Pesquisa Brasileira em Odontopediatria e Clínica Integrada 2025; 25:e230003
https://doi.org/10.1590/pboci.2025.001
ISSN 1519-0501 / eISSN 1983-4632

ORIGINAL ARTICLE

COVID-19: Factors Associated with Dental Students' Fear of Infecting their Relatives as a Result of Clinical Practice

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Academic Editor: Fátima Regina Nunes de Sousa

Received: January 11, 2023 / **Review:** December 07, 2023 / **Accepted:** April 04, 2024

How to cite: Oliveira Júnior M, Souza FC, Gomes RCN, Vargas-Ferreira F, Mattos FF, Abreu MHNG, et al. COVID-19: Factors associated with dental students' fear of infecting their relatives as a result of clinical practice. Pesqui Bras Odontopediatria Clín Integr. 2025; 25:e230003. https://doi.org/10.1590/pboci.2025.001

ABSTRACT

Objective: To evaluate the factors associated with the fear of dental students infecting their relatives with COVID-19 as a result of clinical practice. **Material and Methods:** Online questionnaires were sent by e-mail and social media to dental students from a Brazilian School of Dentistry. The outcome was "fear of infecting the family." The independent variables were sociodemographic data, personal protective equipment use, adoption of infection control measures, and knowledge and feelings about the pandemic and the future of Dentistry. Data analysis used Pearson's Chi-square and Fisher's exact tests ($p \leq 0.05$). **Results:** With 65 participants, the prevalence of fear was 61.5%. Measures to prevent COVID-19, such as frequent hand cleansing ($p=0.028$) and avoiding the use of aerosol-generating instruments ($p=0.027$), not having or not knowing if they have been infected by the disease ($p=0.038$), and feelings of more significant anxiety during the pandemic period ($p=0.047$), and that Dentistry will undergo major post-pandemic changes ($p=0.020$) were associated with fear. **Conclusion:** Changes in behavior about biosafety and feelings of anxiety and uncertainty about the disease were associated with the dental students' fear of infecting their relatives with COVID-19 as a result of clinical practice.

Keywords: COVID-19; Dentistry; Students, Dental; Fear; Teaching.

Introduction

Identified in December 2019 in Wuhan, China, the Coronavirus Disease 2019 (COVID-19), caused by the SARS-CoV-2 virus, was declared a pandemic in March 2020 by the World Health Organization (WHO), configuring as a public health emergency in a short period [1]. It is an infectious disease with symptoms including fever, cough, fatigue, loss of smell and taste, myalgia, and possible death in severe cases [2]. The transmission occurs through inhalation, ingestion, and direct contact with mucous membranes with droplets of saliva containing the virus [3].

Exposed to aerosols containing water, saliva, and blood, the dental staff faces a higher risk of SARS-CoV-2 infection [4]. Such entities as the Center for Disease Control and Prevention (CDC), the American Dental Association (ADA), and the Brazilian Health Surveillance Agency (ANVISA) initially recommended that only unavoidable elective procedures and urgent/emergency interventions should be carried out during the period of the pandemic [5-7]. As SARS-CoV-2 vaccines became available, dental care gradually returned with new biosafety protocols, which were constantly adjusted according to scientific evidence [6,8].

The COVID-19 pandemic caused public health problems due to its contagious nature. Healthcare professionals, especially dentists, incorporated many modifications in their practices to prevent themselves, their families, and patients from the risk of infection [9]. Dental students have been facing several fears, such as the fear of being infected, infecting family members, losing manual dexterity, and anxiety related to the new educational and economic scenario caused by the pandemic and the risks of practicing Dentistry in the post-COVID-19 world [10]. The virus's fast and easy transmission, social restrictions, the initial lack of knowledge about the disease and its consequences, and the uncertainty about how long the situation would endure caused constant feelings of anxiety and fear [11].

