Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Can photodynamic therapy be repurposed to treat oral lesions of COVID-19?

Dear Editor,

We read with great interest the article published recently [1], describing the antiviral potential of photodynamic therapy (PDT) using Methylene Blue and Radachlorin to inactivate and Inhibit SARS-CoV-2 In Vitro. The authors have presented an exciting finding which is very relevant during this COVID-19 pandemic. We want to discuss a novel concept of PDT in treating oral lesions in COVID-19 patients.

Dental health is one of the most effected domains due to this pandemic. Numerous oral manifestations of COVID-19 are reported, such as ulcer of tongue and mouth, fissured or depapillated tongue, halitosis, vesiculobullous lesions, recurrent herpes simplex, candidiasis, and spontaneous bleeding [2–4]. Among these, more than half (68 %) of the oral lesions were symptomatic when 35 cases with COVID-19 were assessed [2]. Various treatment modalities were used to manage these oral lesions [2]. However, many of these drugs have drawbacks, such as the development of resistance and exuberant cost. Therefore, there is an urgent need to identify or develop new treatment modalities to prevent and treat oral lesions in these patients.

In the past, PDT has been used for treating many bacterial, fungal, and viral lesions, including oral vesiculobullous lesions. The authors of this paper themselves have publications, including clinical trials [5–7] that use PDT in periodontal disease. However, during COVID-19 times, none of the studies so far explore PDT's potential in managing oral lesions. Therefore, we hypothesis that PDT may be repurposed to treat oral lesions of COVID-19.

The purpose of this paper is to suggest the prospect of using PDT for the treatment of oral lesions in COVID-19 patients. PDT is a potential antiviral tool that could prove a highly effective method of preventing and treating COVID-19. An evidence-based approach supports our theory as in the past, PDT not only has inactivated bacteria, viruses, and fungi directly but also attenuates the organism indirectly by stimulating the immune system.

PDT has been found to combat secondary infections in COVID-19 patients and can also be a complementary treatment for decreasing the viral and bacterial load in the patient's saliva and oral cavity. Hence, we hypothesize that PDT treats oral vesicular lesions and ulcers following the local application of porphyrin-based PSs onto the vesicular lesions and ulcers. Moreover, PS molecules may act as a 'decoy' (Li et al., 2020) such that SARS-CoV-2 virions would attach to PS molecules instead of healthy oral tissue or attack healthy hemoglobin [8] even without the need for photoactivation.

The susceptibility of SARS-CoV-2 to PDT in humans can be seen in recent literature [9]. Encouraging in vitro results show that PSs Methylene blue (MB) and Radachlorin at very low concentrations (100–1000 times lower than usual) when activated by 662 nm light caused inhibition of SARS-CoV-2 [1]. Recent evidence shows that MB has demonstrated virucidal activity when incubated with SARS-CoV-2 at low micromolar concentrations. Furthermore, MB has been shown to inhibit the SARS-CoV-2 spike protein and its ACE2 receptor, which is crucial in inactivating the virus [10].

Despite this, there is no strong evidence yet regarding the inactivation of SARS-CoV-2 in the oral cavity by using PDT in vivo. Hence, we recommend the need to conduct controlled clinical trials using PDT in the oral cavity to evaluate its effectivity against SARS-CoV-2. We believe that due to the antiviral, immunostimulatory, and immunosuppressive effects of PDT, it can be used not only in symptomatic patients to relieve pain but also in asymptomatic patients' oral cavity, periodontal pockets, and saliva to control the outbreak and avoid oral contact infection.

CRediT authorship contribution statement

Joseph Betsy: Writing - original draft, Writing - review & editing. **Prasanth CS:** Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors reported no declarations of interest.

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