REVIEW ARTICLE
EXTREME SPORTS

Relaxation as a supportive method in chronic, non-malignant pain treatment: a review 2007-2014

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

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Abstract

Common phenomenon of chronic pain is accompanied and determined by the physiological, psychological and social disturbances, decreasing the quality of life. That is the reason to lead multidimensional chronic pain treatment. Not only conventional methods are applied, also alternative, including relaxation. The aim of this review is the effectiveness of relaxation techniques in non-cancer, chronic pain intensity reduction in adults.

Analysis was based on 317 documents retrieved from the PubMed/Medline, Science Direct/Scopus databases in years 2007-2014, referring to the impact of relaxation techniques on chronic, non-cancer pain level in adults. Considering inclusion criteria only 39 articles were qualified to be recognized and cited in this review. They were presented and compared considering the impact of relaxation techniques on pain intensity for chronic non-cancer pain in adults.

This survey present different fields and medical conditions related to chronic pain, where a possibility of using varied relaxation techniques appeared. These results indicate that relaxation techniques might be useful as a complementary and supportive therapy for treatment of chronic, non-cancer pain. Future research should include more precise systematics to set its efficacy.

Key words: chronic pain • Complementary and Alternative Medicine (CAM) • non-pharmacological methods • relaxation techniques • relaxation therapy

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Pain – *noun* the feeling of severe discomfort that a person has when hurt (NOTE: Pain can be used in the plural to show that it recurs: *She has pains in her left leg.*) [51].

Pain barrier – *noun* the point at which pain reaches its peak and begins to diminish, especially as experienced by an athlete [51].

Pain – *note:* The inability to communicate verbally does not negate the possibility that an individual is experiencing pain and is in need of appropriate pain-relieving treatment. Pain is always subjective.

Introduction

Pain is the most common symptom associated with certain diseases. According to the definition of the International Society for the Study of Pain (IASP), "pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described as a failure" [1, p. 3]. Emphasis was placed on what feels, sees, describes a patient, without prejudging the mechanism that causes the pain or the duration thereof. In other words, it can be assumed that pain is what the patient is called pain. Pain that lasts a long time, more than three months, despite the healing of the tissues or is associated with long-term disease process is called chronic pain. In contrast to acute pain it loses its warning function, which makes the incomprehensible and the disease itself, affecting all aspects of human life.

All patients suffering from chronic pain have similar mechanisms causing decreased quality of life: physiological disorders, psychological and social. They depend on the duration and intensity of pain, rather than its cause.

The priority in the treatment of chronic pain is primarily a maximum limit of pain with minimal side effects

and minimal invasiveness. Therefore, the most effective is characterized by the interdisciplinary combination of pharmacological and non-pharmacological treatments.

To complementary and alternative therapies – Complementary and Alternative Medicine (CAM) – in the treatment of chronic pain symptoms include: alternative medical systems-such as Chinese medicine, homeopathy, biological therapies such as diet, use of energy therapies such as *reiki* and *qi gong*; handling methods based on body-such as chiropractic, osteopathy, massage, and integrating body and mind-meditation, relaxation, hypnotherapy [2].

Among non-pharmacological methods, complementary, special attention should be paid to different relaxation techniques, increasingly used as a supplement to psychotherapy and physiotherapy.

Relaxation is all the methods for obtaining the state of physical and mental relaxation. Training and relaxation exercises develop habits to enter into a state of mental and physical relief, reduce physical and mental tension, or demobilization-reduction reaction of the body ready to fight or flight. One of the most well-known definition of relaxation therapy is the one related to Herbert Benson [3], introduced in research on people meditating. Regardless of the term used is a state of relaxation, anti-stress and tension, it binds to the phenomenon of chronic pain. Multidisciplinary pain management programs, including elements of psychological intervention, which includes relaxation are standard procedures [4].

The involvement of patients in the healing process, and improve well-being is usually to enhance self-efficacy and positive and adaptive strategies to cope with the pain, with a simultaneous decrease in anxiety reactions and a tendency to catastrophizing as manifestations of a negative attitude. In the context of implementing self-treatment, self-therapy enables the patient to find individual solutions, decision-making and the use of their resources. For example, Ersek et al. [5] verified the effectiveness of the auto-therapeutic methods, among subjects with chronic non-cancer pain using a program that includes, among others: physiotherapy and progressive muscle relaxation. The impact of these interventions on the intensity of the pain caused by the abnormal activity and strategies for dealing with complaints was analysed. In the control group subjects received books whose contents were related to stress, the psychology of pain and the reduction methods used. Final study showed no significant differences between groups in any of the analysed factors.

A likely explanation for this result is the non-uniformity and test substrate of pain sensations, analysed as in patients with different origins of pain. In addition, authoritarian indicate the need for interdisciplinary care of patients with pain.

The aim of this review is the verification of the effectiveness of relaxation techniques in non-cancer, chronic pain intensity reduction in adults.

Analysis was based on 317 documents retrieved from the PubMed/Medline and Science Direct/Scopus data bases in years 2007-2014, referring to the impact of relaxation techniques on chronic, non-cancer pain level in adults. The search used in PubMed was "chronic pain", "non-malignant pain", "relaxation techniques". The search used in Scopus/Science Direct was "chronic pain", "relaxation training". The one in Medline was "chronic pain", "relaxation therapy". Papers with full text available were considered to be the part of this review.

Papers were rejected that did not meet the following inclusion criteria: (a) studies language – English (excluding introduction in this paper); (b) types of study – randomized controlled trials (RCTs), cohort studies, non-experimental studies and descriptive studies; (c) types of participants – adults with chronic, non-cancer pain; (d) types of interventions – relaxation techniques, as a part of chronic pain management; (e) publication date: 2007-2014.

Considering inclusion criteria only 39 articles were qualified to be recognized and cited in this review (Figure 1). They were presented and compared considering the impact of relaxation techniques on pain intensity for chronic non-cancer pain in adults. The summary of analysis, considering effects of various relaxation methods and/or techniques is presented in Tables 1-5 (in five thematic sets).

Mindfulness, visualization, meditation and guided imagery as relaxation methods used as supportive chronic pain treatment

Relaxation with visualization were a complementary interventions of 6 week program which involved people with chronic non-cancer pain [6]. The authors

Accordingly, pain is that experience we associate with actual or potential tissue damage. It is unquestionably a sensation in a part or parts of the body, but it is also always unpleasant and therefore also an emotional experience[42].

