

## Case Reports

# 10 kHz Spinal Cord Stimulation for the Treatment of Non-Surgical Refractory Back Pain: A Case Report

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Back pain is one of the most common healthcare burdens in the United States and is the number one cause of disability worldwide. Treatment options for back pain usually emphasizes conservative modalities such as reassurance, education, physical therapy, cognitive behavioral therapy, medication management, and interventional pain procedures. Spinal cord stimulation (SCS) is a minimally invasive and reversible therapy used to treat various pain syndromes. The primary indications for SCS therapy are failed back surgery syndrome and complex regional pain syndrome. However, recent advances in therapy have expanded the use of SCS for a variety of chronic pain conditions including nonsurgical back pain and radiculopathy. We present the case of a patient with low back and lumbar radicular pain complaints that were not responsive to traditional conservative and interventional options who was successfully treated with 10 kHz spinal cord stimulation.

## INTRODUCTION

Back pain is one of the most common healthcare burdens and has a point prevalence of 12-33% in the general adult population.<sup>1</sup> It is the number one cause of disability worldwide, affecting 575 million people globally, with highest prevalence in female individuals between 40 and 80 years of age.<sup>1,2</sup> Back pain is also responsible for a large financial burden worldwide, with the largest proportion of direct costs due to physical therapy, inpatient services, pharmacy, and primary care.<sup>1,3</sup>

First-line treatment for back pain usually emphasizes nonpharmacologic modalities such as reassurance, education, physical therapy, cognitive behavioral therapy and other conservative modalities.<sup>4,5</sup> Treatment recommendations also suggest the limited use of analgesics.<sup>5</sup> A small subset of patients with an identifiable pathology may be eligible for spinal surgery.<sup>5</sup> Patients with chronic refractory nonsurgical back pain should also be evaluated by an interventional pain specialists as they may be good candidates for interventional pain therapies to help manage their pain complaints. Spinal cord stimulation (SCS) is a minimally invasive and reversible therapy used to treat various pain syndromes. The primary indications for SCS therapy are failed back surgery syndrome and complex regional pain syndrome.<sup>6,7</sup> However, recent advances in therapy have expanded the use of SCS for a variety of chronic pain conditions.<sup>8-10</sup>

Traditional tonic SCS therapy utilizes parasthesias to overlap a patient's pain pattern to replace painful signals

with more tolerable and comfortable sensations. However, traditional SCS can be uncomfortable and undesirable in many patients.<sup>11</sup> Randomized control trials comparing traditional SCS to conservative therapy found that low frequency SCS had benefit for primarily leg pain.<sup>12,13</sup> A novel, minimally invasive form of SCS using a higher frequency of 10kHz (Senza system, Nevro Corp., Redwood, CA, USA) extends efficacy to include the axial low back component of chronic spinal pain while minimizing paresthesia.<sup>11,14</sup> Early utilization of 10 kHz SCS in patients who have not had spinal surgery may improve outcomes and provide significant pain relief.<sup>15</sup>

We present our experience treating a patient with low back and lumbar radicular pain complaints that were not responsive to other conservative and interventional options. The patient had no identifiable surgical pathology.

## CASE PRESENTATION

The patient was a 45-year-old male with longstanding low back pain and lumbar radicular pain complaints. The patient underwent imaging including MRI of the lumbar spine with no significant pathology. The patient completed several months of physical therapy, chiropractic care, and massage therapy with no benefit. He tried pharmacological treatments including acetaminophen, NSAIDs, gabapentinoids, muscle relaxers and opioids. He also underwent numerous procedures including transforaminal epidural steroid injections, interlaminar epidural steroid injections, caudal epidural steroid injections, medial branch blocks

and radiofrequency ablation with minimal benefit. He was seen and evaluated by two spine surgeons and was not deemed a surgical candidate.

Given the patient's ongoing pain complaints and opioid requirements, spinal cord stimulation therapy was ultimately discussed and pursued for this patient. The patient underwent a successful trial and permanent implantation with 10 kHz high-frequency spinal cord stimulation. The patient tolerated the procedure well without complications. During the patient's follow up appointments he has continued to endorse 80% improvement in back pain and radiculopathy. Additionally, the patient has been able to wean his opioid requirements from 90 morphine milligram equivalents (MME) to 50 MME and is continuing to wean his opioids.

## DISCUSSION

Low back pain is the leading cause of disability worldwide in men and women.<sup>1</sup> In approximately 90% of cases, a specific cause of pain is not identifiable.<sup>16</sup> In two-thirds of patients, the pain persists after 3 months and 65% of people report pain after 12 months, suggesting that back pain has a poor prognosis after the onset of chronicity, despite interventions.<sup>17</sup> In most countries, conservative, non-pharmacologic intervention is recommended in patients with chronic back pain.<sup>4</sup> In patients with refractory, nonsurgical chronic back pain, SCS can be utilized for long-term pain relief, improvement in quality of life, and reduction in opioid use.<sup>14</sup>

Compared to low frequency SCS, 10kHz SCS can provide superior pain relief for chronic axial back pain.<sup>13</sup> The SENZA-RCT was a randomized control trial that compared 10kHz SCS to low frequency SCS in patients with refractory chronic back pain and/or leg pain.<sup>18,19</sup> Similarly, the SENZA-EU trial was a prospective study that enrolled patients with refractory chronic back pain and provided 14-30 days of SCS.<sup>20,21</sup> Subjects with greater than 50% pain reduction were implanted with a permanent spinal cord stimulator.<sup>20,21</sup> Al-Kaisy et al. conducted a subanalysis of data

from both studies and found that average back pain was reduced by 70% after 3 months and sustained after 12 months.<sup>5</sup> After 12 months post-implantation the combined cohort from both studies had a decrease in Oswestry Disability Index (ODI) scores by 15.7% and a decrease in opioid use by over 50%.<sup>5</sup>

A prospective, open-label study by Al-Kaisy et al. evaluated long-term effectiveness of 10 kHz SCS in patients with chronic axial low back pain with no history of spinal surgery.<sup>14</sup> Twenty patients were implanted with a pulse generator and followed over a period of 36 months.<sup>14</sup> The average pain intensity, on the VAS pain intensity scale, decreased from  $79 \pm 12$  mm to  $10 \pm 12$  mm and the use of opioids decreased from 18 patients to just 2.<sup>14</sup> This study further demonstrated that SCS has beneficial long-term effects in pain relief and quality of life.

Utilizing 10kHz SCS early in therapy can have beneficial effects in pain relief and mitigating potential biopsychosocial adverse effects associated with chronic pain and potential spinal surgery. Kumar et al. found that percentage of pain relief was inversely related to the time interval between pain onset and time of SCS implantation.<sup>15</sup> This suggests that early intervention with SCS may improve patient outcomes and have long-term benefits in quality of life.

## CONCLUSION

This case adds to the growing literature supporting the use of SCS for back pain and radiculopathy without previous spinal surgery. Additionally, our case demonstrates that SCS with 10kHz provides pain relief for patients without previous surgery and can help reduce opioid requirements for patients with chronic back pain and radiculopathy.

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