



Review Article

Role of teledentistry in dental care

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ABSTRACT

Teledentistry is an emerging concept in the dental profession that employs telecommunication and innovative means to deliver various services to the community like dental care, consultation, public awareness and education in order to improve and enhance overall oral healthcare status of the society. In addition, it can also get rid of the disparities in deliverance of oral health care among various communities owing to its relatively easy accessibility. The present article discusses the various concepts of teledentistry and its clinical implications in different branches of dentistry.

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1. Introduction

Teledentistry is a developing and a less talked about area in the field of dentistry that connects dental service providers to their patients by virtual means. Teledentistry has been defined as “the implementation of videoconferencing technologies for the purpose of diagnosing and providing guidance regarding treatment from a distance.”¹ Telecommunication technology is utilized to exchange data, graphics, audio, and videos between the dentist and patient who are physically separated and cannot seek immediate dental care.² Unimpeded access is provided by using various telecommunication and computer technologies which are neither limited by time nor space.

1.1. History

The initial framework of teledentistry was drafted at a conference held in 1989, which was funded by the Westinghouse Electronics Systems Group.³ The introduction of teledentistry as a subspecialist field is linked to a military project of the United States Army which aimed to improve patient care, dental education, and communication between dentists and dental laboratories. This military project exhibited that teledentistry as a whole resulted in the reduction of patient care costs, thus extending dental care to otherwise inaccessible areas and rendering information required for deeper analyses.³

1.2. Prerequisites to practice teledentistry

Practicing teledentistry requires certain armamentarium that a dental surgeon should be equipped with. Internet forms the basis for practicing modern day teledentistry, which is up-to-date, fast, and can process large data.³ Other basic armamentarium includes a computer having an

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adequate hard drive, memory, appropriate random access memory (RAM), a processor, an intraoral video camera and modem. A fax machine, scanner and printer may also be at times required in seldom cases.⁴ Nowadays, smartphones incorporated with different video conferencing applications are also being increasingly employed for the purpose of teleconsultations.

1.3. Concept & scope

The concept of teledentistry is based on teleconsultation which involves various approaches. Firstly, real-time consultation where the clinician communicates with the patient through video conferencing in which both the doctor and the patient can listen, visualize, communicate and have a live interaction with each other.⁴ This is a specialized way of providing dental care in remote and otherwise inaccessible areas and also unaffordable sections of the general community. Second is the "Store and forward method" wherein the doctor forwards the necessary clinical data and images to other clinician for consultation and treatment planning.⁵ This sharing of data can be exceptionally helpful for patients requiring specialist consultation. Thirdly, "Remote Monitoring Method", where patients are looked after at a distance which can be either hospital or home based.⁶

Teledentistry harnesses the capability of modern telecommunications to raise an opportunity for offsite dental surgeons of their respective specialty to assist their colleagues and patients in providing care. Also, it can eliminate the existing disparities in oral healthcare and can bridge the gap between urban and rural communities and may serve to become an inexpensive and rapid bridge joining both healthcare sectors.⁷

1.4. Role of teledentistry in various branches of dentistry

1.4.1. Oral medicine and radiology

Teledentistry plays a vital role in this specialty by enabling the transmission of images of oral and mucosal lesions via electronic mail for specialized consultation, discussions, sharing ideas and providing provisional diagnosis for the patient.⁸ Oral lesions can be shared with the aid of photographs and subsequent clinical data can be stored as a textual file for correlation. Diagnosis can be enhanced by using a complete electronic patient history comprising of past medical records, drug history and family history (if any). Digital radiology is equivalent to traditional films for many diagnostic and therapeutic tasks and is considered an essential part of oral diagnosis. In addition, it also serves the advantage of diminished radiation exposure for both patients and dental personnel. Intraoral/Extraoral radiographs of a patient can also be sent to a specialist through different means of applications

for further opinion and consultation, also termed as teleradiology.⁹ A previous study compared the radiological interpretation of periapical lesions when analyzed by a conventional means or teledentistry and the results revealed no significant differences between these two methods.¹⁰

1.4.2. Community dentistry

Teledentistry can help to spread awareness among community about importance of maintaining oral health and how it can influence the overall health status of an individual. It may also be used to spread awareness among the community regarding the importance of maintaining a healthy oral hygiene and demonstrate correct brushing techniques, use of dental floss by organising webinars and online workshops.

