



# SLDA News

SRI LANKA DENTAL ASSOCIATION

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SLDA/2021/2022/07-08 | News Bulletin | June - July 2021 - For circulation among SLDA members

## ANNUAL GENERAL MEETING OF SRI LANKA DENTAL ASSOCIATION

87<sup>th</sup> year Annual General Meeting of SLDA for 2021 was held as a hybrid meeting on 19<sup>th</sup> June, 2021 broadcasted from SLDA Auditorium, Colombo. New office Bearers and Members were elected to the council of SLDA for the year 2021/22. Three past presidents were appointed to the Board of Trustees of SLDA.



Dr Manil C Fonseka  
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## 42<sup>ND</sup> ASIA PACIFIC DENTAL CONGRESS

**Concepts and Critique;  
A Vision for Excellence in Oral Care**

**18<sup>th</sup> - 22<sup>nd</sup> May, 2021**

**BMICH Convention Centre  
COLOMBO - SRI LANKA**



Sri Lanka Dental Association

Organized by



Asia Pacific Dental Federation

The Sri Lanka Dental Association hosted 42<sup>nd</sup> Asia Pacific Dental Congress from 18<sup>th</sup> to 22<sup>nd</sup> May, 2021 themed 'Concepts and Critique; a vision for excellence in oral care.' This was the third APDC hosted by SLDA having hosted previous Asia Pacific Dental Congress in 1997 and 2010. The 42<sup>nd</sup> Asia Pacific Dental Congress was held as a virtual congress and was transmitted from BMICH, Colombo, with the collaboration of the Asia Pacific Dental Federation (APDF). This was the first ever virtual Asia Pacific Dental Congress to be held.

As you are aware organizing the APDC was initiated in preparation for it to be hosted in 2019. However, on the request of the APDF, South Korea was awarded the hosting rights in 2019 and we were to host in 2020. The onset of the COVID-19 pandemic impacted all global events and it was inevitable to postpone the congress to 2021. Thus it was a long and tedious process of organizing this event from 2018 with a considerable strain on finances.

The 2020 congress was shaping up very well with positive signs of it being a true mega event both in terms of the volume of international and local participants and also financially. Attractive sponsorships were confirmed through many multinationals, trade partners and even the Sri Lankan government.

Then came the Covid 19 pandemic, we lost almost every avenue of income including Sri Lankan Government grant. The International Trade had showed reluctance to participate in the Virtual trade compared to a physical one. Thus, we were finding it extremely hard to convince them to join the 42<sup>nd</sup> APDC virtually and resulted in

refund of trade fees.

The Hybrid conference of this magnitude was planned by the Organizing Committee keeping in the flavor of past APDCs' but with the resurgence of Covid 19 especially in India & Sri Lanka, it hampered the preparation with Government imposing two weeks ban on all events. Thus, we were compelled to have the virtual congress for the very first time in the history of APDF.

The 42<sup>nd</sup> Asia Pacific Dental Congress was a great experience for 1196 local and 771 foreign participants from around the world to share the most up-to-date information regarding the scientific advances in Dentistry. An impressive group of 96 international and national speakers shared their insights and knowledge by way of 36 lectures, eight symposia and six virtual workshops in interesting topics. The most important Symposium was on 'The practice of dentistry in the light of the emergence of Covid-19 pandemic' keeping in mind the current prevailing scenario and a concept paper too also was released.

The ICCDE Oration was delivered by Prof N A De S Amaratunga titled 'Recent Conceptual and Treatment Advances in Cleft Lip and Palate'. In addition, commission meetings of Defense Forces Dentistry, Dental Public Health, Oral Diseases, General Dental Practice and Dental Education too were also held.

In parallel Dental Technician Program and Undergraduate Dental Students Program were held. The planned program for School Dental Therapists



and Dental Surgery Nurse Assistants could not be held due to the restrictions imposed and we are hopeful to conduct those programs in the coming days with the improvement of the ground situation.

The 42<sup>nd</sup> Asia Pacific Dental Congress portrayed advances and controversies across several disciplines in dentistry which all participants found relevant and timely. International Virtual Trade exhibition was held concurrently, which shared knowledge and experience on most advanced dental technology and innovation,

with the participants. The recorded presentations were also made available to the registered participants for over two months through the online portal.

The organizing committee convey their gratitude to all the participants, in making this event a resounding success.

