


Effect of the COVID-19 pandemic on the oral health and nutritional status of Japanese older adults who underwent total hip or knee arthroplasty

A 3-year single-institution retrospective cohort study

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Abstract

The coronavirus disease 2019 (COVID-19) pandemic affected the physical and mental health, socioeconomic status, and community behavior of people worldwide. The aim of this retrospective cohort study was to analyze the impact of the COVID-19 pandemic on the oral health and nutritional status of Japanese older adults based on the results of preoperative assessment in patients who underwent total hip or knee arthroplasty under general anesthesia. This study included older adults (≥ 65 years) who underwent total hip or knee arthroplasty in whom orthopantomography was performed for preoperative oral health assessment, during January 2019 to December 2021. Gender, age, number of family members living together, number of teeth, body mass index, and serum total protein and serum albumin levels were collected for analysis of this study. A total of 201 patients aged 65 to 89 years participated in the study. While the COVID-19 pandemic has had no impact on the oral health status, there has been a drop in serum albumin level from the results of multivariable-adjusted regression analysis considering age, gender, number of family members, and time. The COVID-19 pandemic has affected the serum albumin level of Japanese orthopedic patients aged 65 years or older.

Abbreviations: ALB = serum albumin, BMI = body mass index, COVID-19 = coronavirus disease 2019, IQR = interquartile range, TP = serum total protein.

Keywords: multivariable-adjusted regression, nutritional status, older adults, oral health, the coronavirus disease 2019

1. Introduction

Maintenance of oral health and oral care contributes to the prevention of post-surgical pneumonia.^[1,2] Moreover, poor oral health, caused by dental caries or periodontal disease, has been linked to orthopedic surgical site infection, because oral pathogens can cause asymptomatic bacteremia.^[3,4] Finally, the maintenance of oral function associated with remaining teeth may contribute to a good nutritional status and recovery after orthopedic surgery.^[5,6] Hence, oral care and maintenance of oral health have an important role in postoperative outcomes and following orthopedic surgery.^[7]

The present study sought to examine whether the coronavirus disease 2019 (COVID-19) pandemic may have affected

the oral health and nutritional status of Japanese older adults undergoing total hip or knee arthroplasty. The COVID-19 pandemic affected the physical and mental health, socioeconomic status, and community behavior of people worldwide.^[8-10]

Our previous study examining oral health and nutritional status in 2019 and 2020 showed that the COVID-19 pandemic did not significantly affect the oral health and nutritional status of older adults with digestive cancer in our community.^[11] However, prolonged global instability owing to the COVID-19 pandemic may be affecting oral health and nutritional status of older patients.^[12]

Accordingly, the aim of this retrospective cohort study was to analyze the impact of the COVID-19 pandemic on the oral health and nutritional status of Japanese older adults based on

The authors have no funding and conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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How to cite this article: Matsuda S, Kawachi I, Fujita R, Yoshida H, Oki H, Kokubo Y, Matsumine A, Yoshimura H. Effect of the COVID-19 pandemic on the oral health and nutritional status of Japanese older adults who underwent total hip or knee arthroplasty: A 3-year single-institution retrospective cohort study. *Medicine* 2022;101:46(e31937).

Received: 1 October 2022 / Received in final form: 30 October 2022 / Accepted: 31 October 2022

<http://dx.doi.org/10.1097/MD.00000000000031937>

the results of preoperative assessment in patients who underwent total hip or knee arthroplasty under general anesthesia.

2. Methods

2.1. Participants

We defined older adults as patients aged 65 years or older. This study included older adults who underwent total hip or knee arthroplasty in whom orthopantomography was performed for preoperative oral health assessment for general anesthesia at our hospital. Patients with edentulism were included in this study.

2.2. Study period

We divided the study period into the following periods: “Before the COVID-19 pandemic” (January 2019–December 2019), “First year of the COVID-19 pandemic” (January 2020–December 2020), and “Second year of the COVID-19 pandemic” (January 2021–December 2021).

2.3. Data extraction

We collected the following information about patients: general characteristics including gender, age, number of family members living together (including the participant), and surgical plans; clinical indicators of oral health status including the number of teeth that could be used for mastication; and nutritional status indicators including body mass index (BMI), serum total protein (TP) level, and serum albumin (ALB) level.

