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ALTERNATIVE TREATMENTS FOR PAIN MEDICINE (M JONES, SECTION EDITOR)

Effect of Guided Imagery on Pain and Health-Related Quality of Life in Musculoskeletal Medicine: a Comprehensive Narrative Review

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Abstract

Purpose of Review Guided imagery (GI) is a non-pharmacological method used to reduce pain, stress, and anxiety. No comprehensive review has yet investigated the application of GI in musculoskeletal medicine, its various types, and potential mechanisms. The aim of this comprehensive narrative review was to examine the types of GI used in musculoskeletal medicine and GI effect on pain and health-related quality of life.

Recent Findings A comprehensive narrative review of the English language scientific literature. PubMed, Google Scholar, ProQuest, and PEDro databases were searched from inception until August 2020 using keywords related to GI, musculoskeletal disorders, pain, and health-related quality of life. The search results generated 133 articles. After a critical analysis, 12 publications were included in this review. GI characteristics and protocols varied significantly between studies.

Summary Based on the reviewed studies, we advocate GI as a safe, non-invasive technique that can assist in managing pain, depression, stress, fatigue, anxiety, reducing medication use, improving general well-being, wellness, and quality of life in patients with musculoskeletal disorders. We recommend further investigations of GI mechanisms.

Keywords Guided imagery · Narrative review · Pain · Musculoskeletal disorders · Health-related quality of life

Introduction

Guided imagery (GI), an easy-to-use, accessible, and effective method [1], reduces pain, stress, and anxiety and can be performed as a clinical intervention by following simple instructions. GI is widely used, and the awareness of its healing, physical and psychological benefits has increased over the past two decades [2].

The term GI refers to a wide variety of techniques, including simple visualization of images and a series of verbal suggestions utilizing imagery, metaphors, storytelling, fantasy exploration, game playing, dream interpretation, drawing, and active imagination where elements of the unconscious are encouraged to emerge as images, capable of communicating with the conscious mind, producing a desired physical response (i.e., a reduction in stress, anxiety, or pain) [3]. According to Kosslyn [4], GI involves generating or recalling different mental images, such as the perception of objects or events, engaging mechanisms used in cognition, memory, emotional, and motor control.

GI has been viewed as a "relaxation modality" by the National Center for Complementary and Integrative Health since it can profoundly activate the body's natural relaxation response. It is characterized by slower breathing and the lowering of blood pressure, and increased feelings of well-being [5]. A critical review by Trakhtenberg [6] suggested that GI can also influence the immune system. Most studies have examined the effect of GI by utilizing a training technique of GI lasting ~ 12–20 min. In a recent study of a brief GI exercise lasting only 1 to 2 min, it was found that reflecting on a short mental image increased psychosocial stability, which was expressed by the coherence of heart rate variability [7].

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Certain complementary and integrative therapies have been recommended as a treatment for chronic musculoskeletal pain (CMP) to partially address the opioid crisis. There is scarce data as to the utilization of complementary and integrative therapies among patients with CMP. Taylor et al. [8] studied the use of several non-herbal complementary and integrative therapies in a large retrospective cohort of young veterans suffering from CMP. The administrative data (2010–2013, $n = 530{,}216$) was obtained from the Veterans Health Administration. The authors found that 27% of the young veterans suffering from CMP utilized complementary and integrative therapies, 15%—meditation, 7%—yoga, 6%—acupuncture, 5%—chiropractic treatment, 4%—GI, 3%—biofeedback, 2%—tai chi, 2%—massage therapy, and 0.2%—hypnosis. To the best of our knowledge, no comprehensive review has yet investigated the use of GI in musculoskeletal medicine, various types of GI, and potential mechanisms of GI.

The aim of this comprehensive narrative review was to examine the types of GI used in musculoskeletal medicine; to assess the effect of GI on pain and health-related quality of life in musculoskeletal medicine; and to review potential mechanisms of the GI effect on pain and health-related quality of life in musculoskeletal medicine.

Materials and Methods

PubMed, Google Scholar, ProQuest, and PEDro databases were searched from inception until August 2020 using the following keywords: "guided imagery," "mental imagery," "visualization," "psychotherapeutic imagery," "chronic pain," "musculoskeletal disorders," "orthopedic disorders," and the combinations of these terms. The reference lists of all articles retrieved in full were also searched. The search results were pooled, and duplicates were deleted. The titles and abstracts of all articles were reviewed. Full texts of potentially relevant papers were read, and their reference lists searched for additional relevant articles.

