

A Current View of Teledental Applications Future

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Abstract

The purpose of this study was to assess dentists' knowledge, attitudes, and behaviors regarding teledentistry, which has become more popular during the COVID-19 pandemic period.

Between May 2021 and August 2021, an online survey was used to conduct the research. The study included 195 dentists from various specialties (General Practitioner, Oral, Dental and Maxillofacial Radiology, Prosthetic Dentistry, Endodontics, Restorative Dentistry, Oral and Maxillofacial Surgery, Orthodontics, Pedodontics, and Periodontology). The four main topics of this survey include teledentistry, routine teledental use, teledental applications in the near future, and participant demographic information. Participants used a 3-point Likert scale ranging from "agree, undecided, disagree" to answer questions about teledentistry and teledentistry in the near future. In statistical analyses, chi-square tests were used, and $p < 0.05$ was considered significant.

19.5% of our participants said they had previously used a teledentistry. When comparing specialties, oral and maxillofacial surgery had the highest usage (33.3%), while general practitioners (0.0%) almost never used teledentistry. Even though teledentistry is used by a small number of physicians, 77.4% of participants stated that they intend to use teledental application systems in the near future, and 82% stated that they want to receive training on the subject.

When the data from this study are analyzed, it is clear that dentists are eager to use teledentistry. When all of the results are considered, teledentistry is a promising application for initial examination, diagnosis, and treatment planning.

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Introduction

The COVID-19 epidemic began in Wuhan, China in December 2019 and has since become a major and challenging public health problem not only for China but also for the rest of the World.¹ On January 30, 2020, the World Health Organization (WHO) declared this outbreak to be of international concern. It was announced that this is a major public health problem.²

Human-to-human transmission occurs primarily through close contact with people who have the COVID-19 virus and are exhibiting symptoms. Droplets spread when sick people sneeze or cough are the primary mode of transmission.³ Although the virus is more contagious when the patient has symptoms,

studies have shown that it can be transmitted from person to person even when the patient has mild or no symptoms.⁴ It is also possible for the virus to exist outside of living organisms, such as in aerosols or inanimate objects. COVID-19 has a half-life of 1.5 hours and can survive in aerosols for up to 3 hours, according to a study published in the New England Journal of Medicine.⁵

Many medical clinics, including dental clinics, have significantly reduced patient access to contain the spread of COVID-19, limiting clinical activity to only urgent and non-deferrable procedures. Dentists fail to maintain the necessary distance during the procedure, exposing themselves to a high risk of COVID-19 infection due to exposure to saliva, blood, and other body fluids. Furthermore, many dental procedures use aerosols.⁶ Given these findings, it is believed that the risk of cross-infection between dentists and patients is high.

During the COVID-19 period, some solutions for reducing density in dental clinics were developed. Teledental applications are one of them. Cook defined this practice in 1997 as

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"the practice of using videoconferencing technologies to provide diagnosis and advice about remote treatment."⁷

Teletechnological applications have gained popularity in both medicine and dentistry in recent years due to their potential to provide a simple, quick, and secure means of transmitting and sharing health information.⁸ It has begun to be preferred for a variety of reasons, including it, also aiding in the screening of suspected COVID-19 patients by allowing patients to be questioned via phone or video call about any close contact with a COVID-19 patient or whether they have COVID-19 symptoms such as fever, dry cough, and shortness of breath.⁹

Teledentistry can be used for triage, diagnosis and treatment planning, oral-dental health control, oral-dental health education, and physician consultation.¹⁰ These applications make it easier and faster to get high-quality health care at a low cost. Expenses such as personnel-medical equipment incurred in polyclinic examinations and treatments are reduced. Despite its many advantages, teledentistry is still not widely used today. This situation can be explained by the fact that health professionals may find the system complex and technologically challenging.¹¹ At the same time, even though it provides access to people in rural areas, the need for high-speed internet connections and access to electronic devices remains a barrier for this group.¹²

The purpose of this study is to assess dentists' knowledge of COVID-19, which is thought to be useful in reducing the risk of COVID-19 spread, particularly in the phases following the acute epidemic period, and to assess their attitudes toward teledentistry.

Materials and methods

The study was carried out by the rules of the Helsinki Declaration, with the ethics committee's approval numbered 2021/03-31. All volunteers who participated in the study provided consent for their participation in the study and the storage of data.

