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Chronic Pain Rehabilitation for Upper Extremity Pain Following Stimulator Removal

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Data Collection B
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Data Interpretation D
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Conflict of interest: None declared

Patient: Female, 26
Final Diagnosis: Complex Regional Pain Syndrome (CRPS)
Symptoms: Edema • pain • sweating
Medication: —
Clinical Procedure: —
Specialty: General and Internal Medicine

Objective: Unusual or unexpected effect of treatment

Background: Both spinal cord stimulators (SCS) and interdisciplinary chronic pain rehabilitation program (CPRP) are evidence-based treatments for chronic pain but differ on treatment foci. SCS focuses on decreasing the subjective pain experience as a means of improving function and quality of life. CPRP focuses on addressing the cognitive, emotional, and behavioral factors associated with chronic pain to improve function. Due to experimental constraints, these 2 treatment options are difficult to compare; however, this case report offers a unique opportunity to examine outcomes for both interventions in a sequential manner for changes in pain, function, and mood.

Case Report: This single case study examined the separate and sequential outcomes of SCS and CPRP in a 26-year-old patient with a work-related injury resulting in chronic upper extremity pain. This patient was treated within an interdisciplinary CPRP following failure and removal of an SCS. Outcomes were measured by psychological assessments and return-to-work through a 6-month post-CPRP follow-up.

Conclusions: Pain intensity decreased following SCS placement and CPRP, while pain-related distress, pain interference, and overall affect improved only after CPRP, with sustained improvements at 6-month follow-up. Patient evidenced improvement following treatment with SCS and CPRP. SCS resulted in improvement in subjective pain and modest improved self-reported activity. CPRP demonstrated marked improvement in pain, self-reported function, and mood with patient eventually returning to work and maintaining most of these gains 6-months after completing CPRP treatment.

MeSH Keywords: Pain Clinics • Pain Management • Physical and Rehabilitation Medicine • Psychology, Clinical

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Background

Spinal cord stimulation (SCS) continues to gain attention as a treatment for a variety of chronic pain concerns [1], and is approved by the U.S. Food and Drug Administration for chronic pain of the trunk and limbs, pain from "failed" back surgery syndrome, and intractable low back pain [2]. Studies examining SCS treatment for Complex Regional Pain Syndrome) type I (CRPS-I) have paralleled those of SCS treatment of back pain, with stimulation resulting in improvements in pain [3–6] up to 2 years post-implantation [7], but not after 3 years [8]. SCS has demonstrated modest improvement in function; Goff et al., found improved ambulation in a single case study [9], and Rosenberg et al., showed improvement in a measure of pain-related disability [10]. Unfortunately, decreases in pain associated with SCS have not been consistently associated with corresponding improvements in function. For example, in a 5-year follow-up study, Kemler and colleagues [5,8] found no change in range of motion or strength in patients treated with SCS plus physical therapy versus physical therapy alone, and observed changes in pain and health-related quality of life (i.e., sleep, energy, social isolation, emotional reaction, and depression) were not statistically significant.

Interdisciplinary rehabilitation programs offer another pain treatment approach. As opposed to SCS, interdisciplinary rehabilitation programs aim to increase function in the presence of chronic pain. Data on interdisciplinary rehabilitation is strong [11–13], however; less research has examined this technique for upper extremity pain specifically. Treatment guidelines published in 2006 recommended interdisciplinary rehabilitation as the most likely treatment to address all complications associated with CRPS [14]. A systematic review of randomized control trials categorized physiotherapy/rehabilitation interventions as having "strong evidence" of effectiveness, as well as use of bisphosphonates and repetitive transcranial magnetic stimulation [15]. In comparison, SCS was categorized as having "limited evidence" for effectiveness in upper limb CRPS.

This paper presents a case study in which a patient with chronic upper extremity pain was treated with interdisciplinary rehabilitation following failure and removal of an SCS. This single case offers a unique opportunity to examine the efficacy of 2 philosophically different approaches in the same patient. Consistent with contemporary recommendations for examining treatment outcomes in chronic pain [11,16], we evaluated treatment outcomes across a variety of domains (i.e., pain intensity, disability, and psychosocial factors), rather than assessing pain intensity alone.

