

Implicated Guidelines of Cost-efficient Teledentistry during the COVID-19 Pandemic for a Developing Country: A Narrative Review

Joshua MACAPAGAL^{1*}, and Shan Gayle Ann TABLARIN²

¹ Centro Escolar University School of Dentistry, 9 Mendiola Street San Miguel 1008, Manila, Philippines.

² Centro Escolar University School of Dentistry, 259 Sen. Gil Puyat Avenue 1203, Makati, Philippines
E-mail(*): macapagal882005@gmail.com

* Author to whom correspondence should be addressed; Tel.: +639152218314

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Abstract

Introduction: Teledentistry is a widely accepted procedure for dental practice during the coronavirus disease 2019 (COVID-19) pandemic. Due to the nature of strict protocols that aims to prevent the transmission of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 virus), teledentistry is the safest and cost-efficient supplementary interaction that enables dentists to gather diagnostic materials that will lead to appropriate treatment in the Philippines. This article is aimed at providing guidelines on the usage of teledentistry to bridge gaps in the absence of protocols that will help dentists achieve cost-efficient dental services. *Materials and Methods:* This article employed a narrative review through an electronic search in PubMed, Scopus, CINAHL, and ERIC databases. *Result:* A total of nine hundred thirty-four articles were gathered. Twenty-six articles and three websites were included for analysis. All included articles led to the formation of guidelines that were composed of step-by-step processes (screening, management, and postoperative communication). Screening procedures are vital in obtaining health information and available diagnostic materials. The analysis of collected diagnostic materials application leads to the classification of cases. Based on the classification, management of the cases is enabled through clinical scheduling or pharmacological management during the teledentistry interaction. Teledentistry postoperative communication facilitates the monitoring of the condition of the patients. *Conclusion:* The impact of having a cost-efficient teledentistry interaction benefits both the dentist and the patient during the COVID-19 pandemic in the Philippines. A step-by-step guideline is an appropriate approach that will ensure cost-efficiency in a developing country.

Keywords: Dental Informatics; Coronavirus Disease 2019 (COVID-19); Health Informatics; Oral Medicine; Telemedicine

Introduction

The Coronavirus disease 2019 (COVID-19) pandemic made the practice of dentistry limited in terms of clinical consultation and treatment. Any dental health facility can be a ground for viral transmission of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) because possible infected patients can enter the facility [1,2]. Efforts to make dental health facilities have been observed throughout the pandemic, but the potential viral transmission is always present. The face-

to-face nature of the conventional consultation and treatment is the highest probability of infection due to its proximity conditions. Guidelines regarding infection control and personal protective equipment have been implemented by Philippine health organizations and major health organizations around the world, especially dental organizations [3,4]. The protocols managed to give dental health facilities a sense of protection for COVID-19. During the composition of this article, COVID-19 vaccines are being distributed and taken around the Philippines [5]. Distribution may take some time to reach every community in the Philippines, so therefore physical distancing as a health protocol against SARS-CoV-2 must still be implemented by health authorities [6]. The possibility of a viral transmission inside Philippine dental health facilities implies that the frontline management of dental patients still poses a risk. The safest interaction of a dentist with a patient in times of a viral pandemic will always be under the nature of teledentistry [7]. Telemedicine is widely used during the 2020 COVID-19 pandemic [8]. The process has been acknowledged to be safe due to its distant capabilities. Teledentistry is the equivalent concept of telemedicine in the practice of Dentistry in the Philippines. Teledentistry is the information technology-based communication between the dentist and the dental patient to prevent, diagnose, and manage dental diseases [9]. Portability of the consultation process can be implemented through appropriate hardware that will enable teledentistry to function as a distant communication process. A system of video and audio transfer and feedback permits dentists to access clinical information from their patients [10,11]. The information gathered can then be analyzed by the dentist to provide a suitable treatment for the patient [9]. The aim of this article was to describe and implied guidelines in the Philippines for the utilization of teledentistry during a viral pandemic.

Materials and Methods

This study has been certified exempted by the Centro Escolar Institutional Ethics Review Board for ethical review (protocol code no. IERBDENT-123, May 20, 2021). This study employed a narrative review approach that uses a general analysis overview of previously published literature.

