

## ORIGINAL ARTICLE

**Prospectives of Teledentistry for Professional Stakeholders of Health Professional Dental Education in Pakistan; A Cross-Sectional Survey**

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**ABSTRACT**

**Objective:** The aim of this study was to assess the perceived barriers that dental professionals in Pakistan have to use teledentistry, as well as to measure awareness of teledentistry among dental students and dentists.

**Study Design:** A descriptive cross-sectional study.

**Place and Duration of Study:** The study was conducted at the Department of Operative Dentistry, CMH-Lahore Medical College and Institute of Dentistry from September 2021 to December 2021.

**Materials and Methods:** During the course of about four months, a descriptive cross-sectional study of dental professionals and students was carried out throughout Pakistan. Dental professionals and dental students within the age range of 18-60 years were included in the study. Any dental practitioner not using a smartphone was excluded from the study.

**Results:** A total of 428 dental students and professionals, with 222 (51.9%) undergraduate students, 127 (29.7%) house officers, 58 (13.6%) postgraduate trainees, and 21 (4.9%) specialists participated in the study. The overall mean knowledge and attitude scores were reported as  $29.68 \pm 4.24$  and  $32.55 \pm 4.82$ , respectively. Although the study participants had satisfactory/good knowledge and a positive attitude towards teledentistry, they also believed that there are many challenges to face regarding the equipment and awareness.

**Conclusion:** Conclusively, our study displays a good knowledge, attitude, and awareness regarding teledentistry along with its advantages and disadvantages among the dental community of Pakistan where the legislature is bringing public health services to the doorsteps of the general public by use of information and communication technology.

**Keywords:** *Communication, Dentists, Dental Care, Telemedicine.*

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**Introduction**

General health requires good oral health. Over time, there has been a significant rise in interest in maintaining good oral health. Due to a variety of problems with the healthcare delivery system,

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including the absence of effective healthcare services, the increasing distances, and the limited availability of dental specialists in rural areas that may cause delays in patient transportation, teledentistry can be a significant source of solutions for these issues in the healthcare sector.<sup>1</sup> The development of personal computers and information technology has greatly increased the usage of teledentistry in this era.<sup>2</sup>

Teledentistry is the practice of diagnosing and giving treatment recommendations over long distances utilising video conferencing technologies.<sup>3-7</sup>

Teledentistry has the potential to significantly improve the lives of people in underserved or remote locations. That may make dental specialists more easily accessible.<sup>1,2,8</sup> This has led to a rise in low

socioeconomic class individuals' understanding of the importance of maintaining and caring for their dental health.<sup>5,6,7</sup> To facilitate efficient doctor-patient communication, teledentistry can be used as "real-time consultation/video conferencing."<sup>1,6</sup> Moreover, computer-assisted learning (CAL) has been tested and researched in the past.<sup>2,7</sup> The "save and forward approach" can be used to transfer and record patient data as well as for treatment planning.<sup>1,9</sup>

Telestomatology, teleradiology, telepathology, teleoral Surgery, and teleorthodontics are all examples of teledentistry.<sup>3</sup> Moreover, teledentistry may aid in the prevention, early detection, and conservative management of oral illnesses.<sup>3</sup> Telemedicine is advancing globally and it has proved to be bringing a positive change in countries practising it.<sup>3,4,7</sup> According to a recent analysis by Fortune Business Insight, the North American region will dominate the global telemedicine market, which is expected to rise from USD 34 billion in 2018 to USD 185 billion in 2026. Similar to telemedicine, teledentistry is a new method that has the potential to improve several dental specialties. According to an Australian study, using Teledentistry to assess kids with minimal caries risk could result in annual savings of up to \$40 million.<sup>10</sup> The U.S. Army's Whole Dental Access Initiative represents the cutting edge of teledentistry. In July 1994, the US Army conducted the first teledentistry test at Fort Gordon, Georgia. A web-based "Continuing Dental Education" approach ("Case of the Month") that concentrated primarily on clinical oral pathology was designed and assessed by the University of Florida, College of Dentistry (UFCD).<sup>4,5</sup> In six inner-city elementary schools and seven child care facilities in Rochester, New York, a teledentistry project was implemented. Telehealth assistants used intraoral cameras to take pictures of the children's teeth, which they then sent to a pediatric dentist for review in order to recommend a treatment plan and referrals.<sup>4,5</sup>

Pakistan is a nation in development. Existing telemedicine application initiatives in Pakistan are small-scale, individual-level, and operational in only a few locations. Pakistan is aware, however, that incorporating telemedicine into its national health care programme is a crucial part of the process of modernizing and reconstructing that is currently in

progress. A few online Teledentistry businesses operate in Pakistan.<sup>9</sup> Pakistani dentists have not yet experimented with teledentistry.

