

## Oral Healthcare Services Delivered During COVID-19 Lockdown: A Report from Eastern Mediterranean Region

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### ABSTRACT

**Objective:** To describe oral healthcare services administered during the lockdown in the Eastern Mediterranean region and to investigate the role of socio-professional characteristics of dental practitioners or their self-reported COVID-19 infection. **Material and Methods:** A questionnaire was distributed to dental practitioners in all healthcare sectors in Jordan, Egypt, and Saudi Arabia. **Results:** There was a total of 335 participants, with the majority being females (N=225, 67.2%) and general practitioners (N=202, 60.3%). Cellulitis was the most common emergency encountered (N=108). The most common urgent procedures were for pulpitis, abscesses, and pericoronitis (N=191, 130, and 95, respectively). Country-specific significant associations were pulpitis in Egypt and Jordan, broken symptomatic teeth in Jordan, and biopsy in Egypt (p<0.05). The Ministry of Health was significantly associated with the management of dental infections, avulsion, and orthodontic emergencies, while university hospitals were significantly associated with advanced restorative procedures (p<0.05). Male practitioners performed significantly more procedures, particularly surgical emergencies (p<0.05). **Conclusion:** Dental infections were the most common complaints among dental patients during lockdown. Country- and sector-specific dental procedures are detected. Male gender seems to play a determinant role in performing a higher number of procedures, particularly for surgical emergencies.

**Keywords:** Cellulitis; COVID-19; Dentistry; Delivery of Health Care; Emergencies.

## Introduction

The novel coronavirus disease-2019 (COVID-19) is, by far, the most severe type among coronavirus infections emerging in the twenty-first century in terms of global spread and transmission rates [1]. Compared to severe acute respiratory syndrome, and Middle East respiratory syndrome viruses, SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2) has inflicted highly noticeable effects on the provision of healthcare services worldwide. Few months after the emergence of COVID-19 in late 2019, it was declared a pandemic by the World Health Organization, and shortly after that, a lockdown was initiated in many countries to control the transmission of infection and disease spread. The first COVID-19-related lockdowns were initiated in specific provinces in China and Italy in January and February 2020, respectively [2]. A more widespread lockdown was declared in many other countries in March of the same year [3]. While the main aim of the lockdown was to control disease spread and mitigate the sharp rise in cases and fatalities, it has indirectly affected healthcare systems in various ways. Worldwide, Healthcare systems have faced numerous challenges in providing services whether to patients with COVID-19 or other acute and chronic morbidities. Although the world is seemingly recovering from the pandemic, the emergence of new, more fierce variants of SARS-CoV-2 is adversely affecting many countries.

The oral healthcare system has been affected severely by the pandemic lockdown due to several reasons. There was an increasing fear of cross-infection related to the nature of dental procedures, as most dental procedures generate an aerosol, whether in cavity preparation, root canal treatment, surgical or periodontal procedures. Consequently, they represent a possible source of respiratory infections. Further, an estimated 17.9–33.3% of COVID-19 patients develop asymptomatic illness [4,5], which can be a source of infection to dental healthcare personnel through saliva and the upper respiratory tract [6]. Moreover, there was a growing demand for personal protective equipment (PPE) to be reserved for the priority group of frontline healthcare workers. Dental services were not considered a priority in the main, and new official guidelines were issued to organize the provision of oral health care services. Dental practitioners were requested to postpone elective dental procedures and to provide dental treatment in regular dental practices only for urgent non-life-threatening complaints, including severe dental pain, localized dental/periodontal infections, local trauma such as symptomatic fractured tooth or avulsion/luxation, as well as certain urgent restorative procedures [7]. On the other hand, specific emergency cases were to be treated in emergency rooms considering their potentially fatal nature, including life-threatening cases of cellulitis, uncontrolled bleeding, or trauma [7]. While it is important to provide treatment for patients with urgent or emergency dental conditions, the primary goal is to prevent the transmission of infection to patients and dental healthcare personnel.

