



"Teledentistry: Transforming Dental Care Delivery and Education in the Digital Age"

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Date of Submission: 09-06-2023

Date of Acceptance: 19-06-2023

ABSTRACT: Teledentistry involves utilizing telecommunications and information technology to offer dental consultations, concern, education, and promote public knowledge. It presents a more affordable, straightforward, and less intimidating means to engage with dental services. This branch may also be used for long-distance clinical training and continuing education, screening, and dentist-lab communication. Lack of comprehensive and complicated healthcare teledentistry can expand care. Teledentistry also addresses the challenge of providing comprehensive care to distant patient populations at an affordable cost while also tackling the issue of limited availability of specialized dental consultants in rural location. This review specifically highlights the extensive applications of teledentistry across different dental specialties as well as the future outlook of teledentistry and its necessity in the Indian context.

KEYWORDS: Teledentistry, Healthcare, Telecommunication

I. INTRODUCTION:

Teledentistry refers to the utilization of audio, video, and data communication technologies to facilitate the provision of dental care, diagnosis, consultation, and treatment. It also enables the exchange of dental knowledge and education by connecting individuals with specialists in remote communities, all at an equitable cost. Additionally, teledentistry has demonstrated its cost-effectiveness as a viable alternative to visually examining the oral health of young children.^{1,2}

The term "telehealth" describes a broad range of tools and methods for delivering online medical, health, and educational services. By addressing a variety of general and oral issues, telemedicine and teledental care are technological

advances in health care that can help the elderly and isolated communities.³ These innovative technology offer countless opportunities. A more recent speciality that combines dental treatment and telecommunications is called teledentistry. Conditions such as the incapacity of all parties who must participate to be in the same physical location affect whether a teledental event occurs.⁴

Telecommunications and dentistry are combined to form teledentistry. The Greek word "tele" means "distance," and the Latin word "mederi" means "to heal." There are various definitions for telemedicine, which includes teledentistry. Crook in 1997 define Teledentistry as "the practise of using video-conferencing technologies to diagnose and provide treatment advice over a distance."⁵

Teledentistry, a budding field that combines telecommunication technology with dental care, has the capacity to revolutionize the dental practice landscape. The rapid progress in technology empowers teledentistry to provide a groundbreaking method for delivering specialized guidance. By leveraging the capabilities of telecommunications and computer technology, it facilitates interactive access to expert perspectives, unhampered by barriers such as distance, location, time, or any other limitations.^{6,7}Teledentistry, a specialized field within telemedicine focused on dentistry, encompasses the comprehensive handling and facilitation of digital information transmission, networking, remote consultations, and analysis.

HISTORY OF TELEDENTISTRY

The Department of Defence gave the Army the Total Dental Access Programme (TDA) in 1994. TDA sought to reduce associated costs while increasing military access to healthcare. At



the time, they made use of the POTS, or plain-old telephone system. Early in the 1990s, videoconferencing, e-mail, fax, and phone calls were often used, but only recently have high-quality picture transmission and video conferencing become more accessible. These have created totally new opportunities, along with large developments in digital camera technology.⁸

Rocca and colleagues carried out a pilot study in 1995 to use a low-bit-rate satellite system to link a general dentist in Haiti with dental specialist in Washington, D.C. The conclusion showed that most pathological disorders could not be effectively diagnosed via teleconsultation due to the low video quality of intraoral and dental radiographs.⁹

METHODS OF TELEDENTISTRY

Two-way interactive or real time consultation: Through the utilization of advanced telecommunication technologies and high bandwidth network connections, dentists and patients have the ability to partake in consultations from different locations via video conferencing. Dentists can take advantage of the opportunity to seek guidance from other specialized practitioners and, as a result, formulate treatment plans based on their expert recommendations. This technology empowers individuals in remote areas to experience real-time visual and auditory information from a distant location.^{10,11}

Store and forward Method: The dental professional gathers and retains all essential clinical information, digital intraoral and extraoral photographs, as well as radiographs, and subsequently transmits them for consultation through network which are already in use.¹²

TOOLS USED IN TELEDENTISTRY

A commonly used telecommunications system is known as POTS, which stands for plain old telephone system. Employing this method is cost-effective and affordable. POTS encompasses two methods: real-time method and store & forward method. The real-time method allows for immediate data transmission, while the store and forward method involves saving data in a local record before transferring it as required. The telephone based POTS can be considered reliable, albeit at a slower speed. It utilizes the conventional circuits of the public switched telephone network and follows the ISDN (Integrated Services Digital Network) communication standards to transport various forms of information such as voice, video, data, and network services. This mode of information dissemination enhances the accessibility and dependability of this branch of

teledentistry. However, establishing a global ISDN network presents obstacles. Alternatively, global web-based telemedicine is another valuable technology for information conveyance, which is accessible and affordable in most cities unlike ISDN. In addition to utilizing communication technologies in teledentistry, it is crucial to have a competent educator who possesses well-organized education, teaching experience, and computer proficiency. The educator should also be knowledgeable about communication linked through internet and observe particularly all instructional types of effectively.^{13,14}

