

Assessing the Influence of the COVID-19 Pandemic on Dental Care at the Chulalongkorn Dental Hospital through a Comparative Retrospective Study

Uthai Uma¹, Klafan Sae-tia², Yanisa Riewruja², Panuwat Duphong², Asamapon Srisathaporn²

¹Department of Occlusion, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand

²Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand

Abstract

This study aimed to investigate and compare the proportions of dental care over the past six years, encompassing periods both before and during the COVID-19 pandemic. A retrospective study was conducted by selecting new dental patients of Chulalongkorn Dental Hospital who were presented between 2017 and 2022. A data collection form was designed as a standard guideline for information gathering including demographic data, clinical examination findings, and details of dental management. Four data collectors were assigned to gather information from the digital data system under specific instructions. The collected data was initially cleansed and subsequently analyzed using SPSS 29.0. The study recruited a total of 1,359 medical records. There were no significant differences in the proportions of sex, age, address, remaining teeth, underlying diseases, or drug allergies between patients who presented before (G1) and during (G2) the COVID-19 pandemic. G2 exhibited a higher prevalence of oral dysfunctional problems than G1 and underwent more extensive investigation using single-technique radiographs. The top two provisional modified ICD-10 diagnoses were impacted teeth and pulp disease, with no significant difference between G1 and G2. The COVID-19 pandemic resulted in a decrease in the correspondence between provisional and final diagnoses ($p=0.011$). The most common dental procedures performed included surgical removal, extraction, filling, and root canal treatment. In conclusion, the COVID-19 pandemic impacted some variables related to clinical examination, radiographic intervention, provisional and final diagnoses, and their management.

Keywords: COVID-19 outbreak, COVID-19 pandemic, Dental care, Dental treatment, Retrospective study

Received date: Apr 17, 2024

Revised date: May 27, 2024

Accepted date: Jun 12, 2024

Doi:

Correspondence to:

Uthai Uma, Department of Occlusion, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand. Tel: 084-710-7720

E-mail: Uthai.U@chula.ac.th

Introduction

The COVID-19 pandemic has significantly impacted various facets of individuals' lives globally. One aspect of preventing the COVID-19 infection involves minimizing potential exposure through practices such as social distancing

or isolating oneself from high-risk areas.¹ Additionally, a majority of individuals have altered their daily routines and reduced their activities compared to pre-COVID-19 times.² These effects influenced people to consider their

safety from infection before going outside. In the dental field, patients who are apprehensive about their dental issues may modify their behavior, particularly in their approach to seeking dental treatment.³

The effects of the pandemic have extended to dentistry and related issues. For instance, there has been a notable decline in the number of dental patients which can be attributed to the pandemic.^{4,5} Especially during the lockdown period, dental patients' visits to the dentist were reduced due to appointment cancellations and treatment discontinuations.⁶ In addition, the amount of money spent on dental services during the first four months of the COVID-19 pandemic was reduced.⁵ Because dental patients suffered a drop in income after the COVID-19 outbreak, they refused to visit dentists to treat their toothaches.⁷ Consequently, the COVID-19 pandemic has had a negative impact on the number of dental patients.

Furthermore, while the Oral and Maxillofacial Surgery Clinic tended to treat patients most frequently⁸, numerous dental care centers completely stopped performing orthognathic and temporomandibular joint surgery. However, they continued to carry out minor oral surgeries, emergency procedures, and oncological operations.⁸ For orthodontics, patients faced the most pronounced disruptions in services due to government-ordered shutdowns, heightened fear, and increased concerns regarding cross-infection.⁹ During the lockdown, the occlusion of patients slightly regressed and some relapsed to a previous stage of treatment.¹⁰ Additionally, patients with fixed orthodontic appliances had problems e.g., deboned brackets, poking wire, and ulcers.¹¹ However, these studies evaluated the effects of the COVID-19 pandemic during the initial stages of the outbreak and focused on the narrow field of different dental specialties, not all patients in dental hospitals.

