


## Financial Impact of COVID-19 Pandemic on Endodontic Clinics in Egypt: A Questionnaire-Based Report

 Reham HASSAN,  Shehab Eldin SABER,  Tarek ELSEWIFY

### ABSTRACT

**Objective:** To evaluate the financial impact of the COVID-19 pandemic on endodontic clinics in Egypt.

**Methods:** Two hundred Egyptian endodontists holding a minimum of a master's degree were invited to participate in an online survey in March 2021. Participants accessed the survey link shared on the social media group of the Egyptian Society of Endodontology. Participants read and signed an electronic informed consent before participating in this study. The questionnaire was designed exclusively by the authors. A draft was pilot tested on a sample of 15 endodontic masters' students at The British University in Egypt. Suggestions and comments to improve clarity, content, and validity were incorporated into the revised survey. The questionnaire was divided into five sections; the first section comprised of questions about the participants' demographic details. The second section targeted the current and future financial impact of COVID-19 on practices. The third section included information about the average patient flow and the introduction of teledentistry in clinical practice. The fourth section assessed the effect of COVID-19 on the staff in the dental clinics and the changes made in response to COVID-19. The last section estimated COVID-19 prevalence among endodontists and staff. Categorical data were presented as frequencies (n) and percentages (%) and were analysed using Fisher's exact test. Quantitative data were presented as mean and standard deviation values. P-values were adjusted for multiple comparisons utilising Bonferroni correction.

**Results:** A total of 141 endodontists participated in the survey. The negative financial impact of COVID-19 was reported by 84.39% of the participants. Seventy-eight endodontists (55.3%) suffered from the increased cost of endodontic materials. Of the endodontist respondents, 90.8% suffered from the increased cost of PPE, 82.3% did not charge their patients more, and only 14.4% planned to charge more. A decrease in the number of referred cases for endodontic treatment has been noticed by 58.9%. About 47.5% noticed increased patient phone calls replacing patient visits. Only 12.8% have dismissed staff because of financial problems.

**Conclusion:** COVID-19 has negatively affected most endodontists financially and significantly affected their practices' strategies.

**Keywords:** Clinic, COVID-19, endodontists, financial, pandemic, SARS-CoV-2, teledentistry

Please cite this article as: Hassan R, Saber SE, Elsewify T. Financial Impact of COVID-19 Pandemic on Endodontic Clinics in Egypt: A Questionnaire-Based Report. *Eur Endod J* 2022; 7: 135-42

From the Department of Endodontic (R.H.), Minia University Faculty of Dentistry, Minia, Egypt / Department of Endodontic, The Egyptian Russian University Faculty of Dentistry, Badr City, Egypt; Department of Endodontic (S.E.S.), The British University in Egypt Faculty of Dentistry, Cairo, Egypt / Department of Endodontic, Ain Shams University Faculty of Dentistry, Cairo, Egypt / Center of Innovative Dental Sciences, The British University in Egypt, Cairo, Egypt; Department of Endodontic (T.E. [✉tarek\\_elsewify@dent.asu.edu.eg](mailto:tarek_elsewify@dent.asu.edu.eg)), Ain Shams University Faculty of Dentistry, Cairo, Egypt / Department of Restorative Dental Sciences, Gulf Medical University College of Dentistry, Ajman, United Arab Emirates

Received 06 September 2021,  
Accepted 04 January 2022

Published online: 16 June 2022  
DOI 10.14744/eej.2022.15238

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.



### HIGHLIGHTS

- Endodontic practices in Egypt suffered from enormous financial losses, with 37% reported more than a 50% drop in revenue.
- The financial burden was exacerbated by the rising cost of PPE and the increase in the overhead costs and prices of endodontic materials.
- Despite the numerous disadvantages caused by the COVID-19 pandemic, our survey shows that endodontists in Egypt have found ways to adapt to the new situation.

### INTRODUCTION

On the 14<sup>th</sup> of February 2020, Egypt announced the first case of the severe acute respiratory syndrome coronavirus 2 disease (SARS-CoV-2) (COVID-19) in Africa (1). On the 11<sup>th</sup> of March 2020, COVID-19 was declared as a pandemic by WHO (2). Since then, most governments have imposed COVID-19 lockdown restrictions and several control measures to restrict the pandemic spread. For example, several measures were implemented by the

Egyptian government on the 15<sup>th</sup> of March 2020, such as school and university closures, suspension of ritual activities and prayers in all mosques and churches, closing of all public areas (e.g., restaurants, cafes, clubs) throughout the country from 7 pm until 6 am, with a full lockdown during the weekends. In addition, all international flights were suspended till the 30<sup>th</sup> of June 2020. Fur-

thermore, another semi-lockdown measures were announced from the 6<sup>th</sup> of May 2020 until the 21<sup>st</sup> of May 2020 (3).