During lockdown periods related to infectious disease pandemics, several factors must be considered in providing dental services. Firstly, triage of dental complaints should be performed to initiate treatment to only those complaints with urgent or emergency nature. Secondly, the availability of dental services that can deal with these situations has to be evaluated within the context of cross-infection prevention and the availability of PPE. Thirdly, the potential of dental procedures to generate aerosol must be assessed and, if possible, mitigated by conducting other non-aerosol-generating procedures. COVID-19 was not the first challenge to healthcare services worldwide in the twenty-first century, and it may not be the last. Dental practitioners, as part of the healthcare team, must be well-informed and adequately prepared for such events. Studies investigating the types of dental procedures provided during the COVID-19 lockdown have exclusively collected data from public hospitals [8-11]. These studies highlighted the main causes of patient attendance during the lockdown, mainly

odontogenic infections like pulpitis and abscesses. Albeit the importance of these data and their implications, it is equally important to examine all sectors of the oral healthcare system, including private and academic sectors, which provide advanced and varied services to a significant proportion of the population. It is also necessary to explore the nature of these procedures according to their urgency and study the pattern of complaints within the context of urgent and emergency nature. Moreover, it is warranted to investigate the possible influence of the socio-professional characteristics of practitioners working in different geographic areas with varying economic backgrounds and income levels.

Therefore, this study aims to describe types of emergency and urgent oral healthcare services administered during the COVID-19 lockdown. The study also explores a possible influence of socio-professional characteristics of dental practitioners working in three Eastern Mediterranean countries with different economic levels ranging from lower middle to high-income countries.

## Material and Methods

### Data Collection

A questionnaire was constructed in Arabic, consisting of 34 items of closed-ended questions. First part of the questionnaire included 5 items (age, gender, country, specialty, and sector). Second part consisted of 6 items addressing knowledge about therapeutic procedures conducted during the COVID-19 pandemic. Third part consisted of 3 items addressing self-reported COVID-19 infection and its characteristics. Fourth part consisted of 9 items on cross-infection control practices related to the pandemic, and the fifth part consisted of 10 items on economic and professional aspects of the pandemic. The questionnaire ended with one open-ended item on personal views on the impact of the pandemic on the dental profession. Data utilized in this study was concerned with the first three sections of the questionnaire: socio-demographics, types of therapeutic procedures conducted during the pandemic lockdown, and self-reported COVID-19 infection.

The questionnaire was designed by an expert panel of co-authors with expertise in COVID-19's impact on dental practice using Google Forms. Then it was tested for clarity of questions and reproducibility of responses. A group of ten practitioners from Jordan, Egypt, and Saudi Arabia were invited to complete the questionnaire on two occasions, separated by one week, to compare answers. Face validity was carried out within the author's group, who did not share in designing the questionnaire. Unclear or vague questions were modified. The calculated Cronbach alpha and Kappa values were considered acceptable (0.72 and 0.77, respectively).

The questionnaire was distributed between 20th October 2020 and 31st March 2021 to specific dental professional WhatsApp groups in Jordan, Egypt, and Saudi Arabia. Included professional groups consisting of a total 750 dentists. Sample size calculation was carried out using Epi Info™ (CDC, USA). The calculation indicated that for the estimated population of dental practitioners in the three countries (N=40000), an expected frequency of 50% (response rate) and 5% margin of error, a sample size of 269 will yield a confidence interval of 90% and a sample of 380 will yield a confidence interval of 95%. Design effect and cluster size were set at 1 each.

### Data Analysis

The Statistical Package for Social Sciences (SPSS) version 21 (IBM Corp., Armonk, NY, USA) was used to calculate descriptives in frequencies, and percentages for the socio-professional characteristics and types of dental procedures. Statistical significance of the association of socio-professional data with types of procedures was calculated using cross tabulation with Chi-square test, and the significance level was set at  $p \leq 0.05$ . Multiple

linear regression analysis was carried out to investigate variables associated with the number of emergency and urgent procedures conducted. The total number of dental procedures performed (or the variability of procedures) by each practitioner was calculated. Five factors were investigated as possible predictors for the procedure variability calculated for practitioners: self-reported COVID-19 infection, age, gender, sector groups (general, private), and knowledge of COVID-19-related dental practice guidelines. Before processing, reliability was tested on the data of 10 participants who were re-interviewed after one week. Cronbach alpha was calculated, and outliers were excluded.

