eBook

MLS® LASER THERAPY & COVID-19

ASA LASER

Research and Therapeutic Solutions

Summary of topics

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) viral infection has been declared a pandemic by World Health Organization (WHO). The corresponding disease, COVID-19 is not only a **highly infectious respiratory disease**, but it also **involves multiple organs, such as lungs, brain, heart, intestine, vascular system** (*Lin et al 2020, Mason et al 2020, Wu et al 2020*). **Long-term consequences of COVID-19 are still unknown**, but evidence from previous CoV outbreaks demonstrates impaired pulmonary and physical function, reduced quality of life and emotional distress (*Barker-Davies et al 2020*), therefore rehabilitation and recovery of these patients represent important phases of the clinical journey of the patient. Physical therapies in general, and laser therapy specifically, can represent a useful tool to support patient progress to recover physical functionality.

COVID-19 clinical symptoms and progression

SARS-CoV-2 viral infection produces symptoms after an incubation time of few days. According to the severity of the symptoms, infected patients can be classified as: asymptomatic, symptomatic isolating at home, symptomatic patients admitted to hospital, symptomatic patients requiring ventilatory support in critical care (*Barker-Davies et al 2020*).

Most common uncomplicated illness **symptoms are fever** (usually present in >90% of symptomatic patients), **cough, myalgia, dyspnoea, fatigue, and altered sense of taste/smell** (*Huang et al 2020, Chen et al 2020*). Most of these mild symptoms are common to other respiratory tract conditions and create the need for an appropriate diagnosis.

Different levels of severity may include moderate to severe pneumonia, Acute Respiratory Distress Syndrome (ARDS), extrapulmonary manifestations and systemic complications, sepsis and septic shock (*Cascella et al 2020*).

It is estimated that, if the subject immune system is effectively responding to the infection, around 80% of patient is presenting mild symptoms only (*Wu et al 2020*) and in these cases, the disease is self-limiting. Some categories have high risk of developing a severe form of the disease, due to concomitant conditions, such as diabetes, obesity and cardiovascular conditions, or age (*Huang et al 2020, Chen et al 2020; https://coronavirus.jhu.edu/data/racial-data-transparency*). **It has been observed that COVID-19 patients with underlying conditions are at higher risk of morbidity and mortality, secondary to the cytokine storm and ARDS**. Cytokine storm is one of the characteristics of COVID-19 infection and it is mostly observed in patient with impaired immune responses.

This process leads to the release of a wide range of pro-inflammatory molecules (*Rathi et al 2020*), among which cytokines such as IL-16, IL-1b, TNF-a, IL-2, IL- 7, IL-6 and IL-10.

Children who are infected with SARS-CoV-2 generally display mild symptoms. Also, most of the adult patients have a favourable clinical course, while a minority of them experience a worsening of clinical conditions with rapidly worsening respiratory failure after around a week (*Cascella et al 2020*).
A number of pre-existing medical comorbidities have been identified as risk factors for increased mortality, which rate is highly variable, from 0,25% up to 10% based on different countries data (*Peravali et al 2020; Coronavirus Pandemic Research and Data available online: https://ourworldindata.org/coronavirus*).

Overview of proposed treatments

Acute treatment is symptomatic and depends on the severity of each case. In mild cases, monitoring of vital parameters, such as temperature, blood pression, oxygen saturation, respiratory rate, etc. is recommended, as well as rest and an appropriate nutrient and hydration supply (*Hanna et al 2020*).

Currently, no specific therapies have been proven to have a positive impact on disease progression other than supportive care strategies based on O_2 supplementation and mechanical ventilation (*Vashisht et al 2020*) which are needed in more severe cases.

A large number of clinical studies is currently ongoing to try and find potential new successful therapeutic tools to fight acute phase of COVID-19, among which the following approaches are being studied: antiviral therapies, corticosteroids, immunotherapy, exosomes, cell therapy, recombinant ACE2 receptors, etc (*Hanna et al 2020*).

In this search for appropriate strategies, laser therapy has also been investigated as an adjunctive tool to standard conventional protocols for the treatment of acute phase patients (*Sigman et al 2020 a & b*). **In fact, recent findings revealed that laser therapy could be helpful in reducing the lung inflammation and promoting the regeneration of the damaged tissue**.

