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Awareness regarding teledentistry among dental students of Bhopal City – A qualitative study

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ABSTRACT

Background: Teledentistry is an emerging field with significant potential to improve access to dental care, particularly in underserved and rural areas. Dental students, as future practitioners, play a crucial role in integrating this technology into clinical practice. This study aimed to explore the knowledge, perceptions, and attitudes of dental students in Bhopal City regarding teledentistry.

Objective: To assess the awareness, perceived advantages, challenges, and attitudes toward the adoption of teledentistry among dental students in Bhopal City.

Methods:A qualitative study was conducted among 100 dental students (60% undergraduate and 40% postgraduate) from various dental institutions in Bhopal City. Participants were selected using purposive sampling, and data were collected through semi-structured interviews. Thematic analysis was employed to identify key themes. Descriptive statistics were used to summarize demographic data.

Results:85% of students were aware of teledentistry, with postgraduate students having a better understanding of its applications.70% recognized teledentistry's role in improving access to care, while 65% noted its potential to reduce costs and improve efficiency.75% of participants identified inadequate infrastructure, and 60% expressed concerns about data security. Only 30% of students reported receiving any formal training in teledentistry.65% of students were willing to adopt teledentistry in their future practice, while 35% expressed concerns about the quality of care.

Conclusion: While dental students recognize the potential benefits of teledentistry, significant challenges related to infrastructure, data security, and lack of training must be addressed to facilitate its widespread adoption. Integrating teledentistry training into dental curricula and improving infrastructure in rural areas are recommended.

I. INTRODUCTION

Teledentistry is an emerging field within dental practice that utilizes telecommunications technology to provide dental care and consultation remotely. With the increasing demand for access to oral healthcare services, especially in rural or underserved areas, teledentistry has the potential to bridge gaps in dental care delivery. It enables real-time consultations, diagnoses, and patient management through video conferencing, digital imaging, and online communication platforms. The COVID-19 pandemic further accelerated the adoption of teledentistry, highlighting its relevance in reducing the burden on healthcare systems and enhancing accessibility to dental services when physical visits were limited or restricted[1].

Dental students, as future practitioners, are at the forefront of integrating new technologies into their practice. Understanding their knowledge and perception of teledentistry is crucial for the successful implementation and utilization of this technology in routine dental care. Studies have shown that while teledentistry offers numerous advantages such as improving patient access and reducing the cost of care, its integration in dental education and practice faces challenges including technological barriers, lack of training, and concerns about patient data security[2].

Bhopal, the capital city of Madhya Pradesh, is home to several dental institutions that contribute to the growing workforce of dental professionals in India. The knowledge and attitudes of dental students in Bhopal toward teledentistry could serve as an indicator of the future acceptance and implementation of this technology in the region. A qualitative approach to this study provides in-depth insights into the students' understanding of teledentistry, their perceived barriers and facilitators for its adoption, and the potential role it could play in their future practice[3].

This study aims to explore the knowledge and perceptions of dental students in Bhopal City regarding teledentistry. Through in-depth interviews and thematic analysis, we seek to identify key themes that reflect students' awareness, preparedness, and attitudes toward the adoption of teledentistry in their future dental practice.

II. METHODOLOGY

This study employed a qualitative research design to explore the knowledge and perceptions of dental students in Bhopal City regarding teledentistry. A phenomenological approach was used, which allows for a deep understanding of the students' experiences, perceptions, and attitudes toward this emerging field in dental care. The study was conducted across multiple dental colleges in Bhopal to gather a broad range of perspectives from students at various levels of their education, ensuring a comprehensive understanding of the topic.

The study population consisted of undergraduate and postgraduate dental students from dental institutions in Bhopal. The inclusion criteria for participation were students currently enrolled in the Bachelor of Dental Surgery (BDS) or Master of Dental Surgery (MDS) programs, with at least one year of formal dental education completed. Participants were required to have a basic understanding of digital tools and technologies related to dental practice. Students who were not willing to participate or had incomplete educational backgrounds were excluded from the study.

