

COVID-19 Contraction Among Dental Healthcare Workers in the Department of Conservative Dentistry and Endodontics – A Retrospective Analysis During the Pandemic

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Introduction: The COVID-19 pandemic has led to major challenges for the healthcare sector across the globe including dental healthcare workers (DHCWs) due to the increased risk of transmission of virus during aerosol-generating procedures. We conducted the present retrospective analysis determining the risk of contraction of COVID-19 infection among DHCWs since the outbreak of the pandemic for a year (March 2020 through March 2021) in Mumbai.

Methods: In total, 18,058 patients visited the Nair Hospital Dental College for dental treatment related to the Department of Conservative Dentistry and Endodontics during the assessed year. All the patients were subjected to intensive triage, which included recording their body temperature, oxygen saturation level, travel, and COVID-19 exposure history.

Results: A total of 26 DHCWs were responsible for attending and treating the patients with all the standard infection control measures. Seventy-four (0.40%) patients out of 18058 were referred for a nasal rapid antigen test (RAT) on giving a positive affirmation about COVID-19 like symptoms when screened at the triage. Of those 74 patients referred, 20 reported a positive nasal rapid antigen test and the infection was confirmed by Reverse Transcriptase Polymerase Chain Reaction (RT-PCR). Among 26, 9 (34.7%) DCHWs were found to have contracted the infection during the assessed year.

Conclusion: The analysis found that the risk of COVID-19 infection contraction amongst the DHCWs is considerably less. This could be attributed to the intensive triage and the preventive measures taken while rendering treatment.

Keywords: COVID-19, endodontics, infection control, operative dentistry, pandemic

Introduction

Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first detected in Wuhan, China, in December 2019. Given the rapid spread of the disease worldwide, it was declared a pandemic by World Health Organization (WHO) in March 2020.^{1,2} The direct mode of transmission of the virus is attributable to transmission via inhalation of droplets released in the environment by infected individuals while breathing, speaking, coughing or sneezing.³ Moreover, contact transmission can occur in individuals by touching infected surfaces and then touching their own eyes, nose or mouth.^{2,4}

Dental healthcare workers (DHCWs) are at an increased risk of contracting COVID-19 infection due to continuous exposure to saliva, blood and aerosols generated during routine dental procedures.⁵ The procedures identified as aerosol-generating procedures (AGP) are the ones involving the use of high-speed handpieces, 3-in-1 syringes, powered (sonic/ultrasonic) scalers and slow speed handpieces.⁶ Most procedures carried out in the Department of Conservative Dentistry and Endodontics require the use of high-speed handpieces which have been found to cause maximum aerosol generation in a dental set up.⁷

WHO released interim guidance recommending that all routine dental procedures be delayed until the transmission rates of COVID-19 reduced from community transmission to cluster cases and until the risk of transmission of the virus in a dental set-up can be effectively analyzed and evaluated.⁸ In India, a nationwide lockdown was implemented on 24th March 2020, followed by unlocking in a sequential manner.⁹ Most dental hospitals and private dental clinics remained shut during the lockdown period. The Nair Hospital Dental College which is run by the Municipal Corporation of Greater Mumbai (MCGM), was among the few dental hospitals in India providing treatment to patients throughout the COVID period.

Despite the implementation of infection control measures, there was widespread apprehension among dental healthcare workers in carrying out routine dental procedures due to the increased risk of exposure to COVID-19, as most of them are AGPs. Thus, analysing the effectiveness of infection control strategies by evaluating the spread of COVID-19 infection in a dental hospital can help reduce the anxiety associated with dental treatment during the pandemic among patients and oral healthcare workers. This was done by conducting a retrospective study on the number of dental healthcare workers that tested positive for COVID-19 while working in the Department of Conservative Dentistry and Endodontics, Nair Hospital Dental College over one year. The current retrospective study included the faculty, postgraduate students, nursing staff, servants, and clerks who were in contact with patients. Undergraduate students of third and fourth years and interns were excluded from the study since they are posted in different departments on a monthly rotating basis, and hence the prevalence of infection in them could not be attributed to working in a particular department.

