USA – DOCUMENTAION Oct. 2020

A 57-Year-Old African American Man with Severe COVID-19 Pneumonia Who Responded to Supportive Photobiomodulation Therapy (PBMT) COLD LASER: First Use of PBMT in COVID-19

Patient: Male, 57-year-old

Final Diagnosis: COVID-19

Symptoms: Shortness of breath • hypoxia

Medication: —

Clinical Procedure: Photobiomodulation therapy (PBMT) Cold-Laser Therapy

Specialty: Infectious Diseases • Pulmonology

Objective: Unusual or unexpected effect of treatment

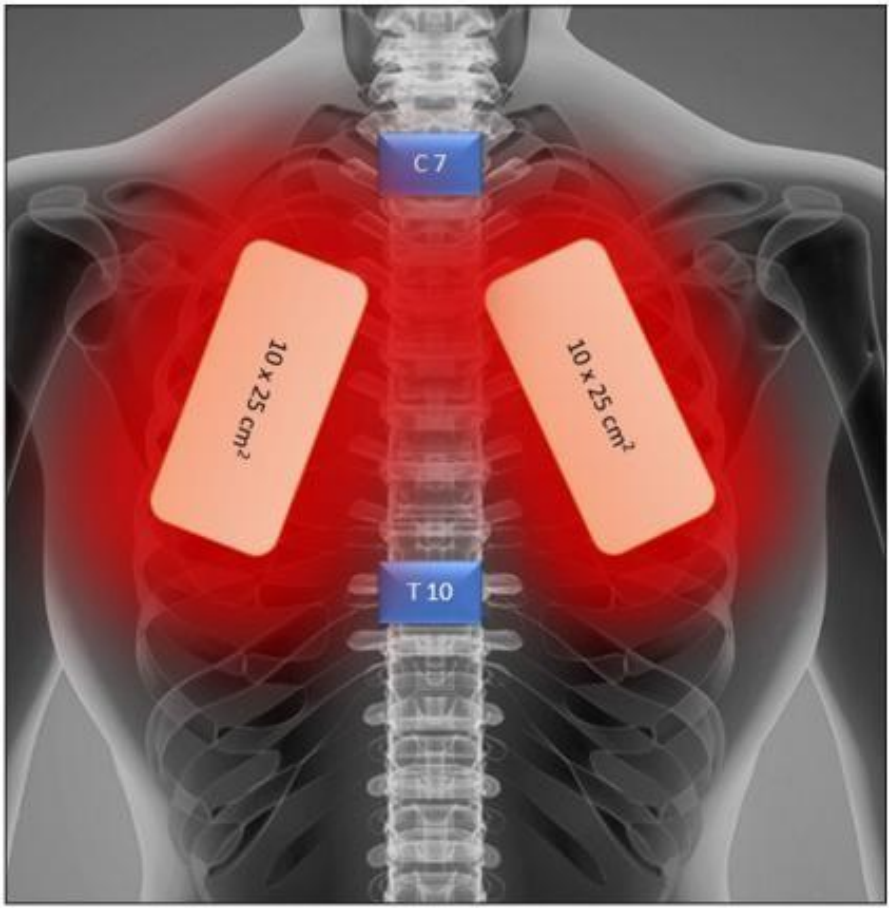
Background: Coronavirus disease 2019 (COVID-19) is associated with lung inflammation and cytokine storm. Photobiomodulation therapy (PBMT) is a safe, non-invasive therapy with significant anti-inflammatory effects. Adjunct PBMT has been employed in treating patients with lung conditions. Human studies and experimental models of respiratory disease suggest PBMT reduces inflammation and promotes lung healing. This is the first time supportive PBMT was used in a severe case of COVID-19 pneumonia.

Case Report: A 57-year-old African American man with severe COVID-19 received 4 once-daily PBMT sessions by a laser scanner with pulsed 808 nm and super-pulsed 905 nm modes for 28 min. The patient was evaluated before and after treatment via radiological assessment of lung edema (RALE) by CXR, pulmonary severity indices, blood tests, oxygen requirements, and patient questionnaires. Oxygen saturation (SpO2) increased from 93–94% to 97–100%, while the oxygen requirement decreased from 2–4 L/min to 1 L/min. The RALE score improved from 8 to 5. The Pneumonia Severity Index improved from Class V (142) to Class II (67). Additional pulmonary indices (Brescia-COVID and SMART-COP) both decreased from 4 to 0. CRP normalized from 15.1 to 1.23. The patient reported substantial improvement in the Community-Acquired Pneumonia assessment tool.

