

ABSTRACT

Title: Use of epidural spinal cord stimulation to influence motor and autonomic functions after complete spinal cord injury

The main objective: The main aim of the bachelor thesis was to investigate the use of epidural spinal cord stimulation (eSCS) to influence motor and autonomic functions in an individual with complete spinal cord injury. We investigated whether it is possible to stimulate individual segments in the lumbosacral spinal cord after electrode implantation to restore voluntary lower limb movements and subsequently standing. We also investigated the effect on the autonomic nervous system, spasticity or trunk stability.

Methods: An individual with a complete spinal cord lesion was selected for the study and implanted with a spinal cord stimulator with a 32-lead electrode inserted into the spinal canal at the L1-L2 level. The entire therapy lasted 9 months. Four examinations were performed. Before the start of the therapy, then after three and six months and the exit examination was performed after nine months of stimulation. During the examination, stimulation programs were set up primarily to stimulate muscle groups in the lower limbs. Once a certain level of control and muscle strength was achieved, stimulation was started in the sitting position, and as stability and strength gradually improved, this was progressed to upright standing. Standing training was initially done using a high walker and the support of two physiotherapists. Standing training then continued with a lower walker with the support of 1 physiotherapist until a stage was reached where there was no need for assistance from another person and the individual was able to get to standing independently using only the support of the walker. At the same time, we monitored possible effects on spasticity, trunk stability, and autonomic function. We used a set of clinical tests and a questionnaire survey for the evaluation.

Results: After 9 months of stimulation and regular locomotion training, the individual's performance improved significantly, and in the presence of the eSCS on, partial lower limb mobility and independent standing was achieved, in which the individual could stand for almost 4 minutes, supported only by a low walker. There was

also an improvement in scores on questionnaires examining voiding and sexual function, quality of life, spasticity, or neuropathic pain.

Conclusion: The results of the study suggest that in an individual with a clinically complete SCI, the combination of eSCS and locomotor training may positively influence the partial recovery of lower limb motor function and enable the individual to stand independently. Also, escs improved autonomic nervous system function, neuropathic pain or spasticity. These positive results suggest that the use of epidural spinal cord stimulation can be a very effective method and has the potential to significantly improve the quality of life of people with complete spinal cord injury.

Key words: Spinal cord injury, epidural spinal cord stimulation, neuromodulation, paralysis, motor function