**Dr Suresh Shanmuganathan**

President - APDF/APRO

Chairman - Organizing Committee (42<sup>nd</sup> APDC)



Past President SLDA, Past President APDF and Past Councilor FDI World Dental Federation, Dr Reggie Goonetilleke Receiving the Life Time achievement award From Dr J M W Jayasundara Bandara, former DGHS, Ministry of Health



Past President SLDA, and Past Vice President APDF Dr Gamini de Silva Receiving the Life Time achievement award From Dr J M W Jayasundara Bandara, former DGHS, Ministry of Health





# CEREMONIAL ADMINISTRATION OF THE DENTAL SURGEON'S OATH AT SLMC

Ceremonial Administration of the Dental Surgeon's Oath and awarding of certificates for newly registered 86 post intern Dental Surgeons was held at Sri Lanka Medical Council as a hybrid event on 31<sup>st</sup> July, 2021.

President Prof. Vajira Disanayake, Vice President Dr Suresh Shanmuganathan and Registrar Dr Ananda Hapugoda represented SLMC at this event.

SLDA wishes all newly registered Dental Surgeons all the best in their carrier and also invite them to become a member of SLDA, the umbrella association for Dental Practitioners Sri Lanka!



## SLDA MEMBERS CONTACT DETAILS UPDATE

The following link can be used to send data to update your contact details at SLDA database.

<https://tinyurl.com/SLDA-Contact-Update>

Members also can text SLMC Reg. No, Email and Name to 076 563 9899 to update your contact details.

## SLDA MEMBERSHIP APPLICATION FORM

SLDA membership application form can be downloaded from the below link for Dental Practitioners who are velly to become members of Sri Lanka Dental Association.

<https://tinyurl.com/SLDA-Membership-Application>

## SLDA - CDA CONTINUING EDUCATION PROGRAMME

# Clinical Meeting on Adult Orthodontics

On 13 - 08 - 2021 | At 8.00 p.m. IST



### Dr. M. Amri Azeez

BDS (Sri Lanka), MD Orthodontics (Colombo)  
M Orth RCS (Edin)  
Consultant Orthodontist  
District General Hospital  
Polonnaruwa, Sri Lanka

Meeting ID  
627 4386 9476

Scan QR code to connect  
with zoom lecture



Sri Lanka Dental Association



Commonwealth Dental Association

Date: Friday, 13<sup>th</sup> of August, 2021 at 8.00 pm IST  
Speaker: Dr Amri Azeez  
BDS, MD (Orthodontics), M Orth RCS (Edin)  
Consultant Orthodontist  
District General Hospital - Polonnaruwa, Sri Lanka.  
Zoom Link: <https://tinyurl.com/SLDA-CDA>

## CONGRATULATIONS !



Prof. Manjula Attygalla, was appointed as the Dean - Faculty of Dental Sciences, University of Peradeniya. SLDA Congratulates him on his new appointment and wish him all the best in future endeavours !

Dr Suresh Shanmuganathan, Past President of SLDA was inducted as the President of Asia Pacific Dental Federation/Asia Pacific Regional Organization during the recently concluded 42<sup>nd</sup> APDC virtual conference held in May, 2021. at BMICH in Colombo.



We wish him all success as the President of APDF/APRO.



SLDA wishes to extend sincere gratitude to Prof. Upul Dissanayake, Immediate Past Vice Chancellor - University of Peradeniya and Dr Vajira Jayasinghe, Immediate Past Dean - Faculty of Dental Sciences for the valuable service rendered to the University of Peradeniya and to the Faculty of Dental Sciences during their tenure in office.



Dr A Sundar Immediate Past President of SLDA was elected as the Vice President - Commonwealth Dental Association. We wish him all the best in future endeavours with CDA !

Dr A M B Amunugama Past President of SLDA was elected as the Chairman Defense Forces Dentistry Commission of APDF. SLDA wishes to congratulate him for the appointment and wish him every success!



### COVID 19 VACCINATION PROGRAMME FOR DSAs & AND DENTAL TECHNICIANS

Sri Lanka Dental Association requested the Ministry of Health to arrange a programme for vaccination of DSAs and Dental Technicians working in the General Dental Practice, who are above the age of 18 years. SLDA is in the process of collecting updated data to be submitted to the Epidemiology unit to organize the vaccination programme Islandwide.

As such please fill this form with necessary details if you wish to register DSAs or Dental Technicians for vaccination against COVID 19.

Please use the following link to submit data. For each individual separate forms need to be filled.

<https://forms.gle/sHbCbJw697jNuV96>

Please make sure that your submission is done on or before 15<sup>th</sup> August, 2021.