Laser therapy, especially based on infra-red lasers, can increase the oxygenation indirectly in order to rehabilitate the affected organs (*Nejatifard et al 2020*). Moreover, some anecdotical reports observed that laser therapy used in combination with conventional medical treatment was safe and appeared to produce a synergistic effect in healing in patients with pneumonia, asthma, chronic bronchitis and other lung conditions (*Amirov et al 2002, Derbenev et al 2000, Ostronosova 2006, Mehani 2017, Miranda et al 2015*).

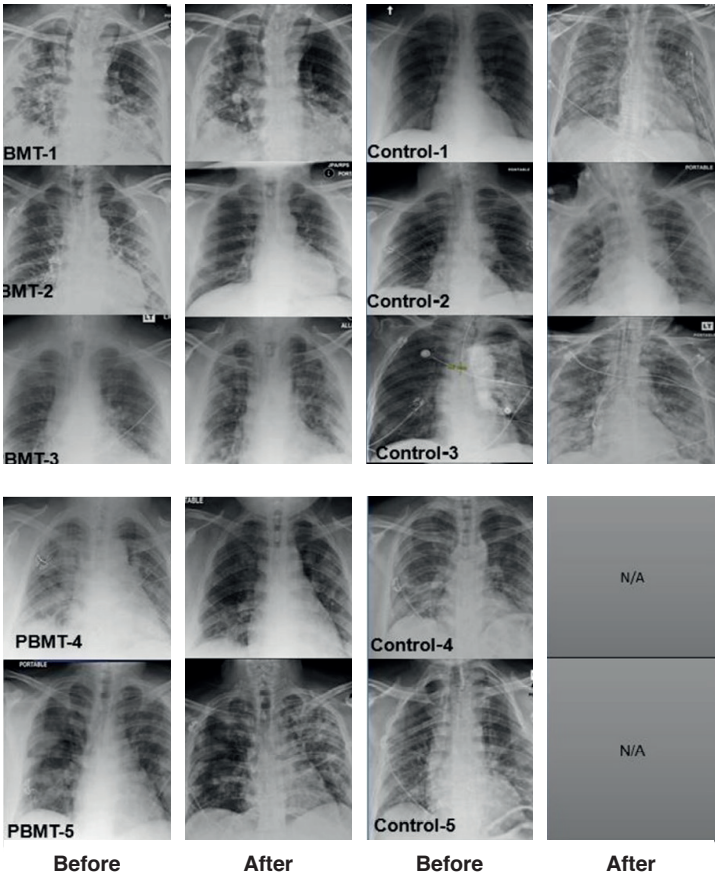
Additionally, recent systematic reviews (*Fekrazad & Fekrazad 2021; Soheilifar et al 2020*) suggest that laser therapy may be applied to target lung tissue in COVID-19 patients.

MLS® Laser Therapy in COVID-19

MLS® Laser Therapy has been used by Sigman et al. in a clinical study on COVID-19 patients with pulmonary disease with the aim of reducing inflammation and promoting lung healing. This clinical application was based on therapeutic effects of MLS® Laser Therapy in terms of **reduction of inflammatory cytokines, cellular infiltrates, edema and fibrosis, and the results suggest that the use of adjunct MLS® Laser Therapy in the early stages of severe ARDS seen in COVID-19 patients can enhance healing and reduce the need for prolonged ventilator support and ICU stay**.

Patients showed improvement on pulmonary indices such as SMART-COP, BCRSS, RALE, and CAP (Community-Acquired Pneumonia questionnaire), showed rapid recovery, did not require ICU admission or mechanical ventilation, and reported no long-term sequelae at 5 months after treatment. In the control group, 60% of patients were admitted to the ICU for mechanical ventilation. The control group had an overall mortality of 40%. At a 5-month follow-up, 40% of the control group experienced long-term sequelae.

