Clinical and Experimental Health Sciences

Comparison of Clinical-related Characteristics of Endodontic Patients Before and During the COVID-19 Pandemic

Tuna Kaplan, Sema Sonmez Kaplan

Biruni University, Faculty of Dentistry, Department of Endodontics, Istanbul, Türkiye.

Correspondence Author: Sema Sonmez Kaplan
E-mail: semak@biruni.edu.tr

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ABSTRACT

Objective: To compare patient-related and clinical-related characteristics of endodontic patients, before and during the COVID-19 pandemic.

Methods: The study population comprised 506 patients (teeth: *n*=674) aged 13–81 years who attended undergraduate dental clinics in the Endodontics Department of the Faculty of Dentistry at Biruni University for endodontic treatment. Patient-related and clinical-related data were compared at two time intervals: before the first COVID-19 case was reported in Turkey and after the first COVID-19 case was reported in Turkey.

Results: There were no significant differences in terms of age and sex of the patients attending the clinics before versus during the pandemic. The incidence of reported pain before the pandemic was significantly lower than that reported during the pandemic *(p*=0.041). Periapical health before the pandemic was significantly better than that during the pandemic (*p*<0.001). The frequency of a diagnosis of asymptomatic irreversible pulpitis before the pandemic was significantly higher than that during the pandemic (*p*<0.001). The frequency of a diagnosis of asymptomatic apical periodontitis was higher during the pandemic than before the pandemic (*p*<0.001).

Conclusion: These results may be explained by patients, other than those with severe symptoms, not wishing to attend endodontics clinics during the pandemic due to concerns about contracting the virus and passing the infection to family members.

Keywords: COVID-19, endodontic diagnosis, PAI score, pandemic, systemic disorders

1. INTRODUCTION

An outbreak of coronavirus disease 2019 (COVID-19) caused by a new coronavirus named severe acute respiratory syndrome coronavirus 2 was reported in Wuhan, Hubei, China in late December 2019 (1). The virus spread throughout China before then spreading to other countries, leading to a pandemic and international health crisis (2). Inhalation and direct contact were suggested as the most likely transmission routes (1). The World Health Organization (WHO) announced COVID-19 a pandemic on March 11, 2020, after which most countries instigated various virus transmission prevention measures, including lockdowns, travel bans and closing services not considered essential (3). By the end of December 2020, vaccination had commenced in a number of countries with the aim of decreasing the spread of COVID-19. Globally, as of March 11, 2021, the WHO had reported over 118.3 million COVID-19 cases and over 2.6 million COVID-19-related deaths (4).

Although vaccination started gradually, people's lives did not return to normal. Many patients did not return to endodontics clinics for treatment, most likely due to concerns about contracting the virus. Clinical education in dentistry faculties resumed in Turkey in October 2020. Treatment in undergraduate dental clinics also resumed at this time. Endodontics clinics are unique among dental clinics in that the patient population tends to comprise individuals with severe odontogenic pain. Pulpal and periapical diseases account for a significant number of all dental emergencies (5,6). Symptomatic irreversible pulpitis, symptomatic apical periodontitis and acute apical abscesses are the most common endodontic emergencies (5-7). Although patients with these disorders may have no clinical symptoms for some time, radiological signs of an endodontic infection may be detected during routine checkups.

The COVID-19 pandemic poses a risk to many individuals, particularly those with systemic disorders. Dental patients with systemic disorders may feel particularly vulnerable to contracting the virus. The dental treatment requirements

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of individuals with systemic disorders during the pandemic need to be addressed (8).

There are no retrospective studies on clinical-related characteristics of endodontic patients before and during the COVID-19 pandemic. The purpose of the present study was to compare patient-related (age, sex and systemic disorders) and clinical-related (tooth type, symptoms, periapical index (PAI) scores and endodontic diagnoses) characteristics of endodontic patients, before versus during the COVID-19 pandemic.

2. METHODS

The present study was approved by Biruni University Institutional Review Board, Turkey (19.03.2021 – 2021/49-15).

2.1. Patient Selection

The study population comprised 506 patients (teeth: *n*=674) aged 13–81 years who visited student clinics in the Endodontics Department of the Dentistry Faculty at Biruni University for endodontic treatment at two time intervals: between October 7, 2019 and January 10, 2020 (Fall semester of the 2019–2020 academic year and before March 11, 2020 when the first COVID-19 case in Turkey was recorded) and between October 5, 2020 and January 08, 2021 (Fall semester of the 2020–2021 academic year and after March 11, 2020 when the first COVID-19 case in Turkey was recorded). Data on the patient's age, sex and medical and dental histories were obtained from the patient database system. In total, the records of 315 patients (teeth: *n*=408) before the first reported COVID-19 case in Turkey and 191 patients (teeth: *n*=266) after the first reported case were evaluated.