Criteria for inclusion were any type of research dealing with GI treatment for musculoskeletal disorders. Trials of any design and methodological quality were also included; all studies were written in English. Excluded were the terms "mental practice" and "motor imagery" as these are types of treatments designed to improve gestures or movements. Data extraction was performed independently by two authors (AK and LK). The search results generated 133 articles. The titles and abstracts of all articles were reviewed after excluding all irrelevant papers; 15 essays were relevant. After a critical analysis, 12 publications were included in this review.

Results

Types and Characteristics of GI

Different types of GI have been described in the literature (Table 1). All studies reporting on GI utilized some form of relaxation techniques. We characterized the GI methods using the following parameters: Was music used? Was there variability in the duration and frequency of GI therapy? Was positive guidance a factor? Was autosuggestion used? Was there intentional guidance when performing functional tasks? Was abstract guidance used?

Menzies et al. [9] played three compact discs (CDs) to encourage GI. The first disc included basic relaxation techniques. Instructions were given as to how to relax in order to release tension. The second offered a pleasant scene imagery script, instructing listeners to imagine feeling better and better while imaging oneself within a pleasant scene of their choosing. In this imagined place, participants were encouraged to become familiar with their surroundings (elicit sensory involvement), envisage themselves in a place of safety and security where it was possible to rest fully and completely, and emerge from their imagery with a sense of feeling refreshed and rejuvenated. The third disc guided the participant on an imaginary journey through their immune system. The imagery script suggested "that this is an imaginary journey through your immune system…your immune system has but one mission… to provide your body with enhanced wellness….imagine now that your immune system is doing what it does best… and knowing how to do it well…" Each script contained encouragement to facilitate symptom improvement and promote well-being, i.e., "feeling better and better;" "feeling relaxed and refreshed."

Verkaik et al. [10] examined the effects of GI on patients with fibromyalgia. The first session included a group discussion of the theoretical background of GI and the distribution of a CD with three GI exercises. A specialized rheumatology nurse led the group discussions, and the instructions were given by a qualified trainer of the Van Praag Institute, The Netherlands. The GI exercises included relaxation techniques, music, positive imagery, and components specifically designed for pain management, i.e., "now imagine that you leave all the pain you have experienced at the beach post." Jacobson et al. [11, 12] examined the effects of GI on functional outcomes of a total knee replacement (TKR) in a pilot randomized controlled trial (RCT). The GI intervention was designed to promote functional outcomes after a TKR. Scripts for each pre-, intra-, and postoperative periods were read by an experienced GI practitioner and recorded with a soothing instrumental music background (Kohn SM. Music for Relaxation and Meditation #2 in D Flat. Unpublished manuscript).

Table 1 Types and characteristics of guided imagery

Study	Design	Types and characteristics of GI	Outcomes	Results
Menzies et al. (2014)	Randomized control study; 72 participants; 36 intervention group usual care + GI 36 control group usual care	**GI:** Guided imagery **Duration:** 20 min 3 compact discs—guided **Frequency:** Once a day, 10 weeks **Characterized:** Relaxation technique: Yes Music technique: No Positive guidance technique: Yes Auto suggestion technique: Yes Guidance for performing functional tasks: Yes Abstract guidance: Unknown Are there enough details about the technique that can be repeated: No	ASES—Arthritis Self-Efficacy Scale PSS—Perceived Stress Scale BFI—for fatigue BPI—for pain CES-D scale—for depression Biobehavioral factors: Immune biomarkers: Cytokine and CRP	Significantly higher reduction in pain, efficacy, stress, fatigue, depression, compared to the control group. No significant changes in the biomarker levels, although, total group CRP was elevated at baseline (indicating an inflammatory process)
Verkaik (2014)	Randomized control study 65 participants; 32 intervention Group received two 1.5-h sessions, including group discussion, instructions related to GI 33 controls received two 1.5-h group sessions, including group discussions	**GI:** Guided imagery **Duration:** GI exercises on CD, varying between 18:48 and 28:36 min **Frequency:** at least one exercise daily for 4 weeks **Characterized:** Relaxation technique: Yes Music technique: Yes Positive guidance technique: Yes Auto Suggestion technique: Unknown Guidance for performing functional tasks: Yes Abstract guidance: Yes Are there enough details about the technique that can be repeated: No	VAS FIQ—Fibromyalgia Impact Questionnaire HAQ—Health Assessment Questionnaire AIMS—Arthritis Impact Measurement Scale CPSS—Chronic Pain Self-Efficacy Scale	No significant effects of GI on pain intensity. Functional status (FIQ) and self-efficacy in patients
Jacobson (2016)	Randomized -controlled pilot study (investigator-blinded) 58 participants; 29 intervention group 29 control group 17- to 21-min audio recordings of Poetry, short stories, essays	**GI:** Guided imagery **Duration:** GI exercises 19- to 21-min audio recordings **Frequency:** every day for 2 weeks before and 3 weeks after surgery; instructed not to miss more than 2 days a week, if possible **Characterized:** Relaxation technique: Yes Music technique: Yes Positive guidance technique: Yes Auto Suggestion technique: Unknown Guidance for performing functional tasks: Yes Abstract guidance: Unknown Are there enough details about the technique that can be repeated: No	Gait velocity SF-36—Acute Version WOMAC—Western Ontario and McMaster Universities Arthritis Index, physical performance measure, the timed 10-M walk, HCC-Hair cortisol concentration T cell activation Cytokine Monocyte function	Higher gait velocity significantly improved at 6 months in the GI group compared to the control group. GI group demonstrated significantly lower scores in reducing the inflammatory and proliferative capability of monocytes and T cells, hair cortisol concentration (HCCs), compared to the control group. GI group had significantly lower WOMAC knee pain scores 3 weeks after surgery than at baseline, whereas the control group had significantly higher mean daily pain VAS scores during the 3-week postoperative period compared with their 2-week mean daily pain