A previous study reported a reduction in the number of patients who visited dental clinics and associated factors.^{4,6} However, there was insufficient evidence to demonstrate the changes of patients and dentists affected by the COVID-19 pandemic. Furthermore, in Thailand, there is a lack of data on dental management in a dental

hospital with a tertiary level of healthcare and a lack of reports about the long-term consequences of the pandemic, such as a comparative study for explaining the COVID-19 impacts on dental schools. Therefore, the purpose of this study was to examine and compare the retrospective dental treatment data from new patients across groups before and during the COVID-19 pandemic that affected clinical examination, radiographic intervention, provisional and final diagnoses, and dental management. The null hypothesis was that there was no difference in dental care delivery before the onset of the COVID-19 pandemic compared to during the pandemic period.

Materials and Methods

Study Design

This retrospective study was designed to investigate the stored medical records of dental patients at Chulalongkorn Dental Hospital. This study was approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand (study code: HREC-DCU 2022-56) before the retrospective study procedures were performed. All medical records housed within the digital data system underwent supervision by the Dean of the Faculty of Dentistry, Chulalongkorn University. The Dean had the authority to oversee all aspects of the research process, including activities conducted before, during, and after data collection.

Samples

This study used a technique that disclosed and gathered handwritten medical information stored in the digital data system. All medical records represented the population for this study. The samples were medical records of new patients who came to Chulalongkorn Dental Hospital between 2017 and 2022. Upon their initial visit, these patients registered at the dental hospital, providing essential demographic data, and were provisionally examined by dental students and dentists. Most patients received appropriate treatment or management tailored to their specific dental concerns. Consequently, all patient history and profiles were recorded and sorted by hospital number (HN) related to the year the patients initially visited.

The HNs of the target population were allocated to two groups:

(1) Group 1 (Before the COVID-19 pandemic): New patients were registered between January 1, 2017 to December 31, 2019. (Total 3 years = 59,422 patients; 20,576 patients in 2017, 19,973 patients in 2018, and 18,873 patients in 2019)

(2) Group 2 (During the COVID-19 pandemic): New patients were registered between January 1, 2020 to December 31, 2022. (Total 3 years = 40,419 patients; 14,604 patients in 2020, 9,516 patients in 2021, and 16,299 patients in 2022)

Due to the separation of the two study groups, the sample size calculation was also defined into two groups. The sample size was estimated using a G*Power v.3.1 program on the exact test family and the statistical test of proportions for two independent groups. The parameters that were inputted into the program were as follows; 1) the expected proportion of group 1 was 0.6, 2) the expected proportion of group 2 was 0.5, 3) the significant level was 0.05, and 4) the power was 0.95. Thus, the calculated sample size was at least 662 medical records per group. The inclusion criteria were new patients who came to the dental hospital between 2017 and 2022. The exclusion criteria were 1) the medical records with missing data related to this study, or 2) illegible handwriting.

Data Collection Form

This retrospective study utilized planned guidelines as its research instrument. These guidelines comprised all question items listed in the data collection form. The form was structured into three distinct parts, each corresponding to specific information gleaned from the medical records: demographic details, clinical examination findings, and management aspects.

Part 1: HN, date of registration, sex (female, male), age, age group (child, young, adult, senior), marital status (single, married, widowed, divorced, unspecified), and address (Bangkok, others)

Part 2: Chief complaints (orofacial pain, oral dysfunctional problem, esthetic concern, others), present illness (no pain, acute pain, chronic pain, unclassified pain),

underlying disease (no disease, one disease, two diseases, more than two diseases, don't know), drug allergy (no, yes, don't know), number of remaining teeth, number of radiographic requests, radiographic techniques (periapical, bitewing, panoramic, submentovertex, transcranial lateral cephalometric, reverse Towne, and cone-beam computed tomography) and provisional diagnoses (International Classification of Diseases, Tenth Revision, Thai Modification (ICD-10, TM).

Part 3: Management status (received, not yet received), treatment clinics, and dental procedures.

The first version of the paper-based data collection form was used to gather pilot data consisting of sixty randomized medical records. Subsequently, this form was evaluated and revised by the authors, resulting in the development of the final version of the standard form for data collection. To ensure its reliability, the final version of the data collection form underwent testing for both inter-rater and intra-rater reliability across two different time points during the pilot data gathering phase, with a one-month interval between assessments. The results indicated nearly perfect agreement for test-retest reliability (intraclass correlation coefficient (ICC) = 0.983) and excellent agreement for inter-rater reliability (Cohen's Kappa = 0.986). Subsequently, the items from the standard form were transitioned from the printed paper to an online digital platform, specifically Google Forms.