#### Ethical Clearance

Ethical approval was obtained from the Faculty of Dental Medicine ethics committee, Al-Azhar University, Assuit, Egypt, on 5th October 2020 (IRB # AUAREC20190509-12).

## Results

### Description of the Sample

Initially, there were a total of 354 participants who participated in the study. A total of 19 respondents were excluded from the study as these were not practicing in either Jordan, Egypt, or Saudi Arabia, giving a final number of 335 and a response rate of: 51.5% (calculated for participants of social media groups within which the questionnaire was distributed).

Participants were mostly females (N=225, 67.2%), with males constituting 110 (32.8%) and with a mean age of:  $36.1 \pm 10.4$  years (age range= 23-73 years). Participants were: 138 (41.2%) from Jordan, 123 (36.7%) from Egypt, and 74 (22.1%) from Saudi Arabia. There were 202 (60.3%) general practitioners and 133 (39.7%) specialists. Participants were affiliated with Ministries of Health (N=70, 20.9%), university hospitals (N=99, 29.6%), private sector (N=158, 47.2%), armed forces (N=6, 1.8%), and non-profit organizations (N=2, 0.6%). Most of the sample (N=225, 67.2%) stated that they did not get COVID-19 infection, while the remainder were distributed as follows: 51 participants (15.2%) reported they got infected with SARS-CoV-2 and a total of 59 (17.6%) were unsure whether they had the infection or not.

### Dental Procedures Conducted During the Pandemic Lockdown

Most of the sample (N=274, 81.8%) indicated that they were aware of the guidelines and recommendations announced concerning dental practice during the COVID-19 pandemic. There were (N=84, 25.1%) practitioners who reported doing regular dental treatment during lockdown. On the other hand, a higher percentage of practitioners performed emergency dental procedures (N= 118, 35.2%). Country-specific analysis of emergency and urgent treatments is presented in Table 1. Participants reported treatment of 172 emergency cases. Cellulitis (N=108) was the most frequent emergency treatment carried out, followed by trauma to facial bones (N=36) and then uncontrolled bleeding (N=28). There were no statistically significant differences between countries in the frequency of emergency procedures ( $p > 0.05$ ). Participants reported a higher number of procedures (N=1010), with the most frequent complaints being: pulpitis, abscesses, and pericoronitis (N=191, 130, 95, respectively). The only statistically significant differences noticed between countries were those concerning pulpitis (most common in Egypt and Jordan), broken symptomatic teeth (most common in Jordan), and biopsy procedures (most common in Egypt) ( $p < 0.05$ ).

**Table 1. Cross-tabulation of various emergency and urgent treatment procedures and countries.**

Variables	Jordan N (%)	Egypt N (%)	Saudi Arabia N (%)	Total N (%)	p-value
<b>Emergency Treatment</b>					
Uncontrolled bleeding	9 (6.5)	15 (12.2)	4 (5.4)	28 (8.4)	0.149
Cellulitis	45 (32.6)	40 (32.5)	23 (31.1)	108 (32.2)	0.971
Trauma involving bones	17 (12.3)	14 (11.4)	5 (6.8)	36 (10.7)	0.441
<b>Urgent Treatments</b>					
Pulpitis	84 (60.9)	77 (62.6)	30 (40.5)	191 (57.0)	0.005*
Pericoronitis or wisdom teeth pain	43 (31.2)	37 (30.1)	15 (20.3)	95 (28.4)	0.213
Dry Socket and dressing	28 (20.3)	24 (19.5)	9 (12.2)	61 (18.2)	0.308
Abscesses and pain	56 (40.6)	53 (43.1)	21 (28.4)	130 (38.8)	0.104
Broken tooth with pain or tissue irritation	33 (23.9)	24 (19.5)	7 (9.5)	64 (19.1)	0.038*
Trauma with avulsion	18 (13.0)	14 (11.4)	4 (5.4)	36 (10.7)	0.222
Dental preparation before critical surgeries	7 (5.1)	15 (12.2)	5 (6.8)	27 (8.1)	0.097
Crown and bridge work	25 (18.1)	17 (13.8)	8 (10.8)	50 (14.9)	0.331
Biopsy	3 (2.2)	12 (9.8)	4 (5.4)	19 (5.7)	0.030*
Extensive caries or faulty fillings	39 (28.3)	27 (22.0)	14 (18.9)	80 (23.9)	0.258
Use of temporary dressing materials	13 (9.4)	11 (8.9)	6 (8.1)	30 (9.0)	0.950
Suture removal	17 (12.3)	22 (17.9)	11 (14.9)	50 (14.9)	0.452
Denture adjustment for oncology patients	13 (9.4)	10 (8.1)	2 (2.7)	25 (7.5)	0.195
Denture adjustments	11 (8.0)	13 (10.6)	5 (6.8)	29 (8.7)	0.610
Replacing temporary filling (endodontics)	31 (22.5)	21 (17.1)	11 (14.9)	63 (18.8)	0.332
Orthodontic emergency treatment	27 (19.6)	21 (17.1)	12 (16.2)	60 (17.9)	0.794