Patients older than 13 years whose endodontic treatment had been performed by fourth – or fifth-year dental undergraduate students and for whom periapical radiographs of the area of interest were available for diagnosis were included in the present study. Pregnant patients, patients with cellulitis, patients with diffuse soft tissue bacterial infections or intra – or extra-oral swellings and patients whose radiographies were difficult to examine were excluded, as well as teeth with periapical cysts, trauma, apical surgery, endo-perio lesions, third molar teeth and retreated teeth.

2.2. Patient Eecords' Assessment

The patients were divided into the following age groups: 13 – to 19-year, 20 – to 29-year, 30 – to 39-year, 40 – to 49-year, 50 – to 59-year and 60+ year. For all patients, the following parameters were recorded: age, sex and systemic disorder history; tooth type; presence of pain and swelling; PAI score; and endodontic diagnosis. Data on medical treatment histories, current meical treatments and current drug use were recorded. Cardiovascular diseases, hypertension, diabetes, chronic kidney disease, respiratory disease, chronic liver disease gastrointestinal disease, obesity, cancer and blood disorders were regarded as systemic disorders.

2.3. Clinical Assessment

The clinical assessment was based on subjective and objective findings. In terms of subjective findings, chief complaints, such as symptoms, duration, location, onset and pain stimuli, were recorded. In relation to objective findings, facial symmetry, sinus tract (if any), soft tissue, caries and restorations were recorded. Pulp tests were performed if necessary, as well as percussion and palpation tests (9). No evoked or spontaneous pain was classified as 'no pain'. Pain that was not spontaneous but provoked by hot, chewing, percussion or palpation was considered 'evoked' pain. Severe, sharp and continuous pain, which kept the patient awake at night and persisted after removal of the stimulus, or deep, continuous, dull and throbbing pain, which increased on biting, was considered 'spontaneous' pain'. Swelling was classified as 'no swelling' or 'swelling', with swelling referring to localized swelling of associated soft tissue.

2.4. Radiographic Assessment

The periapical status was determined using the PAI suggested by Orstavik et al. (10), in which the periapical section on a radiograph is scored as below:

1 = Normal periapical structures

2 = Small changes in bone structure

3 = Changes in bone structure with some mineral loss

4 = Periodontitis with well-defined radiolucent area

5 = Severe periodontitis with exacerbating features

Teeth with more than one root were categorized according to the root with the highest score. The periapical status of all 674 teeth involved in this study were analysed radiographically. The PAI scores were determined based on periapical radiographs taken using a phosphor plate system (Dürr Dental, Bietigheim-Bissingen, Germany), using the parallel technique for standardization. The radiographs were analysed by two experienced endodontists using Picture Archiving and Communication Systems software version 1.1.1.6 for Windows 10 (Microsoft Corporation, Redmont, WA, USA) displayed on a 28-inch Samsung LU28H750UQMXUF monitor (Samsung Electronics, Seoul, South Korea) with 3,840 x 2160 pixel resolution. Before examining the radiographs, for calibration training, each examiner assessed a series 20 radiographs not related to this study. Cohen's kappa was used to assess inter-examiner consensus. A value of 0.89 denoted excellent agreement. Disagreement between the two examiners in the radiographic examinations was resolved through discussion until consensus was reached.

2.5. Diagnostic Assessment

The endodontic diagnoses were based on the criteria of the American Association of Endodontics and American Board of Endodontics (11). According to these criteria, asymptomatic irreversible pulpitis was considered vital inflamed pulp that

failed to resolve in patients without symptoms. Symptomatic irreversible pulpitis was considered vital inflamed pulp that failed to resolve in patients with mild symptoms, which that did not impact on routine activities, or discomfort, which had a moderate or severe impact on routine activities. Asymptomatic apical periodontitis was considered inflammation of pulpal origin or destruction of the apical periodontium in patients with no clinical symptoms. Symptomatic apical periodontitis was classified as inflammation of pulpal origin or destruction of the apical periodontium in patients with discomfort that had a moderate or severe impact on routine activities and responded painfully to chewing, percussion or palpation. An acute apical abscess was classified as an inflammatory reaction to pulpal infection and necrosis, with rapid onset of spontaneous pain and swelling. A chronic apical abscess was considered an inflammatory reaction to pulpal infection and necrosis, with gradual onset and no or mild discomfort, discharge of pus through a sinus tract.

