Teledentistry in the Malaysian Context: Are We There Yet?

Nor Shafina Mohamed Nazari[a], Sharifah Wade'ah Wafa Syed Saadun Tarek Wafa[b]*, Nor Adinar Baharuddin[a]

[a]Department of Restorative Dentistry, Faculty of Dentistry, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

[b]Department of Paediatric Dentistry & Orthodontics, Faculty of Dentistry, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

*Corresponding author: swwafa@um.edu.my

ABSTRACT

Teledentistry has been proven to have the potential in addressing the gap in accessing oral health care worldwide. Nevertheless, more information is needed to support evidence-based teledentistry practice in Malaysia. The article aims to review teledentistry in view of implementing it to be a common practice in Malaysia. The authors describe teledentistry application worldwide, as well as its uses in the field of service and education. The article summarises the needs of teledentistry in South East Asia, as well as the ethical perspectives and legal practices. In addition, the article also reviews the opportunities arising from practicing teledentistry, including during the unprecedented COVID-19 pandemic. Following review, teledentistry seems to be a promising path as it could offer solutions to shortages in the workforce, high demand for treatment needs and unequal service distribution due to lack of accessibility in rural areas in Malaysia. Furthermore, teledentistry can extend care to underserved patients and provide opportunities to supplement teaching in dental education. The authors provide recommendations to overcome challenges to ensure a sustainable teledentistry. Incorporating teledentistry into practice in Malaysia is achievable but proper guidelines are required.

Keywords: Developing countries; teleconsultation; teledentistry; telediagnosis

INTRODUCTION

"Tele" is the Greek word for "distance", and hence, teledentistry refers to the practice of dentistry at a distance. Teledentistry was first introduced in the 1970s by the National Aeronautics and Space Administration (NASA) (Currell e*t al.*, 2000). Then in 1989, the initial concept of teledentistry was developed as part of the blueprint for dental informatics (Chen *et al.*, 2003). However, teledentistry remote consultation was only confined to the United States Army in 1994 (Rocca *et al.*, 1999). Later, teledentistry was redefined as "The practice of using video-conferencing technologies to diagnose and provide advice about treatment over a distance" (Cook, 1997). Over time, the remit of teledentistry has expanded beyond diagnosing and providing advice on dental care (Fricton & Chen, 2009); it is now also encompassing dental education and public awareness (Clark, 2000).

Feasibility

Technological innovations and high-speed internet networks contribute to the feasibility of teledentistry. In addition, mobile phone manufacturers are vying with each other allowing the devices to reach consumers at affordable prices. The high-quality inexpensive smartphones are equipped with digital photography, as well as the ability for data processing and accessing low-cost, secure cloud storage. These features enable pre-operative images, clinical notes and information tasks to be sent from one dentist to another dentist and/or a consultant for the purpose of confirming diagnosis and preparing an appropriate treatment plan. Besides, given the portability of smartphones, these devices are handy to be used as point-of-care devices in order to improve the delivery of patient-centred care.

In Malaysia, high-speed internet networks exist in the form of broadband internet with average speed of 2 Mbps for the general public and higher speed in key economic areas (Gong, 2020). The high-speed internet network is currently supplied as 3G and 4G services, although there is a plan to upgrade the network to 5G in the near future (Ministry of Communications and Multimedia Malaysia, 2021). Nevertheless, 3G and 4G services are still reasonable for general internet access. As of 2020, the percentage of internet users in Malaysia was close to 90% (Department of Statistics Malaysia, 2020a). Among these, the internet was mostly assessed via smartphones for the purpose of communication, social media usage, information acquisition and economic activities. The high percentage of internet users is attributed to the affordable internet pricing in Malaysia (Gong, 2020).

In summary, teledentistry services have the potential to be well-delivered similar to its face-to-face counterpart in Malaysia. There are possible applications for teledentistry, including providing consultation and follow-up care. However, a dentist who utilises teledentistry should also be equipped with sufficient knowledge about the nature and availability of local dental resources to provide appropriate further care to a patient following a teledentistry encounter. For example, a dentist shall refer a patient who suffers common dental emergencies such as toothache or swollen gums to a nearby dental facility. In a more serious scenario like facial injury due to sports or motor vehicle accidents, a dentist should direct the patient to an emergency department. It is also important to note that the subtle nature of oral conditions may confound high technology devices. For example, certain lesions may not be easily differentiated or appear similar in intraoral images. Therefore, on-site consultation would still be required for definite diagnoses and appropriate treatment planning for these cases.