Dental professionals are potentially at a higher risk of infection as the saliva acts as the primary reservoir of droplet transmission (4). Droplets, splash and spatter production are common during dental procedures using high- and low-speed handpieces, three-way syringes, and ultrasonic scalers (5). The virus may remain within the droplets for a few hours to days depending on the surface and may remain suspended in the air for a few hours depending on the surrounding atmosphere (6). The Occupational Safety and Health Administration classified dentists as a very high-risk group due to the potential exposure to SARS-CoV-2 through aerosol-generating procedures (7). Endodontists are in a unique situation as they are responsible for managing emergency cases; odontogenic pain, swelling, and dental alveolar trauma. About 50% of all patients attending emergency dental care are endodontic emergencies, with 53% being symptomatic irreversible pulpitis (8).

Many health regulatory bodies around the world (such as the American Dental Association, the National Health Service, and the Spanish Consejo General) have advised their licensed dentists to perform only emergency dental procedures and to refrain from performing all elective procedures like restorations, extractions of asymptomatic teeth, aesthetic dental procedures, orthodontic adjustments, and routine radiographs (6). Furthermore, certain preventative practices must be followed to limit the risk of infection during the pandemic. For example, pre-procedural mouth rinses should be used regularly, and dental instruments should be frequently disinfected (9). Additionally, high-volume saliva ejectors, anti-retraction handpieces, rubber dam isolation, and personal protective equipment (PPE) should be used (9).

These preventative precautions helped reduce COVID-19 spread; however, it has resulted in significant financial consequences for dental practices worldwide. General dental practices are currently suffering from enormous financial losses since they can only provide emergency dental care. According to a survey conducted by the Irish Dental Association involving 369 dentists, one-fifth of the dentists had closed their practices either temporarily or permanently (10). Furthermore, approximately three-quarters of the participants anticipate a financial loss of more than 70% throughout the COVID-19 outbreak period. The British Dental Association has stated the same, predicting that dental practices in the United Kingdom will suffer from severe losses due to deferring routine dental care (11). Similarly, the Irish Dental Association indicated that about 75% of the dental practitioners face financial losses of more than 70% during the outbreak (10).

This pandemic situation has grounded national and international economies to a halt. Almost all the sectors were affected by the economic recession brought forward by COVID-19. The reported global spillover of COVID-19 engulfed the travel industry, hospitality industry, sports industry, financial sector, financial market, entertainment industry, education sector, and health sector. Governments and dental associations in low- and middle-income countries did not support dental prac-

tices at this challenging time (11). During this COVID-19 surge between March and June 2020, some dental clinics in Egypt preferred to reduce their capacity and postpone elective procedures, while others preferred to remain completely closed. Patients' dental treatments have been disrupted due to the closure of dental clinics because of the COVID-19 outbreak.

In the present study, we aimed to evaluate the financial impact of the COVID-19 pandemic on endodontic clinics in Egypt by conducting an online questionnaire among members of the Egyptian Association of Endodontists.

## MATERIALS AND METHODS

Ethical approval was obtained from the local Ethics Committee at Ain Shams University (Protocol no. 015-01-21). This study was designed as a cross-sectional descriptive online survey through Google Forms.

### Sample size calculation

A power analysis was designed to have adequate power to apply a statistical test of the research question regarding the financial impact of COVID-19 on endodontic clinics in Egypt. According to the results of Ahmadi et al. (12), by adopting a confidence interval of (95%), a margin of error of (5%) with a finite population correction, the predicted sample size (n) was a total of (132) cases. Sample size calculation was performed using Epi info for windows version 7.2.

### Participants recruitment

Recruitment of participants took place from the 1<sup>st</sup> of March 2021 till the 12<sup>th</sup> of March 2021. A total of 200 certified active members of the Egyptian Society of Endodontology holding a master's degree or a doctorate in endodontics were invited to the survey regardless of their city and workplace, whether in private practice, university, or hospital clinics. Masters students in endodontics were not invited.

The survey link was shared on the social media group of the Egyptian Society of Endodontology with a message explaining the study and inviting them to participate. The first page of the questionnaire assured that no personal information was required and data would be kept confidential. Participants were informed of the study objectives, and participation was purely voluntary. Participating endodontists read and signed an electronic informed consent before participating in this study.

### Questionnaire production and validation

The questionnaire was not adopted from any previous study and was designed exclusively by the authors. The entire study team and a public health specialist reviewed an initial draft of the survey for critical feedback regarding the content, clarity, and presentation. We pilot tested the initial draft of the questionnaire on a sample of 15 endodontic masters' students at The British University in Egypt. Suggestions and comments to improve the clarity, content, and validity were incorporated into the revised survey.

### Questionnaire composition

The questionnaire was divided into five sections. The first section comprised questions about the participants' demographic