Table 1 (continued)

Study	Design	Types and characteristics of GI	Outcomes	Results
Torres (2018)	Randomized trial 56 participants 36 intervention group 26 control group—usual care	**GI:** Group Music and Imagery Method (GrpMI) **Duration:** 2-h sessions **Frequency:** 12 weeks **Characterized:** Relaxation technique: Yes Music technique: Yes Positive guidance technique: Yes Auto Suggestion technique: Unknown Guidance for performing functional tasks: Yes Abstract guidance: Yes Are there enough details about the technique that can be repeated: No Other: Creative Drawing (Mandala)	PWS—Psychological Well-being Scale FIQ—Fibromyalgia Impact questionnaire MPQ—McGill Pain Questionnaire ST/DEP—State-Trait Depression Questionnaire STAI—State-Trait Anxiety Inventory	Intra-group analysis showed a significantly higher score in psychological well-being, functional capacity, and health. A significantly lower score was observed in pain perception, anxiety, and depression post-treatment compared to the control group, GRpMI participants had significantly higher scores for psychological well-being and lower-state anxiety post-treatment
Onieva-Zafra (2015)	Randomized control study 60 participants 30 intervention group 30 control group—usual care	**GI:** Guided imagery, following Martha Rogers' model **Duration:** 15 min **Frequency:** At least once a day for 8 weeks **Characterized:** Relaxation technique: Yes Music technique: No Positive guidance technique: Yes Auto Suggestion technique: No Guidance for performing functional tasks: Yes Abstract guidance: Yes Are there enough details about the technique that can be repeated: Yes	MPQ-LF: McGill Pain Questionnaire Long Form BDI—The Beck Depression Inventory VAS for depression	Significantly lower levels of pain and depression than the control group at week 4 evaluation. At week 8, a significant reduction in daily pain scores of the VAS and BDI were observed Questionnaire for depression. No significant differences were found for VAS depression and pain in the MPQ-LF

Table 1 (continued)

Study	Design	Types and characteristics of GI	Outcomes	Results
Baird and Murawski (2010)	Randomized control study 30 participants 15 intervention group 15 control group (planned rest for 12 min twice a day)	**GI:** Guided imagery with relaxation GIR **Duration:** 12-min audiotape-guided **Frequency:** twice a day for 4 months (16 weeks) **Characterized:** Relaxation technique: Yes Music technique: No Positive guidance technique: Yes Auto Suggestion technique: Yes Guidance for performing functional tasks: Yes Abstract guidance: Unknown Are there enough details about the technique that can be repeated: No	NRS—Numeric Rating Scales for pain (0–20) AIMS2-SF—for mobility difficulty WOMAC—for disability Medication use OTC—medication usually taken Prescribed arthritis medication Analgesics ordered	Significantly higher reduction in pain, significant improvement in mobility, and significant decreases in medication use compared to the control group
Lewandowski (2004)	Randomized control study 42 participants 21 intervention group 21 control group The investigator would monitor the patients for 4 days and subsequently would learn and practice the guided imagery technique	**GI:** Guided imagery, utilizing the Martha Rogers' model **Duration:** 7-min guided imagery technique **Frequency:** 3 times a day during 4 days **Characterized:** Relaxation technique: Yes Music technique: No Positive guidance technique: Yes Auto Suggestion technique: No Guidance for performing functional tasks: Yes Abstract guidance: Yes Are there enough details about the technique that can be repeated: Yes	VAS—Visual Analog Scale MPQ—McGill Pain Questionnaire PKPCT—Power as Knowing Participation in Change Tool IAQ—Imaging Ability Questionnaire MCSD—Marlow-Crowne Social Desirability Scale Use of opiate-type drugs Use of NSAIDs drugs	Participants in the treatment group reported significantly less pain during the last 2 days of the study compared to the control group

