



RESEARCH ARTICLE

TELEDENTISTRY DURING THE COVID-19 PANDEMIC: A REVIEW OF LITERATURE

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Abstract

Dentistry is one of the fields that are hugely affected by the COVID-19 pandemic due to high concentrations of contaminated aerosols which can be transmitted while undergoing dental procedures and can potentially lead to the nosocomial spread of the COVID-19 virus. Teledentistry, a subunit of telehealth, is an alternative that is widely chosen to diminish in-clinic appointments and to support social distancing. The four main methods of teledentistry are live or synchronous video, store-and-forward (asynchronous), remote patient monitoring (RPM), and mobile health (mHealth). Teledentistry can be applied to all specialties including oral medicine, oral and maxillofacial surgery, endodontics, orthodontics, prosthodontics, periodontics, pediatric and preventive dentistry with high accuracy and reliability. The process of teledentistry consists of subunits including teleconsultation, telediagnosis, teletriage, and telemonitoring. Focusing on its advantages, regarding the affordability and convenience of teledentistry, it originated a paradigm shift for the prevention and promotion of oral health. COVID-19 patients can still receive dental care with the use of teledentistry. Moreover, it aids patients from rural areas where access to dental specialties is limited. However, solutions to address concerns about the image quality, digital literacy of both healthcare providers and patients, insufficient financial reimbursement of dentists, security and technical issues are required to enhance the effectiveness of teledentistry. Hopefully, this review paper can be helpful for giving information regarding teledentistry.

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Introduction:-

SARS-CoV-2, the virus causing COVID-19 infection, can be transmitted via direct (i.e. respiratory droplets, body fluids and secretions) and indirect transmission (i.e. fomites) (World Health Organization [WHO], 2019). The COVID-19 pandemic placed a burden on medical treatment for all specialties, including dentistry. Dental operations in clinical workplaces produce a great rate of virus transmission due to high concentrations of contaminated aerosols from saliva and microbial deposits (Induriat *et al.*, 2021). Dental procedures involve high-speed handpieces which are used together with water coolants to reduce heat caused by the friction of the instruments (Ge *et al.*, 2020). Aerosols from water coolants plus bodily fluids in the oral cavity create bioaerosols (Grenier, 1995). In order to prevent human-to-human and nosocomial transmission, teledentistry was taken into practice (Wakhloo *et al.*, 2020). Teledentistry is a subunit of telehealth along with telemedicine (Ghai, 2020). To define the term "teledentistry", according to American Teledentistry Association, it is the combined use of electronic information,

imaging and communication technologies to provide dental care delivery. The idea of teledentistry was first created in a conference on dental informatics funded by the Westinghouse Electronics Systems Group in Baltimore, USA in 1989. In 1994, teledentistry was used in the US Army's Total Dental Project for distant and rural areas. During the pandemic, teledentistry is a promising alternative for remote dental delivery, promoting social distancing.

Methods Of Teledentistry:-

There are four methods of teledentistry listed by the American Teledentistry Association(ATDA) including:

1. Live or synchronous video: During a real-time encounter, a two-way interaction exists between a patient and a healthcare provider using audiovisual telecommunications technology. McLaren *et al.* conducted research on rural pediatric patients in 2016 and suggested that a live-video teledentistry consultation can be an effective intervention for treating patients in remote areas.
2. Store-and-forward (asynchronous): NZ Telehealth Forum and Resource Centre describes that collected clinical information including demographic data, medical history, documents, images, and pre-recorded videos are sent to practitioners for evaluation. The asynchronous model is likely to be less expensive compared to other models (Aquilantietal., 2020).
3. Remote patient monitoring (RPM): The data is usually related to physiology such as vital signs, weight, blood pressure (Center for Connected Health Policy, 2021). However, it can also be self-reported symptoms or activity levels (NZ Telehealth Forum and Resource Centre, 2021).
4. Mobile health (mHealth): mHealth is the use of mobile and wearable health information and sensing technologies with mobile phones, tablet computers, and personal digital assistants (Kumar *et al.*, 2013 and ATDA, 2017).

