

TELEDENTISTRY: A REVIEW

Satyaki Arora,¹ Swati Dwivedi,² Pallavi Vashisth,³ Mudit Mittal,⁴ Satyajeet Nayak⁵

1. Senior Lecturer, Department of Pedodontics & Preventive Dentistry, Institute of Dental Sciences, Bareilly, Uttar Pradesh

2. Senior Lecturer, Department of Pedodontics & Preventive Dentistry, Institute of Dental Sciences, Bareilly, Uttar Pradesh

3. Senior Lecturer, Department of Pedodontics & Preventive Dentistry, Institute of Dental Sciences, Bareilly, Uttar Pradesh

4. Senior Lecturer, Department of Periodontology, Kothiwal Dental College & Research Center, Moradabad, Uttar Pradesh

5. Professor, Department of Pedodontics & Preventive Dentistry, College of Dental Sciences, Davengere, Karnataka.

Abstract

Teledentistry is newly introduced technology in the field of dentistry. Until now, telemedicine has been successfully used in many medical specialties but not so widely used or accepted in dentistry (teledentistry). Nevertheless, teledentistry may be quite useful as a practical and potentially cost-effective means to screen a large number of children for signs and symptoms of oral disease. The developing field of teledentistry has the potential for benefiting dental care by enhancing early remote diagnosis, timely treatment of oral diseases, improved utilization of dental services and access to care. In the long term, teledentistry may also help to establish a “dental home” for participating children.

Key Words: - Teledentistry, Children, Oral Diseases.

Introduction

Teledentistry is a relatively new field that combines telecommunication technology and dental care. It provides new opportunities for education and delivery of care that offer much potential and challenges. The practice of teledentistry broadly defines the use of electronic communication and informing technologies to provide or support clinical care at a distance is becoming increasingly common due to the recent innovations in data communication as well as increased demand for accessible and cost effective health care.

Dentists seem to have innate love for new technologies we're “**Gadgeteers**” and we usually respond with great enthusiasm to new developments. While we are seeing a decline in the dental disease among young patients, we are also facing an aging population people are living longer and wanting to maintain their dentitions throughout their lives. They need and demand services that are often complex. Technology needs to evolve to respond to the shift in dental concerns. These advances should make consistently successful treatment of increasingly complex conditions possible. In turn, new technologies challenge the current paradigms of dental practice and will lead significant shift in future treatment modes.

The aim of this presentation is to highlight the significant changes that have occurred in information technology telecommunication technology in the health care field. These changes have made access to health care easy and practicing style has changed drastically.

Hence an attempt has been made to review the literature regarding “Teledentistry” its impact, use, limitations and its future role in the field of Dentistry.

History of Teledentistry

The United States military formally launched a coordinated telemedicine program in 1994. The ultimate purpose of this program is to investigate clinically relevant applications of this rapidly emerging technology. The military efforts in telemedicine are part of a broad attempt to “re-engineer” the delivery of health services.

One of the military telemedicine efforts was to start a teledentistry project. The Total Dental Access (TDA) is a

tri-service teledentistry project, which started in 1994. One of the goals of this project is to increase patient access to quality dental care. The other goal is to establish a cost effective telemedicine system. The Total Dental Access project focuses on three areas of dentistry.¹

Patient care: In some of the remote clinics, a patient must travel hundreds of miles to receive speciality care. Often pre-and post-operative visits take only a few minutes of actual appointment time but require hours of travel by the patient. With the implementation of teledentistry, there is a potential of savings in cost and travel time required by the patient. Referral to specialists, consultations and laboratory communications are some of the clinical areas where teledentistry could improve the patient care.¹

Continuing dental education: Through the use of video teleconferencing equipment, the lectures could be broadcasted to any clinic where continuing dental education is difficult to obtain.¹

Dentist – Laboratory Communications: Occasionally, cases submitted to the dental laboratories have subtle complications or esthetic nuances that require direct contact between the dentist and the laboratory technician. In these instances, the ability to send colour images of the patient's teeth and then to talk about the images can help to prevent making improperly constructed appliances, thereby saving time and money.¹

Teleradiology

In 1994, the American College of Radiology (ACR) defined teleradiology as the electronic transmission of radiologic images from one location to another for the purposes of interpretation, consultation, or both. The distance component of this definition differentiates teleradiology from the local picture archiving and communication systems (PACS) that acquire, store, manage, and display digital images within health care institutions and clinics. Teleradiology systems allow direct digital or digitized film images to be transmitted to distant locations, where they can be viewed and downloaded to hard copy for reading and interpretation.²