Search filters were limited to (1) websites related to teledentistry or health authorities, or (2) peer-reviewed journal articles related to the delivery of teledentistry, or (3) cost-efficient context of remote health care. Search databases for peer-reviewed journal articles were as follows: PubMed/Medline, Scopus, CINAHL, and ERIC. Search interval were limited to published articles in the year 1990 to 2021. Quantitative research articles, qualitative research articles, and review articles were considered for inclusion. Google Scholar was also used for the consideration of initial searching of gray literature that will help in supplementary information regarding the utilization of teledentistry during the COVID-19 pandemic. Official websites of health authorities were included if both authors agreed, and the included articles mentioned their significance. Search terms were refined from literature review key terms and Medical Subject Headings (MeSH). Elements of distant and non-distant principles have been analyzed for the appropriate context.

Table 1. Refinement of search terms

Literature Review key terms	MeSH	Refined Search Terms
“Telemedicine” or “Teledentistry, “Telemedicine during COVID-19”, “Telemedicine Guidelines”, “Remote Oral Health Care”	“Telemedicine”, “Remote Consultation”, “Dental Health Services”, “COVID-19”, “Oral Health”	“Teledentistry during COVID-19”, “Teledentistry Guidelines”, “Teledentistry or Telemedicine”, “Dental health COVID-19 or Oral health COVID-19”, and “Virtual Oral Care or Virtual Dental Care”

This paper is considered as a narrative overview or unsystematic narrative review [12]. A narrative overview can be used to describe the management of a problem [13,14]. The narrative approach has

been selected to imply guidelines to a Philippine setting during the COVID-19 pandemic from different articles related to the practice of teledentistry. Another reason for the selection of the narrative approach is that teledentistry in a cost-efficient context is difficult to subject to a systematic review due to different methodologies.

Results and Discussion

A total of nine hundred thirty-four articles were identified through database searching. four hundred thirty-seven duplicate articles were removed. Title and abstract screening of Four hundred ninety-seven articles resulted in four hundred sixty-five article exclusion. Thirty-two full-text assessments excluded six articles for irrelevance and non-eligibility. Twenty-six peer-reviewed journal articles and three websites related to teledentistry or health authorities were included for analysis. Conceptual, theoretical, and non-peer-reviewed articles were excluded. Articles that did not have the core context of teledentistry were considered non-eligible were also excluded. Books, editorials, commentary articles, thesis, dissertations, unpublished materials, and letters to the editor were also excluded. While most of the non-eligible articles only mentioned teledentistry as an educational tool for patients and students, articles and websites that are relevant for a cost-efficient teledentistry guideline were included. Articles and websites that used the English language were included.

