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Original Article

COVID-19 transmission in dental practice during the pandemic: A questionnaire-based survey in private dental clinics in Japan

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Background/purpose: The global coronavirus disease 2019 (COVID-19) pandemic continues to cause a significant impact on patient care due to its considerable transmissibility, morbidity, and mortality. The aim of this study was to investigate whether dental procedures performed at private dental clinics were associated with the occurrence of COVID-19 clusters and measures taken to prevent nosocomial infection of COVID-19.

Materials and methods: An online questionnaire-based survey on clinical activities, infection control measures, and confirmed or probable COVID-19 cases among patients and clinical staff during the pandemic (February 2020 to September 2021) was administered to dentists at private dental clinics in Nagano prefecture, Japan. Almost all dentists engaged in dental treatment were actively implementing standard precautions.

Results: Twenty-seven dental clinics provided dental care to infected patients (nine confirmed and eighteen probable), but there was no transmission from patients to staff. Ten clinics had staff who were infected, but none exhibited disease transmission from staff to patients.

Conclusion: The results of this survey suggest that COVID-19 clusters might not occur in dental settings where appropriate protective measures are implemented.

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Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a highly contagious coronavirus that emerged in December 2019. SARS-CoV-2 is responsible for the ongoing global coronavirus disease 2019 (COVID-19) pandemic that continues to cause a significant impact on patient care due to its considerable transmissibility, morbidity, and mortality.^{1,2} The main source of COVID-19 infection is through person-to-person contact, and transmission routes of COVID-19 include direct transmission such as coughing, sneezing, and droplet inhalation in addition to contact transmission such as contact with oral, nasal, and eye mucosal membranes and through droplets and aerosols.^{3–6} The practice of dental treatment/care involves the use of high-speed rotary dental instruments, ultrasonic scalers, and air-water syringes. These instruments create a visible spray that may contain particle droplets of water, saliva, blood, microorganisms, and other debris.^{7,8} Therefore, dentists, dental staff, and dental patients have a high potential risk of exposure to and transmission of this virus.⁹ However, there is no evidence that aerosols generated from dental care lead to the transmission of COVID-19.¹⁰ Moreover, few studies have reported the occurrence of COVID-19 clusters in dental clinics or hospitals.^{11–14}

A previous study conducted an online questionnaire-based survey on confirmed or suspected COVID-19 cases among patients and dental/oral surgical staff at a dental and oral/maxillofacial surgery department of a university hospital. The results of the questionnaire-based survey revealed that no COVID-19 clusters occurred in dental and oral/maxillofacial procedures where appropriate protective measures were implemented.¹¹ In practice, dental care is by and large provided at general dental practice clinics rather than hospitals. Therefore, to complement the survey conducted on hospital dentistry, a questionnaire-based survey

was conducted on the implementation of infection control measures and incidence of new coronavirus infection among general practice dentists at private clinics. The aim of this study is to investigate whether dental procedures performed at private dental clinics are associated with the occurrence of COVID-19 clusters and measures taken to prevent nosocomial infection of COVID-19.

Materials and methods

An online questionnaire-based survey was administered to the members of Nagano Dental Association, a group of dentists in charge of front-line dental care that represents over 70 percent of all dentists in Nagano prefecture, Japan (population: 2.02 million). This survey was conducted using Google Forms (San Mateo, CA, USA) in October 2021. The members were invited to participate in the survey through the contact network of the Nagano Dental Association. The questionnaire consisted of questions on the number of patients, clinical activities (administrative control), infection control (vaccination, environmental/engineering control, use of personal protective equipment [PPE]), and confirmed or suspected COVID-19 infection among patients and clinical staff. The study examined the situation in the period from February 2020, when the first wave of COVID-19 infection was observed in Japan, to September 2021. The study was approved by the Shinshu University Medical Ethics Committee (Approval #5306).

Results

Three-hundred and eighty-four dentists answered the questionnaire (overall response rate, 38.4%). The number of newly confirmed COVID-19-positive cases during the study period is shown in Fig. 1. A maximum of 180 positive



Fig. 1 The number of new COVID-19-positive confirmed cases in Nagano prefecture during the study period. Data derived from data provided by the Ministry of Health, Labour and Welfare, Japan.

