**Teledentistry: Dental Consultations Made More Accessible**

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**ABSTRACT**

Teledentistry, an evolving field of dentistry and telecommunications, has revolutionized oral healthcare delivery. This article delves into recent breakthroughs in teledentistry, showcasing its potential as a solution for long distance diagnosis and treatment planning. With the exchange of clinical data for remote consultations and treatment planning, teledentistry addresses enduring dental challenges while facing its own set of obstacles. The underprivileged in rural areas stand to gain quality care, ensuring oral health and well-being. Notably, the rise of real-time videoconferencing, accentuated by the COVID-19 pandemic, has highlighted the versatility of teledentistry. From bridging the rural-urban health divide to extending specialist services worldwide, teledentistry is rapidly advancing in information and communication technology, promising expert dental care even in the remotest corners of the globe.

**Keywords**—teledentistry; telecommunication; telemedicine; digital; real-time consultation; dentistry; COVID-19

1. **INTRODUCTION**

Teledentistry is a developing branch of dentistry that connects patients and dental professionals. With the rapid growth of technology, it has the potential to significantly transform current practice and the face of dental care. This field combines telecommunication technology and dental care. In 1997, the term "teledentistry" was first used, and as defined by Cook, it is "the practice of using videoconferencing technologies to diagnose and provide advice about treatment over a distance." This field provides a new way of providing specialist advice. It is now possible to provide interactive expert consultation and opinions with the help of telecommunications and computer technology that are not constrained by time or space.

1. **HISTORY**

Telemedicine began in 1924 with the concept of a physician seeing his patient over the radio using a television screen. Teledentistry, like telemedicine, was initially started by NASA in the 1970s, followed by the US military. The original idea for teledentistry, a new field that combines computer and information science, engineering, and technology in all aspects of oral health, developed during a conference in Baltimore in 1989 that was funded by the Westinghouse electronics systems group. It was developed as a part of the blueprint for informatics. Teledentistry was first put into practice by the United States Army in 1994 to provide dental consultations to people who lived more than 100 miles apart. Since then, various institutes and organizations have used teledentistry with varying degrees of success.

1. **WHAT IS TELEDENTISTRY?**

Teledentistry is 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.

It is of different forms, like Real-Time Consultation and Store and Forward Method.

**A. Real-Time Consultation:**

This involves a videoconference in which dental professionals and their patients, at different locations, can see, hear, and communicate with each other using advanced telecommunication devices and high-speed internet connections.

**B. Store and forward:**

This involves the exchange of clinical information and static images collected and stored in telecommunications equipment. The dentist obtains all clinical and radiological information from the patient. This data is subsequently forwarded to the professional for consultation and treatment planning. The treatment is thus provided in a more timely, targeted, and cost-effective manner. The patient is not present during the consultation.

1. **REQUIREMENTS**

Certain technology, software, and network connections are required to practice teledentistry. A desktop or laptop computer

with an adequate hard drive, a significant amount of RAM, and a quick processor is essential. To provide the consulting dentist with images of great clinical value, a digital camera, video camera, intra-oral camera, and a panoramic digital x-ray unit, preferably portable, are necessary. For video conferencing, a microphone, speaker, and webcam are required.

1. **APPLICATIONS OF TELEDENTISTRY**

**A. Role in Oral Medicine and Radiology:**

With the advancement of technology and the introduction of teledentistry into oral health services, access to diagnosis and management of the oral health of patients has become easier. Patients with oral ulcerative lesions can get photos of the lesion and send them to the dentist, who can then analyze them and give them appropriate instructions and medications through teleprescription after taking a proper history of any drug allergy. Digital Orthopantomogram (OPG) and Cone Beam Computed Tomography reports can also be sent to the dentist in cases of cysts or tumors for early diagnosis, following which a treatment can be planned. One of the reasons for the delayed diagnosis of oral cancer is the improper diagnosis of oral lesions. In this context, teledentistry facilitates contact between dentists and clinical specialists, enabling swifter measures for the treatment of oral cancer and improving the effectiveness and safety of the therapy. Furthermore, remote diagnostics can be an effective technique for identifying oral lesions.