A purposive sampling method was employed to select participants, with a total sample size of 100 students, which was determined based on data saturation—the point at which no new information or themes emerged from the interviews. This sample size was deemed appropriate for a qualitative study, as it allowed for in-depth exploration of individual experiences while ensuring the feasibility of conducting and analyzing detailed interviews.

Data collection was carried out using semi-structured, in-depth interviews conducted over a period of two months. An interview guide was developed based on existing literature and expert input, focusing on areas such as awareness of teledentistry, perceived advantages and challenges, and the potential role of teledentistry in the future dental practice. Each interview lasted approximately 30 to 45 minutes and was conducted either in person or via video conferencing, depending on the convenience of the participants. All interviews were recorded with participants' consent and later transcribed verbatim for analysis.

The questionnaire used in the interviews consisted of open-ended questions aimed at eliciting detailed responses from participants. Questions covered areas such as their understanding of teledentistry, whether they had received any formal education or training on it, how they perceived the technology’s potential to address dental health disparities, and what challenges they foresaw in its implementation. Probes were used to explore their personal experiences with digital technologies in dental education and clinical practice.

For data analysis, thematic analysis was employed. The transcripts were read repeatedly to identify recurring themes and patterns. A coding framework was developed, and the data were systematically coded by two independent researchers to ensure inter-coder reliability. Thematic categories were refined and organized into overarching themes that captured the essence of the students' knowledge and perceptions of teledentistry. NVivo software was used to assist with the coding and organization of data.

Statistical analysis was not the primary focus of this qualitative study; however, descriptive statistics were used to summarize the demographic characteristics of the participants. Additionally, frequencies and percentages were calculated for key responses to understand the general trends in students' awareness and attitudes toward teledentistry. The results from the thematic analysis were then synthesized to provide a detailed account of the students' perspectives, with representative quotes used to illustrate key points. The study adhered to ethical guidelines, with all participants providing informed consent and confidentiality being maintained throughout the research process. Approval for the study was obtained from the institutional ethical committee.

III. RESULTS

A total of 100 dental students from various dental institutions in Bhopal City participated in the study, with 60% being undergraduate students (BDS) and 40% being postgraduate students (MDS). The participants included a balanced representation of genders, with 52% female and 48% male students. The average age of the participants was 23 years, ranging from 20 to 28 years. All participants had at least one year of dental education, with the majority (70%) being in their third year or higher.

Awareness of Teledentistry

The study revealed that while a majority of the participants (85%) were aware of the term "teledentistry," their understanding of the concept varied significantly. Among the students who had heard of teledentistry, 60% were familiar with its application in dental consultations and remote diagnosis. However, only 40% had a comprehensive understanding of the broader applications of teledentistry, such as patient

management, educational uses, and its role in increasing access to care in rural areas. Postgraduate students demonstrated a higher level of awareness and understanding compared to their undergraduate counterparts, likely due to their more extensive exposure to clinical training and technological advancements.

Perceived Advantages of Teledentistry

Participants highlighted several potential advantages of teledentistry in their responses. The most frequently mentioned benefit (70% of students) was the potential to improve access to dental care, especially for patients in rural or remote areas where access to dental clinics is limited. Around 65% of students believed that teledentistry could significantly reduce patient waiting times and enhance the efficiency of routine dental consultations by enabling remote triaging and diagnosis. Additionally, 50% of participants recognized the potential cost savings for both patients and dental practitioners, as teledentistry could reduce the need for in-person consultations and unnecessary travel.

Postgraduate students, in particular, emphasized the role of teledentistry in continuing education and collaboration between dental professionals. They noted that teledentistry could facilitate remote consultations with specialists, enabling better treatment planning and professional development opportunities. A smaller group of students (20%) also discussed the potential for using teledentistry to monitor patients' oral health post-treatment, suggesting that regular follow-ups could be conducted remotely to ensure proper healing and maintenance of oral health.

Perceived Challenges of Teledentistry

Despite the acknowledged advantages, participants also identified several challenges to the implementation of teledentistry. The most commonly cited barrier (75% of students) was the lack of adequate infrastructure, such as reliable internet access and necessary technological equipment, particularly in rural areas where teledentistry is most needed. Around 60% of participants expressed concerns about the security and privacy of patient data when using telecommunication platforms, with some students questioning the ability of current systems to safeguard sensitive health information effectively.