**TABLE 1.** Frequency and percentage (%) for answers to the questions about the participants' demographic details

Question	Answers	n	%	P
1. Age (years)	56<	4 <sup>c</sup>	2.8	<b>&lt;0.001*</b>
	46-55	6 <sup>c</sup>	4.3	
	36-45	37 <sup>b</sup>	26.2	
	>35	94 <sup>a</sup>	66.7	
2. Gender	Male	73 <sup>a</sup>	51.8	<b>0.674ns</b>
	Female	68 <sup>a</sup>	48.2	
3. How long have you been practicing?	Less than 5 years	17 <sup>c</sup>	12.1	<b>&lt;0.001*</b>
	6-10 years	51 <sup>a</sup>	36.2	
	11-15 years	44 <sup>ab</sup>	31.2	
	16 years or more	29 <sup>bc</sup>	20.6	
Currently, you are?	Holder of Master Degree of Endodontics	28 <sup>a</sup>	19.9	<b>&lt;0.001*</b>
	Holder of PhD Degree of Endodontics	41 <sup>a</sup>	29.1	
	Endodontic Master student	34 <sup>a</sup>	24.1	
	PhD Endodontic student	32 <sup>a</sup>	22.7	
	Other specialty master student	2 <sup>b</sup>	1.4	
	Holder of Master Degree of Other specialty	2 <sup>b</sup>	1.4	
	Holder of PhD Degree of Other specialty	1 <sup>b</sup>	0.7	
	PhD student other specialty	1 <sup>b</sup>	0.7	
4. What describes the nature of your practice?	Solo practice	29 <sup>b</sup>	20.6	<b>&lt;0.001*</b>
	Group endodontic practice	12 <sup>c</sup>	8.5	
	Multi- specialty practice	49 <sup>a</sup>	34.8	
	Faculty practice	39 <sup>ab</sup>	27.7	
	Outpatient clinic in private hospital	12 <sup>c</sup>	8.5	
5. Do you perform treatments other than endodontics?	Yes	97 <sup>a</sup>	68.8	<b>&lt;0.001*</b>
	No	44 <sup>b</sup>	31.2	

Different letters indicate a statistically significant difference within the same question. \*: Significant (P≤0.05), ns: Non-significant (P>0.05)

details, including years of experience and practice type. The second section targeted the current and future financial impact of COVID-19 on practices. Information about the average patient's flow and the introduction of teledentistry in practice were included in the third section. In the fourth section, questions assessed the effect of COVID-19 on the staff and the difficulty faced to pay salary to staff, followed by questions related to changes made in practice in response to COVID-19. The last section estimated the COVID-19 prevalence among endodontists and their staff.

**Statistical analysis**

Data were transferred into Microsoft Excel (Microsoft Corp, Redmond, WA). Categorical data were presented as frequencies (n) and percentages (%) and were analyzed using Fisher's exact test. Quantitative data were presented as mean and standard deviation values. P-values were adjusted for multiple comparisons utilizing Bonferroni correction. The significance level was set at P≤0.05 for all tests. Statistical analysis was performed with R statistical analysis software version 4.0.3 for Windows (R Foundation for Statistical Computing, Vienna, Austria).

**RESULTS**

From the 200 endodontists targeted and invited, 147 participated in the survey. Six participants were excluded from the study because they did not hold any postgraduate qualification in endodontics. Participants' demographic data, including age, gender, years of practice, qualifications, nature of practice, and practice scope, are shown in Table 1.

Responses to sections 2-5 analyzing the financial impact of COVID-19 on practices, staff, patient patterns, and practice strategy are shown in Tables 2-5 with frequency, percentage, and statistical analysis. In addition, the medical status of participants and staff related to COVID-19 is shown in Figure 1.

**DISCUSSION**

More than 175 countries worldwide have reported cases of COVID-19 (13). As of the 9<sup>th</sup> of August 2021, nearly 202,296,216 confirmed cases of COVID-19, including 4,288,134 deaths (14). In Egypt, the current announced numbers are 284,641 confirmed cases of COVID-19 and 16,566 deaths (Figs. 2, 3) (13).

This pandemic and the consequently employed strategies worldwide are unmatched in contemporary times. Mitigation and suppression essential to contain the spread have influenced the economy with disastrous results for small- and medium-sized businesses.

Dental practices are primarily small- to medium-sized businesses operated privately. Governments worldwide are working to stop the pandemic from spreading and lessen the economic impact of COVID-19. Scotland, Wales and Northern Ireland offered capital funding to help dental practices secure new equipment to expand patient numbers (15). So far in Egypt, dental practices have not been included in any specific governmental support or protection schemes. We aimed to analyse the financial impact of COVID-19 on endodontic practices in Egypt.

One year after the initial lockdown in March 2020, the COVID-19 pandemic had an enormous impact on the dental clinics. Ac-