As the dental profession is exposed to infectious respiratory diseases during clinical activities, monitoring biosafety protocols and these professionals' feelings about these risks must be constant. This study is justified in understanding dental students' behavior in the face of this pandemic. Therefore, the present study aimed to evaluate the factors associated with dental students' fear of infecting family members with COVID-19 due to the high risk of infection in clinical practice. This study hypothesizes that the students' fear of infecting their family members was associated with their behavior during clinical activities.

Material and Methods

Study Design and Ethical Clearance

This cross-sectional study was conducted with students from the School of Dentistry of Federal University of Minas Gerais (UFMG), and was approved by the Ethics Committee (Protocol number 4.770.287).

Data Collection

At the beginning of the COVID-19 pandemic, clinical activities at UFMG were suspended for nine months (from March 2020 to December 2020). All students who had contact with clinical dental practice before and after the return of clinical activities were invited to participate in this study. Therefore, students from the 4th to 9th period of the course were invited to participate in the study. At the time of data collection, students in the 10th period of the course had already graduated due to curricular irregularities caused by the pandemic and social isolation.

A self-administered, pre-tested questionnaire was used for data collection. It was created using Google Forms and included purpose-made and adapted questions from other studies [12-14]. A pilot version of the

questionnaire was tested, modified, and retested after 15 days with ten students from different dental schools. A third version of the questionnaire was written to ensure better understanding, and another test-retest pilot study was conducted with eight students. Kappa coefficient (k>0.70) and Cronbach's Alpha (α>0.60) assessed, respectively, the temporal stability and the internal consistency of the questionnaire. The questionnaires were sent to the final sample from December 2021 to February 2022 through e-mail and social media (Instagram and WhatsApp).

The return to dental activities during the pandemic required a behavior change to protect academics and patients due to the possible transmission of SARS-CoV-2 by procedures that generate aerosols [15]. This study was based on a theoretical model, entitled Capability, Opportunity, Motivation – Behavior (COM-B), proposed by Michie et al. [16], which was used to understand behavior changes in the return of post-COVID-19 dental practices [17].

According to the COM-B model, behavior changes are a result of the interaction among three factors: the individual's psychological and physical capability to engage in new behavior, including knowledge and ability to do so; the opportunity, defined by external factors that make behavior possible or can induce it; and motivation, which is the conscious or automatic way of thinking and making plans to act on that new behavior, including analytical decision-making and emotional responses. Interventions or policies can also influence behavior, and regulatory agencies have proposed protocols and legislation for the return of dental care [5-7]. Figure 1 presents the study variables, organized according to the COM-B model.

