Use of Spinal Cord Stimulation in Movement Disorders: Evidence in Parkinson's Disease, Parkinsonian Syndromes, and Dystonia

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Abstract

Introduction: Movement disorders such as Parkinson's disease (PD), atypical parkinsonian syndromes, and dystonia (DT) impair motor control and significantly affect quality of life. Spinal cord stimulation (SCS), traditionally indicated for refractory chronic pain, has emerged as a promising therapeutic option for motor symptoms, especially in patients refractory or ineligible for deep brain stimulation (DBS). This study aims to systematically review the efficacy of SCS in these disorders, assessing benefits, limitations, and current evidence.
Method: A systematic review following the PRISMA protocol was conducted. Databases PubMed, Embase, Scopus, Web of Science, Virtual Health Library (BVS/LILACS), and Cochrane were searched using descriptors in Portuguese and English such as "Spinal Cord Stimulation," "Parkinson's Disease," "Dystonia," and "Parkinsonian Syndromes." Studies involving humans and animal models addressing SCS as a primary or adjuvant treatment were included. Studies focused exclusively on pain, other pathologies, inaccessible articles, and publications older than 20 years were excluded. Two independent reviewers performed screening on the Rayyan platform. Due to methodological heterogeneity, data analysis was qualitative.
Result: A total of 61 studies were included. For PD, 46 publications were analyzed: 21 case reports, 18 case series, 2 case-control studies, and 5 preclinical studies. SCS demonstrated benefits particularly in axial symptoms such as freezing of gait (FoG), postural instability, and bradykinesia. Optimal results were observed with high-frequency stimulation (above 130 Hz) or burst mode, with implants preferably at high thoracic or cervical levels. In atypical parkinsonian syndromes, 10 studies were found (7 case reports and 3 case series) showing preliminary evidence of transient improvement in symptoms such as dysarthria, gait, and posture, especially in patients with multiple system atrophy (MSA). However, effects were limited by the small number of publications, short follow-up, and rapid disease progression. In DT, only 5 studies were identified (4 case reports and 1 case series), mostly predating DBS as the standard treatment. Isolated results, such as in complex regional pain syndrome associated with DT, suggest clinical improvement with SCS, indicating potential use as alternative or adjuvant therapy in specific contexts.
Discussion: SCS emerges as a less invasive approach for patients with unsatisfactory response to conventional treatments. Its mechanism likely involves modulation of proprioceptive pathways and cortico-subcortical circuits, although pain relief may confound motor symptom assessment. Challenges include interindividual response variability, lack of standardized stimulation parameters (frequency, mode, implantation site), and scarcity of high-quality controlled studies. Burst stimulation is notable for its positive effects on symptoms such as FoG and tremor.
Conclusions: SCS is a promising therapy for PD, parkinsonian syndromes, and DT, with benefits on motor symptoms and quality of life. Despite growing evidence, randomized controlled clinical trials are needed to validate efficacy, define optimal stimulation parameters, and elucidate mechanisms of action.

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