

Has the COVID-19 pandemic influenced the oral health and nutritional status of elderly patients with digestive cancer?

A retrospective study in Fukui, Japan

Shinpei Matsuda, DDS, PhD^{a,*}, Hisato Yoshida, DDS, PhD^a, Hitoshi Yoshimura, DDS, PhD^a, Takatori Goi, MD, PhD^b, Yoshio Yoshida, MD, PhD^{c,d}, Hiromichi Iwasaki, MD, PhD^e

Abstract

The coronavirus disease 2019 (COVID-19) pandemic has affected various aspects, including socioeconomic status and health. This retrospective study aimed to investigate the influence of the COVID-19 pandemic on oral health based on the number of teeth that contribute to mastication, and the nutritional status of elderly patients with digestive cancers.

The authors defined the before and during COVID-19 periods in this study as January 2019 to December 2019 and January 2020 to December 2020, respectively. Patients with digestive cancer who underwent general, laboratory, and orthopantomograph examinations for preoperative oral health assessment before general anesthesia participated in this study. The authors investigated the following general characteristics: (1) sex, (2) age, and (3) the organ affected by disease and scheduled for surgery under general anesthesia. The authors collected information about (4) the number of teeth that could contribute to mastication as a clinical oral health parameter. The parameters: (5) body mass index, (6) serum total protein levels, and (7) serum albumin levels were used to indicate the nutritional status.

A total of 233 elderly patients with digestive cancer participated in this study. There was no significant difference between the age of the patients with digestive cancer. There was also no significant difference in the number of teeth that could contribute to mastication. Additionally, there was no significant difference in nutritional status as indicated by the body mass index, serum total protein levels, and serum albumin levels.

This study showed that the COVID-19 pandemic during 2020 did not have a significant influence on the oral health and nutritional status of elderly patients with digestive cancer. However, the influence of COVID-19 on community oral health may become apparent in the future. Thus, dental professionals should continue further research regarding the effects of COVID-19 on oral health.

Abbreviations: COVID-19 = coronavirus disease 2019, WHO = World Health Organization.

Keywords: coronavirus disease 2019, digestive cancer, nutrition status, oral health, teeth

1. Introduction

The World Health Organization (WHO) has defined coronavirus disease 2019 (COVID-19) as “a disease caused by a new coronavirus called severe acute respiratory syndrome coronavirus 2. The WHO first learned of this new virus on December 31, 2019.”^[1] Severe acute respiratory syndrome coronavirus 2 is transmitted by respiratory droplets and contact. To control the

spread of COVID-19, the movements of the general public have been restricted, and physical distancing and mask-wearing have become essential worldwide.^[1] These changes necessitated by the COVID-19 pandemic may have affected the management of various diseases and community health. It has been approximately a year since cases of COVID-19 were first reported. The COVID-19 pandemic has since exacerbated existing racial/ethnic

Editor: Shereen Ali.

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

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

^a Department of Dentistry and Oral Surgery, Unit of Sensory and Locomotor Medicine, Division of Medicine, Faculty of Medical Sciences, University of Fukui, Fukui, Japan, ^b First Department of Surgery, Faculty of Medical Sciences, University of Fukui, Fukui, Japan, ^c Department of Obstetrics and Gynecology, Faculty of Medical Sciences, University of Fukui, Fukui, Japan, ^d Center for Preoperative Assessment, University of Fukui Hospital, Fukui, Japan, ^e Division of Infection Control, University of Fukui Hospital, Fukui, Japan.

* Correspondence: Shinpei Matsuda, Department of Dentistry and Oral Surgery, Unit of Sensory and Locomotor Medicine, Division of Medicine, Faculty of Medical Sciences, University of Fukui, 23-3 Matsuokashimoaizuki, Eiheiji-cho, Yoshida-gun, Fukui 910-1193, Japan (e-mail: shinpeim@u-fukui.ac.jp).

Copyright © 2021 the Author(s). Published by Wolters Kluwer Health, Inc.

