Received: 10 December 2021 | Revised: 22 March 2022 | Accepted: 22 April 2022

DOI: 10.1002/ccr3.5838

CASE REPORT

Clinical Case Reports Open Access WILEY

# Cognitive behavioral therapy for an individual suffering from chronic pain with overactivity and sleep disturbance: A case report

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**Funding information**
JSPS KAKENHI Grant, Grant/Award Number: 19J20623

**Abstract**

Patients suffering from chronic pain (CP) with overactivity frequently experience sleep disturbance. We presented a 35-year-old woman suffering from CP. To improve the sleep disturbance of individuals suffering from CP with overactivity, it is important to combine cognitive behavioral therapy for insomnia and activity pacing.

**KEYWORDS**

activity pacing, case report, chronic pain, overactivity, sleep disturbance

## 1 | INTRODUCTION

Chronic pain (CP) refers to pain that persists or recurs for longer than three months.[1] Overactivity is one characteristic activity pattern in individuals with CP and indicates the tendency to continue with activities despite pain.[2,3] Individuals with overactivity excessively engage in activities, resulting in additional pain and reduced functional capacity.[4]

Individuals suffering from CP with overactivity also frequently experience sleep disturbance.[5–7] A previous study using accelerometers revealed that engagement in high-intensity activities and high fluctuations in activities throughout the day (both characteristics of overactivity) are associated with poorer sleep at night.[5] In addition, a qualitative study reported that individuals with overactivity tend to suffer poor sleep quality.[6] Although the mechanism of the relationship between overactivity and sleep disturbance remains unclear, there are several possible factors for this relationship. One reason is that overactivity causes increased pain, which leads to difficulty sleeping,[5] while the other reason is that hypersensitization of the nervous system in individuals suffering from CP with overactivity leads to sleep disturbance.[7]

Cognitive behavioral therapy for insomnia (CBT-I) is recommended to improve the sleep disturbance of individuals with CP.[8,9] Specifically, CBT-I consists of sleep restriction, stimulus control, cognitive therapy, sleep hygiene education, and relaxation.[10] Randomized controlled trials have reported that CBT-I for individuals with CP

improves not only sleep disturbance, but also pain-related disability and depression.[8,9] In sleep hygiene education and CBT-I, promoting exercise engagement in daytime hours is recommended to improve sleep disturbance.[11] However, Andrews et al[5] cautioned against recommending increased daytime physical activity and exercise that are unguided and not supervised as a part of sleep programs for CP with overactivity. Andrews et al. mentioned that changing daytime overactivity patterns may be a key treatment strategy for addressing sleep complaints.[5]

In order to change the overactivity patterns, activity pacing is recommended.[12] Activity pacing is characterized by dividing tasks into smaller pieces, taking frequent short breaks, and slowing down.[13,14] For example, individuals with CP who engage in activity pacing divide housework into smaller tasks and take 10-minute breaks after completing each task. Activity pacing is one of the core components of CBT for individuals with CP.[12,15]

Although randomized controlled studies of CBT-I for comorbid insomnia and CP have been reported,[8,9] there have been no studies till date on sleep problems in individuals suffering from CP with overactivity. Thus, we report the case of a patient suffering from CP with sleep disturbance and overactivity, in which we intervene with a combination of CBT-I and activity pacing.

## 2 | CASE PRESENTATION

### 2.1 | Current medical history and information at the first visit

The patient is a 35-year-old woman who has been working as a caregiver. When she was in her 20s, she developed low back pain due to the physical burdens and frequent night shifts, which caused her to take two leaves of absence. After she was transferred to a department that did not require night shifts, she managed her low back pain by receiving massages and walking.

When she was 33 years old, she became the chief of the department. Due to her increased workload, her neck, shoulder, and back pain returned. In addition, she did not get along with her boss and became depressed. An industrial physician, who was concerned about her pain and depression, referred her to a psychosomatic medicine clinic. At the clinic, a physician did not prescribe any medication and told her that she did not need to continue visiting the clinic. Thus, the industrial physician referred her to our tertiary pain management hospital.

During the first visit to our hospital (Week 1), she stated, "I have heavy pain in my low back and shoulder." She also mentioned that regular exercise relieved her pain; therefore, she went to the gym and walked with a friend. The workload and relationship with her boss were emotionally upsetting for her. She did not have suicidal ideation and had a good appetite. She said that "Why do I have to work so hard?" but she also said that "I enjoy working and living for the work." She suffered from sleep disturbance. She fell asleep at 3 a.m. and woke at 7 a.m. She took loxoprofen (60 mg) and clotiazepam (5 mg) once a week.