Fig. 1 shows that teledentistry is applicable in three ways namely real-time consultation, store and forward method, and remote-monitoring (Reddy, 2011). In a typical real-time teledentistry consultation, the setups at both hub and remote sites include special video conference equipment, an intraoral camera with high resolution and an internet connection (Fricton & Chen, 2009). These setups would allow general dentists and their patients to communicate with one another from different locations (Subramanyam, 2002; Chang *et al.*, 2003).

On the other hand, the store and forward method requires the dental practitioners to collect the appropriate clinical information, including extraoral photographs, intraoral images and radiographs (digital or scanned), before forwarding them to the patients through either established networks or the internet for the purpose of consultation and treatment planning. By doing so, the consultation and treatment planning can be provided in a timely, targeted and cost-effective manner (Chang *et al.*, 2003).

For remote-monitoring, teledentistry is being utilised for monitoring patients at a distance. For instance, patients' treatment progress can be assessed remotely by instructing the
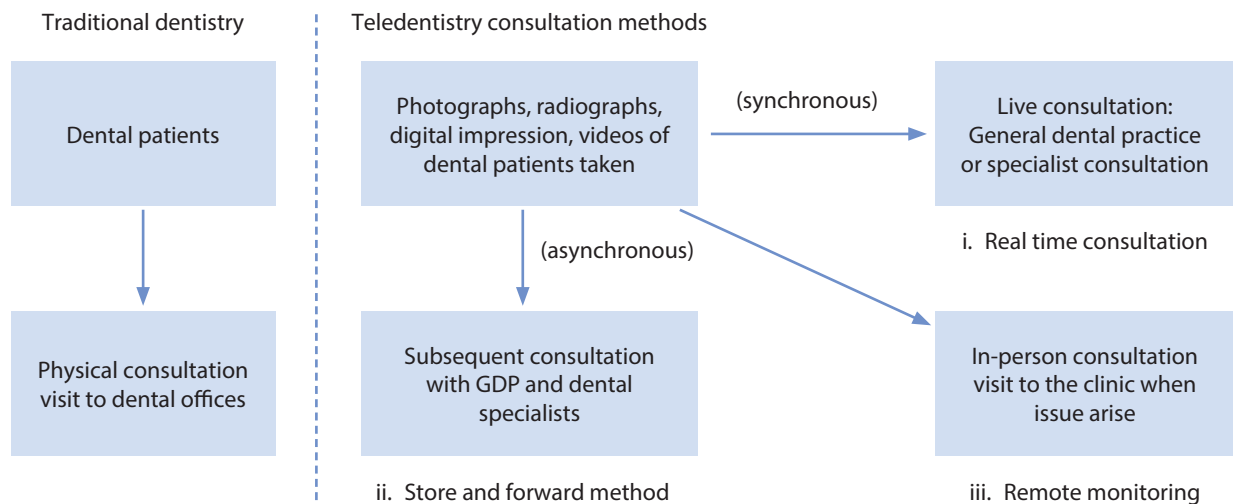
Fig. 1 The difference between traditional dentistry and teledentistry consultation methods.

patients to take standardised photographs at certain time intervals and clinicians can be alerted when abnormalities are detected (Roisin *et al.*, 2016). In short, teledentistry enables the patient to reach a dentist and/ or a specialist at another site, thus saving time and energy. Besides, this permits early diagnosis, consequently allowing preventive treatment and early intervention in order to prevent or reduce the progress of oral diseases.

The Need for Teledentistry

Teledentistry in South East Asia (SEA)

Teledentistry is new in this region hence the lack of practice or even reports on it. This could be due to clinicians' low acceptance towards changes in practice (Wade *et al.*, 2014), as well as, perception and knowledge about teledentistry (Boringi *et al.*, 2015). To the best of our knowledge, Singapore is the only country in this region to have a legal documentation on teledentistry (Dental Protection, 2015a).