This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and build upon the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

How to cite this article: Matsuda S, Yoshida H, Yoshimura H, Goi T, Yoshida Y, Iwasaki H. Has the COVID-19 pandemic influenced the oral health and nutritional status of elderly patients with digestive cancer? A retrospective study in Fukui, Japan. *Medicine* 2021;100:40(e27500).

Received: 18 June 2021 / Received in final form: 21 September 2021 / Accepted: 23 September 2021

<http://dx.doi.org/10.1097/MD.00000000000027500>

and socioeconomic disparities in health, including oral health.^[2] Reducing health disparities and restoring social connections among community residents in the future will be challenging.

Community-based dental health promotions can play an important role in increasing interest in dental education, oral health, and oral health conditions.^[3] Dentists and dental hygienists have worked and performed research to continuously promote oral health worldwide.^[4,5] However, as previously mentioned, due to the COVID-19 pandemic, restrictions on social activities have been imposed to prevent the spread of infection. There are concerns that the ties between local communities and households have been affected by stay-at-home orders and/or lockdowns worldwide.^[4] Additionally, the pandemic may have led to difficulties in conducting community-based dental health promotions to maintain oral health, especially among dentists and dental hygienists involved with public social support organizations. Santos et al. reported that the COVID-19 pandemic reduced the number of oral health procedures provided by the public health system by half in almost all the Brazilian states.^[6] According to pediatric dental research in Australia, the COVID-19 pandemic had significantly influenced the provision of dental services to children of low socioeconomic backgrounds who have severe dental diseases and difficulties accessing dental care.^[7] As such, the interruption of community-based oral health activities and dental check-ups related to the COVID-19 pandemic may have affected the oral health in our communities.

A recent study of patients with esophageal cancer suggested that dental occlusal support and the number of sound teeth have a positive relationship with nutritional status.^[8] However, until now, there have been no reports on the influence of the COVID-19 pandemic on oral health and nutritional status.

This retrospective study aimed to investigate the effects of the COVID-19 pandemic on oral health based on the number of teeth that contribute to mastication, and the nutritional status of elderly patients with digestive cancer.

2. Methods

2.1. Participants

This study focused on elderly patients with digestive cancer. The authors defined “elderly patients” as patients aged greater than 65 years. Based on the WHO declaration, the “Before the COVID-19 pandemic” and “During the COVID-19 pandemic” periods were defined in this study as January 2019 to December 2019 and January 2020 to December 2020, respectively. Participants were divided into these 2 groups for data analysis. Patients with digestive cancer who underwent orthopantomograph imaging as part of their preoperative oral health assessment before general anesthesia at the Department of Dentistry and Oral Surgery of the University of Fukui Hospital participated in this study. Dentate and edentulous patients were both included in the study.

For the purpose of this study, the participants’ experience of chemotherapy, radiotherapy, other treatments, and the period after diagnosis were not considered. In addition, the authors did not consider whether the included patients had COVID-19 in this study.

2.2. Data extraction

The patients’ data were collected based on the preoperative examination before digestive cancer surgery under general anesthesia, including general findings, laboratory results, and orthopantomograph imaging. The authors analyzed the

following general characteristics of the patients: (1) sex, (2) age, and (3) the organ affected by the disease and scheduled for surgery under general anesthesia. The authors collected information about (4) the number of teeth that could contribute to mastication as a clinical oral health parameter. The parameters: (5) body mass index, (6) serum total protein levels, and (7) serum albumin levels, were used to indicate nutritional status.

In this study, the authors defined “a tooth that could contribute to mastication” as a tooth with remaining dentin and prosthetic material that reached approximately the occlusal plane. In other words, residual root teeth and impacted teeth were excluded.

2.3. Statistical analyzes

Statistical analyzes were performed using SPSS version 26 (IBM, Tokyo, Japan). The Mann–Whitney *U* test was used for statistical analyzes, and $P < .05$ was considered statistically significant.

