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ORIGINAL ARTICLE

Impacts of the COVID-19 pandemic on the routine of Brazilian oral radiologists

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Abstract

Objective To analyze the challenges and impacts of COVID-19 on the routine of Brazilian oral radiologists regarding changes in biosafety protocols, number of patients and staff, the flow of acquisition, and availability of images.

Methods Structured digital questionnaires with questions related to the impacts of the COVID-19 pandemic on Oral Radiology were applied and analyzed. Descriptive statistical analysis was used to describe the items included in the survey, and means and standard deviations were calculated to describe continuous variables and frequency percentages to describe categorical data.

Results A high number of Brazilian oral radiologists continued to work in the pandemic period, with little or no change in their working hours. Digital flow and teleradiology are in most of their workplaces and the changes imposed by the pandemic will be incorporated and permanent, according to most of the participants in this study.

Conclusions The COVID-19 pandemic brought important impacts on radiology clinics, with changes in the flow of patients, in the service and in the type of exam performed. In addition, adaptation to biosafety standards became necessary, with a significant increase in spending on personal protective equipment.

Keywords COVID-19 · SARS-CoV-2 · Radiology · Dentistry · Brazil

Introduction

The COVID-19 infectious disease caused by the coronavirus (SARS-CoV-2) has had numerous impacts on global routine, whether in social life, in the economy, but mainly in health and associated services [1]. In this context, the routine of the dentists was widely affected, due to the great potential for aerosol production caused by dental procedures [2, 3].

Complementary imaging exams are important for establishing the correct diagnosis and, consequently, for choosing the most appropriate treatment [4]. Therefore, Oral Radiology, as a dental specialty, had to continue advancing in its role in patient care, even with the challenges posed by the COVID-19 pandemic [5]. For this, biosafety measures to contain the viral spread were adopted [6, 7]. In addition, paying attention to the correct indication of the exam, as well as reducing the number of workers and patients circulating in the clinical environment, was encouraged [8].

During the pandemic, the Brazilian Association of Radiology and Imaging Diagnosis [9] and other international entities released guidelines guiding the use of tele-radiology or digital flow in times of COVID-19 pandemic, considering that this modality presents less risk of dissemination and contamination by harmful agents. Digital systems were preferred over conventional systems to avoid contamination [10]. By associating digital image acquisition and flow strategies with infection control protocols, oral radiologists, staff and patients have had greater safety and protection during the COVID-19 pandemic [5].

Therefore, the aim of this study was to analyze the impacts of COVID-19 on the routine of Brazilian oral

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radiologists to obtain important data regarding changes in biosafety protocols, financial impacts and the number of patients and staff, the flow of acquisition and availability of images and the challenges faced by professionals in the context of the pandemic and post-pandemic.

Materials and methods

This cross-sectional study was approved by the Research Ethics Committee of the Federal University of Juiz de Fora, under protocol number 4.210.683.

Structured digital questionnaires with 30 questions related to the impacts of the COVID-19 pandemic in Brazilian Oral Radiology (Fig. 1) were applied and analyzed. The questionnaires were adapted from a previous study [11] which assessed the impacts of the COVID-19 pandemic on the routine of Brazilian dentists, and contained questions about the work environment, the flow of patients and the issuing of reports, the financial return and biosafety protocols in the context of the pandemic. No volunteer research participant was identified.

The collection instrument was built on the Google Forms platform (Google Forms), and an Instagram account (@covidradiologia) was created to perform an active search for Brazilian radiologists. Then, the access link was disclosed via the internet, through email and social networks (Facebook, Instagram and WhatsApp). Upon accessing the link, the consent form was made available to the participant who, after reading it, declared whether or not they agreed to voluntarily participate in the research through a response box located right below the consent form. Only in this way, the participant was able to access the questionnaire. The form's privacy policy was used, which allowed the participants to remain anonymous.

