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Research Paper: Effects of COVID-19 on Endodontic Care Delivery by General Dentists

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ABSTRACT

Introduction: The COVID-19 pandemic significantly disrupted dental practices worldwide, especially in endodontics, where procedures often involve close patient interaction and aerosol generation. This study aimed to evaluate the impact of the pandemic on endodontic treatment delivery by general dentists in Rasht, Iran.

Materials and Methods: In 2022, this analytical cross-sectional survey was conducted among 110 general dentists using a validated researcher-designed questionnaire. The survey assessed changes in workload, infection control measures, psychological effects, and challenges faced during the pandemic. Statistical analyses were conducted using SPSS version 26, with a significance level set at 0.05.

Results: Over 44% of dentists reported a decline in workload, with 20% experiencing reductions of 50% or more. Despite this, 87.3% continued to provide endodontic services, primarily focusing on emergencies, including pain and swelling. The majority prioritized N95 masks and hand hygiene as protective measures. Female dentists and those with 6-10 years of experience expressed more concern about COVID-19's impact on their practice (P<0.05).

Conclusion: While the pandemic posed significant challenges to endodontic care, many general dentists adapted their practices to continue providing essential services. This underscores the need for ongoing improvements in infection control strategies and preparedness for future health crises in dental practices.

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1. Introduction

The COVID-19 pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has profoundly affected global healthcare systems, particularly in dental practices. As of 2023, the World Health Organization has reported hundreds of millions of COVID-19 cases worldwide, resulting in significant morbidity, mortality, and disruptions to routine health services (1). Dental professionals, whose work involves proximity to patients, have faced unique challenges during this period (2, 3).

Research indicates that the pandemic prompted significant changes in dental care delivery. Dentists worldwide implemented strict infection control measures, including the postponement of non-urgent treatments and a shift toward emergency procedures. This was crucial for minimizing cross-infection risks and addressing the increased demand for urgent care (4, 5). Despite these adaptations, the psychological impact on dental health workers has been observed, with many experiencing increased anxiety and stress due to their heightened exposure risk and changed practice environments (5).

Endodontic procedures often require aerosol-generating techniques that pose more significant risks during a pandemic (6). A review by Pragi et al. emphasized the need for tailored protocols in dental practices to ensure safety while maintaining quality of care (7). Nevertheless, limited studies specifically explore how general dentists adapted their endodontic practices during COVID-19 (8, 9), advising to carry out endodontic emergencies with minimal aerosol production procedures. Research by Choi et al. indicated substantial variations in practice patterns among general dentists, including shifts in the types of procedures performed and alterations in infection control protocols (10). Such changes may have lasting implications for how endodontic care is delivered in the post-pandemic environment.

Previous research has documented increased dental anxiety and reluctance among patients to seek dental treatment, resulting in the potential exacerbation of dental emergencies (11-13). Furthermore, the psychological toll on dental professionals is significant, as evidenced by a survey conducted by Matomane et al., which found that over 80% of dental workers reported high levels of stress and anxiety during the pandemic (14). This emphasizes the clinical challenges and the mental health issues that emerged from the crisis, which need to be addressed to enhance resilience in the workforce (15). Despite the existing literature on the psychological impact of the pandemic, studies explicitly addressing the long-term effects of COVID-19 on endodontic practice remain scarce (16).

During the pandemic, many dentists had to rapidly adopt new technologies, such as tele dentistry, to facilitate patient consultations while minimizing in-person visits (17). This shift affected the delivery of endodontic services and represented a broader transformation in dental care (18). However, these adaptations has raised questions about the sustainability of these changes beyond the pandemic (19).

While the pandemic underscored the vulnerabilities within the dental sector, it also provided an opportunity for innovation and improvement in care delivery (16). Given this context, the objective of the current study is to evaluate how COVID-19 has influenced endodontic treatment delivery among general dentists in Rasht, Iran. This study seeks the specific challenges dental professionals face, their implemented adaptations, and the implications for future practice. Understanding these factors is crucial for developing effective strategies to enhance dental practices' resilience in future public health emergencies.

