Teledentistry: An Art and Science of Healing

Rajan Shirolkar, Kosha Pritesh Ruparelia, Chandramani More, Pritesh Ruparelia

1Professor and PG Guide, Department of Oral Medicine and Radiology, KM Shah Dental College and Hospital, Sumandeep Vidyapeeth University, Vadodara, Gujarat, India
2Postgraduate Student, Department of Oral Medicine and Radiology, KM Shah Dental College and Hospital, Sumandeep Vidyapeeth University, Vadodara, Gujarat, India
3Professor and Head, Department of Oral Medicine and Radiology, KM Shah Dental College and Hospital, Sumandeep Vidyapeeth University, Vadodara, Gujarat, India
4Associate Professor, Department of Oral Medicine and Radiology, KM Shah Dental College and Hospital, Sumandeep Vidyapeeth University, Vadodara, Gujarat, India

Correspondence: Kosha Pritesh Ruparelia, Professor and PG Guide, Department of Oral Medicine and Radiology 47, Jai Ambika Society, Opposite Bhaduatnagar, Isanpur Road, Maninagar, Ahmedabad-380008, Gujarat, India e-mail: pritesh_mds@yahoo.co.in

ABSTRACT

Teledentistry is a relatively new field that combines telecommunication technology and dental care. Teledentistry’s roots lie in telemedicine. Telemedicine (and by inclusion teledentistry) has been defined as “the practice of health care delivery, diagnosis, consultation, treatment and education using interactive audio, video or data communications”. Improvement in accessibility of health care and lowered health care costs are only two of the many advantages that will emerge as teledentistry becomes integrated with, and fundamentally change, the practice of dentistry. Some barriers still exist for teledentistry practice, including legal, educational and insurance issues. In spite of having these “teething troubles”, the potential of telemedicine and teledentistry is tremendous. In this article, we review the development of teledentistry, its use in dental education and treatment planning, its strengths and limitations, and its future role.

Keywords: Tele (Far or distance), POTS, ISDN, SSL, SNOdent.

INTRODUCTION

The dramatic growth of the Internet, Telecommunication standards and Information Technology in the last decade has lead to significant changes in how health care is delivered.

The term “teledentistry” was used in 1997, when Cook defined it as “the practice of using videoconferencing technologies to diagnose and provide advice about treatment over a distance”.

Teledentistry is a relatively new field that combines telecommunication technology and dental care. Teledentistry’s roots lie in telemedicine. Telemedicine (and by inclusion teledentistry) has been defined as “the practice of health care delivery, diagnosis, consultation, treatment and education using interactive audio, video or data communications”.

Thus, the main application of teledentistry is tele-education and remote diagnosis in remote areas of countries like India where the majority of the population live in rural areas. In rural areas, health care facilities are inefficient and inadequate, and tools, like teledentistry, can contribute substantially in bridging the gap between the demand and supply.

DEVELOPMENT AND HISTORY OF TELEDENTISTRY

Radiology was one of the earliest medical specialties to utilize telecommunication as early as 1959 when Albert Jutra used communication cable to transmit videotaped telefluoroscopy examinations between two hospitals in Montreal, five miles apart (Weinstein et al 1987).

The initial concept of teledentistry developed as part of the blueprint for dental informatics (a new domain combining computer and information science, engineering and technology in all areas of oral health), which was drafted at a 1989 conference funded by the Westinghouse Electronic Systems Group in Baltimore.

The US Army’s total dental access (TDA) project is seen as being at the frontier of teledentistry. Begun in 1994, this project initially used a traditional plain old telephone system (POTS) with two different communication methods: real-time and store-and-forward. In 1995, Rocca et al conducted a pilot study in Haiti to connect a general dentist to a dental specialist in Washington DC, via a satellite system.

Two years later, integrated services digital network (ISDN)-based teledentistry was tested in Germany, Belgium and Italy. Studies have also been conducted in Scotland, Japan, England and Taiwan to examine ISDN-based teledentistry.

Since then, an era of teledentistry is expanding worldwide and teledentistry is gaining ground in developing countries.

TOOLS FOR EXCHANGE OF INFORMATION

POTS (plain old telephone system) is still used frequently in teledentistry because of its low maintenance and technical
support costs. The real-time method transfers the information immediately, whereas the store-and-forward method allows data to be stored in a local database to be forwarded as needed. POTS works through the telephone company with low-speed and unreliable connection. Data exchange is also possible with the help of FAX machine.