NRS – the Numerical Rating Scale (NRS) is one of the simplest and most frequently used instruments in clinical practice to measure pain intensity(eg.1-10) [43].

VAS – a Visual Analogue Scale (VAS) is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured. For example, the amount of pain that a patient feels ranges across a continuum from none to an extreme amount of pain [44].

Chronic pain – often defined as any pain lasting more than 12 weeks. Whereas acute pain is a normal sensation that alerts us to possible injury, chronic pain is very different. Chronic pain persists often for months or even longer [42].

Chronic pain treatment – pain therapy, the process of providing medical care that alleviates or reduces pain e.g. analgesic medications, psychotherapy, physiotherapy and other interventions (e.g. relaxation techniques) involving patients in their treatment have also shown some validity for increased pain control [42].

The relaxation response – an integrated hypothalamic reaction in which a human being or animal experiences safety and a sense of nurturing; resulting in decreased sympathetic nervous system activity that, physiologically and psychologically, is almost a mirror image of fight or flight response; it can be self-induced through the use of techniques associated with meditation, yoga, and biofeedback, protective mechanism against stress that brings decreased heart rate, lower metabolism, and decreased respiratory rate [45].

Relaxation technique – the goal is to consciously induce the body's natural relaxation response, characterized by slower breathing, lower blood pressure, and a feeling of calm and well-being. Relaxation techniques may be used by some to release tension and to counteract the ill effects of stress. Relaxation techniques

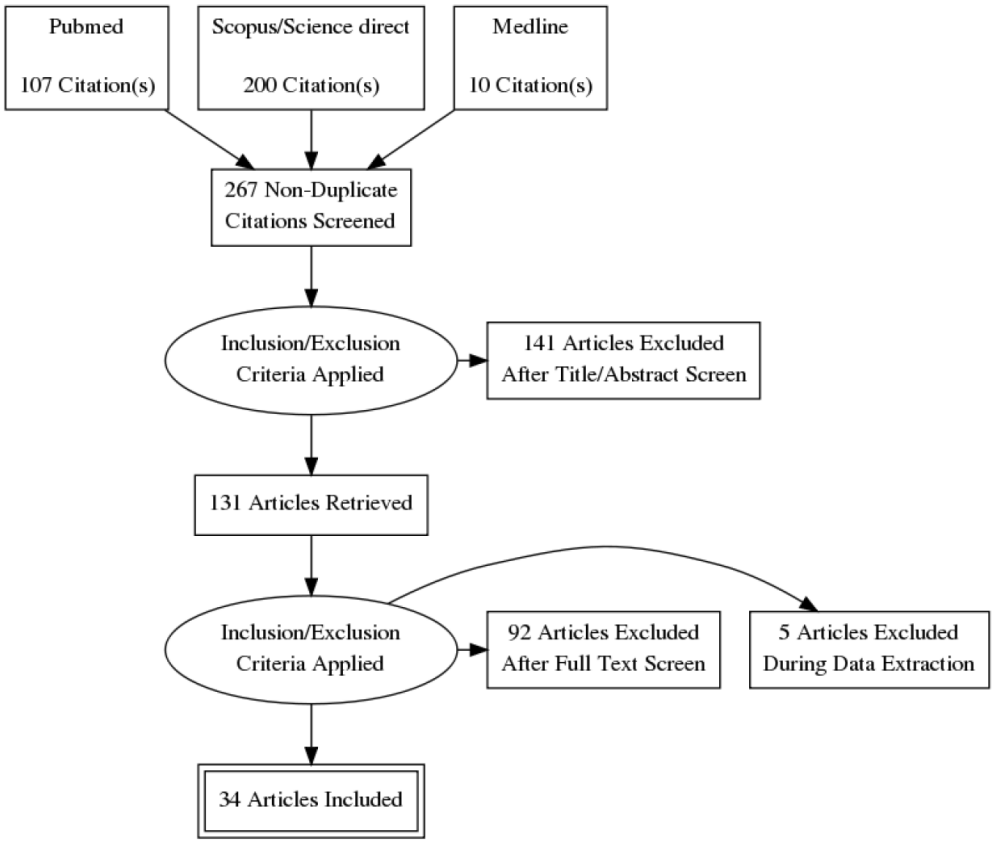

Figure 1. Flow diagram on literature research results on effectiveness of relaxation techniques in chronic, non-cancer pain treatment.

suggest the possibility of the dissemination of these methods in the care of patients in pain as a result of these interventions took place: a reduction of pain, improved quality of life and mental health, which encourages the extension of the process of treatment with complementary methods.

One of the most common phenomena in the modern world, often resulting psychosomatic disorders is low back pain. Cheshire et al. [7] analysed the effectiveness of self-management among patients with chronic low back pain. The studied group underwent various interventions: acupuncture, relaxation, mindfulness training, cognitive-behavioural therapy, pain and stress coping strategies. Results showed that benefits are short-term but multidimensional increase of emotional wellbeing, self-efficacy and cognitive coping, decrease of fatigue and pain intensity. One of determinants of therapeutic success was patient's involvement.

Various methods were applied to support chronic pain treatment. The effectiveness of different approaches was diverse, results are showed in [8-15] (Table 1).

Progressive muscle relaxation, relaxation techniques, autogenic training and self-hypnosis as supportive methods in chronic pain treatment

The effectiveness of the 4-week, interdisciplinary treatment of chronic lower back pain among the active population verified Gagnon et al. [16]. The subjects participated in a number of interventions-physiotherapy, relaxation and biofeedback, occupational therapy, physical activity, education and medication. The analysis demonstrated a reduction in pain intensity and catastrophizing as non-adaptive strategies to cope with the pain.

The relationship between meditation and studied pain intensity was analysed by Morone et al. [17]. In the group of 30 patients, suffering from chronic pain, lumbar spine, performed 8-weekly meditation training, which includes 4 sessions per week, each lasting an average of 30 minutes. Among respondents 48% reported reducing the amount of pain medication. The same sources, in another study to verify the

include a number of practices such as progressive muscle relaxation, *guided imagery*, autogenic training and deep breathing exercises [46].

Guided imagery – in the treatment of chronic pain aims to enhance relaxation, as well as unhooking attention, any of various techniques (as a series of verbal suggestions) used to guide another person or oneself in imagining sensations and especially in visualizing an image in the mind to bring about a desired physical response (as a reduction in stress, anxiety, or pain) [47].