1.4.3. Oral and maxillofacial surgery

Teledentistry can act as a useful tool for diagnostic evaluation of an impacted/semi-impacted third molar.¹¹ It also is a reliable tool for adequate assessment of candidates for dentoalveolar surgery with the aid of both general anaesthesia and nasotracheal intubation.³ It is also helpful in obtaining specialised consultation in emergency cases ultimately giving enhanced care to maxillofacial patients. Medications for orofacial infections and abscesses can also be prescribed by using telecommunication technology.

A recent study has shown that teledentistry when applied for the proper surveillance of patients suffering from oral and head and neck cancer was beneficial in supporting patients with improved general well-being and quality of life. Teledentistry allowed monitoring the medications and reduced patient's hospital visits to avoid cross infection. Additionally, it also provided preoperative counselling, postoperative care, dietary advice and exercise regimen for the neck and shoulders. Communication with colleagues in a multidisciplinary way was made possible through multidisciplinary tumour councils, academic meetings, or multidisciplinary tumor board meetings on virtual platforms.¹²

1.4.4. Orthodontics and dentofacial orthopaedics

Teledentistry can help to provide interceptive orthodontic treatment supervised by specialized orthodontist for decreasing the severity of malocclusion for disadvantaged children who cannot afford orthodontic treatment.¹³ It can also help to identify the children with oral habits like tongue thrusting, mouth breathing, nail biting, lip biting etc. With the help of telecommunication, children as well as their parents can be made aware of the future adverse effects of these habits. Minor emergencies such as rubber ligature displacement, irritation due to an orthodontic appliance which usually warrants visits can be solved by using telecommunication.¹⁴ Peer teleconsultants may also participate from a distance in the creation of a plan and

program of orthodontic management. In a previous study, it was noticed that the clinician's agreement for screening orthodontic referrals on the basis of clinical photographs was comparable to those reported for clinical decision making.¹⁵

1.5. Prosthodontics

Telephonic communication is often needed between the dentist and the laboratory technicians during the time of prosthesis fabrication. When such a situation arises, colored photographs of the patients' teeth taken from different angles can be easily exchanged for the purpose of shade selection, size, shape, and contours of the prosthesis to be fabricated.⁹ Digital impressions are also slowly replacing conventional ways where both jaws are scanned and shared with the laboratory for prosthesis fabrication. Ignatius E et al. investigated the use of videoconferencing for diagnosis and treatment planning for patients in need of prosthetic or oral rehabilitation treatment. The authors concluded that video-consultation in the field of dentistry can increase the total number of dental specialist services in less populated areas.¹⁶

1.6. Pedodontics

The method of teledentistry is as an excellent alternative for children afraid of visiting the dentist. This has led in a reduction in their fear and anxiety compared to clinical examination in real-time. Teledentistry in pedodontics can be utilized for diagnosing caries in young school children and also help in screening of early childhood caries in preschool children.¹⁷ This will ultimately help to improve overall health of children.

1.7. Endodontics

Teledentistry as a medium can be successfully utilized in the field of endodontics in the diagnosis of periapical lesions of teeth, reducing costs associated with distant and multiple visits and rendering urgent help when needed.¹⁸ Teledentistry can also be a very useful tool for evaluating canal orifices on the basis of images of an endodontically accessed tooth.¹⁹ Baker et al. concluded in their study that there is no significant difference with regard to the interpretation of periapical lesions between the images seen locally and images shared via a video- conferencing system.²⁰

1.8. Periodontics

Teledentistry plays a vital role in the field of periodontics by sharing of images of the periodontium, thus detecting and diagnosing periodontal pathologies. The periodontist can then go through the pictures and radiographs to decide on a suitable treatment plan thus improving oral and

overall healthcare of the patient as well as the society.²¹ Teledentistry could also be an effective audio-visual aid for the purpose of delivering oral hygiene instructions to patients, including brushing and flossing techniques, use of interdental cleaning aids, plaque control methods, etc. A previous web-based teledentistry consultation system showed that patient referrals to oral surgery, prosthodontics, and periodontics had the highest consults.²² A total of fifteen patients were subjected to periodontal surgery and their sutures were removed at a faraway place a week later under the telesupervision of the periodontist.

