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COVID-19 transmission in dental and oral/maxillofacial surgical practice during pandemic: questionnaire survey in 51 university hospitals in Japan

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SUMMARY

Background: The coronavirus disease 2019 (COVID-19) pandemic has become a major public health problem. Dental procedures that generate aerosols are considered to impose a high risk of infection; therefore, dental professionals, such as dentists and dental hygienists, may be at high risk of viral transmission. However, few studies have reported COVID-19 clusters in dental care settings.

Aim: To investigate whether dental and oral/maxillofacial procedures are associated with the occurrence of COVID-19 clusters and measures taken to prevent nosocomial infection in dental clinics.

Methods: An online questionnaire survey on clinical activities (administrative control), infection control measures (environmental/engineering control, personal protective equipment, etc.), and confirmed or probable COVID-19 cases among patients and clinical

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staff was administered to the faculties of the dental and oral/maxillofacial surgical departments of university hospitals.

Findings: Fifty-one faculty members completed the questionnaire. All members were engaged in the treatment of dental and oral surgical outpatients and actively implemented standard precautions. Fourteen faculty members treated patients with COVID-19, but no infections transmitted from the patients to the medical staff were observed. In seven facilities, patients were found to have the infection after treatment (medical staff came in close contact), but there was no transmission from patients to medical staff. Four facilities had medical staff with infections, but none of them exhibited disease transmission from staff to patients.

Conclusion: COVID-19 clusters are unlikely to occur in dental and oral surgical care settings if appropriate protective measures are implemented.

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Introduction

Coronavirus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The COVID-19 outbreak started in December 2019 in the city of Wuhan, Hubei province, China, and has become a major public health problem not only in China but also in other countries worldwide, prompting the World Health Organization to declare the COVID-19 outbreak a pandemic on March 11th, 2020 [1]. The Ministry of Health, Labour, and Welfare of Japan reported that 400,000 people had been infected with SARS-CoV-2 in Japan as of mid-February 2021 [2]. Patients with COVID-19 are the main source of infection. Asymptomatic patients are extremely contagious, with strong infectivity in the average incubation period of 5–6 days. Some studies have reported that this period can be as long as 14 days [3]. The person-to-person transmission routes of COVID-19 are direct transmission (such as coughing, sneezing, and droplet inhalation) and contact transmission (such as contact with oral, nasal, and eye mucosal membranes and through droplets and aerosols) [4–6].

The practice of dentistry and oral/maxillofacial surgery involves the use of rotary dental and surgical instruments such as handpieces, ultrasonic scalers, and air–water syringes. These instruments create a visible spray that may contain droplets of water, saliva, blood, micro-organisms, and other debris [7,8]. Hence, dentists, oral/maxillofacial surgeons, clinical staff, and patients have a high potential risk of exposure to, and transmission of, this virus [9]. However, there is no evidence that aerosols generated during dental and surgical care can lead to the transmission of COVID-19 [10]. To the best of our knowledge, no studies have reported the occurrence of COVID-19 clusters in dental hospitals in Japan. Only small clusters in dental clinics have been reported [11]. There is fear that unnecessary refusal of medical treatment or refraining from visiting a doctor or dentist will ultimately have a negative impact on the health of the public. This study aimed to investigate whether COVID-19 clusters have occurred from dental and oral/maxillofacial procedures and what measures have been taken to prevent nosocomial infection.

Methods

An online questionnaire survey was administered to members of the Japanese Council of Chiefs of Dental and Oral/Maxillofacial Surgical Department of University Hospitals