**TABLE 2.** Frequency and percentage (%) for answers to the financial impact of COVID-19 questions

Question	Answers	n	%	P
1. How did COVID-19 affect your practice financially?	Positively	4 <sup>c</sup>	2.8	<0.001*
	Negatively	119 <sup>a</sup>	84.4	
	No effect	18 <sup>b</sup>	12.8	
2. What has been the negative impact of the COVID-19 on your income compared to what is typical at your practice (only answer if the COVID-19 affected your practice negatively)?	Less than 10%	15 <sup>b</sup>	12.6	<0.001*
	Over 10% but less than 25%	54 <sup>a</sup>	45.4	
	Over 50% but less than 75%	44 <sup>a</sup>	37.0	
	More than 75%	4 <sup>c</sup>	3.4	
	Total loss of business	2 <sup>c</sup>	1.7	
3. Did the overhead costs increase per case? (overhead refers to the ongoing costs to operate a business but excludes the direct costs associated with creating a product or service)	Yes	76 <sup>a</sup>	53.9	<0.001*
	No	14 <sup>c</sup>	9.9	
	Unsure	51 <sup>b</sup>	36.2	
4. Did you notice an increase in the price of endodontic materials?	Yes	78 <sup>a</sup>	55.3	<0.001*
	No	32 <sup>b</sup>	22.7	
	Not sure	31 <sup>b</sup>	22.0	
5. Did you face a problem with providing personal protective equipment (PPE)	Did not face any problems	13 <sup>c</sup>	9.2	<0.001*
	Rising in the price of PPE up to 25%	28 <sup>ab</sup>	19.9	
	Rising in price more between 25-75%	45 <sup>a</sup>	31.9	
	Rising in price between 75%-100%	23 <sup>bc</sup>	16.3	
	Rising in the price of PPE More than 100%	32 <sup>ab</sup>	22.7	
6. Have you charged your patients for more?	Yes	25 <sup>b</sup>	17.7	<0.001*
	No	116 <sup>a</sup>	82.3	
7. Are you planning to charge your patients for more?	Yes	20 <sup>b</sup>	14.2	<0.001*
	No	55 <sup>a</sup>	39.0	
	Maybe	66 <sup>a</sup>	46.8	
8. Do you anticipate a decrease in income by continuing the pandemic in the future?	Completely agree	27 <sup>b</sup>	19.1	<0.001*
	Agree	63 <sup>a</sup>	44.7	
	Undecided	36 <sup>b</sup>	25.5	
	Disagree	13 <sup>c</sup>	9.2	
9. If the current situation lasts longer, I will	Completely disagree	2 <sup>d</sup>	1.4	<0.001*
	Find innovative ways to lower my operating costs	43 <sup>a</sup>	30.5	
	Borrow money to address financing shortfalls	4 <sup>b</sup>	2.8	
	Adjust staffing or salaries of my staff	2 <sup>b</sup>	1.4	
	I do not think I can sustain my practice	6 <sup>b</sup>	4.3	
	Do nothing	44 <sup>a</sup>	31.2	
Charge the patients for more	42 <sup>a</sup>	29.8		

Different letters indicate a statistically significant difference within the same question. \*: Significant ( $P \leq 0.05$ ), ns: Non-significant ( $P > 0.05$ )

According to our results, 77.3% reported the pandemic's negative financial impact on their endodontic practices, with 44% reporting a more than 50% drop in revenue. Endodontists were unable to practice during the initial lockdown. The COVID-19 period clearly affected the number of endodontic patients. The number was lower for 66% of the respondents. Moreover, 90% anticipated a decrease in income by continuing the pandemic. Only 20.3% of respondents reported "business as usual" regarding patient numbers. According to a survey conducted on 180 dental clinics in Japan, 46.7% of the dental clinics reported a decrease in the number of patients, in agreement with the current study results (16).

Patients avoided elective dental treatment either for financial reasons or for fear of infection. However, it has been proven that dentistry is an essential service, and practices have been able to remain open despite additional lockdowns across the country, with only 1.7% ( $n=2$ ) suffering from total loss of their businesses.

When practices have experienced unprecedented declines in revenue, the rising cost of PPE has exacerbated the financial burden. The increased cost of PPE has worsened the financial burden for practices that have suffered from unprecedented declines in revenue. Only 9.2% ( $n=13$ ) did not face any problem in providing PPE, while the rest disclosed a substantial increase in PPE price with different percentages. The difference in the increased cost reported could be explained by the surge in demand in rural versus urban areas. A recent report estimated a 1000% increase in PPE cost than the pre-COVID-19 period (17). The Irish Dental Association reported similar findings where 70% of the dentists did not have access to gowns and 30% did not have unimpeded access to face masks (18). Surprisingly, more than 50% of the respondents faced an increase in overhead costs and an increase in the price of endodontic materials.

Most dental practice employers in Egypt paid full salaries to their staff (82.3%) despite the closure of the clinics, in agreement with the results of a cross-sectional study conducted

**TABLE 3.** Frequency and percentage (%) for answers to patient pattern questions

Question	Answers	n	%	P
1. Did you notice a change in the number of referred cases?	Increased	4 <sup>c</sup>	2.8	<0.001*
	Decreased	83 <sup>a</sup>	58.9	
	No change	30 <sup>b</sup>	21.3	
	Unsure	24 <sup>b</sup>	17.0	
2. How does the number of endodontic patients per month compare to this same period last year?	Increased	6 <sup>c</sup>	4.3	<0.001*
	Decreased	93 <sup>a</sup>	66.0	
	Almost the same	42 <sup>b</sup>	29.8	
3. Did you notice a rise in phone calls from patients? (Teledentistry)	Yes	67 <sup>a</sup>	47.5	<0.001*
	No	42 <sup>b</sup>	29.8	
	Maybe	32 <sup>b</sup>	22.7	
4. Have some calls replaced visits?	Yes	71 <sup>a</sup>	50.4	0.933ns
	No	70 <sup>a</sup>	49.6	
5. Have you been treating high-risk patients (close contacts of confirmed or probable COVID-19 patients)?	Yes	50 <sup>b</sup>	35.5	<0.001*
	No	91 <sup>a</sup>	64.5	
6. Have your patients expressed any apprehensions in visiting the dental practice after you have re-opened for elective dental care?	Yes	90 <sup>a</sup>	63.8	<0.001*
	No	29 <sup>b</sup>	20.6	
	Unsure	22 <sup>b</sup>	15.6	
7. The COVID-19 pandemic significantly disrupted patient continuity of care	Strongly Agree	42 <sup>b</sup>	29.8	<0.001*
	Agree	81 <sup>a</sup>	57.4	
	Undecided	13 <sup>c</sup>	9.2	
	Disagree	5 <sup>c</sup>	3.5	
	Strongly disagree	0	0	

