Effectiveness of manual therapy at reducing pain perception in paediatric complex regional pain syndrome (CRPS) type 1

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CLINICAL SCENARIO

Complex regional pain syndrome type 1 (CRPS-1) is a systemic disorder of the central and peripheral nervous systems. Symptoms are characterized by extreme pain inconsistent to the extent of the injury, and with presenting neurovascular changes, oedema and allodynia (Wilder, 2006). There is no definitive treatment protocol for paediatric cases of CRPS-1, but typical care consists of pain medication use, nerve block injections and/or physical therapy (Bialocerkowski, A, & Daly, A., 2012). Long-term pain medication use is not indicated for children, however, as it is not effective in the long term and can lead to addiction problems (Dobe & Zernikow, 2013). Likewise, the efficacy of nerve block injections is not conclusively known (Cepeda, Carr, & Lau, 2005). While physical therapy is recommended, it is not clear what specific manual therapies or treatment strategies are most effective in chronic cases (Bialocerkowski & Daly, 2012).

FOCUSED CLINICAL QUESTION

In children and adolescents with complex regional pain syndrome type 1(CRPS-1), is manual therapy (massage and joint mobilizations) effective at reducing pain perception of affected limb(s) at six months post diagnosis?

SUMMARY of Search, 'Best' Evidence' Appraised, and Key

To better understand the treatment options available for children with CRPS-1 a literature search was conducted. The five most relevant articles to the clinical question consisted of 1 systematic review, 2 randomized trials, 1 narrative review and 1 case series.

A systematic review (Bialocerkowski and Daly, 2012) found poor to fair quality evidence that physical therapy (PT) when used with other interventions could lead to short-term improvements in symptoms and functional ability in children with CRPS-1. A randomized,

single-blind trial (Lee, et al, 2002) and a comparative study (Meier et al, 2006) found that PT improved measures of pain in children at both short and long term follow-up. A case series (Low, Ward, and Wines, 2007) and a narrative review (Wilder, 2006) reported PT as a more effective therapy in the treatment of paediatric CRPS when compared to medications or invasive procedures.

CLINICAL BOTTOM LINE

Research evidence indicates that physical therapy could be a more effective option for treating paediatric CRPS than invasive procedures. Treating a persistently painful condition requires consistent exposure to movement and non-nociceptive stimuli. CRPS-1 is difficult to treat, but the scope of practice and clinical skills of physical and manual therapists provides an opportunity to alleviate pain in this population.

Limitation of this CAT

This critically appraised topic was prepared for a graduate course assignment and has been peer-reviewed by two independent instructors.

SEARCH STRATEGY

Terms used to guide Search Strategy:

- **P**atient/Client Group: Children with complex regional pain syndrome type 1(CRPS-1)
- **I**ntervention (or Assessment): Manual therapy (massage and joint mobilisations)
- **C**omparison: None
- **O**utcome(s): Pain relief
- **T**ime: 6 months post diagnosis

Databases and Sites Searched	Search Terms	Limits Used
Medline ® (Ovid) CINAHL EMBASE	**MESH**: - Complex regional pain syndromes or reflex sympathetic dystrophy - Pediatric or child or adolescent - Musculoskeletal manipulations - Manual therapy - Massage - Physical therapy modalities - Nerve block - Ganglionic blockers - Pain or analgesia or anaesthesia - Pain measurement **Key words**: - CRPS or RSD or causalgia - P$ediatric or children or child or adolescent - Soft tissue therapy or manual therapy or physical therapy or physiotherapy - Pain relief - Massage or chiropractic or joint mobilizations	Age 18 and younger
PubMed	**Key words**: Complex regional pain syndrome and children or adolescents	
PEDro	**Search terms**: Complex regional pain syndrome and children or adolescents	
Rehab+	**Search terms**: Complex regional pain syndrome and children or adolescents	

INCLUSION and EXCLUSION CRITERIA

- Inclusion:
  - Complex regional pain syndrome type 1 diagnosis
  - Subjects aged 0-18 years old
  - Systematic reviews, randomized controlled trials, narrative reviews and case series
- Exclusion:
  - Subjects over 18 years old
  - Single case studies

RESULTS OF SEARCH

Six relevant studies were located and categorised as shown in Table 1.

Table 1: Summary of Study Designs of Articles Retrieved

Study Design/ Methodology of Articles Retrieved	Level*	Number Located	Author (Year)
Systematic reviews	2**	2	Bialocerkowski & Daly (2012). Zernikow et al. (2012).
Randomized trial	2	1	Lee et al. (2002).
Comparative study	3	1	Meier et al. (2009).
Narrative review	4	1	Wilder (2006)
Case series	4	1	Low et al. (2007).

