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Oral COVID-19 disclosing: A novel rapid technique in infection diagnosis

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ABSTRACT
COVID-19 is an acute respiratory disease caused by novel coronavirus SARS-CoV-2 or 2019-nCoV. Recently, on March 11, 2020, COVID-19 was declared by the WHO as a virus pandemic disease. Nucleic acid real-time polymerase chain reaction (PCR) test has become the standard method for diagnosis of SARS-CoV-2 infection, these real-time PCR test kits have many limitations. Antibody tests are expensive and not available especially in developing countries. There is an urgent need for an accurate and rapid test method to quickly identify a large number of infected patients and asymptomatic persons, and also which can be available all over the world. we propose a new test technique based on use of oral gel, mouthwash, or tablets that color the area where the virus is localized in mouth, and then we diagnose the COVID-19 infection. Actually, our test is composed of specificCOVID-19 recombinant antigen of antibody IgM and IgG coupled to colorful or fluorescent molecules (enzymes). The person rinses his mouth with the mouthwash-test for 30 seconds, and rinses then with clean water. If we see some colored surfaces in the mouth, the subject is then COVID-19 positive. In case we use COVID-19 recombinant antigen of antibody IgG and IgM coupled to fluorescent molecules, we will see fluorescent surfaces in the mouth on ultraviolet light. Clinical trials must be done in the few next weeks to benefit of the technique to improve COVID-19 testing.
Keyword: *COVID-19 diagnosis-COVID-19 disclosing-Oral testing- Pandemic-Pneumonia*

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INTRODUCTION

Viral diseases continue to emerge and represent a serious issue to public health. In the last twenty years, several viral epidemics have been recorded such as the severe acute respiratory syndrome coronavirus (SARS-CoV), H1N1 influenza, and the Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012 [1,2].

The 2019-nCoV, also called SARS-CoV-2, was first reported in Wuhan, China in December 2019. The disease was later named Coronavirus Disease 2019 (COVID-19) and the virus responsible for it as the COVID-19 virus, respectively, by World Health Organization (WHO) [3, 4].

COVID-19 is an acute respiratory disease caused by novel coronavirus SARS-CoV-2 or 2019-nCoV. Recently, on March 11, 2020, COVID-19 was declared by the WHO as a virus pandemic disease [5, 6].

CoVs are positive-stranded RNA viruses with a crown-like appearance under an electron microscope due to the presence of spike glycoproteins on the envelope. Genomic characterization has shown that probably bats and rodents are the gene sources of alphaCoVs and betaCoVs. On the contrary, avian species seem to represent the gene sources of deltaCoVs and gammaCoVs (1,7, 8).

SARS-CoV-2is from the beta CoVs viruses and has round, elliptic, or pleomorphic form with a diameter of almost 60–140 nm [9].