Different letters indicate a statistically significant difference within the same question. \*: Significant ( $P \leq 0.05$ ), ns: Non-significant ( $P > 0.05$ )

**TABLE 4.** Frequency and percentage (%) for answers to the effect of the COVID-19 on the staff questions

Question	Answers	n	%	P
1. Did you dismiss any of the staff because of financial problems?	Yes	18 <sup>b</sup>	12.8	<0.001*
	No	123 <sup>a</sup>	87.2	
2. Did you pay the staff their full salaries regardless of the closure of dental clinics?	Yes	116 <sup>a</sup>	82.3	<0.001*
	No	25 <sup>b</sup>	17.7	
3. Did you decrease the salary of the staff due to the reduction in the working hours?	Yes	31 <sup>b</sup>	22.0	<0.001*
	No	110 <sup>a</sup>	78.0	
4. Did any of the staff decide not to work during the COVID-19 pandemic?	Yes	80 <sup>a</sup>	56.7	0.110ns
	No	61 <sup>b</sup>	43.3	

Different letters indicate a statistically significant difference within the same question. \*: Significant ( $P \leq 0.05$ ), ns: Non-significant ( $P > 0.05$ )

in Iran (12). Only 22% (n=31) decreased the staff's salary due to the reduction in the working hours. In contrast, in a US study, only 27% paid the full salary to staff, 45% paid half the salary, and 28% did not pay salaries (19). It is worth mentioning that 56.7% of the dental practices in Egypt reported that one or more of their staff decided not to work during the COVID-19 pandemic.

The infection rate among Egyptian endodontists was 16.3% (n=23), and 31.9% (n=45) reported developing symptoms of COVID-19. This percentage is higher than the reported percentage of US dentists of 0.9% in June 2020 (20) and the infection rates reported in health care professionals was 0.9% in the Netherlands and 1.1% in China (21, 22). Currently, there are no official numbers of infection rates reported among Egypt's healthcare workers. It must be emphasised that this survey targeted Egyptian endodontists only, which could affect the generalisability of these results. Respondents might also have had restricted access to COVID-19 testing and might have had undiagnosed infections.

Our data showed higher infection rates reported by the staff/assistants in endodontic clinics, where 39% suffered from COVID-19 symptoms and 24.8% tested positive. However, it is unclear whether these infections were due to community transmission or transmission associated with oral health care delivery (6). This raises concerns regarding the transmission of virus-containing airborne particles in the dental office. It has been suggested that additional potential for COVID-19 transmission exists in dental settings during the delivery of aerosol-generating dental procedures. The Occupational Safety and Health Administration classified dentists as a very high-risk group due to the potential for exposure to COVID-19 through aerosol-generating procedures (5, 7). The current understanding is that COVID-19 has sustained infectivity in aerosol with a half-life of 90 minutes (23).

Previous studies (26, 27) have stressed the necessity of rubber dam isolation in reducing saliva production and blood-contaminated aerosol or spatter, which has been concurred by most of the respondents in the current study. About 80% of

