

# Mirror box therapy in the complex regional pain syndrome type I

## *Terapia com caixa de espelhos na síndrome dolorosa regional complexa tipo I*

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### ABSTRACT

Complex regional pain syndrome (CRPS) type I is a neuropathic pain condition, commonly affecting a limb extremity after a traumatic event and/or a period of immobilization, in the absence of nerve injury. Besides pain, the clinical features include regional vasomotor alterations and usually a decreased range of motion in the affected extremity. Its actual cause remains somewhat obscure and there are few agreements on optimal treatment. The mirror box is a therapeutic approach based on visual feedback as a way to achieve a new mental imagery of the affected limb by promoting cortical reorganization. This approach has been used for the motor recovery or pain relief in conditions such as stroke or type-I CRPS.

**Keywords:** Complex Regional Pain Syndromes, Upper Extremity, Therapeutics, Occupational Therapy

### RESUMO

A Síndrome dolorosa regional complexa (SDRC) tipo I é um quadro de dor neuropática, que afeta, sobretudo as extremidades dos membros após evento traumático e/ou período de imobilização, na ausência de lesão nervosa. Para além da dor, as características clínicas incluem alterações vasomotoras regionais e frequentemente limitação da mobilidade da extremidade envolvida. Não está totalmente esclarecida a sua causa e existem poucos consensos em relação ao tratamento ideal. A caixa de espelhos é uma modalidade terapêutica baseada no feedback visual, como forma de construção de uma nova imagem mental do membro afetado, promovendo a reorganização cortical. Esta técnica tem sido utilizada na recuperação motora ou no controlo da dor em situações como o acidente vascular cerebral e o SDRC tipo I.

**Palavras-chave:** Síndromes da Dor Regional Complexa, Extremidade Superior, Terapêutica, Terapia Ocupacional

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## INTRODUCTION

The complex regional painful syndrome (CRPS) is a clinical entity characterized by pain with neuropathic characteristics, which affects mainly the extremities of the limbs. There are two forms of this syndrome – the types I and II, which are distinct because in the second there is a documented lesion of nervous structures.<sup>1-4</sup>

The real incidence of type I CRPS is unknown, with most cases described after a traumatic event and/or a period of immobilization of a limb.<sup>1-4</sup>

The criteria for the diagnosis of IASP (*International Association for Study of Pain*) include the history of the previous traumatic event or the cause for immobilization (since this criterion is not compulsory if other criteria are verified), prolonged pain (or other sensory alterations) disproportional to that expected for the initial lesion, and the presence of edema, vasomotor symptoms, or alterations of the sweat in the painful area, in the absence of any other cause that justifies the clinical outlook.<sup>1-3,5,6</sup> Despite not being part of these criteria, the reduction of muscular strength and/or limitation of articular amplitudes, with consequent functional decline, are frequently present and constitute frequent causes for reference in Physical Medicine and Rehabilitation (PMR).<sup>1,3,4,6</sup>

The physiopathology of this entity is not totally clear. Although, by definition, in type I CRPS there is no documented lesion, it seems to be an exacerbation of the sympathetic response to the tissue aggression triggering peripheral sensitization phenomena, which amplify the initial inflammatory response. The importance of an early intervention is the fact that the unrestricted inflammatory stimulus may unleash central sensitization mechanisms,



Figure 1 - Therapy with mirror box.

with the possible evolution of a difficult to treat chronic pain picture.<sup>1,5-9</sup>

The main objectives of the treatment of this condition are the education of the patient, the promotion of utilizing the affected limb, and the treatment for pain so as to minimize the risk of its becoming chronic.<sup>1,3,5,10,11</sup>

There is little consensus in the medical community about the ideal treatment. The therapeutic options are many and may include pharmacotherapy,<sup>5,11-15</sup> kinesiological techniques, and the recourse to physical agents.<sup>1,5,11,16-18</sup>

When these conservative measures fail, other more invasive options can be tried, such as sympathetic/sympathectomy blockages and neuromodulation techniques.<sup>1,5,11</sup> Cognitive-behavioral therapy can play a pivotal role in the management of chronic pain.<sup>1,2,11</sup>

The mirror box was initially developed to be utilized in the treatment of pain for ghost limbs in amputees.<sup>19,20</sup> It is a simple device made with a box divided in half by a mirror with two faces (Figure 1). The objective is to make the patient mobilize the healthy limb. Such movements are reflected in the mirror, which transmits the perception that it is the missing limb that is moving without limitations or pain. It is thought that the central integration of this image stimulates neuroplasticity phenomena, which may constitute a valuable therapeutic asset in the approach to type I CRPS.<sup>19,20</sup>

## OBJECTIVE

To evaluate the benefit of mirror box therapy in the functional recovery of patients diagnosed with type I CRPS involving the upper limb.

## METHODS

The authors monitored the treatment of 6 outpatient clients (External Consultation for Physical Medicine and Rehabilitation at the Braga Hospital) with diagnoses of type I CRPS affecting the upper limb. They evaluated the intensity of pain and active amplitudes of the wrist at three points in time (T0 – initial evaluation, T1 – after 15 treatment sessions, T2 – after 30 treatment sessions).

The evaluation of the intensity of the pain was made utilizing the visual analog scale (VAS). The wrist amplitudes were evaluated by manual goniometry, from the neutral position of the wrist on the transverse axis (flexion/extension) and in complete pronation of the wrist.

