

Ministry of higher education & scientific research Babylon University





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# Biostimulation of taste compromised related to COVID-19 infection by low level laser therapy

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قسم جراحة الفم

# Biostimulation of taste compromised related to COVID-19 infection by low level laser therapy

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بسمرائك الرحيمر

# ﴿ قَالُوا سُبُحَانَكَ لَا عِلْمَرَلَنَا إِلَّا مَا عَلَمُنَّنَا ٢ إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

(البقرة: ٣٢)



#### Abstract:

The aim of the article is to justify the application of low-level laser therapy (LLLT) to prevent the development of endothelial dysfunction in COVID-19 patients. The results of treating and rehabilitating patients with COVID-19 and prevention of the disease using low-level laser therapy (LLLT) are evaluated.

Concluded, Low-level laser therapy is a justified treatment method that promotes lung tissue regeneration and mitigates the consequences of the disease. The obtained results confirm that LLLT can be used for the effective prevention and treatment of COVID-19 patients.

#### **Introduction:**

Coronaviruses are a group of viruses belonging to the family of Coronaviridae, which infect both animals and humans. Human coronaviruses can cause mild disease similar to a common cold, while others cause more severe disease (such as MERS - Middle East Respiratory Syndrome and SARS – Severe Acute Respiratory Syndrome) (Wu et al., 2020).

Coronaviruses (CoVs) refer to a family of enveloped, positive-sense, single-stranded, and highly diverse RNA viruses. There are four genera (alpha, beta, gamma, and delta), among which  $\alpha$ -coronavirus and  $\beta$ -coronavirus attract more attention because of their ability to cross animal-human barriers and emerge to become major human pathogens (Coleman and Frieman, 2014).

The Middle East respiratory syndrome (MERS) is caused by a novel beta coronavirus like the cause of severe acute respiratory syndrome (SARS)

and was first recognized in 2012 in Saudi Arabia. Human cases have been associated with direct and indirect contact with dromedary camels (Moskvin, 2008). SARS-CoV-2 (Severe acute respiratory syndrome coronavirus type 2) is a coronavirus that caused the Covid-19 disease outbreak in late 2019 in Wuhan China. By early 2020, the disease had rapidly spread across the world and was declared a global pandemic as a public health emergency of international concern (Moskvin, 2014).

The tastants perfuse through a mucosal film covering the dorsum of the tongue to the apical opening of the taste buds to stimulate the taste receptor cells (Neyraud and Morzel, 2019). This 'tongue film' provides unique ecological niche and large surface area for microbial colonization, the metabolization products of which modulate the threshold for specific taste sensitivity (Neyraud and Morzel, 2019; Mantelet et al., 2020).

According to the current opinions, which are in good agreement with the practice of clinical application of low-level laser therapy, thermodynamic triggering of  $Ca^{2+}$ -dependent processes is the primary mechanism of the bio modulating effect of LILI. After the photon energy (laser light) absorption by various intracellular components, the intracellular calcium depot is activated, and  $Ca^{2+}$  ions with increased concentration are released in the form of two waves with half periods of 100 and 300 seconds. This is followed by the development of a cascade of responses at all levels, from cells to the body as a whole: activation of mitochondrial functions, cell metabolism and proliferation, normalization of the immune and vascular systems, and the inclusion of the VNS and CNS in the process; as shown in figure-1, (Agyeman et al., 2020).



Figure 1: Biological effects of LLLT.

## Subjects, Materials and Methods:

Fifteen (15) participants were included in this current study, without signs and symptoms for any other medical diseases but with taste compromised as 6 months post COVID-19 complications,  $\cdot$  visits (5 min)(3 visits weekly) for each application points of LLLT therapy; 940 nm (10 W) BIOLASE -U.S.A device used.

Biological application of LLLT application on the surfaces of the tongue extending from the posterior surfaces of the tongue to anterior 2/3 of it; photo glasses were used for both operator and patients to reduce the effect of LLLT on the eye. This study was done in the oral medicine clinic, college of Dentistry, Babylon University under supervision of oral medicine specialist.

## **Results:**

All the participants were improved the taste sensation after the 10 visits of LLLT applications by make a questionnaire for all these patients, 10 visits (3 visits weekly) LLLT for 5 minutes, 2 weeks after end of visits, gradual recovered was occurred.

#### **Discussion:**

The oral epithelial cells including the taste bud cells have been shown to express angiotensin-receptor-2 (ACE2), the entry receptor for viruses of the Coronaviridae family including the SARS-COV-2. Emerging evidence also suggest that the CoV-2 potentially uses multiple entry receptors such as the sialic acid receptors and the toll like receptors (TLR) for host cell entry (Vaira et al., 2020; Gadanec et al., 2021). Binding of SARS-CoV-2 to salivary sialic acid could interfere with the glycoproteins mediated transport of tastants and contribute to loss of taste (Milanetti et al., 2021). In-situ models of direct binding of coronavirus spike protein with TLR1, 4 and 6 support the specific roles of these TLRs in CoV-2 entry and COVID-19 (Choudhury and Mukherjee, 2020). Interestingly, taste bud cells express TLRs more abundantly than the non-gustatory lingual epithelium. Specifically, TLRs 2.3 and 4 are highly observed in the gustducin-expressing type II taste bud cells (Wang et al., 2009).

Thus, the expression of multiple entry receptors makes taste bud cells highly susceptible for SARS-CoV-2 infections. Significantly, SARS-CoV-2 viral infection and replication has been shown to occur in human taste bud cells (Doyle et al., 2021).

Thus, direct infection of the taste bud cells and consequent inflammation could affect taste perception (<u>Wang et al., 2009</u>; <u>Ambaldhage et al., 2014</u>).

The proposal presents the diode laser 940 as possible treatment for the loss of taste sensation in patients with long SARS-CoV2. The effect of low levels of laser energy was first discovered by Dr Endre Mester in 1967.5 Since then it has been used for various applications in the field of medicine and dentistry and is broadly termed 'low level laser therapy'(LLLT) or 'biostimulation' or 'phototherapy'. (Doyle et al., 2021). It is defined as a 'non-thermal' laser light application using photons (light energy) from the visible and infrared spectrum for tissue healing and pain reduction (North American Association of Laser Therapy-NAALT). Several in vitro studies have demonstrated that the effects of laser light on wound healing are much greater than obtained with light from other sources, such as light-emitting diodes (LEDs) (Doyle et al., 2021).

Finally the LLLT therapy used as bio stimulation and bio modulation, convert status from pro- inflammatory to anti inflammatory

#### **Conclusions:**

The presented brief literature review convincingly demonstrates the possibilities of low-level laser therapy for eliminating taste compromised. The LLLT is a pathogenetically justified treatment method that promotes tongue tissue regeneration and mitigates the consequences of the disease.

Finally, a positive experience of applying low-level laser therapy for the comprehensive treatment and rehabilitation of COVID-19 patient.

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