Insomnia: Physiotherapeutic Approach

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1 The Role of Physical Therapy in Insomnia Disorder

Physiotherapy can act on chronic insomnia as adjuvant treatment or, in some cases, being the treatment per se, depending on the type of insomnia, duration, clinical condition of the patient, and various contextual issues. A priori, the physiotherapist should consider how insomnia negatively affects the physical condition and overall health of the patient, but certainly how the physical condition interferes with insomnia, which can help to direct physiotherapy intervention. For example, a patient complaining of knee pain and telling the physiotherapist that he will need a surgical approach may not be able to sleep well from the moment of injury (or surgical indication). This may direct the physiotherapist to focus on pre-surgical interventions that can control pain, prepare local condition (knee), and improve the patient's sleep pattern *before* surgery.

Insomnia may result from an acute or chronic condition, and it will negatively impact the rehabilitation process. Insomnia may be a symptom of a disease, and depending on the diagnosis, the physiotherapeutic approach will be different. In the above example, insomnia in conjunction with the knee injury may generate kinesiophobia, pain, and fear from the surgery and the whole process, which could disrupt

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sleep and generate many thoughts as the patient goes to sleep. The patient may refer that he began with this knee pain a long time ago, and since then sleep was unrefreshing and fragmented and has worsened a lot after the surgery suggestion. He also may report concerns about the surgery, the rehabilitation process, functional difficulties such as walking and getting up/sitting, and getting back to work and social life. So, every night he stays in bed, thinking about the possibilities that may happen and fearing them. The next day, he feels more pain, tired, exhausted, anxious, and sleepy. Along the time, he starts to feel depressed. This clinical picture is often frequent and demands a need for investigation of the insomnia etiology (and in this case, refer the patient to a sleep specialist physician). The purpose here for physiotherapy is to indicate a therapeutic program to achieve the treatment objectives, not only for the pain and the knee itself (strength, flexibility, range of motion, etc.) but also for insomnia. These approaches will prepare the knee and the body as a whole for surgery and for the rehabilitation process and to dissociate the sleep-pain relationship that has been established in this patient (see Chap. 28 for more on sleep and pain relationship). Thus, the physiotherapist can treat insomnia, whether being a symptom or a disease, as an adjuvant or complementary treatment, by using many non-pharmacological resources.

The treatment of insomnia disorder is mainly cognitive and should include sleep hygiene, physical activities such as exercise, increasing the activities at work and at home (climbing stairs instead of the elevator, walking instead of driving, etc.), light therapy mindfulness, and manual therapies, such as acupuncture and soft tissue massage.

2 Cognitive Behavioral Therapy for Insomnia (CBT-I)

Current guidelines have indicated cognitive behavioral therapy for insomnia (CBT-I) as a first-line choice for the treatment of insomnia [1]. CBT-I is a structured program that aids patients to recognize and change thoughts and behaviors that cause or worsen sleep issues with habits that promote sleep, affecting the ability to sleep. CBT-I works with the precipitating, predisposing, and perpetuating factors of insomnia, intending to break the cycle of negative emotions, thoughts, and behaviors related to sleep (or the lack of). Pharmacological intervention should be adopted by a physician in case of failure or impossibility of CBT-I treatment [1, 2]. A detailed sleep diary for 10–14 days may help the patient to understand his/her sleep issue. CBT-I works with some techniques that will be defined by the physiotherapist according to the patient's need and can be seen in detail in Chap. 31.

To be considered effective, non-pharmacological therapies should reduce sleep onset latency and fragmented sleep, and the daytime repercussions such as sleepiness, unrefreshing feeling, and lack of concentration increase total sleep time [3]. However, very often, therapies may not demonstrate altered objective outcomes. The therapies can have positive impacts on patients' functional complaints, reducing symptoms of anxiety and depression and improving quality of life.