2. Materials and Methods

This analytical cross-sectional study was conducted to evaluate the impact of the COVID-19 pandemic on endodontic treatment delivery by general dentists in Rasht, Iran, in 2022.

Participants for this study were selected using a simple random sampling technique from a comprehensive list of general dentists practicing in Rasht. To ensure generalizability, all certified general dentists in the city were considered eligible. The sample size was determined based on an expected response rate of approximately 50%, suggesting that 110 participants (a minimum of 105)

would suffice to achieve statistical significance, allowing for a conservative margin of error.

The study focused on general dentists practicing in Rasht, Iran. Dentists who participated in the research were required to provide informed consent, ensuring they understood the study's purpose and their role in it. They also needed to complete the questionnaire to gather relevant data. Therefore, any dentists who did not give informed consent or failed to submit a fully completed questionnaire were excluded from the study to maintain the integrity of the research findings. Furthermore, general dentists who did not performed endodontic treatments were excluded.

A validated researcher-designed questionnaire was utilized for data collection. The questionnaire contained 20 items divided into two main sections:

Demographics (4 questions): This section collected basic demographic information about dentists, including their gender, years of experience, and type of workplace.

COVID-19 Impact (16 questions): This section assessed how the pandemic affected dentists' ability to deliver endodontic care, with sample questions addressing changes in workload, infection control practices, and concerns related to COVID-19 transmission.

A panel of six faculty members from the Dentistry Faculty assessed the questionnaire's content validity, ensuring that the items were relevant and appropriate for the study objectives. All questions exceeded a Content Validity Ratio (CVR) of 0.95, indicating satisfactory validity. Reliability was evaluated by administering the questionnaire to a group of 15 dentists on two occasions separated by a 10-day interval. This resulted in a Kappa agreement coefficient ranging from 0.9 to 1, confirming the questionnaire's inter-rater reliability.

Data were collected using an online survey platform (Porsline). Dentists were invited to participate via email, and the survey was structured to ensure confidentiality and anonymity. Participants were asked to complete the questionnaire within two weeks, and reminders were sent to improve response rates. We recognized that self-reported data can introduce biases, such as social desirability or recall bias. To address this issue, the questionnaire was created to ensure that responses remained confidential, which would encourage honest reporting. Additionally, participants were instructed to answer questions based on their experiences during the pandemic, reducing the potential for inaccuracies stemming from retrospective assessments.

Data were analyzed using SPSS version 26. Chi-Square tests were conducted to compare the pandemic's impact on dentists based on demographic factors like gender and workplace. Statistical significance was set at 0.05.

3. Results

Table 1 details the demographic characteristics of the participants. Our data showed that approximately 11.8% up to 50% of dentists reported a reduction in their workload, and 8.2% reported a reduction of up to 75%. Only 1.8% of them had a 25% decline in activity. Following the COVID-19 outbreak, 5.5% of dentists chose not to return to their jobs. When general dentists were asked to evaluate how the COVID-19 epidemic affected their patient load, most (44.5%) stated that it had a negative effect. In comparison, 38.2% said it had no effect at all.

Emergency endodontic procedures remained prevalent during the pandemic (Figure 1). The most frequent emergencies were swelling (90%), pain (89.1%), and trauma (84.5%). Despite the challenges, 87.3% of dentists continued to provide endodontic services, primarily focusing on emergency cases.

Figure 2 summarizes the frequency distribution of dentists' opinions on the screening of symptoms during the COVID-19 pandemic, highlighting the most important symptoms observed in patients.

Patient screening methods varied significantly, with self-reporting being the most common approach used by 80% of dentists. This was followed by PCR testing (41.8%) and temperature check (31.8%). Other criteria for screening, including cough, contact with COVID-19 cases, loss of smell, and influenza-like symptoms, were also used.