The aim of the study is to find out whether healthcare workers rendering treatment to patients in the department of Conservative Dentistry and Endodontics while following the advised safety measures are being infected with COVID-19 thereby evaluating the risk to dental healthcare workers and the efficiency of healthcare workers.

Materials and Methods

Study Setting

Nair Hospital Dental College, which is a Mumbai-based integrated health care institution wherein detailed and elaborative dental health care records of each patient across all dental care settings (for example, outpatient, inpatient, and emergency department) are maintained systematically. Each patient is assigned a unique medical record number so that the entire data of the patient is linked across all dental care aspects.

Study Design and Patients

A retrospective cohort analysis was performed on healthcare workers who tested positive while rendering treatment to patients who reported to the Department of Conservative Dentistry and Endodontics from March 2020 to March 2021.

Data Sources

The Nair Hospital Dental College database, Mumbai, proved to be very instrumental in obtaining detailed information. The database contains information for inpatient and outpatient visits at Nair Hospital Dental College, Mumbai, including other data such as demographic characteristics, medications and laboratory tests. Each patient was subjected to a thorough examination of their body temperature, pulse rate, oxygen saturation and travel history since the onset of the COVID-19 pandemic. The chief complaints of the patients as well as the radiographs taken were also recorded and saved in the database of the hospital. The collection of data and its evaluation was done by P.K.V and O.S. The policy of the hospital is to record the data and link it with unique Aadhar card number of the patient.

Ethical Approval

Ethical approval for the execution of the descriptive analysis was obtained based on the Declaration of Helsinki from the Ethics committee, Nair Hospital Dental College, Mumbai, Maharashtra India, with ethical approval code EC-ND-159/Cons/102 ND/2021. Permission for the project was also obtained from the principal and head of the department.

Statistical Analysis

The data was entered and analyzed using the IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp (SPSS, Inc. Chicago, IL, USA). A descriptive retrospective analysis.

Results

The period evaluated for the analysis was between March 2020 to March 2021. The total number of patients visiting the Conservative dentistry and Endodontics department during the evaluated period was 18,058. The dentists responsible for their treatment consisted of 9 staff and 9 postgraduate students. Also, those in direct contact with the patients were 3 nursing staff, 1 clerical staff, and 4 non-teaching (servant). The complete lockdown consisted of March, April and May 2020, for which patients reported treatment (Table 1).

Out of 18,058 patients reporting to department of Conservative Dentistry and Endodontics throughout one year (March 2020 to March 2021), 74 patients with a chief complaint about endodontic treatment gave positive affirmation of COVID-19 symptoms at the triage at the entrance and were referred for Nasal Rapid Antigen Test (RAT). A total of 20 patients failed to report back to the hospital with a negative RAT test, and by telephonic tracing and communication, they were found to be positive and were prescribed for RT-PCR test, which was also found positive. The remaining 54 patients provided a negative RAT report and were allowed further dental treatment. The treatment was carried out under the guidelines given by Indian Dental Association (IDA) and American Dental Association (ADA) which were in effective since the start of COVID-19 pandemic.

A total of 26 dental healthcare workers (DHCWs) rendered their services to the Conservative dentistry and Endodontics department. The 26 DHCWs were divided as faculty, postgraduate students, nursing staff, servants and clerks. The faculty had clinical experience ranging between 6 and 29 years, while the postgraduate students had completed their undergraduate course. During the evaluated period, 9 (34.6%) out of 26 were tested positive. At all times, the DHCWs stuck to the COVID-19 guidelines proposed (Table 2).