## UPCOMING EVENTS

### FDI WORLD DENTAL CONGRESS 2021- 26 TO 29 SEPTEMBER, 2021



FDI World Dental Congress 2021 - Special Edition, organized by the Australian Dental Association and FDI World Dental Federation will be held entirely on a virtual platform 26 to 29 September, 2021. The congress will be broadcasted from the International Convention Centre in Sydney, Australia.

It will offer attendees the possibility to stream live sessions, as well as view all presentations on-demand for 60 days after the event. Attendees will have over 200 CE-accredited scientific sessions to choose from, with speakers from Africa, America, Asia-Pacific (including Australia and New Zealand), Europe, and the Middle East. All participants will also be able to interact with speakers and ask questions in real time.

The industry exhibition will be held through this same virtual event platform, ensuring a seamless experience for participants to engage with exhibitors and view product demonstrations.

*More information: <https://2021.world-dental-congress.org/>*

### ESTHETIC SUMMIT 2021 ORGANIZED BY INDIAN ACADEMY OF AESTHETIC AND COSMETIC DENTISTRY (IAACD) – 27<sup>TH</sup> TO 29<sup>TH</sup> AUGUST, 2021

ESTHETIC SUMMIT 2021 Conference will be held virtually on the given dates. IAACD has invited members of SLDA for complementary registration and applied members will get the complementary registration link from IAACD in due course.

*More information: <https://www.theiaacd.com/>*

### UAE INTERNATIONAL DENTAL CONFERENCE & ARAB DENTAL EXHIBITION 1<sup>ST</sup> TO 3<sup>RD</sup> FEBRUARY, 2022



The 26<sup>th</sup> edition of the UAE International Dental Conference & Arab Dental Exhibition will open its doors to speakers to share their expertise in the field of dentistry with more than 7000 attendees attending the conference from around the world.

*More information: <https://aedc.com/> | Submit Abstracts: <https://abstracts.index.ae/aedc-2022>*

# WORLD ORAL HEALTH DAY 2021

'Be Proud of Your Mouth' is the three-year theme (2021 - 2023) unveiled for the World Oral Health Day (WOHD) 2021. The theme aims at motivating people to value and take care of their mouths and protect their general health and well-being by doing so. SLDA held the main event to celebrate the WOHD on the 25<sup>th</sup> March 2021 at the BMICH under the auspices of former DGHS Dr J M W Jayasundara Bandara. The event was well attended by SLDA members and Health Ministry officials.

## ORAL HEALTH BOOKLET - 'YOUR ORAL HEALTH DURING COVID 19 CHALLENGE'

To mark the WOHD this year, Sri Lanka Dental Association together with College of Community Dentistry of Sri Lanka has published an oral health booklet which can be used by Dental Surgeons and School Dental Therapists to raise public awareness regarding oral healthcare during Covid 19 pandemic. Following links can be used to download PDF versions.

<https://tinyurl.com/WOHD-Booklet-Sinhala-Version> | <https://tinyurl.com/WOHD-Booklet-Tamil-Version>

## WORLD HEALTH ORGANIZATION (WHO) RESOLUTION ON ORAL HEALTH AT THE 74<sup>TH</sup> WORLD HEALTH ASSEMBLY

Oral health was a neglected area on the global health agenda, thus it was an important advance when a resolution on oral health was adopted at WHO's 74<sup>th</sup> World Health Assembly on the 31<sup>st</sup> May 2021, which was proposed by Sri Lanka and supported by 40 WHO member states. The resolution calls for the development of a global oral health strategy by 2022 and action plan by 2023, including a monitoring framework aligned with non-communicable disease (NCD) and universal health coverage (UHC) agendas. This is a milestone in the history of oral health where due recognition is given for oral health in the global health agenda and a golden opportunity for the dental fraternity to address the oral health issues with other general health issues within the scope of the World Health Organization.

*More Information :* <https://tinyurl.com/WHO-Oral-Health-Resolution>

## FOR REFERENCE

### Pre-Hospital Management of COVID - 19 Patients: A Practical Guide for Doctors Published by Primary Care Physicians of Sri Lanka.

The main aim of this document is to provide guidance for primary care doctors to manage a COVID-19 patient prior to hospital care. This is mandatory according to the current Ministry of Health recommendations. Due to the prevailing situation of increasing numbers of COVID-19 patients, the standard recommendation of admitting all such patients may not be feasible within hours or even days due to a number of factors: transport facilities, existing capacity at hospitals and even patients' preference with valid reasons. This pre-hospital management guideline of COVID-19 patients will give the primary care doctors, healthcare staff and patients themselves uniform evidence-based guidance.