TELEDENTISTRY APPLICATIONS IN DIFFERENT DENTAL SPECIALITIES

Oral Medicine & Radiology: Electronic imaging of oral lesions is possible, and all the possible diagnosis can be recorded in one document. A inclusive computerized person's documentation that includes past clinical information, history of usage of drug, and history related to family could help improve the diagnosis even more. As a result, in examples of disease of oral and facial region like mouth cancer, TMJ joint dysfunction and diseases of oral mucosa remote consultation can be quite advantageous. Basic cellphones, according to Aziz and Ziccardi et al., these are able to give speedy along with easy authority to those involving electronics and delivered photos which are digital in nature. Digital radiology includes cone-beam computed tomography, panoramic radiography, intraoral periapical radiography, along with MRI imaging, all of which can be communicated to a professional for consultation with the help of technology. Furthermore, photos from remote places can easily be supplied to the expert for peer assessments along with suggestions from various other people, saving time and assuring a correct diagnosis.¹⁵

Oral & Maxillofacial Surgery: A radiological interpretation and a complete history, including the patient's age, signs, and symptoms, can be utilized to examine impacted teeth. It is also possible to use simple telecommunication or video conference to provide medications for oro-facial infections and abscesses. In their 2009 study assessing the practical feasibility of telemedicine in managing impacted third molars, Duka et al. determined that utilizing telemedicine for diagnostic assessment of impacted or semi-impacted third molars yielded comparable results to real-time clinical diagnosis.¹⁵

Prosthodontics: In some cases, conversation between the dentist and the lab workers is necessary for the creation of prostheses. In these situations, coloured photographs of the patients'



teeth can be transmitted so that the prosthesis can be custom-made with the desired shade, size, form, and features. In place of traditional hand modelling and casting of prosthetic restorations, CAD-CAM systems are ever more being used for producing crowns, inlays onlays. Digital impressions are taking the place of older impression methods that involved scanning the jaws and sending the data as a computer file to the dental lab so that various prosthesis could be created. Telecommunication can be utilized to provide post insertion instructions address temporary adjustments in chewing patterns and speech thereby benefiting patients by saving them time and transportation costs.^{16,17}

Conservative & Endodontics: Teledentistry plays a crucial role in the conservative and endodontics department of dentistry. It enables remote diagnosis, treatment planning, and consultation for conservative procedures and endodontic therapies. Through image and video sharing, secure communication, and virtual consultations, dentists can provide timely and accurate guidance, improving patient access to care and optimizing treatment outcomes. In daily practice, pulp and periapical diseases are more common. In addition to endodontists, ordinary dentists also treat these conditions. In light of this, teledentistry offered a way to obtain professional advice for treating various illnesses through an online diagnostic, treatment strategy, and even treatments.¹⁸

Pedodontics & Preventive Dentistry: both early and effective caries detection. When compared to a clinical examination conducted in person, teledentistry has been shown to be a great alternative for children who are anxious or fearful of seeing the dentist. In Rochester, New York, Kopycka-Kedzierawski et al. used telemedicine, intraoral camera dental imaging, and web-based picture archiving to successfully conduct a study on the prevalence of dental caries in children. Teledentistry can demonstrate the application of fluoride at home. A traumatized tooth's chance of survival, particularly in cases like avulsion, is ultimately increased by reducing the time between the trauma and primary care. Any injury to teeth which causes trauma and which is common in children can be primarily done with help of telecommunication even though from a very distance location. Parents can be given an audio-visual explanation of how nutrition affects dental health. Diet counseling is the primary method of treatment for early childhood caries, is something that may be done remotely.^{16,17}

Periodontology: Teledentistry has the prospective to serve as a highly valuable audio-visual tool intended for providing oral hygiene instructions,

including techniques for brushing and flossing, the utilization of interdental cleaning aids, and chemical plaque control methods. This approach proves valuable in increasing awareness of the connection between periodontitis and overall health as well as illustrating how bad oral hygiene can contribute to various systemic conditions such as cardiovascular disease, respiratory diseases, diabetes mellitus, cerebrovascular complications, and pregnancy related complications. Patients residing at a significant distance can benefit greatly from these explanations as it saves there time and reduces the need for multiple appointments and eliminates transportation burden.¹⁸

