

# Physical Therapy in the Treatment of Lower Extremity Complex Regional Pain Syndrome Type I: A Case Report

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## INTRODUCTION

Complex Regional Pain Syndrome (CRPS) is a rare condition with no known gold-standard for treatment. It is hypothesized to arise from a combination of maladaptive pro-inflammatory responses, disturbances in sympathetic vasomotor control, and maladaptive peripheral and central neuronal plasticity.<sup>1</sup> There are two main presentations for CRPS: Type I develops following a non-direct injury to the nerve and surrounding tissues, while Type II pertains to CRPS symptoms following a nerve injury.<sup>2</sup> Evidence supports various treatments to decrease pain and improve function in patients with CRPS, including the use of pain exposure physical therapy (PEPT)<sup>2</sup> which encourages the use of the affected limb despite complaints of pain.<sup>3</sup> Because CRPS is thought to be closely intertwined with the central nervous system, encouraging patients to push through perceived “danger” signals from their body will stop the reinforcing belief that use of the affected limb is “bad.” Education on pain science and the function of pain as a “false alarm” in the case of CRPS is also thought to help reduce pain.<sup>4</sup> Due to the lack of evidence supporting any one treatment for CRPS, a multimodal therapy in combination with the principles of PEPT was employed in this case.

## CASE DESCRIPTION

The patient was a 32 year old female who sustained a right inversion ankle sprain 7 months prior to examination. Persistent symptoms pain resulting in a diagnosis of CRPS-Type I. The patient had been non-weight bearing with walking boot and bilateral axillary crutches for 7 months. This case report focused on the use of PEPT in combination with manual therapy, electrotherapeutic modalities, temporal agents, and traditional therapeutic exercise techniques in the treatment of CRPS of a 32-year old woman. Data was analyzed retrospectively.

## EVALUATION

In addition to the ankle injury, patient reported a history of anxiety and depression, as well as chronic low back pain and degenerative disc disease, 2 pre-existing conditions known to increase the incidence of developing CRPS-I after an acute injury.<sup>1</sup> Patient reported significant decreased function and quality of life due to her condition, with limitations reported with ambulation, standing activities of daily living (ADLs), stair negotiation, and effects on sleep, driving, and housework. Testing included range of motion (ROM), strength, balance, limb circumference, sensation, and a variety of functional outcome measures (Tables 2 & 3). Sensation testing revealed impaired light touch below the right knee as well as diminished 2-point discrimination.<sup>5</sup> The patient ambulated 100ft at 0.73 m/s with a right walking boot and bilateral axillary crutches, demonstrating touch-down weight bearing and a swing through gait pattern.

## INTERVENTIONS

The patient received outpatient physical therapy 3x/week for 60 minute sessions for a total of 8 weeks. (Table 1)

Table 1		Interventions by Week			
Week	Therapeutic Activity/Aerobic	Balance/Proprioception	Strengthening/ROM	Modalities/Patient Education	Patient Response
1	-Recumbent Bike x 10 min at Level 1 -SL WBAT Treadmill intervals 5x1 min (with pain dependent rest time) Speed: 1.0 mph, Elevation: 0%	-Seated Rocker Board (AP/ML) x 5 min -Seated BAPS board CW/CCW x 5 min Level 2	-DL Squats on Total Gym™: Level 7 x 5 min -Ankle DF stretching x 5 min	Cryotherapy/Moist Hot Pack Contrast 3 min each -Acceptable pain levels for R LE WB/pain experienced “false warning” -Desensitization process	-Marked c/o pain -Frequent rest breaks to allow pain to subside
2	-Progressed: Treadmill intervals 3x 2 min with pain dependent rest time	-Progressed: Rocker Board to 50% R LE WB in sitting	-Added: Resisted Plantarflexion, Eversion, Inversion, Dorsiflexion with red theraband 3x10 each	-Added: Education on transition to unilateral crutch - TENS application and pad placement, mechanism, and rationale	-Moderate c/o pain - Frequent rest breaks due to pain
3	-Progressed: Treadmill intervals 4 x 2 min with pain dependent rest time		-Progressed: Squats on Total Gym™ x 6 min	-Added: Simultaneous TENS with cryo/hot pack contrast x12 min total (3 min intervals of cryo/heat) -Educated on TENS home unit and application of lidocaine ointment	-Minimal increase in pain with resistance exercises of ankle
4	- Progressed: Treadmill intervals 3 x 3 min with pain dependent rest time	-Added: Marble pick-up with toes in sitting x 5 -Progressed: Rocker and BAPS board in standing		-Education on acceptable pain levels during activity and importance of progression and continued use of the limb	-Minimal c/o pain -Standing progression for BAPS/ rocker board
5	- Progressed: Treadmill intervals 3.5 x 3 min with pain dependent rest time	-Progression of taps and holds with rocker board	-Added: Towel scrunches in sitting x 4 min		-Minimal c/o pain during sessions
6		-Added: AP/Lateral weight shifting on foam -Added: Bilateral tandem stance/lateral weight shifting on foam	-Progressed: DL squats on Total Gym™ to Level 8		-Tolerated addition of weight shifts on foam with no increase in symptoms
7	-Added: Gait Training x 300ft over level surfaces with unilateral crutch and no walking boot	-Added: Marching	-Added: Long axis distraction to hip and ankle x 4 min each -Added: Manual 4-way ankle stretching		-Unable to tolerate >30s marching on level surface due to increased patient anxiety
8		-Added: Ankle Alphabet x 3 minutes without rest to increase muscular endurance			-Patient c/o mild pain with increased weight bearing activities

