Assessment of SARS-CoV-2 infection in dentists and supporting staff at a university dental hospital in Argentina

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A R T I C L E   I N F O

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A B S T R A C T

Introduction: Oral healthcare professionals are at increased risk of infection by SARS-CoV-2. The aim of this study was to evaluate the prevalence of COVID-19 in a population of workers who provided services during the COVID-19 pandemic at a dental care and educational institution in the Buenos Aires Metropolitan Area.

Materials and methods: This was a descriptive, cross-sectional study including 358 workers who provided essential services during the first 180 days of the COVID-19 pandemic at the Dental Hospital at Buenos Aires University School of Dentistry (FOUBA). Following epidemiological data, these workers underwent diagnostic testing for COVID-19 (1- nasal or throat swab tests; 2- blood test for enzyme-linked immunosorbent assays [ELISA]; 3- commercial rapid serology test).

Results: Three diagnostic tests were implemented. Rapid tests were performed on 290 subjects, with 255 negative results (88%; CI95: 95–98%) and 35 positive (12%; CI95: 9–16%). ELISA on 317 subjects, with 308 negative (97%; CI95: 95–98%) and 9 positive (3%; CI95: 2–5%); and PCR on 204 subjects, with 196 negative (96%; CI95: 92–98%) and 8 positive (4%; CI95: 2–8%). There were 358 subjects who were evaluated by ELISA or PCR, with 342 negative results (96%; CI95: 93–97%) and 16 positives (4%; CI95: 3–7%).

Conclusion: For this sample of dentists, dental assistants and nonclinical personnel, the weighted prevalence of COVID-19 was 4%. Similar studies should be conducted at other dental care facilities in order to evaluate the worldwide impact of COVID-19 on the dental care community.

1. Introduction

In December 2019, a pneumonia of unknown origin was reported in a cluster of subjects in Wuhan, Hubei Province, China. The etiologic agent was promptly identified as and named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the disease was known as COVID-19.1 It spread rapidly to other Chinese provinces, and then to the rest of the world. On March 11, 2020, the WHO declared the disease to be a global pandemic, and it became a public health emergency of international concern. In Argentina, preventive mandatory social isolation (PMSI) was established on March 20, 2020, under Decree of Necessity and Urgency 297/2020.

Healthcare workers are at increased risk of being exposed to SARS-CoV-2. Among them, dentists are at higher risk because of the unique characteristics of dental procedures, during which a large number of droplets and aerosols can be generated. Standard protection used in daily clinical work may not be effective enough to prevent the spread of COVID-19, especially when patients are in the incubation period, do not know that they are infected, or choose to conceal the fact that they are infected.2 Although symptomatic patients with COVID-19 have been the...
main source of transmission, recent observations suggest that asymptomatic patients and those in the incubation period are also SARS-CoV-2 transmitters.\[^{3,4}\] This epidemiological characteristic of COVID-19 has made it extremely challenging to control because it is difficult to identify and quarantine such patients in a timely manner, which can facilitate community transmission.

Since the risk of infection during diagnosis and treatment of oral diseases was considered high, scheduled dental care was suspended during PMSI at most private and social security oral healthcare centers in the epidemiologically denominated Buenos Aires Metropolitan Area (AMBA), which concentrates 30% of the population in Argentina.\[^{5}\] The epidemiologically denominated Buenos Aires Metropolitan Area diseases was considered high, scheduled dental care was suspended due to the capacity of local testing, the variable incubation period of the frequency and type of testing to identify infected personnel pose a challenge to enable collection of epidemiological data related to COVID-19.\[^{11}\]

In addition to the risk of transmission from symptomatic or asymptomatic COVID-19 patients to healthcare staff, in absence of a detection test an infected but asymptomatic dentist could expose patients and colleagues to the risk of contracting the disease. Although some studies have suggested testing healthcare personnel every two weeks,\[^{6}\] the frequency and type of testing to identify infected personnel pose a challenge due to the capacity of local testing, the variable incubation period of the infection (5–14 days), and the virus window of infectivity. Although several studies have reported data regarding the frequency of infection among healthcare staff at different healthcare facilities,\[^{7,8}\] the prevalence of COVID-19 at dental hospitals is still unclear. Knowledge of the status of SARS-CoV-2 infection among workers in a dental hospital setting could provide information for developing protocols and policies for personnel at facilities of this kind and improve infection control measures.