Study Design/Protocol

The study's design is cross-sectional descriptive research, and it was carried out online between May 2021 and August 2021. The study included 195 dentists from various specialties (General Practitioner, Oral, Dental

and Maxillofacial Radiology, Prosthodontics, Endodontics, Restorative Dentistry, Oral and Maxillofacial Surgery, Orthodontics, Pedodontics, Periodontology). The four main topics of this study include teledentistry, routine teledental use, teledental applications in the near future, and participant demographic information. The questions included in the questionnaire have been prepared on the basis of sample studies found in the literature.^{13,14,15} Participants used a 3-point Likert scale ranging from "agree, undecided, disagree" to answer questions about teledental applications and teledental applications in the near future (Table 1).

Before the research, the survey questions were administered to 10 dentists, and a reliability analysis was performed. The pilot study's participants were not included in the main study.

Data Analysis

SPSS for Windows 22.0 software was used for statistical analyses. Descriptive statistics for demographic and other data are expressed as frequency (%) values. Before the research, the reliability test was subjected to test-retest analysis. Chi-square tests were used to evaluate the statistical analyses between the participants' fields of expertise and their responses. The $p < 0.05$ level was considered statistically significant in all of these analyses.

Results

The reliability coefficient of the test-retest analysis was found as 0.951.

Demographic Characteristics of Participants

The study was completed by 195 dentists in 3 months between May 2021 and August 2021. 125 (64.1%) of 195 dentists are female and 70 (35.9%) are male. The vast majority (54.4%) of the dentists participating in the study are between the ages of 26-40. Looking at his areas of expertise; It was determined that the highest rate of participants with 30.8% was in the field of pedodontics. 43.1% of the participants work in a university hospital and 25.1% in private practice. While 46.7% of the participants stated that they have been working in the profession for 0-5 years, 31.8% stated that they have been working for 16 years or more. 64.1% of the participants stated that they work between 35-49 hours per week.

When our participants' specialties are compared to whether they have previously used

any teledentistry, the highest usage is in the field of oral and maxillofacial surgery (33.3%), while the lowest usage is in the fields of endodontics (8.3%) and general practitioners (0.0%).

Information About Teledentistry

All of the physicians who have previously used teledental applications believe that this system will aid in understanding and following up on patients' oral and dental health problems via the internet (p<0.5).

While 79.5% of participants believe that teledental applications can help monitor patients' oral hygiene levels, 92.3% believe that these applications can help with early diagnosis and treatment (Table 2).

TELEDENTAL APPLICATIONS		F	%
1. Teledental applications use the internet to assist patients understand and track their oral and dental health problems.	Yes	168	86,2
	No	27	13,8
2. Teledental applications aid in the monitoring of patients' oral hygiene standards.	Yes	155	79,5
	No	40	20,5
3. Teledental applications offer treatment and consultation advantages.	Yes	180	92,3
	No	15	7,7
4. Teledental applications make it easier for people to get access to dental care.	Yes	184	94,4
	No	11	5,6
5. Teledental applications are applicable to all dental specialties.	Yes	132	67,7
	No	63	32,3
6. Teledental applications training can (and should) be included in undergraduate and specialized training	Yes	163	83,6
	No	32	16,4
7. I'd like to learn more about teledental applications.	Yes	159	81,5
	No	36	18,5

Table 2. Physicians' levels of teledentistry knowledge.

Routine Use of Teledentistry

While the majority of participants (67.2%) believe that teledentistry will save money for both patients and oral and dental health services, only 5.1% believe that an examination using teledentistry performed on a computer, tablet, or smartphone will provide the same accurate results as a face-to-face examination.

Furthermore, more than half of the participants (53.3%) believe that teledentistry cannot reach patients with low socioeconomic status. General practitioners have the highest participation in this proposition when measured according to their areas of expertise (Table 3).

Teledentistry in the Near Future

Only 19.5% said they had previously used teledentistry. The majority of those who believe these practices violate patient rights and privacy are general practitioners who have never used the practice before.