2.6. Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics for Windows, version 22 (IBM Corp., Armonk, NY). Descriptive statistical methods (mean, standard deviation and frequency) were used for evaluation of the study data. A chi-square test and Fisher's exact chi-square test were used for comparison of qualitative data. A value of $p<0.05$ was considered significant.

3. RESULTS

Table 1 provides information on the distribution of the patients according to age, sex and presence and type of systemic disorders. There were no significant differences in terms of age, sex or presence and type of systemic disorders before versus during the pandemic ($p=0.619$, $p=0.533$, $p=0.994$ and $p>0.05$, respectively; Table 1).

Table 2 shows the distribution of tooth type, the presence and type of pain, the presence of swelling and periapical health and endodontic diagnoses before and during the pandemic. There was no significant difference between tooth types before versus during the pandemic ($p=0.111$). The incidence of reported pain before the pandemic was significantly lower than that reported during the pandemic ($p=0.041$) (Fig.1). In terms of pain types and swelling, there was no significant difference before versus during the pandemic ($p=0.855$ and $p=1.000$, respectively). Periapical health before the pandemic was significantly better than that than during the pandemic ($p<0.001$) (Fig. 2). The prevalence of a diagnosis of asymptomatic irreversible pulpitis was significantly higher before the pandemic as compared with that during the pandemic ($p<0.001$). The prevalence of a diagnosis of asymptomatic apical periodontitis diagnosis before the pandemic was lower than that during the pandemic ($p<0.001$). There were no statistical differences in terms of the frequencies of symptomatic irreversible pulpitis, symptomatic apical periodontitis, acute apical abscess and chronic apical abscess diagnoses before versus during the pandemic ($p>0.05$) (Fig. 3).

Table 1. *The distribution of the patients according to age, sex, presence and type of systemic disorders in terms of pandemic (n=506)*

		Before Pandemic	During Pandemic	
		n (%)	n (%)	p
Age	13-19	59 (18.7)	45 (23.6)	[1]0.619
	20-29	62 (19.7)	44 (23)	
	30-39	73 (23.2)	38 (19.9)	
	40-49	64 (20.3)	32 (16.8)	
	50-59	29 (9.2)	17 (8.9)	
	60+	28 (8.9)	15 (7.9)	
Sex	Male	128 (40.6)	83 (43.5)	[1]0.533
	Female	187 (59.4)	108 (56.5)	
Systemic Disorders	Present	71 (22.5)	43 (22.5)	[1]0.994
	Absent	244 (77.5)	148 (77.5)	
Systemic Disorders	Cardiovascular diseases	9 (12.7)	10 (23.3)	[2]0.226
	Hypertension	36 (50.7)	18 (41.9)	[2]0.470
	Diabetes	9 (12.7)	8 (18.6)	[2]0.555
	Respiratory disease	10 (14.1)	7 (16.3)	[2]0.962
	Chronic kidney disease	4 (5.6)	0 (0%)	[3]0.295
	Chronic liver disease	7 (9.9)	1 (2.3)	[3]0.255
	Gastrointestinal disease	4 (5.6)	0 (0%)	[3]0.295
	Cancer	1 (1.4)	2 (4.7)	[3]0.556
	Obesity	3 (4.2)	3 (7)	[3]0.671
	Blood disorders	4 (5.6)	6 (14)	[3]0.174

[1]*Chi-square test* [2]*Continuity (yates) correction* [3]*Fisher's Exact test*

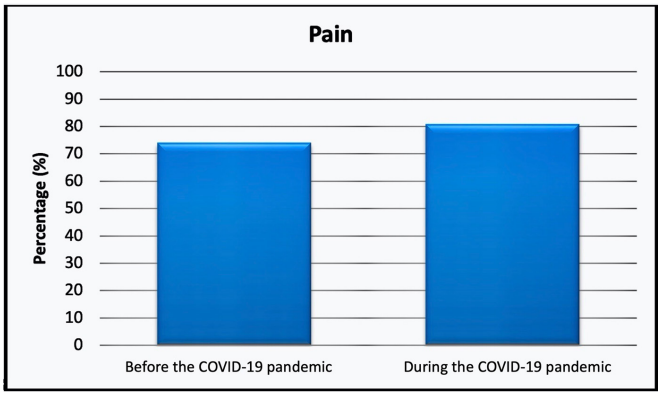

Figure 1. *The frequency of pain in terms of before and during pandemic*

Table 2. *The distribution of tooth type, presence and type of pain, presence of swelling, periapical health and endodontic diagnosis in terms of pandemic (n=674)*