The aim of this study was to describe the frequency of SARS-CoV-2 infection in a sample of workers who provided services during the COVID-19 pandemic at a University Dental Hospital in Buenos Aires Metropolitan Area (AMBA).

2. Materials and methods

This was a descriptive cross-sectional study conducted in the University Dental Hospital of the School of Dentistry of Buenos Aires University (FOUBA, according to its initials in Spanish). Non-probabilistic sampling was performed. The sample consisted of 358 FOUBA workers from clinical and non-clinical areas, male and female, over 21 years old, who provided essential services during the COVID-19 pandemic during the PMSIs.

Because these workers conduct their healthcare activities at the hospital, they had all taken an online training course on infection control in dental practice during the COVID-19 pandemic, which included a final exam. All work-related tasks were performed under patient admission and circulation protocols, and personal protective equipment (PPE) was delivered for use while providing dental care, according to the standards designed by FOUBA,\[^{10}\] based on recommendations from the Argentine National Health Ministry and following the recommendations of the Centers for Disease Control and Prevention (CDC) and the American Dental Association (ADA).

Ethical approval was not required for this study as only anonymous data were used and testing of healthcare workers was part of the dental school policies during the pandemic period.

Clinical and non-clinical staff underwent one or several of the following serologic and/or molecular tests for detection of infection by SARS-CoV-2: (1) Nasal or throat swab tests (specificity 98% and sensitivity 89%); (2) blood test for enzyme-linked immunosorbent assays (ELISA) (specificity 95% and sensitivity 85%); (3) commercial rapid serologic test (Pambiro\[^{14}\] COVID 19 IgG/IgM rapid test device. ABBOTT\[^{8}\]) (specificity 91% and sensitivity 83% as informed by the manufacturer). Samples were collected, maintained and transported by trained, calibrated personnel and processed rapidly following the protocol at the Institute for Biomedical Research in Retrovirus and AIDS (Instituto de Investigaciones Biomédicas en Retrovirus y SIDA - IMBIRS/ CONICET) of Buenos Aires University School of Medicine. Even when rapid test result was positive, a subject was considered positive only when the nasal or throat swab tests or the blood test for enzyme-linked immunosorbent assays (ELISA) was positive too. The test positivity rate was defined as the number of confirmed cases over the total number of tested cases.

**Statistical analysis** The categorical data were described by absolute frequencies and percentages with 95% confidence intervals (CI95). The CI95 were estimated by the score method (Newcombe & Merino Soto, 2006). Frequencies were compared using the Chi-square test or Fisher’s exact test with 5% significance level. In addition, age was described by the following measures: mean, standard deviation (SD), median, first quartile (Q1), third quartile (Q3), minimum and maximum. Median and interquartile range (IQR) were included because age was not normally distributed, as analyzed using Kolmogorov-Smirnov test. The following software was used: Calc, from Apache OpenOfficeTM v. 4.1.6, Apache Software Foundation, 2018, InfoStat v. 2020 and R v. 4.0.3.

3. Results

**Demographics.** The sample consisted of 358 subjects, including 228 female (64%; CI95: 59%–68%) and 130 male (36%; CI95: 32%–41%). Subject age ranged from 21 to 59 years, with mean (SD) 38 (11) and median (Q1–Q3) 36 (29–46). Distribution was not uniform (Chi-square = 89.09; df = 4; p < 0.05). The groups 20 to 29, 30 to 39 and 40–49 years were larger than the groups 50 to 59 and 60 or over. The largest age group in the sample was 30–39 years (31%; CI95: 27%–36%), Table 1.

**Characteristics related to role at the institution.** Regarding role within the hospital, the sample comprised 265 teaching staff (74%; CI95: 69%–78%) and 93 non-teaching staff (26%; CI95: 22%–31%). The distribution of the tested subjects according to the type of activity showed that 313 people performed clinical jobs (90%; CI95: 87%–92%) while 45 performed nonclinical jobs (13%; CI95: 10%–16%).