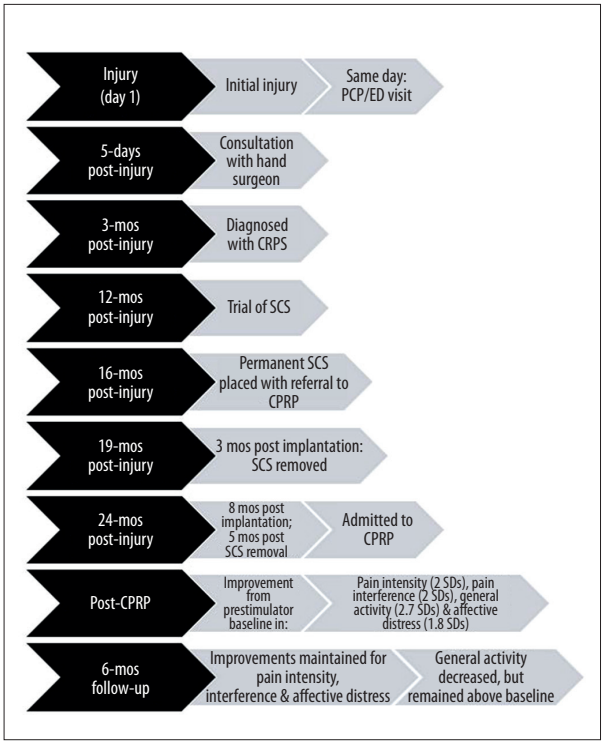

Figure 1. Timeline of events post-injury.

Case Report

Participant case information

The current project was approved by the West Virginia University Institutional Review Board. The patient was a 26-year-old female who sustained an upper-extremity injury when a 6 pound can fell onto her left hand resulting in immediate swelling and bruising (see Figure 1 for injury and treatment timeline). She was seen by a primary care physician and later by the Emergency Department and was treated with conservative interventions (i.e., ice and elevation), and provided with a referral to a hand surgeon. Initial findings were a painful swollen left hand suggesting a sprain/contusion to the left dorsal wrist with an acute carpal tunnel. An electromyogram was conducted 1-month post-injury and confirmed acute carpal tunnel syndrome. Conservative management continued, including hand therapy, edema control, splinting, nonsteroidal anti-inflammatory drugs, and cortisone injections to the dorsal and volar wrist compartments with no improvement.

Three-months post-injury, her edema was accompanied by hyperhidrosis and the diagnosis of CRPS was added. A CRPS hand therapy protocol was instituted including the use of a Jobst pressure pump for the edema, and stellate ganglion blocks. Only slight improvement was noted in her CRPS (e.g., muscle spasms and pain) while her carpal tunnel syndrome complaints (e.g., numbness and tingling) became worse.

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One year following her injury, she underwent a carpel tunnel release with little improvement. A temporary dorsal column SCS was implanted with complete remission of symptoms and a permanent SCS was placed 16-months post-injury. A referral to a chronic pain rehabilitation program (CPRP) was made at this time with the goal of improved function and pain coping. The patient was found to be an appropriate candidate for rehabilitation, but her admission to the CPRP was delayed until she was recovered from surgery. During this period, it became apparent that, in contrast to the temporary placement, the permanent stimulator did not relieve the patient's pain significantly. The stimulator was removed 3-months post-implantation, 19-months post-injury. With persistent complaints, the patient was re-evaluated for CPRP participation and was admitted to the program 24-months post-injury (8-months post-SCS implantation; 5-months post-SCS removal).

The CPRP was an interdisciplinary program requiring patient participation for approximately 6 hours per day, 5 days per week for 20 days with the goals of increased functional capacity and improvements in social and occupational functioning [16,17]. Treatment included 3 hours of physical rehabilitation (exercise/conditioning, work simulation, recreation/cardio) and 3 hours of psychological rehabilitation (cognitive behavioral therapy/pain coping skills, relaxation/stress management), with a minimum of 1-weekly medical visit and 1-2 individual psychology sessions. Additional services included job site visits, if appropriate, and vocational counseling with a counselor provided by the insurance company. It was staffed by an interdisciplinary team including a physician, psychologists, and occupational and physical therapists.