### 2.2 | Outcome measure at the first visit

At the first visit (Week 1), the patient completed six questionnaires to assess her condition. First, the Numerical Rating Scale (NRS), ranging from 0 (no pain) to 10 (worst pain imaginable) was used to evaluate the worst, least, and average pain severity over the past 24 h as well as the current pain severity. Second, the Pain Disability Assessment Scale (PDAS)[16] was used to assess the degree of pain-related disability. The PDAS ranges from 0 to 60, with higher scores indicating a greater degree of pain-related disability. Third, the Pain Catastrophizing Scale (PCS)[17,18] was used to measure catastrophic thinking in relation to pain. The PCS ranges from 0 to 52, with higher scores indicating greater levels of catastrophizing. Fourth, the Pain Self-Efficacy Questionnaire (PSEQ)[19,20] was used to assess the confidence in performing activities despite the level of pain. The PSEQ ranges from 0 to 60, with higher scores indicating greater perceived self-efficacy. Fifth, the Athens Insomnia Scale (AIS)[21,22] was used to evaluate the intensity of sleep disturbance. The AIS ranges from 0 to 24, with higher scores indicating a greater degree of sleep disturbance. Finally, the Hospital Anxiety and Depression Scale (HADS)[23,24] was used to assess the degree of anxiety and depression. The HADS-Anxiety and HADS-Depression subscales range from 0 to 21, respectively, with higher scores indicating greater levels of anxiety and depression.

The cutoff values have been calculated for some of these questionnaires. The NRS scores ≤5 correspond to mild, scores of 6–7 to moderate, and scores ≥8 to severe pain.[25] The PCS score ≥30 represents a clinically relevant level of catastrophizing.[17] The AIS score ≥8 represents insomnia for individuals with CP.[26] HADS-A and HADS-D scores ≥8 represent having anxiety and depression, respectively.[27]

During the first visit, her NRS scores were 2 (worst), 0 (least), 5 (average), and 2 (current), while the scores for the other five scales were as follows: PDAS (8); PCS (28); PSEQ (39); AIS (6); HADS-Anxiety (11); and HADS-Depression (5) (see Table 1). She might have made a mistake when filling out the NRS because her worst pain was less than her average pain. According to the cutoff scores from previous studies,[25,27] she felt mild pain and anxiety.

**TABLE 1** Outcome scores at each visit

| | At the first visit | Six months after the first visit | At the final visit |
|---|---|---|---|
| NRS (worst: 0–10) | 2 | 7 | 3 |
| NRS (least: 0–10) | 0 | 0 | 0 |
| NRS (average: 0–10) | 5 | 5 | 2 |
| NRS (current: 0–10) | 2 | 6 | 2 |
| PDAS (0–60) | 8 | 10 | 13 |
| PCS (0–52) | 28 | 15 | 13 |
| PSEQ (0–60) | 39 | 42 | 38 |
| AIS (0–24) | 6 | 8 | 7 |
| HADS-Anxiety (0–21) | 11 | 6 | 8 |
| HADS-Depression (0–21) | 5 | 3 | 6 |

Abbreviations: AIS, Athens Insomnia Scale; HADS, Hospital Anxiety and Depression Scale; NRS, Numerical Rating Scale; PCS, Pain Catastrophizing Scale; PDAS, Pain Disability Assessment Scale; PSEQ, Pain Self-Efficacy Questionnaire.

**TABLE 2** Details on the timeline and psychotherapeutic interventions provided

| Week | Intervention(s) for each session |
|---|---|
| 1 | First visit (first visit assessment; Table 1) |
| 6 | Leave of absence |
| 7 | Psychoeducation on pain and sleep (physiotherapy started) |
| 8 | Sleep hygiene, relaxation (sleep diary; Figure 1) |
| 10 | Sleep restriction, stimulus control |
| 11 | Sleep restriction, stimulus control |
| 12 | Sleep restriction, stimulus control, activity pacing |
| 13 | Activity pacing |
| 14 | Activity pacing (sleep diary; Figure 2) |
| 16 | Self-monitoring, cognitive restructuring of anxiety about resuming work |
| 17 | Self-monitoring, cognitive restructuring of anxiety about resuming work |
| 18 | Self-monitoring, cognitive restructuring of anxiety about resuming work |
| 19 | Self-monitoring, cognitive restructuring of anxiety about resuming work |
| 20 | (Returned to work) |
| 21 | Cognitive restructuring to counter overactivity |
| 23 | Cognitive restructuring to counter overactivity |
| 25 | Cognitive restructuring to counter overactivity |
| 28 | Cognitive restructuring to counter overactivity (six months assessment; Table 1) |
| 30 | Follow-up |
| 33 | Follow-up |
| 39 | Follow-up |
| 46 | Follow-up (final visit assessment; Table 1) |