Information Gathering

The data collection process comprised three distinct steps. Firstly, after the sample size determination, HNs were randomly generated by an online program using the Number Generator.¹² These HNs were subsequently organized in ascending order based on the generated numbers and printed as paper-based instructions for the data collectors. If medical records were excluded from the study due to the exclusion criteria, other HNs were generated and used instead. Secondly, after the pilot study and having the final version of the data collection form, four examiners were assigned as data collectors. These examiners were provided with instructions detailing how to access medical records within the digital data system

and how to accurately record and submit information using Google Forms. The data collectors completely clarified any doubt if they had any confusing questions. Lastly, the data collectors proceeded to gather information exclusively from partially disclosed documents relevant to the study objective, spanning the period from January to May 2023. Each piece of information was collected individually and stored in a digital format to facilitate subsequent statistical analysis.

Statistical Analysis

The software analyzed the collected data using the statistical software (IBM SPSS Statistics for Windows, Version 29.0, IBM Corp., Armonk, New York, USA). Descriptive statistics comprised mean, standard deviation (SD), frequency (N), and percentage (%). Comparative statistics comprise proportion and mean differences. The proportion differences were analyzed by the Chi-square test and the compare

column proportions test. In addition, the mean differences were initially evaluated for normality using the Kolmogorov-mirnov test. Then, in the case of non-normal distribution, the data were analyzed by the Mann-Whitney U test. If data had normality, it was analyzed by an independent *t*-test. All analyses were considered at a *p*-value of 0.05.

Results

As illustrated in Table 1, the study comprised 1,359 medical records. The ratio of women to men was approximately 2:1. The average age of the patients was around 40 years old, respectively. The majority of patients were single and resided in Bangkok, the capital of Thailand. Patients who sought treatment before the COVID-19 pandemic did not exhibit significant differences from those during the pandemic in terms of sex, age, age group, or address, except for marital status.

Table 1 Demographic data of 1,359 medical records from new patients seeking dental treatment at Chulalongkorn Dental Hospital [N (%)]

Variables		Before Pandemic [N=683]	During Pandemic [N=676]	<i>p</i> -value
Sex ^a	Female	447 (65.4%)	424 (62.7%)	0.295
	Male	236 (34.6%)	252 (37.3%)	
Age ^b , year	Mean±SD	41.9±18.2	42.4±18.4	0.486
	[95% CI]	[40.5-43.2]	[41.1-43.8]	
Age group ^a	Child (0-15 years)	10 (1.5%)	10 (1.5%)	0.951
	Young (16-30 years)	245 (35.9%)	244 (36.1%)	
	Adult (31-60 years)	283 (41.4%)	271 (40.1%)	
	Senior (>60 years)	145 (21.2%)	151 (22.3%)	
Marital status ^a	Single	407 (59.6%)	428 (63.3%)	0.006*
	Married	191 (28.0%)	179 (26.5%)	
	Widowed	34 (5.0%)	44 (6.5%)	
	Divorced	29 (4.2%)	20 (3.0%)	
	Unspecified	22 (3.2%) ^c	5 (0.7%) ^d	
Address ^a	Bangkok	483 (70.7%)	493 (72.9%)	0.365
	Others	200 (29.3%)	183 (27.1%)	

^a = Chi-square test, ^b = Mann-Whitney U test for non-normal distribution, ^{c,d} = statistical significance from the compare column proportions test, * = statistical significance (*p*-value<0.05)

Based on the clinical examination data presented in Table 2, over half of the new patients had orofacial pain problems that caused them to see dentists. These were acute forms that had been present for less than three months. However, patients who came during the

COVID-19 pandemic reported their issues as having higher oral dysfunction than before the COVID-19 pandemic. Most patients had no underlying conditions and no medication allergies. Intraoral examination indicated that patients had an average of 25 remaining teeth.

