Knowledge and Attitudes of Dentistry Students Toward Teledentistry

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Abstract

Aim: This study was conducted to determine dentistry students' views on the use of teledentistry services.
Method: A descriptive cross-sectional study was conducted among dentistry students (169 people) in Zahedan, Iran. A questionnaire was designed to obtain dentistry students' knowledge and attitudes towards teledentistry. The scores less than and more than three were considered undesirable and desirable, respectively, to interpret the results. Mean knowledge, attitude score, standard deviation, and frequency distribution were calculated. Descriptive statistics were used to summarize the demographic information, and the survey data were analyzed using the independent t-test and one-way ANOVA test. The level of significance was fixed at $P \leq 0.05$.
Results: The mean score of the research population knowledge was 2.59± 0.51. The mean score of the research population attitude was 2.53± 0.47. The results of the tests (t-test and ANOVA) performed to examine the relationships between the variables showed that there was only one relationship between the age group variable and students' knowledge.
Conclusion: The present study results showed that dentistry students' knowledge and attitude towards teledentistry was not desirable and needed more attention. Therefore, the relevant institutions must pay more attention to the necessary measures such as holding educational classes and conducting research on the efficiency and cost-effectiveness of teledentistry to improve students' level of knowledge and attitude and make this technology operational and integrate it into the health environment.
Keywords: Teledentistry, Knowledge, Attitude, Dentistry students.

Oral disease is one of the most common human diseases, and most people will experience it during their lifetime (1). Oral health usually affects the quality of life of people (2), and access to it is the right of every person according to the slogan of World Health Organization 2018 "Health for all, universal health coverage: everyone, everywhere" (3). This right obliges governments to provide conditions for all people to receive equal and fair health care services (4). Despite the different strategies and policies implemented by governments, there are still shortcomings and inequalities in providing health services between different areas, which may be related to low economic investment, lack of trained personnel, or limited access routes (5). In Iran, these health inequalities are significant, and among the reasons can be some of the challenges of the health system in Iran, including the lack of skilled workforce in remote deprived areas and limited financial resources (6).

The use of information and communication technologies in the health industry, such as telemedicine, has been an effective solution to eliminating health inequalities. Using telemedicine, different professionals can communicate with each other from different places in the shortest possible time and assist each other in education, diagnosis, and treatment (7-10).

Teledentistry is a part of telemedicine that is progressing rapidly and can be used by general dentists and specialists (11). It can be said that teledentistry is the use of information and communication technology for oral care, counseling, education, and public awareness to improve oral health and is an approach that meets the needs of oral care for people who cannot for various reasons seek care and have little or no access to health care (7).

Cost-effectiveness, providing timely information for decision making, improving the quality of care, facilitating access to services, and improving communication between dentists and their patients are some of the benefits of teledentistry. Of course, teledentistry has several obstacles, including technical, legal, educational, and insurance barriers that prevent its acceptance and widespread use by dentists (12). In a study conducted in 2017 in Kerman, a large number of dentistry students did not have sufficient knowledge about teledentistry (13).

Sistan and Baluchestan province is one of the country's vast provinces, which occupies more than 11% of the country (14). There is a long-distance between the cities and the provincial capital (Zahedan), and there are transportation problems for doctors. Also, there is not enough specialized equipment in the cities, and the inequality in the distribution of doctors in this province has existed in the past and has not been eliminated despite many efforts (15).

Therefore, the use of teledentistry can have a great impact on improving the oral health status of the residents of this province. Knowledge and attitude of dental students can play an important role in the use of teledentistry in their future careers. Therefore, the present study was conducted to determine dentistry students' views on the use of teledentistry services.

Method

A descriptive cross-sectional study was conducted among dentistry students in Zahedan, Iran. The study population consisted of 169 undergraduate and postgraduate students of Dentistry School in 2018-2019 who had completed their fourth semester.

A self-administered structured questionnaire was developed and administered to a convenience sample of 16 dentists and health information managers who were interviewed to gain feedback on the questionnaire's acceptability in terms of language clarity. Cronbach's coefficient was found to be 0.86. Mean Content Validity Ratio (CVR) was calculated as 0.89 based on the opinions expressed by a panel of five dentists and health information managers. The face validity was also assessed, and it was observed that 91% of the participants found the questionnaire to be easy.

A questionnaire designed to obtain dentistry students' knowledge and attitudes towards teledentistry consisted of three sections: Section 1; general demographic information (5 questions). Section 2; integrated 12 questions to collect information about knowledge regarding teledentistry. Section 3; comprised of 17 questions to assess the attitude of dentistry students regarding teledentistry. The participant's responses were ranked according to how much they agreed with each statement based on the 5-point Likert scale with

alternatives: strongly disagree, disagree, do not know, agree, and strongly agree.