It is sensitive to ultraviolet rays and heat, and may be inactivated by lipid solvents as including ether, ethanol, chlorine-containing disinfectant, peroxyacetic acid and chloroform [1].
As with other respiratory pathogens, including flu and rhinovirus, the transmission is believed to occur through respiratory droplets from coughing and sneezing or by being carried to oral or nasal mucosa by hands from the virus-infested surfaces. It appears that all COVID-19 patients – asymptomatic, mild or severe have a massive throat/mucus titre of virus, shedding it in the surroundings. Aerosol transmission is also possible in case of protracted exposure to elevated aerosol concentrations in closed spaces. Analysis of data related to the spread of SARS-CoV-2 in China seems to indicate that close contact between individuals is necessary. The spread, in fact, is primarily limited to family members, healthcare professionals, and other close contacts [10].
Within 5 to 9 days, the person has prodrome of illness and may vehicle infection to others [11].
Also. asymptomatic transmission has been documented, and the viral load is not significantly different between symptomatic and asymptomatic people, therefore the infectiousness may be the same in asymptomatic cases [10,12].
Once inside the airways, the S protein on the viral surface recognizes and adheres to the receptor protein ACE2 and the virus attack cells carrying ACE2 lining the airways. It can infect the upper and affected airways and with dying cells that break down and fill the airways, the virus is carried deeper into the lung [13].
An expression significantly elevated ACE2 is in alveolar type II cells (AT2) of lung, epithelial cells of the esophagus, absorbent enterocytes of the ileum and colon, gall bladder and bile duct cells, myocardial cells, cells of the renal proximal tubules and the urothelial cells of the bladder. Apart from that, ACE2 is also present on the oral mucosa and highly enriched epithelial in cells of the tongue, which is a potentially high risk of this pathway for infectious sensitivity 2019-Ncov. Thus, the expression of ACE2 is higher in the oral mucosa and the tongue than in the oral and gingival tissues. In addition, saliva, urine, stool and rectal swabs showed integrated virus in 19 patients-Covid-19 [14,15].
The WHO recommends collecting specimens from both the upper respiratory tract (nasopharyngeal and oropharyngeal samples) and lower respiratory tract such as expectorated sputum, endotracheal aspirate, or Broncho-alveolar lavage for a diagnostic test. The samples are needed to be stored at 4*C. The amplification of the genetic material extracted from the sample is done through a reverse polymerase chain reaction (RT-PCR) [16]. If the test result is positive, it is recommended to repeat the test for verification. In patients with a confirmed diagnosis of COVID-19, laboratory evaluation should be repeated at intervals to assess viral clearance before discharge from observation. In a positive case, lymphopenia and elevated liver enzymes, LDH, muscle enzymes and C-reactive are negative prognostic factors [17].
Also, antibody tests are mainly used to determine if a person has ever had covid-19. IgM and IgG can begin to become detectable after 4 to 5 days. Furthermore, 70% of symptomatic patients on days 8-14 have positive IgM antibodies vs 90% of the total positive antibody tests in 11-24 days. In addition, with unknown antibody response duration and after several weeks, IgG reactivity can reach more than 98% [16,18-20].
COVID-19 can also be diagnosed using salivary diagnostic platforms (21). Saliva samples could be taken from persons with symptomatic oropharyngeal secretions (22, 23). By avoiding close contact between healthcare professionals and infected persons to collect nasopharyngeal or oropharyngeal samples, the possibility of self-saliva collection can greatly minimize the risk of transmission of COVID-19
Besides, the nasopharyngeal and oropharyngeal collections are very uncomfortable and may causes hemorrhage especially in infected patients with thrombocytopenia [24].

MATERIAL AND METHODS

A disclosing virus test may be the rapidest and most practical way to test COVID-19.
In fact, we propose a new test technique based on use of oral gel, mouthwash, or tablets that color the area where the virus is localized in mouth, and then we diagnose the COVID-19 infection.

RESULTS

Actually, our test is composed of specificCOVID-19 recombinant antigen of antibody IgM and IgG coupled to colorful or fluorescent enzymes (Figure 2). The colorful enzymes that we use are alkaline phosphatase and horseradish peroxidase.
The person rinses his mouth with the mouthwash-test for 30 seconds, and rinses then with clean water. If we see some colored surfaces in the mouth, the subject is then COVID-19 positive. In case we use COVID-19 recombinant antigen of antibody IgG and IgM coupled to fluorescent enzymes, we will see fluorescent surfaces in the mouth on ultraviolet light.

This disclosing test is very promising, because of its rapidity, low cost, prevent any contact with health workers, and also it will be more available than the other tests.
Clinical tries must be done in the few next weeks to benefit of the technique to improve COVID-19 testing.

DISCUSSION

This disclosing test is very promising, because of its rapidity, low cost, prevent any contact with health workers, and also it will be more available than the other tests.