It is crucial to assess the current knowledge levels among dental professionals and students in order to increase the use of teledentistry. The purpose of this study was to evaluate dental students' and dentists' knowledge of teledentistry and to determine the perceived barriers to teledentistry utilization among dental professionals in Pakistan.

## Materials and Methods

Using a pre-existing questionnaire<sup>11,12</sup> that participants willingly filled out online, a descriptive cross-sectional study was carried out. At the outset of the questionnaire, the study's purpose was stated. Earlier research has used this questionnaire.<sup>11,12</sup> The Ethics Review Board gave their approval. The survey was done on survey monkey after receiving ethical permission. In Pakistan, the study was conducted at the Department of Operative Dentistry of CMH-Lahore Medical College and Institute of Dentistry from September 2021 to December 2021 dental professionals and students over the course of four months. The research complied with STROBE recommendations for cross-sectional studies.<sup>13</sup> Based on networks of authors living in different regions of Pakistan, information was gathered through WhatsApp groups, Facebook accounts, and email accounts. It was done via non-probability convenient sampling. Although 428 answers were received, the sample size was retained at 384 as determined by the WHO calculation with a 95% confidence level and a 5% margin of error (Population size correction factor (N): 1000000, Hypothesized% frequency of outcome factor in the population (p): 50%+/-5). Dental professionals and dental students within the age range of 18-60 years were included in the study. Any dental practitioner not using a smartphone was excluded from the study.

The survey was anonymous and in the English language. Participants were informed of the purpose and nature of the research before providing their informed consent. The questionnaire is broken up into four sections. The first step was to compile information on demographics and professional history. The dental professionals providing direct patient care will be questioned regarding their years

of experience working in a dental clinic or university hospital, as well as their time spent online. The second component involved nine integrated questions designed to gather information on teledentistry abilities. The third section evaluated dentists' attitudes towards teledentistry's effectiveness, and the fourth piece asked questions about how frequently teledentistry use was thought to be difficult. A Likert scale of 1 to 5 was used to grade each participant's response on a scale of 1 to 5. (1=Strongly disagree; 2=disagree; 3=Neutral; 4=Agree; 5=Strongly agree).<sup>14,15</sup>

This questionnaire has been utilized in previous research<sup>11,12</sup>, but five senior faculty members from different institutions independently assessed its construct validity and content. As a result, the validity of the questionnaire has already been established. A pilot survey was completed by 20 dentists and dental students. The questionnaire had an internal reliability score of 0.865 or Cronbach's alpha. Based on the findings of the pilot study, the sample size was calculated.

SPSS version 23 was used to analyze the survey responses. The mean and standard deviation for the outcome data were quantitative in nature. The questionnaire responses were compiled using descriptive statistics, and the results were displayed as frequencies and percentages. Chi-square tests were used to determine whether knowledge and attitude varied based on socio-demographic traits or in relation to one another and to determine how they related to practice.

**Results**

A total of 428 dental students and professionals with 222 (51.9%) undergraduate students, 127 (29.7%) house officers, 58 (13.6%) postgraduate trainees, and 21 (4.9%) specialists participated in the study. The gender distribution was 154 (36%) males and 274 (64%) females. The demographic results showed that most participants 323 (75.5%) were 20-25 years old, undergraduate 222 (51.9%), and were using the internet for 6-10 hours/day 221(51.6%). A huge majority, 391 (91.4%) of the participants had less than 5 years of work experience. Almost half of the undergraduates 112 (50.5%), house officers 67 (52.8%), post-graduate trainees 30 (51.7%), and specialists 12 (57.1%) used the internet for 6-10 hours/day. The overall mean knowledge and attitude

