Electric stockings to help intensive-care patients with coronavirus

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Doctors and engineers have together developed an electric stocking to prevent loss of muscle mass in bed-ridden patients. During the coming months, the stocking will be tested on Danish COVID-19 patients at

intensive care units in Denmark.

Muscle loss is a major problem for intensive-care patients, who are totally inactive in hospital beds for long periods of time. As much as 10-20 per cent of the muscle mass in the legs can be lost in just 5-10 days, and at the moment this is a serious problem for the many COVID-19 patients, who are often in hospital for several weeks.

For this reason, in a new project, researchers from Aarhus University and the University of Copenhagen are seeking a technology-based solution to make it possible to stimulate patients' muscles while they are lying in bed.

The research group consists of doctors and engineers, and together they have developed a special biocompatible electrode which can be integrated and 3-D-printed onto textiles—for example compression stockings.

"One characteristic of COVID-19 patients is long-term intensive admissions and long periods on a respirator, often for up to three weeks. It may take months or years to recover from the treatment, and some patients will never fully recover. The idea behind the project is to retain the muscle mass, so that patients are in approximately the same condition when they leave hospital as when they were admitted," explains Professor Charlotte Suetta from the University of Copenhagen, who is leading the clinical trials for the project at Bispebjerg Hospital and Herlev Hospital in Denmark.

The project goes under the name "a solution to counteract muscular atrophy in COVID-19 patients", and it has now received DKK 1 million (EUR 134.000) in support from the Lundbeck Foundation. Production of the first 50 pairs of electric compression stockings has already been started.

Biocompatible electrodes do not irritate the skin, and can remain in contact with the skin for days or even weeks. The 3-D printing technology also makes it possible for the researchers to rapidly scale up production as required.

"We're already 3-D printing electrodes and wires onto the first stockings. The electrodes have three ultra-thin layers, which make it possible to stimulate the muscles through the stocking with minimal irritation. We expect to have the first 50 prototypes ready for testing by patients in a month," says Shweta Agarwala, tenure track assistant professor and printed electronics specialist at the Department of Engineering at Aarhus University.

Today, compression stockings are often used after surgery to counteract blood clots in the legs. Therefore, it is easy to incorporate the new stockings in work-flows in Danish intensive care units without problem.

"Now, we're starting up tests of the stockings on Corona patients. Among other things, we need to measure how well patients maintain their muscle mass during hospitalization, and whether there is any discomfort. This gives us good opportunities to optimise the technological design later," says Peter Høgh Mikkelsen, associate professor at Aarhus University School of Engineering.

The stocking technology has already been patented by the research groups involved.

If the trials with the COVID-19 patients show the reduction in muscle loss that the researchers expect, the universities are ready to produce 500 extra pairs of stockings by as early as the autumn, when Danish Health Authority expects the next wave of the Corona epidemic.

"We've started this project because we're convinced that the technology

can help patients. It really costs a lot of time, money and not least patient wellbeing to recover from long-term hospitalization, and we already know that electric stimulation can help to keep muscles going," says Professor Charlotte Suetta.

Provided by Aarhus University