Massage Therapy Research Fund (MTRF)

Final Report – Project Completion

Current Date:	Nov 13 2017	
Project Title:	Can massage therapy promote recovery of locomotion following spinal transection?	
Amount of grant:	47 158$	
Year grant awarded:	2015	
Indicate extensions granted: x not applicable		
Project completion date:	End of 2017	
Institution:	Faculty of medicine and health sciences, University of Sherbrooke	
Principal Investigator:	Nathaly Gaudreault and Alain Frigon are co-PI	
Co-Investigators:	Eve Langelier	

Section 1 - Results. Provide a summary of results (outcomes, findings etc.)

The goal of the project was to investigate the effects of massage therapy (MT) of the triceps surae muscles on the recovery of hindlimb locomotion after complete spinal cord injury (SCI) in a feline model. Cats were implanted with electrodes to record the muscle activity (EMG, electromyography) of several hindlimb muscles and to stimulate peripheral nerves to evoke reflexes. Massage therapy started one week after complete SCI for 5 weeks (5 days a week, 20 min per session, 10 min per hindlimb) and consisted of longitudinal strokes of the triceps surae muscles in a distal to proximal direction at a frequency of 0.2 Hz. The applied pressure was calibrated to 2-3 N (measured with a sensor placed on the thumb). Data were collected every week, which consisted of EMG recordings during 5 min of MT, electrically-evoked cutaneous reflexes and stretch reflexes elicited by ankle rotations with a robotic arm. The goal of these neurophysiological measures is to assess how spinal circuits are reorganized over time after complete SCI, with and without MT. Before and every week until the end of treatment (i.e. 6 weeks post-SCI), hindlimb locomotion was evaluated on a treadmill.

Our original hypothesis was that cats that received MT would recover hindlimb locomotion faster than cats that did not receive MT after complete SCI. In other words, we had hypothesized that cats receiving MT would recover hindlimb locomotion after 2-3 weeks of locomotor training instead of the minimum of 5-6 weeks usually required.

At present, we have finished data collection for 8 cats, 4 cats that received MT and 4 cats that received no treatment. The same electrophysiological tests were done in both groups. We are currently analyzing the EMG and kinematic data, which is substantial, and we expect a first manuscript to be submitted in 2018, with 2-3 more to follow. A PhD student (Jonathan Harnie) was recruited to work on the project and the results will form the core of his doctoral dissertation. He will be presenting his results in coming years at scientific meetings, such as the Society for Neuroscience.

We also used the preliminary results to obtain additional funding (67K from Merck, Sharpe & Dohme, PI: Alain Frigon) to continue the research and a CIHR Project Grant is currently pending review.

Section 2 - Recommendations. Provide any recommendations based on your findings – 1 page maximum

The fundamental nature of the project does not allow direct recommendations for clinical practice however, our results will have an important impact on our basic understanding of motor learning at the level of the spinal cord. For example, one of the central tenets of neurorehabilitation is that training must be specific to the task to engage appropriate neural circuits. According to the principle of task-specificity, if the goal is to recover walking after neurological injury, such as SCI, then patients must be trained to walk. As a result, locomotor training and robot-assisted stepping became widely used in the clinic. However, recent randomized control trials have shown that locomotor training is no more effective in promoting the recovery of walking than conventional physical therapy. In other words, locomotor training is good, but not better. This has led many clinicians to question the use of locomotor training, as it is a very expensive and time-consuming intervention. Our results show that hindlimb locomotion recovered in spinal-transected adult cats following five weeks of MT to the triceps surae (TS) muscles and overlying skin. Indeed, following 5 weeks of MT and no locomotor training, the hindlimbs could perform stable, full weight-bearing locomotion from slow to fast speeds in the first test session. This indicates that when it comes to locomotion, training does not need to be specific to the task. From a clinical perspective, it also suggests that MT could complement or even replace locomotor training in people with SCI. This is important because many people cannot engage in rehabilitation because of pain and/or other musculoskeletal injuries. However, they could easily receive MT from a trained practitioner. The results of the proposed project could have an enormous financial impact on the treatment of movement disorders.

Section 3 - Did the project take place as proposed?

The project took place as proposed but has since expanded. As stated in the previous progress report, the results far exceeded our expectations. All four cats that received MT post-SCI could produce full weight bearing hindlimb locomotion after 5 weeks of MT, from slow (0.1 m/s) to fast (1.0 m/s) treadmill speeds. The EMG bursts that were evoked by MT also increased in amplitude and became more structure over time after complete SCI and with continued treatment. The electrophysiological results also point to an important role in the recovery of spinal pathways involved in bilateral coordination. There was also some spontaneous recovery in the control group, with 2 of 4 cats recovering full weight bearing hindlimb locomotion without treatment. The results indicate that rhythmic somatosensory inputs not specific to the task (i.e. locomotion) are sufficient to reactivate spinal locomotor circuits after complete SCI.

Section 4 - Budget.

The budget has already been sent to U of T.

Section 5 - Dissemination of information. Include a list all presentations, media appearances or reporting, and publications arising from the grant, specifying status (published, in press, under review, accepted but not yet published, etc.) and indicating whether peer-reviewed or not.

We expect 2-3 publications from the research. The first paper, currently in preparation, will show the effects of massage therapy (n = 4) and locomotor training (n = 4) on the recovery of hindlimb locomotion after complete SCI. These 2 groups will be compared against a control group that received no treatment after SCI (n = 4). We will show that the recovery of hindlimb locomotion after SCI does not require task specific training. The second and possible third papers will show some of the neurophysiological changes that we observed, in particular the return of neuronal excitability and reflex changes (cutaneous reflexes, stretch reflex, wind-up).

Conference presentations:

Gaudreault N, Lévesque P, Boyer-Richard E*, Telonio A, Frigon A. An animal model to study the neural mechanisms of massage therapy in chronic complete spinal cord injury. Acte de colloque du 2016 IN-CAM Research Symposium, Toronto, Canada, novembre 2016

Section 6 - Project summaries. Provide a lay language summary of this project (maximum 400 words).

After a spinal cord injury, walking is often impaired and in the most severe cases, the limbs are paralyzed. However, in animal models of complete spinal cord injury, the legs can recover an involuntary walking pattern after a few weeks of treadmill training. This remarkable recovery, first shown in cats, is due to the presence of a centre within the spinal cord that generates the basic walking pattern without descending commands from the brain. During treadmill training, receptors in the legs that respond to weight support and muscle stretch send signals to the spinal cord. These signals in turn reactivate the centre that controls walking. Treadmill training has been shown to improve walking in people with spinal cord injury. However, whether it is more effective than other treatments has been questioned. Treadmill or locomotor training is based on the principle that mass practice of the desired movement must be made to engage the appropriate neural circuits. In other words, if you want to restore walking then you must practice walking. However, our results show that applying massage therapy to the calf muscles for a few weeks restored walking in our cat model of complete spinal cord injury. These results suggest that when it comes to restoring walking, training does not need to be specific to the task. The results could have an important impact on the rehabilitation of walking in people with spinal cord injury because rhythmic manual stimulation of muscles/skin could complement or replace locomotor training. Many people with spinal cord injury cannot engage in locomotor training or other types of rehabilitation approaches because of pain and/or other musculoskeletal injuries. However, people with spinal cord injury could easily receive massage therapy from a trained therapist.

Submit the final report to Ania Kania-Richmond at akrresearchconsulting@gmail.com