

Teledentistry the future of dental practice

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ABSTRACT:

Teledentistry is a synergistic combination of telecommunications technology, Internet and dental practice. It is a relatively new and exciting field that combines telecommunication technology and dental care. Teledentistry increased patient access to dental care, improved quality of care and the cost effectiveness. Teledentistry is also useful in long-distance clinical training and continuing education, screening and dentist laboratory communication. Some barriers still exist for teledentistry practice, including educational, legal and insurance issues. The purpose of this article is to highlight the various aspects on teledentistry.

Key words: Teledentistry; Tele communication; Video conferencing

Introduction:

There has been extensive technologic innovations in the field of dentistry in recent years. Advances have been made in the use of computers, telecommunication technology, digital diagnostic imaging services, devices and soft ware for follow up analysis and follow up.¹ Using advanced information technology, the science of dentistry today has crossed much longer distances than it was ever able to. New information technology has not only improved the quality of management of dental patients, but also has made it possible their partial or complete management at distances of thousands of kilometers away from health care centers or qualified dentists.² The entire process of networking, sharing digital information, distant consultations, workup and analysis is built up with a segment of science of telemedicine concerned with dentistry called as teledentistry.³

Tele” is a greek word meaning “distance” and “mederi” is a latin word meaning “to heal.” Teledentistry can be defined as the use of electronic information and telecommunications technologies to support long-distance clinical oral health care, patient and professional health-related education, public health, and health administration.⁴

Cook in 1997 defined “Teledentistry” as “The practice of using video-conferencing technologies to diagnose and provide advice about treatment over a distance.”⁵

History of Teledentistry

Telemedicine began in 1924, with the concept of a physician seeing his patient over the radio using a television screen. Telemedicine programs first started in 1950.

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 electronics system group in Baltimore.⁶ Its focus was a discussion of how to apply dental informatics in dental practice. Teledentistry was put into practice in US army in 1994 by doing dental consultations on person located more than 100 miles apart. Since then, various institutes and organizations have practiced teledentistry with varying degree of success.

Forms of Teledentistry:

Teledentistry can take two forms: (1) Real-time consultation and (2) Store and forward.

Real-time consultation Interactive video-conferencing may be conducted via POTS (Plain Old Telephone Service), satellite, ISDN, Internet or Intranet. Interactive video-conferencing includes both a live interactive video-conference with a proper camera set up where the patient’s information can be transmitted; and supportive information (such as the patient’s medical history, radiographs, etc) that can be sent before or at the same time (for example, via fax) as the video conference. The advantage of this type of education system is that the user can receive an immediate feedback^[7]

Store and forward, on the other hand, involves the exchange of clinical information and

static images collected and stored in the telecommunication equipment. In store and forward, the dental practitioner collects all the required clinical information and digital intraoral and extra oral images and radiographs (or scanned, originally no digital images) and forwards them for consultation and treatment planning via established networks and/or the Internet and treatment is provided in a far time, targeted, and cost-effective manner.⁸⁻¹¹

Technological Requirements:To practice teledentistry, there are certain **hardware, software** and **network connection** requirements.

A desktop or laptop computer with substantial hard drive memory, a significant amount of RAM, and a speedy processor is essential. A digital camera, video camera, and intraoral camera, and a panoramic digital X-ray unit, preferably portable, is required to provide consulting dentists with images of maximum clinical value.⁶ Microphone, headset or external speaker, and a webcam is highly desirable for PC-based video-conferencing. A comprehensive software capable of image acquisition and storage, and transmission of the gathered information and software capable of coding and decoding audio and video (codec) is desirable. Digital images for teledentistry transmission should be recorded in DICOM (Digital Imaging And Communications in Medicine) format. This is a standard developed by the American College of Radiology and the National Electrical Manufacturers Association to aid the distribution and viewing of medical images.⁸

There is great variation in levels and speeds of connectivity to the Internet; and this is, of course, a major significance to the practice of any forms of telehealth. Dial-up connections, though economical, are not sufficient for teledentistry, due to limitations in quality and questionable reliability. Broadband technology, increasingly widespread and available, offers a selection of cutting-edge alternatives well suited to the needs of the teledentist and his staff. DSL (digitally subscribed line), cable and satellite modems, ISDN (integrated service digital networks) and ultra high capacity T1 services, are all available for utilization as the basis of any teledentistry system. To enable live videoconferencing, one might employ a widely available stand alone IP/ISDN

videoconferencing solution, or install a PCI codec board into the system. This is a digital signal processing unit that converts analog input into digital on the sending end, while another codec board reverses the mechanism at the receiving end. If a live group session is desired, a multipoint control unit that bridges three or more parties is required. The codec must be able to accommodate audio and visual functions and be compliant within recommended guidelines.⁵

Uses of Teledentistry: Teledentistry has been tried in all the branches of dentistry with favourable results.

Oral Medicine and Diagnosis: Torres-Pereira et al.¹² have shown an effective distant access to oral lesions and benefits of use of e-mail services and a Store-And-Forward image system. Bradley M et al.,¹³ successfully proved the use of teledentistry in oral medicine in community dental service in Belfast, N. Ireland using a prototype teledentistry system.