\*Statistically Significant.

Gender analysis for these procedures showed no statistically significant differences except in one emergency procedure: uncontrolled bleeding and two urgent procedures: biopsy and suture removal. These were significantly associated with males ( $p < 0.05$ ) (Table 2).

**Table 2. Distribution of treatments according to gender.**

Variables	Gender		p-value
	Male N (%)	Female N (%)	
<b>Emergency Treatment</b>			
Uncontrolled bleeding	14 (12.7)	14 (6.2)	0.043*
Cellulitis endangering airways	32 (29.1)	76 (33.8)	0.389
Trauma involving bones	11 (10.0)	25 (11.1)	0.758
<b>Urgent Treatment</b>			
Pulpitis	58 (52.7)	133 (59.1)	0.268
Pericoronitis or wisdom tooth pain	36 (32.7)	59 (26.2)	0.215
Dry Socket and dressing	24 (21.8)	37 (16.4)	0.231
Abscess and pain	43 (39.1)	87 (38.7)	0.940
Broken tooth with pain or tissue irritation	21 (19.1)	43 (19.1)	0.996
Trauma with avulsion	17 (15.5)	19 (8.4)	0.052
Dental preparation prior to critical surgeries	13 (11.8)	14 (6.2)	0.077
Crown and bridge work	17 (15.5)	33 (14.7)	0.849
Biopsy	11 (10.0)	8 (3.6)	0.017*
Extensive caries or faulty fillings	27 (24.5)	53 (23.6)	0.842
Use of temporary dressing materials	14 (12.7)	16 (7.1)	0.091
Suture removal	25 (22.7)	25 (11.1)	0.005*
Denture adjustment for oncology patients	9 (8.2)	16 (7.1)	0.726
Denture adjustments	13 (11.8)	16 (7.1)	0.150
Replacing temp filling in endo patients	26 (23.6)	37 (16.4)	0.114
Orthodontic emergency treatment	24 (21.8%)	36 (16.0%)	0.192

\*Statistically Significant.

The results showed that significantly more procedures were conducted in various Ministry of Health centers in the three countries to treat: cellulitis, pericoronitis, dry socket, broken teeth, trauma with avulsion, and orthodontic emergencies. While significantly more urgent procedures were conducted in university hospitals related to crown and bridge work and extensive caries and temporary dressings ( $p < 0.05$ ) (Table 3).