**TABLE 5.** Frequency and percentage (%) for answers to changes in the practice strategy questions

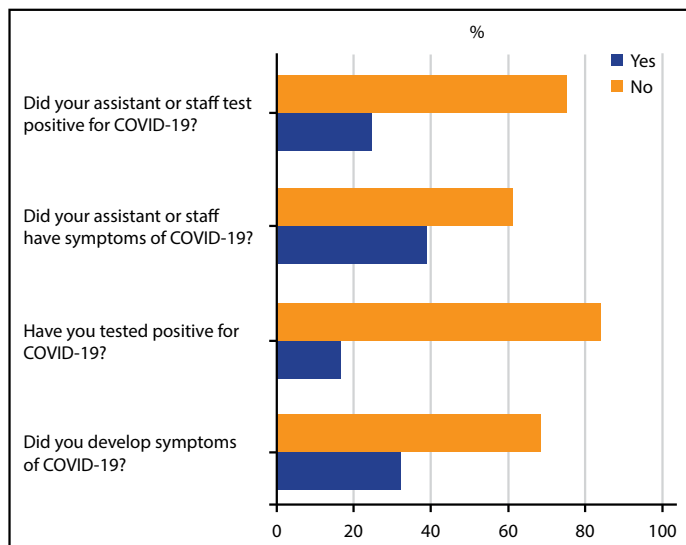
Question	Answers	n	%	P
1. What was your strategy during the first wave of the COVID-19 pandemic?	Closed the clinic and did not see any patients	36 <sup>b</sup>	25.5	<0.001*
	Closed the clinic but treated emergency cases only	58 <sup>a</sup>	41.1	
	Kept the clinic open but lowered the patient volume than usual	43 <sup>ab</sup>	30.5	
	Kept the clinic open, and nothing changed	4 <sup>c</sup>	2.8	
2. Did you change the practice working time in response to the COVID 19 pandemic (shortened treatment time, reduced patient capacity)?	Yes	131 <sup>a</sup>	92.9	<0.001*
	No	10 <sup>b</sup>	7.1	
3. Did you perform any non-emergency procedures during the first wave of the COVID-19 pandemic?	Yes, because of the patients' request	64 <sup>a</sup>	45.4	<0.001*
	Yes, because of financial problems	19 <sup>b</sup>	13.5	
	No	58 <sup>a</sup>	41.1	
4. Did you install a Plexiglass aerosol shield for microscope or Acetate sheets adapted to the binocular as a protective barrier?	Yes	21 <sup>c</sup>	14.9	<0.001*
	No	38 <sup>b</sup>	27.0	
	Do not have a microscope	82 <sup>a</sup>	58.2	
5. Have you been using a rubber dam to minimize saliva production- and blood-contaminated aerosol or spatter in all of your dental treatment?	Yes	114 <sup>a</sup>	80.9	<0.001*
	No	27 <sup>b</sup>	19.1	
6. If no, the reason for not using the Rubber dam is	Difficulties in its handling	12 <sup>a</sup>	41.4	0.353ns
	Financial reason	17 <sup>a</sup>	58.6	
7. For endodontic emergency, during the lockdown period, which endodontic intervention protocol represent your practice	No clinical intervention, only pharmacological approach, i.e., recommended medications to manage severe dental pain	16 <sup>c</sup>	11.3	<0.001*
	Minimal clinical intervention (pulp capping, pulpotomy, root canal debridement only) to control pain	39 <sup>b</sup>	27.7	
	Single-visit endodontics to reduce the number of treatment visits needed (when indicated)	76 <sup>a</sup>	53.9	
	Multiple-visit treatments to reduce the treatment time	10 <sup>c</sup>	7.1	
8. Currently, after the resumption of the clinical practice, which endodontic intervention protocol represent your practice during the pandemic	Single-visit root canal treatment (when indicated) protects the patient, dentist, and staff from potential exposure to the virus during repeated visits	104 <sup>a</sup>	73.8	<0.001*
	Multiple-visit treatments to reduce the treatment time	37 <sup>b</sup>	26.2	
	Direct permanent restoration to protect the patient, dentist, and staff from potential exposure to the virus during repeated visits	105 <sup>a</sup>	74.5	
9. Preferred restorative approach after endodontic treatment during the pandemic	Temporary intra-coronal restorations to reduce the treatment time	36 <sup>b</sup>	25.5	<0.001*
	Direct permanent restoration to protect the patient, dentist, and staff from potential exposure to the virus during repeated visits	105 <sup>a</sup>	74.5	
10. What is your strategy of choice regarding the second wave of the COVID-19 pandemic?	Not going to reclose the clinic again	92 <sup>a</sup>	65.2	<0.001*
	Closing till the end of the alert phase	8 <sup>c</sup>	5.7	
	Closing until the end of the COVID-19 pandemic	1 <sup>d</sup>	0.7	
	Uncertain	40 <sup>b</sup>	28.4	

Different letters indicate a statistically significant difference within the same question. \*: Significant ( $P \leq 0.05$ ), ns: Non-significant ( $P > 0.05$ )

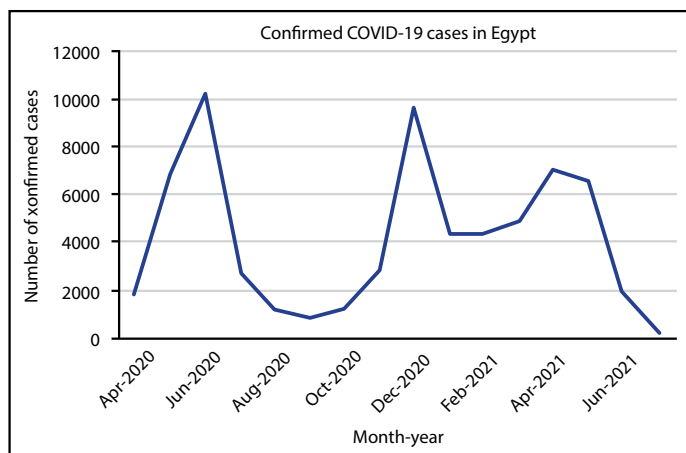
the respondents from this study have been using a dental dam in all dental treatments. As endodontists are on the front lines of the pandemic, the dental emergency can be a devastating experience resulting in systemic infection. Therefore, emergency dental care poses a challenge in balancing patient care with personnel safety (24).