2.4. Ethical approval

This retrospective study was approved by the Institutional Research Board (Ethical Committee of the University of Fukui, Faculty of Medical Sciences; No. 20190082). There were no ethical issues in conducting this study because it was a retrospective study targeting examination findings and images from existing clinical records. The authors declared that all methods were performed as per relevant guidelines and regulations (including the Declaration of Helsinki). Verbal informed consent was obtained from all participants at the time of dental examination at the Department of Dentistry and Oral Surgery at the University of Fukui Hospital. The Ethical Committee of the University of Fukui, Faculty of Medical Sciences, approved this procedure because the information of this retrospective study has been released to the public.

3. Results

A total of 233 elderly patients with digestive cancer participated in this study.

3.1. General characteristics

The “Before the COVID-19 pandemic” group comprised 70 male (67.3%) and 34 female (32.7%) individuals (Table 1). The mean age and standard deviation of these patients were 75.2 ± 6.6 (65–91) years. The most common organ affected by disease and scheduled for surgery under general anesthesia was the colon (43 patients, 41.3%), followed by the stomach (25 patients, 24.0%).

The “During the COVID-19 pandemic” group comprised 79 male (61.2%) and 50 female (38.8%) individuals. The mean age and standard deviation of these patients were 75.7 ± 6.4 (65–91). The most common organ affected by disease and scheduled for surgery under general anesthesia was the colon (58 patients, 45.0%), followed by the stomach (27 patients, 20.9%).

The age of patients with digestive cancer in the “Before the COVID-19 pandemic” and “During the COVID-19 pandemic” groups were not significantly different ($P = .52$, Mann–Whitney *U* test).

3.2. The number of teeth that contribute to mastication

Regarding the number of teeth in patients in the “Before the COVID-19 pandemic” group, the mean \pm standard deviation was

Table 1
Patient characteristics in 2019 versus 2020.

	2019		2020	
	Patients (n)	(%)	Patients (n)	(%)
Sex				
Male	70	67.3	79	61.2
Female	34	32.7	50	38.8
Total	104	100	129	100
Age (yr)				
65–69	28	26.9	29	22.5
70–79	48	46.2	62	48.1
80≤	28	26.9	38	29.4
Affected organ				
Colon	43	41.3	58	45.0
Stomach	25	24.0	27	20.9
Pancreas	17	16.4	15	11.6
Other	19	18.3	29	22.5

15.4±10.2 (0–30) (Table 2, Fig. 1). In contrast, the mean ± standard deviation in the “During the COVID-19 pandemic” group was 15.1±9.6 (0–29) (Fig. 2).

There was no significant difference in the number of teeth that could contribute to mastication in patients between the “Before the COVID-19 pandemic” and “During the COVID-19 pandemic” groups ($P=.67$, Mann–Whitney U test).

3.3. Nutritional status

Regarding the body mass index of the patients in the “Before the COVID-19 pandemic” group, the mean ± standard deviation was 22.2±3.3 (15.3–33.2) (Fig. 3). In contrast, the mean ± standard deviation in the “During the COVID-19 pandemic” group was 23.0±3.3 (16.6–32.4). There was no significant difference in the body mass index between patients in the “Before the COVID-19 pandemic” group and those in the “During the COVID-19 pandemic” group ($P=.09$, Mann–Whitney U test).

Regarding the serum total protein levels of patients in the “Before the COVID-19 pandemic” group, the mean ± standard deviation was 7.0±0.7 (5.2–9.0). In contrast, the mean ± standard deviation in the “During the COVID-19 pandemic” group was 6.9±0.6 (5.4–9.0). There was no significant difference in the serum total protein levels between the “Before the COVID-19 pandemic” and “During the COVID-19 pandemic” groups ($P=.55$, Mann–Whitney U test).

Regarding the serum albumin levels of patients in the “Before the COVID-19 pandemic” group, the mean ± standard deviation

was 3.9±0.5 (2.2–4.7). In contrast, the mean ± standard deviation in the “During the COVID-19 pandemic” group was 3.9±0.4 (2.6–4.6). There was no significant difference in the serum albumin levels between patients in the “Before the COVID-19 pandemic” group and those in the “During the COVID-19 pandemic” group ($P=.64$, Mann–Whitney U test).