Assessment measures

Measures were administered by CPRP staff at 5 time points: pre-SCS, with trial SCS, after removal of permanent SCS/pre-CPRP, after completion of the CPRP, and 6-months following CPRP completion.

West Haven-Yale multidimensional pain inventory

The West Haven-Yale multidimensional pain inventory (WHYMPI) [18] is a validated self-report inventory of patients' pain experience. This inventory has shown good internal consistency and test-retest reliability [18], as well as sensitivity and responsiveness to change as a result of treatment [19,20]. For the purposes of this study, standardized T-scores for the 4 subscale scores were reported: pain intensity, interference, affective distress, and general activity level. The WHYMPI uses a multivariate discriminant model to classify patients into 1 of 3 empirically-derived prototypic profiles [18]. The "adaptive" and "dysfunctional" profiles respectively indicate lower or higher than average pain intensity, interference, and affective distress, and impairment. The "interpersonally distressed" profile is indicative of low levels of perceived social support from a significant other. If discriminant analyses reveal that a case contains significant aspects of more than 1 profile, it is classified as "hybrid."

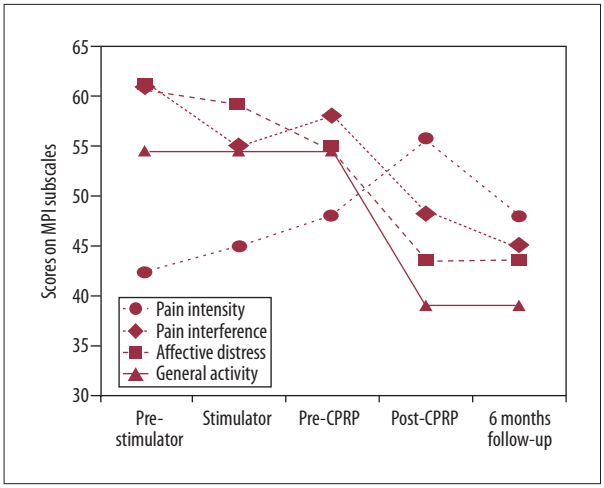

Figure 2. Change in multidimensional pain inventory scores. * The "stimulator" time point refers to the stimulator trial as the permanent stimulator was not successful in reducing pain.

Results of the WHYMPI subscales are shown in Figure 2. Results of each subscale are reported in standardized T-scores [mean (M)=50; standard deviation (SD)=10] derived from a normative group with chronic pain. Scores on the WHYMPI pain intensity subscale showed a decrease approaching significance (i.e., 1 SD) from pre- to post-stimulator, which returned to baseline with stimulator removal, and decreased to significantly below baseline and stimulator levels at the completion of the CPRP. General activity level increased over time; however, only after CPRP treatment did general activity level significantly improve from baseline (+2.7 SD). Results of the pain interference subscale mirrored those of the general activity subscale, with successive decreases in interference and the largest decrease from pre- to post-CPRP (–1.3 SD). At completion of CPRP, scores on the pain interference subscale were significantly lower than baseline (–2 SD) and CPRP admission (–1.3 SD). Scores on the affective distress subscale did not change and remained in the high normative range at the first 3 assessment points (i.e., pre-stimulator, with stimulator, and without stimulator at CPRP baseline), but showed significant decreases to below chronic pain norms following completion of the CPRP (–1.8 SD). Improvements on pain severity, interference, and distress were maintained at 6-month follow-up. General activity decreased at follow-up, but remained above baseline levels.

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In terms of classification, the patient's scores were consistent with a profile of "dysfunctional" at pre-stimulator, with stimulator trial, and pre-CPRP assessment points. Following CPRP treatment, the patient received a classification of "hybrid," evidencing significant aspects of the "interpersonally distressed" and "adaptive" classifications. This result suggests that the patient likely was reporting lower than average pain intensity, interference, and affective distress, but continued to have less perceived social support from a significant other. At 6-month follow-up, the patient was classified as "adaptive," indicating that she continued to report lower than average pain intensity, interference, and affective distress and no longer was reporting issues with support from a significant other.