## RESULTS

Following 4 weeks of treatment, improvements were seen in pain, ROM, strength, and function as indicated by the results of tests and variety of outcome measures. (Tables 2&3)

Table 2	Results of Objective Exam	
Test	Initial Evaluation	4-week Re-evaluation
Limb Circumference (cm)*	31.5	31.75
AROM (degrees)*		
Dorsiflexion	-2	3
Plantarflexion	39	39
Inversion	20	27
Eversion	8	12
Strength/MMT*		
Iliopsoas	4-/5	4-/5
Quadriceps	3+/5	3+/5
Hamstrings	3+/5	3+/5
Tibialis Anterior	2-/5	3-/5
Gastrocnemius	2-/5	2-/5
Posterior Tibialis	2-/5	3/5
Peroneus longus/brevis	2-/5	3/5
*Measured 12cm distal to inferior pole of patella AROM=Active Range of Motion MMT=Manual Muscle Test		

Table 3	Results of Functional Outcomes	
Gait†	Initial Evaluation	4-Week Re-Evaluation
Distance (ft)	100	300
Speed (m/s)	0.73	0.45
Assistive Device/Pattern	Bilateral Axillary Crutches, Walking Boot, 3-point swing-through pattern	Unilateral Axillary Crutch, step through pattern
Lower Extremity Functional Scale (LEFS)*	6/80	9//80
Orebro Musculoskeletal Pain Questionnaire (OMSPQ)	96	91*
Numeric Pain Rating Scale (at worst)	9/10	6/10†
Global Function Rating (%)	30	45
*Moved under cut-off for high cost workers compensation cases? †Denotes medium clinical change <sup>10,11</sup>		

## DISCUSSION

A multimodal approach for a patient with CRPS-Type I resulted in improvements in impairments and function. Lower extremity strength and ROM improved due to stretching and strengthening interventions described in Table 1. Although dorsiflexion did not reach the level of minimal detectable change of 8 degrees<sup>12</sup>, the patient was able to move past neutral, helping to normalize gait mechanics and functional activities such as squatting. Limb circumference of the calf increased 0.25 cm, most likely due to the beginning of muscle hypertrophy from strengthening activities and increased use, but did not yet match the contralateral side due to insufficient time elapsed to produce substantial muscle enlargement<sup>13</sup>. Distance ambulated increased compared to the initial evaluation, most likely due to decreased limb sensitivity and pain, denoting progress toward the long-term goal of full community ambulation. Brown et al identified full community ambulation for adults to be 304 meters(1,000ft).<sup>14</sup> Although gait speed decreased at re-evaluation, the devices used were less restrictive and the quality of the movement pattern improved. Both the LEFS and OMSPQ scores improved, with the decreased OMSPQ score falling under the cut-off for moderate risk for missing work and increased cost in injured workers.<sup>9</sup> Research shows relatively low evidence for a range of physical therapy treatments in the treatment of CRPS, with PEPT and pain science education as the most promising of the new-developing treatments. Similar to this case, education on the symptoms of CRPS and mechanisms of pain, treatment rationale, and progression of the syndrome combined with PEPT resulted in significant improvements in a randomized-control trial comparing PEPT and conventional physical therapy treatment.<sup>3</sup>

## CONCLUSION

Multimodal physical therapy in combination with PEPT tailored to an individual patient may be an effective way to treat CRPS. Pain science education and exposure principles of PEPT may also be important aspects of pain management.

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