

## **NMES and TENS treatment for patients affected by COVID-19**

### **Introduction**

Covid-19 is a widespread issue with a variety of symptoms ranging from body aches and fevers to difficulty breathing or walking. These symptoms can resolve quickly or require hospitalization, and many Covid-19 survivors have reported “long-haul” symptoms lasting months later. As such, it is important for medical professionals to be aware of all possible treatments to help the quality of life for their affected patients.

In order to support our customers, Axelgaard has compiled the following data regarding how treatments such as neuromuscular electrical stimulation (NMES) and transcutaneous electrical nerve stimulation (TENS) can benefit patients currently afflicted with Covid-19 or recovering from it. Further, these avenues of treatment can also be considered for sedentary or older patients struggling with muscle weakness or pain due to decreased physical activity as a result of the pandemic. For older patients or residents in assisted living facilities, NMES can be used as a preventative care measure to prevent muscle loss.

Musculoskeletal issues have been reported as symptoms at all stages of Covid-19, from the very onset of symptoms to the later stages of the disease (Cipollaro et al., 2020). In an analysis of several studies, Pike-Lee, Yuebing & Wolfe (2020) reported a potential correlation between severity of Covid-19 symptoms and skeletal muscle injury. As there is no set course for which Covid-19 affects a patient, we hope that the following data will provide a toolbox to help better understand the various ways in which electrical muscle stimulation can potentially be used to create better quality of life for affected patients during this pandemic.

### **NMES treatment for Covid-19 patients**

NMES is a treatment option for Covid-19 patients at risk of muscle atrophy due to bed rest, sedation or mechanical ventilation, or for recovered patients presenting with complications from post-intensive care syndrome or ICU-acquired muscle weakness.

According to Jolley et al. (2016), up to 80% of patients in the ICU develop neuromuscular dysfunction in some capacity. Given that an estimated 2% of Covid-19 positive cases require admission to the ICU (Stokes, Zambrano & Anderson, 2020), NMES can play a role in helping these patients both during and after their illness.

NMES can provide muscular activity very early during treatment when a patient is otherwise unable to be active or engage in physical therapy exercises. This is important because muscle atrophy makes patients more susceptible to a “higher risk of falls, fractures, physical disability, need for institutional care, reduced quality of life, increased mortality, and increased healthcare costs” (Argilés et al., 2016). Passive mobilization strategies such as NMES can help critically ill patients become more active (Kho et al., 2015), as well as prevent or reverse muscle atrophy. Many studies indicate that early rehabilitation is “safe and feasible in ICU patients, improving muscle strength, mobilization, aerobic capacity” while lowering both ICU and hospital length of stay (Karatzanos et al., 2012).

For patients who are able to engage in manually assisted exercise, NMES is an excellent complement that is well-tolerated and can minimize the duration of intensive care. Valdez dos Santos et al. (2020) found that patients who combined traditional physical therapy exercises with NMES treatment had shorter durations of required mechanical ventilation compared to those patients receiving exercise treatment alone. (Sheehy, 2020) specifically recommends that physical therapy for Covid-19 patients “begin in the acute inpatient setting and continue after transfer to inpatient rehabilitation.” She recommends a variety of traditional physical therapy exercises combined with NMES to assist with muscle strengthening.

### **NMES during ICU care**

NMES is non-invasive, well-tolerated and does not require active participation on the patient’s part. This enables NMES sessions to begin early on in care even in patients who are bed-ridden, sedated or ventilated. Treatment is focused on either the abdomen or the lower limbs, specifically the quadriceps and gastrocnemius muscles.

Leite et al. (2018) reported that NMES of the quadriceps resulted in “less hospitalization time and higher functional independence in critically ill subjects during discharge from ICU” (Leite et al., 2018). Routsis et al. (2010) found that daily NMES treatment on the lower limbs can shorten the weaning time from mechanical ventilation, stating that “both short-term and long-term weaning periods were significantly shorter” in patients treated with NMES. Further, patients treated with NMES had significantly better MRC scores on muscle strength. Finally, the study also suggests that NMES can make critically ill patients less likely to develop CIPNM. This is promising for the treatment of Covid-19 patients, as critical cases of Covid-19 have been associated with CIPNM (Paliwal et al., 2020).