**B. Role in Oral and Maxillofacial Surgery:**

The most common complaint arising in oral and maxillofacial surgery is pain in the third molar region. The patients can send their radiographs to the dentists, which can then be forwarded to the specialist for consultation. The study of patients’ and dental surgeons’ acceptability regarding teledentistry performed through telephone appointments for different patient categories and maxillofacial surgical practice in comparison with the on-site evaluation was highly appreciated. This also demonstrates that due to the challenges of doing a typical ''face-to-face’ consultation, most patients with illnesses like temporomandibular joint disorders, salivary gland disorders, head and neck cancer, and orthognathic surgery require further evaluation. Other studies reported that patients with trauma generally accepted teledentistry well, while patients with temporomandibular joint disorders showed low acceptance. Furthermore, as reported by Saad Ahmed and Omar, teledentistry is advantageous for oral surgery, both for performing dental treatments and for following up on patients’ postoperative status.

**C. Role in Orthodontics:**

With technological advancement, teledentistry has become popular in orthodontics to monitor and consult patients without having to visit the dentist. It can be helpful in early orthodontic consultations for evaluation of treatment options and diagnostic plans. With the help of teledentistry, orthodontic emergencies like bracket breakage or loosening of wire, rubber ligature displacement, pain, and cheek irritation can be managed at home. According to Berndt *et al*. interceptive orthodontic procedures were provided by general dentists under the supervision of orthodontic specialists through teledentistry. When referral to an orthodontist is not feasible, this method has proved effective in lowering the severity of malocclusions in children from low-income households. Even though teledentistry has not completely eliminated the necessity for in-person clinical care, most dentists and patients believe that internet consultations or teledentistry is more convenient and cost-effective for orthodontic treatment.

**D. Role in Endodontic:**

Teledentistry enables the provision of endodontic care to underprivileged patients. Patients' most common complaint is tooth pain and swelling; in these cases, they can have a conversation over the phone with the dentists, informing them about the symptoms they are experiencing. Analgesics can be prescribed for conditions such as symptomatic reversible pulpitis, while antibiotics can be prescribed for infections. Brullmann D *et al.* reported that remote dentists can identify root canal orifices based on images of endodontically accessed teeth. Zivkovic D *et al.* demonstrated that teledentistry can be successfully used in the diagnosis of the periapical lesions of the anterior teeth. It has the dual advantages of reducing the costs of distant visits and improving the availability of emergency aid.

**E. Role in Prosthodontics:**

In Prosthodontics, dislodged prosthesis and broken dentures are the most frequently reported problems. Dentists can handle these complaints by guiding the patients on how to handle the situation at home and coordinating with laboratory technicians to pick up the patient’s dentures and temporarily fix them. Instructions on denture use and hygiene can also be given on call consultations.

**F. Role in Pediatric and Preventive dentistry:**

Oral and dental health have a significant impact on a child’s overall health and well-being. Pediatric dentists can encourage their patients to practice improved dental hygiene habits like proper brushing techniques and use of fluoridated toothpastes with the help of teledentistry. They can even provide counselling over the phone to start treatment regimens. As dental caries is more common in children, the extra dental visits can be reduced through teledentistry. Parents can send the intraoral pictures and describe the symptoms of their child to the dentist. The dentist can then evaluate the severity of the case and give a suitable treatment plan for the child. In cases of dental trauma to the child at home, instructions to apply ice packs at the site of injury can be given, and in cases of avulsed tooth, the parents can be asked to store the tooth in milk. Later the patient can be called to the clinic for re-implantation of the avulsed tooth.

**G. Role in Periodontics:**

In the field of periodontics, teledentistry can be used to form a treatment plan by using the store and forward method. The dentist can take photos of the patient along with the required radiographs and then forward them to the periodontist for consultation. The periodontist can evaluate the photos and radiographs and give a suitable treatment plan for the patient.

1. **ADVANTAGES OF TELEDENTISTRY DURING THE COVID-19 LOCKDOWN**

During the COVID-19 lockdown, many dental offices and institutions temporarily halted elective treatment to reduce the spread of the infection. Due to this, there was rapid adoption of teledentistry by the dentists during this time, as it helps in providing a safe and secure environment in which high-quality care can be delivered while minimizing the risk of infection. Dentists can use teledentistry as an efficient medium for specialist consultation, monitoring patients, and providing treatment plans without the patient having to visit the clinic. The dentist can also manage primary emergencies by prescribing suitable analgesics and antibiotics to the patient; this can help prolong the treatment until the lockdown is lifted.

