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IRB Approval
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INTRODUCTION

Complex regional pain syndrome (CRPS) is a chronic condition involving allodynia, constant limb pain, and hyperpathic autonomic and somatic symptoms that affects at least one extremity and can develop after injury.[1] The five types of allodynia are tactile, pressure, thermal, vibratory, and chemical, with tactile being the most associated with CRPS. The kinesiophobia that results from allodynia may cause decreased movement and excessive guarding from even the most delicate contact, such as wearing clothing over the affected region.[2, 3] Learned non-use may then lead to a multitude of sequelae, including central sensitization and plastic remodeling of the neuromatrix of pain, which can further exacerbate conditions.[4,5]

Conventional therapy for CRPS varies greatly, however, only some forms of treatment are supported by evidence.[6,7] Within the last decade, somatosensory desensitization (SD) has been shown to be effective in the treatment of CRPS and is considered to be an essential component in restoring function.[2,3,8] SD is a functional form of physical therapy involving the management of pain avoidance behavior by repeated exposure to increasingly coarser and irritating materials to the affected regions.[1] This treatment typically involves a 10 to 15 week protocol, much of which is self-massage that can be done at home.[2]

The mechanism of SD is still unclear, but the goal is to decrease pain, allodynia, and kinesiophobia so that the patient will increase self-confidence and contact with the external environment in order to improve functional use of the affected limb.[2,3] While desensitization is considered standard care for CRPS and there is evidence of decreased pain and allodynia in the affected limb, research is still limited.[2,3]

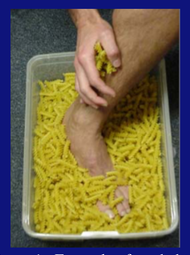


Figure 1. Example of graded tactile desensitization with rotini noodles

PURPOSE

The purpose of this case study is to determine the effectiveness of somatosensory desensitization in reducing the intensity and distribution of pain and tactile allodynia as measured by visual analog scales and pain body diagrams, as well as to assess changes in Semmes Weinstein monofilament testing, two point discrimination, algometry, grip and pinch strength, and weight bearing symmetry. Additionally, we aim to add to the body of literature regarding duration, frequency, types and progression of materials used in the desensitization treatment.

CASE DESCRIPTION

The 54 y.o. male patient had an incomplete C5 SCI. Prior to somatosensory desensitization, the patient experienced constant searing pain and tactile allodynia in all limbs for five years following the diagnosis of type II CRPS, despite 18 months of early physical therapy that restored nearly full functional mobility. Quadrilateral involvement permitted researchers to desensitize one upper (right) and one lower (left) limb.

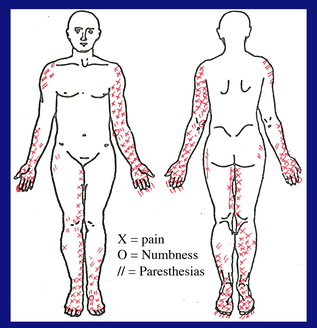


Figure 2. Baseline (3/13/2001)

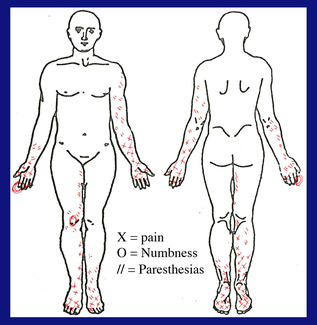


Figure 3. 7-month F/U (2/4/2002)

METHODS

Following three weekly baseline assessment sessions, the patient participated in a ten-week treatment program of progressive tactile desensitization, applied to the distal right upper and left lower limb via self-massage two times per day. The patient completed pain body diagrams (PBD), from which pain distribution scores (PDS) were derived using the modified rule-of-nines. This method divides the body into 46 segments where each segment accounts for a certain percentage of the body, allowing for a total percentage of the distribution of pain experienced by the patient to be quantified.[9] Other weekly outcome measures included individual visual analog pain scales (VAS) for each limb, Semmes-Weinstein monofilament testing, two-point discrimination, allodynia measurements via algometry, grip and pinch strength, and weight bearing symmetry. Monofilament testing, two-point discrimination, and algometry were assessed at both proximal (P) and distal (D) areas of each limb.

