Spinal Cord Stimulation for Chronic Knee Pain After Knee Replacement Surgery: A Case Series

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Introduction

- Chronic knee pain affects 25% of adults and can impair functionality.[1]
- Total knee arthroplasty (TKA) is a common treatment modality for patients with chronic knee pain unresponsive to conservative management
- 44% of patients experience persistent pain symptoms, and up to 7% have worse pain post-TKA as compared to pre-TKA.[2]
- As TKA corrects underlying mechanical dysfunction, pain is suspected to be multifactorial in origin with a significant neuropathic component.[3,4]
- Treatment of chronic knee pain post-TKA includes pharmacologic and interventional management such as neuropathic or opioid medications and radiofrequency ablation of the genicular nerves (RFA).
- These therapies are not without adverse effects and limited efficacy, leaving patients dependent on opioid medications as their only source of pain relief.
- In the hopes of minimizing chronic opioid use and reducing persistent pain, spinal cord stimulation (SCS) has become an increasingly popular treatment modality, specifically in treating chronic pain with neuropathic components.[5,6]

Objectives

- To evaluate the effect of SCS in patients who have persistent chronic knee pain after total knee arthroplasty (TKA) by analyzing the reduction in their daily opioid usage, subjectively reported pain and functional status

Methods

- Retrospective chart review identified three patients with the following clinical course: persistent knee pain after TKA, diagnostic genicular nerve block for peripheral nerve pain, subsequent RFA if nerve block provided ≥70% relief, inadequate relief with RFA, one-week trial of SCS with documented relief of pain after the trial, and permanent SCS placement.
- Patients were evaluated at the following points: pre-SCS trial, one-week post-SCS trial, and post-permanent SCS placement. To quantify daily opioid usage, morphine milligram equivalents (MME) were calculated.
- Patient 1: 56-year-old female with a history of bilateral knee osteoarthritis and continued knee pain despite bilateral TKA, physical therapy, pharmacologic management (tapentadol IR + ER), and genicular nerve block
- Patient 2: 59-year-old male with a history of bilateral knee osteoarthritis and continued knee pain despite bilateral TKA, physical therapy, medications (hydrocodone-acetaminophen, gabapentin), and RFA of right knee
- Patient 3: 41-year-old female with a history of pigmented villonodular synovitis and continued knee pain despite bilateral TKA and revision, physical therapy, medications (fentanyl patches 100mcg/hr, gabapentin), or RFA of bilateral knees

Results

Table 1. Data for Patient 1

Data Points	Pain Medications	MME/Day	MME Reduction (%)	Subjective Pain	Functional Status	SCS Program	Other
Pre-SCS Trial	Tapentadol 50mg q12h Tapentadol 50mg q12h PRN Amitriptyline 50mg q24h	80	-	10/10	Uses cane for ambulation Difficulty getting around the house		
Post-1 Week SCS Trial	No medications	0	100	L knee: 0/10 R knee: 4/10	Able to walk further, cook Less reliance on cane	P-SCS	>90% relief in L knee >65% relief in R knee
Post-SCS Placement (2 month follow-up)	Tramadol 50mg q8 PRN	15	81.3				
Post-SCS Placement (5 & 8 month follow-up)	Tramadol 50mg q48h	5	93.8	5/10	Does not use cane to walk; Has not required since SCS placement		70% relief