Physicians (77.4%) who say they will use teledentistry in the near future believe that they

will save time for both the physician and the patient and will reduce the risk of contact with infectious diseases by avoiding unnecessary travel, compared to physicians who say they will not use the application. 59.5% of our participants said they had previously examined patients using smartphones and cameras. The participants who gave this answer believe that teledentistry makes it easier for patients to access dental health services. Participants (36.9%) who state that they are unfamiliar with teledentistry believe that it will take a long time for their physicians to learn the system and transition to routine practice (Table 4).

ROUTINE USE OF TELEDENTAL APPLICATIONS		F	%
1. Teledental applications used on a computer, tablet, or smartphone produce results that are as accurate as face-to-face examinations.	Disagree	144	73,8
	Undecided	41	21,0
	Agree	10	5,1
2. Teledental applications help patients and physicians save time.	Disagree	18	9,2
	Undecided	45	23,1
	Agree	132	67,7
3. Teledental applications save money for patients as well as oral and dental health services.	Disagree	29	14,9
	Undecided	35	17,9
	Agree	131	67,2
4. Teledental applications lower the risk of infection by reducing the number of journeys patients make to oral and dental health clinics.	Disagree	15	7,7
	Undecided	9	4,6
	Agree	171	87,7
5. Teledental applications may infringe on the privacy and rights of patients.	Disagree	45	23,1
	Undecided	72	36,9
	Agree	78	40,0
6. Patients with poor socioeconomic status are unable to access teledental applications.	Disagree	34	17,4
	Undecided	57	29,2
	Agree	104	53,3
7. Setting up teledental applications is expensive.	Disagree	83	42,6
	Undecided	73	37,4
	Agree	39	20,0
8. It takes a long time for dentists to learn and apply the system on a regular basis.	Disagree	83	42,6
	Undecided	49	25,1
	Agree	63	32,3
9. For teledental applications, patients may be asked to pay reduced examination fees than usual.	Disagree	58	29,7
	Undecided	36	18,5
	Agree	101	51,8
10. For teledental applications, patients may be asked to pay higher examination fees than usual.	Disagree	133	68,2
	Undecided	48	24,6
	Agree	13	6,7

Table 3. Physicians' perspectives on the routine use of teledentistry.

TELEDENTAL APPLICATIONS IN THE NEAR FUTURE		F	%
1. Have you ever tried a teledental application?	Yes	38	19,5
	No	157	80,5
2. In the near future, would you consider employing teledental application systems?	Yes	151	77,4
	No	44	22,6
3. Have you ever used a smartphone and camera to check a patient?	Yes	116	59,5
	No	79	40,5
4. Do you have any experience with teledental applications?	Yes	72	36,9
	No	123	63,1
5. Do you believe that patients would be interested in using teledental applications?	Yes	165	84,6
	No	30	15,4

Table 4. The percentage of physicians who intend to use teledentistry in the near future.

Discussion

Teledentistry, in addition to assisting with patient triage and communication with patients, is an innovative health system that assists clinicians in evaluating diagnosis-treatment results and making recommendations.¹⁶ The purpose of this study is to assess dentists' knowledge of teledentistry, which is thought to be useful in reducing the risk of epidemics such as COVID-19 spreading, as well as to investigate their attitudes and behaviors toward using the system. At the same time, this is the first study to look into the knowledge and opinions of Turkish dentists about teledentistry.

Teledentistry, whose importance and prevalence are expected to grow gradually; enables remote communication rather than face-to-face contact with any patient or colleague. Teledentistry allows for the examination and training of oral hygiene, as well as the diagnosis and consultation of patients.^{17,18} This system, which provides quick and easy access to health services, saves time and money while reducing travel frequency and obligations. Similar to these findings, 67.7% believe that teledentistry will save both the patient and the physician time, and 67.2% believe that it will save money. According to another study in 2019, teledentistry saves both time and money, and it has also been reported to increase overall patient satisfaction.¹⁹

Teledentistry not only saves money by avoiding unnecessary travel but also reduces the risk of contamination.²⁰ In our study, the majority of participants who were familiar with teledentistry system agreed with this proposition and stated that they would be able to use it in the near future ($p < 0.5$).

Although teledentistry has significant advantages, studies have shown that they are not as reliable as clinical practices.²¹ Most of the

time, because there is no institution in charge of controlling patient data in healthcare services, some issues with patient information security may arise. In this study, the most common concern (40%) about teledentistry was that patient rights and privacy might be violated, as in previous studies.^{22,23} This rate was higher in physicians who had previously used teledentistry versus those who had not. This can be explained by the fact that newly established telecommunications operations in developing countries are frequently prone to errors. However, we believe that as teledentistry system evolves, these issues will be resolved.

