



Topical review

Mirror therapy for Complex Regional Pain Syndrome (CRPS)—A literature review and an illustrative case report



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HIGHLIGHTS

- A patient with long-standing CRPS of the lower extremity, improved with mirror therapy.
- Review of CRPS signs and symptoms and the now accepted diagnostic criteria.
- Review of mirror therapy for pain and rehabilitation of CRPS, phantom limb, and stroke.
- Review and evaluation of the published literature for mirror document effects in good quality studies.

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ABSTRACT

Background and purpose: This case of a 42 year old woman with lower extremity Complex Regional Pain Syndrome (CRPS) after a twisting injury of the ankle, effectively treated with the addition of mirror therapy to a rehabilitation programme, prompted a literature review of both CRPS and mirror therapy. Mirror therapy is a newer adjunct to other forms of pain control and functional restoration for treatment of CRPS as well as other difficult clinical problems. This was a required group project as part of a university based course in chronic pain for healthcare workers.

Materials and methods: The PubMed database up to September 26, 2012 was reviewed using four search word groups: “CRPS mirror therapy”, “mirror CRPS”, “reflex sympathetic dystrophy OR Complex Regional Pain Syndrome AND mirror” and “reflex sympathetic dystrophy OR Complex Regional Pain Syndrome AND mirror + RCT”. Nine studies from PubMed met the criteria that this working group had chosen for inclusion in the analysis of mirror therapy as treatment. These references were supplemented by others on CRPS in order to generate an adequate review of both the syndrome CRPS and mirror therapy itself. Some references were specific for mirror therapy in the treatment of CRPS but others described mirror therapy for the treatment of phantom limb pain, brachial plexus avulsion pain, for physical rehabilitation of stroke related paresis and for rehabilitation after hand surgery.

Results: Criteria for the diagnosis of CRPS including the International Association for the Study of Pain criteria and the Budapest criteria are reviewed with an emphasis on the specificity and sensitivity of the various criteria for clinical and research purposes. The signs and symptoms of CRPS are a part of the criteria review.

The main treatment strategy for CRPS is physical rehabilitation for return of function and mirror therapy is one of many possible strategies to aid in this goal.

The patient in this case report had failed many of the adjunctive therapies and rehabilitation had been unsuccessful until the addition of mirror therapy. She then could progress with physical rehabilitation and return to a more normal life. Mirror therapy techniques are briefly described as part of a discussion of its success with relationship to signs and symptoms as well as to the duration of CRPS (and other

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syndromes). Some discussion of the theories of the central effects of both CRPS and phantom limb pain and how these are affected by mirror therapy is included.

An analysis of the 9 most relevant articles plus a critique of each is present in table form for review.

Conclusions: There appears to be a clear indication for the use of mirror therapy to be included in the multidisciplinary treatment of CRPS types 1 and 2 with a positive effect on both pain and motor function. There is also evidence that mirror therapy can be helpful in other painful conditions such as post stroke pain and phantom limb pain.

Implications: CRPS is often overlooked as an explanation for obscure pain problems. Prompt diagnosis is essential for effective treatment. Mirror therapy is a newer technique, easy to perform and can be a useful adjunct to aid physical rehabilitation and decrease pain in this population. Much further prospective research on mirror therapy in CRPS is ongoing and is needed to systematize the technique, to clarify the effects and to define the place of this therapy in the multidisciplinary management of CRPS.

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1. Introduction

Complex Regional Pain Syndrome (CRPS) is a relatively rare form of chronic pain that involves the extremities primarily. After learning about the patient (referred to as “Anna” here) described below, the authors became interested in this problem and also the therapy that Anna received. This review begins with a case presentation, then a description of the syndrome CRPS and its diagnosis and ultimately, an evaluation of the medical literature concerning mirror therapy for chronic pain.

2. Case description

The local ethics committee does not require prior approval of anonymous case report-publications. The patient gave her consent to her pain problem being described anonymously in this case report.

The patient, Anna, is a 42 year old female who has suffered since childhood from back pain. She later developed an abdominal pain diagnosed as “neuropathic” following a laparoscopy and subsequently a facial pain problem diagnosed as “neuropathic” following nasal septum surgery. Anna has an evident predilection for pain problems following trauma and these have been classified as “neuropathic”.