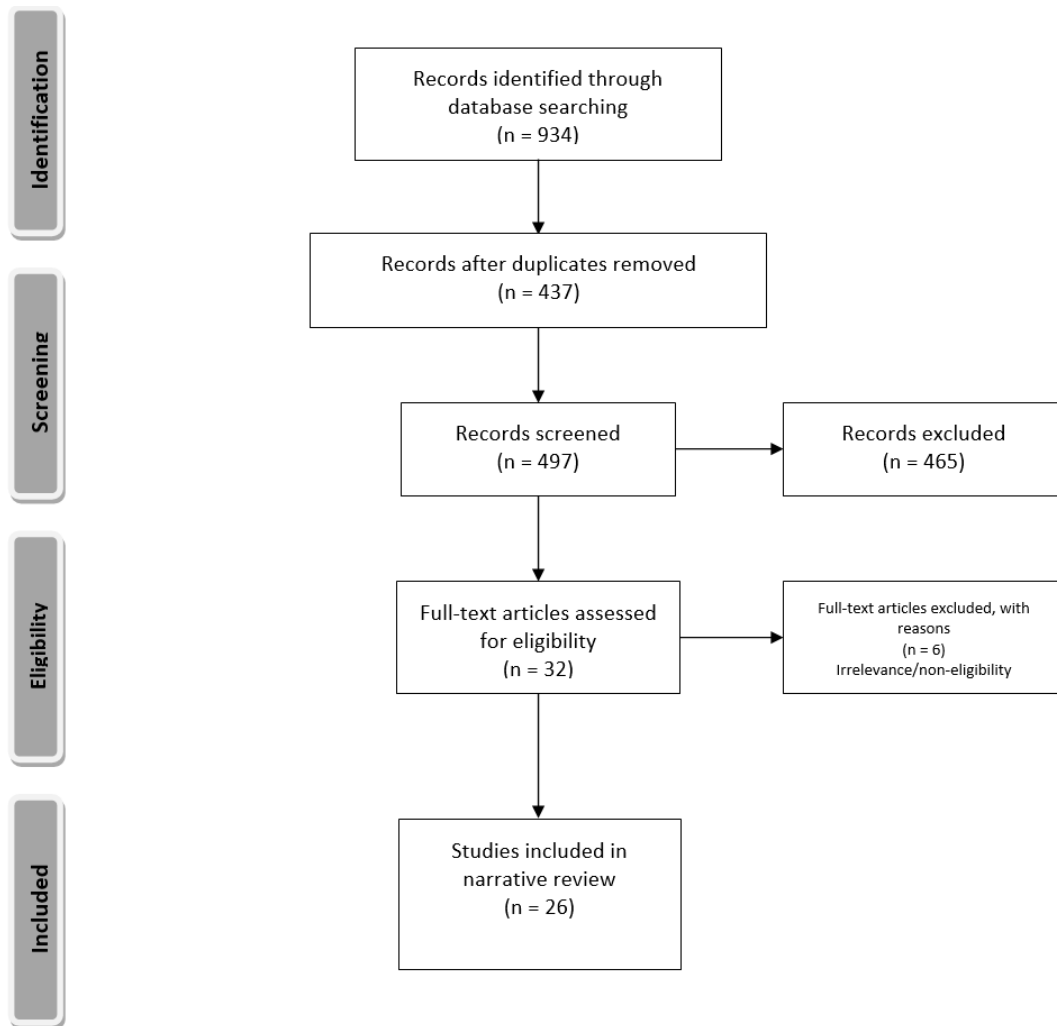


Figure 1. PRISMA Flowchart of reviewed articles

Cost-Efficient Teledentistry

Cost-efficient means that resources are less utilized while achieving acceptable results from the process [9]. Health organizations implemented teledentistry for reaching patients safely. At the same time, there is evidence of the lack of policies, human resources, and technological resources to implement telemedicine and teledentistry in the Philippines. The implementation in the global context reduced the cost of health care for the patients and the health care practitioner [9,15]. Traveling to the health care facility is one of the studied factors that suggested telemedicine and teledentistry cost-efficient because of the absence of travel cost [16]. The same concept can also be applied to teledentistry in the Philippines. Some telemedicine or teledentistry applications are not free and may cost health organizations and patients for their usage (e.g., CareStack, Open Dental, Denticon, and Dentrrix). The applications are subscription-based [17]. Subscription-based applications are costly but will have more features than free video-conferencing applications. Some countries are utilizing subscription-based Teledentistry applications, which can be paid through a universal health care payment system [18]. The circumstance regarding the universal health care payment system still requires financial resources. Characteristics of a good teledentistry application include hardware compatibility, scheduling features, digital prescription, and security. Video-conferencing software applications (e.g., Zoom, Google Meet, Microsoft Teams, and Skype) are well appreciated in terms of distance communication during the COVID-19 pandemic [19]. The applications are known to be free for usage. For teledentistry to achieve a significant cost-efficient state, the video-conferencing software application of choice must be free for the public. This article propagates the idea of having a free video-conferencing application that will result in the allocation of other resources, especially in a developing country that has limited resources for the implementation of teledentistry. Costs that may be used in subscription-based applications may be allocated to other purposes. The choice of having a free application in the Philippines enables dental health practitioners to plan and maximize resources that will contribute to the overall performance of the dental health facility [15,20].

Guidelines for Teledentistry Interaction

No known major organization in the Philippines has claimed technical guidelines for cost-efficient teledentistry. General considerations for the use of teledentistry include but are not limited to: (1) Clinical Dentistry, (2) Video-conferencing application, (3) Patient's rights, and (4) Cybersecurity.

Clinical Dentistry has always been the means to provide adequate professional oral health care. Dentists who will use teledentistry should always keep in mind that clinical management of oral diseases is the top choice in the practice of Dentistry [21]. The choice of having a video-conferencing application is based on the preferences of the management of the dental health institution. The importance of a homogenous use of an application among the dentists in an institution depicts uniformity for communication, familiarity of operations, and recognizable troubleshooting methods for technical issues of the application. Patient's rights should always be considered by any health care professional in any medical setting interaction. Access to the appropriate and sufficient treatment must be available for the patients. Patients are always involved in treatment planning for their cases, and patients' records should always be confidential. Patient confidentiality must always be considered in any teledentistry interaction to avoid issues with any legal regulations [18,22]. Regulations that preserve the patient's records to be confidential involves having cybersecurity. Video-conferencing applications and hardware must have security features that will keep record storage confidential.

