Teledentistry: A Life-Saving Treatment Modality During the Pandemic Era

Rohit Kumar Singh[1], Nagesh Patil[2], Chandan Sengupta[3], Eirsa Farheen[4], Afroz Pattedar[5]

Author's Affiliation: [1]Senior lecturer, [2]Reader, Department of Prosthodontics, [4]Tutor, Department of Endodontics, HKDET'S Dental College & Hospital, Humnabad, Bidar, Karnataka 585330, [3]Senior Lecturer, Department of Prosthodontics Yogita Dental College, Ratnagiri, Maharashtra, [5]Intern, Navodaya Dental College, Raichur, Karnataka, India.

Corresponding Author: Senior lecturer, Department of Prosthodontics, HKDET'S Dental College & Hospital, Humnabad, Bidar, Karnataka 585330, India.

E-mail: rks.prosthodontics@gmail.com

Abstract

Internet sciences and technology have had a substantial impact on the health care system. Execution of Teledentistry in the field of medical sciences has already been in the public eye for a long, but comparatively little has been known about the influence of technology on dental sciences. Teledentistry is the concoction of telecommunication and dentistry, used for exchanging images and case reports, clinical information for dental consultations, dental education, and treatment planning. Teledentistry provides aid in rural areas where there are seldom dental specialists and lack comprehensive and good health care. It is a cost-effective, reliable source to acquire a proper treatment plan and instant remedy for dental discomfort. Dentistry involves close face-to-face interaction with patients, hence during the COVID-19 pandemic, it has been mostly suspended. Teledentistry can offer an innovative way to restart dental practice during this pandemic. This review article emphasizes the benefits and application of telecommunication in dentistry, its importance during the pandemic era, and also highlights legal and ethical issues concerning the practice of Teledentistry.

Keywords: Telemedicine; Teledentistry; Pandemic; Covid19.

Introduction

Teledentistry, as the name suggests "is advancement in Telehealth using Telecommunication in the field of medical science". Telemedicine is the fastest and safest way to deliver healthcare facilities in far and rural Areas through information-based technologies.[1] The telemedicine program was launched in 1994 by the United States military. It harnesses the capability of modern telecommunications to allow offsite dentists of any specialty to assist their colleagues in providing health care.[2] In today's era telemedicine is mostly used by medical centers, rural hospitals,community hospitals, medicare companies and is also being used internationally to link hospitals of developing countries to developed countries for better and good treatments.[3] Teledentistry is not a specific branch in dentistry like endodontic, prosthodontics, and orthodontics. Rather it falls under Telehealth, which is a broad concept within professional healthcare delivery. Teledentistry is a method of delivering care. Essentially telehealth aims to provide Multiple treatment options that anyone can receive from a distance. Digital technologies have enhanced the quality of management of patients and also have made possible their partial and complete treatment at distances that are away from a hospital or qualified doctors.[4] Our whole existing health care system got collapsed during COVID-19. As it spreads by droplets, fomite, and also face-to-face interaction

of healthcare professionals with patients carries a high risk of its transmission and due to this dentists are at high risk to get infected with the coronavirus.[5] Hence, amid COVID-19, it is irrefutable that Teledentistry is safer. You can treat and prescribe from A far, mitigating a lot of risks tethered to the coronavirus. Even, once we're past this global pandemic, safety will be still at forefront of our collective minds. Words like immunocompromised and social distancing will not sail off into the sunset.

History

In 1959 first time Albert Justa used a telecommunication system to transmit videotaped tele fluoroscopy examination results between two hospitals situated in Montreal.[6] A conference held by Westing house electronic system group in 1989 in Baltimore was played a major role in the development of Teledentistry. In this conference, they discussed how to directly apply dental informatics in dental practice to the delivery of oral health care treatments.[7] In 1994, the US military conducted a project aiming to improve patient care, dental education, and easy communication between dentists and dental laboratories. This project concluded that with the help of Teledentistry we can reduce patient treatment costs, extend dental care to rural areas, and offer complete information required for deeper analysis.[8]

Definition

In 1997, Cook defined Teledentistry as "The practice of using video-conferencing technology to Properly diagnose and advice about treatment over distance".[9] Teledentistry is also defined as "The system of online and offline dental care treatment such as diagnosis, treatment planning, consultation, and follow-up through electronic transmission from different-different places".[7]

Types of Teledentistry

Teledentistry is classified into 4 types and further again divided into 4 subunits.