Malaysia is a country in the SEA with a population of 32.73 million (Department of Statistics Malaysia, 2020b). Despite its rapid development, whereby the population moves to urban areas in search of better economic opportunities, it is estimated

that about a quarter of the population are still residing in the rural areas. With regard to the expenditure on the health sector, Malaysia spends about 4% of the gross domestic product (GDP). In 2017, the total expenditure on health (TEH) was RM57,361 million (Ministry of Health Malaysia, 2019b). The capital, Kuala Lumpur, received RM8,653 million TEH that year for a population of 1,791,300 people. In the same year, a more rural Sabah, received RM3,232 million TEH for a population of 3,866,800 people. This succinctly shows that more focus has been given to the urban areas, including dental health. Given such a scenario in Malaysia, teledentistry would bring additional value to the existing dental health care system in Malaysia by bridging the access to oral health care between the rural-urban divide. This is evident in India where lack of specialists and comprehensive facilities in the suburban areas was reported, but later with teledentistry, specialist's consultation can be sought even in remote areas (Shailee *et al.*, 2013).

Distribution of dental services

Teledentistry can help in reducing the disparities in distribution of dentists and dental services. In 2016, the dentist-to-population ratio in Malaysia was 1:4,297 (Malaysian Dental Council, 2017). This

ratio was targeted to reach 1:3,000 by 2020 (Malaysian Dental Council, 2015). The distribution of dentists was also concentrated in Peninsular Malaysia, in particular the urban areas (Malaysian Dental Council, 2015), with the majority (63.7%) of dentists working in the public sector mainly under the Ministry of Health (Malaysian Dental Council, 2017). Similar scenario occurs with dental specialists. The numbers of specialists across dental specialties were low, with a total of 369 specialists working under the Ministry of Health Malaysia in 2018 (Ministry of Health Malaysia, 2019a). Therefore, introducing teledentistry in the country would make dental health services more accessible to general population.

Md Bohari *et al.* (2019) had mapped private and public dental practices against the Malaysian population using the geographic information system. Among the 127 districts populated in Malaysia, they mentioned that 119 districts (94%) have at least 1 dental clinic and 64 districts (50%) had fewer than 10 dental clinics. Furthermore, about 11.3% Malaysians did not reside within 20 km radius of any dental clinic. The study reported the total dental clinic-to-population ratio as 1:9,000, with 1:38,000 and 1:13,000 for public and private clinics, respectively. They concluded that dental services were distributed (1) relative to high population density, and (2) unevenly across Malaysia, where the highest inaccessibility to a dental service was in Malaysian Borneo. Thus, teledentistry would benefit the dental service in Malaysia by ensuring accessibility to dental care for those in remote areas.

Ethico-legal Issues in Practising Teledentistry

There are legal issues on licensure, patient's privacy, and confidentiality, as well as ethical concerns. Clinicians must be made aware of the regulations of these issues prior to practicing teledentistry.

Regulations

Teledentistry is the dental counterpart of telemedicine. Since there is no specific law for teledentistry in Malaysia, the law for telemedicine is being observed. In Malaysia, the Telemedicine Act 1997 (Attorney General's Chambers of Malaysia, 1997) was enacted to regulate the practice of telemedicine and other matters connected therewith. It covers eligibility and regulations to practice telemedicine, as well as informed consent process.

According to the Telemedicine Act 1997, for a clinician to practice telemedicine, they must be registered with a valid full practicing license and endorsed by the council. The Malaysian Medical Council (2020) has outlined its virtual consultation guideline specifically for the COVID-19 pandemic. In the guideline, it was mentioned that "Physicians are advised that they must possess adequate training and competency to manage patients through telemedicine." To date, no training and guidelines are available for dental practitioners to practice teledentistry. Since licensure and regulations of teledentistry may vary in different countries, clinicians must comply with the local law and regulations. Thus, a national guideline is mandatorily necessary to ensure a legal and safe practice of teledentistry in Malaysia.

Consent

Written consent must be obtained from the patients, and parents or legal guardians for those below the age of 18 years old. For the consent to be valid, the practitioners must inform the patients or the guardians of the following (Malaysian Medical Council, 2020):

1. Rights of patients to withdraw consent at any time without affecting future care or treatment.

2. Potential benefits, risks and consequences of telemedicine.

3. Confidentiality protection to any information about the patients gathered during telemedicine interaction.

4. Prohibition on disseminating any data generated, communicated and used from the telemedicine interaction without the consent of the patients.

Informed consent for teledentistry should be like the standard, traditional consent process and shall cover everything that exists in it. The consent must be recorded and kept alongside the patient's dental physical or electronic records. Besides, patients must be informed that despite all precautions taken to ensure confidentiality, there are still possibilities that the information might be accessed by an unauthorised person. Patients must also be informed on the limitations of examination, diagnosing and treatment via teledentistry. They may still need to come to the hospital or clinic if deemed necessary (Arora *et al.*, 2019).