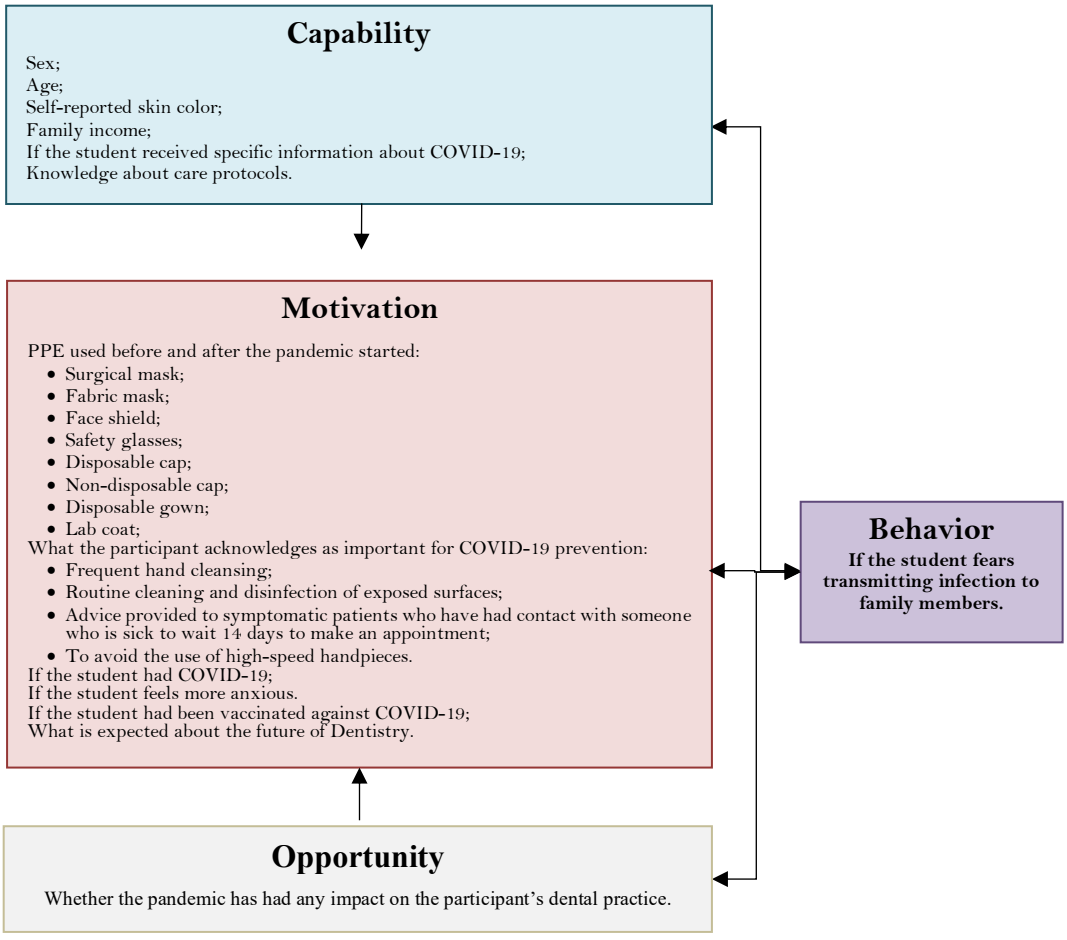

Figure 1. The behavior change flowchart, according to Michie et al. [16], was adapted to the research variables.

The questionnaire included sociodemographic data, personal protective equipment (PPE) used before and after the pandemic started, and the student's perception of necessary measures for COVID-19 prevention, as well as knowledge and feelings about the disease, its impact on dental practice, and expectations about the future of the profession.

The outcome was 'Do you fear bringing the infection from dental practice into your family?'. The original answers (yes, no, or not sure) were dichotomized into 'yes' or 'no,' recoding 'no' and 'not sure' into 'no.' Sociodemographic data were: sex (male or female), age in years dichotomized in medians (21-24 and 25-36 years of age), self-reported skin color ('Yellow,' 'White,' 'Indigenous,' 'Brown,' 'Black' and 'I'd rather not answer') dichotomized in 'white' and 'non-white' ('I'd rather not answer' was considered as missing data), and family income before and at the beginning of the pandemic ('up to 3', '3 to 6', '6 to 9' and 'over 9 minimum wages') was dichotomized in 'changed' or 'did not change.'

The variables' what the student acknowledges as important for COVID-19 prevention' ('frequent hand cleansing with water and soap or 70% alcohol', 'routine cleaning and disinfection of exposed surfaces,' 'advice provided to symptomatic patients or who have had contact with someone who is sick to wait 14 days to make an appointment', and 'to avoid the use of a high-speed handpiece') were dichotomized in 'yes' or 'no.'

Data related to 'if the student had COVID-19' and 'if the student feels more anxious during the COVID-19 pandemic outbreak' were dichotomized into 'yes' or 'no', after adding up 'no' and 'don't know' answers. Information on 'if the student received specific information about COVID-19', 'if the student had been vaccinated against COVID-19', "if the student had 'knowledge about care protocols, and 'if the pandemic had any impact on the participant's dental practice' were dichotomized into 'yes' or 'no.' Answers concerning 'what the students think about the profession's future' ('no change,' 'few changes' and 'great changes') were dichotomized into 'no/few changes' and 'great changes.'

