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EPD Electronic Pathogen Detection

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[1]Electronic Pathogen Detection

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Electronic Pathogen Detection

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ABSTRACT

Electronic pathogen detection (EPD) is a non - invasive, rapid, affordable, point- of- care test, for Covid 19 resulting from infection with SARS-CoV-2 virus.

EPD scanning technology, is a completely novel technique, designed to assess the human body for the presence or absence of a pathogen.
The technology implements a unique scanning method, by delivering an extremely low electrical current to the skin, and then recording the resulting physiological response to this stimulation, from the skin.

Although the technique is unique, there are similarities to existing technologies that can be used to explain the modus operandi, of this novel technology.
The microcurrent delivery component of the diagnostic technology can be loosely described as containing elements analogous to Microcurrent Electrical Therapy (MET) and TENS (Trans dermal electrical nervous stimulation), whereas the response component of the technology can be seen as similar to Electrocardiography (ECG), Elelctro-enchephalogram (EEG) the Electrodermal Response (EDR), and Body Impedance Assessment (BIA).All of these modalities are widely used, considered safe and have been extensively researched.

The skin offers convenient access to study the nervous system, not only is it richly innervated, but it also originates from the same embryonic layer as the nervous system.
It is well known that the immune system and immune response is regulated by the neurological system.

EPD technology uses this physiological platform offered by the skin to access real-time information of the immune response and compares this physiological information to electronically generated pathogen molecular patterns via a proprietary algorythm.

The resulting dermal response , is recorded and displayed on a computer screen as a graph.The graph consists of peaks and troughs.This graph is then statistically verified and analyzed in a proprietary manner.The result of this analysis is then compared to the pathogen dataset that is pre-loaded in the software.This pathogen datatset is derived from the pathogen genes, and a proprietary method, so that the ectodermal response can be compared to the pathogen genes.Once the comparison is complete, the result is displayed.

EPD scanning can be performed on humans and animals with consistent results.
EPD scans have been performed on adults (all ages) and babies, toddlers and children.
EPD scans have been performed on pregnant animals with no adverse results or outcomes to the fetus and newborn.

Full Protocol and background:

Pathogen Diagnosis

The current SARS-COV-2 world pandemic highlights the need for widespread, fast and accurate, point of care testing, and diagnosis. Health experts across the globe agree, that the information gained from testing, is crucial in the management of the epidemiological curve, curbing the spread of the infection, reducing mortality, and optimal use and implementation of medical resources and staff.
It is imperative to identify individuals with current infections, testing both symptomatic and asymptomatic individuals, to stop the human to human transmission, of the virus. To date, no country in the world has had the

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luxury of implementing blanket testing. Mainly because of the steep inclination of the epidemiological curve, whereby governmental and healthcare systems, cannot keep up with the rapid spread of the virus resulting in the exponential increase in symptomatic individuals requiring hospitalization and intensive care. Further challenges include logistical issues, in the distribution of testing kits to existing laboratories, setting up new facilities for sampling and testing, as demand increases. Lastly, third world countries have the added constraints of under-resourced healthcare systems and financial limitations to purchase enough molecular testing equipment.
Even if blanket testing were possible, diagnosing the SARS-COV-2 infected individual accurately remains a challenge.
This challenge exists for the following reasons: properties unique to the SARS-COV-2 virus (incubation period, a large portion of asymptomatic infected individuals spreading virus), the sensitivity of the RT-PCR ASSAY laboratory tests (depend on which combination of target genes are included in the various test kits, viral load present at the time of sampling, and availability of kits).
A positive RT-PCR ASSAY test confirms the presence of SARS-CoV-2 viral nucleic acids (RNA), in a nasopharyngeal swab, oropharyngeal swab, or any bodily fluid or tissue. Generally the sensitivity (accuracy) of RT-PCR ASSAY for SARS-COV-2 is in the region of 80%, with high specificity. Therefore individuals with symptoms of SARS-COV-2 who test negative (up to 20%), should not be managed on the test result alone, but also taking into account epidemiological risk factors (travel history, contacts), clinical symptoms, and by retesting the patient using a different sampling site.