3 Sleep Hygiene

Sleep hygiene is the most widely used behavioral intervention in the treatment of insomnia [4, 5]. This method was developed to guide patients about healthy habits to promote sleep and prevent and treat insomnia (and many other sleep disturbances). Nevertheless, it has become a behavioral treatment for chronic insomnia. This technique can be combined with other resources, and the patient must understand why changes in his/her habits are needed (please refer to Chap. 31).

4 Physical Exercise

Epidemiological studies have described the influence of physical activity [6] and physical inactivity [7] in the natural history of insomnia. Some conditions such as low physical health, depressed mood, and low levels of physical activity were risk factors for the incidence of insomnia; physical activity was highlighted as a protective factor for the evolution of insomnia [6].

In recent decades, the regular practice of physical exercises has been studied as a treatment for insomnia [8]. The exercise characteristics such as type, intensity, duration, and time of the day practiced, as well as the mechanisms responsible for improvements in sleep, have been investigated in clinical studies. Studies investigating the acute effect of physical exercise on insomnia disorder have identified that acute moderate-intensity aerobic exercise is effective in improving sleep and reducing pre-sleep anxiety when performed in the late afternoon [9], and acute morning exercise can improve nocturnal sleep quality in individuals with difficulty initiating sleep, especially during the latter part of the night [10] (Table 1). For the chronic effect of exercise on insomnia disorder, aerobic exercises performed at moderate intensity [11–13], resistance exercise (i.e., muscle strength) performed at moderate intensity, and stretching [14] have been considered effective (Table 2).

Some mechanisms that can explain the effects of exercise on sleep are as follows:

- Thermogenic effect [15–18]: according to this theory, the increase in central temperature caused by exercise would facilitate the onset of sleep due to heat activation by hypothalamus-controlled dissipation mechanisms. Patients with insomnia presented a reduction of nocturnal temperature [19].
- Anxiety reduction: anxiety is one of the markers of insomnia; reducing it via exercise could improve sleep quality [20], and this effect has been observed in patients with insomnia [9].
- *Serotonin increase* (*5-hydroxytryptamine, 5-HT*): chronic insomnia may be the result of a serotonergic deficit [21]. Acute exercise (running) increased the synthesis of 5-HT [22].
- *Antidepressant effect*: there exists evidence on the chronic effects of physical exercise on depression in insomnia [11–13, 23], which correlated with improvement in sleep quality [11, 12].

Table 1 Effective physical exercises in the treatment of chronic insomnia

Type?	Aerobic exercise [11, 23] Resistance exercise (muscle strength)[14] Stretching [14] Regular physical activity (hiking, playing sports, dance classes, etc.) [13] The type of exercise can influence, as well as the environment in which it is performed. Think how different it is to practice swimming, hydrotherapy, or bodybuilding or to take an indoor bike class with a deafening sound and vibrant lights on
Intensity and duration?	Moderate to intense [11–14, 23] Duration of sessions: 50 minutes (3 times a week) [11, 13, 23]
Time?	Widely discussed in the literature and there are still controversies National Sleep Foundation recommends exercise before 2 p.m.. Although it is common to say that physical exercises performed at night impair sleep, there is evidence, both from epidemiological and clinical studies [56, 57], of no problems associated with the practice of exercise 4 hours prior to sleep onset in people with chronic insomnia; there is also reports that exercise increased cortisol concentrations [58], and exposure to intense light during the exercise (which could suppress melatonin levels and delay sleep) could be responsible for the impaired sleep To date, there is no significant evidence of sleep impairing when exercise is practiced before bedtime. However, a recent study provides some support for caution regarding late-night exercise for sedentary individuals with insomnia [59].
For how long?	1 session: improvement objective and subjective sleep in patients with chronic insomnia [9, 10] >4 months: improvements on subjective and objective sleep [11, 13, 14, 23] There is still no evidence of how long it takes to get improvements over time in sleep

- Immunological changes: training with moderate exercise can promote immunity [24]. Depressive symptoms, poor sleep quality, and systemic inflammation markers (e.g., interleukin (IL-6)) are frequently associated [25–28].