Work status

The patient's work status was assessed at each of the assessment time points. Return to work was deemed a key outcome measure given the occupational nature of her injuries and the fact that return to work was a salient indicator of "successful" treatment [21,22].

In terms of vocational outcomes, the patient attempted to return to a new job as a dental receptionist before stimulator implantation, but due to swelling, coldness, and pain in the affected hand, the patient left this job. Notably, the patient returned to work at her pre-injury job following release from the CPRP and continued in this position through 6-months post-CPRP treatment.

Discussion

The current paper presents a case study of a patient with chronic upper extremity pain who was treated with SCS and subsequently an interdisciplinary CPRP. Results of physical and self-report measures indicated improvements after both forms of treatment, with the domains of improvement differing across the 2 modalities. The patient reported decreased pain intensity following stimulator placement with modest improved self-reported activity, but no significant improvement in other treatment outcome domains. The most marked improvements were shown following CPRP for pain intensity, pain interference, affective distress, and general activity. Additionally, improvements in pain intensity, affective distress, and pain interference were maintained at 6-month follow-up. General activity decreased slightly at follow-up, but remained above pre-stimulator or with stimulator levels. The patient's profile classifications remained "dysfunctional" until CPRP discharge, when she continued to show some characteristics of being "interpersonally distressed," but also evidenced significant contributions of "adaptive" coping. Notably, she improved to an "adaptive" classification 6-months after CPRP treatment.

In terms of return to work, it is notable that the patient had an unsuccessful return to work prior to both treatments, but returned to her previous position (pre-injury) at the completion of CPRP treatment and remained in it through the final follow-up assessment. The patient's return to work and improvement in functioning highlights the significant benefits of chronic pain rehabilitation, specifically robust patient outcomes and reduced healthcare utilization and spending. The findings of this case are consistent with other research that has demonstrated that CPRPs are more clinically effective and cost-effective as compared to other chronic pain treatment, including SCS [13,21,23–25].

This report is a single subject study of a unique circumstance in which a patient was provided 2 treatment modalities in a manner creating a natural experimental design. As such, generalizability of the findings is limited. The outcomes are based on self-report measures, and while these measures are valid and reliable, the objective functional experience of the patient cannot be determined. Additionally, due to the longitudinal nature of this type of treatment and the patient's particular experience, it is possible that there was a time effect in which there were gradual improvements unrelated to either treatment. Finally, due to complications related to the implantation of the SCS, it is unclear if the patient experienced maximum benefit prior to SCS removal, which might have altered the outcome.

To clarify, this case report is not an endorsement of one approach over another, rather it is an illustration and reminder of the complexity of the pain experience and potential value of interdisciplinary approach to address the impact of pain. It does appear that the intervention targeting functional improvements had a broader, and more significant treatment effect, at least over the short term in this particular individual. This case also adds to the literature by examining CPRP for upper extremity disorders. To date, there have been relatively few studies published in this domain, especially regarding physical or functional outcomes. Thus, a more comprehensive evaluation of therapeutic results is warranted.

Conclusions

This report is a single subject case study of a unique circumstance in which a patient was provided 2 treatment modalities in a manner creating a natural experimental design. Pain reduction was evidenced following SCS trial and minimally after implantation; however, greater decreases were evidenced following CPRP treatment without the stimulator. Perhaps more importantly, the patient's self-report of function improved, and her affective distress decreased markedly. In general, the patient evidenced improvement following both SCS and

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CPRP. SCS resulted in improvement in pain intensity and self-reported activity. CPRP demonstrated marked improvement in pain intensity, self-reported function, and mood, as well as the patient ultimately returning to work, and maintaining most of these gains 6-months after completion of CPRP treatment. Literature to date has demonstrated pain reductions as a result of SCS [3–5,7,26], and more modest impact on functional status [9,10]. Participation in CPRP generally emphasizes functional improvements rather than pain reduction *per se*, and has demonstrated good efficacy for return to work and improvement in functioning. This case study highlights the outcomes of these differing treatment approaches on this patient's outcomes.

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Conflicts of interest

None.

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