(JCDOUH), a group of dental and oral/maxillofacial surgeons in medical school hospitals in charge of the frontline of medical and dental care. JCDOUH consists of 64 dental and oral/maxillofacial surgical departments at the University School of Medicine in Japan. This survey was conducted using Google forms (San Mateo, CA, USA) in February 2021, when vaccination was not available in Japan. JCDOUH contacted 64 departmental heads through e-mail to invite them to participate in the survey. The first question concerned the number of patients treated at each hospital during the study period. Questions regarding clinical activities related to the implementation of treatment or restrictions on patients and policies for dealing with dental patients with suspected or confirmed COVID-19. Infection control questions were regarding entrance screening and infection control when performing a procedure that produces aerosols. Questions about the dental treatment of patients with confirmed COVID-19 related to treatment history, the procedures performed, and establishment of infection from patient to oral healthcare workers (OHCWs). The questions regarding the exposure status due to close contact with a COVID-19-positive patient concerned the time of contact and the procedure, and transmission from the patient to the OHCWs. There were also questions about the status of COVID-19 among OHCWs during the study period, whether COVID-19-positive staff worked during the period of possible infection, whether transmission from OHCWs to patients could be confirmed, and the route of transmission.

Ethical approval

The study protocol was approved by the committee on medical research of Shinshu University (No. 5306). The questionnaires were anonymous. Informed consent was obtained from each participant before the questionnaire was administered.

Results

The staff of 51 (51/64, 79.7%) hospitals answered the questionnaire. More than 70% of hospitals had >2000 new patients from February 2020 to January 2021 (Table I).

Administrative control

Regarding the restriction of treatment and patients, a change in clinical practices, policies, or procedures was

Table I

Number of patients in each hospital from February 2020 to January 2021

No. of patients	No. of hospitals
1–500	1
501–1500	9
1501–2000	5
2001–2500	11
2501–3000	20
>3000	5

reported in 88% (45/51) of hospitals: restriction of aerosol-generating procedures (e.g. limiting the number of procedures), 31 hospitals; patient (disease) limitations (e.g. urgent, critical, cancer patients), 26 hospitals; prohibition of procedures involving splashes, 21 hospitals; restriction/coordination of patient number, 14 hospitals; and limitation of surgery, three hospitals. Seven hospitals cancelled outpatient care and six hospitals stopped accepting new patients. These limitations persisted for 12 months, with a median duration of 3 months (interquartile range: 2–3 months).

Regarding the treatment of patients with confirmed COVID-19, treatment was postponed in 21 hospitals, palliative/emergency care was provided in 19 hospitals, necessary care with infection control measures was provided in five hospitals, and treatment was determined on a case-by-case basis in four hospitals (Table II).

Infection control

Regarding administrative control measures in outpatient settings, entrance screening for COVID-19 was performed in 49 (96.1%) hospitals. Visitors were asked for symptoms/signs, close contact exposure, and travel from areas endemic for COVID-19, and body temperature was checked in 49 hospitals. Facemasks were encouraged in 42 hospitals, and hand hygiene was encouraged in 29 hospitals.

Table II

Clinical activities during the period from February 2020 to January 2021

Did you implement any restriction on treatment and/or patient?	
Yes	45 hospitals (88.2%)
No	6 hospitals (11.8%)
If yes, what type of restriction did you implement? (multiple answers)	
Restriction of aerosol-generating procedures (e.g. limit the number of procedures)	31 hospitals (60.8%)
Patient (disease) limitations (e.g. urgent, critical, and cancer patients)	26 hospitals (51.0%)
Prohibition of procedures involving splashes	21 hospitals (41.2%)
Restriction/coordination of patient number	14 hospitals (27.5%)
Limitation of surgery	3 hospitals (5.9%)
Cancel outpatient care	7 hospitals (13.7%)
How long (months) were these restrictions implemented?	3 months
Interquartile range	2–3 months
Range	1–12 months
What was your policy for dealing with dental patients with suspected or confirmed COVID-19?	
Postpone the treatment	21 hospitals (41.2%)
Provide palliative/emergency care	19 hospitals (37.3%)
Provide care with infection control measures	5 hospitals (9.8%)
Discuss on a case-by-case basis	4 hospitals (7.8%)

Regarding the infection control measures during the procedures generating splash and/or aerosol, surgical gloves, face/eye guards, and face masks (surgical mask: 46 hospitals and/or N95 mask: 22 hospitals) were used in hospitals. Surgical gowns were used in 38 (74.5%) hospitals, surgical aprons in 31 (60.1%) hospitals, and surgical caps in 37 (72.5%) hospitals. An extraoral dental suction device was used in 47 hospitals, and cleaning and/or covering of potentially contaminated surfaces were performed in all hospitals (cleaning, 38 hospitals; covering, 12 hospitals). Mouth rinse before oral examination/care was encouraged in 36 hospitals (use of water in 19 hospitals and use of mouthwash in 17 hospitals) (Table III).