Mindfulness approach – the practice of maintaining a nonjudgmental state of heightened or complete awareness of one's thoughts, emotions, or experiences on a moment-to-moment basis; *also*: such a state of awareness [48].

Progressive muscle relaxation – is a technique for learning to monitor and control the state of muscular tension. It was developed by American physician Edmund Jacobson in the early 1920s [49].

Autogenic training – a desensitization-relaxation technique developed by the German psychiatrist Johannes Heinrich Schultz and first published in 1932, restores the balance between the activity of the sympathetic (flight or fight) and the parasympathetic (rest and digest) branches of the autonomic nervous system [50].

Qigong (qi gong, chi kung, or chi gung) – (traditional Chinese: pinyin: *qìgōng*; Wade–Giles: *chi gong*; literally: "Life Energy Cultivation") is a holistic system of coordinated body posture and movement, breathing, and meditation used for health, spirituality, and martial arts training. With roots in Chinese medicine, philosophy, and martial arts, **qigong** is traditionally viewed as a practice to cultivate and balance **qi** (*chi*), translated as "life energy" [Wikipedia].

Reiki – is a form of alternative medicine developed in 1922 by Japanese Buddhist Mikao Usui. Since originating in Japan, Reiki has been adapted into varying cultural traditions across the world. Reiki practitioners use a technique they call *palm healing* or *hands-on healing* by which a "universal energy" is allegedly transferred through the palms of the practitioner to a patient in order to encourage healing [Wikipedia].

Table 1. Characteristics of patients, factors analysed and results methods and techniques (mindfulness, visualization, meditation and guided imagery as relaxation) used as supportive chronic pain treatment.

Authors [references]	Characteristic of the group or issue	Factors analysed	Methods (techniques)	Results
Chen YL, Francis AJ [6]	Patients with chronic, non-cancer pain (n = 19)	Pain intensity, level of depression, quality of life	Guided imagery, progressive muscle relaxation	Statistically non-significant
Cheshire A, Polley M, Peters D [7]	Patients with chronic low back pain (n = 108)	Pain self -management	Acupuncture, relaxation, mindfulness, cognitive-behavioural therapy, pain and stress coping	Benefits of self-management in short term: increase of emotional wellbeing, self- efficacy and cognitive coping, decrease of fatigue and pain intensity; important patients involvement
Morone NE, Rollman B, Moore CG et al. [8]	Patients with chronic low back pain (n = 40)	Impact of mindfulness meditation on pain symptoms	Relaxation in examined group and education in control group	Relaxation caused pain decrease and functional disability- effects similar to control group, results non-significant
Carnes D, Homer K, Underwood M et al. [9]	Chronic musculoskeletal pain (n = 685)	Impact of various techniques on patients pain perception	Relaxation, breathing, visualization, mindfulness	Patients appreciated all possibilities of shifting attention from pain symptoms and perceived as effective
Zautra AJ, Davis MC, Reich JW et al. [10]	Patients with chronic, rheumatic pain (n = 144)	Comparison of different interventions and their impact of psychophysical and biochemical condition of rheumatic pain patients	Cognitive-behavioural therapy, mindfulness meditation, in control group- education	In CBT group- increase of self-efficacy in pain control. In CBT and meditation group –improvement of pain coping strategies, in meditation group decrease of depressive symptoms, increase of positive affect and decrease of joints sensitivity
Menzies V, Kim S [11]	Patients with fibromyalgia (n = 48)	Evaluation of interdisciplinary treatment on physical and psychological factors	10-week program with relaxation and visualization	Self- efficacy increase in pain coping strategy, functional state and other symptoms management
Rosenzweig S, Greeson JM, Reibel DK et al. [12]	Patients with chronic pain in osteoarthritis, migraine and fibromyalgia (n = 133)	Physical pain, psychological symptoms and quality of life	8–week mindfulness based stress reduction program	Most effective in osteoarthritis group of patients
Carmody J, Baer RA [13]	Chronic, stress-related disorders, pain and anxiety (n = 174)	Impact of mindfulness meditation on psycho-physical well-being and perceived stress	8 session, including elements of yoga, sitting meditation and body scan as a part of MBSR (Mindfulness Body Stress Reduction)	Mindfulness improvement as well as psychological function, reduction of pain symptoms
Ussher M, Spatz A, Copland C et al. [14]	Patients with chronic, non-malignant pain (n = 55)	Analysis of pain commonness, stress related, ability in daily activity, probability of social disturbances- in clinical and home condition	Body scan as an element of mindfulness program, in control group- recordings on natural history	In clinical conditions there was a significant difference between both groups, at home conditions- no significant change
Beissner K, Henderson CR, Papaleontiou M et al. [15]	Community of therapists and patients with chronic pain (n = 152)	The use and efficacy of cognitive-behavioural therapy(CBT) in alleviating pain	Relaxation, distraction, guided imagery	80% of patients are using complementary methods, including 84% relaxation, 88% guided imagery. Authors suggests the need of using CBT

impact of mindfulness meditation on chronic pain in lower back, showed that relaxation has helped to mitigate the intensity of pain, as well as reducing the associated disability. Results however, were not statistically significant and similar to results obtained in the control group, participating in the educational program [8].

Other authors emphasize the effectiveness of relaxation techniques as a component of cognitive-behavioural treatment of chronic pain of the spine [4, 18]. The test indicators were the pain intensity experienced in conjunction with stress and emotional response. As a result of the applied multi-faceted treatment significantly reduced pain intensity, improved with

strategies for dealing with it, self-confidence and the number of positive beliefs increased and negative attitudes decreased as well as the level of depression and anxiety.

The program created by Artner et al. [19] was designed for patients with chronic low back pain and its purpose was to evaluate the effectiveness of a 3-week, intensive intervention in relieving pain causing functional disability. It contained elements of physiotherapy, occupational therapy, relaxation, exercise, water, massage, TENS (transcutaneous electrical nerve stimulation), traction and education. The result was a significant reduction in the level of pain (66.82% on a numerical scale NRS) and reduced physical disability of 33.33% (Oswestry Disability Index).