Remarkably, the level of evidence of physical exercise in the treatment of insomnia is considered of low quality, with a poor recommendation, according to the European Guideline for the Diagnosis and Treatment *of Insomnia* [1]. However, recently this topic has been the subject of several systematic reviews.

Moderate-intensity programmed exercise in middle-aged women improved sleep quality but had no significant effect on the severity of insomnia, both subjectively measured [29]. Physical exercise can improve the quality of sleep in patients with insomnia, when assessed subjectively, without triggering notable adverse effects [30]. Physical exercise improved the subjective quality of sleep for people with symptoms and insomnia disorder and improved objective measures of sleep (PSG) in participants with symptoms of insomnia [31]. In the most recent systematic review with meta-analysis, physical exercise improved subjective sleep measurements and decreased insomnia severity, with moderate power of effect []. However, the authors did not observe statistically significant differences in the objective variables of sleep

Table 2 Studies evaluating the effects of physical exercise on sleep in patients with chronic insomnia

Study	Number of sessions	Population	Intervention	Outcomes	Results
Passos et al. [9]	1 session	Women/men: MAE: 47,7–10/2; HAE: 42,2–9/3; MRE: 42.4–10/2; Control: 45.2–9/3.	MAE vs. HAE vs. MRE vs. control	PSG Sleep log STAI	Significant results only in the MAE group: PSG: reduction on SOL and TWT and increase in the TST and SE Sleep log: increase in the TST and reduction on SOL Reduction in pre-sleep anxiety
Morita et al. [10]	1 session	Men/women Age 55–65 years	MAE performed in the morning vs. evening in two groups: DIS and EMA	PSG Sleep diary	MAE decreased the number of stage shifts over the whole night. The arousal index and the number of stage shifts were decreased especially during the second half of the night in all groups. Furthermore, MAE decreased the number of wake stages during the second half of the night in the DIS group, but not in the EMA group
D'Aurea et al. [14]	4 months/3 times week	Average age: Women/men: MRE: 44.5–8/2; Stretching: 45.5–8/2; Control: 40.3–6/2.	MRE vs. stretching vs. no exercise (control)	PSG ACT PSQI ISI SF-36	Both resistance exercise and stretching decreased ISI and improved sleep quality (PSQI) and ACT measures (SOL, WASO, and SE) compared to the control group. Stretching also reduced tension-anxiety

(continued)

Table 2 (continued)

Study	Number of sessions	Population	Intervention	Outcomes	Results
Hartescu et al. [13]	6 months (a monitored program of ≥150 min of moderate- to vigorous-intensity physical activity per week)	Average age and women/men: Intervention: 60.10–15/6; Control: 59.50–15/5.	150 minutes of physical activity, moderate to vigorous, per week vs. no exercise (control)	ISI Epworth Sleepiness Scale EuroQoL5D-5 L	The physical activity group showed significantly reduced insomnia symptom severity, with an average reduction of four points on the Insomnia Severity Index and significantly reduced depression and anxiety scores
Reid et al. [12]	Chronic insomnia patients 16 weeks (4 times/week)	Average age and women/men: Intervention: 62–10/0; Control: 63.5–6/1.	Aerobic physical activity plus sleep hygiene vs. sleep hygiene only	PSQI Epworth Sleepiness Scale SF-36	The physical activity group improved in sleep quality on the global PSQI, SOL, sleep duration, daytime dysfunction, and SE (PSQI sub-scores compared to the control group). The physical activity group also had reductions in depressive symptoms, daytime sleepiness, and improvements in vitality compared to baseline scores
Passos et al. [23]	Chronic insomnia patients 4 months (3 times/week)	Homens/women Age 30–55 years	MAE, baseline vs. post-exercise	PSG PSQI BDI Cortisol Immune system	PSG: reduction on SOL, WASO, and REM latency and increase on TST, SE, and in the percentage of REM sleep. Latency of stages 2, 3, and 4 decreased significantly. Decrease in PSQI score, depression, cortisol, CD4, and CD8 and increased in apoA