Table 1 The Pooled Data of the Patients Who Visited Nair Hospital Dental College Were Referred to the Department of Conservative Dentistry and Endodontics

Months	Total Number of Working Days	Total Patients	Total Number of Patients Who Gave Affirmation of Covid-19 During Triage	Total Number of Patients Who Were Tested Positive After the Rapid Antigen Test (RAT)
March 2020	0	0	0	0
April 2020	9 (3.50%)	40 (0.22%)	1 (1.35%)	0
May 2020	11 (4.28%)	60 (0.33%)	0	0
June 2020	12 (4.67%)	132 (0.73%)	3 (4.05%)	0
July 2020	25 (9.73%)	285 (1.57%)	5 (6.76%)	1 (5%)
August 2020	27 (10.50%)	584 (3.23%)	5 (6.76%)	1 (5%)
September 2020	23 (8.95%)	850 (4.70%)	4 (5.40%)	2 (10%)
October 2020	26 (10.12%)	1144 (6.33%)	7 (9.46%)	1 (5%)
November 2020	25 (9.73%)	1560 (8.63%)	9 (12.16%)	3 (15%)
December 2020	24 (9.34%)	2125 (11.77%)	8 (10.81%)	2 (10%)
January 2021	27 (10.50%)	3267 (18.09%)	7 (9.46%)	2 (10%)
February 2021	23 (8.95%)	3611 (20%)	11 (14.86%)	4 (20%)
March 2021	25 (9.73%)	4400 (24.4%)	14 (18.93%)	4 (20%)
Total	257	18058	74	20

Table 2 Total Number of DHCWs and Those Who Tested Positive During the Assessed Year

People Working in the Department	Number	Positive Count
Faculty	9 (34.6%)	3 (11.5%)
Postgraduate students	9 (34.6%)	3 (11.5%)
Nursing staff	3 (11.54%)	0
Servants	4 (15.38%)	2 (7.70%)
Clerk	1 (3.88%)	1 (3.9%)
Total	26	9 (34.6%)

Discussion

The Nair Hospital Dental College experienced a drastic decline in the number of patients seeking dental treatment after a lockdown was declared in India on 24th March 2020 for 21 days.¹⁰ Around this time, the total number of cases of confirmed COVID-19 infection in India was 564 and globally, more than 334,000 had been infected. Due to the drastic rise in the rate of infection worldwide and India, the lockdown was extended thrice until 31st May 2020 (Figure 1).

By the first week of April 2020, more than 890,000 cases and over 45,000 deaths had been reported worldwide.¹¹ The death toll in India had reached 200, with Maharashtra being the worst affected state in the country.¹² Throughout the lockdown period, the patient inflow in Nair Hospital Dental College was minimal, probably due to stringent travel restrictions and fear of transmission of infection among patients during dental treatment. On 10th June 2020, for the first time, the number of cases that had recovered from COVID-19 infection exceeded the number of active cases reported in India, following which new cases of the infection reported per day began to drop steadily.¹³

Concurrently, there was a gradual reduction in the spread of infection in Maharashtra and Mumbai, which was indicated by fewer new cases confirmed each day. In correlation to unlocking on 1st June 2020, the number of patients visiting Nair Hospital Dental College increased significantly (Figure 2). This could result from the relaxation of restrictions implemented by the state in all areas except the containment zones and the decreasing trend of fear among