According to Lillefjel et al. [20], a multidisciplinary rehabilitation program is also indicated for chronic musculoskeletal pain. The group of 143 patients underwent 5-week program involving exercises to reinforcing the muscles of the whole body, and relaxation. The intensity of the 100-point pain VAS at baseline was an average of 77.3, and after 5 weeks of training 74.1. To verify these results, 52 weeks after the first test, during which the patients continued participation in training, but at a lower frequency-three times a week, the intensity of pain was analysed-VAS remained unchanged and amounted to 74.1. After another 52 weeks, during which the training consisted of an hour a day, once a week, the results showed a further reduction in pain intensity to 66.7 on the VAS scale.

Carnes et al. [9] conducted a study under the impact of different methods of relaxation – breathing, mindfulness training, visualization on musculoskeletal pain. Patients appreciated the possibility to enlarge pain management with methods shifting their attention from pain and alleviating pain perception.

Another studies conducted by Mattenklodt et al. [21], analysed the effectiveness of a multidisciplinary program among older people with chronic pain motivated musculoskeletal and neuropathic. After 10 weeks there was a noticeable change in the quality of life and physical condition of patients.

The effectiveness of self-hypnosis in decreasing psychophysical tension related to chronic pain was verified by Roja et al. [22], who confirmed its positive impact not only by questioning patients but also using myonometric and heart rate measurements.

The need for multi-faceted patient care emphasize pain Erlenwein et al. [23]. The 50% suffering from pain in addition to conventional pharmacological treatment required activities such as: psychological and psychiatric care (11.1%), physiotherapy (19.2%) and supporting such a progressive muscle relaxation or TENS (20.2%). More information in [5-7, 11, 15, 24-32] (Table 2).

Psychotherapy, education and biofeedback as supportive in chronic pain treatment

chronic pain accompanied also subjects suffering from rheumatic diseases. Zautra et al. [10] compared the effects of cognitive-behavioural therapy, a group of practicing mindfulness meditation and the control group, only taking part in the program of education. Authors studied both the physical and psychological impact as well as biochemical interventions among people with rheumatic disease. Those involved in cognitive-behavioural therapy declared increased self-efficacy in controlling pain and reducing levels of interleukin (accompanying substances in an inflammatory rheumatic disease, and resulting in a greater intensity of pain). In both groups-the cognitive-behavioural approach and meditation improved strategies for pain coping strategies compared to the control group. Among those with chronic depression, practicing meditation, the most significant change was observed in the area of positive affect, as well in reduction of tenderness in joints (Table 1).

The need to include an interdisciplinary treatment program in other rheumatic diseases with stress was pointed by Suman et al. [33]. A program with such cognitive-behavioural therapy, helped to reduce the intensity of pain, as well as the number of painful areas of the body in patients with fibromyalgia. These effects persisted up to a year after completion of studies (Table 2).

A similar analysis were conducted by Menzies and Kim [11]. After the 10-week program, including relaxation and visualization, patients with fibromyalgia evaluated above their self-efficacy in coping with pain and functional status (Table 1).

The effectiveness of the MBSR (Mindfulness Based Stress Reduction) conducted among persons with chronic disease symptoms was confirmed by Rosenzweig et al. [12]. The study included patients from diverse location of pain that accompanies osteoarthritis,

Table 2. Characteristics of patients, factors analysed and results, methods and techniques (progressive muscle relaxation, relaxation techniques, autogenic training and self-hypnosis) as supportive methods in chronic pain treatment.

Authors [references]	Characteristic of the group or issue	Factors analysed	Methods (techniques)	Results
Ersek M, Turner JA, Cain KC et al. [5]	Patients with chronic, non-malignant pain (n = 218)	Pain intensity, functional disability, coping strategies	Physiotherapy, progressive muscle relaxation; in control group- books on stress, pain psychology, methods used to reduce symptoms	No significant differences between in analysed factors
Chen YL, Francis AJ [6]	patients with chronic, non-cancer pain (n = 19)	Pain intensity, level of depression, quality of life	Guided imagery, progressive muscle relaxation	Statistically non-significant
Cheshire A, Polley M, Peters D et al. [7]	Patients with chronic low back pain (n = 108)	Pain self -management	Acupuncture, relaxation, mindfulness, cognitive-behavioural therapy, pain and stress coping	Benefits of self-management in short term: increase of emotional wellbeing, self- efficacy and cognitive coping, decrease of fatigue and pain intensity; important patients involvement
Carnes D, Homer K, Underwood M et al. [9]	Chronic musculoskeletal pain (n = 685)	Impact of various techniques on patients pain perception	Relaxation, breathing, visualization, mindfulness	Patients appreciated all possibilities of shifting attention from pain symptoms and perceived as effective
Menzies V, Kim S [11]	Patients with fibromyalgia (n = 48)	Evaluation of interdisciplinary treatment on physical and psychological factors	10-week program with relaxation and visualization	Self- efficacy increase in pain coping strategy, functional state and other symptoms management
Beissner K., Henderson CR, Papaleontiou M et al. [15]	Community of therapists and patients with chronic pain (n = 152)	The use and efficacy of cognitive-behavioural therapy(CBT) in alleviating pain	Relaxation, distraction, guided imagery,	80% of patients are using complementary methods, including 84% relaxation, 88% guided imagery. Authors suggests the need of using CBT
Gagnon CM, Stanos SP, van der Ende G et al. [16]	Patients with chronic low back pain (n = 101)	Pain intensity, pain coping strategies	Physiotherapy, relaxation ,biofeedback, physical activity, education, pharmacological treatment	Pain intensity decrease, reduction of catastrophizing as a non-adaptive pain coping strategy
Morone N, Greco C, Weiner DK [17]	Community-dwelling older adults aged 65 years and older with CLBP (chronic low back pain) of moderate intensity occurring (n = 89)	Measures of pain, physical function, attention, and quality of life	Eight-session mindfulness meditation program	Improvement in pain acceptance and physical function
Tan EPG, Tan ESL, Ng BY [18]	Chronic low back pain (n = 29)	Pain intensity, stress and emotional factors	Relaxation as cognitive-behavioural therapy	Significant decrease in pain intensity, pain coping strategies improvement, increase of self-confidence, decrease of negative attitude, depression and anxiety level
Artner J, Kurz S, Cakir B et al. [19]	Chronic low back pain patients (n = 160)	Pain intensity, level of functional disability	3 week multimodal program including physiotherapy, relaxation, water exercises, occupational therapy, manual therapy, TENS	Significant reduction in pain level (66.82%) and reduced physical disability of 33.33%).
Lillefjell M, Krokstad S, Espnes GA [20]	Patients with chronic musculoskeletal pain (n = 143)	The impact of interdisciplinary treatment on pain intensity	5-week program including relaxation and exercises reinforcing the whole body	Long term pain intensity decrease
Mattenklodt P, Ingenhorst A, Wille C [21]	Elderly patients with neuropathic, chronic musculoskeletal pain and migraine (n = 24)	The impact of psychophysical treatment on pain intensity	10-week program including physical and psychological methods	Increase of functional state and quality of life