Table 1 (continued)

Study	Design	Types and characteristics of GI	Outcomes	Results
Kaplun (2020)	Exploratory controlled study (assigned alternately 1:1) 37 participants 18 intervention group 19 control group Usual care After completion of the intervention, the controls also commenced the treatment protocol	**GI:** Brief Guided Imagery, using "Colette's model" **Duration:** 1–2-min guided imagery technique **Frequency:** 3 times a day for 6 weeks **Characterized:** Relaxation technique: Yes Music technique: No Positive guidance technique: Yes Auto Suggestion technique: No Guidance for performing functional tasks: No Abstract guidance**:** Yes Are there enough details about the technique that can be repeated**:** Yes	BPI—Brief Pain Inventory SF-36—Thirty-Six Item Short Form Survey quality-of-life measures	Significantly higher reduction in pain, overall activity, mood, walking ability sleep, and life enjoyment compared to the control group. Intra-group analysis showed significant reductions in the sever-mild pain, and overall pain scores and significant improvement was shown for overall daily activity, mood, sleep, routine work, walking ability, life enjoyment, and relationships with others
Case (2018)	Exploratory efficacy study (assigned alternately 1:1) 23 participants 13 intervention group 10 control group positive journaling activity for 1 h once a week for 10 weeks	**GI:** Healing Light Guided Imagery (HLGI) **Duration:** 1 h **Frequency:** once a week for 10 weeks and daily use at-home **Characterized:** Relaxation technique: Yes Music technique: No Positive guidance technique: Yes Auto Suggestion technique: Yes Guidance for performing functional tasks: Yes Abstract guidance: Yes Are there enough details about the technique that can be repeated: Yes	BDI-II—Beck Depression Inventory-II FSS—Fatigue Severity Scale MS-QOL-54—Multiple Sclerosis Quality of Life instrument	Significantly higher reduction in a depressed mood, and fatigue, and significant improvement in physical and mental quality of life compared to the control group

Table 1 (continued)

Study	Design	Types and characteristics of GI	Outcomes	Results
Chen (2010)	Randomized control study 19 participants 11 intervention group 7 control group—face-to-face session or telephone call	**GI:** Abbreviated Progressive Relaxation Technique (APRT) and Guided Imagery (GI) **Duration:** The APRT procedure (30 min) + GI scripts (9–12 min) **Frequency:** 6 weeks once or twice a day combined abbreviated intervention **Characterized:** Relaxation technique: Yes Music technique: No Positive guidance technique: Yes Auto Suggestion technique: Unknown Guidance for performing functional tasks: Yes Abstract guidance: Yes Are there enough details about the technique that can be repeated: No	McGill Pain Questionnaire DASS-21—Depression Anxiety and Stress 21 Scale RAND 36-item- self-report scale overall health status SF-36 Daily Diary Individual Global Achievement Scales—IGAS	No significant differences were found. But results indicated consistent clinical improvement in pain, mental health, quality of life, and sleep compared to the control group
Lewandowski (2011)	Experimental pilot study 25 participants No control group	**GI:** Guided imagery **Duration:** 17-min compact disc (CD) **Frequency:** Participants were requested to use the GI CD twice daily during the last 8 weeks of the 12-week study period **Characterized:** Relaxation technique: Yes Music technique: Yes Positive guidance technique: Unclear Auto Suggestion technique: Unclear Guidance for performing functional tasks: Yes Abstract guidance: Yes Are there enough details about the technique that can be repeated: No	MPQ—McGill Pain Questionnaire PDI—Pain Disability Index MPI—Multidimensional Pain Inventory Plasma cortisol Lymphocyte subsets Lymphocyte proliferation Interleukin I β Daily journal	Significant statistical improvement in pain intensity and pain disability. No significant changes in plasma cortisol, lymphocyte subsets and interleukin I β

Table 1 (continued)

Study	Design	Types and characteristics of GI	Outcomes	Results
Menzies (2008)	Pilot study—pretest, post-test design 10 participants No control group	**GI:** Relaxation and GI **Duration:** 20 min **Frequency:** 10 weeks **Characterized:** Relaxation technique: Yes Music technique: No Positive guidance technique: Yes Auto Suggestion technique: Yes Guidance for performing functional tasks: Unknown Abstract guidance: Yes Are there enough details about the technique that can be repeated: No	VAS—Visual Analog Scale SF-MPQ—Short-form McGill Pain Scale FIQ—Fibromyalgia Impact Questionnaire ASES—Arthritis Self Efficacy Scale MHI—Mental Health Inventory	Significantly higher reduction in pain improves functional status scores and self-efficacy. No statistical significance was found in psychological distress