Table 2 Clinical examination data at the first visit comparing patients who came before the COVID-19 pandemic to those during the COVID-19 pandemic [N (%)]

Variables		Before Pandemic [N=683]	During Pandemic [N=676]	p-value
Chief complaint ^a	Orofacial pain	385 (56.4%)	385 (57.0%)	0.008*
	Oral dysfunctional problems	122 (17.8%) ^c	159 (23.5%) ^d	
	Esthetic concern	43 (6.3%)	27 (4.0%)	
	Others	133 (19.5%)	105 (15.5%)	
Present illness ^a	No pain	298 (43.6%)	291 (43.1%)	0.366
	Acute pain	247 (36.2%)	240 (35.5%)	
	Chronic pain	115 (16.8%)	109 (16.1%)	
	Unclassified pain	23 (3.4%)	36 (5.3%)	
Underlying disease ^a	0 disease	397 (58.1%)	403 (59.6%)	0.802
	1 disease	173 (25.4%)	174 (25.7%)	
	2 diseases	69 (10.1%)	55 (8.2%)	
	>2 diseases	22 (3.2%)	23 (3.4%)	
	Don't know	22 (3.2%)	21 (3.1%)	
Drug allergy ^a	No	579 (84.8%)	592 (87.6%)	0.066
	Yes	86 (12.6%)	77 (11.4%)	
	Don't know	18 (2.6%) ^c	7 (1.0%) ^d	
Remaining teeth ^b	Mean±SD	25.1±7.0	25.1±7.8	0.888
	[95% CI]	[24.5-25.6]	[24.5-25.7]	

^a = Chi-square test, ^b = independent t-test, ^{c,d} = statistical significance from the compare column proportions test, * = statistical significance (p-value<0.05)

The radiographic examinations presented in Table 3 revealed that approximately 90% of new patients received a prescription for radiographs related to their chief complaints. Patients who arrived before the COVID-19 pandemic were prescribed two or three x-ray techniques, which were significantly higher than during the COVID-19

pandemic, while the request for one technique was significantly higher during the COVID-19 pandemic than in normal situations. The top three radiographs used as a diagnostic tool on the first visit were panoramic, periapical, and bitewing techniques.

Table 3 Radiographic investigations requested by dentists at the first-visit clinical examination

Radiographic Investigation	Before Pandemic [N=683]	During Pandemic [N=676]	p-value
Radiographic Requests [N (%)]^a			
No investigation requests	63 (9.2%)	53 (7.8%)	<0.001*
Investigation requests	620 (90.8%)	623 (92.2%)	
Request 1 technique	234 (34.3%) ^b	308 (45.6%) ^c	
Request 2 techniques	294 (43.0%) ^b	255 (37.7%) ^c	
Request 3 techniques	92 (13.5%) ^b	60 (8.9%) ^c	
Techniques [N of requests (%)]^a	[N=620]	[N=623]	
Panoramic Radiograph	420 (67.7%)	402 (64.5%)	0.199
Periapical Radiograph	341 (55.0%)	320 (51.4%)	
Bitewing Radiograph	332 (53.5%)	271 (43.4%)	
Cone-beam Computed Tomography	1 (0.1%)	2 (0.3%)	
Submentovertex Radiograph	0 (0.0%)	3 (0.5%)	
Transcranial Radiograph	2 (0.3%)	0 (0.0%)	
Lateral Cephalometric Radiograph	1 (0.1%)	0 (0.0%)	
Reverse Towne	1 (0.1%)	0 (0.0%)	

^a = Chi-square test, ^{b,c} = statistical significance from the compare column proportions test, * = statistical significance (p-value<0.05)

Table 4 revealed that the three most common provisional diagnoses were impacted teeth, pulp diseases, and loss of teeth. Most of the provisional diagnoses were not impacted by the COVID-19 situation, except for unsatisfactory restorations and gingivitis. Approximately 60% of new patients who had already received provisional

diagnoses subsequently received final diagnoses from dental specialists, while others did not. The match between the provisional and final diagnoses exceeded 80%; however, this percentage was significantly lower due to the impact of the COVID-19 pandemic ($p=0.011$).