1. **INFROMED CONSENT IN TELEDENTISTRY**

Informed consent is an integral part of the relationship between doctors and patients in the medical field. Consent used in teledentistry should cover all aspects of the standard and conventional consent form. It should also provide information to the patient concerning the inherent risk of diagnostic errors and treatment due to technical failure. The practitioners of teledentistry should take all the necessary precautions to avoid patient privacy being compromised by unauthorized persons. The patients should be made aware that their information is transferred electronically and that there are chances that it can be intercepted, despite the maximum efforts taken by the practitioner to maintain security. To prevent malpractice during the treatment, the consent form should include both the names of the referring and consulting doctors, and the consulting doctor should obtain a copy of the consent form before establishing any form of patient interaction. The medico-legal and copyright issues must also be considered in this practice. These problems mostly arise due to lack of well-defined standards. There is still no method to guarantee the quality, safety, efficiency, or effectiveness of information during its transmission. Electronic commerce poses privacy and security concerns as well as payment, financial, and taxation challenges. Legislative or judicial departments of numerous governments have yet to definitively decide on several legal issues, including licensure, jurisdiction, and malpractice.

1. **SCOPE OF TELEDENTISTRY**

Teledentistry can help improve the access and delivery of oral health care and lower its costs. It has the potential to close the gap between rural and urban communities in terms of oral healthcare. With the advancement of technology and telecommunication, teledentistry can now help provide specialized healthcare to people in remote parts of the world. Lienert N *et al.* found that tele-medical services were helpful for cases related to dental trauma in a Swiss telemedical centre and provided valuable support where a specialty dentist was not available.

Teledentistry for specialist consultations aids in diagnosis, treatment planning and coordination by sharing clinical and radiological photos of the patient among dentists. It also helps with second opinions; pre-authorization and other assurance requirements will be made instantaneously online, using real images of the dental problems rather than tooth charts and written descriptions. Teledentistry will also offer the opportunity to supplement traditional teaching methods in dental education and provide new opportunities for dental students and dentists.

1. **DISCUSSION**

Teledentistry is an emerging aspect of patient treatment that is quickly gaining acceptance and value. The exchange of information through teledentistry will result in better patient care, and the capacity to consult with colleagues more effectively will result in better knowledge of the treatment objectives and better treatment outcomes.

There are still potential shortcomings of teledentistry, including the need for sufficient training, the need for a quick response, message misunderstandings, privacy concerns, and the possibility of overlooking or neglecting the messages. It is important that the practitioners of teledentistry be aware of the legal, technological, and ethical issues that are part of this new field. The dentists must become comfortable with the technology and understand how it will affect and benefit both the patient and the dentist. Teledentistry can also be implemented in professional dental education, and this can help in building up teledental skills. Also, the instructors for the teledentistry education courses should have both teaching experience and computer knowledge.

Concerns about the cost of the telecommunications equipment have also been raised. Scuffham PA and Steed M conducted a 12-month trial of teledentistry and concluded that the cost-effectiveness of teledentistry would improve with greater familiarity and use of equipment. Almost all dental practices now have intraoral cameras, digital cameras, and computers with internet access, making teledentistry solutions easy to implement. Changes in the size, features, and pricing of various technological components have reduced the cost of teledental consultations as technology has improved.

1. **CONCLUSION**

Teledentistry carries immense promise and potential in the field of dentistry. The applications of teledentistry transcend the immediate crisis, reaching into realms such as long-distance clinical training, ongoing education, and proactive screenings. This transformative approach not only brings extended and cost-effective quality care to remote patient groups but also addresses the scarcity of specialized dental expertise in underserved rural areas. By granting primary care professionals' swift access to efficient consultations, it opens new horizons for postgraduate learning and continuous improvement. It promises a future where oral healthcare transcends physical constraints, offering inclusive and accessible solutions to patients everywhere.

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