The researchers referred to the Dentistry School of Zahedan with a letter issued by the Vice-Chancellor for Research and Technology to collect the data. The questionnaires were distributed among the 169 students, and 133 of the students completed and submitted the questionnaire. Completed questionnaires were coded, and spreadsheets were created for data entry. The data were analyzed using SPSS 22 software. Each item of the questionnaire was coded from 1-5 (strongly disagree to strongly agree). Higher scores indicate positive appraisals towards knowledge and attitude regarding teledentistry, while the lower scores indicate negative evaluation. The scores less than and more than three were considered undesirable and desirable, respectively, to interpret the results

Mean knowledge, and attitude score, standard deviation, and frequency distribution were calculated. For frequency distribution, strongly disagree and disagree responses were combined into one category (Disagree) and similarly agree and strongly agree on responses (Agree). Descriptive statistics were used to summarize the demographic information, and the survey data were analyzed using the independent t-test and one-way ANOVA test. The level of significance was fixed at $P \leq 0.05$.

Results

Most of the students participating in this study (51.9%) were male. The study population's average age was 23.5± 2.73, and 72.5% were aged 20 to 24 years. Most of the students (81.2%) were studying in undergraduate courses. Most students (62.4%) used computers and the Internet for less than an hour a day (Table 1).

The mean score of the research community knowledge was 2.59± 0.51. The phrases "I know about the teledentistry applications in the health sector," "I know the advantages of teledentistry technology," and "Teledentistry has the potential to be integrated into our current dental services" had the highest average scores among the phrases related to students' knowledge. The phrases "Teledentistry can be useful in improving access to oral health care" and "Teledentistry can help to monitor my patient's oral health" had the lowest average mean scores among the phrases related to students' knowledge (Table 2).

The mean score of the research population attitude was 2.53± 0.47. The phrase "I think dental examinations are accurate via computers and intraoral camera as in the traditional office setting" had the highest average score among the phrases related to students' attitude. The phrase "Lack of awareness and infrastructure are the main challenges of teledentistry" had the lowest average mean score among the phrases related to students' attitudes (Table 3).

The results of the tests (t-test and ANOVA) performed to examine the relationships between the variables showed that there was only a relationship between the age group variable and students' knowledge (Table 4).

Table 1: Profile of demographic characteristics of dentistry students

Variables		Number	Percent
Sex	Male	69	51.9
	Female	64	48.1
Age	20-24	100	75.2
	25-29	28	21
	30 years and more	5	3.8
Qualification	Undergraduate	108	81.2
	Postgraduate	25	18.8
Computer and Internet usage per day (in hours)	Less than an hour	83	62.4
	1-3	15	11.3
	3-5	24	18
	5-7	8	6
	More than 7 hours	3	2.3

Table 2: Knowledge of population research about teledentistry

Questions	Total Responses			Total
	Agree N (%)	Neutral N (%)	Disagree N (%)	Mean ± SD
I am familiar with the concept of teledentistry.	51 (38.3)	46 (34.6)	36 (27.1)	2.92 ± 1.09
I know about teledentistry applications in the health sector.	44 (33.1)	47 (35.3)	42 (31.6)	3.03 ± 1.17
I know the advantages of teledentistry technology.	48 (36.1)	35 (26.3)	50 (37.6)	3.02 ± 1.23
Teledentistry is the practice of the use of computers, the internet, and intraoral camera technologies to diagnose and provides advice about treatment over distance.	69 (51.9)	51 (38.3)	13 (9.8)	2.47 ± 0.9
Tele-dentistry is not a face to face interview.	77 (57.9)	40 (30.1)	16 (12)	2.45 ± 0.87
Teledentistry will help to consult with an expert about a specific patient's problem.	88 (66.1)	28 (21.1)	17 (12.8)	2.29 ± 0.93
Teledentistry is good for dental education over the internet and for training primary care dentists.	79 (59.4)	35 (26.3)	19 (14.3)	2.41 ± 0.92
Teledentistry is useful to educational goals for inexperienced dentists.	84 (63.1)	32 (24.1)	17 (12.8)	2.31 ± 0.95
Teledentistry can help to monitor my patient's oral health.	91 (68.4)	35 (26.3)	7 (5.3)	2.18 ± 0.85
Teledentistry can be applied in every branch of dentistry.	57 (42.8)	32 (24.1)	44 (33.1)	2.77 ± 1.11
Teledentistry can be useful in improving the access to oral health care	95 (71.4)	32 (24.1)	6 (4.5)	2.17 ± 0.75
Teledentistry has the potential to be integrated into our current dental services.	37 (27.8)	54 (40.6)	42 (31.6)	3.02 ± 0.93