We defined “teeth that could be used for mastication” as teeth with intact dentin and prosthetic material that reached the occlusal plane identified using orthopantomography. Residual roots with caries and impacted teeth were not considered “teeth that could be used for mastication.”

2.4. Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics 26 statistical software (IBM, Tokyo, Japan).

We performed a multivariable-adjusted regression, controlling for confounding variables, as follows;

$$Y = \beta_0 + \beta_1.\text{age} + \beta_2.\text{gender} + \beta_3.\text{number of family members} + \beta_4.\text{time} + \varepsilon$$

(Independent factors were defined as follows: gender (man = 0, woman = 1), time (First year of the COVID-19 pandemic = 0, Second year of the COVID-19 pandemic = 1).

2.5. Ethical approval

This study was approved by the Institutional Research Board of our institution (approval number: 20190082). *There are no ethical issues associated with this study because it is a retrospective study of preoperative examination data.* All methods were performed in accordance with the relevant guidelines and regulations (Declaration of Helsinki). Verbal informed consent was obtained from all participants at the time of preoperative dental examinations at our department. The Institutional Research Board waived the need for written consent because the information of this study have been released to the public.

3. Results

3.1. General characteristics of the participants

This study included 201 patients, with 60, 67, and 74 patients in the “Before the COVID-19 pandemic,” “First year of the COVID-19 pandemic,” and “Second year of the COVID-19 pandemic” groups, respectively (Table 1). There were 13 men and 47 women in the “Before the COVID-19 pandemic” group. Their median (interquartile range [IQR]) age was 77.00 (71.00–79.00) years and the median (IQR) number of family members living together was 2.00 (2.00–3.00). Twelve patients in this group lived alone. Fourteen patients in this group had undergone hip surgery and 46 had undergone knee surgery. There were 13 men and 54 women in the “First year of the COVID-19 pandemic” group. Their median (IQR) age was 75.00 (70.00–79.00) years and the median (IQR) number of family members living together was 3.00 (2.00–4.00). Nine patients in this group lived alone. Twenty-nine patients in this group had undergone hip surgery and 38 had undergone knee surgery. There were 22 men and 52 women in the “Second year of the COVID-19 pandemic” group. Their median (IQR) age was 74.50 (72.00–79.25) years and the median (IQR) number of family members living together was 3.00 (2.00–4.00). Nine patients in this group lived alone. Twenty-three patients in this group had undergone hip surgery and 51 had undergone knee surgery.

Table 1

General characteristics of participants.

Year		Before the COVID-19 (2019) (n)	First year of the COVID-19 (2020) (n)	Second year of the COVID-19 (2021) (n)
Total		60	67	74
Gender	Men	13	13	22
	Women	47	54	52
Age	65–69	6	12	11
	70–79	40	40	45
	80–89	14	15	18
People living together	1	12	9	9
	2	24	24	24
	3	13	8	18
	4	5	12	7
	5	1	4	11
	6	3	7	3
	7	1	3	2
	8	1	0	0
Orthopedic surgery	Hip	14	29	23
	Knee	46	38	51

COVID-19 = coronavirus disease 2019.

3.2. Oral health status of the participants

The median (IQR) number of teeth that could be used for mastication was 17.00 (7.75–25.00) in the “Before the COVID-19 pandemic” group, 21.00 (9.50–25.00) in the “First year of the COVID-19 pandemic” group, and 20.00 (13.25–25.00) in the “Second year of the COVID-19 pandemic” group (Table 2).

3.3. Nutritional status of the participants

The median (IQR) BMI was 25.80 (23.85–28.05) kg/m² in the “Before the COVID-19 pandemic” group, 25.40 (22.55–27.85) kg/m² in the “First year of the COVID-19 pandemic” group, and 24.75 (23.08–27.50) kg/m² in the “Second year of the COVID-19 pandemic” group. The median (IQR) TP level was 7.30 (7.00–7.70) g/dL in the “Before the COVID-19 pandemic” group, 7.20 (7.00–7.50) g/dL in the “First year of the COVID-19 pandemic” group, and 7.10 (6.90–7.40) g/dL in the “Second year of the COVID-19 pandemic” group. The median (IQR) ALB level was 4.25 (4.10–4.43) g/dL in the “Before the COVID-19 pandemic” group, 4.20 (3.90–4.40) g/dL in the “First year of the COVID-19 pandemic” group, and 4.05 (3.83–4.30) g/dL in the “Second year of the COVID-19 pandemic” group.