Read more: <https://tinyurl.com/COVID-19-Pre-Hospital-Mgt>

Date	Event	More Information
17 Sept 2021	World Patient Safety Day 2021	<a href="https://tinyurl.com/WHO-Patient-Safety-Day-2021">https://tinyurl.com/WHO-Patient-Safety-Day-2021</a>
22-23 Sept 2021	Organization of Professional Associations - Annual Scientific Sessions @ Hotel Shangri La, Colombo	<a href="http://www.opasrilanka.org">www.opasrilanka.org</a>
3-6 Nov 2021	DenTech China 2021 (Exhibition & Symposium)	<a href="https://en.dentech.com.cn">https://en.dentech.com.cn</a>

**Dr Chandima Weerasinghe**  
Hony. General Secretary  
Sri Lanka Dental Association



### SRI LANKA DENTAL ASSOCIATION

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**Lakshman Samaranayake**

**Niraj Kinariwala**

# Point-of-Care (POC) Diagnostics for Coronavirus Disease 2019 (COVID-19) and their Potential Impact on Dentistry

**Abstract:** It is clear that the coronavirus disease 2019 (COVID-19) pandemic, due to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) will be with us for the foreseeable future, possibly entrenched as an endemic infection. This poses a grave threat for clinical dental practice as asymptomatic (viral) carriers unknowing of their status, may attend for treatment with the possibility of resultant disease spread to non-immune individuals in the clinic. Even if one is immune through vaccination, the temporal waning of protective antibodies may lead to mild–moderate variant-induced infection, as shown in a number of recent studies. Hence, it is likely that rapid and accurate identification of COVID-19 patients at the point-of-care (POC), that is in the clinic or during the pre-attendance period, will be a critical imperative in the foreseeable future, as a secondary safeguard, in addition to successful vaccination. There are now an array of POC diagnostic tests to detect SARS-CoV-2, and here we summarize their salient features, and the potential utility as an infection control measure in dentistry.

**CPD/Clinical Relevance:** To describe the currently available POC diagnostic tests for COVID-19, and their utility as a critical infection control measure during dental care delivery in the immediate post-pandemic period.

**Dent Update 2021; 48: 000–000**

The COVID-19 pandemic, due to SARS-CoV-2, which began in late 2019, has virtually engulfed the whole world while incessantly spreading in some regions, and gradually receding in others. The morbidity and the mortality of the disease is breathtaking, and makes for grim reading with 179 million infections and 3.88 million

deaths worldwide at the time of writing (July 2021).<sup>1</sup> The miraculous production of effective and efficacious COVID-19 vaccines within the relatively short span of 1 year, and their prompt administration have curbed the viral spread in most regions. For instance, in the People's Republic of China, where up to a billion people have been vaccinated thus far, the disease has been virtually conquered, with sporadic pockets of resurgent infection. In other parts of the world such as the UK, Europe and USA the infection is slowly but surely receding.

Unfortunately, although there are many regions, particularly Asia, where COVID-19 is rampantly spreading with few signs of disease abeyance in the near future, particularly due to vaccine insufficiency, as well as the waves of infection and

re-infection caused by periodically emerging viral variants. At the time of writing, four major SARS-CoV-2 variants, alpha (UK), beta (African), gamma (Brazilian) and delta (Indian) have been identified, and more appear to be on the way, as long as the pandemic persists in any region of the world.<sup>2</sup> While most of the currently available COVID-19 vaccines are highly efficacious in preventing the infections due to the original strain of SARS-CoV-2, they are significantly less effective in preventing variant-induced disease.<sup>2</sup> Such statistics and data are a clear indication of the chronic, and dogged ability of the virus to survive and circulate in the community for the next few years, at least.

