AUDIT ARTICLE

The utility of pre-procedural COVID-PCR testing for dental aerosol generating procedures is questionable

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Abstract

Objective: To compare the number of aerosol-generating procedures performed and the number of coronavirus disease-2019-positive workers in dental practice.

Method: The audit study was conducted in May 2021 at the Aga Khan University Hospital, Karachi, and comprised data from April 1, 2020, to March 31, 2021, which was retrieved from dental clinics at the main hospital and its Clifton branch as well as in three secondary care hospitals in Garden, Kharadar, Karimabad areas of Karachi, and one in Hyderabad, Pakistan. Data of individuals who followed mandatory pre-procedural polymerase chain reaction testing in addition to using personal protective equipment in the main hospital and Clifton branch was placed in group A, and of those using personal protective equipment only at the 4 satellite clinics with no testing was placed in group B. Dental charts of patients who underwent dental aerosol-generating procedures were analysed. Number of dental clinics affected by coronavirus disease-2019 and number of dental patients who were reported positive on pre-procedural polymerase chain reaction testing were evaluated. Data was analysed using SPSS 23.

Results: Of the 63 dental healthcare workers, 44(69.8%) were in group A and 19(30.2%) were in group B. In group A, 19(43.2%) were affected by coronavirus disease-2019 compared to 2(11%) in group B (p=0.01). Among 782(67.8%) patients who underwent polymerase chain reaction testing, 26(3.3%) turned out positive for coronavirus disease-2019. Due to the mandatory testing imposed on patients, 371/1153(32.2%) refused to get the desired dental treatment.

Conclusion: The benefit of pre-procedural testing in dentistry remained uncertain.

Keywords: COVID-19 testing, Dental practice pattern, Personal protective equipment, Polymerase chain reaction.

(JPMA 73: 1457; 2023) **DOI: https://doi.org/10.47391/JPMA.7306**

Submission completion date: 19-08-2022 **- Acceptance date:** 27-01-2023

Introduction

In early January 2020, the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was declared the causative pathogen of a highly infectious disease that originated in Wuhan, China in December 2019.[1] Soon it turned into one of the biggest public health challenges of modern times having spread across 200 countries, and became a global challenge for healthcare providers, including dental professionals.[2] The World Health Organisation named it the coronavirus disease-2019 (COVID-19) on February 11, 2020.[3]

Coronaviruses are made up of four structural proteins: spike (S), membrane (M), envelop (E) and nucleocapsid (N).[4] The COVID-19 targets cells such as nasal and bronchial epithelial cells and pneumocytes through the viral structural spike (S) protein that binds to the angiotensin-converting enzyme 2 (ACE2) receptor for internalisation and aided by Transmembrane protease, serine 2 enzyme in the host cells.[5]

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The transmission of COVID-19 may occur through direct contact, inhalation of the infected droplet, and also through indirect contact communication.[6] The Centres for Disease Control and Prevention (CDC) described the spread of COVID-19 virus by airborne transmission through respiratory droplets which can be through a direct contact or via some vector.[7] Dentists are thought to be at the highest risk of exposure owing to the nature of their work.[8] Dentists work in the proximity of the patients' mouth, and remain in contact with saliva and blood. Conducting aerosol-generating procedures (AGP) make them even more susceptible to contracting the virus. AGP includes dental operations, such as tooth fillings, root canal treatment, scaling, crown/bridge preparation, implants and jawbone surgeries involving high-speed dental drills operating in the presence of air-water spray jet. Moreover, sharp instruments can also perforate glove and/or skin and thus transmit the infection.[6]

Peng et al. in early 2020 recommended thorough COVID-19 screening of patients before embarking upon any dental procedure. They proposed an algorithm for screening of the potential patient. They also recommended pre-procedure mouth rinse with 1% hydrogen peroxide or 0.2% povidone, usage of anti-retraction handpiece, and rubber