## 2.3 | Psychotherapy

Since her low back and shoulder pain included no specific pathology, we decided to intervene with psychotherapy and physiotherapy. Prior to such therapies, the industrial physician gave her a leave of absence because of her pain and depression (Week 6). It is important to note that these therapies were performed simultaneously, and physiotherapy included patient education, stretching instruction, and strength training (Weeks 7 to 46). Furthermore, she had been prescribed loxoprofen (tablet: 60 mg, tape: 100 mg) by the industrial physician

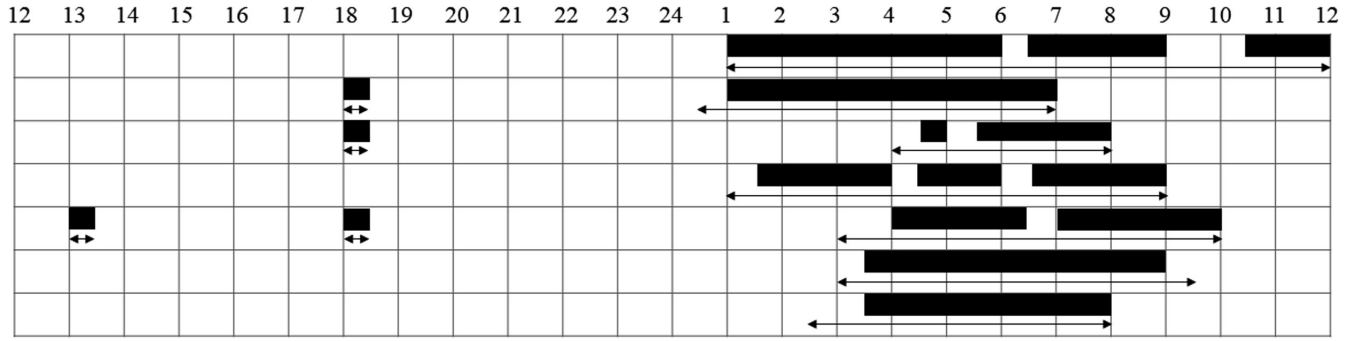


**FIGURE 1** Sleep diary before sleep restriction and stimulus control. Note: The black boxes represent the time that she slept, while the arrows represent the time that she was in bed

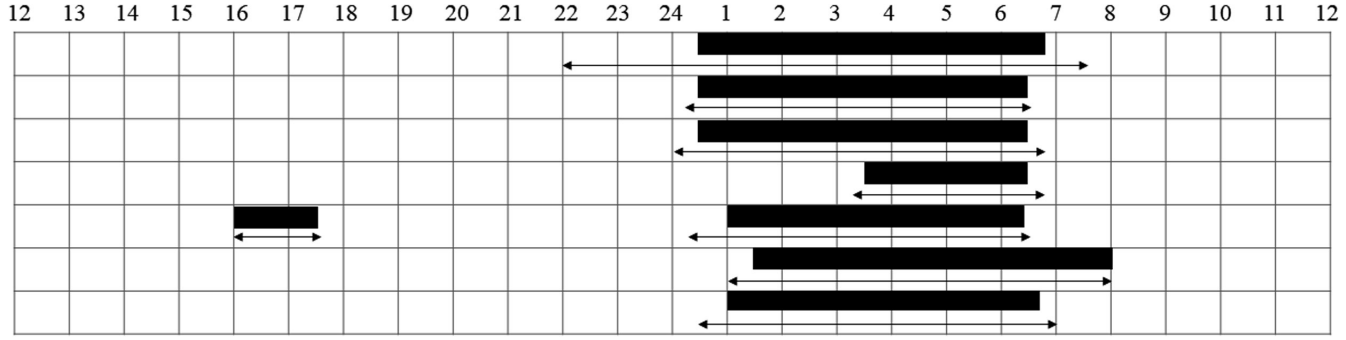


**FIGURE 2** Sleep diary after sleep restriction and stimulus control. Note: The black boxes represent the time that she slept, while the arrows represent the time that she was in bed

during psychotherapy. She only took loxoprofen when her pain flared up.