Dental treatment for patients with confirmed COVID-19

Fourteen (27.4%) hospitals had COVID-19-positive patients for dental/oral surgical treatment. Treatments received by COVID-19-positive patients in different hospitals were as follows: oral care, six hospitals; haemostatic treatment in the oral cavity, three hospitals; tooth extraction, two hospitals; anti-inflammatory medication, one hospital; oral examination, one hospital; denture adjustment, one hospital; and palliative dental treatment, one hospital. No cases of nosocomial viral infection associated with these procedures have been reported (Table IV).

Experience of treating a patient with close contact exposure to COVID-19-positive patients (Have you ever treated a patient who was later confirmed to be infected?) was asked. Seven hospitals (13.7 %) responded positively to the questionnaire. The dental procedures performed on these patients are listed in Table V. In five of the seven hospitals, dental procedures resulting in droplet formation were performed during the period of possible viral transmission. However, no case of viral infection has been reported in the staff who provided treatment to patients who were later diagnosed with COVID-19.

COVID-19 in dental staff

Faculties of the four hospitals reported that their dental staff members were infected with SARS-CoV-2. The source of

Table III

Infection control measures

Did you perform any entrance screening?	
Yes	49 hospitals (96.1%)
No	2 hospitals (3.9%)
If yes, what type of screening did you perform? (multiple answers)	
Ask for symptoms/signs, close contact exposure, and travel from endemic area of COVID-19	49 hospitals (96.1%)
Body temperature measurement	49 hospitals (96.1%)
Wear a mask	42 hospitals (82.4%)
Hand hygiene compliance	29 hospitals (56.9%)
PCR test	1 hospital (2.0%)
What infection control measures were employed during the procedures generating splash and/or aerosol?	
Use of surgical mask	46 hospitals (90.2%)
Use of N95 mask	22 hospitals (43.1%)
Use of surgical gloves	51 hospitals (100.0%)
Use of face/eye guard	51 hospitals (100.0%)
Use of surgical gown	38 hospitals (74.5%)
Use of surgical apron	31 hospitals (60.8%)
Use of cap	37 hospitals (72.5%)
Use of extraoral dental suction device	47 hospitals (92.2%)
Cleaning of possibly contaminated surface	38 hospitals (74.5%)
Cover possibly contaminated surface	12 hospitals (23.5%)
Mouth rinse with water	19 hospitals (37.3%)
Mouth rinse with mouthwash	18 hospitals (35.3%)
Treatment in negative-pressure room	1 hospital (2.0%)

PCR, polymerase chain reaction.

infection in the dental staff members of one hospital was presumed to be outside the hospital, and those of other hospitals were unknown. Although all these staff members provided dental treatment/care during the period of possible viral transmission, none of the patients who received dental treatment or care were diagnosed with COVID-19 (Table VI).

Discussion

Aerosol-generating procedures are routinely performed in dental and oral/maxillofacial surgical practices. As SARS-CoV-2 is found in saliva, it is possible that COVID-19 can be transmitted by aerosolized saliva [12]. The risk of nosocomial transmission is high in dental settings [13]. Moreover, patients in the incubation period have an increased risk of transmission

among dental practitioners and patients [3,14,15]. Hence, considering the characteristics of dental procedures, such as production of splatters and aerosols and the transmission mode of SARS-CoV-2, it is presumed that dental staff and patients are at a high risk of infection.