Roles Of Teledentistry In Each Speciality

1. Oral medicine: In 2021, Amthae *et al.* reported that all 31 patients who used teledentistry services during the COVID-19 pandemic in the Oral Medicine Clinic were in the satisfied and very satisfied categories due to the convenience and effective communication. Torres-Pereira *et al.* conducted a study by sending digital images by email and those images were diagnosed by two oral medicine specialists. Both consultants made a correct diagnosis for 15 out of 25 cases (60%). 7 cases (28%) were accurately diagnosed by only one consultant while the other 3 cases (12%) were wrongly diagnosed by both consultants.
2. Oral and maxillofacial surgery: A study at the Oral and Maxillofacial Surgery Department of Ordu University was conducted on 21 patients with a dental implant, minor surgical procedure (third molar surgery), dental infection and medication-related osteonecrosis of the jaws (MRONJ) and temporomandibular joint disorder (TMD) which needed follow-ups. Participants were contacted via WhatsApp and their examinations have been carried out via video call and the accuracy was evaluated after the face-to-face examination in the clinic. Patients rated a satisfaction level of 71% for video calls and 95% for face-to-face examination. Also, for the clinicians, no significant differences were found regarding the quality and accuracy of the examination (Toruletal., 2021). In another study by Rollert *et al.*, all 43 patients were assessed correctly after using telemedicine consultations for preoperative assessment of dentoalveolar surgery with general anaesthesia and nasotracheal intubation.
3. Endodontics: Endodontists can remotely examine pre- operative, post- operative and emergent oral imaging (Maret *et al.*, 2020). Teleradiology is a tool that helps triage patients referred by general dentists to endodontists (Rodríguez *et al.*, 2017). Internet-based teledentistry can be successfully utilized in the diagnosis of periapical lesions of the front teeth (Zivkovic *et al.*, 2010).
4. Orthodontics: Hansa *et al.* conducted a preliminary study on tele-orthodontics about Dental Monitoring™ (DM) usage on appointment efficiency and suggested that Dental Monitoring could help reduce the number of appointments. Moylan *et al.* investigated the reliability and accuracy of a smartphone-based orthodontic treatment-monitoring application in patients undergoing orthodontic treatment with a rapid maxillary expander and found out that the software could provide an accurate assessment of linear tooth movements.
5. Prosthodontics: Ignatius *et al.* studied the use of videoconferencing for consultation in dental prosthetics and oral rehabilitation. Both patients and dentists were satisfied with the quality of the technology. Mladenović *et al.* presented telemedicine consulting in the patient preparation and planning of prosthetic tooth replacement in 3 cases with different teleconsultation requirements and all consultations were successful without having to go to a regional centre.
6. Periodontics: Periodontal diseases are preventable and noncontagious. Online patient periodontal education, preliminary diagnosis, and oral hygiene instructions (OHIs) could significantly save time with patients in the clinic. Proper practice of oral hygiene could also reduce periodontal inflammation before visiting the

periodontist (Khursheed, 2020). A questionnaire-based study from Menhadjiet *al.* was conducted for 6 months during the COVID-19 pandemic in 2020 to examine patients' and dentists' perceptions of teledentistry. In periodontics, scheduled and non-emergency cases can be treated by teledentistry such as supportive periodontal therapy.

7. Pediatric dentistry: Teleconsultation is the most common form of teledentistry that parents, caregivers or school teachers can seek advice for pediatric patients. Parents can also use their smartphones to take pictures of their children's teeth and to provide information to the pediatric dentist. Smartphones can facilitate the diagnosis of emergencies related to early childhood caries (ECC), dental pain, traumatic dental injuries (TDI), and facial swelling (Nuvvula and Mallineni, 2021).
8. Preventive dentistry: Teledentistry can be used for providing preventive services and oral health education in community settings, such as schools, by dental team members without onsite dentist supervision during the pandemic (Brian and Weintraub, 2020).