A. *Live Video (Synchronous):* Best described as a two-way interaction between patient and dentist, using audio-visual technology.

B. *Store and Forward (Asynchronous):* We can record health information like radiographs, photos, videos, digital impressions, or photomicrographs which we can transmit when required through an electronic communication system.

C. *Remote Patient Monitoring:* Through this, we can collect patients' chief complaints and medical information and we can transmit this data electronically when required for medical use purposes. This could be used in the nursing home setting or an educational program.

D. *Mobile Health:* Advancement in communication system made education and public health care practice is more reliable and easy.[10]

Teledentistry Subunits

I. *Teleconsultation:* With the help of Teledentistry, a patient can consult specialist doctors via telecommunication.[11] Telecommunication turned out to be beneficial for elderly age grouped patients, physically compromised individuals, and in the current COVID-19 pandemic. It encourages patients in continuing their therapy and maintenance of oral hygiene during quarantine and lockdown.

II. *Teledaignosis:* Teledaignosis makes use of technology to exchange images and data to make a diagnosis of an oral lesion.[12] Now these days even smartphones are used forthe detection of caries and it has also served as a reliable tool for screening of oral potentially malignant lesions.[13,14]

Recently some Brazillian investigators said that the use of WhatsApp and Telemedicine can makea differential diagnosis of oral lesions are more accurate.[15] As most of the lesions can be easily diagnosed by observing dental photographs, thus reducing the necessity of clinical examination and successively minimizing the transmission of coronavirus.

III. *Teletriage:* Teletriage is used to determine emergency condition which requires immediate attention.Teletriage is a collection of means or methods for enhancing health care, public health, and health education delivery system. It is safe for transferring patient data through telecommunication technologies. According to Brucoli et al. through the use of teleradiology patient data of maxillofacial trauma patients can be transferred from one peripheral center to the main trauma center.[16]

IV. *Telemonitoring:* During dental treatment, most of the patients are visiting their dentist for follow-up. With the use of telemonitoring, we can reduce frequent physical visits.Monitoring the improvement of treatment virtually is a more cost-effective and time-saving procedure.[17]

Material Requirement

a. *Internet:* The Internet is the boon for modern Teledentistry, being up-to-date and fast, and able to transport large amounts of data is easy now.

Internet-based Teledentistry education enables-students to choose themselves the place, time, and mode of learning.[8]

b. *Gadgets*: A typical store-and-forward Teledentistry system consists of a computer with:

- Substantial hard drive memory
- Adequate RAM
- A speedy processor
- An intraoral camera
- And A digital camera.[18]

To enable Video conferencing or if a live group session is desired, a multipoint control is required. In the codec system, there is an option to accommodate audio and visual functions together.[19] Smartphones, tablets, Ipads are also used as telecommunication devices.

c. *Apps For Teledentistry*: Apps are nothing but a type of software that allows you to perform a specific task. These can be downloaded inexpensively or even for free, and are available for mobile phones, computers. These apps are beneficial for a lot of people around the globe, as it covers the distance and allow you to reach out to consultants remotely. They also facilitate the dentist to provide virtual dental consultation and thus help you to optimize the schedule by knowing your patient's issues in advance.

Uses of Teledentistry

Public Health: In the public health sector, Teledentistry can help dentists connect to multiple communities. It is effective in conducting mobile hygiene programs at schools and clinics. Teledentists can assess snapshots taken by nurses to identify any problem more efficiently.

Private Practice: Teledentistry helps private practitioners to connect with outreach programs and encourages them to engage in social responsibilities while making it less time to do so. This also aids in building up strong relations with specialists as you engage with them more, and in need to connect them to your patients.

Medico-Dental Interaction: To opt-in for proper treatment and better care, it is necessary to have better communication between the medical and dental departments. Through Teledentistry, a dentist can receive immediate, improved, more rounded care and opinion, as they can easily connect with other health care professions. Thus, reducing the chances of delay of treatment and guesswork declines as the doctor can quickly connect to other specialists digitally.