Figure 2 represents a flow of procedures in the implementation of teledentistry. The dentist and patient communicate via a video-conferencing application. The process of screening, management, and post-operative monitoring are emphasized for their importance during a pandemic.

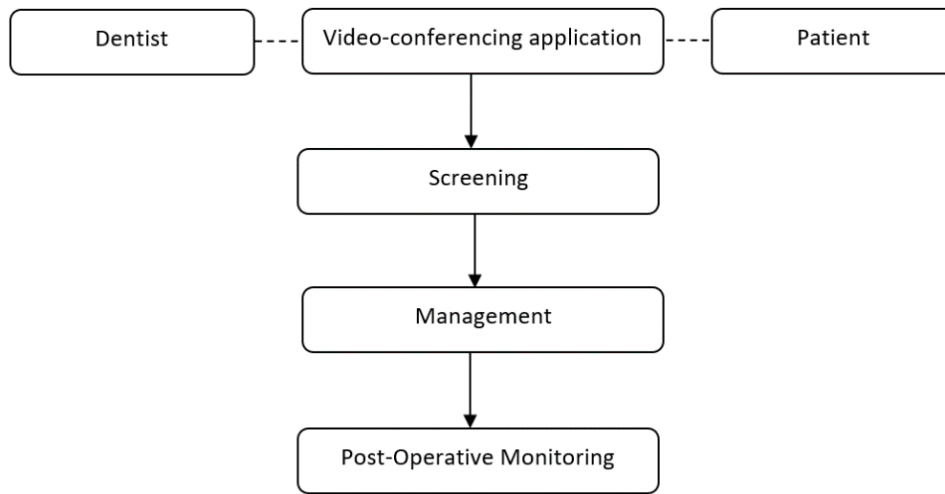


Figure 2. Flowchart of a Teledentistry interaction

Screening

Initial screening is the preliminary process of identifying the current condition of the dental patient. Epidemiologic screening of COVID-19 symptoms is done before oral health screening. The identification of signs and symptoms relating to COVID-19 disease is emphasized for triage. The dental practitioner must question the patient during the initial screening. In this phase, the dentist and the patient are communicating through the video-conferencing application with their audio and video feedback. Questions regarding the dentist’s quality of sound and video should be asked initially before any health-related questions. A clear communication line should be present to prevent misunderstanding of instructions. Table 2 shows a structured assessment regarding the signs and symptoms.

Table 2. Initial screening questions

1. Do you experience any of the following symptoms?	
<ul style="list-style-type: none"> • Cough • Fever • Difficulty breathing • Fatigue • Headache 	<ul style="list-style-type: none"> • Loss of Smell • Loss of Taste • Diarrhea • Nausea or Vomiting • Sore Throat
2. Have had any close contact with anyone with a suspected or confirmed COVID-19 case in the past 10 days?	
3. Have you had a positive COVID-19 test? Or awaiting any COVID-19 test?	
4. Did you travel outside the country in the past 10 days?	

The emphasis of gathering clinical information regarding the possibility of the patient having an infective viral agent is present in Table 2 [3,23]. The screening personnel may use verbal or typewritten questionnaires in the initial screening phase. Verbal questions are advised for an immediate explanation of the questions. After the initial screening phase, the dentist should

immediately assess the patient’s chief complaint, medical history, and dental history to analyze their condition. The gathered information will allow the analysis of dental patients for the classification and eventually influence a concrete diagnosis of the patient’s dental condition [24]. Patients undergo the classification of cases after the initial screening phase. Classification of cases is vital for the triage process. Triage is the process of determining a patient's priority to undergo treatment concerning the severity of their condition [25]. Classification of the dental patient involves the establishment of an initial diagnosis through the gathering of available diagnostic results. After classifying the case of the patient, oral health screening should be immediately done through diagnostic tools available for teledentistry.