Demonstrating seroconversion, the presence in serum of either IgM or both IgM and IgG or IgG, for SARS-COV-2, indicates a past (albeit recent past) exposure, viremia, and production of antibodies. Whether these antibodies are neutralizing and confer immunity is still being established. This type of test cannot be used to identify active infection.

Due to costs and the massive logistical demands on RT-PCR ASSAY producing companies (collection kits, purification units, extraction units, reagent solution production), RT-PCR ASSAY is only used in a certain portion of the population at this stage.

NICD guidelines for RT-PCR ASSAY testing published on their website https://www.nicd.ac.za/wp-content/uploads/2020/04/COVID-19-Quick-reference-v12-09.04.2020_final-1.pdf:
Criteria for the person under investigation (PUI), i.e. a person to be tested for COVID-19 Persons with acute respiratory illness with sudden onset of at least one of the following: cough, sore throat, shortness of breath or fever [≥ 38°C (measured) or history of fever (subjective)] irrespective of admission status.

There is an international upsurge and call for emergency research protocols being submitted and approved for clinical trials of new drugs, vaccine development studies and other technology to combat the spread and loss of life caused by this pandemic.

EPD is Novel technology for pathogen diagnosis

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Background:

Immune system

The immune system consists of cells and proteins found in the blood, lymphatic system and tissue. These cells originate from the bone marrow, and mature in the thymus and spleen.
The purpose of the vertebrate immune system is protection from invading pathogens. This protection relies on the innate immune system's ability to co-ordinate effective cell surveillance and recognition of pathogens. The ultimate goal is the eradication of the pathogen, and the production of a neutralizing antibody via the adaptive immune response, this will eventually lead to protection against disease from the same pathogen, if encountered a second time. (Zinkernagel 2002), (Chaplin 2006).

Embryology of the immunes system
The three components of the immune system originate independently of each other from different parts of the mesoderm. macrophage mesoderm, lymphatic, and hematopoietic systems splanchnic mesoderm.

This co-ordination depends on chemical signalling between cells, and then recognition of pathogens by cells.
Ralph Steinman, Bruce Beutler and Jules Hoffman, were awarded the 2011 Nobel Prize for Physiology in Medicine, for their contributions towards better understanding the interactions between the innate and adaptive parts of the immune response. In particular Ralph Steinman by uncovering that dendritic cells are the bridging communication link, between the cells of the innate and adaptive immune systems.Jules Hoffman and Bruce Beutler for their work on demonstrating how the innate immune system is activated.
The innate immune system recognizes conserved Pathogen Associated Molecular Patterns (PAMP's) through Toll-like receptors (TLR's) expressed on the cell surfaces of immune cells. The concept of PAMP's was first coined by the immunologist CA Janeway in 1989, at a Cold Spring Harbor Symposium on Quantitative Biology, (Beutler 2011),((Paul 2011). Steinman 2012),(Hoffman 2011) (Lemaitre 1996),(Murphy 2017).

Cell communication

Cells communicate in various ways. Apart from the chemical and molecular, receptor-ligand model of cellular communication, that forms the backbone of our current understanding of biochemical and immunological processes in modern science, there is also a large and rapidly growing body of evidence, that there are additional and equally effective forms of cellular communication, in biological systems.

Alexander Gurwitsch was the first scientist to show that onion plant roots communicate with “mitogenic radiation”, radiation in the ultraviolet light range of the electromagnetic frequency spectrum.
(Gurwisch, 1923),(Gurwisch, 1926).

