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Case report

Multimodal physiotherapy treatment based on a biobehavioral approach in a patient with chronic low back pain: A case report

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Abstract: Low back pain and its chronification are among the most common causes of disabilities worldwide. This is why multiple interventions and treatment approaches have been investigated around this pathology in recent years. Currently, the evidence is increasingly leaning towards treating chronic low back pain with a treatment based on the patient's centered biopsychosocial model. This case report presents the evaluation and treatment of a 43-year-old woman with chronic low back pain using a multimodal physiotherapy based on a biobehavioral approach. In the physiotherapy intervention, the patient's pain characteristics and somatosensory, motor-functional, and affective-cognitive states were first evaluated. Subsequently, a multimodal treatment including therapeutic exercise, pain neuroscience education, and orthopedic manual and physical therapies was applied for a total of 14 sessions over a period of 9 weeks. Finally, a post-intervention evaluation and at the one-month follow-up were carried out, in which it was observed that the treatment had significantly improved the patient's symptomatology and their general state. This case suggests that a multimodal physiotherapy treatment based on a biobehavioral approach is an effective option to improve pain symptoms and somatosensory, motor-functional, and affective-cognitive aspects in the reported patient; therefore, a treatment of these characteristics may be an option for patients with chronic low back pain.

Keywords: chronic pain; physiotherapy; biopsychosocial; multimodal approach; chronic low back pain

1. Introduction

Low back pain (LBP) is the most prevalent musculoskeletal pathology and one of the leading causes of disabilities worldwide [1]. LBP is the most common in the 35−55 age range [2]. In addition, more than 70% of the world's adult population in resource-rich countries will suffer from at least one episode of LBP in their lifetime [2].

Traditionally, the diagnosis of LBP was mainly pathoanatomical, with a strong emphasis on imaging techniques; nonetheless, in recent years, the evidence shows that there is often a poor correlation between the results of imaging techniques and the patient's symptomatology [3].

Risk factors for LBP include heavy physical work, prolonged static postures, and abrupt twisting or lifting movements [2]. Furthermore, psychosocial aspects such as anxiety, stress, and depression are also risk factors [4].

Moreover, LBP tends to become chronic, which increases the problems for both the patient and society. This chronification occurs in 7 out of every 100 cases of LBP and it is known as chronic low back pain (CLBP) [5]. Some studies have shown that aspects such as depression, distress, or having a history of previous LBP episodes are risk factors for the chronification of LBP [6].

In most cases of CLBP the cause is not clearly identified and is therefore referred to as non-specific CLBP [7]. In addition, CLBP is characterized by a heterogeneous clinical presentation, which leads to a variety of opinions on treatment and approaches.

Regarding treatments, orthopedic manual physical therapy (OMPT) has traditionally been one of the most interesting therapeutic options for LBP. It is important to mention that the effects of OMPT have been found to be mainly short term [8,9]. Furthermore, neural mobilization, which is within the scope of OMPT techniques, can also be an effective tool for short term improvements in LBP patients [10,11]. In terms of medium to long-term improvements in patients with CLBP, therapeutic exercise (TE) and pain neuroscience education (PNE) are, according to current evidence, effective tools for chronic pain management [12–14].

In terms of approaches, it has recently been shown that the biobehavioral approach based on the patient-centered biopsychosocial model for chronic pain may be a more interesting option than the traditional biomechanical approach, especially in terms of medium to long term changes [15].

This case study describes the use of a multimodal physiotherapy treatment based on a biobehavioral approach in a patient with CLBP. This is one of the first case studies where the treatment for CLBP is based on a biobehavioral approach, rather than a more traditional physiotherapy approach. The use of this multimodal treatment is due to the current evidence and because the patient was previously treated with usual care and did not show any significant medium-term improvements. For these reasons, the aim of the study was to evaluate and treat a patient with CLBP using the patient centered biopsychosocial model as a reference.

2. Materials and methods

2.1. Case history

The patient was a 43-year-old woman with obesity and a sedentary lifestyle, diagnosed with CLBP and trochanteric bursitis, who had previously undergone surgery for various pathologies in the lumbar region. The main symptomatology presented by the patient during the initial interview was the presence of pain in the right inguinal region (pain number one, P1), together with pain in the lumbar region (pain number two, P2).

