**External modulation of electrical stimulated spinal reflexes - a control modality for human lumbosacral networks in injury induced disconnection from brain control**

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Spinal Cord Injury (SCI) can result in various profiles of functional losses in both conducting and processing neural structure in the lesion zone. Sub-lesion structures remain intact, but lose control inputs either directly, due to interrupted efferent pathways or indirectly, by missing reactions due to interrupted afferent pathways, or disturbed processing in damaged higher spinal networks. Identification of artificial control options for this locally altered physiology is an important goal towards improvements in the restoration of movement strategies. Unmasking of functional processes in the present interneuron networks is essential and can be investigated by application of electrical stimulation to afferent nerve structures at lumbar spinal level and recording of reflex reactions from lower extremity muscles. Stimuli can be administered via implanted epidural electrodes or non-invasively via skin attached electrodes. Reactions in the networks reach from monosynaptic, via polysynaptic to complex interneuron processing pathways. Stimulation inputs can induce augmentation and suppression effects resulting in complex motor output patterns that can lead to tonic, rhythmic and even antagonistically coordinated muscle activity. In the current work we show examples how this spectrum of controllable motor outputs can depend on the stimulation parameters frequency and intensity and how the parameter dependent modifications of recorded reflex reactions can support conclusions on underlying neuronal mechanisms, in intact and in altered network structures. Technically this can lead to identification of control characteristics for development of effective support tools, for rehabilitation medicine. We can expect novel treatment options for restoration of movement and a higher potential for regaining functions for persons with SCI.

*Keywords* - input, spinal cord, processing, motor output, external control.