The largest groups of subjects belonged to the departments of Diagnostic Imaging (N = 45; CI95: 10%–16%), Emergency (N = 40; CI95: 8%–15%), Endodontics (N = 36; CI95: 10%–16%), Oral and Maxillofacial Surgery (N = 34; CI95: 7%–13%) and Prosthodontics (N = 29; CI95: 6%–11%), Table 2.

**Diagnostic tests.** Three diagnostic tests were used: commercial rapid serologic test, ELISA and PCR. Rapid tests were performed on 290 subjects, with 255 negative results (88%; CI95: 84%–91%) and 35 positive (12%; CI95: 9%–16%); ELISA was performed on 317 subjects, 308 negative (97%; CI95: 95%–98%) and 9 positive (3%; CI95: 2%–5%); and

**Table 1** Distribution according to age group.

| Group of Age (years) | N  | %     | CI95 |
|----------------------|----|-------|------|
| 20 a 29              | 97 | 27    | 23 a 32 |
| 30 a 39              | 112| 31    | 27 a 36 |
| 40 a 49              | 89 | 25    | 21 a 30 |
| 50 a 59              | 44 | 12    | 9 a 16  |
| 60 or more           | 16 | 5     | 3 a 7  |
| Total                | 358| 100   |       |

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PCR was performed on 204 subjects, 196 negative (96%; CI95: 92%–98%) and 8 positive (4%; CI95: 2%–8%).

There were 358 subjects who were evaluated by ELISA or PCR, with 342 negative results (96%; CI95: 93%–97%) and 16 positive results (4%; CI95: 3%–7%), Table 3.

There was no significant difference in positive test results according to job type (clinical or nonclinical) (Fisher’s exact test: p = 0.70). However, there were significant differences according to job location (intramural activity or extramural activity) (Fisher’s exact test: p < 0.05). Data are shown in Fig. 1 and Fig. 2, respectively.

4. Discussion

There are few reports worldwide that analyze the frequency of COVID-19 infections in dental hospitals and dental schools, and none in Latin America. We studied the infection rate of SARS-CoV-2 in FOUBA workers during the first six months of the COVID-19 pandemic. For this sample of dentists, dental assistants and nonclinical personnel, the weighted prevalence of COVID-19 was 4%. This value was higher than infection rates reported for healthcare workers in the Netherlands (0.9%) and China (1%), possibly because those two studies were conducted early in the pandemic. The study in hospitals in the Netherlands was conducted 15 days after the first diagnosis of COVID-19 in the Netherlands, and tested only professionals who reported fever or any respiratory symptom (symptomatic). In contrast, our study was conducted 180 days after the pandemic was declared, following the first wave of contagion, and estimated infection seroprevalence in Buenos Aires City was 15%, with peaks of 42% in low-income neighborhoods. Our value was similar to the rate in Seattle, Washington (5.3%) and multicentric studies in the Netherlands (5%),12 and lower than the rate reported in Qatar (10%).14 Cameron et al.,14 in what was the first report of COVID-19 prevalence in the dental community in the USA, conducted an online survey, finding COVID-19 prevalence of 1%; however, only 16% of the respondents had undergone specific molecular and/or serological detection testing, whether during check-ups or due to epidemiological criteria, while the rest only reported absence of symptoms and had not undergone testing, which leaves out of the study possible asymptomatic or paucisymptomatic cases. In the UK, 3% of hospital workers tested positive for SARS Cov 2, but they were all considered asymptomatic and/or paucisymptomatic.15 In our study, 100% of the participants underwent one of the specific diagnostic tests, following specific protocols developed by the institution for monitoring and care of hospital staff, thereby including any possible clinical presentations of the disease.