Over-the-counter Dental Products

Innovative Teledentistry companies like smile direct club, candid, Invisalign, snow, and many others offer remote teeth straightening and teeth whitening solutions. This way millions of people can get affordable and easy access to high-quality dental care.

Benefits of Teledentistry

Benefits For Patient: Teledentistry offers millions of people to get benefits from their Homes at a reasonable cost and in less time. Services such as online or over-the-phone medication prescriptions and guidance for in-home orthodontic patients aretime-saving and convenient. In times of emergency or pandemic, a patient can connect with a doctor immediately and which allows doctors to assess the problem, suggest medicine. Thus, there is a lesser need for travel and a reduction in waiting times in dental practices. It is a cost-effective method while providing quality care. It also aids to get a second opinion from a dentist who might be far away from your location.

Several patients arriving at dental clinics travel from different localities and gather under one roof, thus making the hospital environment a dangerous place for the acquisition of infections or habitation for many infections/home for various bacteria, viruses, and pathogens. When an immunocompromised or susceptible patient host comes in contact with these pathogens, they are more likely to develop hospital-acquired infections also known as Nosocomial infections. In these circumstances, Teledentistry is a safer route to choose to prevent Nosocomial infection as it avoids unnecessary visits to hospitals.

Benefits for Dentist: Teledentistry is a time saving method for a dentist as the patients do not need to come into the practice as often, and this will reduce chair times. Because of the virtual nature of the consultation, it saves the time utilized in physical consultation and they can treat more patients per day. Many dental treatments require weekly or monthly check-ups such as root canal therapy, impactions, trauma surgeries, implants, and patients have to visit a dental clinic, but using telecommunication they can connect instantly and get an update.

Patients can get second opinions through Teledentistry and so can dentists. Another benefit to dentists is that you can connect with patients in far-off locations, this increases your reach and number of patients. The use of teledentistry minimizes the risk of transmission of infections in den-

tists as most dental procedures are required close contact with the patient during oral examination and treatment.

Future of Teledentistry

Teledentistry is the branch of dentistry through which we can improve the health care system in remote areas. Light-field-based 3D photography enables the recording of light rays in a single shot and provides a 3D glass-free display with a wide zone of view that could be the next generation of cutting-edge technology in Teledentistry. This provides an immersive display and highly detailed convertible algorithm with all the important details of the patient's case for the doctor and health professional.[20] COVID-19 pandemic not only exposed us to the extreme possibility that we have to face but also showed how Teledentistry can help us during these uncertain times. This has provided insight into what the future of dentistry can look like and how it is constantly evolving due to its overwhelming benefits such as:

- It is a long-term fix for many existing dental problems.
- It decreases overhead costs and increases office revenue.
- It saves in-person chair time.
- It overcomes geographical barriers.
- It provides a better doctor-patient experience.

Ethical and Legal Issues

In the healthcare system, in person, direct examination and treatment is the best way to provide health care facilities but as advances in technology have expanded the options for the specialist health care teams to communicate with health care workers and patients in remote areas made it easier to provide good and economical facilities to everyone. To achieve this goal, health care services delivered via Teledentistry must be consistent and documented with how they would be delivered in person. It is the Doctors responsibility to ensure that all the records collected are sufficient to make the diagnosis and treatment plan and all the records should be properly documented.[21]

Doctor has to make sure, the data collected from the patients including treatment given to the patients are safe and secure according to the law. A simple email or telephonic exchange of a patient's case report to colleagues is also considered as a Teledentistry referral and comes under legal scrutiny. Hence it is the responsibility of each practitioner to understand the implication of the use of telecommunication and their associated legal ramification for the dental practice. To learn and understand Teledentistry and its implication, one must seek advice from a qualified attorney who is familiar with Teledentistry.