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Table 2 (continued)

Study	Number of sessions	Population	Intervention	Outcomes	Results
Passos et al. [11]	Chronic insomnia patients 6 months (3 times/week)	Homens/ women Age 30–55 years	MAE, baseline vs. post-exercise	PSG Sleep diary POMS SF-36	Polysomnographic data shows a significant decrease in SOL and WASO and a significant increase in SE. Data from sleep diaries revealed significant improvement in SOL, sleep quality, and feeling rested in the morning. Some quality-of-life measures improved significantly and a significant decrease in the POMS measures of tension-anxiety, depression, and total mood disturbance

ACT actigraphy, *HAE* high-intensity aerobic exercise, *MAE* moderate-intensity aerobic exercise, *MRE* moderate-intensity resistance exercise, *DIS* difficulty in initiating sleep, *EMA* early morning awakening, *apoA* plasma apolipoprotein A, *RCT* randomized controlled trial, *SE* sleep efficiency, *ISI* Insomnia Severity Index, *BDI* Beck Depression Inventory, *POMS* profile of mood states, *PSG* polysomnography, *PSQI* Pittsburgh Sleep Quality Index, *REM* rapid eye movement, *SF-36* Short Form Health Survey-36, *SWS* slow-wave sleep, *WASO* wake time after sleep onset, *TST* total sleep time, *SOL* sleep onset latency, *TWT* total wake time

(PSG), such as total sleep time, sleep efficiency, sleep latency, and WASO. Unfortunately, this data obtained was considered exceptionally low quality of evidence, due to the heterogeneity of the investigations that composed the meta-analysis.

In general, the studies cited have low reliability, and there are several potential limitations, such as methodological limitations, small sample sizes, more women at old age, and a predominance of moderate-intensity aerobic exercise, among others. Moreover, the absence of data (and protocols) on the characteristics of physical exercises such as a place of practice, time of the day practiced, frequency, duration, type of supervision, and individual or group makes it impossible to infer whether these variables influenced the results of the meta-analysis [29–31].

5 Light Therapy

Several studies have identified the effectiveness of light therapy for patients with insomnia, mainly in those with difficulty starting sleep (initial insomnia) [32]. The treatment consists of luminous stimulation shortly after awakening, from a light box

with blue wavelength, positioned at eye level, at an approximate distance of 75 cm [32]. For the treatment of insomnia, the power of light is 10,000 lux [32], applied between 30 minutes and 2 hours [33]. Exposure to light in the early morning will facilitate sleep at the beginning of the evening [34]. Additionally, in patients with Parkinson's disease and insomnia disorder, a recent study showed that 1 hour of exposure to light, just before retiring/leaving the job market, significantly improved insomnia. Still, light therapy reduced symptoms of other sleep disorders such as REM sleep behavioral disorder by 1 month after the start of light therapy. Furthermore, improvements were maintained while light therapy was continued, for a period of 4–6 years, showing the importance of treating insomnia adjunct to Parkinson's disease [35], for example.

There is little evidence about phototherapeutic treatment in physiotherapy. According to the *European Guideline for the Diagnosis and Treatment of Insomnia*, published in 2017, the level of and evidence of the use of light therapy for insomnia is of low quality, and its recommendation is weak to be used as a single treatment. However, even in the face of these cautions, light therapy is a promising treatment for insomnia, used concomitantly with other treatments [1], still needing more studies in specific populations for a better understanding of its mechanisms and the possible creation of a consensus.

6 Massage

The search for manual therapies has been growing considerably, including massage. From constant skin stimuli on the body surface, touch, pressure, heat, vibration, and pain receptors are activated and transported to the somatic, autonomous, and central systems, triggering important neurochemical reactions [36]. The effects of massage on the circulatory, lymphatic, and muscular systems are already well established [37, 38]. Massage improves visceral functioning and restores body homeostasis.

