when they were extracted postoperatively.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

Acknowledgments

We would like to thank Editage (www.editage.com) for the English language editing.

References

1. Shah NB, Tande AJ, Patel R, et al. Anaerobic prosthetic joint infection. *Anaerobe* 2015;36:1—8.
2. Ong KL, Kurtz SM, Lau E, et al. Prosthetic joint infection risk after total hip arthroplasty in the medicare population. *J Arthroplast* 2009;24:105—9.
3. Kurtz SM, Ong KL, Lau E, et al. Prosthetic joint infection risk after TKA in the medicare population. *Clin Orthop Relat Res* 2010;468:52—6.
4. Kurtz SM, Lau E, Watson H, et al. Economic burden of periprosthetic joint infection in the United States. *J Arthroplast* 2012;27:61. 5.e1.
5. Kohler JG, Holte AJ, Glass NA, et al. Dental screening in elective total joint arthroplasty risk factors for failure. *J Arthroplasty Dent* 2021;36:1548—50.
6. Shrout MK, Scarbrough F, Powell BJ, et al. Dental care and the prosthetic joint patient a survey of orthopedic surgeons and general dentists. *J Am Dent Assoc Dent* 1994;125:429—36.
7. Vuorinen M, Mäkinen T, Rantasalo M, et al. Incidence and risk factors for dental pathology in patients planned for elective total hip or knee arthroplasty. *Scand J Surg* 2019;108:338—42.
8. Fenske F, Krause L, Meyer S, et al. Oral health screening for risk reduction for early periprosthetic joint infections of hip and knee endoprostheses results of a prospective cohort study. *J Clin Med* 2023;12:4451.
9. Young H, Hirsh J, Hammerberg EM, et al. Dental disease and periprosthetic joint infection. *J Bone Joint Surg Am Dent* 2014;96:162—8.
10. Fenske F, Kujat B, Krause L, et al. Preoperative dental screening can reduce periprosthetic infections of hip and knee endoprostheses in the first month after surgery results of a cohort study. *Infection* 2024;52:535—43.
11. Kwan SA, Lau V, Fliegel BE, et al. Routine preoperative dental clearance for total joint arthroplasty is there a benefit. *Cureus* 2023;15:e41352.
12. Frey C, Navarro SM, Blackwell T, et al. Impact of dental clearance on total joint arthroplasty a systematic review. *World J Orthop* 2019;10:416—23.
13. Sonn KA, Larsen CG, Adams W, et al. Effect of preoperative dental extraction on postoperative complications after total joint arthroplasty. *J Arthroplast* 2019;34:2080—4.
14. Workgroup convened by the musculoskeletal infection society. New definition for periprosthetic joint infection. *J Arthroplast* 2011;26:1136—8.
15. Fiorillo L. Oral health the first step to well-being. *Medicina (Kaunas)* 2019;55:676.
16. Scannapieco FA, Cantos A. Oral inflammation and infection and chronic medical diseases implications for the elderly. *Periodontol* 2000 2016;72:153—75.
17. Deppe H, Reitberger J, Behr AV, et al. Oral bacteria in infective endocarditis requiring surgery a retrospective analysis of 134 patients. *Clin Oral Invest* 2022;26:4977—85.
18. Curry S, Phillips H. Joint arthroplasty dental treatment and antibiotics a review. *J Arthroplast* 2002;17:111—3.
19. Lampley A, Huang RC, Arnold WV, et al. Total joint arthroplasty should patients have preoperative dental clearance. *J Arthroplast* 2014;29:1087—90.
20. Adamkiewicz K, Płatek AE, Łęgosz P, et al. Evaluation of the prevalence of periodontal disease as a non-classical risk factor in the group of patients undergoing hip And/or knee arthroplasty. *Kardiol Pol* 2018;76:633—6.
21. Tokarski AT, Patel RG, Parvizi J, et al. Dental clearance prior to elective arthroplasty may not be needed for everyone. *J Arthroplasty Dent* 2014;29:1729—32.
22. Wood TJ, Petruccelli D, Piccirillo L, et al. Dental hygiene in maintaining a healthy joint replacement a survey of Canadian total joint replacement patients. *Curr Orthop Pract Dent* 2016;27:515—9.
23. Barrington JW, Barrington TA. What is the true incidence of dental pathology in the total joint arthroplasty population. *J Arthroplast* 2011;26:88—91.
24. Tai TW, Lin TC, Ho CJ, et al. Frequent dental scaling is associated with a reduced risk of periprosthetic infection following total knee arthroplasty a nationwide population-based nested case-control study. *PLoS One* 2016;11:e0158096.