In conclusion, **MLS® Laser Therapy** is a safe and effective potential treatment for COVID-19 pneumonia and improves clinical status in COVID-19 pneumonia. (Vetrici et al, 2021)

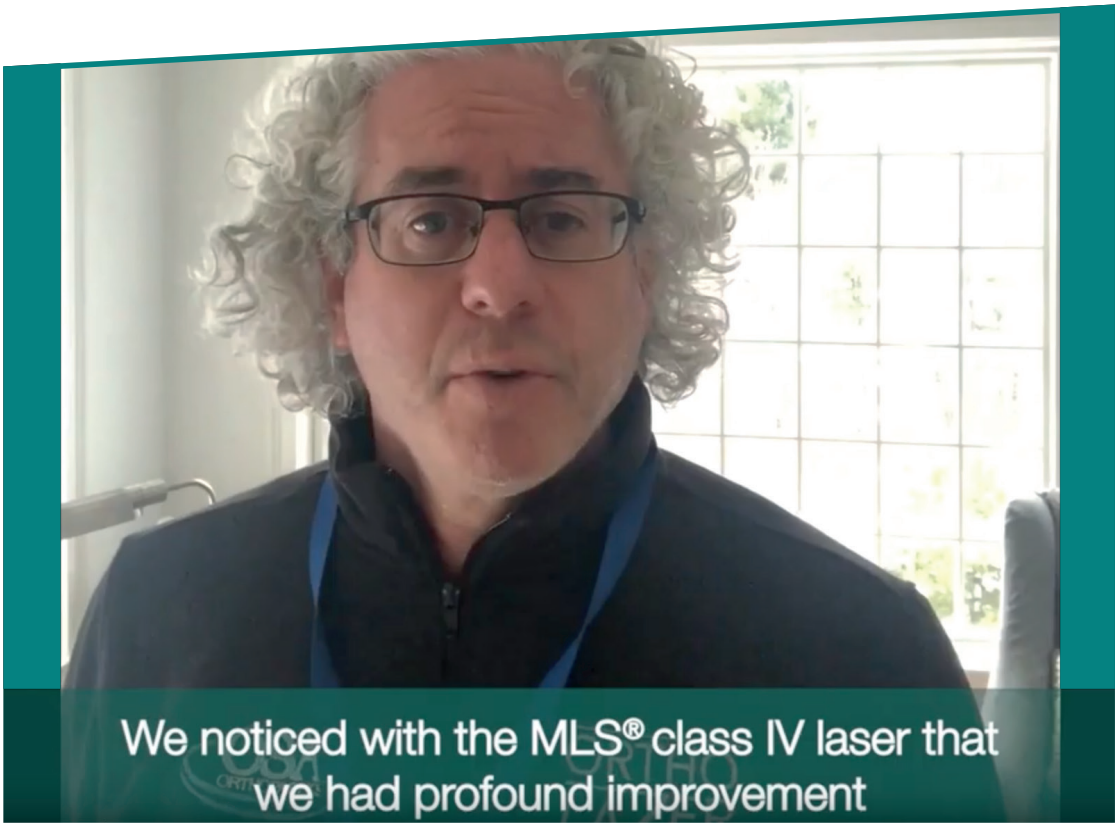


Chest x-rays demonstrate visible improvement in the PBMT group and worsening in the control group. Chest x-rays before and after treatment reveal improved lucency, signifying increased absorption of consolidation and group glass opacities in all PBMT treated patients. In three of five control patients, the chest x-rays show increased consolidation and ground glass opacities, signifying progression of disease (at the end of the observation period). Two control patients were discharged to home prior to obtaining post treatment chest x-rays.

"When the Covid epidemic struck, I thought what about the idea of using the MLS® class IV laser for acute Covid? We saw profound results for acute inflammation for injuries around the joints and that was the natural reason". That's how everything started for Dr. Scott Sigman, Orthopedic surgeon in Boston and Chief Medical Officer at Ortholazer Orthopedic Laser Centers.

"*Evaluation of Adjunctive Photobiomodulation (PBMT) for COVID-19 Pneumonia via Clinical Status and Pulmonary Severity Indices in a Preliminary Trial*", published in the Journal of Inflammation Research, shows the pioneering results of such intuition. Dr. Sigman continues:

> *We stratified the patients into two groups, five where in the treatment group and five were in the control group, at that point, that's what the hospital had allowed us to do. The five patients that were treated with laser, the class IV cold laser therapy that we use with MLS® had outstanding results and all were discharged from the hospital after four laser treatments. One daily laser treatment for approximately 12 minutes per lung field once a day for four days. All of the patients that were treated had profound improvement in their chest X-rays, their ability to oxygenate, and all of their pulmonary severity scores were dramatically improved with the use of the laser. Unfortunately three patients in the control group, who did not receive laser but only standard care, were admitted to the ICU and died after being intubated; other two patients in the control group are showing long hauler or chronic symptoms as a result.*



To watch the whole interview, **click here**.