4. Discussion

A retrospective single-institution study in Fukui, Japan clarified that the COVID-19 pandemic did not significantly influence the oral health and nutritional status of elderly patients during 2020. Previous reports have suggested an association between the number of teeth and nutritional status such as the body mass index, the protein intake, and the serum albumin levels.^[9,10] These reports support the methodology of this study.^[9,10] Therefore, the results of this study are valuable because they showed that oral health awareness and diet-related health maintenance were maintained despite the cancellation of community-based oral health promotions and large-scale dental check-ups during the COVID-19 pandemic. Recent studies have reported oral manifestations related to COVID-19 and have suggested that oral health may influence the severity of COVID-19.^[11,12] Dental and oral health research has been affected by the COVID-19 pandemic, and dental health activities may continue to be limited during the pandemic.^[13] Studies similar to this one should be continued, and dental professionals should consider appropriate strategies for maintaining oral health and nutritional status during/after the COVID-19 pandemic. Community-based oral health promotions, large-scale dental check-ups, and research activities should be reinitiated by dental experts after the COVID-19 pandemic.

The authors’ previous questionnaire survey on tongue cleaning in the same area revealed that members of the general public across a wide age range, who were not hospitalized, were interested in oral hygiene.^[4] The authors also reported on spontaneous intraoral hemorrhage associated with dental calculus and poor oral hygiene in the same community.^[14] Furthermore, in a study conducted before December 2019, when COVID-19 was first reported by the WHO, the authors reported on the status of periodontal disease in patients with digestive cancer at the same institution as the present study.^[15] These results suggest a growing interest in oral health. However, community-based dental promotions need to continue. Based on these results and dental research worldwide, the authors were concerned that COVID-19 would interrupt community-based oral health activities and dental check-ups and that these may have had a significantly negative influence on oral health in our community before conducting this study.^[6,7] Interestingly, the results of this study refuted the authors’ concerns.

In 2015, the United Nations adopted and announced Sustainable Development Goals in 17 targets of health, poverty, and communities.^[15] The United Nations mentioned, “End hunger, achieve food security and improved nutrition, and promote sustainable agriculture” and “Ensure healthy lives and promote well-being for all at all ages” as the second and third items, respectively, on their list.^[15] Therefore, dentists should promote and improve oral health and nutritional status in coordination with these goals. The WHO definition of “oral health” includes various conditions, such as dental caries, periodontitis, tooth loss, oral cancer, oral manifestations of human immunodeficiency virus infection, trauma, noma, and

Table 2
The mean number of teeth and nutritional status.

	2019	2020	* P
Number of teeth	15.4±10.2	15.1±9.6	.67
Body mass index	22.2±3.3	23.0±3.3	.09
Total protein level	7.0±0.7	6.9±0.6	.55
Albumin level	3.9±0.5	3.9±0.4	.64

*Mann–Whitney U test.

