Zapping muscles to restore tired tissues

U of A researcher hopes to treat spinal cord injuries with electrical stimulation

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New and innovative research from the U of A's Human Neurophysiology Lab is focused on the workings of the nervous system, but it's also suggesting some promising applications for treating spinal cord injuries.

Dr Dave Collins, an Alberta Heritage Foundation for Medical Research Scholar at the U of A, is currently proposing a more natural way of electrically stimulating disused muscles. According to Collins, the research could eventually pave the way to restoring mobility in people with spinal cord injuries, but the initial step is to tackle a very present danger for inactive individuals: muscle atrophy.

Muscle atrophy is the wasting of muscle tissue, often caused by disuse, and is markedly linked with heart problems. People who have experienced muscle loss due to a stroke, a broken limb, being encased in a cast for a long period of time or even space flight may develop muscle atrophy. These individuals are also likely to benefit from Collins' research, but his focus is on those with spinal cord injuries.

"One of the main problems after a spinal cord injury is that people die from cardiovascular disease because they're basically the most sedentary group in the world," explained Collins.

Electrical stimulation has been used to treat this condition in the past, but Collins' approach differs in important ways. The typical method has been to directly stimulate the muscle through electrodes, whereas Collins' method includes the use of reflex pathways.

"[The latter is] a much more natural way because you're activating [the muscle] through its own neurons, which are usually involved in normal involuntary contractions," said Collins.

Collins illustrated this further by relating the process to something experienced by anyone in a standard health check-up from the family doctor.

"It's very much like when you tap your knee and your leg goes 'boing,' because you're activating sensory receptors [at the knee] and they go up into the spinal cord, and then activate neurons in the spinal cord that come out to the muscle."

The significance of this method lies in the muscle fibres that it targets.

"There are some muscle fibres that fatigue very quickly and there are some muscle fibres that are very resistant to fatigue. When you activate the muscle through reflex pathways, you activate the type of muscle fibres that are prone to this atrophy. And when you don't stimulate it directly, you don't really activate those types of muscle fibres," Collins explained.

As of yet, most of Collins' research has been tested on able-bodied participants, but he is currently applying for ethics approval to begin experimentation on spinal cord injury patients.

But Collins and his research team also have an eye on the future.

"We believe that our kind of stimulation, where you activate fatigued resistant muscle fibres, is going to have benefits ... for restoring movement as well. But that's a bit more complicated," Collins explained. "To get people walking you have to stimulate a whole bunch of different muscles [and] the timing of the stimulation has to be exactly right. So that's a bit further down the road for us."