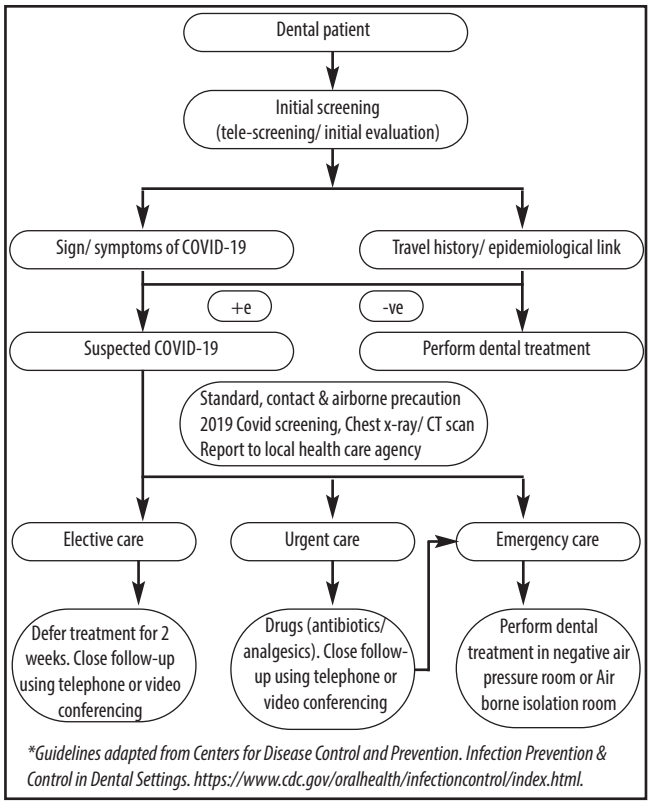

Figure: Dental patient management guidelines during the coronavirus disease-2019 (COVID-19) pandemic.

dam isolation, where possible.[6] Taking into consideration the severity of the pandemic, the American Dental Association (ADA) and other health-related bodies issued several guidelines and recommendations[7,9,10] to manage patients, and to implement cross-infection control guidelines to reduce the risk by following strict standard operating procedures (SOPs). The crux of all such guidelines is essential in dental practice (Figure).

In Pakistan, the government and its relevant ministries as well as regulatory bodies released a guideline, which included detailed instructions for the management of dental clinics during such unprecedented times.[11] The document also included instructions for screening and communication with patients, and measures for the protection of healthcare providers.

The use of dental rotary instruments, such as dental hand pieces and triple-syringes, generate an aerosol that may transmit the virus. These instruments often create a spray that contains droplets of bodily fluids, such as saliva and blood. Under such conditions, standard surgical masks provide insufficient protection from the COVID-19 virus.[12] The ADA recommended an updated personal protection equipment (PPE) for dental healthcare workers (DCHWs). PPE includes glove, gown (disposable/ autoclavable), eye protection (goggles/face-shield), N-95 masks or respirators. These PPEs have been recommended by ADA when dental procedure is undertaken on healthy, COVID19-suspected or confirmed subjects.[9] Umar et al. and Mahmood et al. highlighted the importance of PPEs, including the half-mask filtering face-piece respirators, their fit test and also on the proper donning and doffing of the PPEs.[13,14]

The CDC discussed the provision of elective pre-procedural COVID-19 testing before AGPs.[10] Umer et al. recommended pre-procedural COVID-19 pooled testing as a feasible and cost-effective approach to avoid transmission of infection in asymptomatic patients seeking dental treatment.[15]

The current study was planned to assess the impact of mandatory pre-procedural COVID-19 testing on the infection status of dental healthcare workers (DHCWs) who also uses PPEs, and to determine the compliance of the patients who were offered pre-procedural COVID-19 testing.

Materials and Methods

The audit study was conducted in May 2021 at the Aga Khan University Hospital (AKUH), Karachi, and comprised data from April 1, 2020, to March 31, 2021, which was retrieved from dental clinics at the main hospital and its Clifton branch as well as in three secondary care hospitals in Garden, Kharadar, Karimabad areas of Karachi, and one in Hyderabad, Pakistan.