Table 1. The demographic information of the dentists surveyed

Variables		N (%)
Gender	Male	63 (57.3)
	Female	47 (42.7)
Years of Experience	<5 years	62 (56.4)
	6-10 years	35 (31.8)
	11-20 years	11 (10)
	21-30 years	2 (1.8)
Type of Workplace	Private Dentistry	58 (52.7)

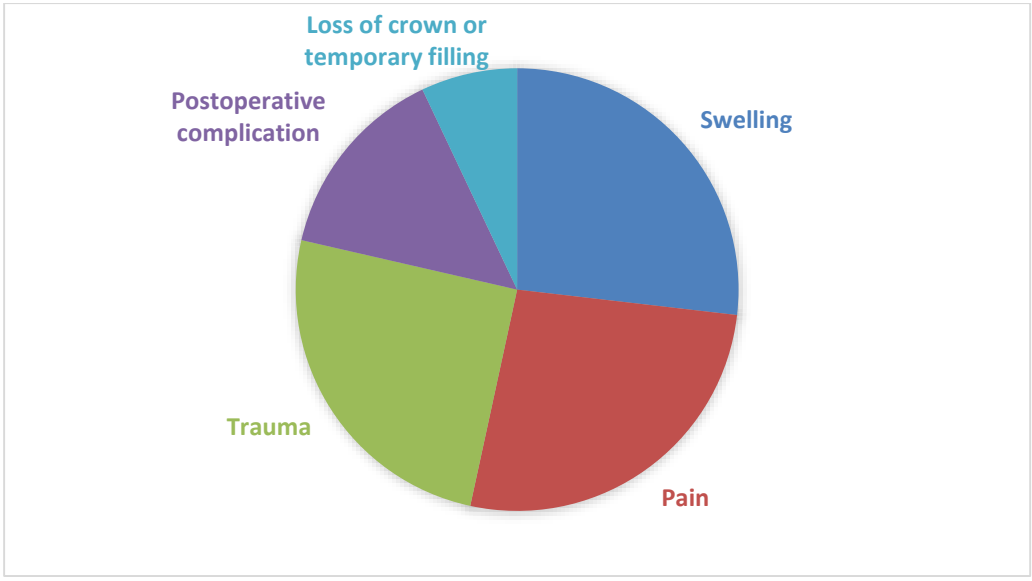

Figure 1. Frequency distribution of dentists' opinions about emergency activity during the COVID-19 pandemic