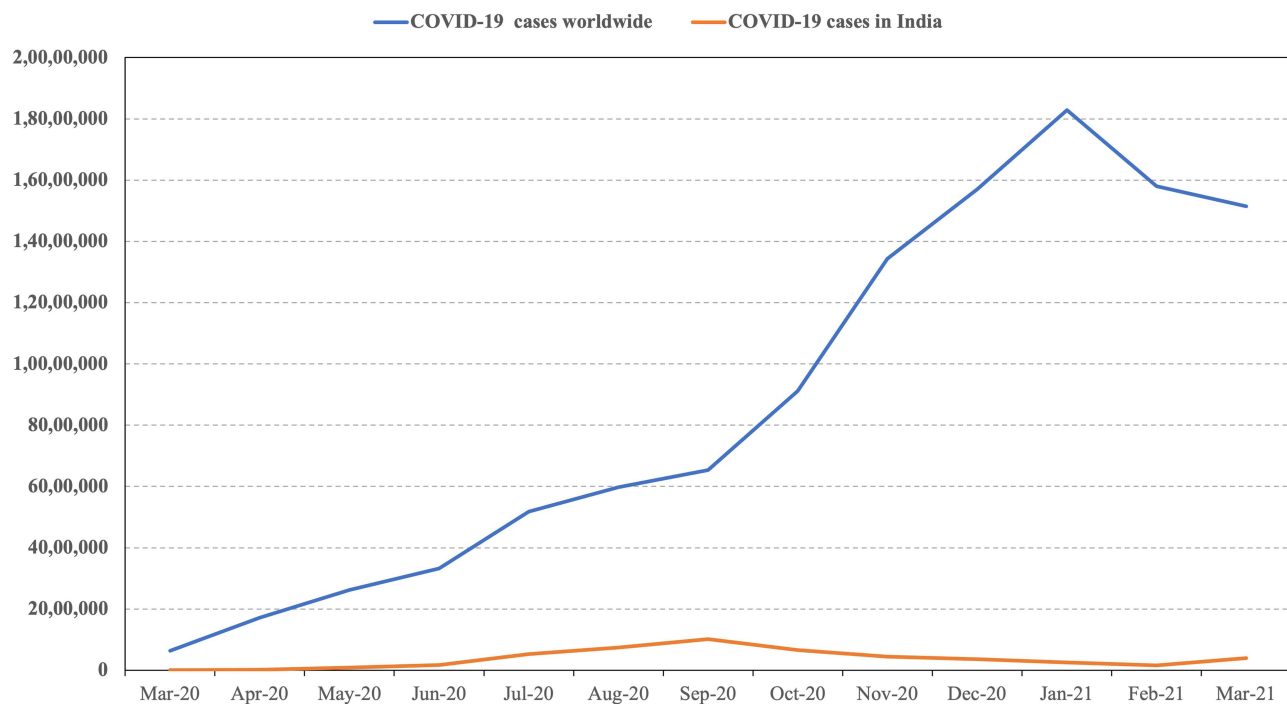


Figure 1 Rate of infection worldwide (blue) and India (Orange) through March 2020 until March 2021.