After exemption from the institutional ethics review committee, the sample was raised followed a census approach without calculating a sample size or a particular sampling technique as the study was an audit. All entries of DHCWs whose complete record was available were included, while data of staff who had been on leave during the period, or who had not been involved in chairside patient care was excluded.

Data was retrieved from the departmental records and was taken down on a study proforma. The information regarding the AGP performed on a monthly basis was extracted from the computer database using unique procedure codes. The patient testing for COVID-19 was checked with file records verified by the laboratory confirmed cases, and data was derived directly from the hospital computer-based outpatient management system (OPMS) without any human interface. The COVID-19 infection of DCHWs was confirmed by the infection control department and medical leave records. Contact tracing was employed with the help of records, where applicable.

Data of individuals who followed mandatory pre-procedural polymerase chain reaction (PCR) testing in addition to using PPE in the main hospital and Clifton

branch was placed in group A, and of those using PPE only at the 4 satellite clinics with no PCR testing was placed in group B.

Operational definitions were worked out. DHCWs meant dental faculty, residents, interns, hygienists, and dental surgery assistants who performed or assisted in AGPs. The AGPs were dental procedures where combination of air water spray was employed at high pressure, like scaling, crowns, and bridge preparations, cutting of dental hard tissue and bone with highspeed dental drills under water irrigation.[16] PPEs included face mask (N-95), face shield, head cap, eye protection, gown and gloves.

Data was analysed using SPSS 23.0 Means and standard deviations of continuous variables and frequencies and percentages of qualitative variables were computed. Chi-square test was used to compare count data. To determine the factors associated with COVID-19 positivity among DCHWs, Cox proportional regression was applied, and unadjusted and adjusted prevalence ratios with 95% confidence interval (CI) were worked out. P<0.05 was considered statistically significant.

Results

Of the 63 DCHWs, 44(69.8%) were in group A and 19(30.2%) were in group B. In group A, 19(43.2%) were affected by COVID-19 compared to 2(11%) in group B (*p*=0.01). Among 782(67.8%) patients who underwent PCR testing, 26(3.3%) turned out positive for COVID-19. Due to the mandatory testing imposed, 371/ 1153(32.2%) refused to get the desired dental treatment (Table 1).

Of the total 8,657 AGP procedures, 3493(40.34%) were in group A, and 5,164(59.65%) in group B. In group A, fillings represented the most common procedure 1485(43%), while in group B, crown bridge preparation was the most common AGP procedure 1,506(29%) (Table 2).

Table-1: Distribution of subjects.

	Group A PPE along with pre-procedural Testing done n (%)	Group B PPE but no pre-procedure Testing n (%)	Total count n (%)	*p*-value*
COVID positive DHCW	19/44 (43)	2/19 (11%)	21/63 (33.3)	0.01
Patients who agreed to pretesting requirements	782/1153 (67.8)			
Patients who decided to defer the treatment due to pretesting requirement	371/1153 (32.2)	NA	NA	NA
COVID positive patients found on pretesting	26/782 (3)	NA	NA	NA

*Chi square/ Fisher Exact test was applied; COVID: Coronavirus disease-2019, DHCW: Dental healthcare workers, PPE: Personal protective equipment.

Table-2: AGP-based dental procedures.

AGP procedures	Group A PPE along with pre-procedural Testing done n (%)	Group B PPE but no pre-procedure testing n (%)	Total count n (%)	*p*-value*
Scaling	611 (17%)	971 (19%)	1582	0.12
Fillings	1485 (43%)	1334 (26%)	2819	<0.001
Root canal treatment	724 (21%)	1353 (26%)	2077	<0.001
Crown bridge work	288 (8%)	1506 (29%)	1794	<0.001
Dental Implants	88 (3%)	0	88	NA
Bone surgeries	297 (9%)	0	297	NA
Total procedures performed	3493 (100%)	5164 (100%)	8657	NA

*Chi square test was applied; AGP: Aerosol generating procedures, PPE: Personnel protective equipment.; Group A: Pre-procedure testing done at dental clinics of main hospital and Clifton medical services; Group B: No pre-procedure testing protocol followed at Garden, Kharadar, Karimabad, and Hyderabad; Percentages are calculated for the columns.