Considering all results, the teledentistry system appears to be a promising method for initial examination, diagnosis, and treatment planning. However, there are only a few dentists who have agreed to participate in this study. More participant studies are required in order to generalize the findings.

Conclusions

The COVID-19 epidemic has prompted a comeback of teledentistry, which has been around for a while but was not widely employed. These devices, which offer significant benefits to both the patient and the physician, are expected to become commonplace in the near future. The goal of this study is to learn what dentists in Turkey think about these systems. We believe that, regardless of their specialty, most physicians will wish to use the system in the future if certain conditions are met, and that this will benefit the country's health system greatly.

Declaration of Interest

The authors report no conflict of interest.

A.		
DEMOGRAPHIC DATA	AGE	18-25
		26-40
		41-55
		56-64
		65+
	SEX	Female
		Male
	DENTIST'S SPECIALIZATION	General Practitioner
		Oral, Dental and Maxillofacial Radiology
		Prosthetic Dentistry

		Endodontics
		Restorative Dentistry
		Oral and Maxillofacial Surgery
		Ortodontics
		Pediatric dentistry
		Periodontology
	CITY	Code for a city plate
	INSTITUTION	Private Practice
		Private Polyclinic
		Private Hospital
		Oral and Dental Health Center
		State/City/Training-Research Hospital
		University Hospital
	PROFESSIONAL WORKING YEAR	0-5 year
		6-10 year
		11-15 year
		16+ year
WEEKLY WORKING HOURS	0-19 hour	
	20-34 hour	
	35-49 hour	
	49-64 hour	
	64+ hour	
B.		
TELEDENTAL APPLICATIONS		<ol style="list-style-type: none"> 1. Teledental applications use the internet to assist patients understand and track their oral and dental health problems. 2. Teledental applications aid in the monitoring of patients' oral hygiene standards. 3. Teledental applications offer treatment and consultation advantages. 4. Teledental applications make it easier for people to get access to dental care. 5. Teledental applications are applicable to all dental specialties. 6. Teledental applications training can (and should) be included in undergraduate and specialized training. 7. I'd like to learn more about teledental applications.
C.		
ROUTINE USE OF TELEDENTAL APPLICATIONS		<ol style="list-style-type: none"> 1. Teledental applications used on a computer, tablet, or smartphone produce results that are as accurate as face-to-face examinations. 2. Teledental applications help patients and physicians save time.

	3. Teledental applications save money for patients as well as oral and dental health services.
	4. Teledental applications lower the risk of infection by reducing the number of journeys patients make to oral and dental health clinics.
	5. Teledental applications may infringe on the privacy and rights of patients.
	6. Patients with poor socioeconomic status are unable to access teledental applications.
	7. Setting up teledental applications is expensive.
	8. It takes a long time for dentists to learn and apply the system on a regular basis.
	9. For teledental applications, patients may be asked to pay reduced examination fees than usual.
	10. For teledental applications, patients may be asked to pay higher examination fees than usual.
D.	
TELEDENTAL APPLICATIONS IN THE NEAR FUTURE	1. Have you ever tried a teledental application?
	2. In the near future, would you consider employing teledental application systems?
	3. Have you ever used a smartphone and camera to check a patient?
	4. Do you have any experience with teledental applications?
	5. Do you believe that patients would be interested in using teledental applications?

Table 1. Questionnaire questions.