1.8.1. Teledentistry in covid-19

The Occupational Safety and Health Administration (OSHA) has placed dental professionals in a very high exposure risk category as dentists operate within a close proximity to the patient's oral cavity.²³ Most of the procedures generate aerosols and can spread infections to dental personnel and others present in the dental operator. Online conversations allow data exchange like audio or text messages for raising queries as well as providing suggestions, video messages for an appropriate judgment of any patient's descriptions of problems in his own words and language. Good-quality images also serve as common means of communication, showing clinical and radiographic reports, or photographs of lesions.

In totality, teledentistry when incorporated into routine dental practice makes way for bigger range of applications ranging from remote triaging of suspected COVID-19 patients for dental check-up to reducing unnecessary exposure of uninfected individuals by reducing their visits. The practice of teledentistry amid COVID-19 can be divided into further subunits. The most common subunit being teleconsultation in which patients seek consultation from specialists using different forms of telecommunication. Teleconsultation has diminished the number of referrals from primary health centres to higher centres. It may aid patients in continuing their therapy during quarantine and lockdown. Telediagnosis makes use of technology to exchange images and data to make a diagnosis of an oral lesion. Telediagnosis can be made by dental photography thus reducing the need of close clinical examination. Another subunit, teletriage involves safe, appropriate and timely disposition of patient symptoms via smartphone by specialists. The use of telemonitoring can replace the frequent physical visits by virtual visits for regular monitoring of treatment outcomes and disease progression. A study concluded that telemonitoring appeared to be a promising tool in the remote monitoring of surgical and non-surgical dental patients, especially in diminishing costs and waiting time.²⁴

2. Limitations of Teledentistry

While teledentistry is an excellent option for many routine dental tasks, it is not completely capable of replacing a visit to a dentist in case of an emergency. Many tasks cannot be performed solely over video conferencing such as any surgery will ultimately require an in person visit for evaluation. Even less invasive procedures such as a tooth restoration cannot be remotely performed over telecommunication. Another concern for teledentistry is privacy and security of the patient. Concerns regarding confidentiality of shared information arise starting from the transfer of current and previous medical records as well as from security issues of information stored in computers.²⁵ At present, there is no method available to ensure quality, safety, efficiency, or effectiveness of shared information. Also, display on intraoral photographs or video recordings may be contrasting from what is present clinically. Supplementary diagnostic tests like percussion and palpation cannot be carried out. The increased cost of the armamentarium needed to practice teledentistry is also considered a disadvantage of this method.

3. Future Directions

Advances in telecommunication have no doubt enabled dental care to promise many exciting changes in the future. Like other countries, India too has opened its doors to telemedicine for addressing different issues faced by the healthcare delivery system, such as inadequate health infrastructure, paucity of qualified doctors, delay in the delivery of treatment and the provision of healthcare by inexperienced primary healthcare service providers to name a few.²⁶

Practitioners of teledentistry should ensure utmost care so that patient privacy is not compromised by unauthorized entities. Patients should also be made more aware of teledentistry as an option for seeking emergency dental care. Also, the subject of teledentistry should be included in the curriculum of dental students to make them more informed of the various methods available for teleconsultation and the legalities that can arise while practicing teledentistry.

4. Conclusion

In the scientific world of today where technology has become a crucial part of life, incorporating it into dentistry will definitely help mankind in many ways. Teledentistry can be used as a very useful tool for an inexpensive, convenient and rapid means to connect with dentistry. Teledentistry can surely improve services regarding dentistry for underserved population such as rural and backward class people who cannot afford expensive transportation and treatment charges. Also it can provide an effective solution for resuming dental clinic during this pandemic by integrating it into routine dental practice.

5. Conflict of Interest

The authors declare that there is no conflict of interest.

6. Source of Funding

None.

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