P1 has been present for two years, is deep and constant, has an intensity of 4/10 on the Visual Analogue Scale (VAS), is sometimes referred to the anterior region of the thigh, and has articular characteristics. Additionally, it improves at rest, with medication, and with trunk flexion. However, it worsens with trunk rotation and extension. P2 has been present for 10 years, its intensity is variable throughout the day (between 4 and 7 out of 10 on the VAS), and it is deep and constant. It improves with rest but worsens after prolonged walking and when moving from sitting to standing. When performing lumbar flexion, P2 is radiated posteriorly, and this pain is considered as pain number 3 (P3). Both P2 and P3 have articular and neural characteristics. Moreover, the patient reports that in terms of the pain frequency, the pain was present every day without interruption, which has meant that she had to take painkillers 17 out of 30 days in the last month. All baseline (T0) measurements of pain characteristics are listed in Table 1. In addition, the pre-intervention body chart with the distribution of symptoms can be found in Figure 1.

Table 1. Baseline and Follow-up Measurements of the Pain Characteristics from T0 to T3.

Measure	T0	T1	T3	T4
P1 intensity (VAS)	4/10	2/10	0/10	0/10
P2 intensity (VAS)	4/10	5/10	1/10	3/10
P3 intensity (VAS)	7/10	0/10	0/10	3/10
Pain frequency (pain/ days of the month)	100% (30/30)	59% (22/30)	30% (9/30)	17% (5/30)
Pain medication (medication/ days of the month)	57% (17/30)	27% (10/30)	33% (10/30)	20% (6/30)

*Note: VAS: Visual Analogue Scale; T0: First session; T1: Tenth session; T2: Fourteenth session; T3: 1 month follow- up.

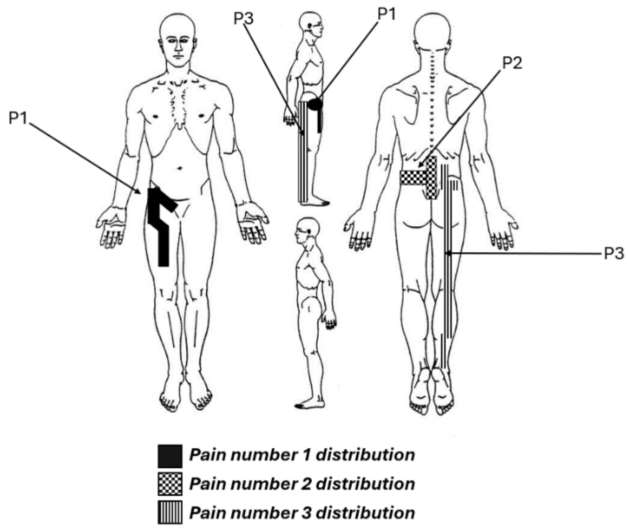

Figure 1. Pre-intervention body chart with symptom distribution.

2.2. Clinical findings

After the medical interview, a physical examination was performed. First, it was observed that the patient had discomfort related to P1 when performing both passive and active trunk extension, homolateral rotation, and homolateral tilt movements. On the other hand, symptoms related to P2 and P3 were reported when performing both passive and active trunk flexion. Second, three tests were used to assess the somatosensory status. The first test performed was the two-point discrimination test (2-PD Test) using an esthesiometer. Following the protocol detailed by Nollan [16], the calipers were set at 70 mm and then the distance between points was reduced by 10mm until the patient indicated that they had gone from feeling two points to one. Three measurements were taken, and the average was calculated to obtain the 2-PD Test value. The 2-PD Test was performed at both the right lateral epicondyle and 1cm lateral to the right of L3. In the second test, Von Frey monofilaments were used to evaluate the time summation magnitude. The test was performed on the L3 spinous apophysis and on the right lateral epicondyle. At the beginning of the test, a primary stimulus was applied using the monofilaments to one of the points selected for the test. Then, the patient was asked to rate the intensity of the pain caused by the stimulus using the VAS scale. Subsequently, 10 rhythmic stimuli were applied to the same point under the guidance of a metronome at 60 bpm. Finally, the difference between the mean of three repetitions of one stimulus and the mean of three repetitions of ten stimuli was calculated. The result of this calculation is the value of the temporal summation effect [17,18]. The third and final somatosensory test was aimed at assessing the pressure pain threshold (PPT) using a digital algometer [19]. A pressure was maintained until pain was provoked and was applied to the spinous apophysis of L3 and the right lateral epicondyle. The quantity of the pressure measure in kg applied by the algometer up to pain provocation was the value of the PPT. All baseline values for the above somatosensory tests are listed in Table 2.