...Table 2. Characteristics of patients, factors analysed and results, methods and techniques (progressive muscle relaxation, relaxation techniques, autogenic training and self-hypnosis) as supportive methods in chronic pain treatment

Authors [references]	Characteristic of the group or issue	Factors analysed	Methods (techniques)	Results
Roja Z, Kalkis V, Roja I et al. [22]	Shoulder, neck and hand pain (n = 350)	Physical and psychological tension	Exercise workout, cognitive hypnotherapy, self -hypnosis	Significant decrease of pain related psychophysical tension, and HR-heart rate measurement
Erlenwein J, Schlink J, Pfingsten M [23]	Patients with chronic pain (n = 882)	The evaluation of need on diverse pain patient's care	Pharmacological, psychological, psychiatric support, physiotherapy, progressive muscle relaxation, TENS	The most effective method appeared a multimodal management, including apart physiotherapy and pharmacological treatment also psychological intervention
Cucciare MA, Sorrell JT, Trafton JA [24]	HIV patients with chronic pain (n = 60)	Pain intensity, level of anxiety	Progressive muscle relaxation, positive reconceptualization	The higher pain intensity and related anxiety the greater reduction of symptoms as a result of using methods
Heutink M, Post MW, Wollaars MM et al. [25]	Patients with neuropathic pain (n = 215)	Patient's preferences in choosing supportive methods in pain management	Physical activity, massage, relaxation, acupuncture, biofeedback, physical therapy	The most effective techniques by patients are acupuncture, physiotherapy and relaxation
Jensen MP, Barber J, Romano JM [26]	Patients with MS with chronic pain (n = 22)	Evaluation of effectiveness of patient's preferences in choosing supportive methods in pain management	Self-hypnosis, progressive muscle relaxation	The most effective method in pain coping was self-hypnosis, in PMR there were no significant pain intensity decrease; both groups were keen to continue and verify various possibilities in alleviating pain
Kirschneck C, Römer P, Lippold C [27]	Craniofacial pain (n = 100)	Pain intensity, beliefs-adaptive and dysfunctional type of patients, pain behaviour	Progressive muscle relaxation	In group of adaptive patients: pain intensity, emotional stress and related disturbances decrease ,in crease of self- control in group of dysfunctional patients- pain intensity and emotional stress increase, decrease of physical activity
Konvicka JJ, Meyer TA, McDavid AJ et al. [28]	Patients with chronic pain (n = 400)	Evaluation of factors determining the choice of pain alleviating methods	Relaxation, massage, physiotherapy	Younger patients are often choosing relaxation, older- massage
Lauche R, Materdey S, Cramer H et al. [29]	Patients with chronic neck pain (n = 61)	The effectiveness of massage and progressive muscle relaxation on pain intensity, functional disability, health related quality of life, affective pain perception, psychological stress, wellbeing	Massage, progressive muscle relaxation (PMR)	Both massage and PMR were effective in pain symptoms decrease
Ndao-Brumblay SK, Green CR [30]	Patients with chronic pain (n = 5,750)	Patients preferences and social, cultural conditioning in relaxation application	Acupuncture, relaxation, biofeedback, manual therapy	The most popular method was acupuncture, manual therapy and relaxation
Sakakibara T, Wang Z, Paholpak P et al. [31]	Back, shoulder, neck, ankle pain (n = 1,853)	Comparison of socio-cultural factors determining choice of supportive pain treatment in 3 countries- Japan, Thailand and Myanmar	Relaxation, massage, heat, osteopathy, acupuncture, physiotherapy, diet	After medical counselling and pharmacological treatment relaxation on 3d position. In different countries- choice of each method depended on country development, quality of life, professional and familiar situation: Japan- pharmacological management, Thailand-massage, Myanmar-meditation
Stein K, Miclescu A [32]	Patients with chronic pain conditions (fibromyalgia, neck pain, shoulder pain and low back pain) (n = 51)	Analysis of psychophysical outcomes after one year multidisciplinary rehabilitation program	The 6-week treatment included cognitive-behavioural treatment, education on pain physiology, ergonomics, physical exercises and relaxation techniques	One year after this program, significant improvements appeared, concerning social activity and depression, but not in anxiety, and physical activity. Although not statistically significant, some numerical decrease in the mean levels of pain intensity, pain severity and opioid consumption were found

Table 3. Characteristics of patients, factors analysed and results methods and techniques (psychotherapy, education and biofeedback) as supportive in chronic pain treatment.