Professor Fritz Alexander Popp continued this line of investigation and contributed a large body of work on biophotons (photons of light in the ultraviolet and low visible light range, produced by biological systems).(Popp et al., 1994.),(Popp 1988.),(Popp and Klimek 2007).
Following on Popp’s work, biophotons and cell communication have been extensively researched by other authors, and in their online book Fields of the Cell (Fels et al., 2015), their work is discussed in great detail.

Irene Cosic describes in her book "The resonant recognition model of macromolecular bioactivity: theory and applications" – an alternative resonant model for cell communication, a model for digital biological activity including, it's potential applications, (Cosic 1997) this model, additional to the current model, of ligands and receptors, describing biological processes.

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Robert Becker the American orthopaedic surgeon, answered the question of how a lizard perfectly grows back an amputated limb. By implementing meticulous research procedures, he showed that following trauma, tissue electrical fields produced at the site of injury, provides an information and communication platform, for cells, to regenerate tissue and amputated limbs to their original specifications. (Becker and Snelden 1998).
In his paper “The Electrical Embryo”, Colin Lowry discusses that electrical fields are essential in embryonic growth, pattern and shape (Lowry 1999).

Cells react to electrical stimulation, fields and frequencies

It has also been shown that electrical stimulation, affects cell membrane receptors and ATP production. (Seegers at al. 2001) demonstrated that a microcurrent DC electrical field of less than 150Hz, interacts with HeLa cell receptors, producing a 50-fold increase in ATP in vitro, and a 163% increase in vivo in plasma.

Similar findings of electric frequencies activating receptors were published by (Wolf-Goldberg et al. 2013.) showing that Epidermal Growth Factor Receptor (EGFR) activation can be induced by applying a short train of pulsed low strength electric field (LEF) frequencies with 10v/cm pulse-width for 180µs, at 500Hz, for 2min.
The idea of using electronic devices, including biosensors to detect pathogenic bacteria is not new and this concept was discussed comprehensively in a review article by (Ivnitski et al.1999).

Technological advances since then, including nanotechnology, has opened new doors and new diagnostic possibilities.
(Patolski et al. 2004.) using nanowire field resistance, demonstrated that sensitive detection of a single virus is possible by coating a nanowire with Influenza specific antibodies and then adding an Influenza virus (antigen) to this coated nanowire, conductance was observed and a flow of current was demonstrated upon molecular docking, with the specific antibody binding to the virus.

Similarly using a slightly different technique, namely impedance spectroscopy, (Abdelghani 2011) demonstrated sensitive detection of the Rabies Virus.

The Nervous System

Consists of the Central end Peripheral nervous system.
The central nervous system – the brain and spine, and the peripheral nervous system consists of the somatic and autonomic nervous system.
The autonomic nervous system (ANS) is divided in the Sympathetic (SNS) and Parasympathetic nervous system (PNS).
Embryologically the nervous system develops from the ectoderm. (Sadler 2011).

Immunity is regulated by the Neurological system

The nervous and immune systems are in constant two-way communication.

Our current knowledge and understanding of the immune response, and the regulator thereof, through neuro immune interaction, is based on a large body of scientific work done over the last decade.

The primary function of the autonomic nervous system (ANS) is to help the body adapt to internal and external environmental stimuli and demands, by maintaining a healthy balance. (Beissner et al. 2013).
The sympathetic nervous system stimulates increased metabolic output.
This is known as sympathetic arousal and is characterized by elevated heart rate, blood pressure, sweating and, shunting of blood from the internal gastrointestinal reservoir to the heart, brain and, skeletal muscle, in preparation of a "fight or flight" response.
The parasympathetic nervous system effects the opposite, by inducing conservation of metabolic energy and restoration.
The brain and immune system are in constant two-way communication to maintain health, and the sympathetic

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nervous system plays an integrative role in the regulation of the immune response.

This physiological equilibrium between the two systems is regulated by two pathways.
Centrally, via the Hypothalamic Pituitary Axis Adrenal Corticotropin Pathway (HPA-CRH) and peripherally via the autonomic nervous system (ANS), which in turn is comprised of the sympathetic (SNS) and parasympathetic (PNS) nervous systems. (Dantzer 2019).