3.4. Statistical analysis

In multivariate-adjusted regressions controlling for confounding variables, “time” was statistically significant only when analyzing ALB level ($P < .05$) (Table 3).

3.5. Analysis of people living alone

The general characteristics, oral health indicators, and nutritional status indicators of the participants living alone have been presented as means and standard deviations in Table 4.

4. Discussion

This study revealed that while the COVID-19 pandemic has had no impact on the oral health status of Japanese older adults who underwent total hip or knee arthroplasty under general anesthesia, it has affected their nutritional status. From our statistically analysis, it seems there was a drop in ALB level and marginal drop in TP level. This is the first paper to suggest an association between the COVID-19 pandemic and the nutritional status of older adults among the similar target groups, namely orthopedic patients in Japan. There was no statistically change in TP level and BMI during the COVID-19 pandemic based on multivariate-adjusted regressions, but changes in it may become apparent in the future considering the change in ALB level. Therefore, it is important to conduct similar follow-up studies in the same population. In addition, stakeholders, including politicians, medical and dental professionals, and family members and care givers, may need to intervene promptly and proactively against the impact of the COVID-19 pandemic on the ALB level of older adults.

The World Health Organization first learned of the novel coronavirus on December 31, 2019.^[8] The first case of COVID-19 in Japan was reported on January 15, 2020.^[13,14] Therefore,

Table 2

Oral health and nutritional status of participants.

Year	Before the COVID-19 (2019)	First year of the COVID-19 (2020)	Second year of the COVID-19 (2021)
Number of remaining teeth, median (IQR)	17.00 (7.75–25.00)	21.00 (9.50–25.00)	20.00 (13.25–25.00)
Body mass index, median (IQR)	25.80 (23.85–28.05)	25.40 (22.55–27.85)	24.75 (23.08–27.50)
Serum total protein (g/dl), median (IQR)	7.30 (7.00–7.70)	7.20 (7.00–7.50)	7.10 (6.90–7.40)
Serum albumin (g/dl), median (IQR)	4.25 (4.10–4.43)	4.20 (3.90–4.40)	4.05 (3.83–4.30)

COVID-19 = coronavirus disease 2019, IQR = interquartile range.

Table 3

Results of multivariable-adjusted regression of the BMI, serum total protein level, and ALB level.

		95% confidence interval	P value
BMI	R² = 0.023		
	$\beta_0 = 24.197$	15.759–32.636	<.001
Age	$\beta_1 = 0.027$	–0.083 to 0.136	.628
Gender	$\beta_2 = -1.172$	–2.661 to 0.318	.122
Number of family members	$\beta_3 = 0.088$	–0.307 to 0.483	.66
Time	$\beta_4 = -0.510$	–1.796 to 0.776	.434
Serum total protein level	R² = 0.053		
	$\beta_0 = 8.285$	7.189–9.380	<.001
Age	$\beta_1 = -0.015$	–0.029 to 0.000	<.050
Gender	$\beta_2 = 0.062$	–0.131 to 0.256	.524
Number of family members	$\beta_3 = 0.001$	–0.051 to 0.052	.978
Time	$\beta_4 = -0.145$	–0.312 to 0.022	.089
ALB level	R² = 0.156		
	$\beta_0 = 5.541$	4.881–6.201	<.001
Age	$\beta_1 = -0.016$	–0.025 to –0.008	<.001
Gender	$\beta_2 = -0.123$	–0.240 to –0.007	<.050
Number of family members	$\beta_3 = -0.022$	–0.053 to 0.009	.162
Time	$\beta_4 = -0.109$	–0.210 to –0.009	<.050

Independent factors: gender (man = 0, woman = 1), time (First year of the COVID-19 pandemic = 0, second year of the COVID-19 pandemic = 1).