Table 2. Baseline and Follow-up Measurements of the Somatosensory Factors from T0 to T3.

Measure		T0	T1	T2	T3
	1cm LR L3	9	7	5.5	5.5
2-PDT (cm)	RLE	4.5	4.5	4.0	4.0
	SA L3	6.2	4.3	3.6	2.3
TS (VAS)	RLE	4.7	3.2	2	1.5
	SA L3	0.79	2.4	4.3	4.8
PPT (Kg/cm^2)	RLE	2.5	4.1	4.5	4.6

*Note: 2-PDT (cm): Two-Point Discrimination Test; TS: Temporal summation; VAS: Visual Analogue Scale; PPT: Pain Pressure threshold (Kg/cm^2) LR: Lateral Right; RLE: *Ri*ght Lateral Epicondyle; SA: Spinous Apophysis; T0: First session; T1: Tenth session; T2: Fourteenth session; T3: 1 month follow- up.

After assessing the somatosensory status, the motor-functional status was assessed. First, the range of motion (ROM) of both the lumbar flexion and thoracolumbar extension was assessed using a goniometer mobile application [20]. Second, using the Stabilizer Pressure Biofeedback unite, the patient's motor control of both her right and left sides was assessed as indicated in the protocol [21]. Then, the grip strength was assessed using a dynamometer, as it is considered a good measure of muscle strength [22]. Subsequently, the Functional Reach Test was used to assess the patient's static stability. The test consisted of the patient first placing both arms in a 90-degree flexion with her elbows and hands extended and then reaching as far as possible in the anterior direction without moving the feet, holding this position for 2−3 seconds. The physiotherapist measures the reach obtained in cm. The test was performed not only in the anterior direction, but also in the right and left directions [23,24]. Next, the patient performed the Y-balance test to assess the dynamic balance. To perform this test, adhesive tape was placed on the floor in the shape of a "Y". Initially, the patient stood with her hands on her hips in front of the "Y". The test consisted of the patient's foot sliding along the "Y" in an anterior direction as far as possible and then returning to the initial position. It was counted as valid if the patient did not move the supporting foot. Three repetitions were performed with each foot and the average of each foot was recorded in cm [25]. Finally, the extensor endurance was assessed using the Ito test [26]. The test consisted of recording how long (in seconds) the patient could remain in a prone decubitus position while separating the sternum from the stretcher. The baseline values of all the motor-functional factors assessed are described in Table 3.

Table 3. Baseline and Follow-up Measurements of the Motor-Functional Factors from T0 to T3.

Measure		T0	T1	T2	T3
ROM (º)	L Flexion	30.5	35	42	43.5
	TL Extension	26.2	28	28.2	31.3
MC (mmHg)	Right	73.3	70	62	55
	Left	61.7	58	57.2	53
Dynamometry (kg)		24.5	27	35.2	38.7
Functional Reach (cm)	Anterior	22.2	26	26.8	29
	Left	18.5	22	23	24.6
	Right	16.7	20	24	25.1
Dynamic Balance	Left	73.2	80	81	92
	Right	82.2	85.3	87.4	95
Extensor Endurance (seconds)		19.07	25	38	60

*Note: ROM: Range of Motion; L: Lumbar; TL: Thoracolumbar; MC: Motor Control; T0: First session; T1: Tenth session; T2: Fourteenth session; T3: 1 month follow- up.

