

Teledentistry – The Indian perspective

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Abstract

Teledentistry, a subset of the concept of Telemedicine, is an upcoming field in dentistry that combines telecommunication, information technology, internet, digital imaging to support clinical oral health care on a long distance, patient education, professional health related education, public health administration. There are broadly two approaches used in Teledentistry, Real time consultation and Store and Forward method. Addition of Teledentistry to our national health care systems like National Rural Health Mission enables enhanced availability of oral health care at the Primary Health Centres, Community Health Centres and District hospitals. Each district hospital can act as a “Main Centre” for providing teledentistry consultations to a group of remotely located Primary Health Centres or Community Health Centres. Effective training and technical support group is required at the main centre (District hospital). Also an institutional framework and a clear set of policies are required which respond to issues such as liability of the professionals involved, malpractice protection for patients, data privacy of patient information and ensuring prior informed consent of the patient. This paper is an attempt to discuss the concept of teledentistry and its implementation model in the Indian context.

Keywords: Dentistry, Teledentistry, Telemedicine.

Introduction

In India, while there is one dentist for every 10,000 urban dwellers in India, in rural areas this ratio falls to one dentist for every 150,000 people.¹ It is also a fact that dental care services are available in very few states at the primary health care level and this remains a fundamental gap in the Indian health scenario. Migratory tendency for educated and qualified professionals away from rural areas, geographic remoteness, lack of effective public transport networks, lack of awareness are the few reasons for this situation.

Teledentistry, a subset of the concept of telemedicine, involves the use of telecommunications and information technologies to support clinical oral health care on a long distance, patient health education, professional health related education, public health administration.

Teledentistry is the transmission of clinical information using electronic health records, digital imaging, telecommunication technology and Internet protocols to provide teleconsultations or second opinion with specialists. It can also be adopted to guide general practitioners in the distant diagnosis and treatment of common or rare diseases and to reduce inappropriate referral rates by providing treatment supervision and a second professional opinion based on the exchange of health information.²⁻⁵ The practice of teledentistry reduces economic costs involved in patient transportation to reference centers, mainly in situations that could be diagnosed or treated in Primary health centres of Community health centres. There is a lack of consistent evidence for the advantages of telehealth in dentistry.²⁻⁵

For teledentistry to emerge as a mainstream element of oral health strategy in India, a number of infrastructures, policy and institutional framework aspects need to be reviewed and addressed as a matter of priority.

The History of Teledentistry

Telemedicine began in 1924, when a physician saw his patient over the radio using a television screen.⁶ Teledentistry was developed in 1989 as part of the blueprint for dental informatics, which was funded by the Westinghouse Electronics Systems Group in Baltimore.⁷ The birthplace of teledentistry as a subspecialist field of telemedicine was in 1994 as part of United States Army Total Dental Access Project which was aimed improve patient care, dental health education, and to have an effective communication between dentists and dental laboratories.⁶⁻⁹ Teledentistry was first practiced by the U.S. Army by doing consultations on persons located more than 100 miles apart.⁶ Ever since, it has been practiced by various public health facilities, remote rural clinics, and organizations with various degrees of success. The variation in the levels of acceptance and use of dental Electronic Health Records has been determined by the mode of communication preferred, type of software and hardware used, and the type of internet connection.

Methods of Communication

Teledentistry uses two approaches namely “real-time” or “store-and-forward” methods.¹⁰ Real-time consultation involves a videoconference (see Fig. 1) in which dental professionals and their patients, at different locations, may see hear, and communicate with one another actually using advanced telecommunication technology and ultra-high bandwidth network communications.^{6,7,9} Store-and-forward (see Fig. 2) refers to the collection and secure transmission of encoded information including patient documents and images (intraoral photos, radiographs, and extra oral photos) which are stored for review by a dentist or specialist at a later time for consultation and treatment planning.⁶⁻⁹