Despite the numerous setbacks caused by the COVID-19 pandemic, our survey shows that endodontists have found ways to adapt to the new situation. More than 90% have changed the practice working time in response to the COVID-19 pandemic. Changes implemented to dental practices included shortening treatment time and reducing patients' capacity. Single-visit endodontics was preferred by 53.9% of the endodontists to reduce the number of treatment visits needed whenever indicated. About 74.5% chose to place direct permanent

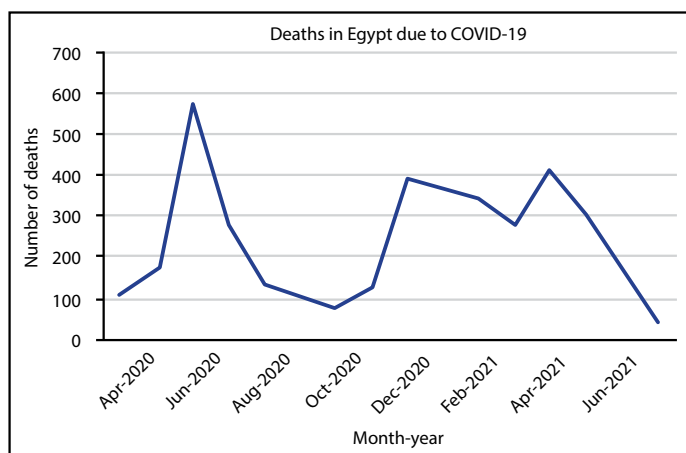
restorations after endodontic treatment to protect the patient, dentist, and staff from potential exposure to the virus during repeated visits. About 11% ( $n=16$ ) chose to stop performing aerosol-producing procedures where no clinical intervention was preferred and only prescribed medications to manage severe dental pain, i.e., a pharmacological approach. A recent international (multi-country) survey showed that only 19.2% of the endodontists had closed their practice, 78.1% ( $n=350$ ) of the endodontic practitioners limited the provision of endodontic treatment to emergency cases only, and 2.7% ( $n=12$ ) continued with normal operations (25). In Egypt, a higher percentage of endodontists 25.5% ( $n=36$ ) reported shutting down their entire practice, 41.1% ( $n=58$ ) treated only emergency cases, 30.5% ( $n=43$ ) chose to decrease the number of patients per day, and 2.8% ( $n=4$ ) kept the clinic open, unchanged practice.



**Figure 1.** Clustered column chart showing participants' response in percentage to questions related to their medical status and their staff related to COVID-19



**Figure 2.** Report by the Ministry of Health and Population in Egypt during April 2020 to ~July 2021 on the number of confirmed COVID-19 cases



**Figure 3.** Report by the Ministry of Health and Population in Egypt during April 2020 to ~July 2021 on the number of confirmed COVID-19 deaths

Teledentistry could be described as one of the adaptive responses applied by patients. About 47% of the endodontists reported an increase in the demand for remote dental consul-

tations through phone calls. About 50% implied that phone calls replaced some in-office visits. While patients' continuity of care was severely disrupted for more than 50% of the respondents, about 63.8% of the respondents indicated that their patients were apprehensive about visiting the dental practice after re-opening. The significant disruption of care and patients' dental treatment concerns justifies the increase in teledentistry demand. However, advanced technologies and platforms that can virtually deliver dental consultations are still required.

To our knowledge, this is the first survey to investigate the impact of the COVID-19 pandemic on the status of endodontic practices in Egypt. There are, however, some limitations to these findings. There might be recall bias in the questions asked about the modifications implemented in the practice strategy in response to the COVID-19 pandemic. Although participants were assured of their anonymity, concerns about being identified may have affected their answers. Respondents likely reported higher levels of infection prevention and control compliance due to social desirability bias and unrecognized lapses in PPE usage.

**CONCLUSION**

COVID-19 has negatively affected most endodontists financially and significantly affected their practice strategies.

**Disclosures**

**Conflict of interest:** The authors deny any conflict of interest.

**Ethics Committee Approval:** This study was approved by The Ain Shams University Ethics Committee (Date: 27/01/2021, Number: 015-01-21).

**Peer-review:** Externally peer-reviewed.

**Financial Disclosure:** This study did not receive any financial support.

**Authorship contributions:** Concept – T.E., S.E.S., R.H.; Design – R.H., T.E., S.E.S.; Supervision – R.H., S.E.S., T.E.; Funding - R.H., S.E.S., T.E.; Materials - None; Data collection and/or processing – R.H., S.E.S., T.E.; Analysis and/or interpretation – R.H., S.E.S., T.E.; Literature search – R.H., S.E.S., T.E.; Writing – R.H., S.E.S., T.E.; Critical Review – R.H., S.E.S., T.E.