In 2001 Anna twisted her right ankle and foot suffering a rupture of a small muscle to the first toe and then developed a tarsal tunnel syndrome. Despite frequent contact with the healthcare system for

pain, Anna did not have appropriate investigation and diagnosis until 3.5 years after the injury. During that time she developed CRPS signs and symptoms in the right lower extremity.

When seen in the Pain Clinic in Falun Hospital, Sweden in 2006, Anna presented on crutches with a swollen, painful foot with alternating periods of pale or of purplish blue skin discoloration. Course hair growth and thickened skin were described. Anna had restricted range of motion of the ankle and foot joints with allodynia to touch and hyperalgesia over the whole foot and lower leg.

Anna had been previously active socially and also physically as an aerobics instructor, but after the ankle injury in 2001 she had a very restricted lifestyle with minimal social and physical activity and a fear of anything or anyone coming in contact with her right foot.

In Falun, Anna had trials of high dose opioids, neuroleptics, and antidepressive medications. She also had trials of ketamine infusions but all with little effect. Spinal cord stimulation was considered but not tried for fear of producing a local pain problem at the insertion site and/or implantation site for the generator due to her previous responses to trauma.

In 2010, Anna was referred to the Pain Center at the Uppsala Academic Hospital, Sweden for evaluation and treatment. She subsequently was admitted for a three week multidisciplinary treatment programme. At discharge, Anna had begun weight bearing on the right foot, took part in water gymnastics and had decreased her use of pain medications. Anna attributes this mostly to the beneficial effects of mirror therapy. She now has full weight

bearing and is returning to a full life. Anna continues with water exercises, mirror therapy, and works with a physiotherapist regularly. She uses oral ketamine irregularly for flare-ups.

3. Complex Regional Pain Syndrome – CRPS

CRPS is a syndrome characterized by burning pain and hypersensitivity in the involved extremity accompanied by changes in the skin appearance, in skin temperature and in sweating. Motor function changes are also seen frequently. Patients develop a “protective zone” around the involved extremity to prevent aggravation of symptoms by contact. CRPS is often precipitated by a fracture or other trauma and it is estimated that 1% of all fractures will evolve into CRPS [1]. The syndrome can also be preceded by a nerve injury, by a reason for immobilization, or by other seemingly minor traumas. According to the taxonomy of the International Association for the Study of Pain (IASP), the symptoms are often not proportional to the initiating event and are not often restricted to a peripheral nerve receptor field if nerve injury is the precipitating cause [2]. Exactly how CRPS evolves is not clearly defined or understood.

The syndrome is not common and an exact prevalence is not known. CRPS can be both under- and over-diagnosed due to the lack of clear criteria, poor knowledge of the syndrome and/or that minor symptoms at the onset are not reported by patients. A Dutch study reported the incidence to be 26/100,000 population per year and that women are affected three times more often than men [3].

CRPS has been previously described as *Reflex Sympathetic Dystrophy*, *Sudeck's Atrophy*, and *Causalgia*. A consensus on the name CRPS and diagnostic criteria came first in 1994 when the IASP taxonomy for pain was published [2]. Those criteria have good sensitivity but poor specificity which could lead to over diagnosis of the syndrome [4]. New diagnostic criteria, the Budapest criteria [5] were subsequently established after an international consensus meeting in 2003 and have been shown to have somewhat better specificity. The Budapest criteria have different interpretations for clinical use than for research use. It is suggested that the clinical criteria are more practical for clinical use due to their sensitivity but that the Budapest research criteria are better for research because of their better specificity i.e. lower inclusion of non-CRPS cases. But one should also bear in mind that the original criteria from 1994 can still be used for both clinical diagnosis and for research.

4. Budapest criteria of CRPS for clinical use, IASP 2003

- (1) Continued pain, which is disproportionate to any inciting event.
- (2) Must report at least one **symptom** in three of the four following categories:
 - *Sensory*: reports of hyperesthesia and/or allodynia.
 - *Vasomotor*: reports of temperature asymmetry and/or skin colour changes and/or skin colour asymmetry.
 - *Sudomotor*: reports of oedema and/or sweating changes and/or sweating asymmetry.
 - *Motor/trophic*: reports of decreased range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nails, skin).
- (3) Must display at least one **sign** at the time of evaluation in two or more of the following four categories:
 - *Sensory*: evidence of hyperalgesia (to pinprick) and/or allodynia (to light touch and/or deep somatic pressure, allodynia to innocuous cold (25 °C) or innocuous warm (40 °C), and/or joint movement).
 - *Vasomotor*: evidence of temperature asymmetry and/or skin colour changes and/or skin colour asymmetry.
 - *Sudomotor/oedema*: evidence of oedema and/or sweating changes and/or sweating asymmetry.