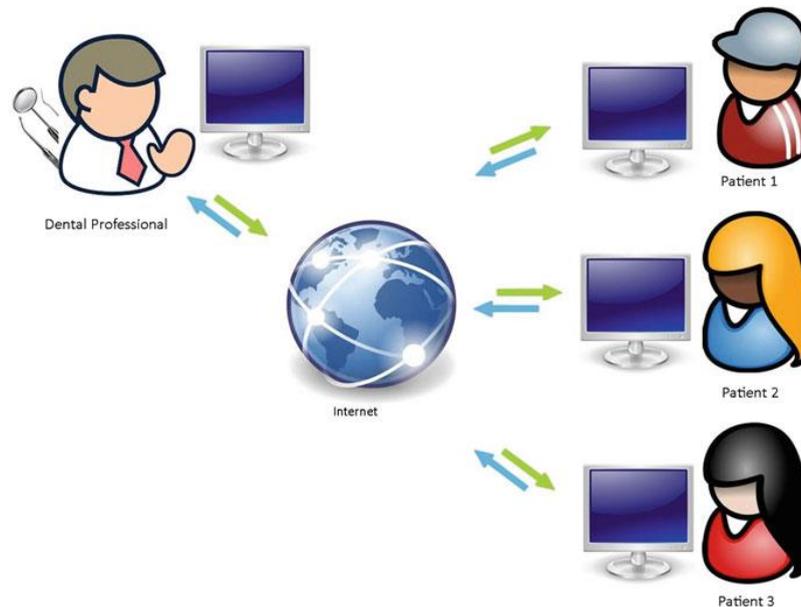


Fig. 1: Type of teleconsultation.

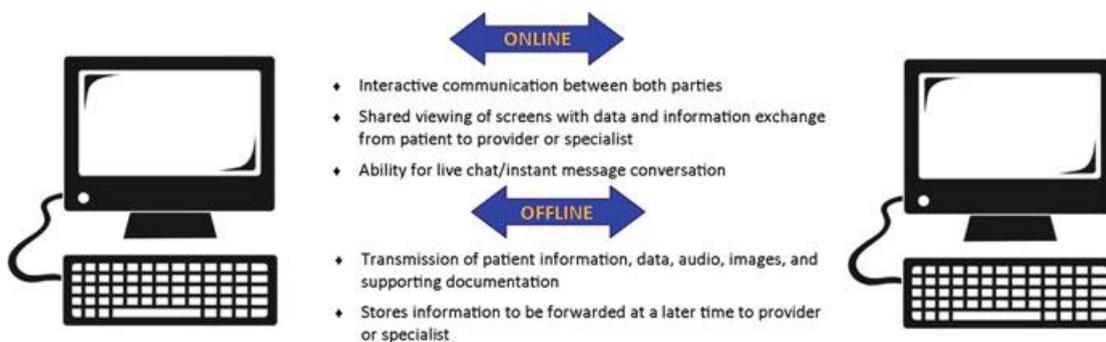


Fig. 2: Types of telecommunication

Technological Requirements

For practicing teledentistry, a desktop or laptop computer with a microphone and substantial hard drive memory are needed. In addition, a significant amount of RAM with a speedy processor; a digital camera, video camera and intraoral camera for the capture of pictures^{6,7} and an x-ray unit are essential. For capturing images of clinical pictures, its storage, transmission of the collected information, for coding and decoding audio and video, desirable software is essential.⁶ A fax machine, scanner, and a printer may also be required.⁷ Another crucial requirement is the availability of high speed internet connectivity and broadband technology, which will meet the needs of the telehealth professional and his or her staff.⁶ Teledentistry has many advantages and disadvantages and are enumerated below.

Advantages of using Teledentistry

Teledentistry helps to overcome the barriers or geography and travel time to deliver long-distance clinical training.^{6,11} Its application is of great importance in rural and urban under-served areas where there is unavailability of specialist consultation which reduces the costs of service and

improves quality of care.^{6,7,12} Teledentistry usage increase inter-professional communications and thereby improves dentistry's integration into the larger health care delivery system.⁹ Second opinions, pre- authorizations and other insurance requirements will be met almost instantaneously online, with the use of real images of dental problems, thereby making traditional dental care more efficient.¹³ In spite of all these advantages teledentistry, still have many legal, financial, and ethical concerns.

Disadvantages of using Teledentistry

Teledentistry allows the dental hygienist to initiate treatment based upon their assessment of a patient's need without a dentist on site.⁸ The crucial aspects to be considered when attempting to establish the foundations of a teledentistry practice are accountability, licensure, jurisdiction, liability, privacy, consents, and malpractice.^{6,9} The most important barrier to a nationwide teledentistry practice is the traditional system of state-by-state licensing. There is no law to clarify the role of the teledoctor and their liability.⁶ The cost of the teledentistry equipment has also been a matter of concern and presently, the cost for virtual

teledental consultations has not been reimbursed by insurance companies. Patients must also be made aware that their medical and dental information will be transmitted electronically and there are possibilities that the information will be intercepted, despite maximum efforts to maintain security and confidentiality. Another disadvantage is the increasing number of cyber dentists using teledentistry technology, as some doctors may use the internet to seek direct patient contact. Doctors and staffs take time to get accustomed to using the teledentistry system which is yet another challenge. The lack of infrastructure and patient literacy remain major obstacles in case of underserved communities who are below the poverty line.

Applications of Teledentistry

In addition to extending general dental care to an underserved population or location; teledentistry can also have a number of specialized applications. Studies have documented successful use of teledentistry to extend highly specialized consultations as well.