Recovery from COVID-19 and consequences

Once the patient has overcome the acute phase of the disease, they have to face the post acute period with the aim to achieve to full recovery. At the moment, there is no universally accepted time frame for defining the onset of post acute period. It is estimated that severe cases of COVID-19 typically require 3-6 weeks for recovery (*https:// www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-finalreport.pdf*). Significant morbidity is forecasted for 3-6 months, with pressure on routine medical and rehabilitation services for 12 months and over (*Barker-Davies et al 2020*). **Many COVID-19 survivors who require critical care may develop psychological, physical and cognitive impairments**. A large number of patients with COVID-19 requiring rehabilitation will have spent time on intensive care unit (ICU) and therefore will display symptoms such as dyspnoea, anxiety, depression, prolonged pain, impaired physical function and poor quality of life, which are problems commonly related to ICU patients (*Barker-Davies et al 2020, Denehy et al 2012, Jackson et al 2012).*

Additionally, there is a clear need for further research on the long-term impact of COVID-19 on survivors (*Barker-Davies et al 2020*). **An initial 6 month follow up study has observed some common consequences of the disease, such as fatigue, muscle weakness, sleep difficulties, and anxiety or depression** (*Huang et al 2020*). The level of severity of these sequelae was directly related to the severity of the disease. These results support that those with severe disease need post discharge care (*Huang et al 2020*). Therefore, a need for guidance on the rehabilitation of COVID-19 survivors is clear. Specifically, as COVID-19 is a multisystem disease, a multidisciplinary rehabilitation team is recommended to enable recovery (*Barker-Davies et al 2020*).

The role of Physiotherapy in COVID-19 rehabilitation

The so-called "**Post COVID syndrome**" presents with a wide range of dysfunctions, ranging from mild to severe, that affect several systems, including the musculoskeletal one.

Patients undergoing rehabilitation can be classified into 3 groups:

1. patients with previous severe viral infections, with long-term hospitalization in Intensive Care Unit (ICU), presenting marked deconditioning, exertional dyspnoea,weakness and marked fatigue, myopathy/neuropathy due to Critical Illness;
2. patients which were hospitalized but without ICU need;
3. patients with viral infection treated at home.

Patients who have been admitted to ICU during previous epidemics have suffered musculoskeletal complications that have required rehabilitation (*Chan et al 2003*). Prolonged mechanical ventilation and immobilisation associated with ICU admissions result in musculoskeletal changes that are not directly related to the primary reason for hospital admission. These issues include: **muscle loss and atrophy** (*Barker-Davies et al 2020*), **heterotopic ossification, muscle wasting, prolonged pain, weakness and dyspnoea** (*Tansey et al 2007*), **decrease of muscle strength, walking capacity and physical activity** (*Bein et al 2018*). Moreover, pain should also be considered when planning post ICU rehabilitation, as evidences are available regarding nociceptive and neuropathic pain (*Dehenly et al 2012; Kemp et al 2019*). In the light of recovery musculoskeletal functionality, **an instrumental role is played by physical rehabilitation** (*Huang et al 2020*).

It is common to find a post COVID syndrome affecting the osteomuscular system >2-3 months post acute phase, even in mild forms. Muscle involvement in post COVID syndrome is constituted by: weakness, muscle pain, fatigue.

The physical therapy strategy for patients with post ICU related weakness includes specific exercise for muscle stretching and strengthening, as well as tools for pain management. Physical rehabilitation programmes can last for some months after patient hospital discharge and should combine different approaches such as home exercise and therapist sessions (*Denehy et al 2012, Jackson et al 2012, Needham et al 2012*).

It is important to note that all patients with functional limitation post COVID-19 can benefit from physiotherapy. To promote the natural recovery process, an individualized rehabilitation program is often necessary, consisting of modular exercises on individual subjects.