Torres et al. [13] examined the Group Music and Imagery Method (GrpMI) among female fibromyalgia patients. The structure of each session commenced with a verbal dialog encouraging an open verbal input and acknowledgment of the images that arose spontaneously while listening to music. In addition, participants reported imaging experiences, such as physical sensations, emotions, memories, and thoughts, that may be associated with the session's given theme or other matters. In the subsequent conversations, patients were encouraged to consider and impart meaning to their imaging experiences and relate them to their everyday life. The next stage was relaxation and its implication. The therapist guided the participants into a relaxed state while adapting to their specific needs to facilitate access to a non-ordinary state of consciousness, i.e., focusing on breathing, progressive muscle relaxation, or color/light sensations enveloping the body. After this relaxation guidance, participants were requested to listen to music while contemplating the session's theme. They were expected to allow images and/or sensations to emerge with the help of the music by listening and experiencing these sensations fully. Focusing on the theme of the session can assist the participants in experiencing the imagery sequences. The next stage consisted of active listening to a selection of music. No dialog ensued between the therapist and the participants during this segment. Next came creative drawing (mandala). Once the music ended, participants were asked to spontaneously draw a picture, graphically and symbolically, expressing what they considered to be most important or significant about the session. Finally, a dialog began between the participant and the therapist. The participants were asked to share their experiences and feelings when they listened to the music, perceiving the images, how the images were expressed in their drawing (mandala), and explain the most significant aspects of this experience. The therapist intervened to offer guidance and summations that helped internalize the participants' perceptions and reinforce their positive internal skills and strengths.

Onieva-Zafra et al. [14] evaluated GI as a nursing intervention for pain management and depression in patients diagnosed with fibromyalgia. The intervention included two GI CDs developed by the authors. The GI intervention group participated in two phases of the treatment application. During the first week, one of the authors performed the initial session of relaxation to familiarize the patient with relaxation and visualization of the images. The intervention was recorded on a CD, using the voice of the same author. Subsequently, the patients attended a second session with the same researcher to further practice GI relaxation based on Martha Rogers's model [15]: "… Close your eyes. Begin by breathing in fully and deeply through your nose, blowing out fully and deeply through your mouth …. Let yourself feel calm and revitalized by each breath …. As you watch your

breathing, you will notice that you have become calmer and more peaceful... that your inner space expands... and that you have become alert but quiet…." "… Silently, begin to describe your pain to yourself… Be present with the pain… Know that the pain may either be physical sensations … or worries and fears … the pain can be anything … whatever comes to your mind …. Let your pain take on a shape … become aware of its dimensions …. What is the height … the width … the depth… Give it color … a shape … feel the texture … give it a sound…" "… Now with your eyes still closed … let your hands come together with palms turned upward as if forming a cup… Put your pain object in your hands … How would you change the shape … the size… Now change the color … and its texture … Give it a different sound … decide what you would like to do with the pain …. There is no right way to finish the experience … just accept what feels right to you …. You can throw the pain away … or place it back where you found it … or move it somewhere else …. Let yourself become aware …. of how pain can be changed …. By focusing with intention, the pain changes."

Baird et al. [16] utilized the Guided Imagery Relaxation (GIR) method in a study of 30 patients designed to evaluate the effect of GI on pain and mobility. Response imagery (imagining oneself in a pleasant scene) with an end-state suggestion was the technique employed. The five components of the GIR script were (1) relaxation induction, (2) utilization of the senses, (3) progressive relaxation, (4) imagining oneself moving easily, and (5) end-state suggestions. GI with relaxation employs guided cognition to increase focus and relaxation. Therefore, verbal offers were given to create a flow of thoughts focusing the individual's attention on imagined visual, auditory, tactile, and olfactory sensations. The script guided the patient to relax from head to toe and not to tense his/her muscles to eliminate any possible additional cause of pain. During the 4th component, the patient returned to the scene after the guided relaxation, and imagined stretching, standing, walking, and climbing with minimal pain and difficulty. The end-state suggestion was that reduction in pain and improvement in mobility would persist after the GIR is completed.

Lewandowski's study [17] of a clinical sample of chronic pain sufferers, using Martha Rogers's model, tested the effectiveness of utilizing GI to promote pattern change. Participants were first guided into a state of relaxed focus. At the beginning of the GI technique, such a state of awareness furthered the participants' ability to form and absorb the images. Sensory images were subsequently suggested, and personal images relating to the participant's pain experience were evoked. The participants were then guided to personally change their experience. Kaplun et al. [18] in an exploratory controlled trial evaluated the effect of a brief GI session on female patients diagnosed with fibromyalgia. This study tested whether training during a brief GI exercise (1–2 min) could reduce perceived pain levels and improve quality of life. The participants underwent imagery training employing the "Colette's technique" model. The group performed six different exercises: breathing to achieve calm and serenity, and five other exercises aimed at promoting the patient's healing power and lowering painful sensations, i.e., the tree exercise, the olive oil exercise, the magnet exercise, the blue light exercise, and the waterfall exercise.