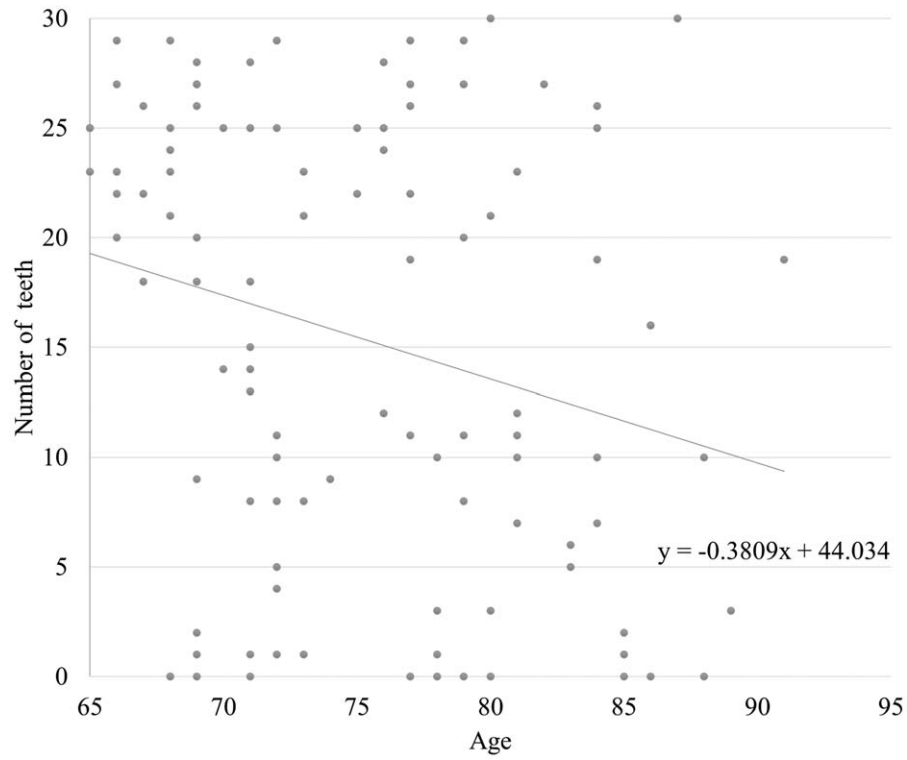


Figure 1. Age and number of teeth in patients in the "Before the COVID-19 pandemic" group.

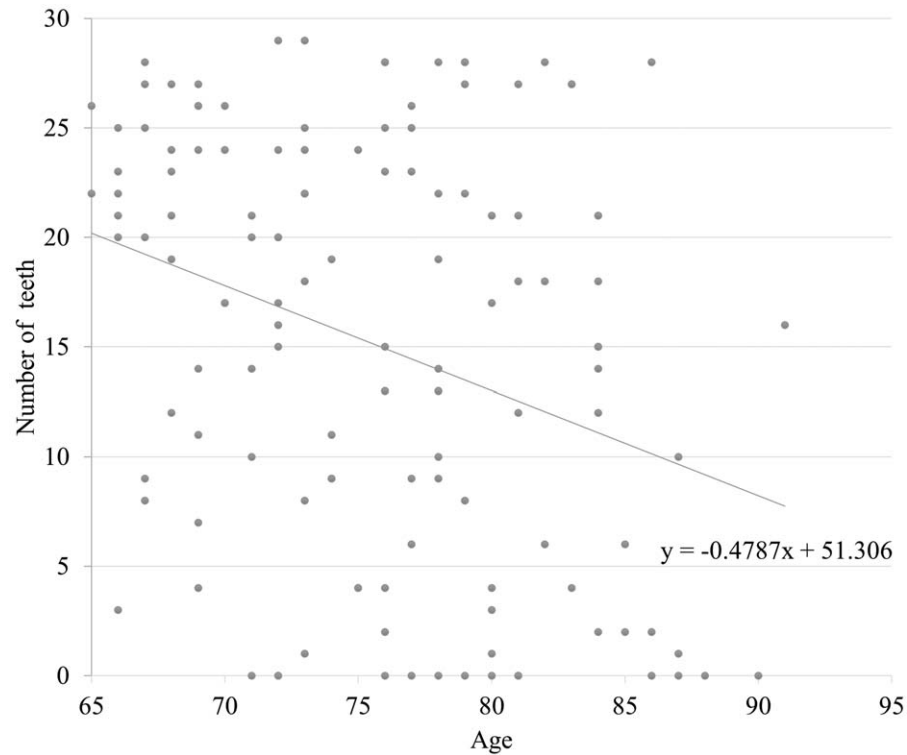


Figure 2. Age and number of teeth in patients in the "During the COVID-19 pandemic" group.