Another significant challenge highlighted by 55% of students was the lack of formal training in teledentistry. While many students recognized the potential of teledentistry, they expressed uncertainty about how to effectively incorporate it into clinical practice due to the absence of dedicated educational modules or practical exposure. Only 30% of students reported having any exposure to teledentistry during their dental education, and even this exposure was limited to brief mentions in lectures or seminars.

Attitudes Toward Future Adoption

When asked about their willingness to adopt teledentistry in their future practice, 65% of students indicated that they were open to integrating it as part of their clinical services, provided they received proper training and access to the necessary resources. Postgraduate students were more likely than undergraduates to express confidence in using teledentistry, with 75% of MDS students stating that they would actively seek out opportunities to incorporate it into their practice.

However, 35% of students expressed hesitation about the widespread adoption of teledentistry, primarily due to concerns about the quality of care that can be provided remotely. These students argued that while teledentistry could be useful for initial consultations or follow-ups, it could not replace the need for in-person clinical examinations, particularly for complex cases requiring hands-on care.

Recommendations from Students

Participants offered several recommendations for enhancing the adoption and effectiveness of teledentistry in dental practice. A large proportion (70%) suggested that dental curricula should include more comprehensive training on teledentistry, with hands-on modules and case-based learning to familiarize students with the technology and its applications. Additionally, 50% of participants recommended that dental institutions collaborate with telehealth providers to offer internships or practical exposure to teledentistry, allowing students to gain first-hand experience before entering clinical practice.

Furthermore, 45% of students advocated for increased government support in terms of funding and infrastructure development, especially in underserved areas where teledentistry could have the greatest impact. Students also stressed the importance of public awareness campaigns to educate patients about the benefits of teledentistry and encourage its acceptance as a viable alternative to in-person consultations.

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Table 1 : Responses of students

Category	Responses	Percentage (%)
Awareness of Teledentistry		
Heard of teledentistry	Yes	85
	No	15
Comprehensive understanding	Yes	40
	Limited understanding	60
Perceived Advantages		
Improves access to care	Yes	70
Reduces waiting times	Yes	65
Reduces costs	Yes	50
Facilitates professional collaboration	Yes	40
Perceived Challenges		
Lack of infrastructure	Yes	75
Data security concerns	Yes	60
Lack of formal training	Yes	55
Exposure to teledentistry	Received formal training	30
Willingness to Adopt		
Willing to adopt teledentistry	Yes	65
Hesitant to adopt	Yes	35
Recommendations		
Need for training in dental curricula	Yes	70
Government support and infrastructure development	Yes	50

IV. SUMMARY OF KEY FINDINGS

- **Awareness:** 85% of students were aware of teledentistry, with postgraduate students having a better understanding than undergraduates.
- **Advantages:** Improved access to care, cost savings, and enhanced collaboration were the most frequently mentioned benefits.
- **Challenges:** Lack of infrastructure, data security concerns, and limited formal training were seen as major obstacles to the adoption of teledentistry.
- **Future Adoption:** 65% of students were willing to incorporate teledentistry into their future practice, while 35% expressed hesitation due to concerns about the quality of remote care.
- **Recommendations:** Participants advocated for more comprehensive training, government support, and public awareness initiatives to promote the use of teledentistry.

These findings indicate that while dental students in Bhopal recognize the potential benefits of teledentistry, there is a need for enhanced education, infrastructure, and support to facilitate its widespread adoption in clinical practice.

V. DISCUSSION

This study aimed to explore the knowledge, perceptions, and attitudes of dental students in Bhopal City regarding teledentistry. The findings revealed that while the majority of students were aware of teledentistry, their understanding of its applications was relatively superficial, with postgraduate students demonstrating a higher level of awareness compared to their undergraduate counterparts. These results are consistent with previous studies, which have also highlighted a general lack of comprehensive knowledge about teledentistry among dental students, especially at the undergraduate level[4]. For example, a study conducted in the United States reported that dental students were aware of telemedicine concepts but had limited exposure to the practical applications of teledentistry[5].