- *Motor/trophic*: evidence of decreased range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nails, skin).

- (4) There is no other diagnosis that better explains the signs or symptoms.

The diagnostic criteria are based on the clinical findings from those with the syndrome. CRPS is divided into two categories depending on whether the symptoms follow injury to a major nerve (CRPS type 2) or on whether there is no evidence for a nerve injury (CRPS type 1). This distinction may not seem to be so obvious and many say that a distinction is not necessary as treatments and prognosis are the same.

If Anna's symptoms and signs are reviewed in the context of the above criteria, it can be concluded that she fulfilled the first criterion, that her condition evolved from a twisting injury and subsequent immobilization and her signs and symptoms following this were out of proportion to the injury. Anna fulfilled criterion 2 in that she had allodynia and hyperesthesia, changes in skin colour, oedema, and decreased motor function. Clinically, Anna even fulfilled criterion 3 with confirmation on examination of the symptoms under criterion 2. We can also assume that Anna also fulfilled criterion 4 since no other cause to explain her problem could be found. All of this is in the context of someone who had the propensity to develop pain problems diagnosed as “neuropathic” after accidental and surgical trauma.

5. Treatment of CRPS

A variety of treatments for CRPS have been studied including neural blockade, spinal cord stimulation, pharmacotherapy, physiotherapy, and cognitive/behavioural therapies. Presently, the optimum treatment should be multidisciplinary with the focus on mobilization of the affected limb [1,2,5]. Some say that the treatment should not be painful but on the other hand, fear of pain and fear of movement in CRPS need to be addressed in treatment and need to be explored with the patient [6].

It must be emphasized that all other of the proposed treatments for CRPS are to help patients increase the movement and use of the affected body part and that the foundation of treatment is mobilization.

6. Outcome of CRPS

The prognosis for patients with CRPS varies between studies. In a study by de Mos et al. [7], 68% of the patients previously diagnosed with CRPS fulfilled the outlined diagnostic criteria at the time of follow-up 2–11 years after the initiating event. They found also that a poorer prognosis was associated with a history of an injury other than a fracture, with an injury to the upper extremity and with persistent coldness of the extremity.

On the other hand, a more optimistic outcome was seen in a study by Geertzen et al. where 72% of their patients could continue working after treatment [8]. The general consensus is that the earlier that treatment is initiated, the better the prognosis. Delays in both diagnosis and treatment are associated with poorer outcomes and much of the delay is due to limited knowledge of the syndromes and limited knowledge of possible therapies in the medical community. Some demographic information from Harden et al. [5] on the incidence and frequency of CRPS after knee replacement surgery shows spontaneous improvement with time.

One theory about CRPS holds that immobility and protection of a body part are contributing factors and this is supported by the finding that there are changes in the cortical representation of the affected body part in CRPS patients [9]. Many patients experience

that the affected body part is not their own, a common phenomenon after stroke, often called a “neglect symptom”. In the case of CRPS, it is usually referred to as a “neglect-like syndrome” and there is ongoing discussion of this phenomenon in the literature. Many of the treatment methods used currently are based on these ideas; for example, mirror therapy.

7. Mirror therapy

Mirror therapy is a treatment method that was first introduced by Ramachandra and Rogers-Ramachandra in 1996 [10]. This therapy originated with the use of mirror images to study the effects of visual input/feedback on phantom limb sensations and on phantom limb pain.

In this method, the affected body part is hidden and the patient concentrates on the mirror image of the unaffected contralateral body part during activity. This gives an illusion that fools the brain into thinking that the injured body part is well and can move normally. There are two methods of using this type of treatment. In one, the patient places the affected limb in a “mirror box” to hide it from sight. The unaffected limb is then viewed in a mirror. The other method is to have the patient at an angle to the mirror so that only the unaffected limb is seen in the mirror. In both cases, the patient then begins to move both limbs in the same way so that the affected body part does similar movements to the unaffected.