Table 4 Provisional modified ICD-10 diagnoses, final diagnosis status, and correspondence of provisional and final diagnoses between patient groups arriving before and during the COVID-19 pandemic [N (%)]

Diagnoses	Before Pandemic	During Pandemic	p-value
Provisional Modified ICD-10 Diagnoses^a	[N=683]	[N=676]	
Impacted teeth	123 (18.0%)	134 (19.8%)	0.172
Pulp diseases	104 (15.2%)	88 (13.0%)	
Loss of teeth	88 (12.9%)	104 (15.4%)	
Dental caries	56 (8.2%)	58 (8.6%)	
Unsatisfactory restoration	46 (6.7%) ^b	66 (9.8%) ^c	
Apical periodontitis	54 (7.9%)	47 (7.0%)	
Periodontitis	44 (6.4%)	39 (5.8%)	
Malocclusion	32 (4.7%)	24 (3.6%)	
Tooth hypersensitivity	21 (3.1%)	28 (4.1%)	
Temporomandibular disorders	19 (2.8%)	25 (3.7%)	
Gingivitis	28 (4.1%) ^b	14 (2.1%) ^c	
Tooth wear	25 (3.7%)	13 (1.9%)	
Diseases of lip and oral mucosa	7 (1.0%)	11 (1.6%)	
Diseases of jaws	8 (1.2%)	3 (0.4%)	
Retained dental root	6 (0.9%)	5 (0.7%)	
Dentofacial anomalies	4 (0.6%)	7 (1.0%)	
Disorders of gingiva and alveolar ridge	5 (0.7%)	3 (0.4%)	
Cysts of jaws	4 (0.6%)	3 (0.4%)	
Tooth development disorders	3 (0.4%)	2 (0.3%)	
Diseases of tongue	3 (0.4%)	1 (0.1%)	
Disease of salivary glands	3 (0.4%)	1 (0.1%)	
Final Diagnosis Status^a	[N=683]	[N=676]	
Received final diagnoses	419 (61.3%)	398 (58.9%)	0.352
Not yet received final diagnoses	264 (38.7%)	278 (41.1%)	
Correspondence of Provisional and Final Diagnoses^a	[N=419]	[N=398]	
Matched diagnoses	363 (86.6%) ^b	322 (80.9%) ^c	0.011*
Unmatched diagnoses	56 (13.4%) ^b	76 (19.1%) ^c	
Due to different dentists	14 (3.4%)	24 (6.0%)	
Due to disease progression	23 (5.5%)	16 (4.0%)	
Due to other reasons	19 (4.5%) ^b	36 (9.1%) ^c	

^a = Chi-square test, ^{b, c} = statistical significance from the compare column proportions test, * = statistical significance ($p\text{-value}<0.05$)

According to Table 5, approximately 60% of the chief complaints reported on the first visit were managed through dental treatment. More of the first group of patients

completed treatment than the second group, whereas the first group was in the process of management less than the second group. Considering the patients who had not

yet received management, most patients canceled the queue and treatment provided by dentists (16.0%) in a normal situation. While, during the COVID-19 pandemic, most patients were waiting in the queue (23.2%). Surgical removal and simple extraction were the most common treatments. The COVID-19 pandemic did not affect dental

procedures, except for root canal treatment and opening and drainage. Patients arriving during the COVID-19 pandemic received significantly more root canal treatments compared with those before the COVID-19 pandemic, while opening and drainage were significantly lower.

Table 5 Management status and clinic for chief complaints reported at the first visit