Benefits Of Teledentistry

Teledentistry is considered a viable solution to tackle difficulties in dental care delivery due to the COVID-19 situation in many countries around the world (Ghai, 2020 and Giudice *et al.*, 2020). It originated a paradigm shift for the prevention and promotion of oral health (Fernández *et al.*, 2021). Teledentistry consists of subunits including teleconsultation, tediagnosis, teletriage, and telemonitoring. In the beginning, the consultation can be via telephones or video conference, which are also helpful for the handicapped (Mishra *et al.*, 2020). Tediagnosis is the exchange of images and data to diagnose oral lesions (Leao and Porter, 1999). Teletriage is the appropriate disposition of patients' symptoms via smartphone by specialists (Estaiet *al.*, 2020). Teledentistry is an effective way to triage patients for problem-focused evaluations in order to limit office visits of patients during the COVID-19 outbreak (Zahra *et al.*, 2020). Besides, telemonitoring can be conducted by virtual monitoring instead of physical visits at the clinic (Marino and Ghanim, 2013).

Overall, teledentistry is beneficial in terms of its affordable price (Clarke *et al.*, 2014) and convenience by saving time on travelling a long distance to see a specialist (Rahman *et al.*, 2020). People in rural areas or those with limited access to specialists can also receive dental care (Surdu and Langelier, 2020). Especially during the pandemic, teledentistry can maintain social distancing and reduce potential exposures of patients, providers, staff, and communities to COVID-19 (Wilson, 2021).

Limitations Of Teledentistry

The overall adoption of teledentistry has been slow and inconsistent due to a lack of professional readiness, lack of clear intraoral imaging, financial issues (Haider *et al.*, 2020). Some dentists may face technological challenges due to unprepared digital literacy and the system's complexity (Smith *et al.*, 2020). Insufficient financial reimbursement also contributes to a lack of acceptance by dental professionals (Estaiet *al.*, 2016). The reliability and accuracy of teledentistry may be limited to image quality (Alabdulla *et al.*, 2018). Aboalshamat reported common barriers of patient satisfaction requiring a dentist's physical presence, violation of patient privacy and low levels of population education. Moreover, a study by Al-Khalifa and AlSheikh revealed that participants showed high concerns related to security, technical issues, digital forgery (76%), hardware incompatibility (78%), and equipment reliability (75%). Patients should be informed that their information will be through electronic transmission and there is still the possibility of data being intercepted, despite high efforts to maintain security (Chang *et al.*, 2003).

Conclusion:-

Teledentistry comprises four methods of delivering dental care including live or synchronous video, store-and-forward (asynchronous), remote patient monitoring (RPM), and mobile health (mHealth). First, it can be conducted with live or synchronous video, which is advantageous in terms of its real-time experience between dentists and patients. Store-and-forward (asynchronous) involves collecting and sending stored clinical data to practitioners for evaluation. This process is longer than using synchronous videos but is more affordable. Remote patient monitoring (RPM) is used typically for collecting physiology data such as vital signs. Lastly, Mobile health (mHealth) uses mobile phones, tablet computers, and personal digital assistants as a tool for receiving dental care.

Teledentistry is taken into practice by every dental speciality during the COVID-19 pandemic. In oral medicine, oral and maxillofacial surgery, prosthodontics, pediatric and preventive dentistry, many researchers successfully conducted the study to examine the accuracy of teledentistry in each field and it is mostly shown to be as reliable as in-clinic visits. In endodontics, teleradiology is also a useful tool for endodontic diagnosis. Dental Monitoring™

(DM) is the technology for orthodontics, which is reported to be beneficial for reducing the number of clinical appointments. Turning to the field of periodontics, proper oral hygiene is encouraged by researchers for lowering the seriousness of periodontal diseases in order to reduce the need for in-clinic treatment.

Despite the affordability and convenience of teledentistry to maintain social distancing during the pandemic, it is not without limits. There are some concerns regarding the image quality, digital literacy of both healthcare providers and patients, insufficient financial reimbursement of dentists, security and technical issues, which still exist and are needed to be fixed soon.

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