References

- Phelan AL, Katz R, Gostin LO. 2020. The novel coronavirus originating in Wuhan, China: challenges for global health governance [epub ahead of print 30 Jan 2020] in press. JAMA.
- Mahase E. 2020. China coronavirus: WHO declares international emergency as death toll exceeds 200. BMJ. 368:408.
- Li P., Fu J.-B., Li K.-F., Chen Y., Wang H.-L., Liu L.-J., Liu J.-N., Zhang Y.-L., Liu S.-L., Tang A., et al. Transmission of COVID-19 in the terminal stage of incubation period: A familial cluster. Int. J. Infect. Dis. 2020;96:452–453.
- Li C., Ji F., Wang L., Wang L., Hao J., Dai M., Liu Y., Pan X., Fu J., Li L., et al. Asymptomatic and Human-to-Human Transmission of SARS-CoV-2 in a 2-Family Cluster, Xuzhou, China. Emerg. Infect. Dis. 2020;26:1626–1628.
- Van Doremalen N., Bushmaker T., Morris D.H., Holbrook M.G., Gamble A., Williamson B.N., Tamin A., Harcourt J.L., Thornburg N.J., Gerber S.I., et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. N. Engl. J. Med. 2020;382:1564–1567.
- Spagnuolo G., De Vito D., Rengo S., Tatullo M. COVID-19 Outbreak: An Overview on Dentistry. Int. J. Environ. Res. Public Health. 2020;17:2094.
- Cook J, Edwards J, Mullings C, Stephens C. Dentists' opinions of an online orthodontic advice service. J Telemed Telecare. 2001;7:334–7.
- Heale R. Communication technology and healthcare. Evid Based Nurs. 2018; 21(2):36–7.
- Ather A, Patel B, Ruparel NB, et al. Coronavirus disease 19 (COVID-19): implications for clinical dental care. J Endod 2020;46(5):584–595.
- Suter N. Teledentistry applications for mitigating risk and

- balancing the clinical Schedule. *Journal of Public Health Dentistry*. 80(2): 126-131.
11. Smith A.C., Thomas E., Snoswell C.L., Haydon H., Mehrotra A., Clemensen J. Telehealth for global emergencies: implications for coronavirus disease 2019 (COVID-19). *J Telemed Telecare*. 2020 doi: 10.1177/1357633X20916567.
 12. Ramaswami E, Pakhmode VK. TELEDENTISTRY - Need to embrace in this COVID scenario. *IDA Times*. 2020;16(9):17-18.
 13. Al-Khalifa KS, AlSheikh R. Teledentistry awareness among dental professionals in Saudi Arabia. *PLoS One*. 2020;15(10).
 14. Pradhan D, Verma P, Sharma L, Khaitan T. Knowledge, awareness, and attitude regarding teledentistry among postgraduate dental students of Kanpur city, India: A questionnaire study. *J Educ Health Promot*. 2019;8:104.
 15. Mathivanan A, Gopalakrishnan JR, Dhayanithi A, Narmatha M, Bharathan K, Saranya K. Teledentistry: Is It the Future of Rural Dental Practice? A Cross-sectional Study. *J Pharm Bioallied Sci*. 2020;12(1):304-307.
 16. Wosik J, Fudim M, Cameron B et al. Telehealth transformation: COVID-19 and the rise of virtual care. *J Am Med Inform Assoc* 2020; 27: 957-962.
 17. Ghai S. Teledentistry during COVID-19 pandemic. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews* . 2020;14(5):933–935.
 18. da Costa C. B., Peralta F. D. S. How has teledentistry been applied in public dental health services? An integrative review. *Telemedicine Journal and E-Health* . 2020;26(7):945–954.
 19. Wood, P. R., & Caplan, L. (2019). Outcomes, satisfaction, and costs of a rheumatology telemedicine program: A longitudinal evaluation. *JCR: Journal of Clinical Rheumatology*, 25(1), 41-44.
 20. Fadaizadeh, L., Najafzadeh, K., Shajareh, E., Shafaghi, S., Hosseini, M., & Heydari, G. (2016). Home spirometry: Assessment of patient compliance and satisfaction and its impact on early diagnosis of pulmonary symptoms in post-lung transplantation patients. *Journal of Telemedicine and Telecare*, 22(2), 127-131.
 21. Toader E., Damir D., Toader I. A. (2011). Ethical and legal issues related to the clinical application of telemedicine. in 2011 E-Health and Bioengineering Conference (EHB) (pp. 1-4). 24th-26th November, Iași, Romani.
 22. Estai M, Kanagasingam Y, Tennant M, Bunt S. A systematic review of the research evidence for the benefits of teledentistry. *J Telemed Telecare*. 2018;24(3):147–56.
 23. Kim E, Torous J, Horng S, Grossestreuer AV, Rodriguez J, Lee T, et al. Mobile device ownership among emergency department patients. *Int J Med Inform*. 2019;126:114–7.