Table 1 Clinical activities during the period from February 2020 to September 2021.

Questions	Response	n	%
Did you implement any restrictions on treatment and/or the patient?	Yes	235	61.2
	No	149	38.8
If yes, what type of restriction did you implement? (multiple answers)	Suspension of treatment	27	11.5
	Restriction/coordination of patient number	194	82.6
	Stop accepting new patients	21	8.9
	Patient (disease) limitations (only urgent and/or critical patients)	53	22.6
	Restriction of aerosol-generating procedures (e.g., limit the number of procedures)	42	17.9
What was your policy for dealing with dental patients with suspected or confirmed COVID-19?	Prohibition of procedures involving splashes	29	12.3
	Postpone the treatment	220	57.3
	Provide palliative/emergency care	77	20.1
What was your policy for dealing with dental patients with suspected or confirmed COVID-19?	Provide care with infection control measures	14	3.6
	Referral to hospital dentistry	36	9.4
	Other	7	1.8

a Abbreviation: COVID-19, coronavirus disease 2019.

patients per day were identified. The cumulative number of patients during the study period was 8723 with approximately 0.43% of the population of the prefecture testing positive for COVID-19.

The results of the questionnaire-based survey are summarized in Tables 1–4. Regarding the restriction of treatment and patients, changes on clinical practices, policies, or procedures were reported in 61% (235/385) of the clinics (Table 1). These limitations had continued for a median duration of 3 months (interquartile range, 1–6 months). In terms of the policy concerning treatment of patients with confirmed COVID-19, 220 dentists (57.3%) answered that he/she postponed treatment, 77 (20.1%) provided palliative/emergency care, 14 (3.6%) provided care with infection control measures, and 36 (9.4%) referred patients to hospital dentistry.

Infection control measures are described in Table 2. Seventy-seven percent of the clinics answered that all staff members completed the vaccination, and 22% answered that some staff members completed the vaccination. In terms of administrative control measures, entrance screening for COVID-19 was carried out in 370 (96.4%) clinics. Visitors were asked for symptoms/signs, close contact exposure, and travel from endemic areas of COVID-19 in 87.0% of the clinics, and body temperature was checked in 89.3%. The use of facemasks was encouraged in 90.1% and hand hygiene in 86.1% of the clinics. Antigen test was employed in six clinics (1.6%). Regarding infection control measures during procedures that generate splash

Table 2 Infection control measures during the period from February 2020 to September 2021.

Questions	Response	n	%
Vaccination status	All staff completed	296	77.1
	Some staff completed	84	21.9
	None completed	4	1.0
Did you perform any entrance screening?	Yes	370	96.4
	No	14	3.6
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	334	87.0
	Body temperature measurement	343	89.3
What infection control measures were employed during the procedures generating splash and/or aerosol?	Wear a mask	346	90.1
	Hand hygiene compliance	331	86.2
	Antigen test	6	1.6
	Use of surgical mask	326	84.9
	Use of N95 mask	56	14.6
	Use of surgical gloves	377	98.2
	Use of face/eye guard	337	87.8
	Use of surgical gown	42	10.9
	Use of surgical apron	134	34.9
	Use of cap	106	27.6
	Use of extraoral dental suction device	305	79.4
	Cleaning of possibly contaminated surface	365	95.1
	Cover possibly contaminated surface	77	20.1
	Mouth rinse with water	100	26.0
Mouth rinse with mouthwash	221	57.6	
Installation of partition between units	181	47.1	
Treatment in negative pressure room	2	0.5	

a Abbreviation: COVID-19, coronavirus disease 2019.

and/or aerosol, surgical gloves (98.2%) and masks (surgical mask, 84.6%; N95 [not resistant to oil, 95%] mask, 14.6%) were used in almost all the clinics. Face/eye guard was used in approximately 90% of the clinics, and an extraoral dental suction device was used in approximately 80%. Surgical gowns were used in 10.9%, surgical aprons in 34.9%, and surgical caps in 27.6% of the clinics. Cleaning of potentially contaminated surfaces was performed in almost all clinics (95.1%) and covering in 20.1%. Mouth rinse before oral examination/care was encouraged in over 80% of the clinics (use of water, 26.0%; use of mouthwash, 57.6%).