Furthermore, 'PPE used before' and 'PPE used during the pandemic' ('surgical mask,' 'N95/PFF2/PFF3 mask', 'fabric mask,' 'face shield,' 'safety glasses,' 'disposable cap,' 'non-disposable cap,' 'disposable gown' and 'lab coat') were assembled as 'PPE used before and during the pandemic.' Each PPE was compared and classified as 'changed' and 'did not change.' For example, if the student answered 'yes' to 'use the fabric cap' before the pandemic and answered 'yes' to 'use the fabric cap' during the pandemic, it was categorized as 'did not change.'

Data Analysis

The results were descriptively analyzed using the Statistical Package for Social Sciences (IBM Corp. Armonk, NY, USA), version 22.0. Pearson's Chi-Square and Fisher's Exact tests were used with a significance of 5% ($p<0.05$) to assess the association between the exposures and the outcome.

Results

At first, 75 students answered the questionnaire, but ten answers had to be excluded. One student had no clinical practice before the COVID-19 pandemic, three had not returned to clinical activities, five were duplicated, one was duplicated, and the other had not returned to clinical activities. The final sample consisted of 65 answers, totaling 17.71% of the population (N=367).

The prevalence of fear was 61.5%. Most of the students were female (76.9%), 21 to 24 years old (61.5%), and self-reported their skin color as white (66.2%). Family income remained the same for most students (86.2%) before and after the pandemic. Frequent hand cleansing with water and soap or alcohol 70% (90.8%), routine

cleaning and disinfection of exposed surfaces (90.8%), and avoiding the use of high-speed handpieces (64.6%) were considered to be essential for COVID-19 prevention by the majority of the participants. Most students reported that they did not have or did not know if they had been infected by COVID-19 (70.8%) and felt more anxious during the pandemic outbreak (87.7%). All students were informed that they were vaccinated. Most of the students reported knowing COVID-19 care protocols (92.3 %), that the pandemic caused an impact on their dental academic practices (96.9%), and that Dentistry will undergo few changes in the future (53.8%) (Table 1).

Table 1. Descriptive analysis of the virtual forms answered by dental students.

Variables	N	%
Fear of transmitting the disease from dental practice to family members		
Yes	25	38.5
No	40	61.5
Sex		
Female	50	76.9
Male	15	23.1
Age (Years)		
21 to 24	40	61.5
25 to 36	25	38.5
Self-reported skin color*		
White	43	66.2
Non-white	16	24.6
Family income		
Increased	4	6.2
Decreased	5	7.7
Remained the same	56	86.2
What the student acknowledges as important for COVID-19 prevention		
Frequent hand cleansing with soap or 70% alcohol		
Yes	59	90.8
No	6	9.2
Routine cleaning and disinfection of exposed surfaces		
Yes	59	90.8
No	6	9.2
Advice provided to symptomatic patients or who have had contact with someone who was sick to wait 14 days to make an appointment		
Yes	25	38.5
No	40	61.5
To avoid the use of high-speed handpieces		
Yes	42	64.6
No	23	35.4
Knowledge and feelings about the disease		
If the student had COVID-19		
Yes	19	29.2
No/I don't know	46	70.8
If the student feels more anxious		
Yes	57	87.7
No/I don't know	8	12.3
If the student received specific information about COVID-19		
Yes	65	100.0
No	0	0.0
If the student had been vaccinated against COVID-19		
Yes	65	100.0
No	0	0.0
Knowledge about care protocols		
Yes	60	92.3
No	5	7.7
Impact on dental practice and expectations about the future		
If the pandemic had any impact on the participant's dental practice		

Yes	63	96.9
No	2	3.1
What is thought about the future of Dentistry		
No/Few changes	35	53.8
Major changes	30	46.2

*Six participants answered, "I'd rather not answer."