Given this scenario, healthcare workers, including dental care workers, have a

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Manufacturer	Test	Technology used	Samples required	Time to result	Claimed sensitivity/specificity	Approved by	Reference
Cepheid (Figure 2c)	Xpert Xpress SARS-CoV-2 test for use on GeneXpert Xpress system	rtPCR	Nasopharyngeal swab Nasal swab Mid-turbinate swab Oropharyngeal swab	~40 minutes	100%/100%	FDA EUA	<a href="https://www.cephheid.com/coronavirus">https://www.cephheid.com/coronavirus</a>
Abbott Laboratories (Figure 2b)	ID NOW COVID-19 test	LAMP	Nasopharyngeal swab Oropharyngeal swab	Positive result in 5 minutes; negative result in 13 minutes	100%/100%	FDA EUA	<a href="https://www.alere.com/en/home/product-details/id-now-covid-19.html">https://www.alere.com/en/home/product-details/id-now-covid-19.html</a>
Fisher Scientific/ (Mesa Biotech) (Figure 2a)	Accula SARS-CoV-2 test	rtPCR	Throat swab Nasal swab	~30 minutes	100%/100%	FDA EUA	<a href="https://www.mesabiotech.com/coronavirus">https://www.mesabiotech.com/coronavirus</a>
Cue Health	Cue COVID-19 test	LAMP	Nasal swab	~20 minutes	95%/100%	FDA EUA	<a href="https://www.cuehealth.com/covid-19">https://www.cuehealth.com/covid-19</a>
iAbra and TT Electronics (Figure 2d)	Virolens COVID-19 test	Holography and artificial intelligence (AI)	Oral swab	~20 seconds	98%/100%	MHRA	<a href="https://instant-covidtest.com/workplace-covid-testing/">https://instant-covidtest.com/workplace-covid-testing/</a>

**EUA:** Emergency user authorization; **FDA:** Food and Drug Administration, USA; **MHRA:** Medicines and Healthcare products Regulatory, Agency, UK; **rtPCR:** real-time polymerase chain reaction; **LAMP:** loop mediated isothermal amplification. Data from the quoted sources. Note: There are over 220 EUA approved tests in the FDA directory, at the time of writing and fewer than 20 are currently approved as POC tests, other tests need to be performed in a hospital setting. EUA status is also temporary, so it is desirable for the EUA tests to eventually become FDA cleared under normal regulatory pathways to enable full-fledged long-term usage.

**Table 1.** Examples of point-of-care (POC), rapid diagnostic tests for COVID-19 currently in use.

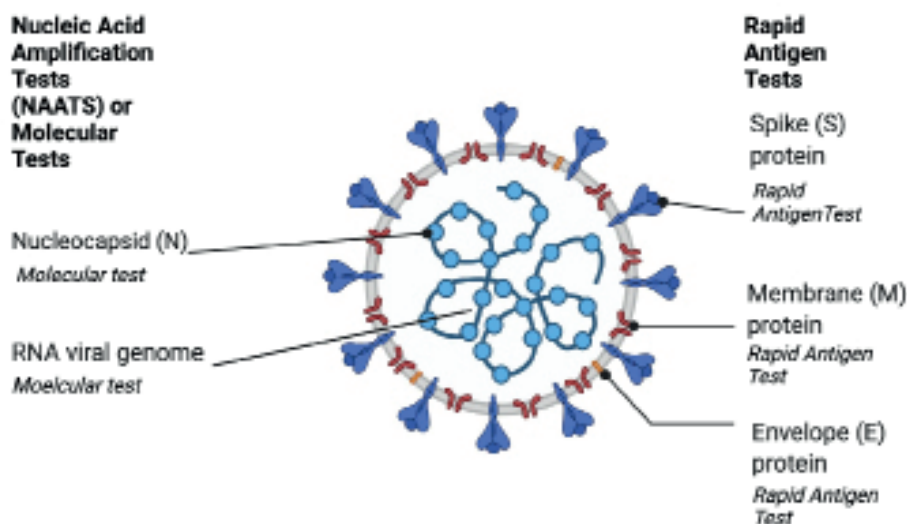
stark choice in front of them for infection control during routine patient care. One major way to allay the constant worry and anxiety of either a symptomatic and /or asymptomatic, COVID-19 patient attending the clinic, and creating a cluster of infection, is to implement the so called, point-of-care (POC) diagnostic tests for the infection, prior to beginning any dental treatment. This will be in addition to taking the routine temperature measurements, medical and travel history eliciting potential patient exposure to COVID-19, as well as the patients' vaccination history, and related serological tests.

Additionally, a rapid diagnosis of an infected individual will help in his/her quick isolation and diminution of the community spread of the disease. In practical terms, a patient should be immediately tested on arrival at the clinic, possibly in a separate room, prior to entering the patient waiting area, and further steps taken in the event of a positive outcome. In such an event, it is likely that a confirmatory test will be required, with immediate patient referral to the local centre for COVID-19 assessment and care.