Table 3 represents the diagnostic tools that can be sent as file attachments in the video-conferencing applications. The transfer of file attachments can be reached through the features available in the video-conferencing software applications (e.g., Google Meet and Zoom chat function) [26]. Previously taken clinical diagnostic information can be sent during the screening phase. While intraoral photographs and extraoral photographs can be provided by the patients, photographs of dental casts are usually exchanged among dentists. Requests for additional diagnostic materials can be issued during the screening phase. Dentists can request diagnostic procedures that will be taken in a clinical schedule inside the dental health facility. Almost all the preliminary diagnostic methods in Dentistry should be taken inside the dental health facility [27]. Teledentistry is considered as a supplemental method for preliminary diagnostic procedures [28]. The dentist can do immediate analysis of diagnostic materials if the diagnostic materials are available. After the analysis, the classification of cases based on the diagnosis is performed. The following is a classification of cases related to dental appointments.

Table 3. Dental diagnostic tools that can be gathered as a file attachment through teledentistry

Dental Diagnostic Tools
<ul style="list-style-type: none"> • Intraoral Photographs • Extraoral Photographs • Digital Radiographs • Photographs of Dental Casts • Cone Beam Computed Tomography Images • Dental and Medical History

Table 4 represents three categorical dental cases based on the severity of the patient’s dental condition [29]. In this phase, the dentists will use their clinical decision-making skills to identify and classify each case. Dentists should consider giving priority to emergency cases. Urgent cases are given more attention than elective cases. The triage consideration gives teledentistry a justifiable method of choice during the pandemic [30]. Consultation with a dental specialist is also acceptable and encouraged during the classification of cases [31]. Differentiation of cases depends on the dentist’s clinical judgment. After the classification of the dental case, appropriate management will be presented to the patient.

Table 4. Classification of dental cases

1. Elective Cases. Cases that do not involve an emergency or immediately life-threatening condition, e.g.:	
<ul style="list-style-type: none"> • Dental cleaning • Restoration of asymptomatic carious teeth • Esthetic procedures • Non-urgent orthodontic procedures 	<ul style="list-style-type: none"> • Preventive procedures • Fluoride treatments • Tooth whitening procedures
2. Urgent Cases. Cases that require immediate treatment to eliminate severe pain or risk of infection	

<ul style="list-style-type: none">• Significant localized swelling and pain due to abscess• Severe symptomatic pulpal inflammation• Tooth fracture with severe pain• A localized pain in the posterior molar region due to an impacted tooth• Dental trauma with tooth avulsion• Biopsy of abnormal tissue• Pericoronitis• Cementation of crown restoration• Dental treatment related to critical medical procedures• Suture removal• Denture adjustment procedures• Urgent orthodontic procedures
<p>3. Emergency cases. Cases that are debilitating or life-threatening that requires immediate treatment</p> <ul style="list-style-type: none">• Uncontrolled profused bleeding• Oral maxillofacial trauma• Diffused bacterial infection with intraoral and extraoral swelling that impedes airway

Management

Teledentistry is supplemental to the clinical management of patients. Most of the treatment in Dentistry requires a clinical visit, which can be efficiently attained through Teledentistry communication. Consideration of Teledentistry as an accompanying utility to attain appropriate management will result in cost-efficiency [32]. In the context of management, a scheduled clinical visit for treatment or pharmacological management are the two resulting activities that may be used through teledentistry. *Patients classified as elective cases or urgent cases can be given a clinical schedule after 10 days of deferment if they responded with unfavorable answers from the initial screening phase (signs hinting COVID-19 exposure). Patients who are classified as emergency cases are excluded from schedule deferment.* Immediate deferment can be given to dental cases that are considered elective. Elective cases can be reached again after 10 days for follow-up appointments. Urgent cases require immediate attention because of their circumstance. Pharmacological management for pain and localized swelling is recommended. Urgent pharmacological management can be immediately given through scanned prescription letters or digital prescriptions. Urgent cases that require clinical treatments must be done accordingly. Emergency cases also require immediate attention. Life-threatening conditions are considered the most critical procedure in the classification of cases. Emergency cases must be attended to before urgent cases [25,33].

Figure 3 represents the flow of management after classifying the dental case [33]. All cases must be properly documented. Elective cases can proceed to a clinical schedule if there is a favorable response from the patient during the initial screening phase. Urgent and Emergency cases may have postoperative pharmacological management. Teledentistry may be used as a platform for close follow-up for postoperative pharmacological management [25].