Case et al. [19] examined the potential of the Healing Light GI (HLGI) technique developed by multiple sclerosis (MS) patients, specifically, for help in alleviating their symptoms. In addition to the relaxation component, the therapeutic use of GI includes employing active visualization or directed imagery to change behavior and receptive imagery to help relieve symptoms and improve one's mood. The following are components of a typical HLGI session (8 steps): (1) induction process to relax the patient; (2) creative imagination when walking up 20 stairs; (3) pending visualization of the stairs, the patient and therapist either walk down the stairs together (to deepen the experience) or if there is a blockage, to identify and resolve it; (4) suggest to the patient to imagine sitting on their favorite chair and its comfortability; (5) suggest that they imagine viewing a rainbow in the distance with a certain color standing out. Through their creative imagination, the patient either sees or does not see the rainbow. If there are visualization difficulties, i.e., the patient sees only a single-color light (usually white), the therapist would then work with the patient until he/she would allow the light to embrace, thus, enabling their creative imagination to continue with the necessary steps; (6) the patients are asked to creatively imagine bending this light toward their needs at that moment, i.e., that the light is weaving its way through their neural pathways, providing support to their nervous system. This is often reported as a tingling sensation. Once the patient's capacity to work with the light is in place, the same process is enacted for the heart, the circulatory system, various organs, and cells. The patient should observe these systems lighting up, pending his/her visualization process that day. During this process, subtle changes will appear in the patient's posture and expression. Additional suggestions may be provided to keep the patient engaged in this process; (7) following this main element of the HLGI session, the patient and therapist reverse direction and walk down the stairs together, and the patient is brought out of the GI state; (8) the session concludes with a debriefing and discussion of the patient's experience.

Chen and Francis [20] examined the effect of a combined abbreviated progressive relaxation technique (APRT) and GI intervention in the management of chronic pain. The APRT procedure encompassed feet, legs, and thighs; lower back and stomach; upper back and chest; shoulders and neck; arms and hands; mouth and jaws; eyes and forehead. Both the dominant and the non-dominant sides of the body were

simultaneously activated, followed by a conscious tension release.

Individualized GI scripts were created for the participant's preferred scenery/place, utilizing information obtained during the initial session. The participant was guided to create a place in their mind by using their senses of touch, smell, sound, sight, and taste. Furthermore, the GI script incorporated suggestive phrases to transform the participant's pain/tension and increase their awareness of control over the pain. Lewandowski et al. [21] in a sample of patients with chronic cancer and no pain, employed a GI intervention to evaluate its effect on pain and pain disability. The GI consultant also provided a professional voice-over narration of the script with soft background music playing from the GI CD throughout the session. While listening to the CD, the participants were guided into a state of relaxation. Sensory images were suggested, and the participants' own images relating to their pain experience were evoked. Subsequently, the participants were guided to create a personal change in their pain experience.

Menzies and Kim [22] in a pilot study, evaluated the effect of relaxation and GI in Hispanic patients diagnosed with fibromyalgia. The intervention consisted of relaxation and GI audiotapes. The first tape of the 3-tape intervention series included instructions on muscle relaxation and release of tension, encouraging an overall sense of well-being. The second tape was a shortened version of the relaxation response script, followed by the imagery of a pleasant scene. The listeners were instructed to carefully notice that when they were in their imagined pleasant scene, they felt "better and better." The participants were encouraged to become familiar with the surroundings of their imagery. The third tape reinforced the conditioning for relaxation. Within the familiarity of the relaxed state, the imagery script reminded the participants that with imagery, they could imagine anything they wanted, including seeing themselves with their "mind's eye" performing certain behaviors as if they had been free of all fibromyalgia symptoms (end-state imagery). The characteristics of the GI methods are summarized in Table 2. Only three studies (out of 12) provided sufficient details relating to the GI technique, allowing the study to be replicated.