Chief Complaint's Management	Before Pandemic	During Pandemic	p-value
Management Status^a	[N=683]	[N=676]	
Received management	419 (61.3%)	398 (58.9%)	<0.001*
Completely managed	405 (59.3%) ^b	353 (52.2%) ^c	
Undergoing managed	14 (2.0%) ^b	45 (6.7%) ^c	
Not yet received management	264 (38.7%)	278 (41.1%)	
Waiting queue	76 (11.1%) ^b	157 (23.2%) ^c	
Canceled	109 (16.0%) ^b	31 (4.6%) ^c	
Changed hospitals	23 (3.4%) ^b	7 (1.0%) ^c	
Other reasons	56 (8.2%) ^b	83 (12.3%) ^c	
Dental Procedures by Dental Students and Dentists^a	[N=419]	[N=398]	
Surgical removal	91 (21.7%)	103 (25.0%)	0.009*
Simple extraction	78 (18.6%)	60 (15.1%)	
Filling	49 (11.7%)	42 (10.6%)	
Root canal treatment	24 (5.7%) ^b	52 (13.1%) ^c	
Removable prosthesis	41 (9.8%)	33 (8.3%)	
Scaling and root planing	24 (5.7%)	24 (6.0%)	
Remove deep caries	25 (6.0%)	21 (5.3%)	
Occlusal splint	14 (3.3%)	14 (3.5%)	
Opening and drainage	22 (5.3%) ^b	5 (1.3%) ^c	
Minor and major surgery	12 (2.9%)	7 (1.8%)	
Fixed prosthesis	9 (2.2%)	8 (2.0%)	
Physical therapy	6 (1.4%)	9 (2.3%)	
Orthodontic treatment	7 (1.7%)	2 (0.5%)	
Drugs	5 (1.2%)	4 (1.0%)	
Biopsy	3 (0.7%)	4 (1.0%)	
Implant	3 (0.7%)	4 (1.0%)	
Occlusal adjustment	1 (0.2%)	4 (1.0%)	
Periodontal surgery	3 (0.7%)	0 (0.0%)	
Other	1 (0.2%)	2 (0.5%)	
Incision and drainage	1 (0.2%)	0 (0.0%)	

^a = Chi-square test, ^{b, c} = statistical significance from the compare column proportions test, * = statistical significance (p-value<0.05)

Discussion

The COVID-19 pandemic was a devastating global problem in daily life and the dental field.¹³ The present study found that the pandemic influenced dental

patients' behavior in pursuing dental treatment and the dentists' management of their cases. Certain variables, including patients' chief complaints, radiographic requests,

correspondence between provisional and final diagnoses, management status, and dental procedures performed by dental students and dentists, were affected by the pandemic, as evidenced by statistical differences in both Chi-square and compare column proportions tests, thereby rejecting the null hypothesis. However, focusing on the proportion and ranking of these variables between patients arriving before and during the pandemic, most variables were nearly unaffected by the pandemic. This indicates that although the COVID-19 pandemic has persisted for three years since it began at the end of 2019, the proportions of dental diseases and patients' needs have remained relatively unchanged over time, despite a decrease in the number of dental patients. Fewer changes in patients' characteristics resulted in fewer changes in the dental management provided by dental students and dentists. These findings have not been previously reported.

Considering the number of patients at the time of the outbreak, the study of Semprini found that fewer adult Americans visited dentists.⁴ Morita *et al.* also observed that patients in Japan reduced the number of dental clinic visits.⁵ Moreover, Olayan *et al.* indicated that during the lockdown period in Saudi Arabia, the number of new patients decreased.⁶ The reduction in patient number peaked at a short duration. After reopening, the number of patient visits reached nearly that of the normal situation.⁶ Our results demonstrated that new patients who arrived at Chulalongkorn Dental Hospital before the COVID-19 pandemic comprised 20,576 patients in 2017, 19,973 patients in 2018, and 18,873 patients in 2019. In contrast, during the COVID-19 pandemic, there were 14,604 patients in 2020, 9,516 patients in 2021, and 16,299 patients in 2022. Comparing the ratio over a span of six years, the pre-COVID-19 period accounted for approximately 60% of patients, totaling 59,422, while the during-COVID-19 period comprised roughly 40%, totaling 40,419 patients. To calculate the percentage reduction in patient numbers, authors employed the formula $((59,422 - 40,419) / 59,422) * 100$, resulting in a decrease of 32% in patient attendance during the pandemic compared to pre-pandemic period.

The present study found a reduction in the number of new patients similar to a previous study, and it peaked in 2021, approximately 50% of the new patients at the time of the normal situation. Furthermore, Choi *et al.* found that dental utilization was less than medical utilization.¹⁴ This indicated that dental problems were considered less important than medical problems.