Massage is pointed out as a pleasant intervention, as it promotes relaxation and sleep [39], as well by patients with insomnia to treat sleep complaints [40]. For instance, when investigating the severity of insomnia related to the postmenopausal period, the authors identified an improvement in the quality of sleep after the massage, as all participants fell asleep more quickly and reported better well-being upon awakening – probably due to the activation of the autonomous nervous system. Polysomnographic findings showed a decrease in REM sleep latency and an increase in the NREM stage N3 (slow-wave sleep) [37, 38].

In a multicenter investigation, massage was applied for the treatment of insomnia, and after subjective evaluations of symptoms, 96% of participants reported significant improvement of insomnia [41]. Despite some findings, massage alone is not recommended for the treatment of chronic insomnia due to an exceptionally low level of evidence [1]. However, due to few side effects and its high power of relaxation, massage can be used adjunctly to the treatment of insomnia.

7 Acupuncture

Acupuncture is an ancient technique of traditional Chinese medicine. Its effectiveness in the treatment of chronic insomnia has been described in several systematic reviews [42, 43]. For specific acupuncture points for insomnia, please see [42].

Some mechanisms have been suggested to explain the effects of acupuncture on sleep: acupuncture affects the central nervous system through structures in the spinal cord and the brain that regulate some neurotransmitters such as dopamine, norepinephrine, and acetylcholine [44]. Acupuncture can increase nocturnal melatonin secretion [45]. However, acupuncture alone is not recommended for the treatment of chronic insomnia due to the level of evidence [1].

8 Mindfulness

Many individuals with insomnia have sought alternative medicine and complement different approaches to try to expand the result of the various treatments already proposed. Data from the 2007 *National Health Interview Survey* (NHIS) indicate that 45% of adults with insomnia symptoms use some type of alternative medicine annually [46]. The physiotherapist can also act with the practice of mindfulness.

During mindfulness, the person intentionally seeks to "be attentive with his inner, thoughts and emotions," as well as the external perceptions that occur at present, without applying any form of judgment to them [47, 48]. The practitioner begins to observe the events that occur in his/her mind and let them go, without judgments, reflections, or desire to change the things that are happening around him/her.

The practice of mindfulness began in Eastern traditions, and the practice of meditation is considered a key point for its realization. This technique has been used in several clinical protocols, and its applicability in insomnia has been increasingly frequent, with encouraging results. Most sleep research has applied two types of interventions: mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction (MBSR) [47].

Some studies suggest that the practice of mindfulness can improve the quality and the amount of sleep in individuals with insomnia. The results are promising and point out that this method can significantly reduce the severity of insomnia, sleep latency, and pre-sleep hyperstimulation (presented in most patients with insomnia). Other benefits such as increased total sleep time, sleep efficiency, and sleep quality have already been reported by individuals with chronic insomnia after practicing mindfulness [48–51].

In addition, mindfulness is effective in secondary insomnia and in individuals who present other comorbidities such as cancer, depression, anxiety, and obesity [52–54]. The interesting fact is that mindfulness is a process of learning self-regularization of the body itself, of its emotions and needs, and, after learning, can be practiced whenever needed. For example, women in the postmenopausal period with insomnia demonstrated, after the practice of mindfulness, excellent results in

the quality of sleep and in reducing the severity of insomnia and ameliorating the quality of life, including better levels of attention and reduction in menopausal symptoms [47]. After 8 weeks of intervention, the severity of insomnia decreased by 15 points (in the Insomnia Severity Index) in the group that received mindfulness training. Note that a 6-*point* reduction is already considered a significant clinical change [55].