A total of 9 (2.3%) clinics experienced the dental treatment of confirmed COVID-19-positive patients (Table 3). Treatments performed on COVID-19-positive patients were as follows: scaling in two patients, followed by fitting of prosthetics, removal of sutures, impression taking, fixation of traumatized teeth, cutting and draining pus, root canal treatment, and restoration of tooth caries in one patient each. As a result, no case of nosocomial viral infection associated with these procedures was re-ported.

Table 3 Dental treatment for patients with confirmed COVID-19 during the period from February 2020 to September 2021.

Questions	Response	n	%	
Did you have any experience of dental treatment for a confirmed COVID-19 patient?	Yes	9 ^a	2.3	
	No	375	97.7	
If yes, what procedure was performed? (multiple answers)	Scaling	2		
	Fitting of prosthetics	1		
	Removal of sutures	1		
	Impression taking	1		
	Fixation of traumatized teeth	1		
	Cutting and draining pus	1		
	Root canal treatment	1		
	Restoration of tooth caries	1		
	Were there confirmed cases of viral transmission from patient to dental staff?	Yes	0	
		No	9	

^a Five before vaccination and four after vaccination. Abbreviation: COVID-19, coronavirus disease 2019.

Participating dentists were asked whether they had experience in treating patients who were later confirmed to be infected, of which eighteen dentists (4.7%) indicated they had close contact exposure to a COVID-19-positive patient. Dental procedures performed on patients are listed in Table 4. In twelve of the eighteen dentists, dental procedures resulting in droplet formation (i.e., scaling, tooth preparation, restoration of tooth caries) were performed during the period of possible viral transmission, although there was variation in the number of days between treatment and the confirmation of infection. However, as a result, no case of viral infection was reported.

Dentists at ten clinics reported that dental staff members were infected with COVID-19 (ten before vaccination and zero after vaccination). The source of infection in dental staff members of seven clinics was presumed to be outside the clinic and those of others were unknown. Although eight of these staff members provided dental treatment/care during the period of possible viral transmission, no patient who received dental treatment/care was diagnosed with COVID-19 infection.

Discussion

SARS-CoV-2 viruses have been found to be present in saliva.¹⁵ It has also been confirmed that there is an elevated risk of virus transmission during the communication without mask.^{16,17} Some dental procedures produce splatters and aerosols, which is the mode of transmission of SARS-CoV-2. Considering the above, dental treatment/care is considered to have an elevated risk of infection because

Table 4 Close contact exposure to COVID-19-positive patient during the period from February 2020 to September 2021.

Questions	Response	n	%	
Did you have any experience of treating patients with close contact exposure to a COVID-19-positive patient?	Yes	18*	4.7	
	No	366	95.3	
If yes, how many days were there between treatment and confirmation of patient's COVID-19 infection	Within 3 days	8		
	4–7 days	6		
	8–14 days	3		
	Unknown	1		
If yes, what procedure was performed? (multiple answers)	Dental scaling	7		
	Tooth preparation (dental cutting)	4		
	Attach dental restorations	2		
	Root canal treatment	1		
	Restoration of tooth caries	1		
	Fitting of denture	1		
	Orthodontic treatment	1		
	No description	2		
	Were there confirmed cases of viral transmission from patient to dental staff?	Yes	0	
		No	18	

* Ten before vaccination and eight after vaccination. Abbreviation: COVID-19, coronavirus disease 2019.

patients are unmasked during dental treatment. In addition, both the dental staff and patients are often in contact with saliva, splatters/aerosols, and mucosal membranes which may contain viruses. Viral infections were thus initially believed to be common in dental practice.¹⁸

In practice, however, cases of infection in clinical dental practice appear to be rare. Few studies have studied the cases of COVID-19 transmission in a dental setting.^{11–13} The Hospital of Stomatology, Wuhan University, provided dental emergency treatment during the outbreak. Three-hundred and twenty staff members wearing N95 masks and sophisticated PPE provided dental treatments to 2,025 patients; however, none of the staff members were infected with COVID-19.¹² Froum et al.¹³ reported no nosocomial infections at three dental clinics in New York. The prospective study involved 2,810 patients treated over a 6-month period in three different dental clinics by two dentists and three hygienists during and shortly after the peak of pandemic in New York. The above is the result of a comprehensive search of a bibliographical database, and the possibility cannot be ruled out that infection may have been occurring.