Teleradiology has not been used as extensively in dentistry as it has in medicine. Nonetheless, there are a multitude of

actual and potential applications, including dental insurance authorization, consultations and referrals, compatibility with electronic record retrieval systems, forensic cases, electronic grand rounds, and continuing education.³

Transmission of dental radiographic images requires that the image files be in a digital format conventional dental radiographic films can be scanned to convert them from analog to digital formats, a process termed digitization. Two basic types of digital dental systems are commercially available to acquire images without the need to scan conventional films. One is a direct digital system with electronic sensors using charge-coupled devices (CCDs) or complementing metal oxide semiconductors as image receptors. The other is an indirect digital system using storage phosphor plates as image receptors. The storage phosphor system has also been referred to as computed radiography. Post processing of the electronic images is possible with virtually all of these systems, which allows the practitioner to enhance, magnify, and measure the images as well as vary the contrast and density after acquisition. A variety of proprietary systems are marketed specifically for dental imaging needs, which manage intraoral (dental film sizes 0, 1, 2, 3 and 4) and extra-oral (panoramic and cephalometric) image formats. Digital systems are reported to offer advantages over film-based intraoral radiography in decreased patient radiation risk and a wider range of contrast. Extra-oral systems offer comparable patient radiation risk to film-based extra-oral systems using 400-speed screen film combinations.⁴⁻⁵

Telestomatology

An e-mail based oral medicine consultation was undertaken as a pilot study by Younai and Messadi in 2000 to assess whether text based electronic patient data transmission (e-mail) is a reliable source of information for the diagnostic decision making process.⁶ The main objective was to determine if the information contained within a transmitted text could be reliably used as a basis for making general recommendations for diagnostic tests and follow-up or referral plans pertaining to a variety of oral mucosal pathologic conditions. Using an Oral Medicine clinic, patient databases 100 charts were randomly selected for the project covering a 5 year period. These patients had been seen each time by a team of 2 (two) faculty consisting of Oral Pathologists or Oral Medicine specialists attending the clinic. Two posts graduate residents for the orofacial pain programs were asked to retrieve the charts and transfer all the relevant information from the charts to a standard patient data previously designed online consultations.

Tele Oral Surgery

Coultard *et al* in 1999 did a study in great Manchestre to know the requirement / need of telemedicine in oral surgery referrals.⁷ 400 general dental practitioners were randomly selected for the study. A questionnaire was sent by post to each practitioner in the study out of which 336 general dental practitioners replied back giving a participation rate of 84%.

42% of the respondents stated that they were not satisfied overall with the service of the current specialist in oral surgery facilities. The reasons for the dissatisfaction were: -

1. Length of the waiting list for consultation and treatment.
2. The distance and the length of time it may take a patient to attend a specialist unit.

23% of the general dental practitioners wished to improve their communication with the oral surgeon and 70% desired for their involvement in consultation and the treatment plan.⁷

After the study, the authors concluded that a significant number of dentists were dissatisfied with the current referral system suggesting that there was a need to change the system of oral surgery specialist care. The principal concern being the amount of time wasted for consultation and the treatment and perceived difficulty in traveling to the specialist unit, usually at the hospital.⁷

Coultard *et al* suggested that telemedicine in oral surgery could conceivably be another way to improve access to specialist oral surgery care.⁷

Telepathology

To the best of our knowledge, very few teleconsultations is being used in the field of pathology.

Dr. Ace Allen of Dartmouth-Hitchcock Medical Centre (USA) in 1999 reported that in 1998 Dr. Vincent Menoil, Section Chief of Anatomic Pathology at Dartmouth-Hitchcock Medical Centre started experimenting with their "Homegrown" web-based, store and forward Telepathology system. It worked reasonably well but did not allow him to do what he felt was the critical part of the review process: scan the glass slides in real to select exactly the right fields, focal depth and magnification. The video Telepathology system he was familiar with was far too expensive and cumbersome to justify for what he needed: simple compact equipment that would cost well under \$10,000/- per set. He teamed up with Sony's Medical Group to see if their Trinicom Digital Meeting System (DMS) might fit the bill.⁸

The DMS was a multimedia information hub, essentially a "Grand Central Station" for routing and processing of digital and audio video information. He planned a DMS based Telepathology system, with 2 rural sites and the hub at the medical centre. The equipment delivered very reasonable image fidelity and allows for full interaction between the rural pathologist and medical centre sub specialists.⁸

The Digital Meeting System links the imaging environment to the hospital system's electronic medical record. Each integrated computer can be used at the same time to bring up e-mail, library services and web access. They also planned a "Pathology Picture Archiving Communication System" to enable long term filling and storage of digital images. Its main applications and interactive care consultations and conferences and for teaching.