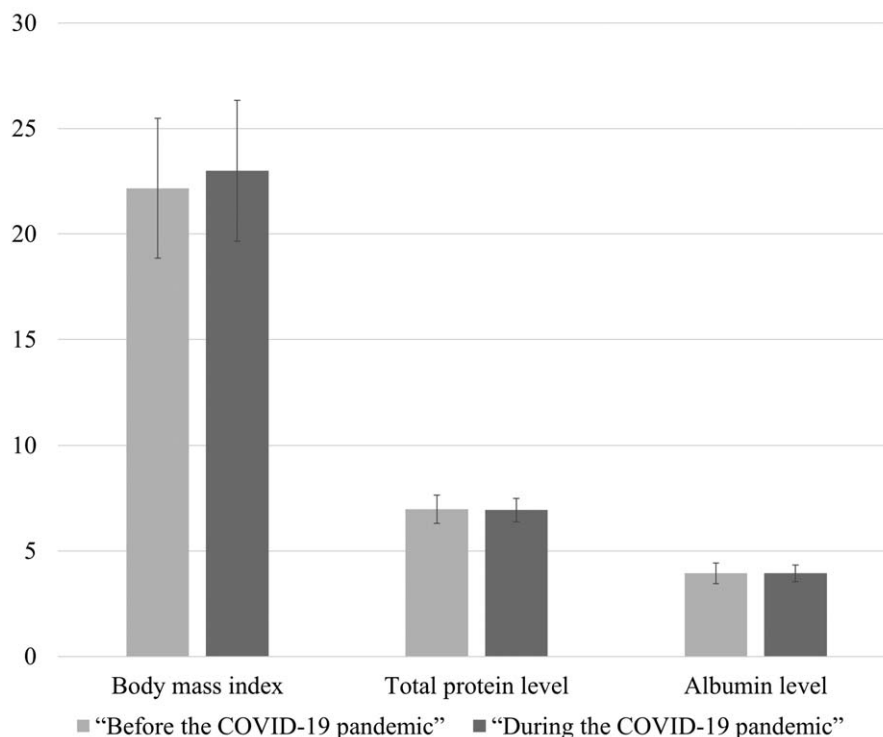


Figure 3. Nutritional status of the “Before the COVID-19 pandemic” and “During the COVID-19 pandemic” groups. There was no significant difference between the 2 groups regarding the nutritional status.

birth defects. These conditions have become key indicators of health and quality of life.^[16] Oral health not only includes dental and orofacial problems but also the prevention and treatment of diseases, including appropriate rehabilitation services, thereby maintaining general health and quality of life.^[16] New areas of work, new policies, and clinical challenges as noted by politicians and medical experts, including the development and administration of vaccines, have been instituted to maintain global public health due to the COVID-19 pandemic.^[17] These are the most urgent global issues related to the achievement of sustainable development goals, and therefore, dental professionals should be involved.

The COVID-19 pandemic was not anticipated. As a result, the authors collected our data retrospectively in this study from the preoperative examinations. Therefore, the results of this study should be interpreted with this methodological limitation in mind. Moreover, the clinical oral health status was assessed by only the number of teeth that could contribute to mastication, and the nutritional status was assessed only by body mass index, serum total protein levels, and serum albumin levels. Therefore, the study did not consider other factors that may influence nutrition and function such as dental prosthetic appliances, including dentures and bridges. Furthermore, participant selection was limited to 2 periods: January 2019 to December 2019 (“Before the COVID-19 pandemic”) and January 2020 to December 2020 (“During the COVID-19 pandemic”) the period covered by this study, from January 2020 to December 2020, may have been the beginning of the pandemic. Therefore, the impact of the COVID-19 pandemic on community oral health may become apparent in the future.

5. Conclusion

This retrospective single-institution study in Fukui, Japan clarified that the COVID-19 pandemic during 2020 did not significantly influence oral health and nutritional status. The effects of the COVID-19 pandemic on community oral health may become apparent in the future. Therefore, further research is needed.

Acknowledgments

The authors would like to thank the staff of the Department of Dentistry and Oral Surgery of the University of Fukui Hospital and the staff of the Center for Preoperative Assessment of the University of Fukui Hospital for their help in this study.

Author contributions

Conceptualization: Shinpei Matsuda.

Data curation: Shinpei Matsuda.