Orthodontics: Orthodontic care provided through teledentistry projects is viewed as a part of modern healthcare because a large portion of the hands-on care may be provided by technicians and general practitioners under the direction of an orthodontist. Since orthodontic tooth movement requires time, a long time follow-up is generally necessary, and the majority of orthodontists treat a patient over a period of time that is consistently spaced out. Teledentistry plays a pivotal role in the orthodontics department of dentistry. It enables remote consultations, treatment planning, and monitoring of orthodontic cases. Through digital imaging, video conferencing, and secure communication, orthodontists can provide timely and efficient care, improving accessibility and convenience for patients while ensuring effective treatment outcomes.¹⁸

Community Dentistry: Teledentistry is an innovative technique to provide long distance clinical training, continuing education, and hands on instruction to dentists and dental hygienists at remote clinics. It also promotes patient education on self-care practices. This method effectively saves patients time and money by minimizing the need for multiple appointments for preventive and diagnostic care. Teledentistry requires the use of user-friendly equipment to enable face-to-face communication between both parties. To enhance dental hygiene students' understanding of public health and community health concerns, teledentistry equipment can be implemented in primary health centers and community health centers in India. By employing general dentists and dental hygienists at these sub-centers and leveraging teledentistry to connect them with specialists, affordable dental care can be made accessible to the community, thereby improving education and service quality.^{17,18}



FUTURE PROSPECTIVES OF TELEDENTISTRY

Further division of such involvements of branches of telecommunications in the ages/years to come idealizes to come up with many ideas which seem to fascinate a bundle of people that will lawfully allow everybody to have admittance to dental care. However, it won't be simple or pleasant, like any revolution. For this branch of teledentistry to be successful, a few problems need to be solved. These concerns range from technological, ethical, and security concerns to interstate licensure, jurisdiction, and malpractice.¹⁹ Implementing teledentistry successfully can be achieved through the utilization of various strategies, such as:

- Telecommunication advancements are bringing significant changes to the future of dental treatment.
- Overcoming a variety of challenges is crucial for the achievement of teledentistry.
- These challenges encompass issues related to authority, interstate licensure, malpractice, technology, security, and ethical considerations.
- Teledentistry finds application in various areas, including the education of teledentistry courses where instructors should possess adequate teaching experience and strong computer skills.
- Teledentistry practitioners are required to obtain licenses in each state where they practice.
- Dentists must prioritize the security of their systems and ensure the protection of any communicated data.^{20,21}

ADVANTAGES OF TELEDENTAL CARE

- Reduced service costs and enhanced care quality.
- Greater specialist help, knowledge, and a decrease in peer isolation.
- General dentists can send multimedia patient records to dental experts allowing specialists to diagnose and formulate treatment plans without requiring the patient to come in.
- Improved dental integration within the broader healthcare delivery system.
- Increased engagement with the insurance sector concerning preferences and requirements.
- Contact with dental laboratories has improved.^{18,22}

LIMITATIONS OF TELEDEDENTISTRY

- Only preventive and diagnostic procedures may benefit from teledentistry. The patient must see the specialist for the majority of dental treatments.
- Acquiring digital photographs of an oral lesion, transferring them to an internet-connected device, and sending them as attachments for diagnosis necessitate technical proficiency and familiarity. This procedure can take a long time for both the professional and the patient. Teleconsultations might encounter delays stemming from technical hurdles or insufficient network connectivity.
- Clinical photography is used to make a diagnosis, which may vary based on in-person interactions. It's possible that the accurate representation on intraoral pictures or video recordings differs from what's truly there. The use of further diagnostic tools like percussion and palpation is not possible.
- Specialists are unable to conduct physical examinations. The diagnosis is less precise because a patient must rely on the dental team's inspection at the distant location.
- The confidentiality of medical and dental data is another issue brought up by telemedicine and teledentistry. Therefore, it is necessary to obtain the patient's informed permission and to advise them of the inherent danger of receiving an incorrect diagnosis or course of treatment as a result of technological failure. Technical issues that arise during data transmission could lead to incorrect diagnoses or medical mistakes.
- Most education programs in teledentistry are predominantly conducted in English, which is not a language that rural people, especially in India, are fluent in. The internet may be a global instrument, but future objectives should take more multilingual programs into account.^{23,24}

II. CONCLUSION:

Teledentistry is a innovative and motivating field with limitless prospective. It can be utilized for long-distance clinical training, continuing education, screening, and dentist laboratory communication. Teledentistry is a potential method for providing care to remote patient groups at a low cost while addressing the scarcity of specialised dental consultants in rural locations where complete and complex healthcare is lacking. Moreover, teledentistry presents fresh avenues for dental education, granting primary care professionals convenient access to efficient



consultations and facilitating postgraduate education and continuing dental education programs. Although certain challenges remain to be resolved, the potential of teledentistry is immense and warrants further exploration.

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