Table 2. Data for Patient 2

Data Points	Pain Medications	MME/Day	MME Reduction (%)	Subjective Pain	Functional Status	SCS Program	Other
Pre-SCS Trial	Hydrocodone-acetaminophen 10-325mg q8h Gabapentin 300mg q12h	30	-	10/10	Pain is affecting sleep and function Not able to enjoy all activities of his life		
Post-1 Week SCS Trial	No medications	0	100		"Huge" difference in ascending and descending stairs; able to ascend stairs with reciprocal step pattern Able to tolerate walking household distances without pain	MicroBurst SCS & Low-Rate Paresthesias	60% relief of pain
Post-SCS Placement (1month follow-up)	Hydrocodone-acetaminophen 10-325mg q12h Gabapentin 600mg qHS	20	33.3				50% relief of pain
Post-SCS Placement (3 month follow-up)	Hydrocodone-acetaminophen 10-325mg q12h Gabapentin 600mg qHS	20	33.3	7/10	Exercising and losing weight	Contour, HF-SCS	50% relief of pain Adjustments made to device
Post-SCS Placement (5 month follow-up)	Hydrocodone-acetaminophen 10-325mg q12h Gabapentin 600mg qHS	20	33.3	R Knee: 7/10	Trouble sleeping		Decrease in relief from 50% to 30% Scheduled for re-programming
Post-SCS Placement (8 month follow-up)	Hydrocodone-acetaminophen 10-325mg q12h Gabapentin 600mg qHS	20	33.3	6/10	Pain better during day, worse at night; able to work out more and use recumbent bike	P-SCS	50% relief of pain since re-programming; happy that he had stimulator placed
Post-SCS Placement (9 month follow-up)	Hydrocodone-acetaminophen 10-325mg q24h Gabapentin 600mg qHS	10	66.7		Staying active		Continued relief

Table 3. Data for Patient 3

Data Points	Pain Medications	MME/day	MME Reduction (%)	Subjective Pain	Functional Status	SCS Program	Other
Pre-SCS Trial	Fentanyl 100mcg/hr q72h Gabapentin 600mg q8h	240	-	7/10	Uses cane for ambulation Unable to walk for any significant amount of distance		No significant relief from RFA
Post-1 Week SCS Trial	Gabapentin 600mg q8h	0	100		Able to walk around mall freely		60% improvement in pain
Post-SCS Placement (1month follow-up)	Hydrocodone-acetaminophen 5-325mg q4h Gabapentin 600mg q8h	30	87.5	7/10	Limited exercise due to surgeon's post-operative advice	Combination therapy with contour at 200 Hz (after re-programming)	Not getting significant coverage of both knees, requests re-programming
Post-SCS Placement (2 month follow-up)	Hydrocodone-acetaminophen 10-325mg q6h Gabapentin 600mg q8h	40	83.3	7/10	Trouble with stairs, R>L knee pain	Combination therapy with contour at 200 Hz	Does not feel that stimulator is capturing pain in both knees, does not feel paresthesia in either knee on paresthesia mode

Figure 1. MME Pre and Post 1 Week SCS Trial

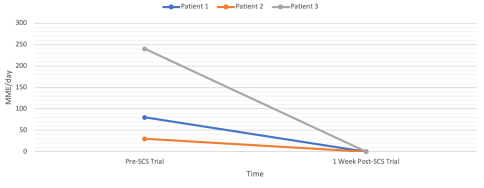
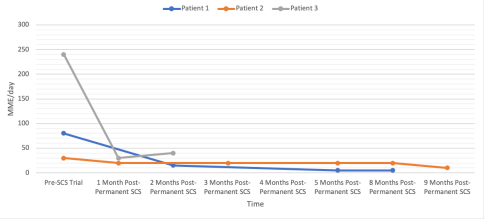


Figure 2. MME Pre-SCS Trial and Post Permanent SCS Placement



Conclusion

- Reductions in Opioid Use (MME)
  - Patient 1: 93.8 %
  - Patient 2: 66.7%
  - Patient 3: 83.3%
- Subjective Pain Scores:
  - Patient 1: 50 % decrease
  - Patient 2: 30% decrease
  - Patient 3: 0% decrease (before re-programming)
- Functional Status:
  - Patient 1: no longer using a cane
  - Patient 2: increased activity
  - Patient 3: minimal mobility, per post-op instructions
- Limitations: retrospective data collection, small sample size, concurrent neuropathic medication use (patient 2 & 3), and lack of validated measures for functional status
- Patients who received permanent SCS placement displayed both short and long-term reductions in opioid use and subjective pain scores. Additionally, patients reported improved subjective functionality.
- Overall, these improvements indicate that SCS may be a beneficial option for patients with persistent knee pain after undergoing TKA.

References

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