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SHORT COMMUNICATION

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Reshaping dental practice in the face of the COVID-19 pandemic: Leapfrogging to Dentronics

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Since the advent of the COVID-19 pandemic in late December 2019, regular dental practice has been crippled (Odeh et al., 2020). Dentists and their assistants worldwide feel that practices regarded as routine during the pre-COVID-19 era may no longer be plausible because of continuing risk of transmission of disease to staff and patients—even from asymptomatic individuals—who may visit dental clinics with emerging virulent and highly contagious SARS-CoV-2 variants (Limeres Posse et al., 2021). Currently, the general public is reluctant to visit dentists because of inherent fears of contracting disease. Concurrently, the progressive aging of the global population increases the need for the provision of oral healthcare services and the requirement for safe facilities (Mascitti & Campisi, 2020). At the same time, the ever-changing global COVID-19 situation with waves of new variants causing new epidemics is preventing dentists from engaging in oral health programs, as they are confronted with escalating risks when they are at work. Major risks include the potential transmission of SARS-CoV-2 by fomites, droplets, and aerosols from COVID-19 asymptomatic people (Innes et al., 2021). Aerosol generating procedures (AGPs) in general dental settings increase these risks, and it is impossible to remove them entirely (Innes et al., 2021, Dudding et al., 2021).

Totally safe and reliable facilities and logistics to prevent cross infection in the current climate, and with inevitable future epidemics, need to be developed (Mascitti & Campisi, 2020). Dentists require enhanced settings for the provision of patient care. The application of Dentronics could facilitate these: Dentronics is the hypernym of a wide field of modern dental technologies, such as medical robot systems and specialized artificial intelligence, hardware, software, human-machine interaction, robot safety, and assistive functions. Until recently, there has been little use of Dentronics in dental practice, but it is beginning to gain popularity in some countries (Grischke et al., 2020). This paper delineates numerous applications of Dentronics, which every dentist can embrace for the safe and uninterrupted provision of dental care.

Dentronics can enable many activities to be performed remotely with minimal exposure to patients. These require the application of artificial intelligence and big data analytics. Artificial intelligence (AI), the term first coined by John McCarthy (1989) (McCarthy, 1989), is a technique used for tasks usually performed by humans to be superseded by a computer or a robot controlled by a computer. Big data analytics is a complex process of examining a vast amount of data to uncover hidden patterns, correlations, trends, and preferences, for example, in screening patients for oral disease (Listl & Chiavegatto Filho, 2021). Records of patients' medical and dental histories, symptoms and signs of disease, photographic images, radiographic, PET and MRI data, and results of laboratory tests can be stored and appropriately linked in computer cloud. Under digitalized systems, maneuvering such data could be done with the aid of the Internet of Things (IoT). IoT refers to a system of interrelated and internet-connected objects that collect and transfer data over a wireless network without human intervention (Balaji Ganesh & Sugumar, 2021).

With these AI-assisted technologies, scientists have invented state-of-the-art technology-embedded products and systems for dentistry. These include (1) smart goggles with LED illumination and eyesight corrections resulting in reduced eye strain, improved productivity, less time taken for patient observation (Chandrasekaran et al., 2021), (2) smart facemasks with inbuilt viral load detection facility enabling identification of COVID-19 infectious people visiting clinics (Hyysalo et al., 2021; Xue et al., 2021), (3) intelligent robotics with improved services for telemedicine, cleaning, assistance rendered in dental equipment mobility, data recording, and medicine dispatching (Khan et al., 2020), (4) 3-D printing for improved production of physical models for implants, the manufacture of dental, craniomaxillofacial, and orthopedic implants, and the fabrication of copings and frameworks for an implant and dental restorations (Jain et al., 2016), (5) intraoral cameras fitted with LIDAR sensors with improved data acquisition rate, accuracy, signal to noise ratio, and dynamic depth resolution in imaging systems, and automatic Lux level adjustments (Sandborn, 2017), (6) Convolutional Neural Network-assisted software enabling the preliminary and cost-effective screening of dental caries (Zhang et al., 2020), (7) big data handling repositories for storing patient's information and data for easy clinical decision-making, monitoring the progression of oral diseases, and pattern recognition (Nanayakkara et al., 2019) and (8) Intelligent systems for the diagnosis for oral medicines (Ehtesham et al., 2019).

These devices assist dentists in educating, screening and diagnosing, and follow-up activities with patients while maintaining good hygiene, even when dealing with large numbers for a given day. During pandemics, these devices help reduce the risk of disease transmission by shortening the exposure duration of patients compared to that of a conventional setting. Besides, such Dentronic applications can reduce the downtime or fallow time between dental patients so that the number of patients visiting a clinic could be improved. Muehlematter et al. (2021) elaborate that 222 and 240 such devices have been approved in the USA and Europe (Muehlematter et al., 2021), respectively, as medical devices to be used to ease the situation caused by the COVID-19 pandemic.

With new SARS virus variants of concern emerging globally, awareness of their probable high infectivity, high transmission (reproduction number), increased severity of disease, increased airborne time, and less effectiveness against vaccines makes the growth of Dentronics essential. While evidence for the efficacy of the above devices is limited, it is prudent to put Dentronic applications to the test as we strive to provide oral health services in these challenging times.

Dentists are currently confronted with many challenges in setting up, operationalizing, training, maintaining, and repairing facilities to provide oral health care. Public- and private-sector involvements in providing such services have been limited, particularly in developing countries. The necessary networking between professions with the range of competencies needed is absent. Inherent fears prevent many dentists from embracing these technologies. Governmental support is lacking in many countries. Approval procedures required for these devices need to be streamlined while retaining rigor. Privacy in patient's data storage systems needs to be guaranteed. In many countries, legal aspects covering ethical and privacy matters are lacking.

Standard dashboards and agreed policies are needed to facilitate data sharing among stakeholders. For example, international funders such as Welcome Trust and the Bill & Melinda Gates Foundations have mandated that funding recipients share data from research related to COVID-19 as soon as a study is complete, regardless of publication status. Nevertheless, the digital era for a sound dental practice is demanded in the COVID-19 situation, particularly in public health clinics. It will become a new normal for dentists.

The digitalization era in dental settings has just begun, and it will continue in many parts of the world in the foreseeable future. There have been many new Dentronic applications developed worldwide based on AI architecture. The time has come for dentists to deploy such applications in dental settings in averting the transmission potential of the COVID-19 virus. With these devices, a dentist can cut down the time spent on a patient's dental care; thereby, productivity can be enhanced. Such improvements then help dentists to engage in their routine work even if new virulent viruses emerge in the future.

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CONFLICT OF INTEREST

None to declare.

AUTHOR CONTRIBUTIONS

Mahesh Jayaweera: Conceptualization; Data curation; Writing-original draft. **Hemantha Amarasinghe:** Conceptualization; Data curation; Investigation; Writing-original draft; Writing-review & editing. **Newell W Johnson:** Conceptualization; Supervision; Writing-review & editing.

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