Most students reported that they changed the use of surgical masks (75.4%), and all students answered that they started to use N95/PFF2/PFF3 masks in clinical activities after the pandemic outbreak. Most students (98.5%) responded that they were not using fabric masks. Some 98.5% of the participants had started using face shields after the pandemic began. Most students reported maintaining safety glasses (81.5%) and disposable caps (90.8%), and 75.4% reported not using non-disposable caps. Most of the participants answered that they changed their lab coat use, 78.5% stopped using lab coats, and 86.2% started using disposable gowns (Table 2).

Table 2. Descriptive analysis of the PPE used before and after the onset of the pandemic.

Variables	N	%
Surgical Mask		
Changed	49	75.4
Did not change	16	24.6
N95/PFF2/PFF3 Mask		
Changed	65	100.0
Did not change	0	0.0
Fabric Mask		
Changed	1	1.5
Did not change	64	98.5
Face Shield		
Changed	64	98.5
Did not change	1	1.5
Safety Glasses		
Changed	12	18.5
Did not change	53	81.5
Disposable Cap		
Changed	6	9.2
Did not change	59	90.8
Non-disposable Cap		
Changed	16	24.6
Did not change	49	75.4
Disposable Gown		
Changed	56	86.2
Did not change	9	13.8
Lab Coat		
Changed	51	78.5
Did not change	14	21.5

Students who considered avoiding the use of high-speed handpieces (p=0.027) and frequent hand cleansing with water and soap or 70% alcohol (p=0.028) to be essential protection measures were associated with more fear of transmitting the disease to family members. Moreover, students who answered that they did not have or did not know if they had been infected by COVID-19 (p=0.047) and who reported more anxiety during the pandemic (p=0.038) were associated with a greater fear of infection. Those who believed that dentistry would undergo significant changes after the pandemic were related to having a greater fear of the disease (p=0.20) (Table 3).

Table 3. Analysis of associations between 'Do you fear transmitting infections from your dental practice to your family members?' and independent variables.

Variables	Outcome (Yes) N (%)	p-value
Sex		
Male	8 (53.3)	0.177**
Female	17 (34.0)	
Age (Years)		
21 to 24	25 (62.5)	0.840**
25 to 36	15 (60.0)	
Skin Color		
White	29 (67.4)	0.218**
Not white	8 (50.0)	
Family Income		
Increased	3 (75.0)	0.634**
Decreased	3 (60.0)	
Remained the same	34 (60.7)	
PPE used Before and After the Pandemic Started		
Surgical Mask		
Changed	31 (63.3)	0.617**
Did not change	9 (56.3)	
Tissue mask		
Changed	0 (0.0)	0.385*
Did not change	40 (62.5)	
Face shield		
Changed	40 (62.5)	0.385*
Did not change	0 (0.0)	
Safety goggles		
Changed	8 (66.7)	0.754*
Did not change	32 (60.4)	
Disposable cap		
Changed	3 (50.0)	0.668*
Did not change	37 (62.7)	
Tissue cap		
Changed	10 (62.5)	0.927**
Did not change	30 (61.2)	
Disposable gown		
Changed	36 (64.3)	0.288*
Did not change	4 (44.4)	
Lab coat		
Changed	31 (60.8)	1.000*
Did not change	9 (64.3)	
What participant acknowledges as important for COVID-19 prevention		
Frequent Hand Cleansing		
Yes	39 (66.1)	0.028*
No	1 (16.7)	
Routine cleaning and disinfection of exposed surfaces		
Yes	37 (62.7)	0.668*
No	3 (50.0)	
Advice provided to symptomatic patients or who have had contact with someone who is sick to wait 14 days to make an appointment		
Yes	34 (63.0)	0.737*
No	6 (54.5)	
To avoid the use of high-speed handpieces		
Yes	30 (71.4)	0.027**
No	10 (43.5)	
Knowledge and feelings about the disease		
If the student had COVID-19		
Yes	8 (42.1)	0.038**
No/I don't know	32 (69.6)	