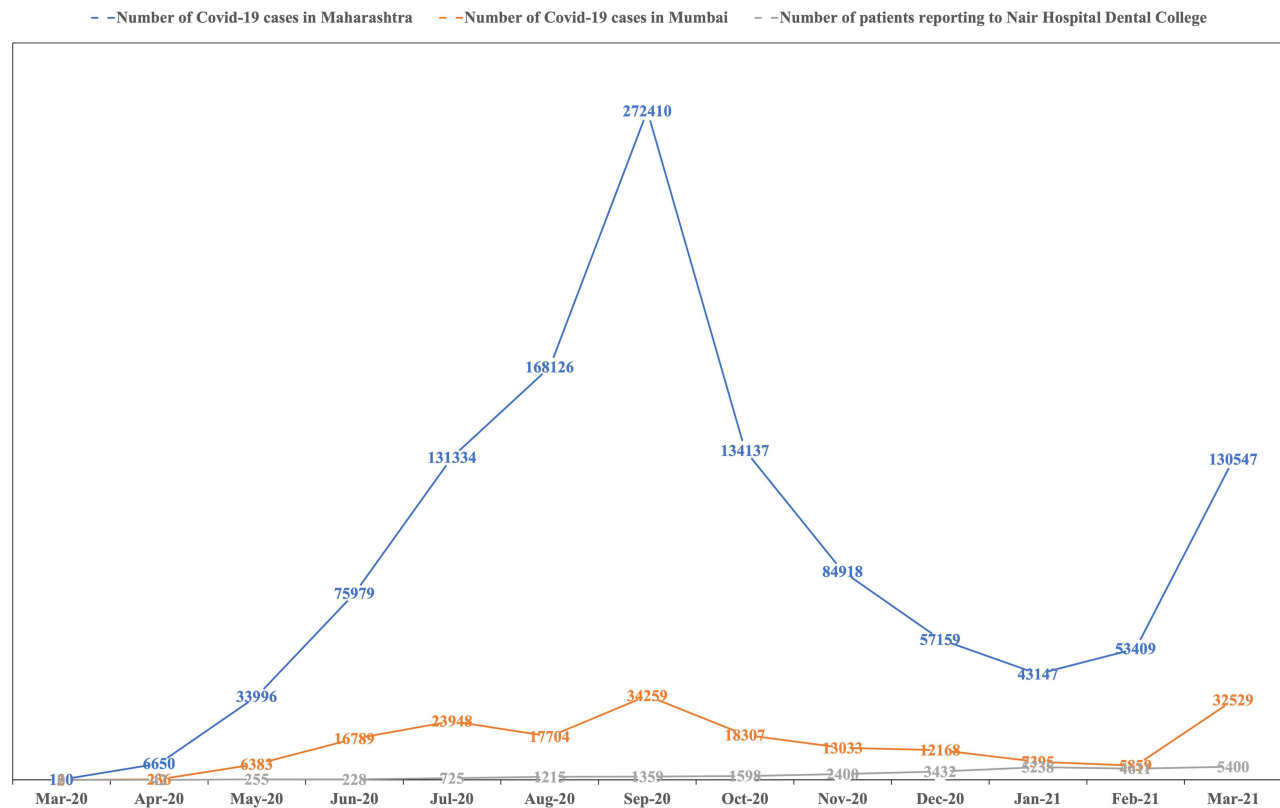


Figure 2 Rate of infection worldwide (blue), India (Orange), and patients those visiting Nair Hospital Dental College (grey) through March 2020 until March 2021.

people. Daily cases reported in India peaked around mid-September 2020 but dropped in January 2021. However, this did not affect the increase in patient inflow, which rose to over 4000 patients by March 2021, the same month the second wave of COVID-19 began in India.

In an advisory released by the Dental Council of India on 16th April 2020, dentists nationwide were urged to provide only emergency dental treatment to limit the spread of infection.¹⁴ Dental conditions requiring immediate care include uncontrolled bleeding, intraoral or extraoral swelling that may be obstructing the airway or have systemic effects and severe trauma.^{15,16} While most private dental clinics throughout Mumbai remained shut, Nair Hospital Dental College was open for emergency dental procedures. The trend of restrictions in carrying out dental procedures was seen not just in India but also in other countries such as China and Italy.¹⁷ In a study conducted in the department of Prosthodontics at the Wuhan University they mentioned that only emergency procedures were carried out in the department during the first few months of the pandemic. Non-emergency cases were catered to via telephone and online platform. Eventually prior to resumption of routine procedures in the department, all healthcare workers underwent extensive training pertaining to the use of personal protective equipment and other safety measures.¹⁷

A survey involving over 200 periodontists from the United States and Brazil shed light on the strain on dentists including the financial burden caused due to the intense safety protocol including the use of personal protective equipment in addition to reduced number of patients and working hours.¹⁸

Covid-19 also led to a severe psychological burden on healthcare workers worldwide. A survey conducted in Pakistan reported that 82.4% of the participants including dentists, dental assistants and hygienists were suffering from stress and anxiety due to impact of the pandemic. Moreover, 52% of the participants were not willing to continue rendering dental treatment to patients due to the associated risk of exposure.¹⁹ Another study carried out in Saudi Arabia showed that clinical healthcare workers were under higher stress and were more anxious about contracting the virus and spreading it those around them, specially their children, than the non-clinical oral healthcare workers. However, most of the healthcare workers belonging to both groups were well aware of the risk of infection and prepared to adapt the necessary safety measures.²⁰