**REFERENCES**

1. Saied AA, Metwally AA, Madkhali NAB, Haque S, Dhama K. Egypt's COVID-19 recent happenings and perspectives: a mini-review. *Front Public Health* 2021;9:696082. [CrossRef]
2. World Health Organization. Coronavirus disease (COVID-19). Available at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>. Accessed Feb 18, 2022.
3. Al Arabiya English. Coronavirus: Egypt to lift lockdown from June 27 as COVID-19 restrictions ease. Available at: <https://english.alarabiya.net/coronavirus/2020/06/23/Coronavirus-Egypt-to-reopen-restaurants-cafes-sports-clubs-from-July-27>. Accessed Dec 13, 2021.
4. Xu R, Cui B, Duan X, Zhang P, Zhou X, Yuan Q. Saliva: potential diagnostic value and transmission of 2019-nCoV. *Int J Oral Sci* 2020; 12(1):11. [CrossRef]
5. Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. *Int J Oral Sci* 2020; 12(1):9. [CrossRef]
6. Meng L, Hua F, Bian Z. Coronavirus disease 2019 (COVID-19): emerging and future challenges for dental and oral medicine. *J Dent Res* 2020; 99(5):481–7. [CrossRef]
7. OSHA. Guidance on preparing workplaces for COVID-19. Available at: <https://www.osha.gov/sites/default/files/publications/osha3990.pdf>. Accessed Feb 21, 2022.
8. Yu J, Zhang T, Zhao D, Haapasalo M, Shen Y. Characteristics of endodontic emergencies during coronavirus disease 2019 outbreak in Wuhan. *J En-*

- dod 2020; 46(6):730–5. [CrossRef]
9. Centers for Disease Control and Prevention. Guidance for Dental Settings. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/dental-settings.html#section-1>. Accessed Jul 6, 2021.
  10. Irish Dental Association. Scale of dental collapse highlighted in survey. Available at: <https://irishdentalassociation.newsweaver.com/newsletter/13ctcsav7cz1cys22xtzj2?a=1&p=56657247&t=22322575>. Accessed Jul 6, 2021.
  11. Farooq I, Ali S. COVID-19 outbreak and its monetary implications for dental practices, hospitals and healthcare workers. *Postgrad Med J* 2020; 96(1142):791–2. [CrossRef]
  12. Ahmadi H, Ebrahimi A, Ghorbani F. The impact of COVID-19 pandemic on dental practice in Iran: a questionnaire-based report. *BMC Oral Health* 2020; 20(1):354. [CrossRef]
  13. COVID Live Update: 270,458,617 Cases and 5,322,992 Deaths from the Coronavirus – Worldometer. Available at: <https://www.worldometers.info/coronavirus/>. Accessed Dec 13, 2021.
  14. World Health Organization. WHO Coronavirus (COVID-19) Dashboard With Vaccination Data. Available at: <https://covid19.who.int/>. Accessed Jul 7, 2021.
  15. Westgarth D. COVID-19: Can anything change for the better? *BDJ Pract* 2021; 34(4):16–21. [CrossRef]
  16. Tada H, Shao W, Ishimaru N, Kudo Y. The life in Japan and status of private dental office at the times of COVID-19. *Oral Dis* 2021; 27 Suppl 3:727–9.
  17. SHOPP. SHOPP PPD COVID Costs Analysis. Available at: [http://cdn.cnn.com/cnn/2020/images/04/16/shopp.covid.ppd.costs.analysis\\_.pdf](http://cdn.cnn.com/cnn/2020/images/04/16/shopp.covid.ppd.costs.analysis_.pdf). Accessed Feb 21, 2022.
  18. Irish Dental Association warns that Dental Profession on the Brink of Collapse. Available from: <https://www.dentist.ie/latest-news/irish-dental-association-warns-that-dental-profession-on-the-brink-of-collapse.8336.html>. Accessed Jul 7, 2021.
  19. ADA. HPI poll examines impact of COVID-19 on dental practices. Available at: <https://www.ada.org/en/publications/ada-news/2020-archive/april/hpi-poll-examines-impact-of-covid-19-on-dental-practices>. Accessed Jul 7, 2021.
  20. Estrich CG, Mikkelsen M, Morrissey R, Geisinger ML, Ioannidou E, Vujicic M, et al. Estimating COVID-19 prevalence and infection control practices among US dentists. *J Am Dent Assoc* 2020; 151(11):815–24. [CrossRef]
  21. Kluytmans-van den Bergh MFQ, Buiting AGM, Pas SD, Bentvelsen RG, van den Bijllaardt W, van Oudheusden AJG, et al. Prevalence and clinical presentation of health care workers with symptoms of coronavirus disease 2019 in 2 Dutch hospitals during an early phase of the pandemic. *JAMA Netw Open* 2020; 3(5):e209673. [CrossRef]
  22. Lai X, Wang M, Qin C, Tan L, Ran L, Chen D, et al. Coronavirus disease 2019 (COVID-19) infection among health care workers and implications for prevention measures in a tertiary hospital in Wuhan, China. *JAMA Netw Open* 2020; 3(5):e209666. [CrossRef]
  23. Guo H, Zhou Y, Liu X, Tan J. The impact of the COVID-19 epidemic on the utilization of emergency dental services. *J Dent Sci* 2020; 15(4):564–7.
  24. Patel B, Eskander MA, Ruparel NB. To drill or not to drill: management of endodontic emergencies and in-process patients during the COVID-19 pandemic. *J Endod* 2020; 46(11):1559–69. [CrossRef]
  25. Galicia JC, Mungia R, Taverna MV, Mendoza MJ, Estrela C, Gaudin A, et al. Response by endodontists to the SARS-CoV-2 (COVID-19) pandemic: an international survey. *Front Dent Med* 2021; 1:1–10. [CrossRef]