Loeper and Crouzon demonstrated in 1904 that subcutaneous injection of epinephrine (adrenaline) causes a marked leucocytosis in humans.
Primary and secondary lymphoid organs receive substantial sympathetic innervation.
With sympathetic nervous system activation, neurotransmitters are released from sympathetic nerve endings in the lymphoid organs, they then bind to specific receptors on lymphatic cells, not only affecting cell traffic, division and, circulation, but also the production of cytokines. This may modulate the type of immune response to either a Th1 cell or Th2 cell type. (Pavlov et al. 2003), (Kin and Sanders 2006).
Studying the sympathetic nervous system and particularly the sympathetic response has been ongoing since the 1970's using a variety of biofeedback systems.
The most widely studied and used of these methods must be the Galvanic Skin Response, otherwise known as Skin Conductance or Electro Dermal Activity (EDA), (Dawson 2007).

Furthermore, T-lymphocytes have also been found to have B2 adrenergic receptors), indicating a neurological regulation of the immune response. (Fan and Wang 2009).

The Integumetary system

Consists of the skin and its appendages – hair and nails. The purpose of this system is to protect the body from various kinds of damage, such as loss of water or external harm. Apart from these it also has other functions; thermoregulation, waterproofing, protecting deeper tissues, and waste excretion. The skin is richly innervated with sensory receptors for pain, temperature, pressure and sensation.

Embryologically the skin originates from the ectoderm. (Langman's Essential Medical Embryology, 2011).

The skin is the largest organ in the human body, the first defence barrier between the human body and the external environment offering protection against pathogens, chemicals, toxins, and is also richly innervated with about 2500 per cm^2 nerve endings in the fingertips. (McBride and Schmorrow 2005).

Lastly, the integumentary system synthesizes vitamin D.
The skin utilizes solar energy which is transmitted as electromagnetic waves. These waves are classified according to their wavelength and frequency. The skin makes use of these properties of the electromagnetic spectrum to produce Vitamin D. (Cavalcanti Soriano Coutinho et al. 2019)

Microcurrent electrical therapy (MET)

Microcurrent is used for wound healing and pain relief. (Wirsing et al.2013)
Application of subsensory micro-amperage current (300 to 500 micro amps pulsed at 0.1 to 680 Hz) to tissue, increases cellular output of ATP. (Seegers et al. 2002)
These currents compliment and augment the physiological tissue electrical fields produced at the site of injury which provides an information and communication platform, for cells, to regenerate tissue and amputated limbs to their original specifications. (Becker and Snelden 1998).

Tens

This technology is widely used for pain management.
Application of milliamp current, to blocks pain messages, relayed by sensory nerve fibres, A beta (Aβ), (afferent: to the brain), thereby reducing the 'c' fibre (efferent: from the brain) noxious stimulus transmission (pain sensation).
The two primary pain relief mechanisms which are targeted are: the "Pain Gate Mechanism" and the "Endogenous Opioid System". Endorphins (endogenous opoids) are produced in the brain, upon peripheral nervous stimulation.
The current intensity (A) (strength) will typically be in the range of 0 - 80 mA up to 100mA. The current is pulsed (the pulse rate or frequency (B) will normally be variable from about2 – 150 Hz. (Vance et al. 2014.)