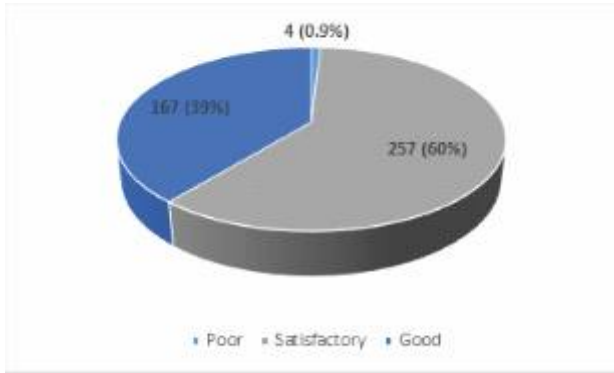
scores were reported as 29.68 ± 4.24 and 32.55 ± 4.82 respectively. On average, the participants had satisfactory knowledge of teledentistry. The frequency (%) and mean ± standard deviation for each category of the demographic variables is displayed in Table 1.

**Table 1: Category-wise descriptive measures of the demographic variables**

| Demographic variables | Frequency (%) (n=428) | Knowledge (mean ± s.d) | Attitude (mean ± s.d) |
|-----------------------|-----------------------|------------------------|-----------------------|
| <b>Overall</b>        |                       | 29.68 ± 4.24           | 32.55 ± 4.82          |
| <b>Age (years)</b>    |                       |                        |                       |
| 20-25                 | 323 (75.5%)           | 29.84 ± 4.28           | 32.88 ± 4.71          |
| 26-30                 | 77 (18%)              | 28.74 ± 4.48           | 31.01 ± 4.94          |
| 31-40                 | 20 (4.7%)             | 30.30 ± 3.39           | 32.95 ± 5.54          |
| 41-60                 | 8 (1.9%)              | 30.50 ± 3.21           | 33 ± 4.24             |
| Above 60              | 0                     | 0                      | 0                     |
| <b>Gender</b>         |                       |                        |                       |
| Male                  | 154 (36%)             | 29.27 ± 4.44           | 32.31 ± 4.92          |
| Female                | 274 (64%)             | 29.91 ± 4.10           | 32.68 ± 4.76          |
| <b>Qualification</b>  |                       |                        |                       |
| Undergraduate         | 222 (51.9%)           | 29.66 ± 3.93           | 32.55 ± 4.27          |
| House officers        | 127 (29.7%)           | 30.16 ± 4.89           | 33.42 ± 5.46          |
| Post graduate         | 58 (13.6%)            | 28.57 ± 3.85           | 30.29 ± 4.78          |
| Specialist            | 21 (4.9%)             | 30 ± 3.80              | 33.43 ± 4.49          |
| <b>Years of</b>       |                       |                        |                       |
| 0-5                   | 391 (91.4%)           | 29.76 ± 4.20           | 32.72 ± 4.69          |
| 6-10                  | 19 (4.4%)             | 27.26 ± 4.88           | 28.05 ± 5.59          |
| 11-15                 | 10 (2.3%)             | 30 ± 4                 | 34.30 ± 4.06          |
| 16-20                 | 6 (1.4%)              | 30.50 ± 3.15           | 33.17 ± 5.46          |
| 21-25                 | 2 (0.5%)              | 31.50 ± 4.95           | 30.50 ± 3.54          |
| <b>Internet usage</b> |                       |                        |                       |
| 0-5                   | 147 (34.3%)           | 30.12 ± 4.46           | 32.76 ± 5.43          |
| 6-10                  | 221 (51.6%)           | 29.50 ± 3.98           | 32.67 ± 4.41          |
| 11-15                 | 60 (14%)              | 29.27 ± 4.57           | 31.57 ± 4.62          |

For the assessment of the knowledge of dental students and professionals about teledentistry, the total knowledge score (range=8-40) was broken down into three categories as poor (8-19), satisfactory (20-30), and good (31-40). It is quite encouraging that only 4 (0.9%) participants had poor while 99% had satisfactory or good knowledge about tele dentistry (Figure 1).