Questionnaires answered by Brazilian oral radiologists from August to October 2021 were included. Questionnaires answered by dentists who do not have the title of specialist in Oral Radiology, by professionals from other areas, by oral radiologists who do not work in the area, by oral radiologists

Questionnaire
1. What is your gender?
2. How old are you?
3. In which year did you complete your degree in Dentistry?
4. When did you become an oral radiologist?
5. Have you already taken any other postgraduate studies? If yes, which one?
6. In which job(s) are you working? If necessary, you can tick more than one option.
7. In which state does most of your professional activity take place?
8. What types of exams are performed at your workplace?
9. How is the exam processing flow at your workplace?
10. Do you or your workplace use image processing software?
11. Do you or your workplace make images and reports available online?
12. How many exams did you perform weekly before the pandemic?
13. Currently, how many exams do you report weekly?
14. How the patient appointment is occurring at your workplace?
15. How do you evaluate the impact of the pandemic on your work routine?
16. Which of the following personal protective equipment have you been using?
17. Do you or the place where you work carry out some type of patient screening for COVID-19 ?
18. What disinfectant or antimicrobial agents are you or your workplace using to decontaminate imaging devices?
19. Are you or your workplace allowing the presence of companions?
20. How many individuals worked at your workplace including you before the pandemic?
21. How many individuals currently work at your workplace including you?
22. Which exam was the most performed in your workplace before the pandemic?
23. Which exam is currently the most performed in your workplace?
24. How do you evaluate the impact of the pandemic on your financial income?
25. How do you evaluate the impact of the pandemic on the flow of patients in your workplace?
26. How do you evaluate the impact of the pandemic on the amount spent on personal protective equipment by your workplace?
27. Has your working hours been reduced?
28. Do you believe that your workplace is prepared for teleradiology?
29. Do you believe that the current changes in your workplace due to the pandemic will be permanently incorporated?
30. How do you see your specialty in the post-pandemic context?

Fig. 1 Structured digital questionnaires with 30 questions related to the impacts of the COVID-19 pandemic in Brazilian Oral Radiology

who do not work in the national territory and by foreign oral radiologists were excluded.

After the application of the questionnaires, the data were tabulated in an Excel spreadsheet and analyzed using the SPSS software (Statistical Package for the Social Sciences, version 21.0, Chicago, USA). Descriptive statistical analysis was used to describe the items included in the research. Means and standard deviations were calculated to describe continuous variables and frequency percentages to describe categorical data.

Results

One hundred and three Brazilian oral radiologists answered the questionnaire, 74 (71.8%) of them were females and 29 (28.2%) males, aged between 23 and 61 years. The sample consisted of professionals from 16 Brazilian states, being the most represented the states of Minas Gerais (32%), São Paulo (19.4%) and Rio de Janeiro (11.6%), respectively. According to the Federal Council of Dentistry, there are 3791 active Brazilian Oral Radiologists. Considering a confidence level of 95%, the sample used has a margin of error of 8%. Most individuals had between 12 and 19 years of general dental practice and between 4 and 11 years of specialization practice. It is worth to emphasize that the data were collected from August to October 2021, when most health professionals in Brazil had already received the second dose of the vaccine against COVID-19, but there were still major restrictions on circulation in some states.

In relation to the workplace, most of the sample (48.5%) owned a private radiological clinic, followed by radiologists who work in the preparation of reports remotely (34.5%). The processing flow of these exams was digital in 69.6% of the places, partially digital in 25.5% and manual in 4.8%. The vast majority (94.1%) of these clinics used image processing software and 78.4% made the images and reports available online.

When asked about how the patient appointment for image acquisition was occurring during the COVID-19 pandemic in their workplaces, 52% reported that they happened by spontaneous demand and by appointment, 34% only by appointment and 8% of the places were not providing care. Twenty-nine (28.2%) clinics allowed the presence of companions in the waiting room and in the places where the exams were carried out only for children and/or people with special needs, 24 (23.3%) only in the waiting room for children and/or people with special needs, 18 (17.5%) did not allow it either in the waiting room or in the exams' locations, and 16 (15.5%) allowed it only in the waiting room for any patient. Regarding the screening of patients in relation to COVID-19 before the appointment, 40.8% answered that they measured the patients' temperature, 35% applied a face-to-face questionnaire about general health, and 24.2% did not perform any type of screening. To decontaminate the surface of image acquisition devices, 73.8% used 70% alcohol, followed by diluted sodium hypochlorite (4.8%), and 21.4% answered "not applicable", since they work remotely.