Dall’Acqua et al. (2017) found that NMES combined with conventional physical therapy was able to prevent the loss of muscle thickness in the rectus abdominis and chest muscles during mechanical ventilation. These patients had significantly shorter stays in the ICU. McCaughey et al. (2019) reported that patients who received abdominal functional electrical stimulation (FES) required less time on mechanical ventilation and had a shorter length of stay in the ICU.

### **NMES during rehabilitation**

As Covid-19 is a novel coronavirus, the medical community is continually updating best practices for the rehabilitation of patients. Individuals who have recovered from Covid-19 can have rehabilitation stints ranging from short to longterm. Long-lasting symptoms in Covid-19 “long-haulers” range from cardiovascular problems to neuromuscular imbalances. Covid-19 survivors who underwent treatment in the ICU are especially prone to complications such as post-intensive care syndrome, which is associated with “reduced inspiratory muscle strength, poor knee extension, poor upper extremity and grip strength, and low functional capacity” (Ohtake et al., 2018).

For recovered Covid-19 patients facing muscle weakness or atrophy from hospitalization or long bed rest, rehabilitation is important to prevent these symptoms from worsening or becoming

permanent. There is a lot of knowledge for best practices that can be derived from similar SARS coronaviruses and other critical illnesses that cause similar ICU-level hospitalizations. Disser et al. (2020) write that “it is appropriate to anticipate short-term and long-term musculoskeletal complications in patients with moderate and severe Covid-19.” In particular, they write that medical professionals should expect symptoms such as myalgias, atrophy, weakness and fatigue in Covid-19 patients.

For patients who are presenting with these symptoms, NMES therapy can help. The earlier that a patient can begin working on rehabilitation, the better the outcome. As these symptoms will present differently in each patient, it is important for medical professionals to work with their patients to locate problem areas and treat them accordingly. Many studies on CHF, COPD and ICU patients suggest that NMES can benefit “aerobic exercise capacity, cachexia and muscle mass preservation, and quality of life” (Katsogianni et al., 2019). As such, NMES is an important potential avenue of treatment for Covid-19 survivors both on its own and in tandem with traditional physical therapy exercises.

Axelgaard provides several resources for NMES education, including our educational video series with USC’s Dr. Lucinda Baker and our recently launched app. Both can be viewed at the following links:

[axelgaard.com/education](http://axelgaard.com/education)

[axelgaard.com/app](http://axelgaard.com/app)

### **TENS treatment for Covid-19 patients with pain or spasticity**

The CDC lists muscle pain as a common symptom of Covid-19, referencing a World Health Organization report that found muscle or joint pain in 14.8% of patients. Further, the CDC reports that muscle pain is a long-term symptom “that can last for weeks or even months after recovery.” As such, pain management is an incredibly important tool to increase the quality of life for afflicted Covid-19 survivors. TENS treatment is a non-invasive treatment that is safe, effective, inexpensive and patient-friendly.

Muscle pains and fatigue are among the most common symptoms for Covid-19 long-haulers experiencing symptoms months after disease onset. For patients who had severe cases of Covid-19, it is also likely that they underwent long periods of immobilization, sedation and ventilation and are “at particular risk of developing chronic pain” (Kemp, Corner & Colvin, 2020). Additionally, Covid-19 patients have reported muscle spasticity both during and after their illness.

TENS treatment can help Covid-19 patients experiencing muscle pain or spasticity during or after their illness. TENS is a well-documented avenue of treatment for patients that is safe and effective for both short and longterm use. Safe, non-addictive pain treatments are especially important now in relation to the opioid epidemic. Multiple reports indicate that the opioid epidemic has worsened during the pandemic (Silva & Kelly, 2020), showing a need for avenues of pain treatment that are non-habit forming. TENS treatment offers an alternative for pain management that is safe, effective and also cost-effective.

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