Privacy and confidentiality

In order to protect the patient's privacy, teledentistry sessions should be conducted in a closed area. It should only involve the clinician, the assistant and the patient (with the addition of parents or guardians for minors). Patient's confidentiality must be secured for this purpose. Apart from issues on the patient's side, there are also issues about data storage and sharing. Concerns were raised regarding data security, inappropriate access of records (Estai *et al.*, 2016; Alsharif & Al-harbi, 2020) and risk of data forgery (Alsharif & Al-harbi, 2020; Estai *et al.*, 2020). These could possibly take place during information transfer (Favaretto *et al.*, 2020) and due to unauthorised access to the data storage system. Hence, a stable storage system with a layer of security to protect access from unauthorised users, such as password-protection, is necessary to ensure safe keeping of records since digital technologies are commonly vulnerable to hacking (Filkins *et al.*, 2016). With regard

to data sharing, global connection allows information sharing but it is unethical to share with unauthorised parties as this may compromise patient's confidentiality. In some countries, sharing information outside the practicing country or state is prohibited by the law unless expressed permission is obtained prior to consultation (Dental Protection, 2015b; Bhargava *et al.*, 2019).

Record keeping

Good record-keeping is essential to safeguard practitioners in meeting legal requirements, and aid the investigation of any incidence, complaints or any medico-legal issues (NHS, 2019). With teledentistry, the standards of record-keeping are the same as when the patients are seen in the clinical settings. Patient's records must be created and maintained throughout the teledentistry service. The records shall be kept for a specific period according to the statutory requirements for retention of records based on local laws.

Risk of malpractice

Inadequate and inaccurate information can contribute to malpractice since in teledentistry there is no personal interaction and perhaps delayed in consultation (store and forward method). Technical issues such as hardware malfunction, connection disruption or poor quality of picture can lead to malpractice (Bhargava *et al.*, 2019). When there are doubts, patients should be called for a face-to-face examination prior to a definitive diagnosis, treatment plan and potential referrals.

Studies have demonstrated high sensitivity and specificity of teledentistry screening (Estai *et al.*, 2016), as well as comparable results between photography and face-to-face visual examination (Estai *et al.*, 2018). Nevertheless, it is still limited to a certain condition (Irving *et al.*, 2018), as well as the competency of properly trained telepresenters (McLaren *et al.*, 2017). Irving

et al. (2018) argued that the quality of studies included in the systematic review by Estai *et al.* (2018) was only fair, and consequently the results may be biased. Thus, there is a possibility that failures of teledentistry were not reported in the outcomes. Another study by McLaren *et al.* (2017) reported that Estai *et al.* (2018) were only looking at a small number of patients' records, and therefore, results may change with a bigger number of records.

There are two main questions from the clinicians' perspective. First, is it safe to practice teledentistry? Second, if we were to practice teledentistry, does malpractice insurance cover teledentistry? The malpractice in teledentistry may be compounded by technicality issues beyond clinicians' control. As for now, the indemnity and malpractice insurance only cover face-to-face procedures. Looking at the current COVID-19 pandemic situation, teledentistry becomes more relevant and necessary compared to before. Hence, there is a great need for insurance protection to be available in the country.

Opportunities Arising from Teledentistry

Convenience for the patients

Teledentistry would reduce the number of face-to-face visits and consequently easing the patients' burden towards attending dental treatment. In a virtual dental care clinic in the United Kingdom, a survey done to patients revealed that such clinics would reduce the time taken for attending a face-to-face visit, specifically on travelling time, finding a carpark and waiting time prior to being called into the consultation room. As a result, the patients found it easier to plan for childcare and work (Rahman *et al.*, 2020). The survey also reported that more than 90% of patients would like to attend the virtual clinic again. In another study at a university dental setting in Minnesota, patients reported less distance travelled with a teledentistry programme. The patients

only need to travel between 12 and 13 miles when teledentistry is involved in comparison to 300 miles when attending conventional dental visits in order to consult a specialist (Fricton & Chen, 2009).