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Electrocardiogram (ECG)

The heart is a self-powered pump, cardiac pacemaker cells, produce a pace-making current (action potentials) of up to about -50 millivolts, with an amplitude of about 5 nano amperes. This current travels from pacemaker cells via conducting fibers, through the heart muscles, triggering muscle contractions (pumping actions). This current can be measured from the skin with electrodes, (the electrolyte rich fluid of the body, is a good conductor of current). This current of about 1 millivolt, is displayed as a graph the ECG – and represents the sum of all the electrical potentials generated by pacemaker cells at any given time. (Fye 1994)

Electroenchephalogram (EEG)

Neurons communicate electrically and chemically. Mammalian neurons, produce action potentials of up to about -55 millivolts, with an amplitude of about 1 nano ampere. This can be seen as units of power or watts, or 1.05 x 10^-10 W / neuron. There are billions of neurons in a human brain. Total brain wattage can be calculated as, (1.05 x 10^-10 W / neuron) x (800 million neurons / brain) = 0.085 Watts / brain.
The electrical activity in the brain can be recorded via scalp electrodes and displayed on a graph like an ECG, where voltage is plotted against time. The general voltage range of the scalp EEG lie between 10 and 100 µV.(Nunez 2006). (Bronzino, 1999).

Electro Dermal Activity (EDA)

Electrodermal activity (EDA) is the umbrella term used for defining autonomic changes in the electrical properties of the skin.
Historically the two principles used in modern-day skin conductance were discovered by Féré in 1888, who demonstrated decreases in skin resistance with different sensory stimuli, and the Russian physiologist Tarchanoff in 1890, who showed changes in electrical conduction between two skin electrodes during sensory stimulation. (Fere 1888),(Dawson 2007).

Skin Conductance or EDA has been shown to provide a sensitive index of the status of the sympathetic nervous system. (Critchley et al., 2000.), (Critchley, 2002).
Sweat glands or eccrine glands (sudomotor) are innervated by sympathetic post-ganglionic fibers, consisting of non- myelinated class C fibers. Activation of these nerve fibres modulates sweat secretion. (Figure 1). EDA "taps" into these nerve fibres, and therefore into the sympathetic nervous system
Correlation between EDA and functional MRI has shown an extensive network of the SNS. (Beissner et al., 2013.), (Critchley et al., 2002).

A recent study at Harvard University's Massachusetts Institute of Technology (MIT) by Professor Rozalind Pickard, whilst investigating emotional responses in Autistic Children, revealed an unexpected finding, that EDA can predict the onset of Sudden Death Epilepsy (SUDEP) 24 hours prior the event. SUDEP is a life-threatening condition with cardiac arrest, following post-ictal generalized electrical suppression (Sarkis et al., 2013).
Following this discovery, the EMBRACE bracelet warning system was developed. (Poh, 2011.), (www.empatica.com).

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Bioelectrical Impedance Analysis (BIA) and EPD scan measuring technique

Bioelectrical Impedance Analysis (BIA) takes advantage of the conductive properties of the body, and is a method extensively used in studies assessing body composition, water, fat, muscle. (Kyle 2004),(Mialich et al. 2014).

The body's response to electric current, is similar to an RC circuit, where body fluids (intracellular water (ICW) and extracellular water (ECW)) are represented by resistors and cell walls by capacitors. The impedance measurement is generally measured from the wrist to the contralateral ankle and uses either two or four electrodes. A small current on the order of 1-10 μA is passed between two electrodes, and the voltage is measured between the same (for a two electrode configuration) or between the other two electrodes
Fat cells have very high impedance or resistance compared to muscle cells, organ cells, extracellular components (including connective tissue). Therefore, electric current will mostly propagate through the fat-free body mass and not the fatty tissue. This means that BIA measures the volume of fat-free mass.

EPD technology a combines existing and novel technology for pathogen diagnosis.

EPD technology is utilizes the principles of electric stimulation and the resulting response thereto, to investigate the real-time immune response to pathogens.
However EPD technology goes further in that it can identify the presence or absence of a pathogen in the mammalian body from these readings.

Frequencies are applied in the range of 10 kHz to 500 kHz in a proprietary manner. The body's reaction is measured and statistically analyzed using propriatory algorythms.

This measuring technique uses voltages in the range of 6-volt peak to peak (similar to a line-up of 4 penlight batteries) generating a body current of approximately 500 micro-amp (500 millionth of one amp), at applied frequencies. This well below all safety standards, and is proven to be safe for human subjects. (ICNIRP,1998).

