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Improvement in Arm Function after Spinal Cord Injury

Individuals with cervical spinal cord injuries at or above C5-C7 usually experience a disruption in arm and hand function. The extent of the disruption depends on the level and the completeness of the injury. Dr. Vivian Mushawhar's Human Rehabilitation Engineering Laboratory at the University of Alberta is investigating the effectiveness of two interventions for improving arm function after incomplete cervical spinal cord injury. The first intervention focuses on inducing "targeted plasticity," or guided modifications, in the neuronal networks of the spinal cord. This involves the use of biofeedback-based strategies to retrain the arm control networks within the cord and to strengthen the connectivity from the brain to the spinal cord, the result of which is expected to provide a general improvement in arm function. The second intervention focuses on the use of arm ergometer training in conjunction with functional electrical stimulation (FES). Cyclic arm movements are induced through FES against various levels of resistive loads. The use of this intervention is expected to improve muscle strength and to regulate the sensory input to the arm control networks in the spinal cord. Regulation of sensory input could reinforce the original neural circuits involved in the control of arm movements and enhance the connectivity between the brain and the spinal cord. The effectiveness of each intervention in improving arm function is evaluated separately. Methods for combining both interventions to further enhance the recovery of arm function after spinal cord injury will be investigated in future extensions of the work.

Prevention of Deep Pressure Sore Formation after Spinal Cord Injury

Pressure sores frequently develop after spinal cord injury, especially in individuals with extensive loss of motor or sensory function. Sores can develop at the surface of the skin and extend to deep tissue if unattended. They can also develop deep within the body, at bone-muscle interfaces, and extend to the surface. Sores originating deep within the body are more perilous than surface sores because they are very difficult to detect early in their process of development. Once they exhibit themselves at the surface of the skin, significant tissue damage involving bone, muscle, fascia and fat would have occurred. Deep sores primarily develop due to the occlusion of blood flow through capillaries to muscles surrounding bony prominences such as the ischial tuberosities. Occlusion of blood flow deprives the muscle of its oxygen and nutrient supply and results in its death and decay. To avert the formation of deep sores, frequent relief of pressure is necessary to allow the restoration of blood supply to muscles around bony prominences. Dr. Vivian Mushawhar's team at the University of Alberta is developing a technique for inducing frequent pressure relief to prevent the formation of deep pressure sores in wheelchair-dependent individuals with spinal cord injury. This technique involves the use of intermittent electrical stimulation (IES) to induce contractions in the gluteus maximus muscles of the buttocks. Intermittent, or periodic, contractions of the muscles provide periodic reconfiguration of internal pressure and, in turn, pump blood into occluded capillaries. Experiments are currently underway to assess the effectiveness of this intervention in preventing the formation of deep tissue sores.

FACULTY OF MEDICINE AND DENTISTRY:

Spinal Cord Injury research laboratory tours will be held the week of **January 22nd, 2006**.

Dr. Vivian Mushawhar's labs will be a part of the tour. See www.scitcs.org for an overview of the applied research.



*You may be on
the right track,
but if you just sit
there you'll get
run over.*

- Paul H. Dunn