*The Oxford Levels of Evidence 2

** Downgraded due to poor study quality

BEST EVIDENCE

The following study (Lee et al, 2002**)** was identified as the 'best' evidence and selected for critical appraisal:

- Most applicable to the PICO question
- Researched the effectiveness of physical therapy, including manual techniques (massage) in the management of paediatric CRPS

- Only randomized trial of physical therapy effectiveness for CRPS-1 management.
- Inclusion criteria used a standardized diagnostic test for CRPS.

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of "Physical therapy and cognitive-behavioral treatment for complex regional pain syndromes" by (Lee et al, 2002).

Aim/Objective of the Systematic Review

The objectives of this study were to prospectively examine effects of a structured physical therapy (PT) and cognitive-behavioural treatment (CBT) program on pain and function, and to assess the frequency of PT on patient outcome.

Study Design

This study is a prospective, randomized, single-blind dose trial. Children who met the inclusion criteria were randomly assigned by means of a random number table to one of two treatment groups.

Setting

Participants were recruited at Children's Hospital, Boston from October 1997 to January 2001. Physical therapists treated the children as outpatients and assigned daily home care exercises.

Participants

There were 28 participants (26 females, 2 males). The average age was 12.5 years in Group A and 13.3 years in Group B. The average duration of pain was 2 months for Group A and 5 months for Group B. Every participant had pain in the lower extremity.

The inclusion criteria included: diagnosis of CRPS using an established protocol, patient and parent consent, and ages 8-17 years old. Exclusion criteria included: previous active participation in a PT program, systemic neurologic or psychiatric illness or previous sympathetic blockade.

The Clinical Investigation Committee at Children's Hospital, Boston, approved the study.

Intervention/Phenomenon Investigated

Physical therapy was provided by registered physical therapists in an outpatient setting. Differing doses of PT were administered. Group A was allocated low frequency PT of 1 visit a week for 6 weeks while Group B was allocated high frequency PT of 3 visits a week for 6 weeks. A co-intervention of CBT was equal in both groups, 1 visit per week for 6 weeks. The PT interventions were individualized for each participant and no treatment consistency or specific protocol was documented. The modalities included progressive weight bearing,

desensitization, massage and contrast baths. All were instructed in home care regimens and given goals to be achieved between visits. These were not specified.

Outcome Measures

Measures of pain intensity and allodynia were the primary outcomes. Pain intensity, was measured using a 10-cm visual analogue scale (VAS) at three time points: 1) pre-treatment, 2) Short-term follow-up (6 weeks to 3 months) and 3) Long-term follow-up (6-12 months). Allodynia was assessed using a 7 point Likert scale (1 = extreme allodynia, 7 = no allodynia).

Main Findings

The findings showed no significant group differences in duration of pain at short and long-term follow-up. At initial presentation all patients used assistive devices for walking. At long-term follow-up (mean 66 weeks), no assistive devices were being used and both groups showed improvements in all outcome measures related to pain and physical functioning.

The median pain intensity for both groups at pre-treatment was 6.4 cm on the VAS and at short-term follow-up it reduced to 0.6 cm, a difference of 5.8cm. . what was the difference in the likert scale scores?

Table 2b: Status of patients at end of study follow-up (Between Group ANOVA).

	Group A (n=13)	Group B (n=12)	P value
Recurrence of CRPS	5 (38%)	7 (64%)	.22
CRPS another limb	3 (33%)	2 (22%)	.60

Original Authors' Conclusions

Children and adolescents with CRPS show reduced pain and improved function with a 6-week program of PT and CBT. All patients not lost to follow-up (n=25) had excellent improvement in functional status. No assistive devices for walking, limb atrophy, limb contractures or vascular compromise was reported at long-term follow-up.

All patients received 6-18 PT sessions over 6 weeks, but the frequency and intensity of PT that is most effective could not be addressed from this study. Because PT was used in conjunction with CBT on all patients, conclusions cannot be made on the benefits of PT as a solitary treatment option.

Since treatment was not standardized after the initial 6-week protocol, drawing inferences regarding which factors had the most influence on longstanding outcomes is unknown and should be addressed in future research.

Although the outcomes were not different between the groups and both received the same home exercise program, there was inadequate documentation of who was compliant with the exercises and whether this had any effect between the groups.

Critical Appraisal

Study Purpose:

The purpose was clearly stated.

Literature:

Due to the lack of research in this area there are not many articles to provide a thorough background for this study. The authors noted that there are no prospective, controlled, descriptive or interventional studies of paediatric CRPS.

Design:

This study was a prospective, randomized, single-blind dose trial. This is a desired design for an intervention study and is therefore appropriate (Hoffmann, Bennett, & Del Mar, 2013).