Molecular identification of Pathogens

Watson and Crick received the Nobel prize in 1962 for "for their discoveries concerning the molecular structure of nucleic acids and its significance for information transfer in living material." Kerry Mullis in recognition of his invention of the polymerase chain reaction technique, shared the Nobel Prize in 1993 in Chemistry with Michael Smith**.** (Crick 1962),(Mullis 1993),(Watson 1962).
These two scientific milestones paved the way for modern day molecular biology and medicine and our understanding of diseases.
It is now possible to sequence the genomes of pathogens and their proteins rapidly, and this information is uploaded to large open domain databases.
EPD technology makes use of this information.
For the purpose of the Xprise competition, the complete sequenced genome, all genes of SARS-CoV-2 virus will be implemented. However due to the unique properties of EPD technology, it is possible to target not only the viral genome, but also the proteome, and immune response including, lymphocyte antigens, cytokine production, to the viral infection. Cytokines identification, and individual proteins testing are scarce resources and not widely available for data validation in South Africa.
EPD technology makes use of an AI model taking all of the above into account.
This approach has been used in a Pilot Study using EPD technology on Bovines infected with Mycobacterium Bovis.(Michel et al.2018)

Safety

The safety of bioelectrical instrumentation is assessed by two parameters. One is the aspect of electrical isolation from ground potentials for the subject. The second is the definition of what is a harmless current vs. frequency that can be deliberately introduced into the subject.
There are few references that have explicitly established the standards for what is a safe subject current and frequency. (Geddes andBaker, 1975) in Applied Biomedical Instrumentation, describe the threshold of electrical perception of alternating currents of varying frequency.
There have been many applications of electrical impedanceat frequencies from 10 KHz to 5 MHz that have been introduced to critical human organs. (Nyboer and Kornmesser, 1970) applied an impedance plethysmograph

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(designed and built by Rudolph J. Liedtke) to the area of the uterus, to monitor pregnancy labor movements. There were no reported abnormalities after these observations using this method. The instruments that were used had a frequency of 100 KHz (crystal controlled) at approximately 3 milliamps.
(Bishop and Nyboer,1970) applied the same instrument directly to the eye with an electrode array, configured in a contact lens, with no ill effects at this frequency and current (100 KHz at 3 milliamps).

The EPD frequency in the range of 10 kHz to 600 kHz. This measured body reaction, is mathematically analyzed to extract information, that seems to bear a relationship between certain frequencies, and viruses, that have activated the body's immune system at the time of measurement.
This measuring technique, uses voltages in the range of 6 volt peak to peak (similar to a line-up of 4 penlight batteries) generating a body current of approximately 500 micro-amp (500 millionth of one amp), at applied frequencies.This well below all safety standards, and is proven to be safe for human subjects.(ICNIRP,1998).

Body exposure to applied electrical signals:

EPD Tracer
·Electrical Current used for measurement : 100 to 800 micro-amp induced by applying up to 6 volts
·Applied Frequency: 10 to 600 Kilo Hertz
·Emf radiation : None – direct application of measuring current

EDR Electro dermal activity
- Electrical Current used for measurement : None
- Sensor Frequency: 4 Hertz
- Emf radiation : None

(BIA) Body Impedance Assessment
·Electrical Current used for measurement : 100 to 800 micro-amp using up to 6 volts
·Applied Frequency: 2100 to 600 Kilo Hertz
·Emf radiation : None – direct application of measuring current

TENS Trans dermal electrical nervous stimulation
·Electrical Current used for measurement : up to 50 milli-amp using up to 9 volts
·Applied Frequency: 250 Hertz pulses with pulse duration .01 to1 milli -seconds
·Emf radiation : None – direct application of measuring current.