Table 3: The attitude of population research about teledentistry

Questions	Total Responses			Total
	Agree N (%)	Neutral N (%)	Disagree N (%)	Mean ± SD
I want to use Teledentistry.	65 (48.8)	32 (24.1)	36 (27.1)	2.65 ± 1.12
The use of Teledentistry increases the career opportunities of hospital dental staff.	52 (39.1)	51 (38.3)	30 (22.6)	2.83 ± 0.94
Teledentistry can provide me a good understanding of the patient's oral health problem over the internet.	74 (55.6)	40 (30.1)	19 (4.3)	2.52 ± 0.82
Using teledentistry, I will be able to monitor my patient's condition well.	55 (41.3)	46 (34.6)	32 (24.1)	2.83 ± 0.96
I think dental examinations are accurate via computers and intraoral cameras as in the traditional office setting.	36 (27.1)	43 (32.3)	54 (40.6)	3.18 ± 1.02
I think children and parents would be receptive to having a dental examination done via computers and intraoral cameras.	44 (33.1)	67 (50.4)	22 (16.5)	2.79 ± 0.95
Teledentistry is a convenient form of oral health care delivery which makes dental examination easier.	72 (54.1)	40 (30.1)	21 (15.8)	2.56 ± 0.87
Teledentistry will be a standard way of oral health care delivery.	51 (38.3)	50 (37.6)	32 (24.1)	2.80 ± 0.87
Teledentistry can be an addition to the regular care we (the dentists) provide.	101 (75.9)	18 (13.5)	14 (10.6)	2.20 ± 0.82
Teledentistry can reduce costs for dental practices.	81 (60.9)	38 (28.6)	14 (10.5)	2.41 ± 0.92
Teledentistry can save time for me.	102 (76.7)	22 (16.5)	9 (6.8)	2.14 ± 0.8
Teledentistry can be considered as a solution to reduce medical travel.	95 (71.4)	27 (20.3)	11 (8.3)	2.26 ± 0.88
I think Teledentistry can increase the accessibility of specialists to rural and underserved communities for their dental needs.	90 (67.7)	17 (12.8)	26 (19.5)	2.37 ± 0.99
Teledentistry can improve the shortage of dental professionals in medical centers.	81 (60.9)	30 (22.6)	22 (16.5)	2.46 ± 0.88
Tele-dentistry provides the necessary information to make it easier to diagnose.	78 (58.7)	41 (30.8)	14 (10.5)	2.41 ± 0.85
Teledentistry can improve diagnosis skills and dentist's knowledge through continuous professional development.	64 (48.1)	57 (42.9)	12 (9)	2.55 ± 0.74
Lack of awareness and infrastructure are the main challenges of Tele-dentistry.	97 (72.9)	30 (22.6)	6 (4.5)	1.99 ± 0.86

Table 4: Dependency between demographic characteristics, knowledge, and attitude of the dentistry students

Variables		Knowledge			Attitude		
		Mean ± SD	ANOVA	P-value	Mean ± SD	ANOVA	P-value
Age group (years)	20-24	2.62 ± 0.50	0.04	2.92	2.54 ± 0.46	0.83	2.28
	25-29	2.50 ± 0.48			2.52± 0.50		
	30 and more	2.61 ±0.24			2.66 ± 0.19		
Computer and Internet usage per day (in hours)	Less than an hour	2.64 ± 0.52	0.63	0.65	2.58 ± 0.51	0.42	0.99
	1-3	2.45 ± 0.57			2.47 ± 0.30		
	3-5	2.53 ± 0.43			2.41 ± 0.35		
	5-7	2.56 ± 0.58			2.59 ± 0.63		
	More than 7 hours	2.59 ± 0.50			2.59 ± 0.50		
variables		Knowledge			Attitude		
		Mean ± SD	T-test	P-value	Mean ± SD	T-test	P-value
Sex	Male	2.55 ± 0.51	-0.79	0.43	2.49 ± 0.47	-0.89	0.38
	Female	2.62 ± 0.50			2.56 ± 0.47		
Qualification	Undergraduate	2.59 ± 0.51	0.29	0.77	2.51 ± 0.46	-1.09	0.28
	Postgraduate	2.56 ± 0.47			2.62 ± 0.51		

Discussion

Advances in technology have changed the way of providing oral care services. Teledentistry is one of the technology-influenced and expanding dentistry fields and can be used in various fields of treatment, counseling, education, and research, and allows different dentists to work together in these matters (12, 16, 17). Therefore, dentistry professionals' knowledge and attitude can be very useful in using this technology and its capabilities.