Patient's rights

A patient who is willing to get treated through tele mode has the right to ask health care providers about their practice license. They have the right to access the licensure and board certification qualification of the oral health care practitioner who is providing the care in advance of the visit. Its patient rights to ask about safety, quality care, and positive health outcomes. The healthcare team informs the patient about the identity of the doctor collecting or evaluating their information or providing treatment. It is the healthcare team's responsibility that data collected during treatment will be properly documented and the records will be handed to a patient upon request. Doctors have to make sure patient is actively involved in treatment decisions. Doctors have to explain treatment costs and methods of delivering treatment services.[21]

Licensure

The health care professionals who deliver services through Teledentistry must be licensed under the laws of the state in which the patient receives treatment. Exchange of information between colleagues in other states is now considered as a Teledentistry modality, on that account, many states have decided that such referrals constitute the practice of medicine. Therefore, practitioners engaged must be licensed in each state where they practice.

Malpractice

Teledentistry comes with Pros and Cons. Any practitioner offering an opinion over the internet either to a colleague or a layperson, through E-mail or formal consultation has indeed established a doctor-patient relationship.[22] This online built relation is constrained and has few risks. The risk of telecommunication includes the possibility of suboptimal diagnoses and treatments, along with the added threat of failure to refer. Risks involve are confidentiality issues, reimbursement issues, and restrictions of the internet in some areas, etc. Another thing to consider is that Teledentistry has no assurance that the consultant has looked at the patient's x-rays, patient's history. Therefore, Teledentistry is not promised to be effective for all patients all the time. Besides these risks and Cons of Teledentistry, another alarming disadvantage

of Teledentistry is online medicine prescription which can threaten patient safety as it lacks physical evaluation.

Telemedicine guidelines of India 2020 promise to build a road map for the regularization and diversification of Teleconsultation services across the country. For safety purposes,medications are grouped and listed for the specific type of consultation and restricted drugs are notified. The guideline especially helps mitigate the gaps in legislation and reduces uncertainty while providing a practical, safe, & cost-effective framework to improve healthcare service.[23]

Practice Implication

Teledentistry is extensively practiced in various departments of dentistry, which are as follow:

Oral Medicine and Radiology

Digital diagnostic imaging services, digital radiography, rvg, intraoral cameras, and much more digital software play a drastic role to improve the quality and management of dental patients in a radiology department. Oral lesions can be electronically photographed using a 50mm macro lens and clinical data can be saved in a textual form. Specialists in the department of oral medicine can then analyse the obtained images and clinical information, and make a diagnosis independently.[24]

Therefore, in case of emergencies or orofacial disorders which require immediate attention, the role of Teleconsultation can prove to be a good treatment option for the patients. Bradley proved that by the use of Teledentistry in oral medicine in a community dental service in Belfast using a proto type Teledentistry system that distant diagnosis is an effective alternative in the diagnosis of oral lesions using transmission of digital image by email.[25] Duke M et al. showed that diagnostic assessment of the clinical diagnosis of impacted or semi-impacted third molars assisted by the telemedicine approach was equal to the real-time assessment of clinical diagnosis.[26]

Digital radiology is an application providing films that are equivalent to traditional films and these films have the advantage of reduced radiation exposure for the patient and dental personnel.[27] Clinical examination and radiographs, both are necessary to obtain a final diagnosis of the disease. IOPA, CBCT, MRI, CT scan can be transferred to a specialist through the internet for consultation also known as Teleradiology. These images can be sent to the respective specialist or for a second opinion from remote areas, thus saving a lot of time in obtaining an accurate diagnosis.

Orthodontics

Displacement of ligature wire, irritation due to brackets, ripped of elastic bands or other minor emergencies can be solved by telecommunication. Interceptive orthodontics treatments provided by general dentists and supervised remotely by orthodontic specialists through Tele mode are a viable approach to reducing treatment cost and time is the best example of Teledentistry.[28] Orthodontic specialists, after taking dental impressions of the jaws, instead of casting jaw models in plaster, can send the impression by special postal service to specialized companies for 3D digitization of working models, then they create digital 3D models and return them through the internet to the therapist. The dentist can forward these digital models with another specialist through the network, effectuating necessary consultations with his colleagues.[24]

Endodontics

There is no statical significant difference noted in the interpretation of periapical lesions between the images viewed locally and images transmitted through a video-conferencing system and interpreted by a different specialist in that field.[29]