COVID-19 can be diagnosed according to a combination of epidemiological data, direct or indirect laboratory tests and clinical symptoms.16 Clinical presentation is highly variable. There are asymptomatic patients, who pose a problem at epidemiological level due to their ability to transmit the disease unperceived, and paucisymptomatic patients who have only very mild symptoms. Mean incubation period is about 5 days (range 0–14 days), with 97.5% of patients developing the disease within the first 12.5 days of incubation. Direct laboratory detection of viral RNA or molecular diagnosis is based on RT-PCR techniques that study specific sequences of the virus genome. Our study used the molecular target proposed by Argentina’s Reference Laboratory (ANLIS, Malbrán). Regardless of the method used, sensitivity and specificity of the different RT-PCR kits are not 100%,18 which means that they can present false negatives. In negative cases in which suspicion or clinical signs of the disease persists, it is recommended to repeat the RT-PCR with a swab sample within a few days. COVID-19 infection can also be detected indirectly by measuring the host’s immune response to infection by SARS-CoV-2. Diagnosis by serology is especially important for patients with mild to moderate disease, who may come forward late, after the first 2 weeks since the beginning of the disease. It is also important for identifying asymptomatic individuals who have had the disease. Diagnosis by serology is becoming an important tool to understand the extent of COVID-19 in the healthcare community. Specific IgA, IgM and IgG isotype antibodies to different viral proteins are detected by enzyme-linked immunosorbent assay (ELISA).19 IgM and IgG antibody assays based on ELISA have specificity higher than 95% for diagnosing COVID-19. Detection of class IgG, IgM + IgA antibodies for COVID19 SARS-CoV-2, is performed on blood and evaluates patient immune status after exposure to the virus. Class IgM/IgA antibodies (COVID-19) are the first to appear. They are detected as from one week after the onset of the infection, and generally persist up to 35 days; suggesting recent infection with SARS-CoV-2. Class IgG antibodies (COVID-19) generally reach detectable levels 2 weeks after infection and usually persist several months, suggesting recent or prior infection with SARS-CoV-2.20 In our study, 317 ELISAs were performed. Rapid tests for detecting antibodies

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**Table 2**

| Department                          | N   | %     | IC95(%) |
|-------------------------------------|-----|-------|---------|
| Diagnostic Imaging                  | 45  | 12.57 | 9.53 a 16.41 |
| Emergency                           | 40  | 11.17 | 8.31 a 14.86 |
| Residence Program                   | 38  | 10.61 | 7.83 a 14.23 |
| Endodontics                         | 36  | 10.06 | 7.35 a 13.61 |
| Oral Maxillofacial Surgery          | 34  | 9.50  | 6.88 a 12.98 |
| Prosthodontics                      | 29  | 8.10  | 5.7 a 11.39  |
| Extramural activities               | 22  | 6.15  | 4.09 a 9.13  |
| Pediatric Dentistry                 | 17  | 4.75  | 2.99 a 7.47  |
| Maintenance                         | 15  | 4.19  | 2.56 a 6.8   |
| Comprehensive care clinic           | 12  | 3.35  | 1.93 a 5.77  |
| Periodontics                        | 7   | 1.96  | 0.9 a 3.06   |
| Preclinical Restorative Dentistry   | 7   | 1.96  | 0.95 a 3.98  |
| Microbiology                        | 6   | 1.68  | 0.77 a 3.61  |
| Orthodontics                        | 5   | 1.40  | 0.6 a 3.22   |
| Treasury                            | 5   | 1.40  | 0.6 a 3.32   |
| Restorative Dentistry               | 4   | 1.12  | 0.44 a 2.84  |
| Sterilization center                | 3   | 0.84  | 0.29 a 2.43  |
| Medically Compromised Patient Clinic| 5   | 1.40  | 0.6 a 3.23   |
| Physiology                          | 3   | 0.84  | 0.29 a 2.43  |
| Digital Technologies for Oral Rehabilitation | 3  | 0.84  | 0.29 a 2.43  |
| Community and Preventive Dentistry  | 3   | 0.84  | 0.29 a 2.43  |
| General Administration              | 2   | 0.56  | 0.15 a 2.01  |
| Technical department                | 2   | 0.56  | 0.15 a 2.01  |
| Internal Medicine                   | 2   | 0.56  | 0.15 a 2.01  |
| Admission                          | 2   | 0.56  | 0.15 a 2.01  |
| Postgraduate office                 | 2   | 0.56  | 0.15 a 2.01  |
| Dinning room                        | 1   | 0.28  | 0.05 a 1.57  |
| Accounting                          | 1   | 0.28  | 0.05 a 1.57  |
| Legal department                    | 1   | 0.28  | 0.05 a 1.57  |
| Oral Medicine                       | 1   | 0.28  | 0.05 a 1.57  |
| Histology                           | 1   | 0.28  | 0.05 a 1.57  |
| Dental Materials                    | 1   | 0.28  | 0.05 a 1.57  |
| Pathological waste                  | 1   | 0.28  | 0.05 a 1.57  |
| Undergraduate office                | 1   | 0.28  | 0.05 a 1.57  |
| Administrative Research Office      | 1   | 0.28  | 0.05 a 1.57  |
| Total                               | 358 | 100.00|         |