Authors [references]	Characteristic of the group or issue	Factors analysed	Methods (techniques)	Results
Cheshire A, Polley M, Peters D et al. [7]	Patients with chronic low back pain (n = 108)	Pain self -management	Acupuncture, relaxation, mindfulness, cognitive-behavioural therapy, pain and stress coping	Benefits of self-management in short term: increase of emotional wellbeing, self- efficacy and cognitive coping, decrease of fatigue and pain intensity; important patients involvement
Gagnon CM, Stanos SP, van der Ende G et al. [16]	Patients with chronic low back pain (n = 101)	Pain intensity, pain coping strategies	Physiotherapy, relaxation ,biofeedback, physical activity, education, pharmacological treatment	Pain intensity decrease, reduction of catastrophizing as a non-adaptive pain coping strategy.
Morone N, Greco C, Weiner DK [17]	Community-dwelling older adults aged 65 years and older with CLBP(chronic low back pain) of moderate intensity occurring (n = 89)	Measures of pain, physical function, attention, and quality of life	Eight-session mindfulness meditation program	Improvement in pain acceptance and physical function
Tan EPG, Tan ESL, Ng BY [18]	Chronic low back pain (n = 29)	Pain intensity, stress and emotional factors	Relaxation as cognitive-behavioural therapy	Significant decrease in pain intensity, pain coping strategies improvement, increase of self-confidence, decrease of negative attitude, depression and anxiety level
Mattenklodt P, Ingenhorst A, Wille C [21]	Elderly patients with neuropathic, chronic musculoskeletal pain and migraine (n = 24)	The impact of psychophysical treatment on pain intensity	10-week program including physical and psychological methods	Increase of functional state and quality of life
Roja Z, Kalkis V, Roja I et al. [22]	Shoulder, neck and hand pain (n = 350)	Physical and psychological tension	Exercise workout, cognitive hypnotherapy, self -hypnosis	Significant decrease of pain related psychophysical tension, and HR-heart rate measurement
Erlenwein J, Schlink J, Pfingsten M [23]	Patients with chronic pain (n = 882)	The evaluation of need on diverse pain patient's care	Pharmacological, psychological, psychiatric support, physiotherapy, progressive muscle relaxation, TENS	The most effective method appeared a multimodal management, including apart physiotherapy and pharmacological treatment also psychological intervention
Heutink M, Post MW, Wollaars MM [25]	Patients with neuropathic pain (n = 215)	Patient's preferences in choosing supportive methods in pain management	Physical activity, massage, relaxation, acupuncture, biofeedback, physical therapy	The most effective techniques by patients are acupuncture, physiotherapy and relaxation.
Ndao-Brumblay SK, Green CR [30]	Patients with chronic pain (n =5,750)	Patients preferences and social, cultural conditioning in relaxation application	Acupuncture, relaxation, biofeedback, manual therapy	The most popular method was acupuncture, manual therapy and relaxation
Stein K, Miclescu A [32]	Patients with chronic pain conditions (fibromyalgia, neck pain, shoulder pain and low back pain) (n = 51)	Analysis of psychophysical outcomes after one year multidisciplinary rehabilitation program	The 6-week treatment included cognitive-behavioural treatment, education on pain physiology, ergonomics, physical exercises and relaxation techniques	One year after this program, significant improvements appeared, concerning social activity and depression, but not in anxiety, and physical activity. Although not statistically significant, some numerical decrease in the mean levels of pain intensity, pain severity and opioid consumption were found
Suman AL, Biagi B, Biasi G et al. [33]	Patients with fibromyalgia (n = 25)	Pain intensity, sensitivity and touch soreness depression level and biochemical factors	3-week program, including physical exercises and cognitive-behavioural therapy	Pain intensity and level of depression decrease
Pöhlmann K, Tonhauser T, Joraschky P et al. [34]	Patients with chronic low back pain and other kind of pain (n = 189)	Pain intensity, level of disability, depression, catastrophizing and professional activity	Interdisciplinary program including physical and psychological management	Decrease of pain symptoms intensity, increase of professional activity

migraines, back pain, neck and fibromyalgia. MBSR turned out to be the fullest improving the quality of life intervention in patients affected by degenerative disease, in patients with headache to a lesser extent the intervention had a positive impact on the intensity of pain and quality of life, while in patients with fibromyalgia had the smallest impact on psychological stress (Table 1).

The evaluation of the effectiveness of complementary methods of pain treatment for chronic non-cancer was also taken for other illnesses. Heutink et al. [25] were conducting studies among patients with spinal cord chronic pain, under their preferences and effectiveness of methods supportive in pain treatment. Relaxation and physiotherapy were classified as most effective in pain relief. The study on the effectiveness of self-hypnosis and progressive muscle relaxation in reducing the intensity of pain and related limitations were enrolled among patients with MS and suffering from chronic pain [26]. The analysis showed that the most effective form of dealing with pain was self-hypnosis. In contrast to this group, those taking PMR (progressive muscle relaxation) recorded no significant decrease in pain. In both groups of respondents expressed a desire to continue learning and testing methods of pain relief options (Table 2).

Progressive muscle relaxation, along with other components of the cognitive-behavioural approach has proven to be highly effective in relieving pain in people infected with HIV and suffering from AIDS [24]. The analysis showed that the greater the intensity of the pain and distress associated with, the more significant the reduction of symptoms in patients treated with this method (Table 2).

Another study on progressive muscle relaxation as a method influencing craniofacial pain perception and patients beliefs was conducted by Kirscheck et al. [27]. Generally pain intensity was reduced as well as related disorders and irrational beliefs. The extent of PMR impact was determined by type of patients-those, classified as adaptive showed more positive effect than those with dysfunctional attitude (Table 2).

Progressive muscle relaxation and massage as a supportive methods alleviating chronic neck pain were analysed by Lauche et al. [29]. Both methods appeared to be effective in decreasing pain intensity and related disturbances functional disability, psychological stress, health related quality of life and well-being (Table 2). More information in [7, 16, 18, 19, 30, 32-34] (Table 3).

Physiotherapy, TENS, massage, manual therapy, physical activity as supportive methods in chronic pain treatment

The relationships between the practice of mindfulness meditation and mental well-being, physical symptoms and perceived stress assessed Carmody and Baer [13]. Eight sessions including elements of yoga, meditation and sitting body scan was as a parts of Mindfulness Based Stress Reduction program (MBSR). As a result an increase in awareness has been achieved, mental functioning improved, which reflected in the reduction of pain symptoms (Table 1).

Immediate effects of the application of MBSR program practice containing the body scan in patients with chronic pain, non-malignant verified Ussher and colleagues [14]. The subjects performed twice daily body scanning technique under different conditions: clinical and home. The comparison was made with a control group who listened recordings about natural history. Both tests before and after the completion analysed the prevalence of pain and related stress as well as the ability to make everyday activities as well as the likelihood of the disorder caused by social relationships. Under clinical conditions a significant difference between the study and control group appeared in the parameters associated with pain intensity decrease, and at home, where there were no significant differences between them (Table 1).

More information in [5, 16, 18, 19-23, 25, 28-34] (Table 4).

Other methods: pharmacological, osteopathy, acupuncture supporting chronic pain treatment

Pohlmann et al. [34] showed a long-term effect of a multidisciplinary pain treatment program for chronic, non-malignant pain in 189 subjects. They verified the pain intensity, level of pain-related disability, vitality, depression, catastrophizing and professional activity. The subjects demonstrated significant improvement in the symptoms manifested 6 months after the treatment, moreover 63% of the persons participating in the study were able to return to work (Table 4).

Similar factors were analysed in Stein and Miclescu study [32], which was run among 51 patients with chronic pain conditions (fibromyalgia, neck pain, shoulder pain and low back pain) who completed the multidisciplinary rehabilitation program at the primary health care unit. The 6-week treatment included

Table 4. Characteristics of patients, factors analysed and results: methods and techniques (physiotherapy, TENS, massage, manual therapy, physical activity) as supportive in chronic pain treatment.

