

CPG in the Recovery of locomotion after partial spinal cord lesions

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After a partial Spinal Cord Injury (SCI), various functions of the sensory and motor systems are lost (Rossignol et al. 2007). A remarkable finding however, from animal experiments and observations in humans, is that there can be a remarkable recovery of some level of functions with time after partial spinal cord injuries. This might be due to sprouting of undamaged pathways but plastic changes could also occur in the spinal circuits themselves below the lesion. Indeed, the concept of a spinal central pattern generation (CPG) that can operate autonomously within the spinal cord is well established. We showed for instance that adult cats completely spinalized could regain spontaneous hindlimb locomotion on a treadmill after weeks of locomotor training (Rossignol 2006). To what an extent is the CPG of the hindlimbs involved in locomotor recovery after partial spinal lesions? We devised a dual lesion paradigm in which a first unilateral partial spinal lesion was produced at T10-11, treadmill training provided to facilitate locomotor recovery and then a complete spinal section was made at T13, thus about 2 segments below the first lesion (Barrière et al. 2008). The main idea here was that changes occurring within the spinal cord itself during the locomotor recovery after the partial lesion could be retained after the complete spinalization. Our major finding was that, within 24 hours (i.e. the first testing session) following the complete spinal section, treadmill-trained cats walked remarkably well on the treadmill with the hindlimbs. Thus, although both supraspinal and spinal mechanisms are involved in the recovery of voluntary goal-oriented locomotion after partial SCI, the present experiments show for the first time a major functional contribution from the spinal cord itself. This highlights the importance of fostering such neuroplasticity in rehabilitation strategies. The latter should reinforce both voluntary aspects of locomotion and endogenous spinal circuitry in humans with SCI.

Reference List

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