The psychotherapy entailed CBT for nine months with a total of 19 sessions. Table 2 presents the timeline and content of the psychotherapy intervention.

Initially, we decided to intervene in sleep disturbance to improve not only such disturbance, but also pain-related disability and depression. She was instructed on sleep hygiene and relaxation (Week 8), and completed a sleep diary (Figure 1). According to this diary, her sleep efficiency was 82.5%, and the wake-up and bed times differed every day (Week 8). Furthermore, her wake time after sleep was more than 30 min on many days. In this regard, she stated, "I want to sleep after I do everything that I want to do that day." Accordingly, she went to the gym, completed take-home work, and watched recorded television programs at midnight. A psychologist recommended that she should regulate her wake-up and bed times (Weeks 10 to 12). Based on the sleep diary, her average sleep time was six hours. Thus, she decided to go to bed at 12:15 a.m. and wake-up at 6:45 a.m.

She attempted to perform sleep restriction and stimulus control. However, it was difficult for her to go to bed at 12:15 a.m. because she did not want to stop doing the activities at night. Consequently, she and the psychologist discussed how to spend her daytime hours. For example, she agreed to go to the gym earlier in the day and watch her recorded television programs in the morning. When adjusting her schedule, she looked back on the work and realized that her late hours at work as well as the excessive workload exacerbated her pain. In order to change her working style, she was taught activity pacing (Weeks 13 and 14), after which she applied it to her housework or other activities. Due to these efforts, she was able to go to bed and wake-up at the same time every day. Eventually, her sleep efficiency increased to 85.2% (Figure 2).

After she managed to regulate her sleep schedule, she described her anxiety about having to return to work (Weeks 16 to 19). She was worried about the possibility of relapse and intensification of her pain, together with increased workload after resuming work. However, upon practicing self-monitoring and cognitive restructuring taught to her by a psychologist, she was able to control her anxiety to a certain extent.

During the psychotherapy, she returned to work and was transferred to a different department (Week 20). Although this new department included a high physical workload, she no longer had to deal with her former boss. However, her overactivity and sleep disturbance returned, after which she stated, "It is difficult for me to use activity pacing at work" (Week 21). The psychologist then asked her to identify the automatic thoughts that

led to her overactivity. In this regard, she often thought, "I have to do this and that" and "I must do them perfectly." In some instances, she even performed her colleague's work.

Subsequently, she and the psychologist used cognitive restructuring to transform the automatic thought of "I have to do this and that" into a well-balanced thought (Weeks 21 to 28). Specifically, she replaced this automatic thought with "I am doing my job well" and "I don't care as long as I do what I have to do." In addition, she attempted to take regular breaks during work. As a result, she was able to reduce her overactivity and maintain a regular bedtime.

At the final visit (Week 46), she stated, "I just want to live comfortably." Despite her lower back feeling occasional pain because of the physical burdens of caregiving, she was not worried about such pain. Although she still faced an excessive workload at certain times, she adjusted by refusing the requests for more work from her colleagues. Again, this allowed leaving work earlier and maintaining a regular bedtime.

### 2.4 | Outcome measure at six months and at the final visit

At six months (Week 28) and at the final visit (Week 46), she completed the same questionnaires from the first visit. At six months, her NRS scores were 7 (worst), 0 (least), 5 (average), and 6 (current), while the scores for the remaining five scales were as follows: PDAS (10); PCS (15); PSEQ (42); AIS (8); HADS-Anxiety (6); and HADS-Depression (3) (see Table 1). According to the cutoff scores from previous studies,[25,26] she experienced mild to moderate pain and sleep disturbances.

At the final visit, her NRS scores were 3 (worst), 0 (least), 2 (average), and 2 (current), while the scores for the other five scales were as follows: PDAS (13); PCS (13); PSEQ (38); AIS (7); HADS-Anxiety (8); and HADS-Depression (6). According to the cutoff scores from previous studies,[25,27] she felt mild pain and anxiety. Based on the findings, catastrophic thinking decreased, pain-related disability increased, and the other scores remained relatively the same. According to the PDAS's response, in this visit, she experienced more difficulty with the activities that required her low back at the final visit than at the first visit.

After completing the questionnaires at the final visit, the psychologist showed her the scores from the first visit to the final. She was surprised that the scores did not change substantially. She said that "I was upset at the first visit and might not have answered the questionnaire properly. I could not monitor my feeling well at the first visit."