		Before Pandemic	During Pandemic	
		n (%)	n (%)	*p*
Tooth Type	Maxillary anterior	44 (10.8)	36 (13.5)	0.111
	Maxillary premolar	101 (24.8)	55 (20.7)	
	Maxillary molar	102 (25)	51 (19.2)	
	Mandibular anterior	21 (5.1)	10 (3.8)	
	Mandibular premolar	53 (13)	38 (14.3)	
	Mandibular molar	87 (21.3)	76 (28.6)	
Pain	Absent	106 (26)	51 (19.2)	0.041*
	Present	302 (74)	215 (80.8)	
Type of Pain	Evoked	131 (43.4)	95 (44.2)	0.855
	Spontaneous	171 (56.6)	120 (55.8)	
Swelling	Absent	394 (96.6)	257 (96.6)	+1.000
	Present	14 (3.4)	9 (3.4)	
Periapex	Healthy	368 (90.2)	202 (75.9)	<0.001*
	Not healthy	40 (9.8)	64 (24.1)	
Diagnosis	Asymptomatic irreversible pulpitis	124 (30.4)	33 (12.4)	<0.001*
	Symptomatic irreversible pulpitis	85 (20.8)	72 (27.1)	
	Asymptomatic apical periodontitis	108 (26.5)	111 (41.7)	
	Symptomatic apical periodontitis	76 (18.6)	36 (13.5)	
	Acute apical abscess	14 (3.4)	9 (3.4)	
	Chronic apical abscess	1 (0.2)	5 (1.9)	

Chi-square test *+Continuity (yates) correction* **p<0.05*

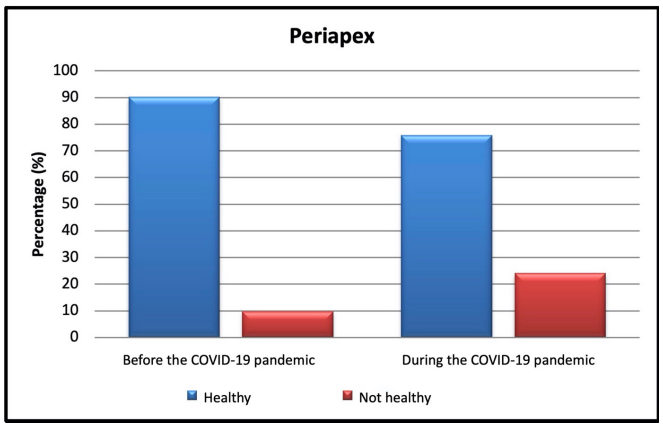

Figure 2. *The status of periapical health in terms of before and during pandemic*

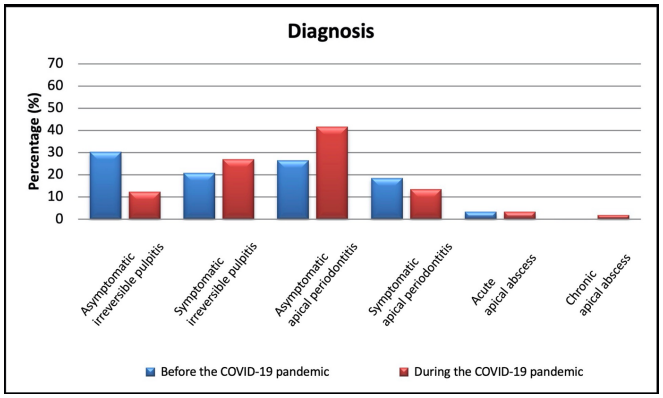

Figure 3. *The distribution of endodontic diagnosis in terms of before and during pandemic*

4. DISCUSSION

Undergraduate clinics in the endodontics department of our dentistry faculty resumed practice in the fall term of 2020–2021 academic year. As shown in this study, a smaller number of patients (n=191) visited these clinics during this period as compared with the same period the previous year (n=315). This finding was in accordance with that found in a research across the United States, which reported a decrease in the number of individuals attending endodontics clinics after the end of lockdowns (12). The decrease in numbers may be due to patients' fears of contracting the virus in the clinics and transmitting it to their families.

In our study, the results revealed no difference in the ages of the patients attending clinics before versus during the pandemic. In terms of sex, more females than males attended the clinics during both time intervals. The latter may be explained by the relatively low percentage of working women in Turkey. In contrast, Yu et al. reported little difference in the percentage of male and female patients attending endodontics clinics in Wuhan during the COVID-19 pandemic (13).