Physiotherapy can be used for patient post COVID-19 to:

- Promote a faster recovery of mobility;
- Return to active daily life;
- Recovery pulmonary function;
- Manage fatigue.

The role of laser therapy in COVID-19 rehabilitation

Laser therapy is a physical therapy that employs the laser beam to act on several human body mechanisms such as:

- **Heating the tissues**, to provide an immediate relief from joint and muscle pain and stiffness;
- **Promoting local microcirculation** function, to decrease inflammation, edema and pain symptoms;
- **Favouring cell metabolism**, to enhance tissue repair processes and functional recovery.

Thanks to the effects on pain, edema and inflammation, laser therapy is a useful tool in many clinical specialties, such as pain management, rehabilitation, physiotherapy, etc. **Laser therapy can be a powerful tool in the post COVID-19 patients presenting musculoskeletal conditions**. In fact, it is widely used to treat a variety of painful conditions of the musculoskeletal system, contributing to pain management and functional improvement. Moreover, **laser therapy is a well-tolerated and non-invasive method of treatment**. Laser therapy treatments have demonstrated significant and effective results in decreasing muscle fatigue in elderly women (*Toma et al 2013*).

MLS® Laser Therapy is a specific laser therapy based on the patented MLS® pulse, which comes from the combination and synchronization of 808 nm and 905 nm wavelengths. MLS® Laser Therapy has been shown to act on several musculoskeletal conditions (*Blevins et al 2019, Alayat et al 2017*), decreasing inflammation and increasing the biostimulation effect on tendons (*Perazzi et al 2014*), increasing functionality of ligaments by decreasing thickness, decreasing patient pain, increasing myoblast function thus increasing recovery of damaged muscle tissue (*Vignali et al 2011, Blevins et al 2019*).

Why MLS® Laser Therapy in COVID-19 rehabilitation: biological rationale

The pathogenesis of muscle pain and weakness in post COVID has uncertain explanation, probably secondary to the production of cytokines by the immune system. The perfectly normal response to an acute viral attack tends to remain active even when the infection has disappeared. It is possible that there is also a problem in the production of energy at the mitochondrial level. A further theory indicates COVID-19 as a cause of muscle pain with mechanisms completely different from other acute viral infections: the hypoxic pathology would lead to ischemic muscle pain.

In order to understand the mechanism of action of MLS® pulse, studies on cells have been performed (*Monici et al. 2013*). These scientific experiments conducted by ASAcampus, the joint laboratory between ASA and the Department of Experimental and Clinical Biomedical Sciences of the University of Florence, have shown that the treatment of muscle cells with MLS® Laser Therapy not only induces cell differentiation, but also promotes the synthesis of a large group of proteins. Some of those proteins are specifically related to defined biological mechanisms, involving among the others inflammation modulation, angiogenesis promotion, muscle contraction and nerve fibres regeneration.

The inclusion of MLS® Laser Therapy in the rehabilitation plan is appropriate for the treatment of joint pain, muscle contracture, inflammation and muscle weakness.

As Dr. Monici explains:

> *Part of our studies is devoted to investigate the molecular and cellular mechanisms underlying the effects of physical therapies and related devices. The results of our "in vitro" and "in vivo" studies demonstrate that MLS® emission has a significant anti-inflammatory action. MLS® treatment induces the increase of a protein named NLRP 10. This is an anti-inflammatory protein, because it inhibits the production and release of the proinflammatory cytokines interleukin-1-β (IL-1β) and interleukin 18 (IL-18).*

When released by cells, IL-1β and IL-18 stimulate the production of other pro-inflammatory cytokines, such as interferon-γ (INF γ), TNFα, IL-6, ect., thus triggering a cascade of events which further increase and perpetuate inflammation. In summary, by inhibiting the release of IL-1β and IL-18, the anti-inflammatory protein (NLRP10) induced by MLS® treatment is able to control and dampen the inflammatory reaction. Therefore, MLS® can be applied in the treatment of diseases where a reduction of inflammation is needed.
In general, a decrease in inflammation leads to normalization of the vascular function and edema resorption.