To date, since the outbreak of the pandemic, utmost importance has been given to strictly following several precautionary measures suggested by various authorities such as the American Dental Association (ADA), the Indian Endodontic Society (IES) and the Indian Dental Association (IDA) to control the transmission of SARS-CoV-2 during dental procedures at Nair Hospital Dental College.^{20,21}

Every patient visiting Nair Hospital Dental college was thoroughly screened at triage for any symptoms of COVID-19 infection, once at the entrance of the hospital and once in the Department of Conservative Dentistry and Endodontics. The triage included checking the patient's body temperature, pulse, and oxygen saturation using an infrared thermometer and pulse oximeter. This was followed by enquiring about the history of symptoms like fever, cough, sore throat, dyspnoea or loss of sense of smell or taste. Patients were also asked whether they had contracted COVID-19 infection before or had been exposed to any infected individuals to rule out the presence of active infection of COVID-19. According to the Centres for Disease Control and Prevention, any patient with an active COVID-19 infection must not be treated in a dental setting.²² If a patient showed any symptoms or answered affirmatively to the questions mentioned above, they were immediately referred to Topiwala National Medical College and B.Y.L. Nair Charitable Hospital for Rapid Antigen Testing (RAT). RAT, a type of lateral flow immunoassay known as an immunochromatographic test, detects viral proteins in the specimen.^{23,24} The spike (S) protein and the nucleocapsid (N) proteins of SARS-CoV-2 are highly immunogenic. This immunologic method of testing comprises specific antibodies to bind with antigens to confirm their presence or absence. Interpretation of test results is made by observing the appearance of colour strips and hence can be quickly done with the naked eye. Other advantages associated with the use of RAT were their quick execution and timely results.^{25,26}

Out of the 74 patients sent for testing by the Department of Conservative Dentistry and Endodontics representative after showing symptoms or reporting exposure to COVID-19 infection at the triage, 50 returned with a negative RAT report. The remaining 20 were contacted via telecommunication, and they informed that their RAT report was positive, which was confirmed with Reverse Transcription Polymerase Chain Reaction (RT-PCR) Test. RT-PCR tests are often considered the gold standard for diagnosing COVID-19 infection due to their high specificity and sensitivity.^{27,28} The polymerase chain reaction is an enzymatic technique to amplify minute quantities of genetic material and obtain sufficient specimens for laboratory analysis. The viral RNA sequence is transferred onto cDNA by reverse transcription. Multiple copies of the gene sequence located by a primer are made using DNA polymerase, followed by their detection using gel visualisation and sequencing.^{29,30} Hence by preventing contact between these COVID-positive patients and the dentists, screening at triage proved effective in reducing SARS-CoV-2 transmission in the department. Aerosol particles generated during dental procedures are suspected to be a possible route of transmission of the SARS-CoV-2 virus.⁶

SARS-CoV-2 infection predominantly occurs through airborne droplets of infectious respiratory fluids that may be inhaled or settled on mucous membranes. Thus, the use of appropriate personal protective equipment is essential for protecting ocular, nasal and oral mucosa.^{31,32} Faculty, postgraduate students, nursing staff, servants and clerks dealing with patients donned personal protective equipment comprising disposable gown, protective eyewear, head cap, N-95 facemask, face shield, two pairs of gloves and shoe covers. The patients were strictly prohibited from entering the hospital premises without masks. The seating arrangement in the waiting area was modified to ensure social distancing of about 6 feet among patients. A pre-operative mouth rinse with antimicrobial mouthwash containing oxidative agents such as 1% hydrogen peroxide or 0.2% povidone is believed to significantly reduce the viral load in the oral cavity.^{33,34} Thus, patients were instructed to rinse using povidone-iodine solution before starting any dental procedure.