Finally, the affective-cognitive status was assessed using various instruments. The Spanish version of the Oswestry Low Back Pain Disability Scale was used to assess the patient's level of disability [27]. This scale consists of 10 questions that are scored from 0 to 5. The total score is multiplied by 2 to obtain the patient's disability %, which is also known as the Oswestry Disability Index (ODI). To assess kinesiophobia, the 11-item Spanish version of the Tampa Scale of Kinesiophobia (TSK-11) was used. The TSK-11 has a score between 11 and 44 points, and the higher the score the higher the level of kinesiophobia. In TSK-11, a change of more than 5.6 points is considered a significant change [28]. As for the assessment of the pain catastrophism, the Spanish version of the Pain Catastrophizing Scale was used. The PCS consists of 13 questions, with a maximum score of 52 points. The higher the PCS score, the higher the degree of catastrophism. If the change in the PCS score is greater than 9.1 points, then it is considered a significant change [29,30]. The quality of life was measured using the SF-12 questionnaire, which has a maximum score of 100 points and consists of 12 questions. The higher the score on the SF-12, the better the patient's quality of life [31]. The Spanish version of the Hospital Anxiety and Depression Scale (HADS) questionnaire, consisting of two subscales, was used to measure both anxiety and depression in patients with CLBP. The maximum score on each subscale was 21 points, and the higher the score, the higher the level of anxiety or depression [32]. Finally, the Spanish version of the Chronic Pain Self-Efficacy Scale (CPSS) questionnaire was used to establish the patient's level of chronic pain self-efficacy. The CPSS consists of 19 items, and the higher the score, the higher the patient's degree of pain self-efficacy [33]. All baseline measures of the affective-cognitive factors can be found in Table 4.

Table 4. Baseline and Follow-up Measurements of the Affective-Cognitive Factors at T0, T1 and T3.

Measure	T0	T1	T3
Disability (ODI)	48%	24%	18%
Kinesiophobia (TSK-11)	29/44	26/44	19/44
Pain catastrophizing (PCS)	17/52	13/52	10/52
Quality of Life (SF-12)	25/100	28/100	28/100
Anxiety (HADS)	16/21	14/21	8/21
Depression (HADS)	8/21	8/21	6/21
Chronic pain self-efficacy (CPSS)	92	114	128

*Note: ODI: Oswestry Disability Index; TSK-11: 11-item Tampa Scale of Kinesiophobia; PCS: Pain Catastrophizing Scale; HADS: Hospital Anxiety and Depression Scale; CPSS: Chronic Pain Self-Efficacy Scale; T0: First session; T1: Tenth session; T2: Fourteenth session; T3: 1 month follow-up.

2.3. Therapeutic intervention

During the 9 weeks of treatment, the patient attended to a total of 14 sessions. Each session lasted approximately 60 minutes. During the first 5 weeks, the patient attended 2 sessions a week, while from week 6 to 9, the patient only received one session a week. The biobehavioral physiotherapy approach included PNE, OMPT, and TE. Table 5 shows the therapeutic intervention that was pursued.

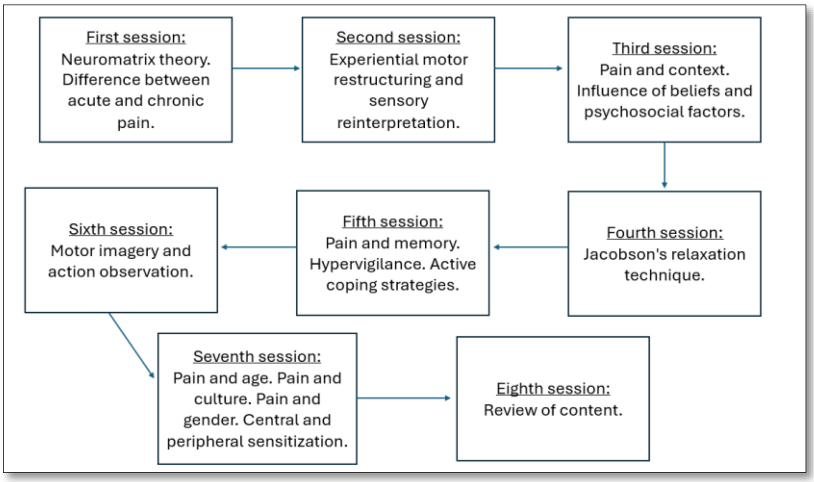

Figure 2. Contents of each PNE session.

Table 5. Therapeutic intervention in detail.