There are certain similar characteristics of GI which have been utilized in most studies evaluating the effect of GI on pain and function, i.e., all studies used relaxation as a component of GI. Eleven out of 12 studies used positive guidance techniques and guidance for performing functional tasks; 9/12 studies used abstract guidance. Therefore, we believe that these characteristics are universal when applying GI techniques and should be used in all future studies (to allow a fair comparison) and clinical practice. On the other hand, music and auto-suggestive techniques were rarely used in these reviewed studies. The duration and frequency of GI sessions also varied considerably between studies. In most studies, GI training took place at least once a day for 4–12 weeks, with an average duration of ~20 min (12–30 min). However, two studies reported training sessions lasting 1–2 h [13, 19], one study 7 min [17], and another study 1–2 min of brief GI [18]. Due to the great variability and lack of accurate information relating to this experiment, no conclusions can be drawn as to the recommended frequency and duration of the training. Nevertheless, it can be concluded that when GI is utilized in treatment or research, practice and repetition are necessary. Additional studies are required to establish the most effective protocols of GI.

Efficacy of GI

Numerous studies have demonstrated the efficacy of GI in reducing pain, anxiety, depression, stress, medication use, and improving quality of life (Tables 1, 3).

GI in Fibromyalgia Patients

Six studies evaluated the effect of GI on fibromyalgia symptoms. Menzies et al. [9], in their RCT of 72 participants, examined the effectiveness of GI as an adjunctive modality on self-reported self-efficacy, levels of perceived stress, and selected biobehavioral factors in women who have fibromyalgia. The participants were divided into two groups: 36 in the intervention group were treated according to their prescribed regimen + GI, and 36 in the control group were treated only according to their prescribed regimen (subjects were asked to maintain their current care practices in managing fibromyalgia). The authors found a significantly higher reduction in pain, stress, fatigue, and depression in the GI group compared to the controls. No statistically significant changes were found in biomarker levels (cytokine and C-reactive protein, CRP). Verkaik et al. [10] examined the effect of GI in an RCT of 65 patients who have fibromyalgia. The intervention group ($n = 32$) participated in group discussions and received information explaining the GI protocol. The control group ($n = 33$) participated only in group discussions. No significant effects due to GI were observed on pain intensity, functional status (FIQ), and self-efficacy in the fibromyalgia patients.

Torres et al. [13] investigated the effect of the GrpMI on the symptoms of fibromyalgia patients in an RCT of 56 participants. The intervention group ($n = 36$) included sessions of GrpMI. The control group ($n = 26$) did not receive additional services and simply followed the existing care regimen. The authors performed an intra-group analysis and found that the GrpMI significantly increased

Table 2 Characteristics of the guided imagery

Characteristics	Results out of 11 studies
Duration	Great variability between studies: 2–120 min
Frequency	Great variability between studies: 4 days to 16 weeks, between 1–3 × day
Relaxation technique	12 studies
Music technique	4 studies
Positive guidance technique	11 studies
Autosuggestion technique	4 studies
Guidance for performing functional tasks	10 studies
Abstract guidance	9 studies
Is there enough information to replicate the study?	3 studies

the patients' psychological well-being, functional capacity, and health and significantly decreased pain perception, anxiety, and depression post-treatment, with a sustained benefit observed at the 3-month follow-up for all variables except for psychological well-being. In the inter-group analysis, GrpMI participants scored significantly higher for psychological well-being and lower-state anxiety post-treatment compared with the controls; however, no differences were observed between groups at the 3-month follow-up. Onieva-Zafra et al. [14] reported on the effects of GI on patients diagnosed with fibromyalgia. The RCT comprised 60 participants randomly assigned to a GI ($n = 30$) or a control group ($n = 30$). The intervention group listened to two GI compact discs, according to Martha Rogers's model. The control group was treated according to the usual care regimen for fibromyalgia patients. The results showed significantly lower levels of pain and depression than the controls at the 4th-week evaluation. At the 8th week, no significant differences were found in the visual analog scale (VAS) for depression and the McGill Pain Long Questionnaire (MPQ-LF) for pain. However, a significant improvement in the intervention group was observed in the daily pain scores from baseline to week 4, both while resting and in movement. Furthermore, a significant improvement from baseline to week eight was found for depression as measured by the Beck Depression Inventory. Kaplun et al. [18] investigated the effect of a brief GI session on 37 patients who have fibromyalgia in an exploratory controlled study (assigned alternately 1:1). Participants in the treatment group ($n = 18$) used Colette's model, a brief GI technique [23]. The control group ($n = 19$) was treated according to the usual care

Table 3 Efficacy of the guided imagery

Outcome measures	Significant	Not significant
Pain	8	2
Pain disability	1	
Anxiety	1	
Mobility	1	
Gait velocity	1	
Stress	2	
Fatigue	1	
Depression	4	
Mental health		1
Mood	1	
Quality of life, well-being	2	1
Sleep		1
Functional status and self-efficacy	1	1
Over the counter (OTC) medication	1	
Prescribed analgesics, prescribed arthritis medication	1	
Biomarker levels		1
Plasma cortisol, lymphocyte subsets, and interleukin I β		1
The inflammatory and proliferative capability of monocytes and T cells	1	
Hair cortisol concentration	1	

regimen for fibromyalgia patients. After completion of the intervention, the control group also commenced the treatment protocol. The authors' findings indicated a significant improvement in pain, overall activity, mood, walking ability, sleep, and enjoyment of life compared to the control group. The intra-group analysis demonstrated significant reductions in all types of pain (severe to mild), and overall pain scores. Significant improvement was also reported for overall daily activity, mood, sleep, routine work, walking ability, enjoyment of life, and relationships with others.