Application in Oral Medicine and Radiology

Oral Medicine and Radiology is concerned with identifying, investigating and diagnosing an oral disease. Due to general lack of qualified and experienced specialists in remote locations of India, accurate diagnosis of complex and serious oral conditions is severely constrained and therefore an appropriate line of treatment is not employed. Teledentistry, therefore, provides an opportunity for timely diagnosis, and treatment planning of oral diseases for patients located in such remote areas. Direct consultation through video conferencing or transfer of the collected data like history, radiographs etc. to the specialist consultant through e-mails can significantly enhance diagnostic accuracy and further treatment of the patients.¹⁴

Application in Oral and Maxillofacial Surgery

Studies have been done to prove the use and efficacy of teledentistry in treatment planning and pre-surgical assessments of oral surgical interventions. These approaches can be used in early detection of oral cancer cases. Thus teledentistry may prove to be an important tool in delivering improvements in treatment prognosis and survival rate amongst oral cancer patients.¹⁵

Application in Orthodontics

Uses of teledentistry tools, for remote specialist supervision of orthodontic treatments and interventions undertaken by local dentists have proved to be very beneficial.¹⁶

Application in Conservative dentistry and Endodontics

Teledentistry is very helpful in reviewing of radiographs and images by remotely located specialists, thus ensuring a better understanding of dental morphology including the location of root canal orifices as well as aiding more correct diagnosis of the condition of the dental pulp and/ or periapical tissue.¹⁷

Application in Prosthodontics

With the use of teledentistry, suitable technical guidance can be provided to the general dentists by remotely located specialists at critical stages including diagnosis, treatment planning, laboratory works, post-treatment follow-ups and

contingent interventions in full mouth rehabilitation cases, immediate denture and over denture prosthesis.¹⁸

Application in Pediatric and Preventive dentistry

Teledentistry can play a very important role in educating schools children about dental diseases and in spreading awareness about basic oral hygiene.¹⁴

Teledentistry in India

A large percentage of Indian population dwells in rural areas, with limited resources in terms of education, infrastructure and most importantly, basic health care facilities. The National Rural Health Mission (NRHM), now under National Health Mission by Ministry of Health and Family Welfare, Government of India was started in 12th April, 2005 with a purpose to improve rural health care system.¹⁹ Through this program many PHCs (primary health centres) and CHCs (Community Health Centres) have been established in rural and remote areas. Government has also appointed many primary level health workers to work in coordination with these PHCs and CHCs in providing basic health care and education. Most of the District hospitals lack specialist expertise and experience in differential diagnosis, modern treatment planning and expert follow up/ contingent interventions that may be required for responding to the more complex cases.

Since dental treatment is highly specialized and technique sensitive, addition of teledentistry to our national health care system can not only enable enhanced availability of oral health care at the PHCs/ CHCs but can also have a significant preventive impact by spreading awareness about oral diseases and importance of proper oral hygiene (including, by using web based self-instruction and/ or video conferencing tools). In addition, teledentistry can also be utilized to remotely provide specialized clinical training to dental professionals located at the beneficiary locations.

Also encouraging is the fact that specialized telemedicine programs undertaken in certain remote parts of the country have already been a success; example, the successful implementation of a Teleophthalmology project in Tripura has inspired the Planning Commission of India to incorporate the Teleophthalmology program in the 12th Five Year Plan of the country.²⁰

High reliability and low latency internet bandwidth is a key infrastructure backbone required for effective teledentistry. Effective video conferencing at a resolution suitable for clinical consultations requires stable data speed of about 3 -4 mbps. While data protection law in India states that mishandling of any digital data a crime, the application of such principles to remotely transmitted or stored patient data is yet to be settled in India.²¹

For providing teledentistry consultations each District hospital can act as a "Main centre". It can be connected to a group of remotely located PHCs or CHCs (sub centres). Relevant Data can be collected by local dentists or healthcare workers appointed at PHCs and CHCs and transferred to the 'Main centers' through email or smart phones and scheduled consultations can be performed via direct video conferencing. Each Main centre (District

hospital) may also maintain tele contact with a remote panel of super specialists, who may be called upon for additional consultation/ advice on an as -needed basis. For the success of the teledentistry initiative, it is therefore important to partner with an Internet Service Provider (ISP), who could support this initiative by providing either free or low cost bandwidth, as a part of their Corporate Social Responsibility (CSR) program. Such programs are now mandatory for large corporate by way of a recent amendment in the Companies Act and interestingly, healthcare is one of the primary focus areas identified under the relevant Schedule of the Companies Act, 2013.²²

Also, from an infrastructure standpoint, it may be noted that most, district hospitals in the country would have appropriate Information Technology (IT) systems at their end to support such an initiative. The sub centres (i.e. the PHCs/ CHCs) can leverage mobile/ handheld devices and wireless connectivity provided by the partnering ISP (or other implementation partners) to transmit digital data, images and to conduct video-conferencing. Record keeping could be a shared responsibility between Main centre (District hospital) and the sub centres (PHCs/ CHCs), with paper/ hard copy data and records being maintained at the sub centres and electronic data stored within a secure, dedicated data server.