Phase *(sessions)*	Weeks *(times per week)*	Session duration	Treatment performed
First phase *(1st−10th)*	1st–5th *(2)*	60 *min*≈	**-PNE:** Pain education was present in 8 of the 10 sessions of the first phase. The PNE was responsible for providing the patient with coping tools and strategies as well as knowledge about pain with the aim of helping to change the patient's pain experience by eliminating negative and erroneous thoughts and improving self-efficacy. The contents of each session are detailed in Figure 2. **-TE:** The therapeutic exercise of the first phase was composed of basic lumbar and hip motor control exercises, aquatic strength training and aerobic training. **-OMPT:** i. *Bilateral hip joint traction:* 4 sets of 10 seconds of traction maintenance. ii. *Bilateral lumbopelvic traction:* 4 sets of 10 seconds of maintenance of traction. iii. *Central posteroanterior lumbar mobilization*: 3 sets of 2 repetitions at a rate of 2 Hz. iv. *Neural mobilization:* Three sets of 12 repetitions of neural tube and sciatic nerve mobilization were performed.
Second phase *(11th−14th)*	**6th–9th** *(1)*	60 *min*≈	**-TE:** The therapeutic exercise of the second phase was composed of advanced lumbar and hip motor control exercises and land-based strength training without load restrictions. **-OMPT:** i. *Bilateral hip joint traction:* 4 sets of 10 seconds of traction maintenance. ii. *Bilateral lumbopelvic traction:* 4 sets of 10 seconds of maintenance of traction. iii. *Central posteroanterior lumbar mobilization*: 3 sets of 2 repetitions at a rate of 2 Hz. iv. *Neural mobilization:* Three sets of 12 repetitions of neural tube and sciatic nerve mobilization were performed.

*Note: PNE: Pain neuroscience education; TE: Therapeutic exercise; OMPT: orthopedic manual physical therapy.

3. Results

The patient obtained a total of 14 sessions in a period of 9 weeks. After the intervention, the patient was re-evaluated to see the results of the treatment. In addition, a one-month follow up was also performed. In total, 4 measurements were obtained: the first was basal (T0), the second took place at the tenth session (T1), the third at the end of treatment (T2), and the fourth a month after the treatment completion (T3).

As for the general results of the treatment, all pains decreased, and improvements were obtained in the somatosensory, motor-functional, and affective-cognitive factors.

In terms of the pain intensity, there was a significant improvement in the post-treatment over baseline, with both P1 and P3 scoring 0/10 on the VAS, while P2 went from a 4/10 to a 1/10 on the VAS. In terms of pain, there was a significant improvement in the post-treatment over baseline, with both P1 and P3 scoring 0/10 on the VAS, while P2 went from a 4/10 to a 1/10 on the VAS. These improvements were not completely maintained at the one-month follow-up, but even so, if we compare the measurements at the 1-month follow-up with those at baseline, we can affirm that there was a very significant change. In addition, the pain frequency and pain medication intake improved on all measures, including at the 1-month follow-up, compared to pre-intervention. Table 1 shows all the results of the pain characteristics measured, in detail. Finally, in terms of pain expansion, there were also significant improvements between the baseline and 1-month follow-up, which can be visualized in the body chart that can be found in Figure 3.

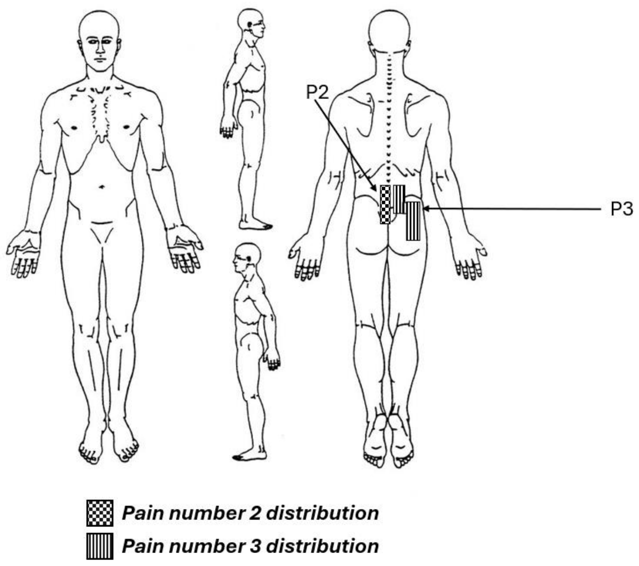

Figure 3. At 1-month post-intervention follow-up body chart with symptom distribution.

Regarding the results of the factors measured, first, somatosensory factors generally improved after treatment. There was a post-intervention improvement in the accuracy in the 2-PD Test that was maintained at the 1-month follow-up. In addition, both TS and PPT improved on all measures. Table 2 details all measures of somatosensory factors. Second, the motor-functional factors also showed an overall improvement after the intervention. This improvement increased not only until just after the end of the intervention, but also at the one-month follow-up. All measurements of the motor-functional factors are listed in Table 3. Finally, the affective-cognitive aspects were measured pre-intervention (T0), post-intervention (T1), and at the one-month follow-up (T3). In all these measures, a significant improvement was seen in all affective-cognitive factors. Table 4 shows all the measures of the affective-cognitive factors, in detail.