ISDN3 (integrated services digital network) provides a higher speed, and information can travel in both directions simultaneously, which increases accessibility and reliability in teledentistry. But building an international ISDN network is too expensive and impractical. The World Wide Web4-5 is popular tool for easy access of information, it has no equal. It is available in most cities. Web-based teledentistry, unlike the ISDN, does not require a special network and, hence, is more cost-effective. However, there are no ‘rules’ on the internet—there is no licensure and no verification and there is little accountability. The web-based network poses privacy and security concerns because of hackers and crackers. An ISDN network, on the other hand, is connected from one point to another with no network sharing. Live interactive videoconferencing can also be conducted via satellite.2

TELECONSULTATIONS (E-CONSULTATIONS)

Patients are becoming more and more knowledgeable and are demanding access to a full range of high-quality treatment options. The quality of care that a dentist renders to a patient is often limited by his ability to make the proper diagnosis and formulate an appropriate treatment plan. When a dentist is unsure of the diagnosis, it is usually in the best of the patient for the dentist to seek another opinion.

Teledentistry allows for a whole new way of providing this specialist advice. Through the use of telecommunication and computer technologies, it is now possible to provide interactive access to specialist opinion that is not limited by the constraints of both space and time.

It is the responsibility of the referring dentist to obtain patient’s consent6-8 before making online referrals and every reasonable attempt should be made by the dentist to conceal patient’s identity, such as covering of eyes and other identifiable marks.

Dental-Consults8,9 is a web-based ‘teledentistry’ consultation system developed for use by dentists. Thus, the referring dentist logs into the secure web server, fills in the patient’s details, specific reasons for consultation, chief complaints, and provisional diagnosis information and uploads intraoral images as well as dental radiographs.

The specialist is notified immediately of the new referral. The specialist subsequently logs into the secure web server and reviews the consult and suggests his diagnosis and treatment plan within five working days after receipt of the complete patient case. A good teledentistry consultant is one who makes sure that adequate information is provided by the consultant (e.g. good photographs, adequate patient history, general health and review of systems information, and accurate physical examination findings). The referring dentist is then informed by e-mail to retrieve this information. Further discussion, if required, is possible. When the consultation is completed, the dentist is invited to give feedback comments.

The Dental-Consults teledentistry system uses secure sockets layer (SSL)9 to encrypt the information that flows between the web browser and the web server receiving the referral. When the lock or solid key is visible, the browser has established a secure encrypted connection with the server, meaning it is safe to send sensitive data. Confidentiality comes with SSL during the transmission of patient information.1,6-13

TELE-EDUCATION

Formal online education can be divided into two main categories: Web-based self-instruction and interactive video-conferencing.

The web-based self-instruction educational system contains information that has been developed and stored before the user accesses the program. The advantage of web-based self-instruction is that the user can control the pace of learning and can review the material as many times as he or she wishes. Disadvantages of web-based self-instruction also have been noted in areas of satisfaction (lack of face to face communication with peers and instructors) and accuracy (lack of face to face patient examination).1,14

Interactive videoconferencing (conducted via POTS, satellite, ISDN, Internet or Intranet) includes both, a live interactive videoconference (with at least one camera set-up where the patient’s information is transmitted; however, cameras at both locations are ideal) and supportive information (such as patient’s medical history and radiographs) that can be sent before or at the same time (e.g. via fax) as the videoconference (with or without the patient present). The advantage of this educational style is that the user (typically the patient’s health care provider) can receive immediate feedback.

Dental chat rooms are available through numerous dental organizations and study clubs, as well as through individual practitioners who exchange information on a variety of topics.1,14

STRENGTHS

In rural areas, where there is a shortage of specialists, the lack of comprehensive and sophisticated health care is a problem. Teledentistry can extend care to remote patient populations at a reasonable cost as well as ease the problem of a shortage of specialized dental consultants and professional isolation in rural areas.15

Teledentistry teaches general dentists when to refer a patient and how to treat more complicated cases, which can change their practice style and give them more choices in treating patients. Global communication with colleagues is instantly available through a simple click of the mouse.

With the help of teledentistry it is possible to make/get cumulative data4 (longitudinal data) record of the patient from different dental clinics, which will aid in the diagnosis and
proper management of the patient. As the patient’s data record is converted into digital form (EPR system–electronic patient record system), its storage will require less space, data can be retrieved with speed and reviewed any time.