Authors [references]	Characteristic of the group or issue	Factors analysed	Methods (techniques)	Results
Ersek M, Turner JA, Cain KC et al. [5]	Patients with chronic, non-malignant pain (n =218)	Pain intensity, functional disability, coping strategies	Physiotherapy, progressive muscle relaxation; in control group- books on stress, pain psychology, methods used to reduce symptoms	No significant differences between in analysed factors
Gagnon CM, Stanos SP, van der Ende G et al. [16]	Patients with chronic low back pain (n =101)	Pain intensity, pain coping strategies	Physiotherapy, relaxation ,biofeedback, physical activity, education, pharmacological treatment	Pain intensity decrease, reduction of catastrophizing as a non-adaptive pain coping strategy
Artner J, Kurz S, Cakir B et al. [19]	Chronic low back pain patients (n =160)	Pain intensity, level of functional disability	3 week multimodal program including physiotherapy, relaxation, water exercises, occupational therapy, manual therapy, TENS	Significant reduction in pain level (66.82%) and reduced physical disability of 33.33%).
Lillefjel M., Krokstad S, Espnes GA [20]	Patients with chronic musculoskeletal pain (n = 143)	The impact of interdisciplinary treatment on pain intensity	5-week program including relaxation and exercises reinforcing the whole body	Long term pain intensity decrease
Mattenklodt P, Ingenhorst A, Wille C et al. [21]	Elderly patients with neuropathic, chronic musculoskeletal pain and migraine (n = 24)	The impact of psychophysical treatment on pain intensity	10-week program including physical and psychological methods	Increase of functional state and quality of life
Roja Z, Kalkis V, Kalkis H et al. [22]	Shoulder, neck and hand pain (n = 350)	Physical and psychological tension	Exercise workout, cognitive hypnotherapy, self -hypnosis	Significant decrease of pain related psychophysical tension, and HR-heart rate measurement
Erlenwein J, Schlink J, Pfingsten M et al. [23]	Patients with chronic pain (n = 882)	The evaluation of need on diverse pain patient's care	Pharmacological, psychological, psychiatric support, physiotherapy, progressive muscle relaxation, TENS	The most effective method appeared a multimodal management, including apart physiotherapy and pharmacological treatment also psychological intervention
Heutink M, Post MW, Wollaars MM et al. [25]	Patients with neuropathic pain (n = 215)	Patient's preferences in choosing supportive methods in pain management	Physical activity, massage, relaxation, acupuncture, biofeedback, physical therapy	The most effective techniques by patients are acupuncture, physiotherapy and relaxation.
Konvicka JJ, Meyer TA, McDavid AJ et al. [28]	Patients with chronic pain (n = 400)	Evaluation of factors determining the choice of pain alleviating methods	Relaxation, massage, phytotherapy	Younger patients are often choosing relaxation, older- massage
Lauche R, Materdey S, Cramer H et al. [29]	Patients with chronic neck pain (n = 61)	The effectiveness of massage and progressive muscle relaxation on pain intensity, functional disability, health related quality of life, affective pain perception, psychological stress, wellbeing	Massage, progressive muscle relaxation (PMR)	Both massage and PMR were effective in pain symptoms decrease
Ndao-Brumblay SK, Green CR [30]	Patients with chronic pain (n = 5,750)	Patients preferences and social, cultural conditioning in relaxation application o	Acupuncture, relaxation, biofeedback, manual therapy	The most popular method was acupuncture, manual therapy and relaxation
Sakakibara T, Wang Z, Paholpak P et al. [31]	Back, shoulder, neck, ankle pain (n = 1,853)	Comparison of socio-cultural factors determining choice of supportive pain treatment in 3 countries- Japan, Thailand and Myanmar	Relaxation, massage, heat, osteopathy, acupuncture, physiotherapy, diet	After medical counselling and pharmacological treatment relaxation on 3d position. In different countries- choice of each method depended on country development, quality of life, professional and familiar situation: Japan pharmacological management, Thailand-massage, Myanmar- meditation
Stein K, Miclescu A [32]	Patients with chronic pain conditions (fibromyalgia, neck pain, shoulder pain and low back pain) (n = 51)	Analysis of psychophysical outcomes after one year multidisciplinary rehabilitation program	The 6-week treatment included cognitive-behavioural treatment, education on pain physiology, ergonomics, physical exercises and relaxation techniques	One year after this program, significant improvements appeared, concerning social activity and depression, but not in anxiety, and physical activity. Although not statistically significant, some numerical decrease in the mean levels of pain intensity, pain severity and opioid consumption were found

...Table 4. Characteristics of patients, factors analysed and results: methods and techniques (physiotherapy, TENS, massage, manual therapy, physical activity) as supportive in chronic pain treatment.

Authors [references]	Characteristic of the group or issue	Factors analysed	Methods (techniques)	Results
Suman AL, Biagi B, Biasi G et al. [33]	Patients with fibromyalgia (n = 25)	Pain intensity, sensitivity and touch soreness depression level and biochemical factors	3-week program, including physical exercises and cognitive-behavioural therapy	Pain intensity and level of depression decrease
Pöhlmann K, Tonhauser T, Joraschky P et al. [34]	Patients with chronic low back pain and other kind of pain (n = 189)	Pain intensity, level of disability, depression, catastrophizing and professional activity	Interdisciplinary program including physical and psychological management	Decrease of pain symptoms intensity, increase of professional activity

Table 5. Characteristics of patients, factors analysed and results methods and techniques (other: pharmacological, osteopathy, acupuncture) supporting chronic pain treatment.