Formal analysis: Shinpei Matsuda.

Investigation: Shinpei Matsuda.

Methodology: Shinpei Matsuda.

Writing – original draft: Shinpei Matsuda.

Writing – review & editing: Shinpei Matsuda, Hisato Yoshida, Hitoshi Yoshimura, Takanori Goi, Yoshio Yoshida, Hiromichi Iwasaki.

References

- [1] World Health organization. Coronavirus disease (COVID-19). 2020; <https://www.who.int/news-room/q-a-detail/coronavirus-disease-covid-19>.

- [2] Bharmal N, Bailey J, Johnson V, et al. Addressing COVID-19 health disparities through a regional community health response. *Cleve Clin J Med* 2021;doi: 10.3949/ccjm.88a.ccc072.
- [3] Piskorowski WA, Fitzgerald M, Mastey J, Krell RE. Development of a sustainable community-based dental education program. *J Dent Educ* 2011;75:1038–43.
- [4] Matsuda S, Saito T, Yoshida H, Yoshimura H, Sano K. Prevalence of tongue cleaning using a toothbrush: a questionnaire survey in Fukui Prefecture, Japan. *Biomed Res Int* 2019;2019:6320261.
- [5] Matsuda S, Goi T, Yoshida Y, Yoshimura H. Periodontal disease in preoperative patients with digestive cancer: a retrospective, single-institution experience in Fukui, Japan. *BMC Oral Health* 2021;21:3.
- [6] Dos Santos MBF, Pires ALC, Saporiti JM, Kinalski MA, Marchini L. Impact of COVID-19 pandemic on oral health procedures provided by the Brazilian public health system: COVID-19 and oral health in Brazil. *Health Policy Technol* 2021;10:135–42.
- [7] Hopcraft M, Farmer G. Impact of COVID-19 on the provision of paediatric dental care: analysis of the Australian Child Dental Benefits Schedule. *Community Dent Oral Epidemiol* 2020; doi: 10.1111/cdoe.12611.
- [8] Yamanaka-Kohno R, Shirakawa Y, Inoue-Minakuchi M, et al. Association of dental occlusal support with the Prognostic Nutritional Index in patients with esophageal cancer who underwent esophagectomy. *Esophagus* 2021;18:49–55.
- [9] Srisilapanan P, Malikaew P, Sheiham A. Number of teeth and nutritional status in Thai older people. *Community Dent Health* 2002;19:230–6.
- [10] Nakamura M, Ojima T, Nagahata T, et al. Miura K; NIPPON DATA2010 Research Group. Having few remaining teeth is associated with a low nutrient intake and low serum albumin levels in middle-aged and older Japanese individuals: findings from the NIPPON DATA2010. *Environ Health Prev Med* 2019;24:1.
- [11] Amorim Dos Santos J, Normando AGC, Carvalho da Silva RL, et al. Oral manifestations in patients with COVID-19: a living systematic review. *J Dent Res* 2021;100:141–54.
- [12] Kamel AHM, Basuoni A, Salem ZA, AbuBakr N. The impact of oral health status on COVID-19 severity, recovery period and C-reactive protein values. *Br Dent J* 2021;1–7. doi: 10.1038/s41415-021-2656-1.
- [13] Sardana D, Yiu CKY, McGrath CP. Impact of COVID-19 on ongoing & ensuing dental research. *J Dent* 2021;106:103590.
- [14] Matsuda S, Yoshida H, Ohta K, Ryoke T, Yoshimura H. Intraoral hemorrhage caused by dental calculus: two case reports. *Quintessence Int* 2020;51:598–602.
- [15] United Nations. Department of Economic and Social Affairs, Sustainable Development, The 17 goals. <https://sdgs.un.org/goals>.
- [16] World Health organization. Oral health. https://www.who.int/health-topics/oral-health/#tab=tab_1.
- [17] Cirillo N. Reported orofacial adverse effects of COVID-19 vaccines: the known and the unknowns. *J Oral Pathol Med* 2021;50:424–7.