For attitude and perceived challenges, question-wise analysis was carried out by combining the strongly disagree and disagree responses into one category, disagree. Similarly, agree and strongly agree responses were combined into agree. Overall, the



**Fig 1: Knowledge assessment of dental students and professionals**

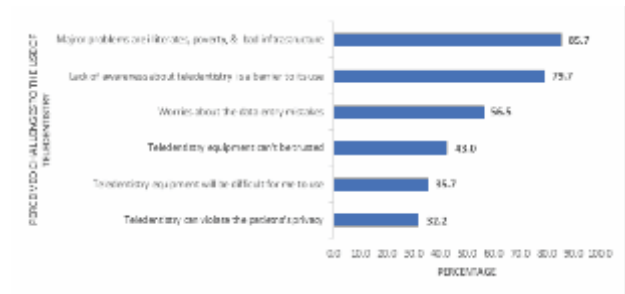
participants demonstrated a very positive attitude towards teledentistry as a noticeable proportion agreed with each of the attitude questions. For instance, 81.3 % agreed that the teledentistry could be an addition to the regular care the dentists provide followed by 71% who agreed that it can reduce the isolation of practitioners by providing peer contact and specialist support (Table 2).

**Table 2: Attitude of dental students and professionals towards teledentistry**

| Attitude towards teledentistry                               | Disagree   | Neutral     | Agree       |
|--------------------------------------------------------------|------------|-------------|-------------|
| It provides a good understanding of health problems          | 22 (5.2%)  | 102 (23.8%) | 304 (71 %)  |
| Children & parents would be receptive to teledentistry       | 60 (14%)   | 70 (16.4%)  | 298 (69.6%) |
| It is a convenient form of oral healthcare delivery          | 36 (8.4%)  | 111 (25.9%) | 281 (65.7%) |
| It would be a preamble in robotic dentistry                  | 88 (20.5%) | 112 (26.2%) | 118 (53.3%) |
| It can be an addition to the care, dentists provide          | 15 (3.5%)  | 65 (15.2%)  | 348 (81.3%) |
| It can reduce the costs of dental practices                  | 26 (6.1%)  | 131 (30.6%) | 271 (63.3%) |
| It can be time-saving for me                                 | 69 (16.1%) | 140 (32.7%) | 219 (51.2%) |
| It can increase accessibility to rural and underserved areas | 78 (18.2%) | 153 (35.7%) | 197 (46%)   |
| It can reduce isolation of practitioners                     | 63 (14.7%) | 125 (29.2%) | 240(56.1%)  |

Although the study participants had satisfactory / good knowledge and positive attitude towards teledentistry, but they also believed that there are many challenges to face regarding the equipment and awareness. The percentage of participants who agreed with the mentioned challenges varied from 32% to 86%. Overall, 367 (85.7%) agreed that the “major challenges in tele dentistry are illiteracy,

poverty, and lack of infrastructure” while according to 341 (79.7%), “lack of awareness about tele dentistry benefits and applications by dental professionals will be a barrier to its use” (Figure 2).



**Fig 2: Agreement (%) of dental students and professionals with the perceived challenges**

**Discussion**

In the following study, knowledge and awareness, attitude, and perceived challenges to using Teledentistry among dental professionals and undergraduates were assessed. Dental specialists should remain current with this quickly creating field to settle on fitting decisions in utilising innovation.<sup>16,17</sup> Web destinations containing clinical, histopathological, and radiographic information establish a climate for understudies to learn at their own speed.<sup>18</sup> Teledentistry bridles the constant capacity of modern media communications to permit offsite dental specialists of any speciality to help their associates give consideration.<sup>19,20,21,22</sup> Dentistry with innovation can revolutionize the clinical and essential medical services in our country.<sup>23,24,25</sup> This new technique guarantees better days to come for both; the patients as well as the specialists inside its constraints. The study revealed that people of the age group 20-25 years who were mostly undergraduate students had the most knowledge and awareness regarding Teledentistry, about 75.5% and 51.9% respectively. In contrast to these results, people aged 41-60 mostly belonging to the postgraduate trainees and specialists' group had the least awareness, approximately 18.5%. These results are in accordance with a few other studies,<sup>1,9,12,16,20,22,26,27,28,29</sup> whereas, lesser values were recorded comparatively by Ata and Ozkan.<sup>4</sup> These findings can be associated with the increased use of technology by the younger generation and advanced exposure to innovative technology.