In present study, there was no significant difference in frequency of patients in the same age groups before versus during the pandemic. However, patients in the 30–39 year age group (23.2%) accounted for the majority of endodontic patients attending the clinics before the pandemic, whereas patients in the 13–19 year age group (23.6%) accounted for the majority of patients attending the clinics during the pandemic. This finding may be explained by schools being closed during the pandemic and children having a reduced risk of severe illness if infected with the virus. In contrast to our study, Yu et al. reported that those aged 45–64 years accounted for the majorioty of endodontic patients in their study on visits to endodontics clinics in Wuhan (13).

The presence of a systemic disorder is a major risk factor for severe illness if contaminated with SARS-CoV-2 (14). In the present study, number of patients with systemic disorders attending our endodontics clinics during the pandemic did not decrease significantly as compared with the number before the pandemic. Hypertension was the most frequent systemic disorder both before and during the pandemic. This result was similar to that of Bogari et al., who reported that hypertension was the most common systemic disorder (63.7%) among their endodontic patients (15). As one in every three people worldwide is expected to develop hypertension in their lifetime (15), the high frequency of this disorder in our study is not unexpected. Clinicians have a duty to evaluate risk factors for this systemic disease as part of health care, especially during the pandemic.

In terms of tooth type and endodontic treatment, in our study, maxillary molars most frequently required treatment before the pandemic, whereas mandibular molars most frequently required treatment during the pandemic. Our results also showed that mandibular anteriors were the least likely teeth to require endodontic treatment both before and during the pandemic. Our study results were comparable to those of other studies in terms of tooth types most commonly requiring endodontic treatment. Abuzenada et al. noted that mandibular molars were the most commonly involved tooth considering the endodontic treatment (16). In contrast, Demirci et al. reported that maxillary molars were more vulnerable to caries than mandibular molars (17). Differences in patient profiles with respect to education, income or social class might explain the inconsistency between the results in our study versus those reported in the literature.

Johnson et al. reported that a higher number of patients visited emergency endodontics clinics before the COVID-19 pandemic than during the pandemic (18). In our study, although there was a decrease in the number of individuals visiting undergraduate clinics of our endodontics department during the pandemic, the prevalence of individuals with the complaint of pain increased during the pandemic in comparison with the frequency before the pandemic (80.8% vs. 74%). In terms of evoked and spontaneous pain, the frequency was almost the same before versus during the pandemic in the present study. Both evoked and spontaneous pain are subjective findings. In the absence of confirmation by a clinical examination, subjective findings may not be a reliable indidcator of pain that occurred before and during the pandemic. In this study, the frequency of swelling was the same before the pandemic as during the pandemic. This may be due to swelling being a clinical emergency that caused patients to visit the clinic immediately, irrespective of the presence or absence of the pandemic.

A healthy periapical structure is vital for dental health. During the lockdown, all undergraduate clinics in dentistry faculties in Turkey were closed for at least 6 months. Therefore, treatment plans, both for patients midway through endodontic treatment and those scheduled to commence treatment could not proceed. As can be seen from the results of our study, the periapical health of the patients attending our clinics was significantly worse during the pandemic than before the pandemic. An increase in periapical lesions is to be expected, as no treatment was available while the clinics were closed. Rechenberg et al. pointed to a correlation between PAI scores and pain (19). In this study, PAI scores of the patients increased during the pandemic in comparison with those before the pandemic, indicating an unhealthy periapical apex and pain.

Previous studies reported that symptomatic irreversible pulpitis and symptomatic apical periodontitis were the most common endodontic diseases at the beginning of the pandemic (13,20). In our study, asymptomatic irreversible pulpitis and asymptomatic apical periodontitis were more common than other diseases before and during the pandemic, respectively. The inconsistency in the results might be explained by the earlier studies focusing on events during the first months of the pandemic (13,20). In the present study, patient records pertaining to the fall term of 2019–2020 academic year were taken as the first time interval, and the records of the fall term of 2020–2021 academic year were taken as the second time interval. In addition, in our study, the high frequency of asymptomatic apical periodontitis was clearly associated with the increase in PAI scores during the pandemic.

5. CONCLUSION

In the present study , there was an increased frequency of pain and higher PAI scores detected during the pandemic versus before the pandemic. Furthermore, the frequency of asymptomatic apical periodontitis after the COVID-19 pandemic was higher than normal. These results may be explained by patients, other than those with severe symptoms, not wishing to attend endodontics clinics during the pandemic due to concerns about contracting the virus and passing the infection to family members.

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