Discussion

PCR test, which is a nucleic acid amplification test, is the most sensitive test for the diagnosis of COVID-19. The sensitivity of PCR kits have reported to vary, ranging from 71% to 98%.[17] No testing method is 100% accurate, as there is always a chance of false negative or false positive cases.[18] The current findings indicated 3% COVID-19 positivity among patients tested before AGP. This was quite low considering the positivity percentage peaked up to 10.9% in April 2021 when there was an overall peak in COVID-19 cases (reaching over 39,850 confirmed cases per day) nationwide.[19]

Pre-procedural COVID testing in dentistry is observed with multiple challenges. Patients are scared of such testing, fearing that they will be labelled infection-positive.[15] Besides, an additional test would involve more time and money[20], and, lastly, as most dental AGPs are carried out across multiple visits, the fear among patients that they will be subjected to COVID-19 testing at every visit created significant stress and anxiety among the patients.

Singer et al. suggested that pre-procedural COVID testing may give relaxation in PPE in asymptomatic-negative patients.[21] In the current study, nearly 32% patients refused to get testing done and in fact decided to either defer dental treatment or sought dental care elsewhere in facilities where PCR testing for AGPs was not a requirement. Losing one-third patient volume during the pandemic turned out to be a big hit on the revenues of the clinic, but the financial domain lies beyond the scope of the current report.

During the initial stages of the pandemic, the global guidelines for dentists were limited to pain management. Later, non-AGPs were initiated that

include simple extraction or fabricating removeable dental prosthesis (dentures) and continuation of the fixed braces treatment.[11] After some awareness and initiation of vaccination, some relaxation was permitted in the form of AGPs performed either under rubber dam isolation or with pre-procedural COVID-19 testing. During this period, under all circumstances, PPE was strictly used. When used properly, the equipment acts as a barrier between the staff and any infectious material, thereby minimising the exposure, and blocking the transmission of contaminants. Pre-procedural testing is widely conducted for surgical procedures under general anaesthesia.[22]

More DHCWs turned COVID-19-positive in clinics where pre-procedural PCR testing was the norm compared to the sites where only PPE was exercised. Although the source of infection to the staff remains unidentified or assumed community-based, the benefit from the pre-procedural testing protocol in dental setting remained unclear. The findings suggest that stringent adherence to PPE along with screening triage protocols was more than sufficient in preventing the infection. There was no apparent or tangible benefit of mandatory pre-procedural PCR testing. There is no explanation for why the positivity was significantly greater in centres where pre-procedure testing was done and the average number of AGPs performed per person were much less. There is no clear answer. A plausible explanation would be that the dental staff at the tertiary care centre had more chances of being exposed to the infected patients or their contacts as a big number of people were visiting the hospital for their COVID-19 testing, whereas the secondary centres were not engaged in any COVID-19 testing service at all.

The ADA recommends standard, contact and airborne precautions that include appropriate PPE, equipment and surface disinfection, hand hygiene, limitation of patient movement and containment in isolation rooms for suspected or confirmed COVID-19 patients.[9] The requirement of pre-procedural testing in dental setting is debatable.

The limitations of the present study include its retrospective data, and the fact that information related to AGPs was gathered from computer-based records, which does not necessarily correlate with the actual number of aerosols generated in each procedure.

Conclusion

By employing proper screening triage and adhering to mandatory use of standard PPE, dental procedures involving AGPs can be safely performed without the need of any pre-procedural COVID-19 PCR testing.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

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