Authors [references]	Characteristic of the group or issue	Factors analysed	Methods (techniques)	Results
Cheshire A, Polley M, Peters D et al. [7]	Patients with chronic low back pain (n = 108)	Pain self -management	Acupuncture, relaxation, mindfulness, cognitive-behavioural therapy, pain and stress coping	Benefits of self-management in short term: increase of emotional wellbeing, self- efficacy and cognitive coping, decrease of fatigue and pain intensity; important patients involvement
Gagnon CM, Stanos SP, van der Ende Get al. [16]	Patients with chronic low back pain (n = 101)	Pain intensity, pain coping strategies	Physiotherapy, relaxation ,biofeedback, physical activity, education, pharmacological treatment	Pain intensity decrease, reduction of catastrophizing as a non-adaptive pain coping strategy
Erlenwein J, Schlink J, Pfingsten M,et al. [23]	Patients with chronic pain (n = 882)	The evaluation of need on diverse pain patient's care	Pharmacological, psychological, psychiatric support, physiotherapy, progressive muscle relaxation, TENS,	The most effective method appeared a multimodal management, including apart physiotherapy and pharmacological treatment also psychological intervention
Heutink M, Post MW, Wollaars MM et al. [25]	Patients with neuropathic pain (n = 215)	Patient's preferences in choosing supportive methods in pain management	Physical activity, massage, relaxation, acupuncture, biofeedback, physical therapy	The most effective techniques by patients are acupuncture, physiotherapy and relaxation.
Ndao-Brumblay SK, Green CR [30]	Patients with chronic pain (n = 5,750)	Patients preferences and social, cultural conditioning in relaxation application o	Acupuncture, relaxation, biofeedback, manual therapy	The most popular method was acupuncture, manual therapy and relaxation
Sakakibara T, Wang Z, Paholpak P et al. [31]	Back, shoulder, neck, ankle pain (n = 1,853)	Comparison of socio-cultural factors determining choice of supportive pain treatment in 3 countries- Japan, Thailand and Myanmar	Relaxation, massage, heat, osteopathy, acupuncture, physiotherapy, diet	After medical counselling and pharmacological treatment relaxation on 3d position. In different countries- choice of each method depended on country development, quality of life, professional and familiar situation: Japan- pharmacological management, Thailand-massage, Myanmar- meditation

cognitive-behavioural treatment, education on pain physiology, ergonomics, physical exercises and relaxation techniques (Table 4).

Primary outcomes included pain intensity, pain severity, anxiety and depression scores, social and physical activity. One year after this program, significant improvements appeared, concerning social activity and depression, but not in anxiety, and physical activity. Although not statistically significant, some numerical decrease in the mean levels of pain intensity, pain severity and opioid consumption were reported one year after completing the treatment.

Treatment of chronic pain, that the duration of the patient becomes incomprehensible and disease in itself, is a challenge for modern medicine. It requires an interdisciplinary approach to conventional methods, such as drug treatment with complementary ones. Most commonly methods used were: relaxation and biofeedback (13%) and the method of handling (manual therapy, osteopathy) (24%) [30].

More information in [7, 16, 23, 25, 30, 31] (Table 5).

Biopsychosocial determinants of pain

Biopsychosocial determinants of the phenomenon of pain and its treatment were noticed by Argoff et al. [35]. The choice of methods should take into account the patient's attitude, expectations, preferences, and psychophysical and emotional capabilities, can be carried out only after a comprehensive analysis of the effectiveness of actions. The effectiveness of psychological interventions for pain also confirms Kroner-Herwig [36]. These methods have been applied in the case of chronic pain symptoms associated with headache, low back pain and fibromyalgia. Regularity and patients involvement in multimodal pain management were the main factors, determining the need and the effectiveness of comprehensive program studied by Siedentopf et al. [37]. Kirschneck at al. [27] confirmed in their study that personal attitude is an important condition, influencing the effect of relaxation on pain relief.

A need to implement a psychological approach, which includes elements of cognitive-behavioural perspectives of patients suggest Turk et al. [38].These authors point out the difference between the outlook of patients their attitude, expectations, beliefs, which according to them are more important than the techniques that affect and strengthen their sense of efficacy, thus minimizing the passivity and dependence. At the same time emphasize the importance of interdisciplinary pain management programs that include mental, physical and social components.

A similar issue was raised in the analysis Beissner et al. [15] who suggested actual obstacles in the way of widespread use of complementary methods to treat chronic pain. Not only a low level of knowledge on this topic, unregulated classification of these methods but also the inability to include them in the standard medical and paramedical procedures decide on incomplete research reports, putting a question mark over their effectiveness. Another factors determining patient's choice are: country development and related treatment access, familiar and professional situation as well as trauma history [31].

Results of this study should be viewed in light of several limitations. First, this is an effectiveness study with no control group. Although this review shows that pain treatment including relaxation may aid in symptom reduction and health behaviour improvements, in a real-world mind body clinical practice, because of the absence of random assignment to a control group, it does not allow to draw conclusions about the efficacy of the relaxation techniques [39]. Lastly, the lack of long-term follow-up data does not allow for conclusions about the maintenance of symptom improvements. Patients who showed improvement immediately post-treatment may not sustain these gains over time. Thus, further research is needed to evaluate the long-term effects of relaxation training in pain therapy.

Another perspective may occur – use of relaxation methods, as supportive ones, may induce not only improvement in medical and psychologic symptoms, but also increase in health-promoting lifestyle behaviours. Future studies should replicate these results with a randomized controlled trial including a long-term follow-up to demonstrate the efficacy and sustainability of the intervention. Health care providers should be aware of this treatment option, particularly for those with stress-related symptoms and medical conditions that do not respond sufficiently to conventional treatment.

The age factor in the perception of pain

An important factor in determining the perception of pain is age. Chronic pain poses many difficulties in

treatment, due to significant psychological components, increasing the dimension of the problem. A particularly important aspect is the relief of pain in the elderly, including cognitive impairment which may exist. Then the selection of appropriate methods that can reduce the intensity of pain is becoming increasingly important [40].

Age criterion in terms of the use of complementary methods to treat pain was part of the Konvicka et al. analysis [28]. Studies have shown that younger people more often choose a relaxation technique, in contrast to older people , who prefer herbal medicine and massage.

Age and related disorders (e.g. cognitive-dementia), cultural and social factors are determinants of pain perception and therefore the effectiveness of different methods for their treatment. The complexity of the phenomenon of chronic pain and the importance of the inclusion of behavioural methods in its mitigation are presented in the analysis Norelli and Harju [41].

Conclusions

The current study reinforces the importance of providing patients with relaxation methods in chronic pain treatment. The final results of relaxation techniques used as supportive method in pain management depends on numerous conditions biological, psychological and social. The discrepancies in the assessment of the effectiveness of relaxation methods to reduce pain intensity may indicate a non-uniform methodology of tests, which should contain strict criteria for selecting groups of subjects, use of specific relaxation method, use of research tools and specific systematics research. There is a significant need for more studies to provide meaningful data to guide clinician recommendations.

Competing interests

The authors declare that they have no competing interests.

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