**Table 3. Distribution of emergency and urgent treatment procedures within the sector.**

Variables	Sector			p-value
	Ministry of Health N (%)	Private Practice N (%)	University N (%)	
<b>Emergency Procedures</b>				
Uncontrolled bleeding	11 (14.1)	9 (5.7)	8 (8.1)	0.089
Cellulitis threatening airways	33 (42.3)	54 (34.2)	21 (21.2)	0.009*
Trauma of facial bones endangering airways	14 (17.9)	15 (9.5)	7 (7.1)	0.053
<b>Urgent Procedures</b>				
Pulpitis	50 (64.1)	102 (64.6)	39 (39.4)	0.000*
Pericoronitis or wisdom tooth pain	36 (46.2)	50 (31.6)	9 (9.1)	0.000*
Dry Socket and dressing	23 (29.5)	30 (19.0)	8 (8.1)	0.001*
Abscess and pain	43 (55.1)	63 (39.9)	24 (24.2)	0.000*
Broken tooth with pain or tissue irritation	21 (26.9)	34 (21.5)	9 (9.1)	0.006*
Trauma with avulsion	14 (17.9)	18 (11.4)	4 (4.0)	0.012*
Dental preparation before critical surgeries	8 (10.3)	10 (6.3)	9 (9.1)	0.525
Crown and bridge work	13 (16.7)	30 (19.0)	7 (7.1)	0.029*
Biopsy	7 (9.0)	7 (4.4)	5 (5.1)	0.347
Extensive caries or faulty fillings	20 (25.6)	48 (30.4)	12 (12.1)	0.003*
Use of temporary dressing materials	6 (7.7)	21 (13.3)	3 (3.0)	0.018*
Suture removal	13 (16.7)	25 (15.8)	12 (12.1)	0.638
Denture adjustment for oncology patients	8 (10.3)	14 (8.9)	3 (3.0)	0.126
Denture adjustments	12 (15.4)	10 (6.3)	7 (7.1)	0.053
Replacing temp filling (endodontics)	18 (23.1)	38 (24.1)	7 (7.1)	0.002*
Orthodontic emergency treatment	21 (26.9)	30 (19.0)	9 (9.1)	0.008*

\*Statistically Significant.

### Regression Analysis

The results of the regression analysis are shown in Tables 4 to 6. Table 4 is a summary of the regression model showing that chosen predictor variables are responsible for only 2.1% of the variance of numbers of different performed procedures. However, the Durbin-Watson test does not indicate a serial correlation between various independent variables (ideally 1.5-2.5).

**Table 4. Model summary<sup>a,b</sup>.**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.144 <sup>a</sup>	0.021	0.006	27.15047	2.107

<sup>a</sup>Dependent Variable: Number of procedures performed; <sup>b</sup>Predictors: (Constant), Knowledge of COVID-19 dental guidelines, COVID-19 self-reported infection, Gender, Sector Groups, Age.

Table 5 shows the ANOVA of the regression model with a not significant value at  $p = 0.227$ .

**Table 5. ANOVA<sup>a,b</sup> of the regression model, F-value, and significance.**

	Sum of Squares	df	Mean Square	F	Sig.
Regression	5127.462	5	1025.492	1.391	0.227 <sup>b</sup>
Residual	242521.774	329	737.148		
Total	247649.236	334			

<sup>a</sup>Dependent Variable: number of procedures performed; <sup>b</sup>Predictors: (Constant), Knowledge of COVID-19 dental guidelines, COVID-19 self-reported infection, Gender, Sector Groups, Age.

Table 6 shows the regression model coefficients with only gender as the significant variable ( $p=0.044$ ), as male practitioners are predicted to carry out six more dental procedures than their female peers. The regression model shows other non-significant predictor variables and predicts that age and self-reported infection with COVID-19 have a small effect on the number of procedures carried out by each practitioner. Sector of practice and knowledge of guidelines were also shown to be non-significant. However, practitioners in the private sector were predicted to perform 2.72 more procedures than practitioners in the public sector, and practitioners who reported knowledge of treatment guidelines during the COVID-19 pandemic were also predicted to perform 4.37 more procedures than practitioners with no such knowledge. Table 6 also shows that values of tolerance and variance inflation factor (VIF) do not suggest multicollinearity of independent variables.

**Table 6. Coefficients<sup>a</sup> of regression model.**

Predictors	Unstd. Coefficients		Std. Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
Constant	38.19	9.152		4.17	0.000	20.19	56.193					
Self-reported COVID-19 infection	0.054	4.259	0.001	0.013	0.990	-8.32	8.431	-0.008	0.001	0.001	0.940	1.064
Age	-0.025	0.148	-0.009	-0.17	0.868	-3.15	0.266	0.007	-0.01	-0.01	0.931	1.074
Gender (M, F)	-6.42	3.174	-0.111	-2.02	0.044	-12.67	-0.179	-0.118	-0.11	-0.11	0.990	1.010
Sector groups (public, private)	2.72	3.079	0.050	0.884	0.377	-3.336	8.777	0.062	0.049	0.048	0.932	1.073
Knowledge of COVID-19 dental guidelines (no, yes)	4.37	3.894	0.062	1.12	0.262	-3.290	12.032	0.073	0.062	0.061	0.974	1.026

<sup>a</sup>Dependent Variable: number of procedures performed.

