TELEDENTISTRY: DENTAL CONSULTATIONS MADE MORE ACCESSIBLE

Abstract

Teledentistry, an evolving field of dentistry and telecommunications, has revolutionised 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

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I. INTRODUCTION

Teledentistry, an emerging branch of dentistry that connects patients and dental professionals through telecommunication. With the rapid advancement of technology, it has the potential to drastically revolutionise the present practice of dental care. This field involves the use of telecommunication technology in dental care. The term "teledentistry" was first used in 1997, and was defined as," the practice of using videoconferencing technologies to diagnose and provide advice about treatment over a distance" by Cook. It provides a new way of providing specialist advice. With the help of this, it is now possible for patients to access professional consultation through the use of telecommunication and computer technology that are not constrained by time or space.

II. HISTORY

Telemedicine began in 1924 with the idea of a patient consulting a physician over the radio using a television screen. Teledentistry was initially started by NASA in the 1970s, followed by the US military. The initial concept for teledentistry was developed during a conference in Baltimore in 1989 that was sponsored by the Westinghouse electronics group and which was developed for informatics as a part of the blueprint. 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.

III. TELEDENTISTRY

Teledentistry is the use of information technology and electronic telecommunications to facilitate oral health care in remote and rural areas through patient education and professional consultation.

It is of two types: Real-Time Consultation and Store and Forward Method.

1. **Real-Time Consultation:** This involves the use of advanced telecommunication devices, where patients and dental professionals can interact from different locations through videoconferencing.

2. **Store and forward:** This consists of the exchange of clinical information and images that are collected and stored on telecommunications equipment. The dentist obtains all the clinicalinformation, along with the radiographs, from the patient. This data is further forwarded to a professional for diagnosis and treatment planning. This thus helps provide a more precise, less time-consuming and economical treatment. In this method, the patient does not need to be present during the consultation.

IV. REQUIREMENTS

Certain technology, software, and network connections are required to practice teledentistry. A desktop or laptop with a sufficient-sized hard drive and RAM and a quick processor is required. The consulting dentist can be provided with images of great clinical value using digital, intra-oral, or video cameras, and intra and extra-oral x-ray units are necessary. For consultations through videoconferencing, speaker, microphone, and webcam are required.

V. APPLICATIONS OF TELEDENTISTRY

1. **Oral Medicine and Radiology:** With the advent of teledentistry, access to diagnosis and management of various dental problems has become easier. Early diagnosis of oral lesions such as pre-malignant lesions and vesiculobullous lesions can be made by analysing the images sent by the patient to the consulting dentist. This enables the dentist to provide appropriate instructions to the patients for the management of the condition and to prescribe medication through teleprescription. Radiographs such as intra-oral radiographs, Digital Orthopantomogram (OPG) and Cone Beam Computed Tomography reports can be sent to the dentist for early diagnosis and treatment planning of cysts, tumours, and fractures. Tobacco cessation counselling can also be provided through telecommunication. Moreover, teledentistry aids in the diagnosis of oral conditions even in remote areas.

2. **Oral and Maxillofacial Surgery:** In this branch, teledentistry plays a major role in the consultation of patients presenting with pain due to 3rd molar impaction, which is the most common complaint oral surgeons come across. The consulting dentist can forward the images and radiographs of the patient to the specialist for consultation in case of complications or a second opinion. This can also be helpful in providing economical pre-operative and post-operative evaluation of the patients in cases where transport is not feasible. Some 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 should have been patients' ostoperative status.

3. **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 the evaluation of treatment options and diagnostic plans. Minor orthodontic emergencies such as displacement of the rubber ligature, broken and exposed wire, or bracket breakage causing pain and irritation to the cheek, can be advised to be managed at home. According to Berndt *et al*. teledentistry aided in the provision of interceptive orthodontics by general dentists under the guidance of orthodontists. In case of low-income households that do not have proper access to dental care, teledentistry can help reduce the chances and severity of malocclusion. Despite the fact that teledentistry has not totally eliminated the need for in-person clinical care, most dentists and patients think that online consultations or teledentistry are more convenient and cost-effective for orthodontic treatment.

4. **Endodontics:** Teledentistry enables access to endodontic care even for the underprivileged sections of society. Patients presenting with the common complaint of pain and swelling can describe their symptoms on-call to the dentist. Further, the dentist can prescribe medications like analgesics and antibiotics to reduce the symptoms. According to Brullmann D *et al.* remote dentists can identify root canal orifices using images of endodontically accessed teeth. Zivkovic D *et al.* demonstrated that the diagnosis of the pulp and periapical lesions of the anterior teeth can be successfully done through teledentistry. It offers the additional benefit of lowering the expense of distant visits and increasing the availability of emergency treatment.