8. Literature review of mirror therapy for CRPS

The aim of this focused review was to document the present knowledge about CRPS and mirror therapy as a treatment for CRPS. The questions asked were:

- (1) can mirror therapy impact pain in the extremity with CRPS?
- (2) can mirror therapy impact function in the extremity affected by CRPS?

8.1. Method

Literature search

8.1.1. Inclusion criteria

Articles in English or Swedish about mirror therapy and CRPS.

8.1.2. Exclusion criteria

Animal studies. Languages other than English and Swedish.

8.1.3. Database used and triage of articles

The PubMed database up to September 26, 2012 was searched using four search word combinations (see Table 1).

After completing the search, we reviewed the titles and abstracts to evaluate the relevance of the articles to the aims of the study. From the articles retrieved with the search, we initially agreed that nine fulfilled the inclusion criteria for the study. Of these, 4 or possibly 5 were randomized, controlled studies. We include the information from the nine relevant articles in this report.

The articles were triaged according to the protocol of Willman et al. [11]. A summary evaluation of the study quality was done and

studies were graded to three levels: high, medium and low. Each of the included articles was evaluated by one of this report's authors who did an initial grading of the study's quality. The article was then presented to the entire group who had access to the article, there was a discussion of the article and a consensus reached on the study's quality and grading.

8.1.4. Ethical considerations

The patient in the case presentation above was consulted and gave her consent to her pain problem being described anonymously in a case report. The local ethics committee has given a general information statement that the committee's approval is not required for publication of adequately anonymized patient case histories.

8.2. Results

8.2.1. Quality analysis

The description, critique, and conclusions about the studies chosen for inclusion are listed in Table 2.

8.2.2. Evidence for effect of mirror therapy in CRPS

In those nine studies, our analyses find clear indications that mirror therapy has a positive effect on both pain and motor function in CRPS.

However, there are also different opinions on how effective mirror therapy is as a stand alone therapy for CRPS. Moseley shows in his studies that mirror therapy only has an effect on pain and function when it is incorporated in his “Motor Imagery Programme (MIP)” and if it is used along with “mental movement training” (visualization) [16].

McCabe et al. [15] and Cocchio et al. [12] show that mirror therapy produces pain reduction and improved motor function as a stand alone treatment. Selles et al. [17] emphasize in their study that their patients with CRPS type 2 had an improvement in both pain and function with mirror therapy, although with different degrees of improvement and duration of improvement.

There are also different opinions on the importance of the duration of CRPS on the outcome of mirror therapy as a treatment. Several studies demonstrate that CRPS symptoms present for over 1–2 years have a poor prognosis for improvement with this technique. However, in a study of stroke patients with CRPS of the upper extremity where the symptom duration was more than a year there was a clear improvement in pain and motor function with mirror therapy [13].

According to Vladimir Tichelaar et al. [18], there is a further need to have studies to clarify whether or not the patients' perception of the affected area as not part of their body (*neglect-like-symptom*) has an effect on the outcome of mirror therapy for improving pain and motor function.

8.3. Discussion of literature review findings on mirror-therapy

8.3.1. Mirror therapy for various conditions with pain or motor dysfunctions

The areas of application of mirror therapy vary among all studies. Besides the qualified articles here that refer to CRPS, there are

Table 1
Search words and “hits” in the database PubMed.

Database	Search words	No. of articles	No. triaged	No. used
PubMed	CRPS mirror therapy	12	2	2
PubMed	Mirror CRPS	19	2	2
PubMed	Reflex sympathetic dystrophy OR Complex Regional Pain Syndrome AND mirror	49	2	2
PubMed	Reflex sympathetic dystrophy OR Complex Regional Pain Syndrome AND mirror + RCT	5	4	4

Table 2Data from the studies evaluated; *N* = 9.