RESULTS

PAIN DISTRIBUTION

Whole body:
Pain ↓ 23.5% Numbness ↓ 5.5% Paresthesias ↑ 10.5%

Treated limbs:
Pain ↓ 9.5% Numbness ↓ 4.5% Paresthesias ↑ 3.0%

Untreated limbs:
Pain ↓ 14.0% Numbness ↓ 1.0% Paresthesias ↑ 7.5%

VISUAL ANALOG PAIN SCALE
Treated Limbs: ↓ 3.95 cm Untreated Limbs: ↑ 0.45 cm

SEMMES-WEINSTEIN
Treated Limbs (P): ↓ 3 sizes Untreated Limbs (P): ↓ 4 sizes
Treated Limbs (D): ↑ 2 sizes Untreated Limbs (D): ↑ 1 size

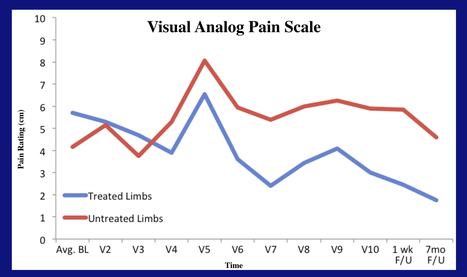
TWO-POINT DISCRIMINATION
Treated Limbs (P): ↓ 14 mm Untreated Limbs (P): ↓ 5.2 mm
Treated Limbs (D): ↓ 0.5 mm Untreated Limbs (D): ↓ 1.9 mm

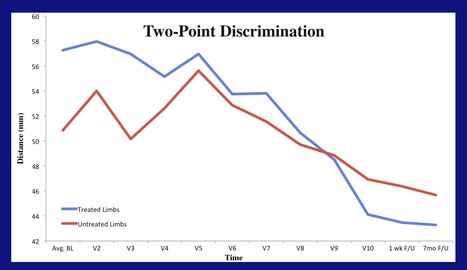
ALGOMETRY
Treated Limbs (P): > 60 kg Untreated Limbs (P): > 60 kg
Treated Limbs (D): ↑ 14.3 kg Untreated Limbs (D): ↑ 4.8 kg

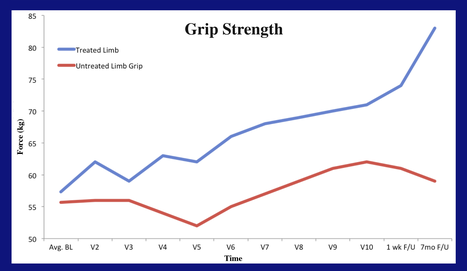
GRIP STRENGTH
Treated Limb: ↑ 25.7 kg Untreated Limb: ↑ 3.3 kg

PINCH STRENGTH
Treated Limb: ↑ 5.7 kg Untreated Limb: ↑ 1.1 kg

WEIGHT BEARING SYMMETRY
Treated Upper Limb: ↑ 19.2 kg Untreated Upper Limb: ↑ 4.5 kg
Treated Lower Limb: ↑ 3.8 kg Untreated Lower Limb: ↓ 5.3 kg







DISCUSSION

Throughout the somatosensory desensitization (SD) protocol and seven months following the treatment, the participant experienced a general trend of greater improvements in treated versus untreated limbs of all studied outcomes. Changes observed in pain body diagrams revealed that as pain decreased, paresthesias and numbness increased, indicating a transformation towards normal sensation. As pain intensity and distribution decreased, there was also a corresponding improvement in somatosensation of proximal areas, even though those areas were not directly treated. Prior to the SD, the participant's neuromatrix may have been reorganized in a way such that more of his somatosensory homunculus was devoted to painful distal areas, effectively cramming out the representation of non-painful proximal areas. Secondary to the treatment, the participant may have undergone a process of central reorganization, where those underrepresented areas were gradually normalized. Improvements were also noted in untreated limbs, most notably with Semmes Weinstein monofilament testing, two-point discrimination, and allodynia. This suggests that an overall central desensitization may occur in response to SD regardless of where exactly the treatment is applied.

The patient also improved with more functional measures, which suggests not only a decrease in pain, but also a reduction in fear of symptom provocation. CRPS is often exacerbated by fear-avoidance behavior, so the ability to weight bear more heavily through limbs that used to be too painful to even touch is indicative of a return towards an improved level of function. Improvements in pinch and grip strength were likely due to a decrease in allodynia, though muscular atrophy due to non-use may have been a factor, as well. The changes observed in these two outcome measures have obvious functional implications, and are representative of the gains that the participant made as a whole.

While the data suggests a consistent trend towards improvement across all outcome measures overall, the participant did experience a notable spike in symptoms that occurred during his fifth visit. This may have been due to a pacing issue, in which he likely overexerted himself the day before the visit due to improving so rapidly following five years of constant pain. Despite this setback, the patient again responded well to treatment and continued on the path towards his previous level of function.