ALB = serum albumin, BMI = body mass index, COVID-19 = coronavirus disease 2019.

Table 4**General characteristics, and oral health and nutritional status of participants living alone.**

Year		Before the COVID-19 (2019)	First year of the COVID-19 (2020)	Second year of the COVID-19 (2021)
Total		12	9	9
Gender	Men	0	0	1
	Women	12	9	8
Age (mean ± standard deviation)		76.50 ± 4.70	78.56 ± 7.54	77.78 ± 5.29
Number of remaining teeth (mean ± standard deviation)		12.58 ± 9.32	17.33 ± 9.85	16.89 ± 10.78
Body mass index (mean ± standard deviation)		25.78 ± 4.24	23.43 ± 2.95	24.69 ± 3.44
Serum total protein (g/dl) (mean ± standard deviation)		7.37 ± 0.53	7.11 ± 0.51	6.88 ± 0.40
Serum albumin (g/dl) (mean ± standard deviation)		4.24 ± 0.30	4.00 ± 0.41	4.04 ± 0.27

COVID-19 = coronavirus disease 2019.

we defined the period from January 2019 to December 2019 as “Before the COVID-19 pandemic,” the period from January 2020 to December 2020 as “First year of the COVID-19 pandemic,” and the period from January 2021 to December 2021 as “Second year of the COVID-19 pandemic.” In other words, “Before the COVID-19 pandemic” group can be considered the control group in this study.

Older adults who live alone may have a poorer nutritional status than those who live with family.^[15] In this study, the percentage of older adults living alone was 20.00% in the “Before the COVID-19 pandemic” group, 13.43% in the “First year of the COVID-19 pandemic” group, and 12.16% in the “Second year of the COVID-19 pandemic” group. Almost all of the patients living alone were women. The results of the analysis of people living alone were not significantly different from the overall results. In the period following the Great East Japan Earthquake, Japanese older adults hesitated to wash their dentures because of the shortage of tap water.^[16] Because of the socioeconomic impact of COVID-19, we fear that Japanese older adults with a social life might be hesitant to eat and consume scarce resources.

In a previous study, we reported an increased interest in oral health among our community members.^[17] Nevertheless, we also found that oral health awareness may not be sufficiently widespread and its maintenance may not be adequate.^[18] Following medical–dental collaboration at our hospital, we reported on the oral health intervention provided at our department and found that older adults have a large number of remaining teeth.^[19] Furthermore, our recent retrospective study, published in 2021, showed that the COVID-19 pandemic had no significant influence on oral health and nutritional status. In that study, we compared the oral health status of older patients with cancer who underwent preoperative oral health assessment in 2019 and 2020.^[11] Nevertheless, the impact of the COVID-19 pandemic on oral health cannot be completely ruled out because detailed information on the incidence of periodontitis and dental caries has not been analyzed. We consider that such long-term studies are important because the COVID-19 pandemic–related factors may have ongoing social and economic effects.^[20]

This study had the following limitations: it was a retrospective between-group analysis, it included older adults who underwent total hip or knee arthroplasty under general anesthesia, it was conducted at a single institution in Japan, and oral health status was assessed using orthopantomography. In addition, limitations on the statistical analysis aspect were as follows: we only controlled for 3 variables (age, sex, number of family members), and we did not control for other potential confounding variables, such as socioeconomic status (income,

education), co-morbidity, and other factors that could have affected the patient mix before versus after the COVID-19 emergency declaration. Therefore, the generalizability of our findings may be limited, and it is not possible to completely eliminate individual confounding factors from the results of this study

All countries should independently study their response to the COVID-19 pandemic and the impact of the COVID-19 pandemic on public health, including general health and psychosocial health, food supply and demand, and socioeconomics.^[21] Researchers should aid these efforts and work to end the acute phase of the COVID-19 pandemic.^[21]

5. Conclusion

The COVID-19 pandemic has affected the ALB level of Japanese orthopedic patients aged 65 years or older. Stakeholders, including politicians, medical and dental professionals, and family members and care givers, should promptly and proactively intervene against the impact of the COVID-19 pandemic on the ALB level of these patients.

Author contributions

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