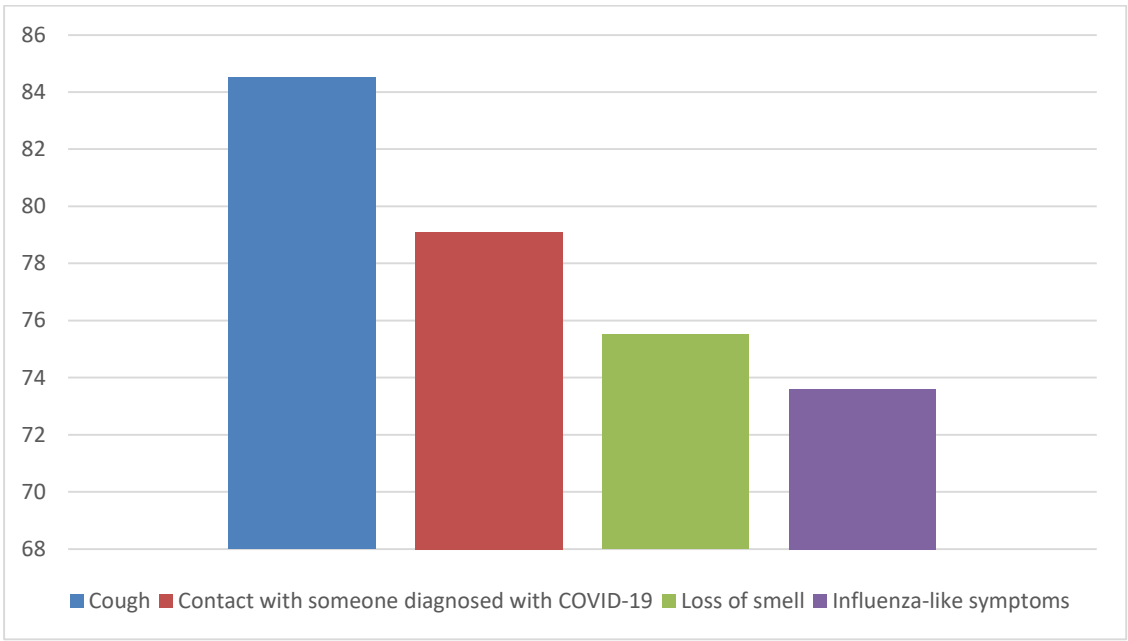

Figure 2. The frequency distribution of dentists' opinions on screening symptoms

Figure 3 presents the frequency distribution of dentists' concerns regarding dental practice during the COVID-19 pandemic. A significant majority of dentists (93.6%) expressed worries about the risk of

their family members becoming infected.

In terms of infection control measures, approximately 80.9% of dentists agreed that rubber dams were effective in reducing COVID-19 transmission (Table 2). The most commonly prioritized protective measures included N95 masks, hand washing, and the use of hand sanitizer, which were emphasized by 65.5% of dentists (Table 3).

Furthermore, over half (53.6%) of the dentists acknowledged that the pandemic affected their delivery of endodontic treatments. This impact was statistically significantly associated with gender (p=0.003) and years of experience (p=0.004), as shown in Table 4. Notably, female dentists (70.2%) and those with 6-10 years of experience (77.1%) reported a greater impact.

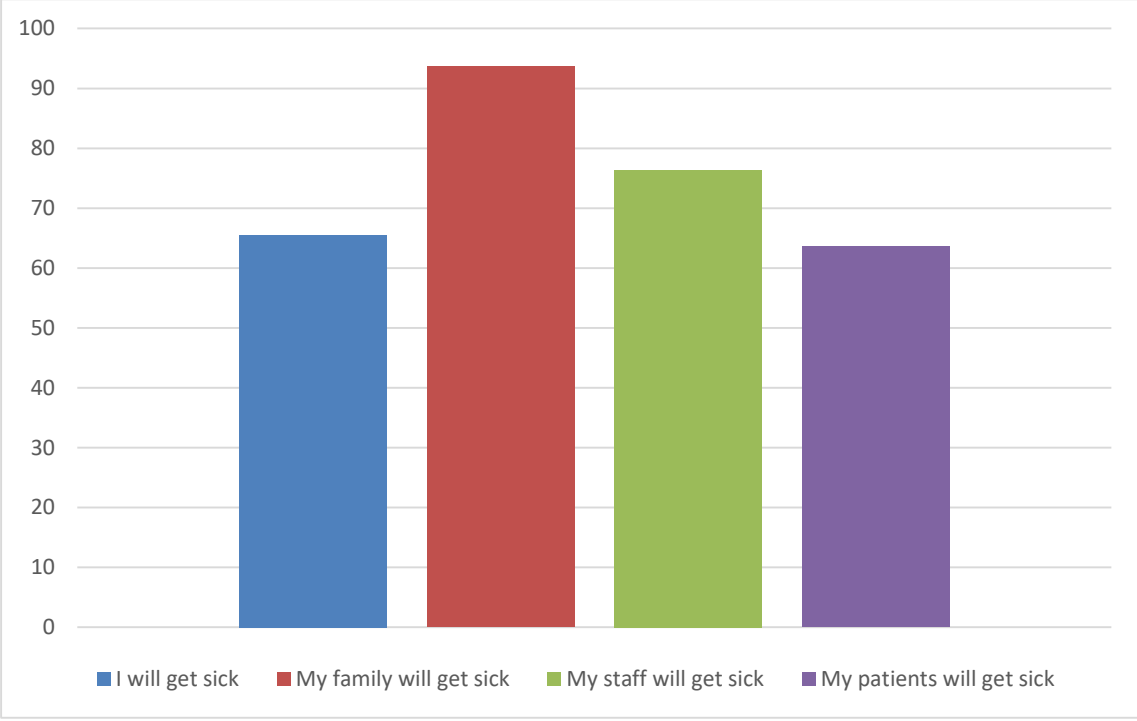

Figure 3. The frequency distribution of dentists' concerns about dental practice during the COVID-19 pandemic