Ref nr	Author yr. country	Title	Purpose	Methods/design	Subjects/study	Results	Quality
[12]	Cacchio, De Blasis, De Blasis, Santilli, Spacca, 2009, Italy	Mirror therapy for chronic Complex Regional Pain Syndrome type 1 of the upper limb in stroke patients	Evaluate effect of mirror therapy on pain and function in the upper extremity in patients with CRPS 1 after acute stroke	RCT. Randomized to two groups. Over 4 weeks both groups had conventional stroke rehabilitation. Mirror therapy group had limb movement training during mirror therapy. The control group had the same limb movement training with the mirror concealed. Evaluation 1 week and 6 months after treatment	24 with mirror therapy 24 in control group	Mirror therapy decreased pain significantly and improved motor function in the upper extremity in stroke patients with CRPS 1 of the upper extremity. No change in control group	High
[13]	Cacchio, De Blasis, Necozone, di Orio, Santilli, 2009 Aug, Italy	Mirror therapy for chronic Complex Regional Pain Syndrome type 1 and stroke	Evaluate if treatment with either mirror therapy or guided imagery has any effect on pain and motor function in post stroke patients with chronic CRPS for more than 1 year	Randomized controlled study. 3 groups. Studied for 4 weeks (1) active mirror therapy, (2) covered mirror, (3) mental imagery training	24	Mirror therapy decreased pain significantly and improved motor function compared with mental imagery group and the control group in patients with stroke present over 1 year	Medium/low
[14]	Moseley, Wiech, 2009, Australia	The effect of tactile discrimination training is enhanced when patients watch the reflected image of their unaffected limb during training	To evaluate if watching the mirror image of the healthy limb while stimulating the limb with CRPS produces increased acuity of the sensations evoked	Clinical study. Tactile stimulation discrimination training under 4 different conditions: (1 and 2) observing the non-affected hand in the mirror with and without seeing the skin, (3 and 4) observing the affected hand directly with and without seeing the skin directly. Evaluation of two-point discrimination (TPD) threshold and pain at conclusion and 2 two days later	10 patients with CRPS (1 or 2 not defined)	Two-point discrimination threshold decreased more in Group 1 than in 2 and 3. 2 and decreased more than 4. Even after 2 days was TPD threshold less in Group 1 than in the other groups and also less than at baseline. No difference among the other groups. Pain decreased most in Group 1 post training. No change among the other groups. No changes in pain in any group after 2 days	Medium
[15]	McCabe et al., 2003, Great Britain	A controlled pilot study of the utility of mirror visual feed-back in the treatment of Complex Regional Pain Syndrome (type 1)	Can mirror therapy decrease pain and increase function in patients with CRPS 1?	Pilot study. Training of extension/flexion with mirror for 10 min. as often as they were willing under 6 weeks. Primary endpoints were pain by VAS (0–10) and temperature difference between healthy and affected sides	8 patients with CRPS type 1	It seems that mirror therapy can have a pain decreasing effect and decreases the temperature difference between the healthy and injured side in those with early CRPS. If patients have had the diagnosis for 1 year or more it appears that mirror therapy has little effect	Low
[16]	Moseley, 2005, Australia	Is successful rehabilitation of Complex Regional Pain Syndrome due to sustained attention to the affected limb? A randomized clinical trial	Does the effect of a Motor Imagery Programme (Moseley, 2004) depend on observing the affected body part or on sequential activation of the sensory network?	Randomized clinical study. 6 weeks treatment with different interventions beginning at weeks 0, 2 or 4. Patients were randomized to three groups with various interventions based on MIP	20 patients with CRPS, type 1	The order of the interventions has an effect which supports the hypothesis of sequenced activation. Mirror therapy turns out to decrease pain and increase function if it is preceded by the therapy <i>imagined movements</i>	Medium