Oral Surgery: According to Roltert MK et al.,¹⁴ telemed consultations are as reliable as traditional methods in assessing patients for dentoalveolar surgery with general anesthesia and nasotracheal intubation. He also concluded that telecommunication is an efficient and cost effective mechanism to provide pre-operative evaluation in situations in which patient transport is difficult or costly. Brickley stated that telemedicine could conceivably be one way to improve access to specialist oral surgery care.¹⁵

Periodontics: US Army in July 1994¹⁶ tested teledentistry at Fort Gordon, Georgia. In this study, the patient records and images were transmitted from the dental clinic Fort McPherson over to Fort Gordon, Georgia, a distance of 120 miles. Fifteen periodontal patients were referred to Fort Gordon for surgery. One week after their surgery, each patient reported to Fort McPherson for suture removal and intra-oral imaging. At the time of suture removal, color still images were obtained of the surgical sites and these images were transmitted to Fort Gordon for examination by the Periodontist who performed the surgery. The results of this study showed that 14 of the 15 patients saved the return trip to Fort Gordon. The patients uniformly felt that they had received better care than they normally

received and were especially pleased at the elimination of the long trip to Fort Gordon. The dentists were also comfortable in their ability to make proper decisions and diagnosis using the equipment.

Orthodontics: Interceptive orthodontic treatments provided by sufficiently prepared general dentists and supervised remotely by orthodontic specialists through teledentistry are a viable approach to reducing the severity of malocclusion in disadvantaged children whose referral to an orthodontist is not feasible.¹⁷ A survey by Mandall et al.,¹⁸ revealed that general dental practitioners generally supported a teledentistry system patient orthodontic referrals.

Endodontics: Zivkoric et al.,¹⁸ demonstrated that teledentistry can be successfully utilized in the diagnosis of periapical lesions of the front teeth, reducing the costs associated with distant visits and making urgent help available Baker et al¹⁹ showed that no statistical difference existed between the ability of evaluators to identify periapical bone lesions using conventional radiographs on a viewbox and their ability to interpret the same images transmitted on a monitor screen by a video teleconferencing system.

Preventive Dentistry: A teledentistry project was implemented in Rochester,²⁰ New York in six inner city elementary schools and seven child care centers using intraoral cameras. Telehealth assistants recorded images of children's teeth and sent images to a pediatric dentist to review & provide treatment and referral recommendations. In the first nine months of 2005, 123 children were screened, revealing that almost 40% of the children had active dental caries. For the first time many children attending those inner city schools and child care centers had their teeth examined at an early age and were given prompt feedback on the need for dental care.

Teledentistry in Allied Health Sciences:

Dental hygienists and staff are being trained to take the case histories with the local dentist when the patient is treated through teledentistry service.²¹ In an effort to raise the dental hygiene student's awareness concerning the public health and community health issues currently associated with

access to care, a course in Teledentistry was added to their curriculum at the Minnesota state University, Mankato.

Specific objective was to assess student's knowledge levels, attitudes and confidence levels following completions of a teledentistry course.²⁰

Online education:

Teledentistry provide a unique way to deliver long-distance clinical training and continuing education and hands-on training to the dentist/dental hygienist at remote clinics.²² It can even facilitate patient education about self-care. Online education is of two types, web based self instruction and interactive videoconferencing.

So, teledentistry can be useful in rural and farflung areas, where there is a shortage of specialists and the lack of comprehensive & sophisticated health care is a problem. Teledentistry can extend care to remote patient populations at a reasonable of specialized dental consultants & professional isolation in rural areas. In India, where a majority of population lives in rural areas and where healthcare facilities are insufficient, teledentistry can have a significant contribution in bridging the gap between the demand and the supply.

It can teach general dentists when to refer a patient & how to treat more complicated cases, which can change their practice style.

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

Legal issues such as such as accountability, jurisdiction, liability, privacy, consent and malpractice is crucial to consider, when attempting establishing sound foundations for telehealth practice.²⁴

Licensure of teledentistry practice largely depends upon the country definition of teledentistry. The most significant barrier to a nationwide teledentistry practice is the traditional system of state-by-state licensing.

Confidentiality: Patients should be made aware that their information is to be transmitted electronically and the possibility exists that the

information will be intercepted, despite maximum efforts to maintain security. The form should contain the name of both the referring and consulting practitioners to ensure adequate coverage for malpractice, and the consulting doctor should acquire a copy of the informed consent before any form of patient contact is established.²⁴ In addition a clear nationwide teledentistry protocol is needed (eg forms,equipment recommendations, privacy & security requirements) which would enable organizers to control the problems caused by different standards & result in more objective program evaluation.

Liability Teledentistry raise concerns about liability. There is no law to clarify the role of the teledoctor and their liability.

Future Prospectives Of Teledentistry:

There are certain issues which require resolution for the success of teledentistry. These issues include inter-state licensure, jurisdiction and malpractice, as well as technological, security and ethical aspects.²⁵

Various measures that can be employed for the effective implementation of teledentistry are:

1. The instructors of the teledentistry education courses need to be well versed with computer knowledge and they should have adequate teaching experience.²⁶
2. The practitioners who are engaged in teledentistry must have a license in each state in which they practice.²⁶
3. Dentists who are engaged in teledentistry must make every effort to ensure the security of their systems, as well as of any data that they may transmit. For example, data encryption, password protection and user access logs can help in deterring most of the people and in protecting patient.²⁵

Conclusion: Teledentistry can be used as a valuable tool for providing dental care in rural areas, where there is a shortage of specialists and a lack of comprehensive and sophisticated health care. It can be a solution to the barriers of dental care like the lack and cost of transportation, time off from work and school and to save the patient's money.

Currently, teledentistry has not yet become an integral part of mainstream oral health care, but in the near future teledentistry will be just another way to access an oral health care. In spite of some issues which need to be resolved, the potential of teledentistry is tremendous in future.

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