EPD Modus Opperandi:

Introduction

Gene Targets

All sequenced genes of the SARS-CoV-2 virus.

Note: Make sure the SARS-CoV-2 virus text file is correctly uploaded into the EPD software.

Equipment

-EPD scanner
-Transmitting electrode
-Receiving electrode
-Laptop with EPD software
-Patient
-Table
-Chair x 2
-PPE
-Alcohol based surface disinfectant

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-Hand sanitizer

EPD software
-EPD 101

Procedure

Step 1:
Switch on EPD scan unit and PC, connect EPD scan unit to PC.

Note: Make sure both PC and EPD scanner are on, and connected.

Step 2:
Open EPD software.
Note: Make sure both PC and EPD scanner are on, and connected.

Step 3:
Enter patient details into EPD software.
Note:

Step 4:
Connect receiving electrode to LT middle finger terminal phalange of patient. Give patient transmitting electrode to hold in RT hand.
Note: Clean electrodes with alcohol based disinfectant. Make sure hands are clean and skin is dry.

Step 5:
Commence scan.
Note: Make sure the EPD software reads the EPD scan machine.

Step 6:
Read the result.
Note:

Step 7:
Communicate the result.
Note:

Troubleshooting

If problems getting scan to initiate:
Check that scanner is on and connected.
Make sure skin is clean and dry.
Make sure probes are clean and dry.

Time Taken

From the time that the scan is commenced, to final result takes around 8 minutes.

Anticipated Results

Accurate diagnosis of the presence or absence of SARS-CoV-2 virus.

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GUIDELINES

Transmitting electrode should be held in the RT hand.
Receiving electrode should be connected to the LT middle finger terminal phalanx. (In the event of loss of middle finger, any other finger on the LT hand can be used).

In the event of loss of arm or hand a foot can be used as a substitute.

In the case rare case of loss of multiple limbs electrodes can be fixed to the rump.Minimum distance of electrode should be 20cm apart.

MATERIALS TEXT

Material required to peform and EPD test:

Patient.
EPD machine, transmitting electrode, receiving electrode.
Laptop computer with EPD software.
Table.
Chair x 2.
Operator.
PPE.
Disinfectant solution to clean probes and surfaces.
Hand santizer.
Electricity (optional).

SAFETY WARNINGS

Electrodes should be clean and dry.

Patients with cardiac pacemakers and pregnant individuals should consult their doctor before taking an EPD test.