Oral and Maxillofacial Surgery

Treatment for the patients of dentoalveolar surgery with general anaesthesia and nasotracheal intubation by available healthcare team with the help of specialist through teleconsultations are as reliable as those treatments done by a specialist in Hospital. So that we can tell telecommunication is an efficient and cost-effective mechanism to provide a pre-operative evaluation in situations in which patient transport is difficult or costly.[30]

Brickley M stated that there is a need and demand for change in the referral system for oral surgery specialist care. Teledentistry could conceivably be one way to improve access to specialist oral surgery care.[31]

Prosthodontics

Even in the field of prosthodontics, proper communication is very important between the dentist and the laboratory technicians for the fabrication of prostheses. Computer-aided design (CAD) and computer-aided manufacturing (CAM) systems are gaining popularity in the manufacturing of crowns, inlays, Onlays, and bridges over traditional hand

modelling prosthetic reconstructions. Since there are a dentist and dental technicians who are not very skilfulin doing this somewhat complicated procedure of designing shapes and inter jaw relationships using CAD software, the usual practice is to request the help of a computerized dentistry specialist with the use of Teledentistry.[32] The digital impression is replacing the conventional impression technique where the jaw is scanned and sent as a computer file to the dental lab for fabrication of various prostheses.[24]

Pediatric and Preventive Dentistry

It is the need of the hour to develop models for schools and child care centers in our country to utilize tele dentistry to increase access to dental care for children. Schools and child care centers play a vital role in ensuring the optimum oral health of the children through Screening for dental problems before these become emergencies, helping children in managing chronic illnesses, connecting children and their families to the needed health and social services, and providing urgent care.[33]

Forensic Dentistry

Since the digitization of data Id required in Teledentistry, the data are stored and can be used retrospectively. It can thus help in solving criminal cases related to forensic dentistry.[24] Stored data can be used in various retrospective studies, cohort studies, and surveys.

Discussion

Teledentistry can facilitate dental care, guidance, education, and treatment via the use of information technology rather than through face-to-face contact with the patient.[34] Over the years Teledentistry is proven to be beneficial for remote dental screening, making a diagnosis, providing consultations, and proposing treatment plans. Teledentistry is useful inproviding real-time consultations in areas with limited access to facilities, in school children, and long-term health care facilities.[35] Although this form of treatment is not error-free and has medico-legal implications, it has the potential for facilitating faster diagnostics or therapies and often leads to a better prognosis.[36] The unpredicted effects of the COVID-19 pandemic also presented new challenges for the dental community that has never been seen before. The restriction placed in-office visits to treat only essential dental emergencies combined with having to minimize social interaction, greatly impacted a professional where

contact is essential. In today's circumstances of the ongoing COVID-19 pandemic, the main aim is to avoid in-person contacts and Teledentistry fulfils the precautionary needs of avoiding close contacts during this pandemic. Its application is of utmost importance and great value in rural and urban areas with a scarcity of dental consultation. Exchange of information will lead to improved patient care, and the ability to consult more efficiently with colleagues will lead to a greater understanding of the treatment objectives and better treatment outcomes.[37] According to a study conducted by the oral medicine department, the University of California at Los Angeles, Email was considered to be best for exchanging ideas, disseminating the latest scientific information, and discussing the potential diagnosis.[38]

The referring dentist can log into a secure web server, fill in the patient details, specific reason for consultation, chief complaint, and provisional diagnosis information, and can upload intraoral images as well as dental radiographs.[39] Efficient utilization of Teledentistry will bring fruitful development of family dentistry in the future, as the family dentist can serve as a gatekeeper for specialist services, coordinating the dental treatment provided by other dental specialists.[40]

Conclusion

The field of dental sciences plays an important role in our health care system, which has become severely compromised during the current pandemic of COVID-19. Knowledge of Teledentistryis the best solution to resume dental practice during the current pandemic. Hence, the need of the hour is to incorporate Teledentistry into routine dental practice is important. Even for the prevention of infection, the practice of Teledentistry plays a key role. Doctors who opt for Teledentis try as a part of their practices must educate themselves as to the legal, technological, and ethical issues that are a part of this new practice. It would also help in providing new opportunities for dental education providing primary care professionals with easy access to efficient consultation and helping in conducting postgraduate education and continuing dental education programs.

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