### Point-of-care (POC) diagnostic tests for COVID-19

An array of new POC diagnostic tests are currently available. According to the World Health Organization (WHO) and the United States Food and Drug Administration (FDA) over 450 such tests have been developed thus far for rapid identification of COVID-19 patients in clinical settings.<sup>3</sup> Although these are not widely used in routine dentistry, as yet, possibly due to the novelty and the initial expenditure outlay, it is hoped that some of these tests will be mass produced and available in the near future





**Figure 1.** SARS-CoV-2 viral components used in POC testing. Components of the nucleic acid amplification tests (NAATS) are shown on the left, and the rapid antigen tests are on the right.

as inexpensive test kits to facilitate easy administration by any member of the dental team. Indeed the stated goal of some of the manufacturers is to produce simple, inexpensive kits akin to 'home pregnancy tests' so that they are widely available and easily accessible to the public.

### Point of care diagnostic technologies: definition and ideal properties

POC diagnostic tests can be defined as 'a diagnostic test that is performed near the patient or treatment facility, has a fast turnaround time, and may lead to a change in patient management'.<sup>4</sup>

The following are considered the ideal attributes for POC diagnostic technology.<sup>4</sup>

- **Simple to administer and user-friendly:** the major desirable property of a POC diagnostic test is that it should be simple so that the user/s can easily administer, with minimal training, without the help of a highly trained medical/dental professional.
- **Inexpensive:** the POC test must be inexpensive and affordable so that it could be administered in large numbers either in routine clinical practice or in mass screening programmes particularly, in resource-poor regions.

- **High sensitivity:** ideally, the sensitivity of a POC test should be 100%, if possible, with minimal, if any, false-negative test results.
- **High specificity:** similarly, the specificity should reach 100%, ideally with no false-positive test results, as far as possible.
- **Rapid functionality:** this is required to perform all steps, from sample collection to test result readout, within minutes, if not seconds, is important so that the test could be quickly interpreted. This attribute is critical, especially in a busy clinic/hospital to facilitate rapid patient turnover.
- **Robust and equipment-free:** ideally a POC test should be self-contained in a kit with a reasonably long expiry period, with the possibility of storage at ambient temperature, and not requiring low temperature fridges or freezers.

### Classification of current POC diagnostic tests

The Food and Drugs Administration (FDA) USA classification of the POC tests for COVID-19 fall into three main categories.<sup>5</sup> In each category there are over 100 'kits' produced by various commercial manufacturers, and this list is dynamic with new products added virtually on a daily basis. Owing to the severity of the pandemic, the FDA usually gives emergency

user authorization (EUA) for these tests, which is recalled in the event of any adverse events/reports. The tests are basically divided into three categories:

- **Molecular tests:** to detect molecular RNA of the pathogen (Figure 1);
- **Rapid antigen tests:** to detect protein markers on the outside of the virus (Figure 1); and
- **Serology and adaptive immune response tests:** these antibody tests are not used in POC tests for SARS-CoV-2 as they look for the serological response from a previous infection or vaccination, and hence, not further discussed here.

### Molecular tests and rapid antigen tests

#### Molecular tests

These are also called viral nucleic acid amplification tests (NAATS) because they detect and amplify the viral genomic material specific to SARS-CoV-2 (Figure 1). The SARS-CoV-2 viral genomic material evaluated is its ribonucleic acid (RNA), which is present in the body only when the virus is still replicating.<sup>6</sup> These tests can detect even very low levels of the virus. NAATs include the polymerase chain reaction (PCR) tests, loop-mediated isothermal amplification tests (LAMP), and next generation sequencing (NGS) assays (Table 1).

The patient samples for these tests could either be nasopharyngeal swabs, deep throat saliva or sputum. The nasopharyngeal swabs, however, are the most reliable, as they essentially sample the primary colonization site of SARS-CoV-2 once it infects an individual. Hence, these swabs are likely to yield adequate quantities of viral particles from very early, asymptomatic disease. Indeed, these are the patients who need to be detected as early as possible, not only to prevent aerosol generated cross-infection in the dental clinic, but also 'silent' viral transmission in the community – for they are still asymptomatic. The sensitivity and the specificity of the newly developed NAATs are so good that saliva samples are thought to be adequate for a number of test kits currently in circulation.

#### Rapid antigen tests

Rapid antigen tests detect specific viral proteins (not the RNA) of SARS-CoV-2, such as the S or spike protein, M or membrane



**Figure 2.** Some examples of currently available devices used in point-of-care diagnostic tests for COVID-19. **(a)** Fisher Scientific (Mesa Biotech) ACULA Biotech test kit. **(b)** ABBOTT Laboratories test kit. **(c)** Cepheid Xpert Xpress SARS-CoV-2/Flu/RSV for use on GeneXpert Xpress system. **(d)** Abra and TT Electronics Virolens system.

proteins and E or envelope protein (Figure 1). These surface antigens of the virus are copious in either symptomatic or asymptomatic patient samples, such as a nasal or nasopharyngeal swabs or saliva, during viral replication. Most of the current rapid antigen tests detect basic levels of the antigen/s providing only a qualitative 'yes' or 'no' response, similar to a pregnancy test, and do not quantify the viral load in the sample. Currently there are over 100 of these tests, but only a handful are useful for POC testing in a dental clinic.