A much quicker case turnaround time was the expected benefit, since this system eliminates the rate limiting step of a consultation sending the hard copy slides via surface mails; the case turnaround was expected to be reduced from days to hours.⁸

Teleorthodontics

Orthodontic practice via teledentistry project is a universally accepted part of modern healthcare as much of hands on care can be done by technicians and general practitioners under the supervision of an orthodontist.⁹

Orthodontic tooth movement takes time and this is the main reason why a long term follow-up is required and most of the orthodontists work on a patient in a uniformly spaced interval of time.⁷

Although the orthodontic practice via teledentistry projects seems to be practical, but in most parts of the world it is practiced at the grass root levels. But the United Kingdom is an exception to this as tele-orthocare is widely practiced there. The reason for this is multi-fold and most important is the lack of the orthodontists in the United Kingdom population. There are currently 920 orthodontists practicing orthodontia for a population of 56 million and this means that there is a shortage of orthodontists in the United Kingdom.¹⁰⁻¹¹

So almost all the children who receive orthodontic care in United Kingdom do so within provisions of the United Kingdom National Health Services.¹² More than half of these cases are treated by a fully trained specialist with the use of multi-bracketed fixed appliance techniques. The National Health Services (NHS) appoint general practitioners to undertake orthodontic treatment.¹³ Although many of the dentists have participated in continuing education programmes in orthodontia, others are only familiar with maxillary removable appliance techniques. Even when they have received further training, general dentists lack sufficient diagnostic knowledge to enable them to distinguish cases that are straightforward and can be treated successfully by them from cases that require specialist care.¹⁴

Conclusion

It is clear from the above discussion that teledentistry is fastest growing segment of dentistry. Teledentistry has shown promise in eliminating the gap between the undeserved patient in rural areas and the specialists. Teledentistry has been fruitful in reaching the masses. Although history has shown growth of teledentistry since 1994, but the growth curve is exceptionally high since past five years, which is a good sign of our profession.

We have summarized various specialties of dentistry in terms of tele-health and it can be concluded from here that teleorthodontics, periodontics, teleradiology and dental care for rural population has shown very good results as much of the hands on care can be rendered by dental hygienist, technicians and general practitioners who are provided

hands on course to render treatment under the guidance of specialists.

References:

1. Chen JW, Hodbell MH, Dunn K, Johnson KA, Zhang J. Teledentistry and its use in dental practice. *J Am Dent Assoc* 2003;134(3):342-346.
2. Benson BW. Teleradiology. *Dental Clinics of North America*. 2000;44(2).
3. Bauer JC, Brown WT. The digital transformation of oral health care. *J Am Dent Assoc* 2001;132(2):204-209.
4. Farman AG, Farag A, Yeap PY. Communication in digital radiography. *Dentomaxillofac Radiol* 1992;21(4):213-215.
5. Johnson LA, Schleyer T. Developments of standards for the design of educational software. Standard committee of Dental Informatics. *Quintessence Int* 1999;30(11):763-768.
6. Clark GT. Teledentistry; What will it be now and what will it be tomorrow? *Cand Dent Assoc J* 2000;28(2).
7. Nuttal NM, Steed MS, Donachie MA. Referral for secondary restorative dental care in rural and urban areas of Scotland: findings from the Highlands and Islands Teledentistry Project. *Br Dent J* 2002;192:224-228.
8. Folke LEA. Teledentistry: An overview. *Texas Dent J* 2001;118(1):10-8.
9. Krupinski EA, McNeil KM. Teleradiology. *Oral Maxillofac Surg Clin North Am* 2001;13(4).
10. Scuffam Pa, Steed M. An economic evaluation of the highlands and islands teledentistry project. *J Telemedicine and Telecare* 2002;8:165-177.
11. Stephens CD, Cook J. Attitudes of UK consultants in teledentistry as a means of providing orthodontic advice. *J Orthodont* 2002;29:137-142.
12. Cook J, Mullings C, Vowles R, Stephens C. The use of teledentistry to provide GDPs with advice in Orthodontics Dental Update June 2002.
13. Stephens C, Cook J, Mullings C. Orthodontic referrals via teledent Southwest. *Dental Clinics of North America* 2002;46:507-510.
14. Eaton KA, Francis A, Odell EW, Reynolds A. Participating dentist's assessment of the pilot regional online videoconferencing in dentistry (PROVIDENT) Project. *Br Dent J* 2001;191:330-334.

Corresponding Author

Dr. Pallavi Vashisth
Senior Lecturer,
Department of Pedodontics
Institute of Dental Sciences
Bareilly, Uttar Pradesh (India)
Email Address: pallavivashisth@yahoo.in