Choi *et al.* studied U.S. dental patients. During the pandemic, all dental procedures rapidly declined. However, when the dental clinics were reopened, patients had the greatest demand for oral surgery and less demand for preventive dental services after the first COVID-19 outbreak.¹⁵ Likewise, the present study found that new patients received surgical removal and simple extraction as the two highest rankings. These were the major problems for patients who had pain that required treatment from dentists. Moreover, these dental problems and dental procedures provided by dentists were not self-limiting or self-resolving. This is a reason why patients came to the dental hospital as quickly as they could. Additionally, although all dental procedures were stopped during the COVID-19 outbreak, teledentistry quickly increased while the clinics were closed.^{15,16} In another previous study, Alonaizi *et al.* found that after the lockdown period, there were more cases of acute pulpitis with apical periodontitis, abscesses, and pericoronitis.¹⁷ Similarly, pulp diseases were the third most frequent diagnosis for this study during the COVID-19 pandemic but were not significantly different from the normal situation. This reflects that pulp diseases are common in dental patients and were not affected by the pandemic.

The present study showed the competency of dental students and dental specialists through the agreement of provisional and final diagnoses. There was a very high level of agreement (~80%). However, the COVID-19 pandemic reduced the level of agreement for reasons other than different dentists, and disease progression. This finding indicates that dentists altered their approach to patient investigation due to the pandemic.^{18,19} For example, they spent less time taking patient histories,

limited procedures related to oral examinations, and requested fewer radiographic techniques. These changes were likely implemented to reduce close contact time and potential exposure to the virus, adhering to heightened safety protocols. The current study found that in a normal situation, dentists often requested two different techniques of radiographs (~43%), while during the pandemic, dentists limited their request to only one technique (~45%) for investigating their patients. These may be the reason that a high percentage of unmatched diagnoses occurred during the pandemic.

During the early stages of the COVID-19 pandemic in 2020, the dental clinics for undergraduate and postgraduate students at Chulalongkorn Dental Hospital completely closed down and underwent lockdown as directed by the Dean's office. Only urgent dental care was administered by faculty members specializing in various areas, with limited availability of clinics and procedures. This situation persisted for approximately 2-3 months and impacted the outcomes of the study. However, due to the short duration and the limited number of patients during this period, there was a reduced likelihood of randomization into the study, thus minimizing its impact. Furthermore, most dental patients at Chulalongkorn Dental Hospital sought treatment from dental students practicing clinical skills throughout the academic year. Despite the initial disruption caused by the COVID-19 outbreak, dental students were able to resume their learning through clinical practicum activities, encountering a similar variety of cases as before the pandemic.

As previously mentioned, the main factors, including the unchanged proportions of dental patient's behaviors, the decreased number of patients seeking dental treatment, the most common dental procedures provided for patients, the competency of diagnoses, and the management of a tertiary dental hospital involving dental student trainings, are essential information for further effective administration of dental clinics or hospitals during a normal or critical situation. For example, in the case of a new future global pandemic, the management of the dental clinic will consist of preparing dental equipment,

facilities, medical staff, and specialized dentists. These preparations will consider the previous data and develop an individual protocol based on the facts and findings of this present study.

The limitations of this study should be considered. To begin with the study design, this study examined only the medical records of new patients following the HN randomization method. The advantage of this method was that the HNs had a two-digit number appearing the year patients came. It was an easier technique to separate and explore the target samples. However, the results of this study were the underestimated values of these findings due to including only the first visit of new patients, not all visits from new and old patients. Secondly, the duration of the pandemic was long for this study investigation. Some studies focused on a short duration, such as a lockdown period.²⁰ The studies showed that dental clinics or centers were closed, and dental treatment was inhibited. In the present study, the duration of the pandemic covered the initial outbreak and after, a total of three years. It was said that this was a long-term effect of the pandemic that had never been examined before.

Conclusion

This retrospective study provided valuable insights into the impact of the COVID-19 pandemic on dental care at Chulalongkorn Dental Hospital. Only some factors related to dental treatment, including chief complaints, radiographic requests, provisional and final diagnoses, and dental procedures were affected by the COVID-19 pandemic. These proportions changed significantly compared with before and during the pandemic, while most other factors did not change proportionally. Despite the challenges of the pandemic, the study highlights the resilience of dental care delivery and underscores the importance of adapting practices to meet evolving patient needs in times of crisis.

Acknowledgement

The authors extend their sincere appreciation to Dr. Kevin Tompkins for his invaluable critical review and

English language editing of the manuscript. Furthermore, this research received support from the Dental Research Fund, Dental Research Project, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand, under Grant Number 3200502#25/2022.