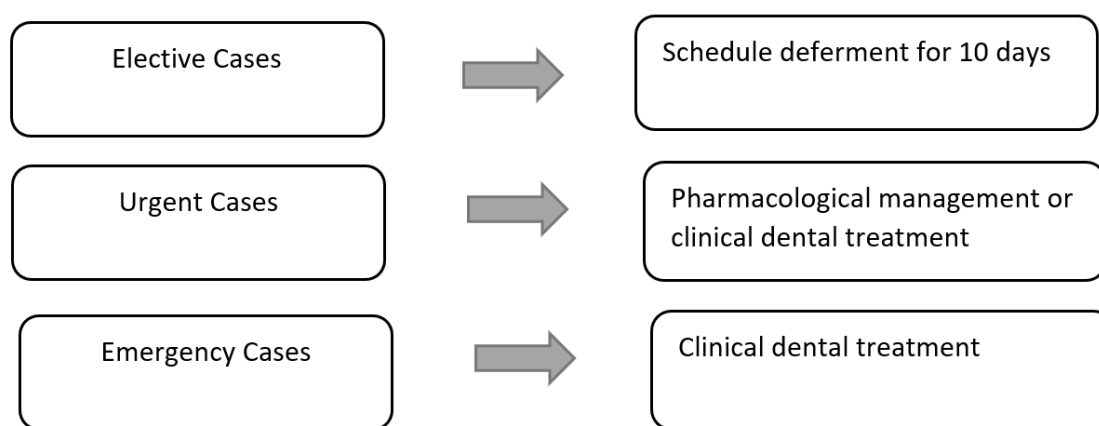


Figure 3. Classification of cases with their corresponding management.

Postoperative Considerations

The postoperative phase of teledentistry interaction is communication between the dentist and the patient after a clinical intervention or a follow-up for pharmacological management. Significant postoperative progress should be known by the dentist to justify that the treatment has been successful [34]. Through a safe process of follow-up communication, dental patients can be monitored by Dentists appropriately during the pandemic. The postoperative consultation or follow-up in teledentistry prevents the risk of infection by eliminating the need to wait inside the dental health facility, preventing unnecessary clinical appointments, and minimizing outdoor activities [35,36]. By allowing patients to consult their Dentists without waiting inside a dental health facility, the risk of infection from public places is prevented. The importance of a scheduled appointment also prevents the risk of viral infection [37]. The risk of viral transmission in a patient-to-patient interaction will be prevented inside the dental health facility if there is a system of scheduled appointments. The mentioned details also allow the allotment of clinical schedules for cost-efficient scheduling of dental appointments. Further clinical appointments are up to the dentist's postoperative judgment. Further clinical examinations, which require a scheduled appointment, can be discussed during the Teledentistry interaction. Appointments should also be triaged according to the classification of cases presented.

Technical Issues of Cost-Efficient Teledentistry

In the context of the COVID-19 pandemic, clinical absence in Dentistry prevents the risk of viral transmission. One of the limitations of teledentistry is the absence of a clinical presence between the dentist and the patient [10]. The limitation is also its considerable benefit. Various factors affect the implementation of a teledentistry interaction. The following subchapter contains the issues concerning teledentistry in the Philippines.

Hardware Issues

The Philippines has limited resources for the implementation of teledentistry in a nationwide context [38]. Primary tools needed for connectivity must be present to enable teledentistry interactions. It includes hardware (i.e. mobile phone, desktop computer, laptop computer, or tablet), software applications, and internet connection. Some patients from the urban and rural regions do not have all the primary tools needed to utilize teledentistry. Previous concerns with telecommunication in the Philippines are widely discussed in different disciplines. Internet connectivity through a fixed broadband connection and mobile data connection is an old issue in the Philippines. Some remote areas from the rural region do not have an internet connection. When compared to other countries, broadband speed and mobile data speed are not fast and stable for

optimal connection. Mobile data network connection and broadband network connection are the means to connect to the internet. The dependence of teledentistry on the capabilities of the internet shows the importance of having a stable connection [39]. Disruption of the mentioned networks will result in incapacity of the function of teledentistry. Application malfunction (e.g., screen freeze and feedback delay) may arise if there is a problem with the network connection. The transfer of file attachments may also be delayed due to network problems, which will result in the delay of immediate diagnostic analysis [9].