Another noteworthy point for both the molecular tests and the antigen tests described above is that a positive test is indicative only, and needs to be confirmed with a more robust laboratory test.

## POC test technology

Although PCR technology has been the backbone of diagnostic tests so far, newer methods such as lateral flow testing and LAMP technology, which do not require temperature changes for the process, are gaining popularity in POC tests. Additionally, cutting edge technologies such as holography and artificial intelligence<sup>5</sup> are likely to be new genres that will be used in future for POC testing.

The technology underpinning the current POC diagnostics and their pros and cons are discussed below.

### Rapid antigen tests

Rapid antigen tests detect easy-to-find surface markers on the outside of the

virus and avoid extraction and amplification steps. Researchers or clinicians collect samples from easy-to-reach areas (such as the nasal passage) where the virus tends to replicate the most.

- Advantages: can detect active production of viral proteins, fairly rapid tests (minutes to results). RNA extraction and amplification steps are not needed as in PCR tests.
- Disadvantages: the test may yield false negatives if viral protein production is low, or if there is not enough virus replication in the sampled area. Hence confirmatory tests are required.

### Molecular tests or nucleic acid amplification tests (NAATs)

#### Real-time reverse transcriptase quantitative polymerase chain reaction (rRT-qPCR)

rRT-qPCR identifies and quantifies the presence of SARS-CoV-2 nucleic acids in a sample through the process of detection, amplification, and output measurement.

- Advantages: this test has extremely high specificity and could be quickly modified to detect new viral variants to fit its new iterations. Many (virtually hundreds) of samples can be run at once, and it detects low copy numbers of viral RNA, hence it is extremely sensitive (low limit of detection).
- Disadvantages: requires trained personnel and special equipment, and the test may take 1–3 hours. Hence, not ideal for the clinic situation where quick sample throughput is necessary, not only for identification of viral carriers, but also for efficient functionality of busy clinics.

#### Reverse transcription loop-mediated isothermal amplification (rtLAMP)

Here the rapid amplification of viral RNA is coupled with a colour- or light-based readout. The foremost advantage of this method, as opposed to the standard PCR-based technology, is that the test can be performed at a single (isothermal) temperature.

- Advantages: extremely rapid with results in seconds to minutes with the test performed at a single temperature 60–65°C. Extremely high sensitivity to defined SARS-CoV-2 sequences. Ideal for POC diagnostics.



- Disadvantages: Provides only a qualitative 'yes' or 'no' response and viral quantification is not possible.

#### **Recombinase polymerase amplification (RPA)**

Basically, these tests detect RNA sequences through exact matches of an enzyme called recombinase and then amplify the specific viral genes.

- Advantages: requires a single temperature only, as in LAMP tests. Extremely rapid with result in seconds/minutes. Has high sensitivity and specificity for defined SARS-CoV-2 sequences.
- Disadvantages: Provides only a qualitative 'yes' or 'no' response, and viral quantification is not possible.

#### **CRISPR-based diagnostics**

As per the principles of clustered regularly interspaced short palindromic repeats (CRISPR), this method uses highly specific targeting and cleaving action of CRISPR-Cas systems to locate and cut a specific part of the SARS-CoV-2 RNA genome sequence. The cleaving action results in a visual signal that indicates the presence of the virus.

- Advantages: extremely rapid with result in seconds/minutes. Has high sensitivity and specificity for defined SARS-CoV-2 sequences
- Disadvantages: depending on the specific kit system, the samples may need to undergo RNA extraction before the test can be run, adding another 1–2 hours, depending on lab capacity. The technology is still very complex for clinics.

### **Cutting edge technologies evaluated for POC diagnostics**

Apart from molecular technology, such as PCR and LAMP-based tests, newer, more cutting-edge technologies are being evaluated for rapid testing of COVID-19. One example of this is the use of holography and artificial intelligence (AI)-based methods that are in the developmental stages. With these tests, the results of a saliva sample for instance, could be delivered within 60 seconds. A UK-invented POC test is currently being trialled for mass use in airports and public

spaces for rapid detection of infection in individuals (Table 1 and Figure 2).