The current review reflected how most of the dental experts concurred that Teledentistry is both cost-effective, as agreed by 63.3% of the professionals and a convenient form of oral health care delivery (65.7%). Comparable discoveries were accounted for in other studies.<sup>4,8,9,20,24,26,30,31,32</sup>

The mentioned outcomes became evidently popular during Covid 19 period as the idea of Teledentistry developed and came into training among dental experts and dental students. Almost half of the participants believed Teledentistry to be a timesaving mode of practice as supported by a number of studies.<sup>33</sup>

However, these results appear to contradict a study done in Udaipur, India with a percentage of only 33.3% agreeing with the opinion that Teledentistry saves time.<sup>1</sup> The interpretation of Teledentistry expanding accessibility to rural and underserved areas was also evaluated. The results showed a significant inclination (46%) towards the mentioned statement being correct with respect to the 18.2% disagreeing and the remaining 35.7% being neutral.<sup>1,20,21,22,23,26</sup> These results are specifically determined by the fact that the majority of the population in Pakistan belongs to a low socioeconomic status.

A noteworthy number of professionals that is 56.1% are convinced that Teledentistry can reduce the isolation of practitioners by bridging the gaps between general dental practitioners and specialists thus providing affordable, accessible and quality dental care to underprivileged patients. This also tends to facilitate isolated populations deprived of basic dental care services due to lack of awareness, transportation and established oral health care systems in their areas.<sup>1,26</sup> It is believed that in the near future, dentists practising Teledentistry can be hired at primary health care centres in order to discuss complicated cases with the more experienced dental care providers. Additionally, Dental teaching institutions could act as rather more suitable sites for teledentistry consultation as all experienced specialists there could work under the same roof. In there, a multidisciplinary team of dental specialists could communicate daily for a specified number of hours with the dental care providers (Dentists/Hygienists) and the patients at the clinics in remote areas.<sup>1,15,30</sup> Bauer and Brown announced that dentists could hope to experience progressive

changes in light of computerized change. The internet, the world wide web and different advancements of the information revolution will redefine patient consideration, reference connections, practice management, quality, proficient associations, and contest.<sup>24</sup>

A few different studies detailed that the key techniques utilized in Teledentistry are electronic well-being records, electronic reference frameworks, digitizing pictures, teleconsultations, and telediagnosis, all of which means to work on the precision of treatment, openness to individuals below the poverty line and reduced disease burden locally.<sup>21,22,23</sup>

Since Teledentistry is a rather new field and yet to be explored, it comes with a lot of challenges. A remarkable number of professionals (85.7%) are convinced that in Pakistan, lack of infrastructure, poverty and illiteracy is going to be the main obstacle for Teledentistry to be flourished as an independent branch of the healthcare system. Similar recordings have been catalogued by a study on dentists of Udaipur and Kolkata, India.<sup>1,20</sup> Moreover, lack of awareness acts as a key challenge in regard to Teledentistry with a good 79.7% of candidates supporting the statement.

Furthermore, Teledentistry brings about technological difficulties such as data entry mistakes and risks of breach in patients' privacy. 32.3% of the participants agreed that it was a major concern. Henceforth dental specialists who are engaged in teledentistry must make every effort to guarantee the security of their systems as well as any information that they might communicate. For instance, data encryption, password protection and client access logs can help in dissuading the vast majority of individuals and in safeguarding patients' confidentiality.<sup>25</sup>

In addition to the above, 35.7% of professionals have an opinion where they think the equipment for Teledentistry will be hard to use with a 43% believing that it also cannot be trusted.

### Limitations

The review was led by dental students and professionals from academic colleges and hospitals. Hence the consequences of the review can't be ascribed to the entire dental populace.

The sample size likewise was not adequate to generalize the discoveries of the study. Dentists

working in rural regions could have been considered to get a superior perspective on teledentistry in unreached areas.

## Conclusion

Conclusively, our study displays a good knowledge, attitude, and awareness regarding Teledentistry along with its advantages and disadvantages among the dental community of Pakistan where the legislature is using Information Communication Technology for change of public health services at the doorsteps of common people. However, due to insufficient training programmes, many professionals fail to adapt to the newer advancements and are more comfortable continuing their conventional practices. This makes the introduction of structured educational programmes and courses vital to enhance the knowledge and attitude of dentists. This can be acquired by promoting Teledentistry at the central government level via establishing legislation.

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