One of the most prominent findings in our study was the recognition of the potential advantages of teledentistry. A significant proportion of students acknowledged its role in improving access to dental care in underserved and rural areas, reducing patient waiting times, and cutting costs associated with in-person consultations. These findings align with previous research that has emphasized the role of teledentistry in bridging the

gap between urban and rural dental services[6]. A study in Brazil found that teledentistry helped improve dental care accessibility in remote regions, thereby enhancing the overall healthcare delivery system[7]. Similarly, a review of teledentistry's impact in Australia highlighted its ability to reduce costs and improve access, especially for rural and indigenous populations[8].

However, despite recognizing these advantages, the students also identified several challenges. The most frequently cited challenge was the lack of adequate infrastructure, particularly in rural areas. This is consistent with studies from other low- and middle-income countries, where the adoption of teledentistry has been hindered by poor internet connectivity, insufficient digital tools, and a lack of government support[9]. For instance, a study conducted in India reported that poor infrastructure and lack of technology were significant barriers to the implementation of telemedicine and teledentistry services in rural areas[10]. Additionally, concerns about patient data security were prominent among participants, with many expressing skepticism about the current telecommunication systems' ability to protect sensitive health information. These concerns echo the findings of other studies, which have emphasized the importance of robust cybersecurity measures in teledentistry[11].

Another major challenge identified was the lack of formal training in teledentistry. Although many students recognized its potential, they were unsure about how to incorporate it into clinical practice due to the absence of dedicated modules or hands-on experience. This is in line with other studies that have called for the integration of teledentistry into dental curricula[12]. A study in Saudi Arabia, for example, found that dental students who received formal education in teledentistry were more confident in using the technology compared to those who had not[13]. Similarly, research from Canada recommended that dental schools include teledentistry as part of their clinical training to better prepare students for the future[14].

In terms of future adoption, it is encouraging that 65% of the participants were open to incorporating teledentistry into their practice, provided they received adequate training and access to necessary resources. This willingness to adopt new technologies is similar to findings in other studies, which have shown that dental students are generally receptive to new technological advancements, especially when they perceive clear benefits for patient care[15]. However, the 35% of students who expressed hesitation raised valid concerns about the quality of remote care. This sentiment is echoed in studies that highlight the limitations of teledentistry for complex cases requiring hands-on diagnosis and treatment[16].

The limitations of this study include its qualitative nature and relatively small sample size, which limits the generalizability of the results to a larger population. Although the sample size of 100 students provided valuable insights, it may not fully represent the diverse range of perspectives among dental students in other regions or countries. Furthermore, the reliance on self-reported data from interviews may have introduced bias, as students may have overestimated or underestimated their knowledge or attitudes toward teledentistry. Future studies could expand the sample size and include students from a broader range of institutions and geographic locations to provide a more comprehensive understanding of the topic. Additionally, quantitative studies could be conducted to measure the actual impact of teledentistry training on students' knowledge and practice.

In terms of recommendations, it is essential to integrate formal teledentistry training into dental curricula. This would not only improve students' knowledge but also equip them with the practical skills needed to implement teledentistry in real-world scenarios[17]. Dental institutions could partner with telehealth providers to offer internships and clinical rotations in teledentistry, allowing students to gain hands-on experience. Additionally, addressing concerns about infrastructure and data security will be critical for the widespread adoption of teledentistry. Governments and healthcare organizations must invest in upgrading digital infrastructure in rural and underserved areas while ensuring that adequate cybersecurity measures are in place to protect patient data[18].

VI. CONCLUSION

In conclusion, this study sheds light on the knowledge, perceptions, and challenges faced by dental students in Bhopal City regarding teledentistry. While the majority of students recognized its potential to improve access to care, significant barriers such as lack of infrastructure, data security concerns, and insufficient training were identified. Addressing these challenges through education, infrastructure development, and policy changes will be essential for the successful integration of teledentistry into dental practice.

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