Studies have indicated that SARS-CoV-2 can survive up to 3 hours in aerosols and up to 48 and 72 hours on plastic and stainless-steel surfaces, respectively.³⁵ Thus, to prevent nosocomial transmission of SARS-CoV-2, all potentially contaminated surfaces and instruments must be disinfected and sterilized.³⁶ Disinfection of potentially contaminated surfaces such as dental chairs by spraying 0.1% sodium hypochlorite solution was done after every patient. Sterilization of instruments used in the oral cavity was done using a class B autoclave. They contain a vacuum pump to remove contaminated air inside the chamber, create negative pressure and force steam entry. Hence, they can be used for the sterilization of solid and porous items.³⁷ Sound natural and mechanical ventilation within the dental operatory are also required to clear contaminated aerosols. Therefore, following the National Centre for Disease Control guidelines, the Department of Conservative Dentistry and Endodontics was well ventilated with numerous windows, doors, and exhaust fans to facilitate air circulation.³⁸ In addition to that, High-Efficiency Particulate Air (HEPA) filters were used to reduce

the number of virus-containing aerosols in the environment. Moreover, fumigation of the entire department is carried out every day.

Dental healthcare workers (DHCP) were advised to undergo a reverse transcription-polymerase chain reaction (RT-PCR) test if they suspected exposure to SARS-CoV-2 to prevent the spread of infection to patients. A total of 26 dental healthcare personnel, including 9 dentists, 3 nursing staff, 9 postgraduate students, 4 servants and 1 clerk, were responsible for rendering treatment to the 18,058 patients treated in the department throughout the year. The treatment modalities involved root canal treatment and apicoectomy, endodontic surgeries, bleaching of discoloured teeth, management of dental trauma, inlays, onlays and temporary and permanent restorations. Interns and undergraduate students were also involved in treating patients in the department. However, they were not included in the study since they were posted in different departments carrying out different kinds of procedures with a variable amount of aerosol generation on a monthly rotary basis and hence the prevalence of COVID-19 infection could not be directly attributed to transmission of SARS-CoV-2 in the Department of Conservative Dentistry and Endodontics.

Among these, 3 faculty, 3 postgraduate students and 2 servants and a clerk tested positive, summing up to 9 healthcare workers. One of the faculty who tested positive for COVID-19 infection had symptoms such as sore throat, cold, cough, loss of sense of smell and taste. He/She spent long hours dealing with patients at triage from 9 am through 4 pm every day. Thus, it can be deduced that the healthcare worker could have contracted COVID-19 infection due to transmission of the virus in the department. Another contributing factor in their case could have been exposed during travelling to and from their house (in Virar) to the hospital (at Mumbai Central) at a distance of 75 kilometres, necessitating a travel time of one hour twenty-one minutes in local trains daily. The other dentist had been exposed while travelling with an individual who had further been exposed to an infected person. The third one had recently travelled to his native place in mid-September 2020. Around 9000 active cases were reported in that district, indicating that the travel history could have been responsible for SARS-CoV-2 infection.³⁹ Following the positive test results for three faculty members, the remaining six faculty members underwent COVID-19 antibody testing to check for exposure and tested negative. Two postgraduate students were symptomatic, due to which they got an RT-PCR test done and were tested positive. Since all postgraduate students had been in close contact, they voluntarily got tested, following which another student who had been asymptomatic turned out to have contracted the virus. Prevalence of COVID-19 infection in postgraduate students could be associated with working in the department as their travel was limited to the hospital and the hostel. The servants and the clerk who tested positive with SARS-CoV-2 infection showed cough, headache and body ache. Their infection could not be attributed solely to working in the Department of Conservative Dentistry and Endodontics as they had been working in COVID-19 wards set up in Nair Hospital Dental College.