However, no case of dental and oral/maxillofacial surgical treatment-associated SARS-CoV-2 infection was found in our study to assess the effect of the COVID-19 pandemic in university hospitals, where the staff of nearly all (>70%) hospitals accepted >2000 new dental/oral surgical patients. Few studies have reported cases of COVID-19 transmission in dental settings [15,16]. In Wuhan, 34 cases of SARS-CoV-2 infection among OHCWs were reported during the epidemic period from January to March 2020. Of these, 21 individuals worked in dental outpatient clinics, seven worked in fever outpatient clinics, two

Table IV

Dental treatment for patients with confirmed COVID-19 during the period from February 2020 to January 2021

Did you have any experience of dental/oral surgical treatment for confirmed COVID-19 patients?	
Yes	14 hospitals (27.5%)
No	37 hospitals (72.5%)
If yes, what procedure was performed? (multiple answers)	
Oral care	6 hospitals (11.8%)
Haemostatic treatment in the oral cavity	3 hospitals (5.9%)
Tooth extraction	2 hospitals (3.9%)
Anti-inflammatory medication	1 hospital (2.0%)
Oral examination	1 hospital (2.0%)
Denture adjustment	1 hospital (2.0%)
Palliative dental treatment	1 hospital (2.0%)
Is there a confirmed case of viral transmission from patient to dental staff?	
Yes	0 hospitals
No	14 hospitals

Table V

Close contact exposure to COVID-19-positive patients during the period from February 2020 to January 2021

Did you have any experience of treating patients with close-contact exposure to a COVID-19-positive patient?		
Yes	7 hospitals	(13.7%)
No	44 hospitals	(86.3%)
If yes, when and which procedure was performed at the time of close contact?	Extraction of wisdom tooth	
7 days before the diagnosis of COVID-19		
1 week before the diagnosis of COVID-19	Extraction of impacted third molar	
2 weeks before the diagnosis of COVID-19	Dental scaling	
2 days before the diagnosis of COVID-19	Dental scaling	
1–2 weeks before the diagnosis of COVID-19	Oral care	
On the same day of the diagnosis of COVID-19	Oral examination	
2 days before the diagnosis of COVID-19	Not described	
Were there confirmed cases of viral transmission from patient to dental staff?		
Yes	0 hospitals	
No	7 hospitals	

worked as clerks, and one worked in the surgical inpatient ward [15]. Dental treatment was not confirmed as the route of infection in the 21 OHCWs working in dental outpatient clinics. It is possible that some of these 21 OHCWs may have been infected because of the spread of COVID-19 in Wuhan, where the infection was prevalent at that time. The Hospital of Stomatology at Wuhan University provided emergency dental treatment during the outbreak. During the period from January 23rd, 2020 to April 7th, 2020, 320 staff members wearing N95 masks and sophisticated personal protective equipment (PPE) provided dental treatments to 2025 patients; however, none of the staff members was infected with SARS-CoV-2 [15]. Scott *et al.* reported no nosocomial infections at three dental clinics in New York [16]. This prospective study involved 2810 patients treated over a 6-month period (March 15th, 2020 to September 15th, 2020) in three different dental clinics by two dentists and three hygienists during and shortly after the peak of the pandemic in New York. In addition, Estrich *et al.* reported that, of 2195 dentists in the USA, 20 (0.9%) were already infected with SARS-CoV-2 by June 2020, when the COVID-19 pandemic broke out in the USA [17]. According to an epidemiological investigation, the source of infection in 75% of these dentists was unknown, and that in 15% of dentists was community-acquired. In this study, patients with close contact exposure to COVID-19-positive patients underwent dental treatment in seven of 51 hospitals, and those with SARS-CoV-2 infection received oral

treatment in 14 of 51 hospitals; however, no case of SARS-CoV-2 nosocomial infection was reported. In addition, staff members of four hospitals who were later diagnosed with COVID-19 engaged in clinical care during the period of possible transmission; however, no cases of staff-to-patient transmission were confirmed as a result of meticulous follow-up. These results suggest that the occurrence of clusters related to dental treatment in dental-care settings is low.