Widening dental health care promotion and screening of dental diseases

Teledentistry can be a great model for prevention strategies and early detection of dental diseases, especially those in remote areas (Bradford *et al.*, 2016). For example, teachers or school staff can be trained to assist in dental screening on school children and this has been shown to have positive impacts on dental care (Sankaranarayanan *et al.*, 2005; Nunn *et al.*, 2009; de Silva *et al.*, 2016). To depict an example, a group of researchers in Western Australia is utilising a screening protocol using the store-and-forward method (Estai *et al.*, 2020). In this protocol, non-dental personnel have been trained to capture dental photographs of school children using a mobile phone application. These photographs are stored securely in the mobile phone application and then assessed remotely by oral health therapists for treatment plans. Later, the treatment plan will be mailed to the parents. Another example is in Rochester, where a similar teledentistry programme had successfully screened 123 children (Kopycka-Kedzierawski *et al.*, 2006). The results of the study revealed that almost 40% of the children aged 1 to 2 years old had active dental caries.

Ease of referral from primary care

A community dental service in Belfast in collaboration with the Oral Medicine Department at the School of Dentistry Belfast Trust had set up a prototype teledentistry system for oral medicine referral. With this, the feasibility of teledentistry for oral medicine referral was positively established (Bradley *et al.*, 2010). One of the challenges in dentistry revolves around high-risk lesions. Identification of

these lesions is not easy for untrained health care practitioners and its access to referral is difficult to those living in remote areas (Sungwalee *et al.*, 2016). Recently, a mobile phone application named MeMoSA® (Mobile Mouth Screening Anywhere) was developed to screen high-risk oral lesions, and its feasibility of documentation and communication for management decisions were evaluated (Haron *et al.*, 2020). Interestingly, in comparison to clinical oral examination, the use of this mobile phone application has almost 90% sensitivity in detecting a lesion. It enables documentation of the lesion through easy photography and facilitates patient management through quick communication between dentists and specialists. This makes it a reliable tool for early detection of high-risk oral lesions in low-resource settings and potentially could increase the access to healthcare in geographically hard to reach populations (Ching & Memosa Working Group, 2018).

New normal

Although transmission of COVID-19 is mostly by symptomatic patients, the absence of transmission from asymptomatic patients cannot be ruled out. Thus, in the era of COVID-19, teledentistry may replace some routine dental practices in order to prevent the spread of disease from COVID-19-infected persons to the dental personnel and other patients. Teledentistry enables pre-screening of patients even before their arrival to dental settings, in which their risks and symptoms can be screened. If the risk is high, face-to-face appointments can be scheduled later when the risk is low. In this new normal, dental consultation can be undertaken with the real-time as well as store-and-forward methods and monitoring of disease can be done via remote-monitoring.

RECOMMENDATIONS

Here are the recommendations to overcome the challenges of having a sustainable teledentistry:

1. Developing a guideline specifically on teledentistry based on the Telemedicine Act to address legality issues including licensure, patient's privacy data protection and fraud.

2. Credentialing of the clinicians to ensure safe practice of teledentistry amongst dentists.

3. Introducing standard operating procedures related to teledentistry in Malaysia, including a referral pathway, to avoid any legal issues and ensure patients' safety.

4. Having a clear and effective complaints procedure pertaining to teledentistry practice.

5. Provision of insurance coverage by insurance companies should be extended to teledentistry users to protect both patients and clinicians.

6. Using teledentistry as a new norm beyond the COVID-19 pandemic, be it for dental care or education purposes.

7. Training for non-dental personnel as telepresenters in terms of capturing appropriate images and information, as well as familiarising them with the referral pathway in order to minimise the risk of malpractice and errors.

8. Including teledentistry in dental training programmes.

9. Collaboration between clinicians and technology experts to work together in producing a teledentistry system that suits the needs of the Malaysian population.

10. Ensuring sufficient technologies and internet penetration in rural areas by policymakers.

CONCLUSION

The COVID-19 pandemic has caused a sudden change to the traditional practice of dentistry and forced clinicians to explore teledentistry. Besides, teledentistry could offer solutions to shortages in the workforce, high demand for treatment needs and unequal service distribution due to lack of accessibility in rural areas in Malaysia. However, absence of guidelines, as well as lack of knowledge and training among clinicians would be a setback to move forward. This is not only an issue in Malaysia but rather a global issue. Teledentistry model includes clinicians-technology-patients. Despite the potential benefits, patient's acceptance to this remote concept is equally important towards the success of teledentistry.

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