Conclusion

Addition of teledentistry to our national health care system enable enhanced availability of oral health care at the PHCs and CHCs in remote areas and also helps in spreading awareness about oral diseases and importance of proper oral hygiene. It can also be utilized to remotely provide specialized clinical training to dental professionals located at the beneficiary locations. High reliability and low latency internet bandwidth is a key infrastructure backbone required for effective teledentistry. Effective training and technical support group is required at the Main centres and Sub centers. Also, an institutional framework and a clear set of policies are required, which respond to issues such as liability of the professionals involved, malpractice protection for patients, data privacy of patient information and ensuring prior informed consent of patients.

Conflict of Interest: None.

References

1. Gambhir RS, Brar P, Singh G, Sofat A, Kakar H. Utilization of dental care: An Indian outlook. *J Nat Sci Biol Med* 2013;4(2):292–7.
2. Daniel SJ, Wu L, Kumar S. Teledentistry: a systematic review of clinical outcomes, utilization and costs. *J Dent Hyg* 2013;87(6):345–52.
3. Mariño R, Ghanim A. Teledentistry: a systematic review of the literature. *J Telemed Telecare* 2013;19:179–83.

4. Khan SA, Omar H. Teledentistry in practice: literature review. *Telemed J E Health* 2013;19:565–7.
5. Jampani ND, Nutalapati R, Dontula BS, Boyapati R. Applications of teledentistry: a literature review and update. *J Int Soc Prev Community Dent* 2011;1(2):37–44.
6. Sanjeev M, Shushant GK. Teledentistry: a new trend in oral health. *Int J Clin Cases Investig* 2011;2(6):49–53.
7. Jampani ND, Nutalapati R, Dontula BSK, Boyapati R. Applications of teledentistry: a literature review and update. *J Int Soc Prev Community Dent* 2011;1(2):37–44.
8. Williams KT. The use of teledentistry to provide dental hygiene care to rural populations. *Access* 2011;1–6.
9. Bhambal A, Saxena S, Balsaraf SV. Teledentistry: potentials unexplored. *J Int Oral Health* 2010;2(3):1–6.
10. Kumar S. Teledentistry. Switzerland. Springer publications. 2015.
11. Skillman SM, Doescher MP, Mouradian WE, Brunson DK. The challenge to delivering oral health services in rural America. *J Public Health Dent* 2010;70:S49–57.
12. Chhabra N, Chhabra A, Jain R, Kaur H, Bansal S. Role of teledentistry in dental education: need of the era. *J Clin Diagn Res* 2011;5(7):1486–8.
13. Skillman SM, Doescher MP, Mouradian WE, Brunson DK. The challenge to delivering oral health services in rural America. *J Public Health Dent* 2010;70:S49–57.
14. Bradley M, Black P, Noble S, Thompson R, Lamey PJ. Application of teledentistry in oral medicine in a community dental service, N. Ireland. *Br Dent J* 2010;209(8):399–404.
15. Duka M, Mihailovic B, Miladinovic M, Jankovic A, Vujicic B. Evaluation of telemedicine systems for impacted third molars diagnosis. *Vojnosanit Pregl* 2009;66(12):985–91.
16. Berndt J, Leone P, King G. Using teledentistry to provide interceptive orthodontic services to disadvantaged children. *Am J Orthod Dentofacial Orthop* 2008;134(5):700–6.
17. Brullmann D, Schmidtmann I, Warzecha K, d'Hoedt B. Recognition of root canal orifices at a distance –A preliminary study of Teledentistry. *J Telemed Telecare* 2011;17(3):154–7.
18. Ignatius E, Perala S, Makela K. Use of videoconferencing for consultation in dental prosthetics and oral rehabilitation. *J Telemed Telecare* 2010;16(8):467–70.
19. www.nrh.gov.in.
20. Governance Knowledge Centre, Ministry of Personnel, Public Grievances and Pensions, Government of India, August 2011. Case Study, Tele-ophthalmology in Tripura. New Delhi: Government of India.
21. Dalal P. Data Protection law in India: The TRIPS prospective 2006;11:126–31.
22. Press Trust of India, Apr 6, 2014. Promoting healthcare comes under CSR ambit: Government. Press Trust of India: New Delhi. Available at http://articles.economictimes.indiatimes.com/2014-04-06/news/48908562_1_csr-norms_csr-activities-csr-work.

How to cite this article: Gopi VV, Daryani D, Uthkal MP, Zehra F. Teledentistry – The Indian perspective. *Int J Oral Health Dent* 2019;5(2):59–62.