4. Discussion

This case report presents a detailed description of both the multimodal physiotherapy treatment used for an adult women patient with CLPB and the results obtained. The somatosensory, motor-functional, and affective-cognitive aspects were significantly improved. Additionally, there were positive results in terms of the pain intensity, frequency, expansion, and medication.

This is not the first time that a treatment based on a biobehavioral approach has produced positive effects in a patient with CLBP. Grande-Alonso et al. [34] obtained significant improvements using a treatment with the same approach. Despite using the same approach, this case report differs from the Grande-Alonso [34] study in some key points such as the patient profile, the type of study, the number of sessions, the treatment dose, and the tools included in the intervention. For example, our intervention includes neural mobilization, which is within the scope of the OMPT, as recent studies have shown that the use of this intervention can be beneficial in patients with CLBP [10,11]. Although Grande-Alonso et al. [34] found no differences in the use of a biobehavioral approach with or without OMPT, OMPT was included in the treatment of this case report. The inclusion of OMPT in this treatment is justified first because, as we have already mentioned, there are many differences in the key points that make the results of Grande-Alonso et al. [34] not entirely comparable to our case report. Second, the evidence shows that the general belief is still based on a classical physiotherapeutic model, where manual therapy is still seen by patients as one of the most effective tools in LBP [35]. This influences the patient's beliefs and expectations, which are aspects that play an important role in the possible placebo effect generated. Therefore, OMPT is included not only because of the effect it may have on our patient with CLBP, but because it can effectively contribute to maximizing the placebo effect, the maximization of which is recommended by experts [36]. In addition, it is important to mention that the differences in the key points such as the patient profile, assessment, and intervention make this case report unique as compared to studies with a similar approach such as Grande-Alonso et al. [34].

As for the somatosensory factors, some studies have shown that these factors are directly related to the expansion and intensity of pain [37,38]. Therefore, the improvement obtained in these factors may be one of the causes that has led to a significant improvement in both the pain intensity and in the reduction of its expansion.

Regarding the motor-functional factors, the results obtained are similar to those obtained by Searle A et al. [39]. In Searle A et al. [39], it was seen that TE caused significant improvements in motor-functional factors in patients with CLBP. Therefore, it is possible that the significant improvement in the motor-functional variables was mainly due to the TE carried out in the physiotherapy intervention. Furthermore, Searle A et al. [39] and another similar study [40] found that an improvement in motor-functional factors could lead to an improvement in the pain symptoms of patients with CLBP, which could be one of the causes of the overall improvement in the patient's pain symptomatology.

Regarding the affective-cognitive aspect, it should be noted that the improvement in the motor-functional variables may have influenced not only the improvement in pain symptoms, but also an improvement in the affective-cognitive factors, especially disability and quality of life [40,41]. Disability may also have been improved by neural mobilization, which is included in the OMPT techniques, as seen in some studies [10,11]. On the other hand, the improvement in the pain catastrophism and kinesiophobia may have been mainly due to the PNE [42]. Finally, it is possible that the improvement in affective-cognitive factors may have been enhanced by the use of a multimodal treatment including the TE and PNE as seen in other studies [43,44].

The present case report presents several limitations that should be considered. First, there was a lack of knowledge of the long-term effectiveness. Since the follow-up was only performed one month after the end of the intervention, we do not know the evolution of the patient's condition in the following months. We believe that a follow-up at 6 months and at 1 year would have been important, especially in a patient with CLBP, to be able to obtain both short-medium term and long-term results. Second, since this is a clinical case of a single patient, this study does not allow for comparisons. Finally, unlike other types of study designs, the case report design limits the generalizability of the results obtained. Nevertheless, it can be concluded that the multimodal physiotherapy treatment based on a biobehavioral model used has had a significant impact on the patient's improvement and may therefore be an interesting option in the treatment of patients with CLBP.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

Author contributions

Ferran Cuenca-Martínez, Mónica Grande-Alonso: conceptualization, supervision; all authors: methodology, validation, data curation, writing—original draft preparation, writing—review and editing, visualization; Mónica Grande-Alonso: investigation, project administration. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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