Most of the participants in this study were male and were studying in undergraduate courses, which is consistent with the findings of a study conducted in India (18). The mean age of the subjects in this study was 23.5 years, and they used computers and the Internet for less than one hour during the day. In studies conducted in Pakistan and India, participants' mean age was 29.5 and 32.4 years, respectively (18, 19). The use of the Internet and computers is varied in different societies. In India, for example, they used computers and the Internet for up to two hours a day (18), while in Pakistan, most of the study population used the Internet between zero and 10 hours a week, and they considered them experienced in using computers (19).

The mean score of knowledge and attitude of the research population in this study was less than three and was undesirable. Bahaadinbeigi and Boringi achieved similar results in their studies (11, 13), while the results of studies conducted by Balsaraf and Pradhan were consistent with the results of this study (16, 17). A study conducted to evaluate Iranian dentists' knowledge, and performance about the use of information technology in 2013 also showed that dentists did not have sufficient knowledge about the professional use of information technology and were weak about the general use of Information technology. Most dentists in this study had never provided online counseling, and only about one-third of them sometimes did online counseling.

Evidence shows that dentists do not pay much attention to modern counseling methods, while these methods are used successfully in developed countries (20). Therefore, it is needed to upgrade dentistry students' knowledge to use this technology more in the future. However, with the new situation in which all countries are currently affected by the epidemic of COVID-19, this threat can be used to improve the medical community's attitude to the use of this technology in everyday affairs.

The results of the participants' knowledge assessment in this study showed that most of them believed that they are aware of the applications of teledentistry in the health sector and know its benefits and dentistry can integrate into current dental services. In similar studies, the application of teledentistry for dental education (18), oral health education in the community, dental tourism (13), and oral health care (11) were mentioned. Also, saving time (7, 13, 17), reducing costs (7, 17, 18), and improving access to services (7, 17, 19) were among the benefits mentioned in various studies. According to some other studies, this technology was not economical and cost-effective (11, 13).

Patel considered full understanding and attention to the healthcare environment and a commitment to full integration of teledentistry in that environment as prerequisites for the implementation of teledentistry programs. To achieve this goal, it was necessary to coordinate clinical strategies with organizational goals, which requires strong political support. In his view, the challenges of stakeholders should be considered in particular (21).

Therefore, to make teledentistry operational, it is necessary to make detailed plans at the country's health management's highest levels. It is also essential to use the opinions of various

stakeholders who will be the users of this technology in planning, including managers of dental clinics, various specialists in dental sciences, different personnel working in dental clinics, and other employees that are somehow related to this technology. It is noteworthy that the support of senior political managers of the country is a requirement for teledentistry.

Few people in this research population considered teledentistry useful in improving access to oral health care and believed that this technology could help monitor their patient's oral health. In Boringi's study, most respondents believed that teledentistry had limited use in dental emergencies and general dentistry (11), but another study found that teledentistry had a positive effect on dental services in rural areas (5). Therefore, more studies are needed to prove the efficiency and economics of this technology to change experts' views on the use of this technology.

According to the assessment results of the attitude of the research population, most participants in the study believed that examinations through computers and intraoral cameras are as accurate as in-office examinations (11, 18), and this could be because new generation students are more likely to use various technologies, including smartphones, and have more confidence in and use new technologies. As found in the Nagarajapa study, those with more than ten years of experience had less knowledge of teledentistry than those with less than ten years of experience (18). The findings of the present study also showed that there was only a relationship between the age group variable and the knowledge and attitude of the research community, which confirms the above statement.

Most of the participants in this study did not consider the lack of awareness and infrastructure as the most important teledentistry challenges. Lack of computer skills and the impossibility of providing services online were obstacles to the implementation of teledentistry mentioned in the study conducted in Pakistan (22), and lack of infrastructure was also mentioned in several studies as obstacles to the implementation of this technology (7, 11) which was not consistent with the results of this study.

Conclusion

The results of the present study showed that the knowledge and attitude of dentistry students towards teledentistry was not desirable and needed more attention. Due to the new conditions due to the outbreak of infectious diseases such as COVID-19 globally, the need to use telemedicine technology in all clinical areas, including dentistry, has become more urgent. Therefore, the relevant institutions must pay more attention to the necessary measures such as holding educational classes and conducting research on the efficiency and cost-effectiveness of teledentistry to improve students' level of knowledge and attitude and make this technology operational and integrate it into the health environment.