Conclusions: This report has presented supportive PBMT in a patient with severe COVID-19 pneumonia. Respiratory indices, radiological findings, oxygen requirements, and patient outcomes improved over several days and without need for a ventilator. Future controlled clinical trials are required to evaluate the effects of PBMT on clinical outcomes in patients with COVID-19 pneumonia.

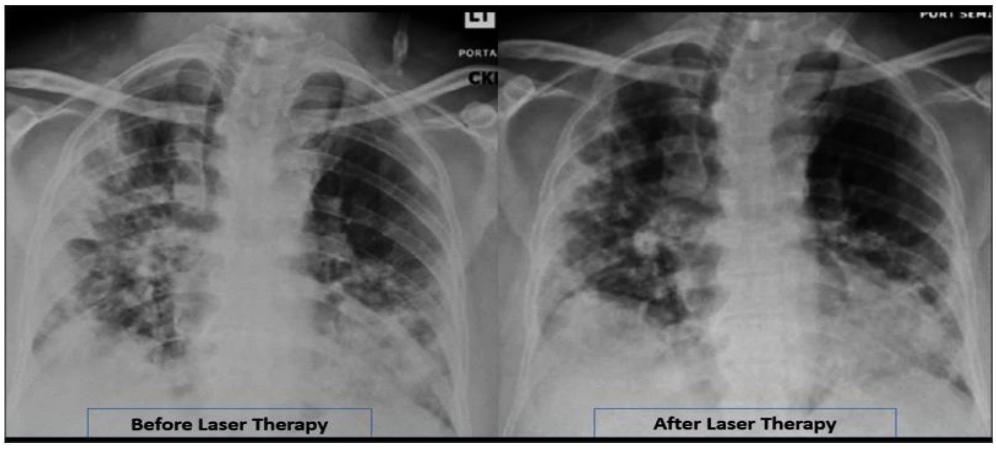
	808 nm (GaAlAs) diode	905 nm (GaAs) diode
Mode of radiation	Pulsed	Pulsed
Frequency	1500 Hz, (Duty Cycle 50%) (1 Hz÷2 kHz)	1500 Hz (90 kHz Modulated at 1 Hz÷2 kHz)
Pulse duration	333 µs (500 ms÷250 µs)	100 ns
Peak power	3 W	75W×3
Average power	1.5 W	11.25×3=33.75 mW
Spot size	19.625 cm^2	
Area	On each lung 25×10=250 cm^2	
Dose	7.1–7.2 J/cm^2	
Distance from the skin	20 cm	
Treatment time	14 minutes each lung	
Total energy	3600 J 1794.24 each lung	
Total time	28 minutes	
Sessions	Once daily for 4 days	

Table 1. Laser parameters for COVID-19 pneumonia patients.



Parameters	Before treatment	After treatment	Normal range or evaluation criteria
PSI	Class V (142)	Class II (67)	Risk Class (Points): Disposition Class I (<50): Outpatient Class II (51–70): Outpatient Class III (71–90): Outpatient/brief Inpatient Class IV (91–130): Inpatient Class V (>130): Inpatient
SMART-COP	5	2	0 points: Very low risk of needing IRVS 1 point: Low risk (1 in 20) of needing IRVS 2 points: Moderate risk (1 in 10) of needing IRVS 3 points: High risk (1 in 6) of needing IRVS ≥4 points: High risk (1 in 3) of needing IRVS; Consider ICU admission
Brescia-COVID	4	0	0 – monitor 1 – add O_2 and monitor 2 – CXR, ABG, O_2 therapy, monitor >2 – HFNC and reassess. If still >2, intubate.
CAP total	36.68	82.82	Calculated based on (CAP) score questionnaire: 75–100%
CAP respiratory	67.52	87.17	75–100%
CAP well-being	0.0	73.07	75–100%
RALE	8	5	Lungs score dependent on extent of involvement based on consolidation or ground-glass opacities for each lung, total score is the sum of the score of the lungs: 0 – no involvement; 1 – <25% of lung involved; 2 – 25–50% of lung involved; 3 – 50–75% of lung involved; 4 – >75% of lung involved.
WBC	10.7	6.5	4.5–11
CRP	15.1	1.23	3 mg/mL
O_2 Requirement	2–3 L/min	1 L/min	0 L/min
SpO_2	93–94%	100%	≥94%