## 3 | DISCUSSION

In this case study, we combined CBT-I, activity pacing, and cognitive restructuring with a patient suffering from CP with overactivity and sleep disturbance. As a result, she was able to return to work, reduce her overactivity, and maintain a regular bedtime. In addition, many of the scores of the outcome measures did not change, while catastrophic thinking decreased and pain-related disability increased.

Her sleep disturbance occurred because she wanted to perform many of her daily tasks and activities at night. Although we first intervened by suggesting sleep restriction and stimulus control, she did not want to go to sleep earlier. Andrews et al[5] argued that changing overactivity patterns in daytime hours may be a key treatment strategy for addressing sleep disturbance. Thus, we changed how she spent time during the day. As a result, her sleep phase advanced. In addition, after returning to work, she was able to leave work early by doing activity pacing, which allowed her to maintain a regular bedtime.

Previous studies have suggested that the relationship between overactivity and sleep disturbance may be influenced by increased pain and hypersensitization of the nervous system.[5,7] Moreover, this case suggests that individuals with overactivity tend to engage in more activities during the day, which is likely to reduce their sleep time. Hence, to improve sleep disturbance in individuals with overactivity, it is important to combine CBT-I and activity pacing.

However, it was difficult for her to use activity pacing at the workplace. Previous studies have suggested that individuals with overactivity are often perfectionists or have obsessive personalities, which can be a barrier to activity pacing.[6] In fact, she suffered from the automatic thought of "I have to do this and that." Therefore, we used cognitive restructuring to reduce perfectionist thought patterns; so that, she could perform activity pacing at the workplace. In this case, the implication is that in order to change overactivity patterns, it may be necessary to use cognitive restructuring, in addition to activity pacing.

Her pain flared up at six months, but finally, it was comparable with the first visit. She might have coped with the flare-up of pain by using cognitive behavioral therapy skills. Interestingly, although she was able to return to work and manage her pain and sleep disturbance, her scores in the questionnaires did not significantly change. There are several possible reasons for this finding. First, she was transferred to a new department and her physical workload increased, which might have increased her pain-related disability. According to the PDAS's response, in the final visit, she experienced more difficulty with the activities that required her low back than the first visit.

The physical workload might have affected her lower back. Second, she might have been unable to assess her mental condition well. At the first visit, she cried and complained, and the psychologist assessed that she was depressed. However, her HADS-D score was only five at the first visit. She said she could not monitor her feelings well at that time. This difficulty in recognizing her feelings at the first visit may be related to the lack of change in the questionnaire scores.

There are also some limitations in this case study that should be noted. First, the effect of the physiotherapy may have influenced the improvement of her insomnia and overactivity. Second, we did not assess the activity patterns through questionnaires such as the Patterns of Activity Measure-Pain (POAM-P)[3] or the Pain and Activity Relations Questionnaire (PARQ).[28] Hence, we are unable to clarify that she actually changed her overactivity patterns. Third, all of the outcome measures were self-reported questionnaires. To assess the findings on a wider scale, an objective sleep measure, such as actigraphy, would be useful.

In conclusion, we conducted CBT-I for an individual suffering from CP with overactivity and sleep disturbance. Based on the results, it is important to combine CBT-I and activity pacing to improve the daily life of such individuals. In the future, the intervention studies that combine CBT-I, pacing, and cognitive restructuring should be conducted for individuals with CP with overactivity.

## AUTHOR CONTRIBUTIONS

KE, MK, and SF were involved in the clinical practice of the patient. KE drafted the manuscript and JS supervised it. All of the authors read and approved the final manuscript.

## ACKNOWLEDGEMENTS

We would like to thank Dr. Teruyo Kitahara for her clinical support. This study was supported by a JSPS KAKENHI Grant (No. 19J20623). This paper is appeared as preprint publication (URL: https://assets.researchsquare.com/files/rs-702708/v1/f465c99e-ca2c-41fd-bffc-1cf691007e4d.pdf?c=1631886575).

## CONFLICT OF INTEREST

The authors declare that they have no competing interests.

## DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

## CONSENT

We obtained written consent for publication from the patient herself.

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**How to cite this article:** Enomoto K, Kugo M, Fukui S, Sasaki J. Cognitive behavioral therapy for an individual suffering from chronic pain with overactivity and sleep disturbance: A case report. *Clin Case Rep*. 2022;10:e05838. doi:10.1002/ccr3.5838