Other technologies under development include the use of biological sensors, or biosensors, such as electrochemical sensors, field-effect transistor (FET)-based biosensors, magnetic biosensors, immunosensors, enzyme-based sensors and DNA biosensors.<sup>7</sup> These analytical systems comprise a transducer and an immobilized biological component. The biological component recognizes a target biomarker in the sample and the transducer converts the corresponding biological signal into an electrical signal.<sup>8</sup> Biosensors have been evaluated for detection of infectious disease such as MERS-CoV<sup>9</sup> and influenza.<sup>10</sup>

### **Examples of currently used POC diagnostic tests for COVID-19 (Table 1)**

Five examples of brand-name POC tests for COVID-19 currently in use in different jurisdictions are given with some of their specifications in Table 1.

#### **Cepheid's Xpert Xpress SARS-CoV-2 test<sup>11</sup>**

This is a simplified system designed to be used in clinical settings, including dental and physicians' offices.

#### **Abbott Diagnostic's ID NOW COVID-19 test<sup>12</sup>**

This test relies on isothermal nucleic acid amplification, targeting a unique region of the RNA-dependent RNA polymerase (RdRP) gene of SARS-CoV-2. As mentioned above, a constant temperature, between 60 and 65°C, using two to three sets of primers and a polymerase with high strand displacement activity, is used, avoiding the need for thermal cycling. To achieve good specificity, four different primers are used to amplify six distinct regions of the target gene.

#### **Fisher Scientific/Mesa Biotech's Accula SARS-CoV-2 test<sup>13</sup>**

This test is a combination of RT-PCR and lateral flow immunoassay.<sup>13</sup> It targets the N gene of SARS-CoV-2 from nasal and throat samples. As in a pregnancy test, the results are simple to read, with colour lines indicating positivity/negativity. The reported analytical sensitivity is 200 viral copies/mL.

#### **Cue Health's Cue COVID-19 test<sup>14</sup>**

This is a rapid, portable assay that delivers results to a mobile phone in less than 25 minutes. Similar to Abbott's test, Cue's test also uses isothermal amplification on nasal swabs, but it detects the SARS-CoV-2 N gene. Additionally, Cue's disposable POC test cartridge forms a connected diagnostic platform with a mobile phone that enables a patient to have convenient access to their health information.

#### **Violens artificial intelligence test system<sup>15</sup>**

The Violens system uses a portable machine that creates a microscopic holographic image to detect the virus in saliva samples in 20 seconds. Developed in UK, the system uses a digital camera attached to a microscope, which then runs data through a computer that can identify the virus. The device has been trialled at Heathrow Airport, with satisfactory preliminary results.

### **Future perspectives**

It is generally recognized that the COVID-19 pandemic will be with us at least for the next few years, and is most likely to end up as an endemic disease, as in the case of the Ebola infection in some parts of Africa that raises its ugly head sporadically. Although the latter disease is endemic only in Africa, only time will tell whether COVID-19 will also be endemic, and if so, in which regions of the world. A likely future scenario is that COVID-19 could be virtually eradicated in the West and some Asian countries, such as China, due to the development of herd immunity through mass vaccination programmes. Nevertheless, pockets of COVID-19 infection are likely to smoulder in less-developed countries for many reasons, including vaccine deficiency, and above all, the emergence of new viral variants and the so-called 'escape mutants' that emerge during viral replication in unvaccinated cohorts. These variants, in turn, raise the spectre of new waves of infection throughout the world.

Such a grim scenario is bound to impact the clinical dental practice, particularly in the UK with its cosmopolitan population mix. Hence, it

will be critical that practitioners ensure that the patients they are handling on a daily basis do not have 'viral reservoirs' that may lead to new bouts of infection. One way to obviate such an outcome is to perform POC diagnostic tests for the SARS-CoV-2 antigens for all clinic attendees using simple, inexpensive and reliable tests that do not require training and are easily deployable in clinics and outpatient settings.

Almost all of the current POC systems yield qualitative, yes/no data, but not quantitative data for the viral load in the processed samples. Yet, in the longer term, it is also important to develop systems that can provide quantitative diagnoses, in order to understand disease progression after symptom onset. Newer POC diagnosis systems are also currently in development for both qualitative and quantitative data yields within seconds. These will certainly allay the anxieties of clinicians and patients alike, and hopefully assist in delivery of safe and wholesome clinical dental care in a post-COVID-19 world.

#### Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

Informed Consent: Informed consent was obtained from all individual participants included in the article.

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