5. **Prosthodontics:** In prosthodontics, dislodged prosthesis and broken dentures are the most frequently reported problems. These problems can be managed at home by the patients with the guidance provided by the dentists. In cases of broken dentures the dentist can coordinate with a laboratory technician for the collection and repair of the denture. On-call consultations can also include instructions on denture care and hygiene.

6. **Pediatric and Preventive dentistry:** Oral health has a significant impact on a child‘s overall 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 describe their child‘s symptoms and also send pictures to the dentist. The dentist can then assess the severity of the situation and provide an appropriate treatment plan for the child. In situations of dental trauma at home, parents can be instructed to apply cold packs to the site of injury, and in cases of avulsed teeth, the tooth can be stored in milk. The patient can be given an appointment to visit the clinic for re-implantation of the avulsed tooth.

7. **Periodontics:** In the branch of periodontics, the store and forward method of teledentistry can be used to formulate treatment plans for patients. Images and radiographs of patients with gingival and periodontal problems can be sent to the specialist for further consultation. The dentists can provide instructions on-call regarding proper brushing techniques and the use of various oral hygiene aids.

VI. ADVANTAGES OF TELEDENTISTRY DURING THE COVID-19 LOCKDOWN

During the COVID-19 lockdown, many dental offices and institutions temporarily suspended elective treatment in order to limit the spread of the infection. During this time period, there was a rapid shift towards teledentistry, as this helped provide a safe environment by decreasing the chances of infections. Teledentistry can be used as an effective medium for expert consultations, monitoring patients, and providing treatment plans, decreasing the number of patient visits. Minor emergencies can also be managed by the dentist prescribing analgesics and antibiotics, which can help reduce the symptoms until the lockdown is lifted.

VII. INFROMED CONSENT IN TELEDENTISTRY

Informed consent is an important aspect of the doctor-patient relationship in the medical field. In teledentistry, informed consent should include all the aspects of the standard and conventional consent forms. The consent should also provide information to the patient regarding the risk of treatment and diagnostic errors that can occur due to technical failure. The practitioners of teledentistry should take all the necessary precautions to avoid patient privacy being compromised by unauthorized persons. Despite the practitioner's best efforts to ensure security, patients should be informed that their information is conveyed electronically and that there is a potential that it may be intercepted. The names of the referring and consulting doctors should be listed on the consent form, and the consulting doctor should receive a copy of the consent form before beginning any type of patient engagement in order to prevent malpractice during the course of treatment. The copyright and medico-legal aspects must also be considered while practicing teledentistry. The reliability, security,

efficacy, or efficiency of the information transferred cannot yet be ensured. Along with financial, payment, and tax obstacles, electronic commerce raises privacy and security issues. Legislative or judicial departments of numerous governments have yet to definitively decide on several legal issues, including licensure, jurisdiction, and malpractice.

VIII. SCOPE OF TELEDENTISTRY

Teledentistry can help improve the access and provision of oral health care while being cost-effective. It has the ability to close the gap between rural and urban communities in terms of oral healthcare. With the advancement of technology and telecommunications, teledentistry can now help provide specialized healthcare to people in remote parts of the world. According to Lienert N *et al.* at a Swiss telemedical center, telemedical services were beneficial for cases involving dental trauma and offered crucial support in cases where a specialist was not present.

Teledentistry aids in diagnosis and management by sharing clinical and radiological images with the specialist consultant. It also plays an important role in providing second opinions for complicated cases. Moreover, it helps in getting second opinions because pre-authorization and other assurance criteria may be quickly accomplished online utilizing actual dental issues as opposed to tooth charts and textual descriptions. Additionally, teledentistry presents a chance to enhance conventional teaching strategies in dental education and create new options for dental professionals and students.

IX. 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 necessity for adequate training, a quick response, misunderstanding of messages, concerns regarding privacy, and the possibility of overlooking the messages. Teledentistry practitioners must be aware of the technological, legal, and ethical challenges that may arise. The dentists must be well-versed with the technology and should know its effect on both patients and the dentist. It is possible to incorporate teledentistry into professional dental education, which will aid in developing teledental skills. Additionally, teledentistry education course instructors should be knowledgeable about computers in addition to having teaching expertise.

Concerns about the cost of the telecommunications equipment have also been raised. Following a 12-month experiment of teledentistry, Scuffham PA and Steed M arrived at the conclusion that with the increased familiarity and use of equipment would improve teledentistry's cost-effectiveness. The availability of intraoral cameras, digital cameras, and computers with internet connectivity in almost all dental offices has now made teledentistry easier to use. The price of teledental consultations has decreased as technology has advanced due to changes in the size, features, and cost of various technical components.

X. 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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