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References

1. Riley III JL, Gilbert GH, Heft MW. Dental attitudes: proximal basis for oral health disparities in adults. Community dentistry and oral epidemiology. 2006;34(4):289-98.
2. Mazaheri R, Rouzbahani NA, Jabarifar SE, Birjandi N, Bayat HR. Evaluation of oral health status in 8-11-year-old primary school students of Isfahan and its effect on their family. Journal of Isfahan Dental School 2012:151-61.
3. Piri M, Jalali R, Amini AA. Factors contributing to the Development of justice the centrality health

insurance organization. Iran J Health Insur. 2020;2(4):228-37.
4. Moghaddam AV, Damari B, Alikhani S, Salarianzedeh M, Rostamigooran N, Delavari A, et al. Health in the 5th 5-years Development Plan of Iran: main challenges, general policies and strategies. Iranian journal of public health. 2013;42(Supple1):42.
5. Troconis CM, Ribón JR, Puello P. Impact of Teledentistry Programs on Dental Service in Rural Areas: A Systematic Review. International Journal of Applied Engineering Research. 2018;13(19): 14417-23.
6. Lankarani KB, Ghahramani S, Zakeri M, Joulaei H. Lessons learned from national health accounts in Iran: highlighted evidence for policymakers. Shiraz E-Medical Journal. 2015;16(4):e27868.
7. Daniel SJ, Kumar S. Teledentistry: a key component in access to care. Journal of Evidence-Based Dental Practice. 2014;14:201-8.
8. Estai M, Kruger E, Tennant M. Optimizing patient referrals to dental consultants: implication of teledentistry in rural settings. Australasian Medical Journal (Online). 2016;9(7):249.
9. Mir Hosseini S, Ziadlou D, Nasiri N, Sayerinia A. Study of Awareness and Attitude of Staffs in Treatment and Health Service Centers Affiliated to Kerman University of Medical Sciences Towards Telemedicine. Journal of Hospital. 2014:1-19.
10. Nematolahi M, Abhari S. Assessing the information and communication technology infrastructures of Shiraz University of Medical Sciences in order to implement the telemedicine system in 2013. Interdisciplinary Journal of Virtual Learning in Medical Sciences. 2020;5(2):44-51.
11. Boringi M, Waghray S, Lavanya R, Babu DBG, Badam RK, Harsha N, et al. Knowledge and awareness of teledentistry among dental professionals–A cross sectional study. Journal of clinical and diagnostic research: JCDR. 2015; 9(8):ZC41.
12. Chandra G, Rao J, Singh K, Gupta K. Teledentistry in India: Time to deliver. Journal of Education and Ethics in Dentistry. 2012;2(2):61.
13. Bahaadinbeigi K, Tabatabaei F, Jahromi ME. Attitude and readiness of Dentistry students in Kerman University of Medical Sciences concerning Tele-dentistry in 2017. Medical Technologies Journal. 2017;1(4):91-2.
14. Portal of Sistan and Baluchestan province: Governorship of Sistan And Balouchestan 2020 [updated 8/6/2020; cited 2020 8/6/2020]. Available from: https://www.sbportal.ir/fa/aboutostan.
15. Shahraki M, Ghaderi S. Inequality in distribution of physician and general practitioner in Sistan and Baluchestan province, Iran (2009-2017). Payesh (Health Monitor).0-.
16. Balsaraf SV, Chole RH. Knowledge, awareness, and attitude among practicing dentists about teledentistry in Indore, Central India. Journal of Indian Association of Public Health Dentistry. 2015;13(4):434.
17. 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. Journal of education and health promotion. 2019;8.
18. Nagarajappa R, Aapaliya P, Sharda AJ, Asawa K, Tak M, Pujara P, et al. Teledentistry: Knowledge and attitudes among dentists in Udaipur, India. Oral Health Dent Manag. 2013;12(502):2.
19. Nayar P, McFarland KK, Chandak A, Gupta N. Readiness for Teledentistry: validation of a tool for Oral health professionals. Journal of medical systems. 2017;41(1):4.
20. Mohebbi SZ, Sahebjamei M, Bonabi M. Application of Information Technology by Iranian Dentists: Assement of Knowledge and Performance. Journal of Islamic Dental Association of Iran. 2014;26(2):129-35.
21. Patel RN, Antonarakis GS. Factors influencing the adoption and implementation of teledentistry in the UK, with a focus on orthodontics. Community dentistry and oral epidemiology. 2013;41(5):424-31.
22. Latif N, ALAM AN, Abdullah S. Knowledge and attitude of dentists towards tele-dentistry in Pakistan. Pakistan Oral & Dental Journal. 2016; 36(2).