[17]	Selles et al., 2008, Holland (J Rehabil Med)	Mirror therapy in patients with causalgia (complex regional pain syndrome type 2) following peripheral nerve injury: two cases	Describes the use of mirror therapy in patients with CRPS 2 investigates the effect on pain and function	2 case reports	2 patients with causalgia after traumatic nerve injury of upper extremity	Mirror therapy can decrease pain and improve function in an injured hand. Improvements can be short lived or long lived. Further studies are needed to clarify why this is so mirror therapy is a possible treatment method for causalgia	Low
[18]	Vladimir Tichelaar, 2007, The Netherlands (Int J Rehabil Res)	Mirror box therapy added to cognitive behavioural therapy in three chronic Complex Regional Pain Syndrome type 1 patients: a pilot study	To investigate if mirror therapy is a useful addition to CBT in treatment of chronic CRPS 1	Pilot study. 3 cases.	3 patients	Mirror therapy combined with CBT can have a positive effect in rehabilitation for CRPS. Decreasing pain at rest and with stimulation contributes to a decrease in medication use and an increase in function. Different predictors play a role among which are the syndrome's duration and the sensation of "foreignness"	Low
[19]	Moseley, 2004, Australia	Graded motor imagery is effective for long-standing Complex Regional Pain Syndrome: a randomized controlled trial	Compare MIP (Motor Imagery Programme) with conventional treatment of chronic CRPS 1	Single blind RCT. 6 weeks MIP treatment in 7 pt. or ongoing pharm. treatment in 6 pt. Follow up after 2, 4, 6 and 12 weeks. If successful, intervention group to control treatment and control group to intervention after 12 weeks	13 pt. with CRPS 1 of the upper extremity	Improvement in the intervention group was seen for pain, swelling and time to recognize the body part. There was no improvement in the control group until switched to the treatment after 12 weeks	Medium
[20]	Moseley, 2006, Australia	Graded motor imagery for pathologic pain. A randomized controlled trial	Investigate if graded motor imagery can diminish pain and disability in pt. with CRPS 1 and pt. with phantom pain	Single blind RCT with 6 mo. follow up. 2 weeks limb laterality recognition, 2 weeks imagined movements, 2 weeks mirror movements in the intervention group	51/125 intervention group, 26 control group	Pain was decreased and function improved in the treatment group	High

many published studies on mirror therapy for other chronic pain problems/syndromes including phantom limb pain after amputation [21] and pain after brachial plexus evulsion [22]. Other studies have also focussed more on the use of mirror therapy for training to improving motor function after stroke [23–26]. Mirror therapy has also been used to help with rehabilitation after hand surgery [27].

8.3.2. Mechanisms behind mirror-therapy effects

The mechanisms behind the positive effects of mirror therapy on pain are not yet clear. Several theories have been proposed and can be found in the literature. It has been postulated that phantom pain can be the result of a disruption of the normal interaction between motor control and sensory feedback [28–30]. With mirror therapy one can create a visual illusion of normal, pain free movement of the painful extremity. That agrees with the hypothesis that all experiences of pain have a cortical source [30]. In the situation where one lacks a cause for pain i.e. CRPS type 1, phantom limb pain, and focal dystonia of the hand one can explain pain as a mismatch among motor control, proprioception and visual feedback. This explanatory mechanism holds that a visual illusion rectifies this mismatch [15,16].

Another theory is that modified or absent feedback results in a cortical reorganization of the homunculus, the “body map” in the primary sensory and motor cortices (S1 and M1) and that the degree of reorganization with therapy is in proportion to the pain experienced [31,32]. The cortical reorganization can be modified by a different sensory input produced by a visual illusion, thereby reducing pain [21,22,27]. According to Selles et al., it is most likely that mirror therapy affects pain through an effect on the central nervous system in the case where there is no clear peripheral cause such as phantom limb pain and CRPS type 1 as opposed to CRPS type 2 where pain supposedly has a local source in the limb, and it is less likely that different mechanisms such as distracting the patient's attention have any great effect on pain [17].

8.3.3. Less effect of mirror therapy in long-standing cases and cases with neglect-like symptoms

The intended effects of treatment for CRPS are to reduce pain, facilitate mobility, and improve function [15,23,33,34]. The requisites for effective treatment are early diagnosis and early institution of treatment. According to Vladimir Tichelaar et al. [18], mirror therapy itself is not effective if undertaken after the clinical picture has been present for more than 2 years. Furthermore, how patients experience the affected body part plays an important role. If patients feel that the affected area is no longer a part of their body, this is an indication of irreversible changes in the primary sensory cortex and resistance to mirror therapy as treatment [18].

9. Conclusions

The patient Anna in the case study had had more than 6 years suffering from a severe CRPS before mirror-therapy was added to her treatment regimen. Mirror-therapy clearly had beneficial effects in Anna's case in spite of a long history of apparently treatment-resistant CRPS.

The results of this literature review indicate that mirror therapy is an appropriate treatment alternative for decreasing pain and improving motor function both when mirror therapy is the main focus of treatment to facilitate active movement/mobilization of the limb and when used as part of multidisciplinary treatment. The majority of studies indicate the importance of starting treatment as early as possible after the injury for the best effect. Symptoms that have continued for more than about 2 years respond less to

treatment. However, there are reports, such as the present case, that indicate that “one should never give up”.

Conflict of interest

None declared.

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