Dr. Monica Monici

Scientific Research Manager of ASAcampus Joint Laboratory, University of Florence

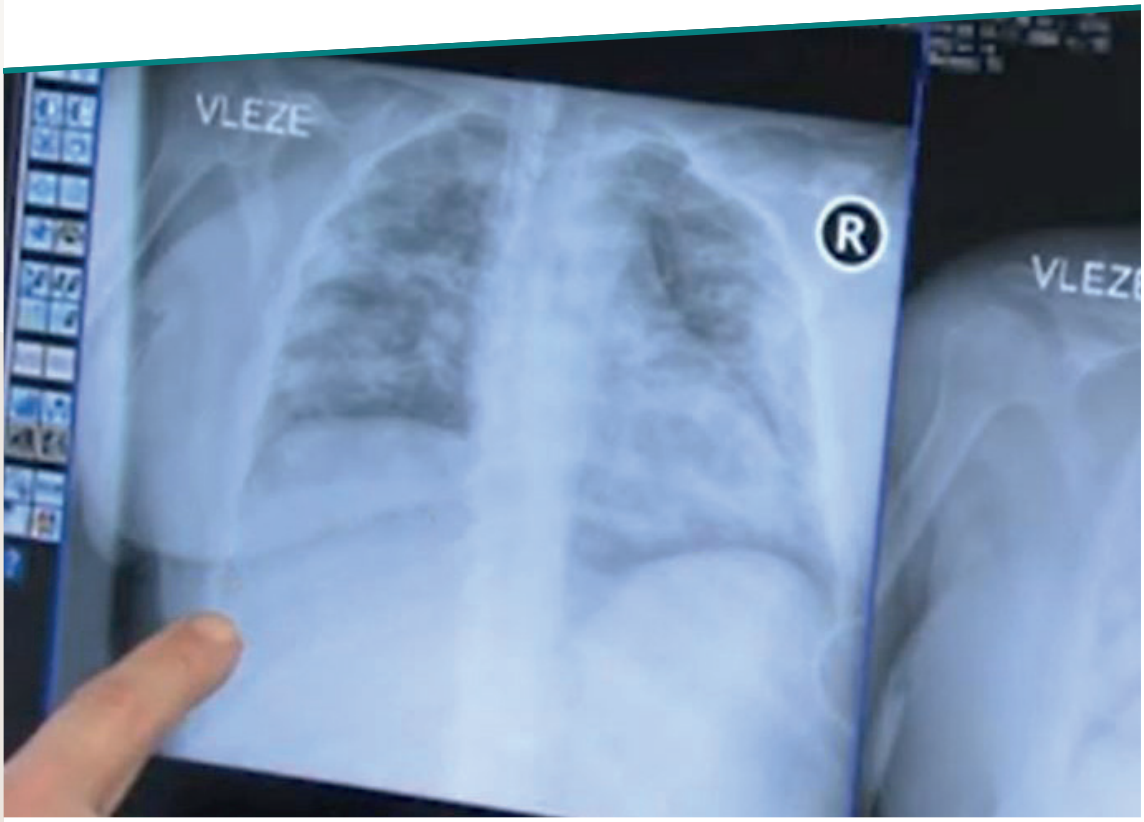
To watch the whole interview, **click here**.

Why MLS® Laser Therapy in COVID-19 rehabilitation: first experiences

Dr. Sigman's successful experience in using MLS® Laser Therapy in a clinical trial to treat interstitial pneumonia caused by COVID-19 has become an international reference point. Significant results have been reported by the COVID unit of the Kolin Hospital, in Bohemia (CZ), where one of the very first experiences on "large scale" about MLS® Laser Therapy in COVID-19 recovery is taking place. As the local TV news are reporting, Chief Doctor MUDr. Lukáš Cibulka, together with his colleague Vašíčková, started using MLS® in cooperation with the Chief Doctor of Internal Medicine Emìlia Niedobovà, Head of the local COVID department. The local TV news confirms that from the spring the hospital has admitted approximately 750 patients with COVID infection and treated hundreds more on an outpatient basis. MUDr. Lukáš Cibulka explains:

> *In both lung fields, you can see a bilateral significant COVID inflammation with a large blurring of both lung fields. And here in the second image, on the left, there is an image right after MLS® Laser Therapy treatment, where there is a significant remission of inflammatory changes, improving the transparency of both lung fields. All this was accompanied by an improvement in the patient's clinical condition.*

To watch the video inside the COVID unit of the Kolin Hospital, **click here**.