The rehabilitation program included the following techniques:

- in the Occupational Therapy area: mirror box therapy, utilizing a square cardboard box approximately 30 cm high, in which one of the internal sides is totally covered by a mirror. The patient placed the extremity of the injured hand inside the mirror box, moving it freely, so as to visually control the movements produced in the mirror. The injured hand was placed outside the box, behind the mirror and without visual control;

- in the Physiotherapy area: hydrotherapy in tank equipped with a whirlpool, drainage massage, and kinesiotherapy.

The therapy sessions lasted an average of 30 minutes and were done 3 times per week.

All the patients were medicated with 1,500 mg/day of calcium carbonate and 200 IU/day of salmon calcitonin. No other pharmaceutical analgesics were prescribed.

## RESULTS

The six patients included in the study were observed by a physiatrist in Outpatient Consultation, and diagnosed with type I CRPS, according to the IASP criteria. In all cases a previous pernicious stimulation was identified, which caused immobilization of an upper limb – 5 patients had bone fracture of the upper limb (2 were submitted to surgery and 3 to conservative treatment and 1 patient had been submitted to tenosynovectomy for tenosynovitis of Quervain).

Five patients completed the complete rehabilitation program (30 sessions), however, one patient (patient 2) abandoned the treatment after 15 treatment sessions, despite clinical improvement up to T1, and it was not possible to discover the reason for the abandonment.

The results registered according to gravity of pain and of active articular amplitudes of the wrist are presented in the table below (Table 1).

No complications were registered during the rehabilitation program.

## DISCUSSION

Given that the physiopathology of the type I CRPS is still not clarified, the treatment of this condition is a challenge. There are many therapeutic options, although precise orientations in relation to the ideal treatment are non-existent.

**Table 1** - Evaluation of pain and arc of wrist movement.

		Patient 1		Patient 2		Patient 3		Patient 4		Patient 5		Patient 6	
T0	Pain	7		6		4		2		6		3	
	AWM	E 30	F 25	E 20	F 25	E 15	F 15	E 0	F 0	E 50	F 30	E 50	
T1	Pain	4		1		4		1		4		1	
	AWM	E 30	F 25	E 40	F 50	E 35	F 35	E 0	F 0	E 55	F 70	E 50	
T2	Pain	3		4		0		2		1		1	
		E 40	F 45			E 45	F 50	E 0	F 0	E 50	F 80	E 60	

AWM - arc of active wrist movement; E- extension, F- flexion (referred to in degrees).  
Classification of pain intensity utilizing the visual analog scale.

Because the immobility is an aggravating factor of functional limitation, one of the few consensuses in this area relates to the importance of early mobilization and incentive to the use of the affected limb. In this context, Physical Medicine and Rehabilitation plays a relevant role in the approach of this pathology.

In addition to the pharmacological therapy prescribed, the patients fulfilled a rehabilitation program that included the following modalities: kinesiotherapy, local massage (utilized for its relaxing, desensitizing, and edema draining actions), hydrotherapy in tank equipped with whirlpool (to promote vascular dynamics, to relieve regional vasomotor alterations), and mirror box therapy. This lattermost has shown promising beneficial effects in some studies.<sup>19,20</sup> The probable action mechanism involves cerebral neuroplasticity phenomena triggered by the visual feedback of the image of full pain-free movement of the affected limb, projected on the mirror when the patient moves the healthy extremity.

Many advantages have been attributed to this therapeutic modality,<sup>19,20</sup> among them the easy construction and low cost of the device in addition to other aspects such as excellent tolerance, the absence of side effects, the possibility of self-manipulation, with no need for supervision by a professional and the promotion of active participation of the patient in the treatment. However, the greatest advantage of this therapeutic modality is its action mechanism. Especially in view of what was presented in the physiopathology related to the central sensitization phenomena which lead to chronic pain, some authors consider the type I CRPS as essentially a central nervous system pathology with peripheral manifestations.<sup>8</sup> Thus, the mirror box therapy would act on the etiological location of the problem, the central neuronal circuits.

In this study, a global improvement was verified in the sampling, as much in the intensity of the pain as in the active mobility of the wrist, in all the patients.

In relation to pain, the AVS score averaged 4.7 in the initial evaluation, 2.5 in T1, and 2 in T2, which represents a decrease of over 50% in the intensity of pain after completing the rehabilitation program. Only one patient did not improve from pain complaints (patient 3), but gained more wrist amplitude.

Regarding the clinical evolution in terms of active wrist movement amplitudes, an average gain of 30° of flexion and 14° of extension was verified after completing the rehabilitation program. It is noteworthy that in these calculations patient 4 was not considered, for his being submitted to arthrodesis surgery of the wrist and received treatment merely against pain.

This clinical improvement after the rehabilitation program cannot, however, be attributed exclusively to the mirror box therapy, since other therapeutic modalities were also applied. For an individualized evaluation of the mirror box benefit it will be necessary to make a controlled and random study, which is already being developed by the authors of the present study.

### Limitations of the study

The sample was small and there was no control group.

### CONCLUSIONS

There is no consensus in relation to the ideal treatment for type I CRPS.

A functional rehabilitation program is important in the healing of articular movement limitations and in the relief of pain.

The mirror box, for its action mechanism, can be a valuable aid in the approach to this pathology, therefore random and controlled studies are necessary to establish the evidence of its benefit, as well as guidance on the criteria for selecting patients and on the length of treatment.

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