Regarding the impact of the pandemic on their routine in their main job, 36.3% rated it as intermediate, 23.5% as low and 18.6% as strong. In relation to the working hours fulfilled by the respondents, 37.9% did not have their work hours reduced, 36.9% had a small reduction and 13.6% had their work hours drastically reduced. Regarding the impact of the pandemic on the flow of patients in their workplaces, 28.1% of oral radiologists said that there was an intermediate impact, 23.3% classified it as mild and 20.4% as strong. As for spending on individual protection equipment, 28.1% responded that the pandemic had an intermediate impact, 26.9% strongly and 19.2% very strongly. Finally, when asked about the impacts on their financial income, 40.7% of individuals had an intermediate impact. For 23.3% of the sample, the impact was light and for 18.4% the impact was strong. In Fig. 2, it is possible to verify all these impacts.

In Fig. 3, comparative graphs are presented to demonstrate the consequences of COVID-19 in the number of reports issued by the participants, in the number of workers present in the workplaces and in the main type of exam performed by the clinics.

When asked about the preparation and adequacy of their workplaces for the new reality in the context of teleradiology, 47 participants (45.6%) stated that their workplaces were fully prepared for teleradiology, 31 (30.1%) believe that their workplaces are prepared, but small adaptations are still needed and 13 (12.6%) believe that their workplaces are not prepared. About 75% think that the current changes in their jobs will be partially incorporated permanently, 14.6% believe that all will be incorporated and 5.8% stated that no changes have been made.

Discussion

Health care was necessary during the pandemic, even though elective procedures were suspended. It is known that COVID-19 is transmitted due to the contact of healthy individuals with the secretions of sick people (direct contact) or through surfaces contaminated with the coronavirus (indirect contact) [12]. Due to the close contact with the patient's saliva and the possibility of stimulating coughing and/or vomiting through the technical procedure, intraoral exams are the ones that most pose a risk of cross-infection [12]. To reduce this risk, extra oral exams were recommended during the outbreak of the coronavirus as an infection control strategy [8, 10, 13]. In this study, we can observe an increase in the number of extra oral exams,