A study evaluating the impact of the pandemic on the department of maxillofacial surgery in 23 surgical units throughout Italy noted the incidence of COVID-19 infection among 4% of maxillofacial surgeons and 22% of the residents in spite of significant reduction in the number of procedures that were carried out, specially in the first month of the pandemic. However, it is necessary to mention that they reported an acute shortage of personal protective equipment with only 61% of the maxillofacial departments having access to N95 masks for carrying out surgical procedures. This could be one of the primary contributing factors in the spread of infection among surgeons and residents.⁴⁰

A similar study was conducted in China to assess the efficiency of prevention strategies adopted in a dental hospital during three months of lockdown. The strategies included ensuring that patients made dental appointments in advance through telephone or internet to avoid overcrowding, instructing them to follow cough etiquette and wear face masks properly at all times and implementation of correct usage of personal protective equipment and hand hygiene methods by the dentists and nurses. They found that the infection control methods were effective in preventing spread of COVID-19 among dental healthcare workers.⁴¹ A two-month long study was carried out in an Italian school of dentistry suggesting strategies for management of workload in a dental set up focusing on assessment of patients, management of dental procedures in two phases and controlling spread via instruments and environment.⁴² Precautionary methods akin to those observed in the current study involving triage, social distancing, using hydrogen peroxide mouth rinse prior to treatment, donning and doffing of personal protective equipment in an appropriate manner and post-treatment sterilization and disinfection of instruments as well as the dental unit were also found to be effective in a study conducted in the department of Conservative

dentistry and Periodontology in a dental hospital in Munich.⁴³ To the best of the author's knowledge, this is the first study conducted to evaluate the prevalence of SARS-CoV-2 infection among healthcare workers in a dental hospital in India.

It is suggested that these precautionary measures must be undertaken by dental practitioners even after vaccination due to the rapidly mutating nature of the virus giving rise to the appearance of newer strains. Hand hygiene practices and wearing masks must be continued until the COVID-19 pandemic is completely over for sure. In addition to the safety measures mentioned above, certain new techniques can also be adopted to combat the spread of infection more efficiently such as installation of facilities equipped with airborne isolation transmission through aerosols (AIIRS) for treatment of patients suspected to be infected.³³

To the best of the author's knowledge, this is the first study conducted to evaluate the prevalence of SARS-CoV-2 infection among healthcare workers in a dental hospital in India.

Limitations in This Study

Risk of exposure outside the department such as at home or other places visited by the healthcare workers cannot be efficiently monitored and thus it serves as a limitation of the current study. Also, aerosol generating procedures carried out in other departments of Nair Hospital Dental College were not included in the study.

Conclusion

As a consequence, while 9 healthcare professionals in the Department of Conservative Dentistry and Endodontics infected the SARS-CoV-2 virus, only 4 of them could be traced to dissemination in the department. The remainder sufferers were most likely impacted by external origins, suggesting that the preventative measures implemented in the department for preventing infection during the outbreak were competent for maintaining a low rate of SARS-CoV-2 transmission in a dentistry setting.

Abbreviations

RAT, Rapid antigen test; RT-PCR, Reverse Transcriptase Polymerase Chain Reaction; COVID-19, Coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; DHCWs, Dental healthcare workers; AGP, Aerosol-generating procedures; MCGM, Municipal corporation of greater Mumbai; SPSS, Statistical package for social sciences.

Data Sharing Statement

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

Ethics and Consent

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics committee, Nair Hospital Dental College, Mumbai, Maharashtra, India with the Ethics approval code (EC-ND-159/Cons/102 ND/2021). Informed consent was waived by the Institutional Review Board Nair Hospital Dental College, Mumbai, Maharashtra, India due to retrospective nature of the study. Additionally, the patients sign a general consent before any treatment or investigation is rendered which includes a consent to use the findings in future retrospective studies without any personal identification.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically

reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

Disclosure

The authors declare no conflicts of interest in relation to this work.

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