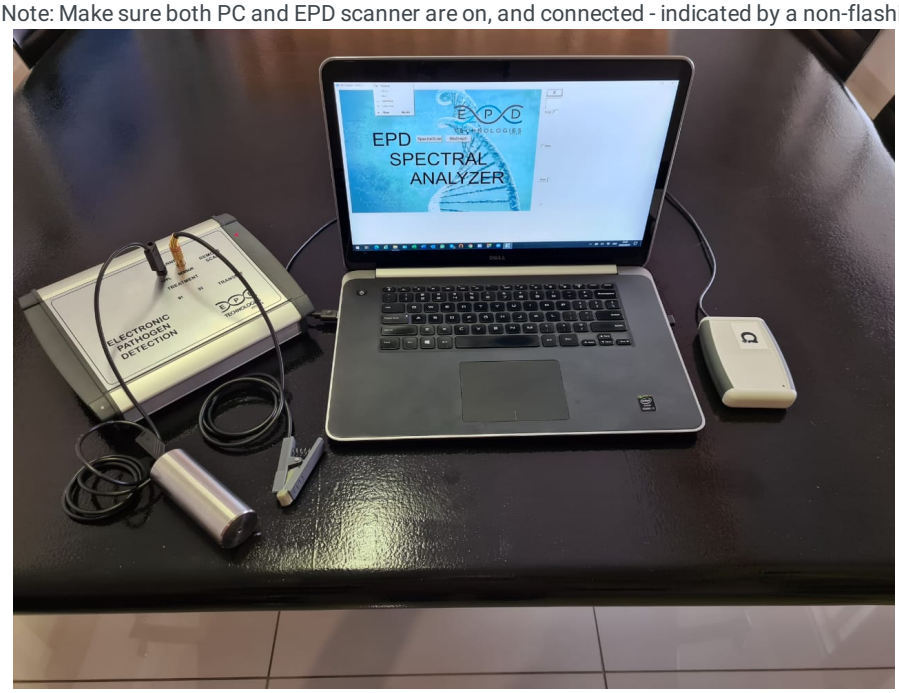
BEFORE STARTING

Check that equipment has been sanitized.
Skin of hands or feet should be clean and dry.

Equipment Setup 3m 30s

1 Switch on EPD scan unit and PC, connect EPD scan unit to PC. 3m

Note: Make sure both PC and EPD scanner are on, and connected - indicated by a non-flashing LED indicator



1.1 Insert elecrode cable plugs in the matching sockets

2 Open EPD application software on PC 30s

Subject Preperation 2m 20s

3 Clean electrodes with alcohol based disinfectant. Make sure subjects hands are clean and skin is dry. 30s

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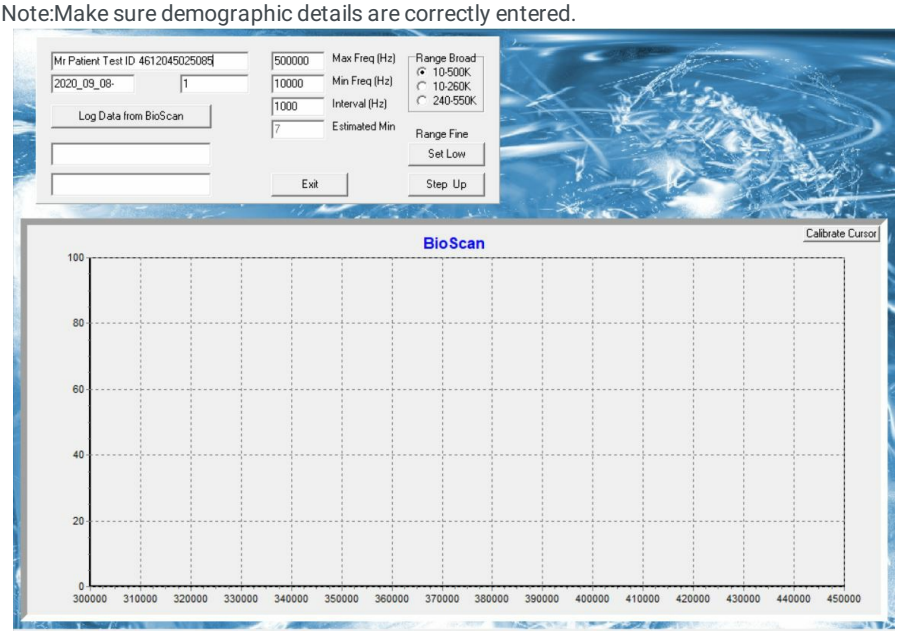
4 Enter patient details into EPD software. 1m

Note:Make sure demographic details are correctly entered.



4.1 Enter subject identifier 30s

5 Connect receiving electrode to LT middle finger terminal phalanx of patient. Give patient transmitting electrode to hold in RT hand. 20s

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Subject Scan 7m 30s

6 Commence scan from EPD application software. Scan duration 7 minutes. 7m

Note: Make sure the EPD software reads the EPD scan machine. Make sure patient remains connected to electrodes for the duration of the scan 7 minutes before disconnecting.

7 Calculation of result. 30s
Read the result.
Note: Result is generated in 30 seconds.

Results 1m

8 Communicate the result. 1m

Ready for next scan **go to step #3**

Note:Make sure result is communicated to the appropriate person and that all confidentiality protocols are met.Be mindfull of notifiable contition reporting laws.

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