However, our finding that the rate of COVID-19 transmission in dental clinics was low should be interpreted with caution. One possible reason for the low transmission rate is that infection control measures, such as the use of PPE, were thoroughly followed in dental and oral/maxillofacial surgical practice during the COVID-19 outbreak. 'Standard precautions' described by the Centers for Disease Control and Prevention in the USA in 1996 indicated avoiding contact with blood, any type of body fluids, secretions, and excretions (excluding sweat) regardless of whether they contain blood, non-intact skin, and mucous membranes [18]. Secondary precautions – 'transmission-based precautions' – were designed to reduce the risk of pathogen transmission through contact, droplets, and airborne routes. Standard precautions have been reported to be sufficient to prevent the transmission of influenza and rhinoviruses through dental aerosols [19]. Samaranyake and Peiris reported that, during the SARS-CoV outbreak in 2003, no dental healthcare workers were infected in clinical settings

Table VI

COVID-19 in dental staff during the period from February 2020 to January 2021

Were there any staff members who were positive for COVID-19?		
Yes	4 hospitals	(7.8%)
No	47 hospitals	(92.2%)
If yes, did the infected staff members work during the period of possible viral transmission?		
Yes	4 hospitals	
No	0 hospitals	
Was there a confirmed case of viral transmission from dental staff to patient?		
Yes	0 hospitals	
No	4 hospitals	
Suspected route of infection?		
Out of hospital	1 hospital	
Unknown	3 hospitals	

[20]. However, it has been reported that many healthcare workers who did not wear PPE on a regular basis and failed to use it properly were infected with SARS-CoV [13,18,20]. Regarding COVID-19, Wuhan University Hospital reported that staff members wearing N95 masks and sophisticated PPE who provided dental treatment to 2025 patients did not have COVID-19 [15]. Scott *et al.* reported no nosocomial infections at three dental clinics that used screening questionnaires in New York [16]. The results of this study revealed that PPE was used in nearly all the hospitals. The level of awareness of standard precautions for droplet infection through aerosols and saliva in daily dental and oral/maxillofacial surgical practice was high. Importantly, the low transmission rate of COVID-19 is the result of following standard precautions in daily practice. Even in OHCWs for whom COVID-19 was confirmed in this study, it was not considered a nosocomial infection (Table VI). In other words, patient-to-OHCW or OHCW-to-patient transmission of COVID-19 was not confirmed. It could be inferred that there were no SARS-CoV-2 nosocomial infections in any of the hospitals. This may be because the use of PPE, such as surgical masks, face guards, and extraoral dental suctioning was adequately and appropriately implemented (Table III). Regarding SARS-CoV-2 infection in the dental field, aerosols generated using high-speed handpieces are problematic, but it has been reported that aerosol production can be reduced by 90% with the use of extraoral dental suction [8,21]. In this study, 92.2% of the hospitals were using this system.

Another possible reason for the low transmission rate is the entrance screening for COVID-19. In this study, entrance screening was performed in 96% of hospitals. Visitors were asked about symptoms or signs, close contact exposure, and travel from areas endemic for COVID-19; moreover, their body temperature was measured. The use of facemasks was encouraged in 42 hospitals and hand hygiene compliance was encouraged in 29 hospitals. Nsawotebba *et al.* assessed the effectiveness of thermal screening for the detection of COVID-19 and reported a high specificity of 99.5% [22]. Guan *et al.* reported that fever with a body temperature $>37.5^{\circ}\text{C}$ occurs in 88% of COVID-19-positive patients [23]. Peng *et al.* reported that in addition to measuring body temperature in outpatient settings, medical interviews should be conducted before patients sit on a dental chair to prevent the spread of COVID-19 [6]. Moreover, hospital restrictions on patients and treatment for other reasons may have had an impact. The number of new patients decreased during the COVID-19 pandemic; however, most hospitals accepted >2000 new dental patients. Moreover, 88% (45/51) of the hospitals had restrictions during only one-fourth of the survey period. However, COVID-19 clusters in dentistry were unlikely to occur in this study. Many hospitals that participated in this study restricted the numbers and treatments of the patients and aerosol-generating procedures. These limitations may have affected the results of the present study. A further limitation of this study is that it was a retrospective study based on a questionnaire survey, and the patient and procedure restrictions implemented by each hospital were not necessarily based on the same criteria.

In conclusion, this study investigated the prevalence of COVID-19 in dental and oral/maxillofacial surgical care settings using a questionnaire survey and found that, if appropriate protective measures are taken, COVID-19 clusters are unlikely to occur in dental and oral/maxillofacial surgical care.

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Conflict of interest statement

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Appendix A. Supplementary data

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