Software Issues

Patients and dentists may be subjected to technological challenges on software applications. Patients, who do not have any knowledge of the use of software applications for teledentistry, may prefer the traditional appointment interaction for the practice of dentistry. Technical support is a feature provided by almost all software applications but may not be immediately available. An immediate specialized technical support may not be available for free video-conferencing applications because free video-conferencing applications are utilized by multiple disciplines. They are made as a general means to communicate through an internet connection or mobile connection [40]. In relation to software applications, the technical problem of video and audio feedback are a concern in any virtual remote meetings. Software settings that disable audio and video feedback are compatibility problems that will prevent communication by disconnecting hardware services. Audio echoes may also be present during feedback but may be tolerated by the patients or dentists. Hardware incompatibility may also cause echoes that will confuse teledentistry interactions. Server-side issues (i.e. non-responding servers) of the video-conferencing application can cause the failure of communication between the dentist and the patient. The server is a centralized host of resources that enables connection between two clients of the video-conferencing application. Server-side issues are more administrative in nature and concern the application developer's management of video-conferencing applications. [41]. Adequate training with the use of software applications are recommended for dentists to maximize the potential use of teledentistry.

User-Related Issues

User-related issues include concerns of the knowledge, comprehension, and ability of the client or user in the use of video-conferencing applications and hardware. Patients and dentists must have a basic knowledge of the use of the hardware and video-conferencing applications. Concerns on the technical knowledge of desktop computers, laptops, mobile phones, and tablets will impede proper diagnosis and management [38]. Some issues from hardware and software applications can contribute to user-related issues. Clarity of diagnostic photographs may also be an issue for the dentist during the exchange of information. The stability of the connection may affect the quality of the images, videos, and audio during teledentistry interactions that may result in misdiagnosis and wrong treatment planning. The dentist's ability to recognize diagnostic details within a photograph may also be impaired if the photographic details are not recognizable. The patients' self-taken intraoral photographs are discouraged because the procedure may post difficulty producing a substantial diagnostic photograph. Proper training regarding the hardware and video-conferencing applications will address the issue.

Patient Confidentiality

Information storage and privacy have always been an issue for remote practice. As announced by the National Privacy Commission, the security of health information is also an issue that needs to be addressed in the Philippines because there have been incidents regarding information leakage. Concerns regarding the transfer of information through doctor-patient or doctor-doctor communication are issues that need security for the safety of private data. Legal issues concerning patient confidentiality are bound within the context of legislation formed by the Philippine congress towards doctor-patient confidentiality. The data privacy act of 2012 and the anti-wiretapping law are

some of the legislation that regulates the privacy between the dentist and the patient in the Philippines [42]. To avoid legal issues, the practice of teledentistry should follow a country's policies surrounding health information privacy.

Future Implications

This study only serves to synthesize previous literature to form guidelines and does not have the research data for the acceptance or usage of teledentistry in the Philippines. A future study on the acceptance, usage, and effectiveness of teledentistry during the COVID-19 pandemic in the Philippines is recommended. Research data on the actual utilization of teledentistry may help improve or modify the formed guidelines. The guidelines presented in this study may serve as a basis for educational training regarding teledentistry. Future policies and other scholarly works can also base their contents on the implicated guidelines.

Conclusions

Cost-efficient teledentistry is important in delivering a safe method of oral medicine in times of a viral pandemic. Oral diseases of confirmed cases of COVID-19 patients can still be managed through teledentistry in the Philippines. The method has a potential impact on the oral health of both COVID-19 patients and non-COVID-19 patients. All the included articles in this study have contributed to the implication of guidelines regarding teledentistry. The presence of a stable connection during the teledentistry interaction enables dentists to screen, manage, and monitor the postoperative condition of the patients. Teledentistry is supplemental to diagnostic and treatment procedures. The application allows scheduling from safe initial screening. Through a system of screening and classification of cases, teledentistry effectively supplements the treatment of oral diseases. The preference for cost-efficient application is beneficial in times of a pandemic, especially in a developing country. A cost-efficient Teledentistry video-conferencing application allocates resources that maximize the practice of Dentistry. Due to its financial-saving capacity, cost-efficient teledentistry allows Dentists in the Philippines to plan and strategize other concerns with their finances. A cost-efficient approach is appropriate for a developing country. The approach is not limited to the Philippines as it may be used in other developing countries. Information regarding cost-efficiency may also be appropriate for developed countries.

Conflict of Interest

The authors declare that they have no conflict of interest.

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