When interviewed by Ceska Televize - national TV broadcast - MUDr. Lukáš Cibulka said:

Following our direct experience, we confirm the value of MLS® in the treatment of interstitial pneumonia caused by the virus. Its action consists in reducing the progress of the tissue inflammation, with consequences also on pulmonary fibrotization.

To see Ceska Televize interview, **click here**.

In March 2021 during an online conference, MUDr. Lukáš Cibulka explained that at the Regional Hospital in Kolin the staff already completed the treatment to 70 patients.
During the same event, a very interesting input came from MUDr. Ema Kaslová who shared her experience on post COVID patients:

In our rehabilitation clinic, there was a significant increase in the number of patients who, after COVID-19, suffer from chest pain, persistent cough and dyspnea. We borrow the laser from our outpatient treatment unit. We objectively evaluate the therapy with MLS® and we see results in the oxygen increase of saturation of the blood, oximetrically. Results occur after three to five applications of MLS®.

Another strong testimonial comes from Ing. Ivo Žolnerčík, Director of Karviná Hospital, who experienced first-hand the rehabilitation from COVID-19 through MLS® Laser Therapy:

I had a cough and bilateral pneumonia. It's no fun. I had problems going up the stairs. I had trouble breathing. Around December 20, 2020, I had to start some therapy, which means antibiotics, corticoids. I ended the infusions on January 4. Since my lungs were very weak, I was looking for a solution. And one of the options was to use the laser that we had for rehabilitation, and there I had been going for about 14 days. This means 10 therapies on each side of the lungs for fifteen minutes. I must say that my condition got improved. Prior to that, I had a suffocating cough and it turned into a cleansing cough-up after therapies. They X-rayed me and after the therapies, I was X-rayed again and my condition was many times better.

To watch the whole conference, **click here**.

Why MLS® Laser Therapy in COVID-19 rehabilitation: the treatment plan

MLS® allows the treatment of large target areas and of different areas at the same time, stimulates cell metabolism and myogenesis eliminating pain symptoms.

Main muscle and joint issues experienced by post COVID-19 patients are:

- Fatigue (in part as specific symptomatology, in part due to deconditioning);
- Diffused myalgia;
- Arthralgia (mostly seen in wrist, ankle, knee);
- Low back pain;
- Weakness in upper limb/hand (handgrip strength);
- Orthostatic Intolerance (that is difficulty in keeping the standing position for prolonged time);
- Exacerbation of pre-existing painful symptoms (neck pain, low back pain, neuropathic pain);
- Dyspnoea.

The inclusion of MLS® Laser Therapy in the rehabilitation plan is appropriate for the treatment of joint pain, muscle contracture, inflammation and muscle weakness.

To enhance the natural recovery process, an individualized rehabilitation program is often necessary – consisting of exercises that can be personalized on the individual subjects which must be adapted to the patient's needs based on both initial clinical evaluation and progresses during the recovery phases.

The treatment plan can be applied to different topics:

1. Rib cage

- Breathing exercises and chest expansion exercises, reconditioning of the respiratory muscles subjected to the stress of prolonged cough and treatment of potential pain contractures of the thoraco-abdominal muscles. Relaxation exercises.
- MLS® Laser Therapy for intercostal pain due to contracture.

2. Muscle repowering – inferior and superior limbs, especially hand and quadriceps

- Cautious muscle recovery exercises and stretching of muscles of the upper (shoulder, elbow, hand) and lower limb muscle.
- MLS® Laser Therapy for pain and biostimulation for muscle weakness.

3. Reinforcement and recovery of the standing position through myofascial stimulation

- Manual methods of stimulation of the muscle-tendon bands.
- Scanning treatment with MLS® Laser Therapy at distance, in particular of the posterior fascia (important indirect photomechanical effect on fibroblasts and Extra Cellular Matrix).

4. MLS® specific treatment of both neuropathic and nociceptive pain

To know more about why MLS® Laser Therapy is a safe and effective potential treatment for COVID-19 recovery, **click here**.

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