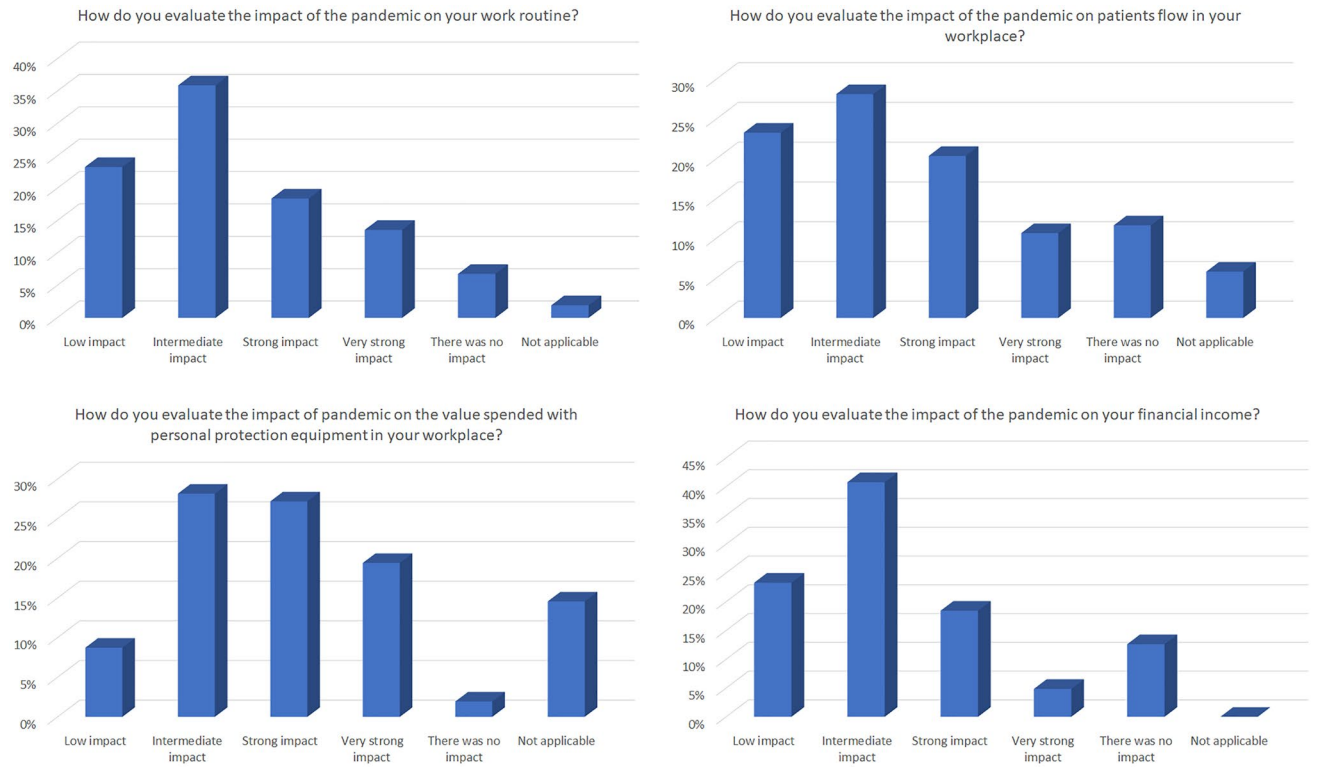

Fig. 2 Impacts of the COVID-19 pandemic on Brazilian oral radiology

panoramic radiography and cone beam computed tomography (CBCT), respecting the recommendations regarding to the safest type of radiographic exam to avoid contamination by coronavirus.

Another factor of fundamental importance to be considered is teleradiology. Few radiology clinics in Brazil are still exclusively in the analog flow, and the vast majority already work with the digital flow of images or are in a transition phase [14]. It is important to emphasize that conventional (non-digital) imaging exams can bring an increased risk of transmission of harmful agents. On the other hand, many private dental offices, which contain devices for intraoral radiographs, still maintain the analog pattern of the images, requiring more cautious measures during the execution of the exams [10, 13, 14].

On the other hand, in specific radiology clinics, the digital flow, added to their high mastery of image processing software and the ease of file sharing through teleradiology [13], allows exams to be evaluated and documented remotely, which makes the transmission of SARS-CoV-2 more difficult in these environments, either by reducing the staff at the workplace or by not handling printed exams. Teleradiology is extremely important for situations such as the COVID-19 pandemic or even to facilitate patient care, or to share information through digital means more quickly and efficiently [15]. Some professionals may not be prepared for this change, but it is evident that it is necessary and essential in oral radiology.

Strategies to contain biological risks practiced before are still necessary and were reinforced during the COVID-19 outbreak [16]. For professionals, the use of Personal Protective Equipment (PPE), hand hygiene, and a care environment were recommended. Due to the uncertainties brought by the COVID-19 pandemic, any health environment was forced to adapt to stricter biosecurity standards [13], which generated an increase in the consumption of PPE. Most Brazilian radiologists felt a financial impact during this period, which may be related to the increase in PPE spending, which was described as intermediate to very strong in this study. Another reason for this financial impact could be the reduced flow of patients to clinics. This change in the flow of patients was expected, due to patients' fear of the disease and the non-prioritization of elective procedures.

For most professionals in this study, patient screening was performed only by temperature measurement or a face-to-face questionnaire, reflecting the non-adherence to one of the recommendations to carry out prior screening of patients, at a distance, through teleservice [8, 13]. Regarding the presence of companions, most care centers allowed patients to stay with companions, varying only their access, which could be limited to waiting rooms, to the place where the exam was performed, or to both.