Teledentistry can be a very good tool for teaching postgraduate students and even for providing continuing education for dentists. Teledentistry significantly elevates health care knowledge and computer skills. Interactive videoconferencing is more effective than web-based self-instruction. An advantage of the online CDE is that it obviates travel to and from continuing education lectures. Often dentists do not have the extra time necessary to access CDE courses due to family and job responsibilities. In fact, when considering all of the costs that a professional has to consider for a CE course (travel, lodging, food, and time away from work), online CDE has many advantages as compared to traditional CDE.2,7,10

Teledentistry can be used to increase the awareness regarding oral hygiene, dental and oral diseases in general population. Thus, it can be used to educate and motivate them.

LIMITATIONS

Although teledentistry looks promising for dental consultation and dental education, users need to understand its limitations and certain critical factors.

Legal issues exist, including licensure, malpractice, privacy, security and ethics. One of the advantages of teledentistry is its ability to increase access to dental care, but users must be careful when providing consultations across country lines. If technical problems occur during data transmission that cause a misdiagnosis or medical error, issues of responsibility and malpractice need to be considered. In addition, privacy and security are important issues in cyberspace. If patient’s data are lost or stolen during the process of transmission, the entire project may need to be discontinued, especially once the Health Insurance Portability and Accountability Act becomes law.

A clear, nationwide teledentistry protocol is needed (e.g. forms, equipment recommendations, privacy and security requirements), which would enable organizers to control the problems caused by different standards and result in a more objective program evaluation. A standardized recording system would make the data-collecting process much easier and decrease the learning curve. Diagnostic codes pose another problem, because no universal dental diagnostic coding system exists that would enable users to maintain uniformity.

Undetectable alteration of patient’s records has been a longstanding problem. Consequently, most countries do not consider an electronic record to be an acceptable form of medical information storage. All electronic records should be supported with a written copy of patient information, in addition to any electronic archives. In addition, the original record should be identified and maintained as such. In United States, the Health Insurance Portability and Accountability Act of 1996, commonly known as HIPAA, specifically addresses many of the standards surrounding electronic exchange. This issue can become critical for insurance claims processing.

Along with these limitations of teleconsultation, teledentistry also has some limiting factors. Instructors of teledentistry education courses need to have both teaching experience and computer knowledge. The educational team must continuously update the course. Educational courses should be guided by instructors who are experienced in leading online communication, able to promote discussion and familiar with the use of computer technology.

Furthermore, before any teledentistry videoconference begins, it is necessary to test all of the connections. A backup communication system and technical support group (for example made up of network technicians, computer hardware and software technicians and security experts) also are needed. Reimbursement for CE courses is another issue that needs to be addressed. Currently, no insurance company has a particular reimbursement scheme for teledentistry. Without reimbursement from insurance companies, the financial support for these projects is limited to grants and other limited resources, sustaining such high-maintenance projects after the grant period ends can be a serious problem.1,7

Finally, most of the teledentistry-based education programs are in English. Since the internet is a worldwide tool, future goals should include consideration of more multilingual programs.

CONCLUSION

The explosive growth of the internet and its use bring with it the potential for electronic media (e.g. teledentistry) to fundamentally alter the way dentistry and medicine is practiced.

Teledentistry is gaining ground in developing countries and increasingly being viewed as a tool for improving care and enhancing access to healthcare. Information is now universally accessible to health care practitioners and to the general public. With the help of EPR (electronic patient record system), it is now possible to make/get cumulative data (longitudinal record) of the patient from different dental clinics which will aid in the diagnosis and proper management of the patient. Data storage does not require much space and there are less chances of damage or loosing of data. Data retrieval also becomes easy and quick and there is greater legibility of information.

The universal dental diagnostic coding system (SNODent17—The Standard Nomenclature for Dentistry) is developed which consists of diagnostic terms, terms describing symptoms, clinical signs and findings, radiographic observations and related test findings. It can provide a basis for designing into the digital record forms of artificial intelligence to further assist the dental care provider in making more accurate diagnostic decisions.

In addition to these, the technological advances also aid in improvement of the quality of education and treatment.

With a better understanding of the dental applications, strengths and limitations, and the future of teledentistry,
individuals in applied areas will be able to identify more easily how teledentistry can potentially help them in their own work and in future, teledentistry will become a common diagnostic and education tool.

REFERENCES