Validity

Limitations:

There were no standardized treatment protocols for PT utilized in this study. Each treatment program was individualized and different modalities were used for each participant. This makes the generalization of the findings difficult. A list of modalities used was provided, but the frequency, intensity and duration was not mentioned. There was no control group. Both treatment groups received unspecified PT sessions as well as CBT. For this reason, any result seen at the end of treatment cannot be determined whether the effect was due more to the PT or CBT interventions.

Potential biases:

Sampling: Participants were not representative of the larger population as patients who had previously received physical therapy were excluded. This likely omitted patients who had been suffering for longer periods. In addition, the study groups were not statistically equal at the start, group B participants had an average length of symptoms 3 months longer than group A ($p=.08$), potentially favouring group A.

Intervention: It was not indicated how many therapists provided the treatments, and if the same therapist treated both the treatment groups, if the participants were treated by more than

one therapist, or most importantly, if the therapists were blinded (potentially favouring group B).

Measurement bias: Participants and their families were telephone interviewed with a follow-up questionnaire at a mean of 133 weeks post treatment. The expectations of the participants to provide favourable responses, accuracy of memories and ability of the children to comprehend the questions could create bias in favour of treatment Group B as there was more contact.

Maturation: CRPS tends to resolve itself over time. Therefore, without a control group the effects might be due to natural resolution of symptoms.

Attention bias: Group B had three times the therapist attention and contact than group A. It was not discussed whether each group was blinded from the other. This creates a potential bias in favour of Group B.

PEDro score:

8/11 was scored for this article. Points were deducted for no concealed allocation, lack of blinding of subjects and lack of blinding for the therapists who administered the therapy.

Sample:

Once enrolled, participants were randomly assigned to either treatment group via a random number table. Their allocation concealment was not mentioned in the article and therefore cannot be assumed. Specific inclusion and exclusion criteria were identified. An ethics review board at the treating hospital approved the study. A power analysis determined a sample size of 26 was needed provide an 80% power level. With 28 participants, 2 lost to follow-up, the study was adequately powered. For the two participants lost to follow-up an intention to treat analysis was completed.

Outcomes:

The 2 outcome measures used for pain, the VAS and the 7 point likert scale, are well-established, valid and reliable measures for pain outcome research (Kahl & Cleland, 2013), but currently there is no agreed upon minimal clinically important difference for the VAS. In the absence of a gold standard for pain measurement, they were appropriate for this study. The methods used to attain the measures and an explanation for their selection was adequately explained.

Intervention:

A combination of manual therapies and weight bearing exercises were used, but there was no standard treatment protocol and little description of the therapy sessions. It was not

mentioned how many therapists were involved in the study and which groups they treated. It would be difficult to replicate this intervention.

Missing information:

No mention was made if the participants were using any pharmaceuticals to manage their pain, or if they were receiving any other therapies in conjunction to what they were receiving in the study.

The questionnaire used for the phone interview at long-term follow-up was not included.

Interpretation of Results

At short-term follow-up, both groups showed improvements in measures of pain intensity and allodynia ($p<.001$). All participants were symptom free and able to return to normal activities by the end of the study period. The differences between the groups were not clinically meaningful because both groups showed similar levels of improvement, indicating the dose of PT received had little effect.

The responses to physiotherapy treatment are clinically significant because they do suggest that PT may be used effectively as part of an overall treatment strategy for children with CRPS.

Summary/Conclusion:

This article was the first randomized dose trial of PT in the treatment of paediatric CRPS. Although there are limitations in the study design, with neither double blinding nor a non-intervention control group, the resolution of symptoms and increase in physical function seen at the short and long-term follow-up is promising. Good quality research conducted with adults with CRPS needs to be duplicated in paediatric samples.

IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH

The findings of this study are consistent with the small body of research that exists in this field. There is significant bias based in the study design, however, the results indicate PT could be effective as part of a treatment regime for paediatric CRPS.

The optimum treatment for CRPS needs to be determined as it can be a debilitating disorder. Currently on Vancouver Island, children with CRPS are left out of hospital based pain clinics and can spend many months suffering with pain and disability unnecessarily. There is a significant lack of knowledge in the manual therapy community on how best to treat CRPS, and patients can be given harmful and expensive treatments with no supporting evidence. Clinicians need to avoid painful treatments that could increase sensitivity in peripheral and central neural mechanisms. Proper pain education should be the first treatment goal and

treatment strategies that focus on the needs and values of the patient should be undertaken on a weekly basis for 6 weeks.

Modern pain science education needs to be adopted in all health care professions to equip clinicians with the knowledge and clinical skills to effectively treat and manage pain conditions.

Therapy techniques with proven effectiveness in adults have the potential to be safe and effective in children too. More high quality research to determine the optimum dosage of therapy is needed.

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