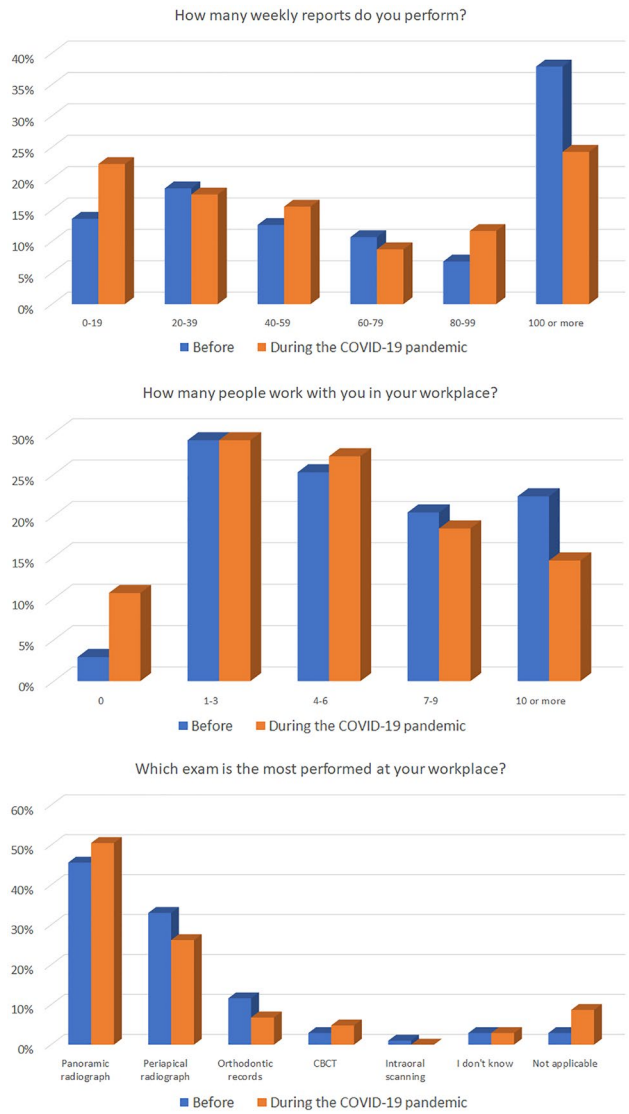

Fig. 3 Comparison of the number of reports, the number of workers and the main type of examination performed by Brazilian oral radiology clinics before and during the COVID-19 pandemic

This practice, necessary in some cases, such as children, the elderly and people with special needs, exposed these patients, considered risk groups for COVID-19. In addition to hand hygiene, patients and their companions were recommended to wear a mask throughout the journey to the dental office and, during the service, protective aprons and shoe protectors, to avoid the transmission of the coronavirus. As for controlling the flow of people in clinics and radiology centers, the recommendation was that there should be an interval between consultations [7, 13, 17], but, according to the professionals in this study, this was not strictly followed. Most participants attended their patients in a continuous flow, which can lead to an increase in the transmission of COVID-19, not allowing the appropriate action of disinfection for each patient, reinforcing what the literature brings about the neglect of biosafety in dentistry [18].

Cleaning and disinfection of all services, including the floor, handle, light switch, table, bench, chairs and equipment, is necessary for each service, as the coronavirus spreads easily. Most respondents stated that they decontaminate the surface of radiology equipment with 70% Ethanol and few use sodium hypochlorite. It is recommended that 0.5% sodium hypochlorite be used for blood and body fluids and the disinfection of environments and surfaces, 0.1% sodium hypochlorite, 70% alcohol, and hydrogen peroxide above 0.5 are used%. The way this is done varies according to the location, but it is essential to use protective barriers, as well as the use of a disinfectant agent, to reduce the spread of infectious agents [7, 8, 13].

The COVID-19 pandemic has brought significant and permanent changes in several sectors of society, including health services [7]. In Brazilian dental radiology, according to the participants, many of the changes implemented during the pandemic will be incorporated and made permanent, whether in relation to biosafety or teleradiology.

Conclusion

Brazilian radiologists continued their work activities during the pandemic period despite the flow of patients having reduced. Most clinics were already using digital images and teleradiology allowed them to continue providing their services. The COVID-19 pandemic brought important impacts on radiology clinics, with changes in the flow of patients, in the service and in the type of exam performed. In addition, adaptation to biosafety standards became necessary, while spending on personal protective equipment increased.

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Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest Matheus Sampaio de Oliveira declares that he has no conflict of interest. Marcos Paulo Maia de Lima declares that he has no conflict of interest. Paulo Victor Teixeira Doriguêtto declares that he has no conflict of interest. Júlia Pereira Americano declares that she has no conflict of interest. Karina Lopes Devito declares that she has no conflict of interest.

Ethics approval This study was approved by the Research Ethics Committee of the Federal University of Juiz de Fora (UFJF), under protocol number 4.210.683.

Human rights statements and informed consent "All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all patients for being included in the study."

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