Conflicts of Interest: There are no conflicts of interest to disclose in relation to this matter.

Funding Resources: The Dental Research Fund, Dental Research Project, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand, Grant Number 3200502#25/2022.

References

1. Haleem A, Javaid M, Vaishya R. Effects of COVID-19 pandemic in daily life. *Curr Med Res Pract* 2020;10(2):78-9.
2. Park KH, Kim AR, Yang MA, Lim SJ, Park JH. Impact of the COVID-19 pandemic on the lifestyle, mental health, and quality of life of adults in South Korea. *PLoS One* 2021;16(2):e0247970.
3. Mattos FF, Pordeus IA. COVID-19: a new turning point for dental practice. *Braz Oral Res* 2020;34:e085.
4. Semprini J. Estimating the within-person change in dental service access measures during the COVID-19 pandemic in the United States. *Int J Dent* 2023;2023:5601447.
5. Morita I, Sakuma S, Kondo K. Impact of the coronavirus disease 2019 pandemic on dental visits in Japan. *Oral Health Prev Dent* 2023;21(1):179-84.
6. Olayan AA, Baseer MA, Ingle NA. Impact of the COVID-19 pandemic on the dental preferences of patients at private university hospitals in Riyadh, Saudi Arabia. *Cureus* 2023;15(5):e39435.
7. Koyama S, Aida J, Mori Y, Okawa S, Odani S, Miyashiro I. COVID-19 effects on income and dental visits: a cross-sectional study. *JDR Clin Trans Res* 2022;7(3):307-14.
8. Ahmed A, Evans K, Rajapakse S. How has COVID-19 affected surgical practice in oral and maxillofacial surgery in the East Midlands, UK? *Surgeon* 2021;19(5):e276-e80.
9. Sabbagh Y, Chadwick SM, Lewis BRK, Abu Alhaja ES. The COVID-19 experience of orthodontists in Jordan. *J Orthod Sci* 2023;12:10.
10. Riekkinen R, Suominen A, Svedstrom-Oristo AL. Effects of the COVID-19 pandemic on orthodontic care in Finland. *Acta Odontol Scand* 2023;81(8):578-85.
11. Miao Z, Zhang H, Han Y, Wang L, Wang S. Orthodontic care in orthodontic patients during the COVID-2019 pandemic: emergency, emergency response and orthodontic treatment preference. *BMC Oral Health* 2023;23(1):364.
12. Vij M. Number generator [Internet]. [cited 2023 May 31]. Available from: <https://numbergenerator.org/>.
13. COVIDental Collaboration Group. The COVID-19 pandemic and its global effects on dental practice. An International survey. *J Dent* 2021;114:103749.
14. Choi SE, Mo E, Sima C, Wu H, Thakkar-Samtani M, Tranby EP, et al. Impact of COVID-19 on dental care utilization and oral health conditions in the United States. *JDR Clin Trans Res* 2023;9(3):256-64.
15. Choi SE, Simon L, Basu S, Barrow JR. Changes in dental care use patterns due to COVID-19 among insured patients in the United States. *J Am Dent Assoc* 2021;152(12):1033-43.e3.
16. Ghai S. Teledentistry during COVID-19 pandemic. *Diabetes Metab Syndr* 2020;14(5):933-5.
17. Alonaizi N, Alharran S, Baskaradoss JK. Dentists' perspective on the impact of COVID-19 on the utilization of emergency dental services in Kuwait: a cross-sectional study. *Clin Pract* 2023;13(3):638-47.
18. Gurgel BCV, Borges SB, Borges REA, Calderon PDS. COVID-19: Perspectives for the management of dental care and education. *J Appl Oral Sci* 2020;28:e20200358.
19. Eggmann F, Haschemi AA, Doukoudis D, Filippi A, Verna C, Walter C, et al. Impact of the COVID-19 pandemic on urgent dental care delivery in a Swiss university center for dental medicine. *Clin Oral Investig* 2021;25(10):5711-21.
20. Humagain M, Humagain R, Rokaya D. Dental Practice during COVID-19 in Nepal: A Descriptive Cross-sectional Study. *JNMA J Nepal Med Assoc* 2020;58(230):764-9.