## Discussion

In this study, a survey was conducted in three neighboring Eastern Mediterranean countries with slight differences in income level according to the World Bank ranking system: high-income (Saudi Arabia), upper-middle-income (Jordan), and lower-middle-income (Egypt) countries [12]. The study showed that dental practitioners with various socio-professional characteristics have contributed to oral healthcare services during the COVID-19 pandemic lockdown and that all types of procedures were conducted, including elective or regular dental treatment. It was intriguing to see that almost one in four practitioners conducted regular (elective) dental treatments during lockdown. The finding that approximately 18% of the sample were not aware of the COVID-19 dental guidelines may indicate that lack of knowledge was a main contributory factor to the provision of regular dental treatment, although it was prohibited per the guidelines. However, this does not rule out the potential mal conduct by some practitioners in disregarding such guidelines. This calls upon official bodies to spread timely awareness of the current guidelines and activate a monitoring system of dental practices.

All types of emergency and urgent procedures were performed with variable frequencies in the participating countries. The most frequently encountered emergency in all participating countries was cellulitis, followed by facial bone trauma and uncontrolled bleeding. It is anticipated that cases of facial trauma to be reduced during the lockdown because of traffic restrictions, quarantine policy, and closing of schools and universities [9].

On the other hand, studies from Western Europe reported an overall sharp reduction in the incidence of facial cellulitis. Maxillofacial departments in all public hospitals in France reported a 44% decrease in cellulitis admission cases [13]. This was explained by the practice of self-medication with antibiotics which could negate the need to visit the dentist [8]. However, previous studies reported a different scenario in the Eastern Mediterranean, wherein dentists working in Jordan indicated that oral infections were the most commonly cited complaints communicated from their patients through social media channels during the COVID-19 lockdown [3]. Similarly, a study from India estimated that the most common emergencies in the hospital setting were acute dental infections such as pulpitis, abscesses, and cellulitis [10]. Meanwhile, only 65.8% of residents in Saudi Arabia reported that they were willing to go for emergency treatment for cellulitis, compared to 94.5% who were willing to seek care for facial bone trauma [15]. This was partially attributed to underestimating the severe and potentially fatal outcomes of cellulitis and increased fear of contracting COVID-19 while seeking healthcare [14].

Cellulitis developing as an emergency case presents a serious problem taking into consideration the potentially fatal complications associated with such morbidity. On the other hand, cellulitis could be prevented by early treatment of dental caries that prevents the complications of pulp necrosis and abscess formation. In the inevitable situation of pulp necrosis, root canal treatment should be initiated to eradicate infection and prevent its progress to cellulitis [15].

The relatively higher number of cellulitis cases encountered during the COVID-19 lockdown in this study is an anticipated consequence of the deteriorating oral health status of many patients who have either neglected oral hygiene or postponed seeking oral healthcare due to various reasons, including high treatment costs. There is a high burden of dental and periodontal diseases among populations in this geographic area of the East Mediterranean [16]. This is complicated by poor dental attendance [17] and high dental treatment costs, which could deter patients from seeking timely treatment. High cost of dental treatment was the second most important cause for delaying dental treatment among Arab populations [18], and it was the most frequently cited cause for seeking self-treatment with natural remedies to reduce dental symptoms and defer professional dental treatment [19].

As for the urgent procedures, the most common complaints were acute dental infections such as pulpitis and abscesses, consistent with similar studies conducted in Asia [9,11,20], and Europe [21-23]. This finding echoes the high prevalence of dental caries as the most common form of oral disease [24]. It was observed that pulpitis was more significantly reported in Egypt and Jordan than in Saudi Arabia. However, there were no statistically significant differences between these countries concerning other dental and periodontal infections, including abscesses and pain. Therefore, there could be an overlap in the interpretation of urgent dental painful complaints reported by practitioners in the three countries. Other country-specific urgent procedures were also noticed. While broken symptomatic teeth were significantly reported in Jordan, more biopsy cases were reported in Egypt. It is hard to explain this finding as the “broken symptomatic teeth” is another indication of deteriorating dental conditions due to untreated/poorly treated dental caries. At the same time significantly higher cases of biopsy in Egypt could indicate a higher prevalence of soft tissue lesions requiring biopsies. A

possible explanation could relate to the fact that Egypt has probably one of the highest overall incidence rates of cancer of the oral cavity and pharynx among Middle East countries [25].