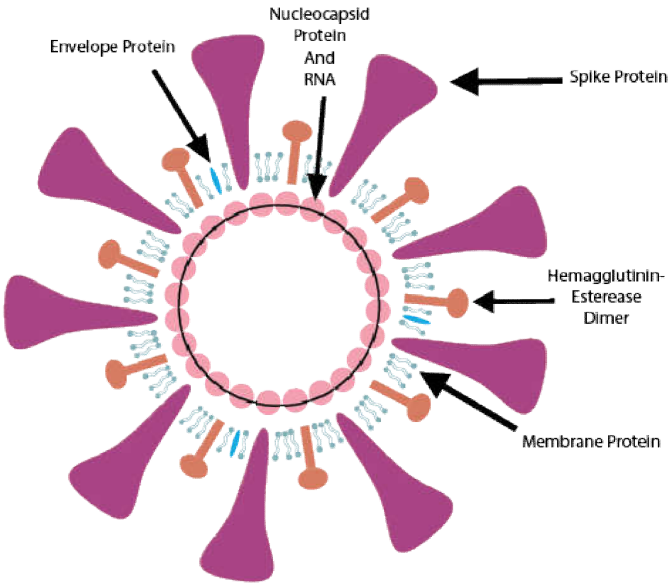

Figure 1: SARS-Cov 2 Structure (9)

1. The glycosylated Spike protein (S) is a large component making the distinct spikes on the surface of the virus. It utilizes an N-terminal signal sequence to gain access to the endoplasmic reticulum and mediates the attachment to host angiotensin-converting enzyme II (ACE2) receptors. The S protein is cleaved by a host cell furin-like protease into two separate polypeptides S1 and S2.
2. The RNA genome of the virus is bound by the phosphorylated nucleocapsid protein (N) in a beads-on-a-string conformation. On entering the host cells, the N protein potentially tethers the viral genome to replicase-transcriptase complex (RTC), and helps in packaging the encapsulated genome into viral particles.
3. The Envelope protein (E) is found in small quantities in the virus and is appears to be a transmembrane protein with ion channel activity. The protein facilitates assembly and release of the new virions. It is related to the disease pathogenesis and important for the disease progression.
4. The Membrane protein (M) is the most abundant structural component of the virus. It exists as a dimer and enables to maintain membrane curvature on one end and bound to nucleocapsid proteins on the other.
5. The Hemagglutinin-esterase (HE) is also a dimer protein and binds to sialic acids on surface glycoproteins. It is responsible for facilitating and enhancing S protein-mediated cell entry and virus spread through the mucosa [9].

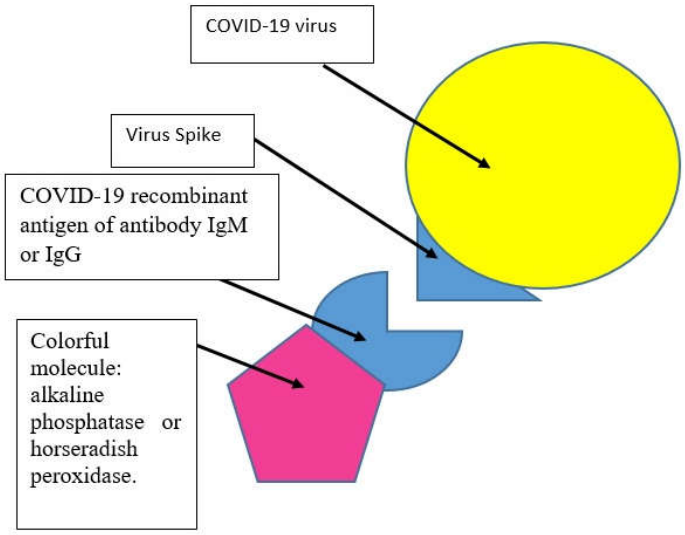

Figure 2: The principle of COVID-19 oral disclosing test

CONCLUSION

Clinical tries must be done in the few next weeks to benefit of the technique to improve COVID-19 testing.

COMPETING INTERESTS

The authors declare no competing interest.

AUTHORS' CONTRIBUTIONS

Specify the contribution to the work and write-up of the manuscript for each person listed as author

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