Table 2. The Effectiveness of rubber dam on Reducing COVID-19 Transmission in endodontic procedure

Questionnaire items		N (%)
The Effectiveness of Rubber Dam on reducing COVID-19 Transmission in Endodontic Procedure	Strongly Agree	26 (23.6)
	Agree	43 (39.1)
	Somewhat Agree	20 (18.2)
	Neither Agree nor Disagree	10 (9.1)
	Somewhat Disagree	2 (1.8)
	Disagree	6 (5.5)
	Strongly Disagree	3 (2.7)
	Total	110 (100)

Table 3. The prioritization of protection against COVID-19 infection during the COVID-19 pandemic

Questionnaire items		N (%)
The prioritization of protection against COVID-19 infection	N95 respiratory mask, hand washing, hand sanitizers	72 (65.5)
	N95 respiratory mask, hand sanitizer, hand washing	20 (18.2)
	Hand sanitizer, N95 respiratory mask, hand washing	6 (5.5)
	Hand washing, Hand sanitizer, N95 respiratory mask, face mask	5 (4.5)
	Hand washing, N95 respiratory mask, hand sanitizer	4 (3.6)
	Hand sanitizer, hand washing, N95 respiratory mask	3 (2.7)
	Total	110 (100)

Table 4. The frequency distribution of dentists' opinions regarding their concerns about the impact of COVID-19 on their endodontic treatment, based on their demographic characteristics

Variables		The concern about the impact of COVID-19 on their endodontic treatment		
		No N (%)	Yes N (%)	*P-value**
Gender	Male	37 (58.7)	26 (41.3)	0.003*
	Female	14 (29.8)	33 (70.2)	
Work Experience	<5 years	36 (58.1)	26 (41.9)	0.004*
	6-10 years	8 (22.9)	27 (77.1)	
	11-20 years	6 (54.5)	5 (45.5)	
	21-30 years	1 (50)	1 (50)	
Type of Workplace	Private Dentistry	28 (48.3)	30 (51.7)	0.152
	Group Dentistry	15 (48.4)	16 (51.6)	
	Company	1 (100)	0 (0)	
	Military	0 (0)	6 (100)	
	Public Health Institutions	2 (66.7)	1 (33.3)	
	School of Dentistry	4 (40)	6 (60)	
	Hospital	1 (100)	0 (0)	

4. Discussion

The COVID-19 pandemic has profoundly impacted dental practices worldwide, particularly in endodontics, where urgent care needs surged as access to routine dental services was severely restricted. This study aimed to evaluate how the pandemic affected endodontic treatment delivery by general dentists in Rasht, Iran. Our findings reveal significant changes in patient care, infection control measures, and the psychological well-being of dental professionals during this unprecedented health crisis.

Our study found that the most common reasons for emergency dental visits during the pandemic included swelling, pain, and trauma. This pattern aligns with previous research suggesting that a substantial percentage of patients only seek dental care during acute situations due to fears of contracting COVID-19 during routine visits, reported by Guo et al. (4). Furthermore, a survey by Martinho et al. indicated that many patients deferred dental treatments, resulting in a heightened prevalence of emergency conditions (3). A review by Nosrat et al. highlighted similar trends in dental practices globally, where dentists reported increased emergency visits, reflecting the critical nature of dental emergencies exacerbated by the pandemic's limitations on care accessibility (19). This reliance on urgent care underscores the need for flexible and responsive patient management strategies in dental practices, especially during public health crises. Therefore, some dental organizations recommended telehealth for non-urgent consultations (21, 23).

The pandemic has heightened the necessity for stringent infection control within dental settings. Our study demonstrated that a substantial majority (80%) of dentists employed self-reported screening measures prior to patient visits, with significant percentages utilizing PCR testing (41.8%) and temperature checks (31.8%). This proactive approach is consistent with recommendations from dental health authorities, which emphasized the importance of screening to protect patients and staff from potential COVID-19 transmission (22, 23).