Gender was the only factor determined by this study to be a significant predictor of the number of dental procedures performed by each practitioner. Furthermore, statistically significant differences were noticed between male and female practitioners in three specific situations: uncontrolled bleeding, biopsy, and suture removal, where significantly more males performed these procedures. These procedures are surgical in nature, which may highlight the dominant role of male practitioners in the surgical maxillofacial specialties regionally or globally [26]. It may also emphasize the social role of females in caring for the family during critical times of lockdown [27]. Closure of nurseries and schools that shifted to online learning obliged female practitioners to assume more family-centered roles, such as homeschooling their children and supervising them during online classes. This may have also been complicated by the fear of female practitioners contracting the infection from patients and transmitting it to other family members [28].

Although non-significant, private sector practitioners and those with knowledge of dental practice guidelines were predicted to perform more procedures during lockdown. Better knowledge will inevitably improve clinical practice, provide confidence, and guide practitioners throughout the critical times of the pandemic. Further, the pandemic has inflicted major economic drawbacks on practitioners who work in private practice since the closure of their practices during lockdown meant the loss of perhaps the only source of income. The COVID-19 pandemic has certainly influenced practitioners' income in the private sector, while the income of public sector employees remained unaffected [29]. A substantial number of dental practitioners working in the private sector had a significant reduction in income associated with the COVID-19 pandemic [30]. Egypt represents the country with the largest dental practitioner workforce in this study. It was reported that more than 50% of the practitioners closed their practices in Egypt for durations ranging from a few weeks to 7 months [31]. Accordingly, it seems that fear of reduced income has prevented some practitioners working in the private sector from complying with the lockdown regulations. Although some industrialized countries offered to compensate for the lockdown-related losses of practitioners working in the private sector [32], this may not apply to the less developed countries of the East Mediterranean.

Significantly more procedures were conducted in the Ministry of Health centers to treat cellulitis, pericoronitis, dry socket, broken teeth, avulsion, and orthodontic emergencies. While significantly more advanced fixed prosthetic and restorative urgent procedures were conducted in university hospitals. The Ministry of Health in the three countries represents the primary healthcare provider to the population with slight differences. Free healthcare services are provided to nationals free of charge in Saudi Arabia, while in Jordan and Egypt, nationals can claim free healthcare services if they are government employees as they have health insurance. Other Uninsured nationals, on the other hand, can receive low-cost primary healthcare services. Further, university hospitals represent secondary and tertiary health care providers dealing with more advanced therapeutic procedures and having more resources to address these procedures. This finding may highlight the strength of any healthcare system with predefined roles of various sectors contributing to this system. It also calls upon policymakers and official parties to strengthen the healthcare system infrastructure and connect the different sectors by assigning each one of them specific tasks.

The study has limitations. It is cross-sectional, describing responses of dental practitioners at the time of the COVID-19 lockdown. It also collected self-perceived data, which could lead to potential bias in reporting. Another important limitation is the relatively small sample size which may under-represent the complete picture

of all dental practitioners in the three participating countries. However, the study included three countries and involved all public and private healthcare sectors, allowing for an actual representation of the situation.

## Conclusion

Inflammatory or infectious oral diseases remain the most common emergency and urgent complaints among dental patients in some Eastern Mediterranean countries. This calls upon promoting oral health awareness and attitudes among the respective populations. It further warrants updating dental practitioners in diagnosing and adequately managing dental infections, particularly pulpitis and cellulitis. Factors contributing to female practitioners' reduced participation in surgical procedures should be explored. Further, it is also warranted to determine the pattern and contributing factors to the failure of some dental practitioners to follow official guidelines set to organize dental practice during the COVID-19 lockdown. The provision of oral healthcare services can greatly improve by transforming healthcare systems towards integrating the coordination between all healthcare providers in the public and private sectors.

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## 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.

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