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**Table 3**

| Result       | Rapid test | ELISA | PCR |
|--------------|------------|-------|-----|
| N            | %          | N     | %   | N   | %   |
| Negative     | 255        | 88    | 84 a 91 | 308 | 97 | 95 a 98 |
| Positive     | 35         | 12    | 9 a 16  | 9   | 3  | 2 a 5  |
| Total        | 290        | 100   |       | 317 | 100|      |

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have been widely developed and marketed, and are of variable quality. They are purely qualitative and can only indicate presence or absence of antibodies for SARS-CoV-2. Serology techniques enable detection of IgM and IgG antibodies. There is evidence that these tests can begin to detect antibodies as from 5 days after the onset of symptoms, so can only be useful for populational seroprevalence studies. We performed 290 tests. There are now commercial serologic tests (immunochromatography) available, which are performed with whole blood and could be useful for

Fig. 1. Type of Job and diagnosis (N; %). Fisher’s exact test: $p = 0.70$.

Fig. 2. Place of Job and diagnosis (N; %). Fisher’s exact test: $p < 0.05$. 

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diagnosis. 31

The majority of workers who provided services during the pandemic took part in this study, although it did not include all the staff at FOUBA. Out of the total 430 workers who provided services, only 358 were tested, due to economic or logistic constraints, which is a limitation of the study. The study included staff from the Emergency Service and Resident Program (n: 78), endodontics, diagnostic imaging and oral and maxillofacial surgery areas (n: 114) and workers who performed extramural activities (community services) (n:22). These departments performed over 90% of the dental practices during the study period, which makes the sample representative in terms of the aims of this study. Five (4.1%) workers from the Departments of Endodontics, Diagnostic Imaging and Oral and Maxillofacial Surgery were positive for COVID-19 tests. There were no positive results for tests on the staff working in the Emergency Service and Resident Program. Out of the 22 workers who performed community services, 6 (27.2%) were positive for COVID-19. Community services consisted of extramural activities performed mainly in low-income neighborhoods during the peak of the contagion curve. The main mission of community workers was to cooperate with epidemiological and nasopharyngeal testing in non-hospital settings and providing personalized assistance in the field, which would explain the fact that they had a higher positivity rate than other members of hospital staff. Nguyen et al. clearly determined that this class of health personnel is at greater risk of infection during this pandemic.22 If community workers who did not provide dental care in the FOUBA setting had not been considered in the sample, the prevalence of COVID-19 would have been 2.95%. Having included personnel involved in activities with potentially greater risk of contagion, and not having been able to monitor them with more frequent testing as from the beginning of the pandemic in order to ascertain not only prevalence but also incidence, are also limitations of this study.

During the WHO-China Joint Mission on COVID-19, 2055 laboratory confirmed cases were reported among healthcare workers from 476 hospitals in China, mostly (88%) from Hubei Province. Most healthcare workers were believed to have been infected within household settings rather than in healthcare settings, although conclusive evidence was scant.23 Our study found no epidemiological link between providing dental care and COVID-19 contagion. Any cases for which it was possible to establish links were found to have occurred in non-hospital settings or in community work. During the period included in this study, 21,641 patients received care at the FOUBA, on whom more than 30,000 dental practices were performed, most of which were to treat dental urgencies. Even though this study does not analyze the efficacy of using PPE or of the dental care protocols used by the personnel,24 the low rates of contagion among clinical personnel still enable the inference that their proper use25,26 while providing dental care, and the habits acquired for out-of-hospital behavior, are effective for preventing infection by SARS-CoV-2.

5. Conclusion

To the best of our knowledge, this is the first study to estimate the frequency of SARS-CoV-2 infection among Latin American workers in a dental hospital. For this sample of dentists, dental assistants and nonclinical personnel, the weighted prevalence of COVID-19 was 4%. Further studies will assess ongoing rates of COVID-19 for the dental community around the world, in addition to defining the incidence of disease rates.

Declaration of competing interest

The authors declare no conflicts of interest.

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