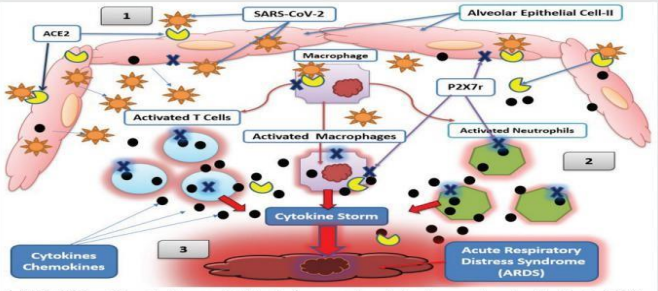
Table 2. Evaluation criteria before and after photobiomodulation therapy in a COVID-19 patient. PSI – Pneumonia Severity Index; SMART-COP – Systolic blood pressure, Multilobar infiltrates, Albumin, Respiratory rate, Tachycardia, Confusion, Oxygen, and pH; CAP – Community-Acquired Pneumonia; RALE – Radiographic Assessment of Lung Edema; SpO2 – Oxygen saturation; WBC – White Blood Cells; CRP – C-Reactive Protein; IRVS – Intensive Respiratory or Vasopressor Support; CXR – Chest x-ray; ABG – Arterial Blood Gas; HFNC – High-Flow Nasal Cannula.



Radiographic Assessment of Lung Edema (RALE) by CXR showed reduced ground-glass opacities and consolidation following PBMT. Lung radiographic score is dependent on extent of involvement based on consolidation or ground-glass opacities for each lung. Total score is the sum of both lungs. Scores classification: 0 – no involvement; 1 – <25% of lung involved; 2 – 25–50% of lung involved; 3 – 50–75% of lung involved; 4 – >75% of lung involved. RALE score before laser therapy (04-27-2020)=8. Laser therapy started on (04-29-2020). RALE score after laser therapy (05-03-2020)=5.

FIGURE 1

The effects of SARS-CoV-2 on alveolar cell and cytokine storm.



1 – SARS-CoV-2 particles attack lung epithelial cells, immune cells and alveolar macrophage by attaching to ACE-2 to generate more viruses and release cytokines/chemokines (Inflammatory Elements). SARS-CoV-2 Induces ACE2 downregulation and suspending the ACE2. Activation of P2X7 receptors by extracellular ATP plays a key role in the induction of inflammation.
2 - Cytokine/chemokine-activated macrophages and virally infected T cells and other neutrophils lead to an extensive immune response and the initiation of cytokine storm.
3 - Released chemokines load more inflammatory cells from blood vessels into the site of inflammation, and this amplifies cytokine storm and leads to Acute Respiratory Distress Syndrome (ARDS).

FIGURE 2

The effects of SARS-CoV-2 versus LLLT on cytokine storm and lung tissue.

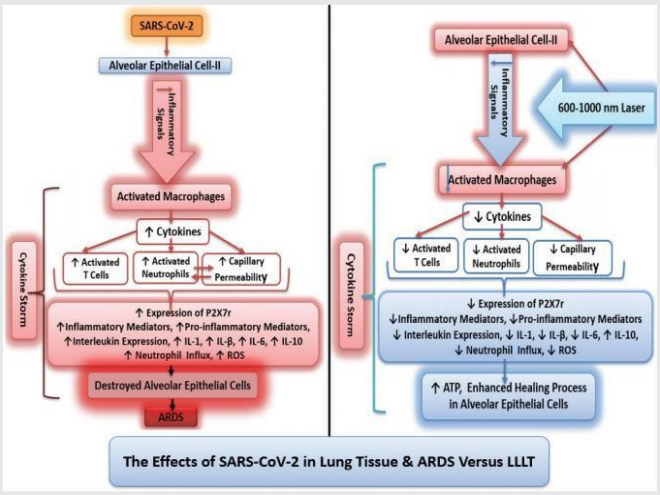


FIGURE 3

LLLT for COVID-19.