One prior study has reported on infection outbreaks in a dental department of a university hospital that was designated for treating patients infected with COVID-19.¹¹ The results revealed that 14 of 51 faculty members who treated

patients with COVID-19, but no transmissions were observed from infected patients to the medical staff. In seven facilities, medical staff came in close contact with patients who were found to have the infection after treatment; however, there was also no transmission from patients to medical staff. Medical staff infection was found in four facilities, but there was no transmission from the staff to patients. In this study, we surveyed the COVID-19-related infection control practices in dental clinics, which are the frontlines of dental treatment/care. The results of this study also revealed that no patient-to-dental staff or dental staff-to-patient transmission was identified. In situations where infection is observed amid a pandemic, there might be a possibility that patient treatment/care may not have been provided. Daily patient counts in this study showed no remarkable difference from the pre-pandemic patient counts. In addition, although each dental office indicated that they restricted patients and treatment, the period during which restrictions were applied was only a short part of the study period (median value of 3/20 months), suggesting that treatment activity was near-normal. These results suggest that the occurrence of clusters related to dental treatment in dental care settings was low.

There would be several reasons for the low transmission rate in dental practice. First, entrance screening (waterfront measures) may have worked well in the dental clinics. Most clinics were checking outpatients, and visitors were asked regarding their symptoms or signs, close contact exposure, and travel from endemic areas of COVID-19. In addition, their body temperatures were measured, and the use of face masks and hand hygiene were encouraged. Nsawotemma et al.¹⁹ assessed the effectiveness of thermal screening in the detection of COVID-19 and reported a high specificity of 99.5%. Guan et al.²⁰ reported that fever with a body temperature above 37.5 °C occurs in 88% of COVID-19-positive patients. Peng et al.⁶ reported that in addition to measuring the body temperature in outpatient settings, medical interviews should be conducted before patients sit on the dental chair to prevent the spread of COVID-19 infection. The fact that approximately 90% of the dental clinics had a policy of postponing treatment or providing only emergency care for patients suspected of being infected with the COVID-19 may have contributed to the lack of transmission. Another probable reason for the low transmission rate is that infection control measures such as use of PPE were thoroughly followed in dental clinics. Standard infection control measures such as contact infection control and standard PPE (masks, face shields, eye guards, gloves, gowns, and aprons) were in place at almost all clinics. Furthermore, approximately 80% of the clinics used extraoral vacuums and 85% encouraged gargling. The well-implemented infection control measures may have been a factor in the low infection rate and incidence of transmission. The concept of standard precautions has been reported to be sufficient for preventing the transmission of influenza and rhinoviruses through dental aerosols.²¹ Samaranayake and Peiris²² reported that during the SARS-CoV outbreak in 2003, none of the dental health care workers were infected in clinical settings. On the other hand, many health workers who were not in the habit of wearing PPE on a regular basis, and those who failed to use it properly were infected with SARS-Cov.^{22,23} Vaccination would also be

an important factor for preventing of nosocomial infections. In fact, in the result of this survey, infections among dental staff were no longer seen after vaccination.

There are several limitations to this study. First, the survey was conducted in a single prefecture of Japan. It is unclear whether a larger national survey would yield similar results, and further studies are warranted to clarify the use of protective measures on a multi-prefectural or national level. Second, the overall response rate was 38.4% and may have potentially presented some degree of selection bias. It is possible that respondents were more likely to be concerned or interested in safety protocols than non-respondents. However, considering the need for timely information and scarcity of medium-to-large scale surveys on COVID-19 measures at private dental practices, we believe that the data in this study would be useful for clinicians. Finally, the questionnaire survey was based on self-reporting; therefore, there is a small possibility that the data could be prone to misclassification by the responding private practice dentist.

In conclusion, we investigated the prevalence of COVID-19 infections in dental clinics using a questionnaire-based survey and found that if appropriate protective measures are taken, COVID-19 clusters are unlikely to occur in dental practice. We are waiting for the results of epidemiological surveys to obtain data on prevalence and incidence of infection in dental care.

Declaration of competing interests

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

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