If the student feels more anxious		
Yes	38 (66.7)	0.047*
No	2 (25.0)	
Knowledge about care protocols		
Yes	36 (60.0)	0.641*
No	4 (80.0)	
Impact on dental practice and expectations about the future		
If the pandemic had any impact on the participant's dental practice		
Yes	40 (63.5)	0.144*
No	0 (0.0)	
What is expected about the dentistry future		
No/Few changes	17 (48.6)	0.020**
Great changes	23 (76.7)	

*Fisher's exact test; **Chi square test.

Discussion

Students mostly reported being afraid of transmitting COVID-19 infection to their relatives. Those who considered it essential to avoid the use of high-speed handpieces, when possible, those who frequently clean their hands with soap and water or 70% alcohol, those who did not have COVID-19 or did not know, those who reported more anxiety and who believed that Dentistry would undergo significant changes after the pandemic were associated with a greater fear of transmitting the disease to the family.

Other studies with dental students reported that the fear of infecting family members with COVID-19 was the most stressful factor related to spreading the disease to elder relatives with comorbidities and children [10,18]. Several factors have been associated with the fear of the disease, such as its quick transmission, mortality rate, the large number of asymptomatic carriers, the uncertainty about its origin, and the contradictory statements of medical authorities [18]. A scoping review analyzed the mental health issues and stressors that impacted dental students and showed that undergraduate dental students experienced stress, anxiety, or depression during the pandemic period. Besides that, fear of infection, especially during patient interaction, adapting to virtual learning, clinical skill deficit due to lack of/limited practical training and social isolation were other reported stressors [19].

Compared to other courses, dental education is recognized as highly stressful due to the large amount of information it requires, academic competition, the fear of failure, and the risk of treatment complications [20]. Furthermore, studies on previous outbreaks of similar diseases, such as severe acute respiratory syndrome (SARS), have demonstrated various factors leading to psychological trauma in training care providers and healthcare workers, including the fear of being infected and infecting their families [21]. The outbreak of the COVID-19 pandemic may have increased anxiety by raising doubts about the reliability of new preventive protocols since dental care involves a high risk of infection [4]. However, infection rates among oral health professionals have been similar for the general population, demonstrating that care protocols have been successful [22].

Higher rates of COVID-19 infections and deaths were found among those with lower income, and the pandemic has increased social disparities caused by its social and economic consequences [23]. Nevertheless, most students answered that their family income remained the same when compared to the pre-pandemic period. This can be explained by Brazil's university education and its unequal demographics when compared to the general population, especially in public dental education, where, on average, dental students are from high-income families [24]. This group was most likely less affected by the pandemic's social and economic consequences [25].

Previous studies found similar results on what students and dental staff recognize as necessary for COVID-19 prevention, like hand cleansing with water and soap or 70% alcohol, routine cleaning and disinfection of exposed surfaces, and the avoidance of high-speed handpiece use [26,27]. However, in the present study, only frequent hand cleansing and high-speed handpiece avoidance were associated with the fear of infecting family members. Manual instruments can replace high-speed handpieces as a strategy for aerosol reduction [26]. However, data from the literature is inconclusive in reporting students' perceptions of the need for aerosol reduction in dental care and its importance in controlling COVID-19 [26,27].

Many students in this study did not consider advising symptomatic patients or potential asymptomatic patients to wait before making an appointment as an essential measure. Such a finding could be related to students not controlling patients' scheduling in SD-UFMG clinics. Given the higher risk of infection during dental care, it is critical that students be aware of COVID-19 symptoms and delay elective procedures should they suspect any infection [5-8].

UFMG dental students reported not being infected by COVID-19 or not knowing if they had been infected by the disease, which was related to their fear of infecting relatives. This finding may be related to the fact that those who are most afraid of infecting their family members are more careful in their clinical routine and do not infect themselves. The literature has already shown that healthcare workers who adopt additional protective measures are more afraid of being infected and infecting their relatives [28].