Moreover, our finding that 80.9% of dentists recognized the effectiveness of rubber dams in minimizing aerosol transmission reflects a growing awareness of best practices in infection control. Studies have shown that rubber dams significantly reduce aerosol generation during dental procedures, thereby enhancing safety measures (24-26). However, as noted by Winter et al., the implementation of such practices requires adequate training and resources, which may not always be available, especially in low-resource settings (27).

The psychological toll on dental professionals during the pandemic has been substantial. Our study revealed that a high percentage of dentists expressed anxiety about infecting family members and clinic staff. This aligns with the findings of a systematic review that reported elevated levels of stress and mental health disorders among healthcare workers during COVID-19 (15). The psychological distress experienced by dental practitioners is compounded by their close contact with patients and the inherent risks associated with aerosol-generating procedures (28).

Addressing these psychological challenges is crucial for fostering resilience among dental professionals. Implementing mental health support systems within dental practices, such as counseling services and peer-support programs, can provide essential resources to help alleviate stress and anxiety (29, 30). Additionally, training programs that emphasize not only clinical skills but also coping strategies and emotional resilience may enhance practitioners' preparedness for future crises (31).

Following the pandemic, approximately 70. 9% of dentists in our study resumed full practice, while 11.8% reduced their activity by up to 50%. This discrepancy contrasts with findings from Salgarello et al., who reported that 83% of Italian dentists reopened their practices, indicating regional differences in pandemic response and readiness to return to normalcy (32).

In this study women expressed more significant concern about COVID-19's impact on their practice. As Behforouz et al. reported that factors such as being female, living with parents, lacking an administrative position, heightened fear of infection, worries about restrictions, and academic experiences were linked to increased levels of stress related to COVID-19 amoung dental academics (33).

While our study offers valuable insights, it is essential to recognize several limitations. The reliance on self-reported data, which can be influenced by recall bias and social desirability bias, may introduce biases that could impact the accuracy of the findings. Additionally, as this is a cross-sectional study, it limits our ability to draw causal inferences due to its snapshot nature. Furthermore, the sampling was restricted to one city (Rasht), which may limit the generalizability of the results beyond this specific area. Future research should consider broader geographic and demographic factors to improve the applicability of the findings across various contexts.

To ensure the safety of both staff and patients, dental practices should maintain a strong focus on implementing effective infection control measures. This includes appropriately using personal protective equipment (PPE) and rubber dams and installing enhanced ventilation systems. The continued use of telehealth for initial consultations can help reduce patient volume and allow for timely care, all while minimizing the risk of infection transmission, further reassuring the safety of dental practices.

Considering the psychological stress observed, it is crucial to emphasize the need to integrate mental health resources and wellness programs into dental settings. This will be crucial in supporting practitioners facing ongoing stressors. Future studies should explore the long-term implications of the pandemic on dental education, clinical practices, economic or financial implications of the pandemic, and the resilience of dental professionals to prepare for subsequent public health challenges.

5. Conclusion

The COVID-19 pandemic has significantly affected dental practice, particularly in endodontics, leading to reduced workloads and a shift towards emergency care among general dentists in Rasht, Iran. Effective infection control measures, including PPE use and patient screening, were crucial in mitigating transmission risks. Additionally, the psychological impact on dental professionals highlights the need for mental health support within the workforce. As practices adapt to the post-pandemic landscape, maintaining infection control standards and integrating mental health resources will be essential for resilience and preparedness for future public health challenges.

Ethical Considerations

The study was approved by the internal ethical review board of the Guilan University of Medical Sciences (IR.GUMS.REC.1401.559).

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Authors' Contributions

Narges Simdar: Conceptualization, Methodology, Supervision, Validation, Project administration.**, Kiana Baghernieh Yazdi:** Data curation, Writing-Original draft, Investigation, Visualization.**, Elham Jafari:** Writing-Original

draft, Writing-review & editing.**, Ali Shabaniyan:** Visualization, Writing-Original draft, Writing-review & editing.

Conflict of Interests

There is no conflict of interest to declare.

Availability of data and material

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

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