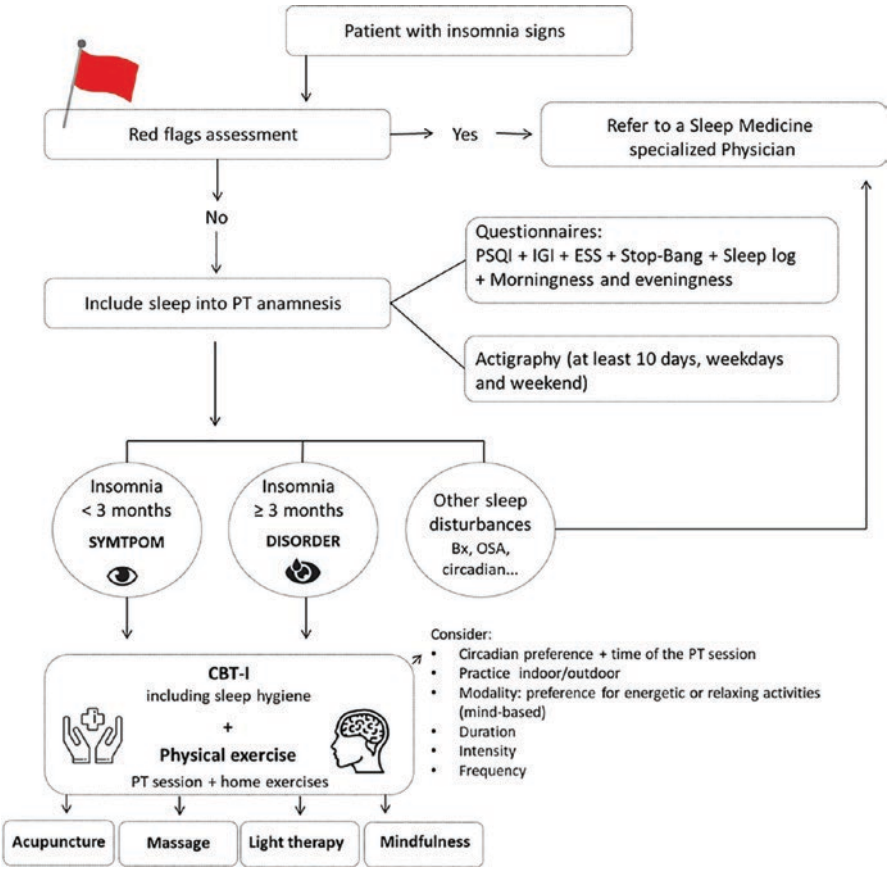

Fig. 1 Proposal for the physiotherapist for the management of both insomnia disorder and its symptoms. Red flags are specific characteristics derived from a patient's medical history and clinical exam which are usually linked with a high risk of having a serious disorder (such as inflammatory or neurological conditions, structural musculoskeletal damage or disorders, recurrent headaches, learning difficulties, fatigue, circulatory problems, suspected infections, tumors, or systemic diseases). *PSQI*, Pittsburgh Sleep Quality Index; *ISI*, Insomnia Severity Index; *ESS*, Epworth Sleepiness Scale; *Stop-Bang*, Stop-Bang questionnaire for the screening of sleep apnea; *CBT-I*, cognitive behavioral therapy for insomnia; *Bx*, sleep bruxism; *OSA*, obstructive sleep apnea. (Courtesy from Dr. Cristina Frange)

9 Final Considerations

Given the above results, physical therapists can take decision-making in the treatment of insomnia, as a single treatment, concomitant with other pharmacological treatment prescribed by the physician or not, based on the individual treatment choices and according to scientific evidence. In this sense, partnering with specialists in the field of sleep medicine and other areas can guarantee effectiveness in the treatment of insomnia, ultimately bringing benefits to the quality of life and, improving the prognosis of insomnia for patients.

The patient can seek a physical therapist to treat insomnia, or the physical therapist can observe the symptoms and refer to the specialist for diagnosis. Figure 1 shows a proposal for the physiotherapist for the management of both chronic insomnia disorder and its symptoms, highlighting the red flags. Red flags are indicators of possible serious pathology such as inflammatory or neurological conditions, structural musculoskeletal damage or disorders, circulatory problems, suspected infections, tumors, and systemic diseases, where serious medical disease may present as insomnia complaints such as other sleep disorders (e.g., excessive diurnal somnolence or obstructive sleep apnea), depression, anxiety, substance abuse, bipolar disorder, and menopausal symptoms.

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