All students were informed about the pandemic, and most reported knowledge about care protocols. This finding can be explained by the fact that SD-UFMG demanded that students do a mandatory training course on COVID-19 transmission routes, signs, symptoms, and preventative measures before returning to patient care in academic dental clinics [27].

All participants reported being vaccinated against COVID-19. In Brazil, vaccination uptake and acceptance have been high, with more than 80% of Brazil's population protected with two doses by the time of this study [29]. Brazil has a tradition of a strong primary healthcare system and cultural vaccination acceptance [30].

Students who expected significant changes in Dentistry had a larger prevalence of the fear of infecting relatives. Pandemics have devastating and transformative effects on society, the economy, and health systems. Current knowledge about pathogen transmission through direct contact with blood and saliva makes resistance to PPE usage in dental care unsustainable [31]. COVID-19 is a new opportunity for optimizing cross-infection control protocols, especially for air-borne diseases.

All participants changed the use of surgical masks and began to use N95/PFF2/PFF3 masks, which are more effective, as they have more layers, can be reusable [5,7], and have an electrostatic treatment capable of filtering tiny particles. These also provide better sealing and avoid air leakage [32]. It should be noted that the students carry out their clinical activities using the biosafety protocols of the higher education institution. As SD-UFMG demanded that students do a training course on COVID-19 [27], and revised the biosafety protocols for the return clinical activities during the COVID-19 pandemic, this behavior change was probably strongly induced and monitored by the new protocol.

It is advisable to combine the use of safety glasses and face shields to prevent splashes and droplets that can reach one's eyes through spaces between the equipment and the face [5] to prevent COVID-19 transmission. This requirement is part of SD-UFMG's care protocol. Nearly all students began to use face shields in dental clinics, and many continued to wear safety glasses. The reason why students did not wear safety glasses may well be because their use, together with face shields, could disturb their eyesight. In the past, practitioners

reported thermal discomfort leading to decreased accuracy, concentration, and visibility during surgery caused by the additional protection [28].

One previous paper reported poor knowledge of PPE use to prevent COVID-19 infections among SD-UFMG students [27]. Although most participants in this study exchanged lab coat use for disposable gowns, some reported the continued use of lab coats. This finding may have resulted from lab coats being still allowed in laboratories, and some students needed to understand the use of those in different academic environments. However, this same study found an inadequacy among SD-UFMG students concerning their knowledge about the proper PPE to be used against COVID-19 infections [27]. Most respondents continued to wear disposable caps and did not use fabric masks and non-disposable caps, as required by SD-UFMG protocols.

The present study investigated a specific population with a limited sample caused by a low response rate (17.71%), which does not allow for generalizations, and its cross-sectional design does not allow one to determine causality. Data collection could only be performed through online surveys due to social distancing and, as the literature states when online data collection is compared to paper-based surveys, response rates drop consistently [33]. However, these study findings offer information to understand better the psychological implications of the risks of SARS-CoV-2 infections among dental personnel, such as fear and anxiety, especially when one considers the fact that dental students are already distressed academics. However, nowadays, COVID-19 cases have reduced considerably, and healthcare professionals and students are leaving out all practice modifications previously incorporated [9]. Higher Education Institutions need to be aware of the changes in biosafety protocols caused by COVID-19 to mitigate future risks.

Conclusion

Measures to prevent COVID-19, such as frequent hand cleansing and avoiding the use of aerosol-generating instruments; not having or not knowing if the disease has infected them; feelings of greater anxiety during the pandemic period, and that Dentistry will undergo major post-pandemic changes were associated with a fear of the disease.

Authors' Contributions

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All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

Financial Support

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

Acknowlegements

Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Pró-Reitoria de Pesquisa da Universidade Federal de Minas Gerais (PRPq-UFMG).

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