Menzies and Kim's [22] pilot study of 10 patients diagnosed with fibromyalgia examined the effectiveness of relaxation and GI on symptom management, finding a significant improvement in pain, FIQ, self-efficacy for managing pain, and self-efficacy for other symptoms (fatigue, function, etc.). No statistical significance was found in psychological distress, i.e., anxiety, depression, and loss of behavioral/emotional control (Mental Health Inventory).

GI Treatment in Patients Suffering from Chronic Pain

Lewandowski's study [17] on patients suffering from chronic pain investigated the effectiveness of utilizing GI. Forty-two participants were randomly assigned to treatment ($n=21$) and control ($n=21$) groups. Participants in the treatment group employed the GI technique according to Martha Rogers's model. Participants in the control group were apprised that the investigator would monitor them and that after this period, they would learn and practice the technique. The findings of this study revealed that GI was effective in reducing pain in a sample of chronic pain sufferers. Participants in the treatment group reported significantly less pain during the last 2 days of the study compared to the controls. In Chen and Francis's RCT [20], the efficacy of a combined APRT and GI intervention in participants presenting with chronic pain, was investigated. The intervention group ($n=11$) practiced the APRT and GI. An audio recording was provided to participants for home practice. The control group ($n=7$) participated in a face-to-face session or telephone call. The results showed no statistically significant differences between the groups. However, a trend of clinical improvement was observed for two types of measures: quality of life domains (especially those related to pain) and mental health (depression and stress).

Lewandowski et al.'s pilot study of 25 subjects [21] evaluated the effects of GI on pain and pain disability in patients suffering from chronic pain and observed a significant reduction in pain intensity and pain disability, but no significant changes in plasma cortisol, lymphocyte subsets, and interleukin Iβ.

GI Treatment in Patients with Osteoarthritis or After TKR

Baird et al. [16] evaluated the effect of GIR exercises in an RCT of 30 patients with osteoarthritis. The results of this study support the efficacy of GIR in reducing symptoms. Compared to the control group, the authors found a significant reduction in pain, significant improvement in mobility, as well as a significant reduction in over-the-counter medication, prescribed analgesics, and prescribed arthritis medications. Jacobson et al.'s RCT [12] examined the effect of GI on patients after a TKR. The subjects were divided into an intervention group ($n=29$) who received a GI audiotape and the controls ($n=29$) who received an audiotape recording of poetry, short stories, and essays. The duration of the audiotape was similar in both groups. The authors found that higher gait velocity significantly improved in 6 months in the GI group and that GI significantly reduced the inflammatory and proliferative capability of monocytes and T cells, hair cortisol concentration compared to the controls. The intervention group exhibited significantly lower Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) knee pain scores 3 weeks after surgery than at baseline, whereas the controls exhibited significantly higher mean daily pain VAS scores during the 3-week postoperative period compared with their 2-week mean daily pain.

GI in Patients with MS

Case et al. [19] examined the HLGI in MS patients ($n=23$) and their symptoms in an exploratory efficacy study (assigned alternately 1:1). The intervention group ($n=13$) practiced HLGI. The control group ($n=10$) employed positive journaling and active wait-list control activity. The researchers found significant reductions in depressed moods and fatigue as well as significant improvements in the patient's physical and mental quality of life compared to the controls. When we examined the effects of GI in the 11 studies (Table 3), in most, a significant positive effect on pain, quality of life, and biological indices were observed. Only two studies showed no significant improvement in any parameter. What characterizes the effect of GI on musculoskeletal problems, is the ability to generate a positive effect on chronic conditions such as fibromyalgia, osteoarthritis, and MS. We believe that by employing GI, a positive effect on chronic pain and quality of life will be created.

Possible Mechanisms of GI's Effect on Pain and Health-Related Quality of Life

To the best of our knowledge, the mechanism of GI on pain is not entirely well-defined. Scientific publications have reported on various viewpoints and theories as to the effect

of GI. Chadderdon et al. [24] in their review of the underlying mechanisms of psychological interventions observed during magnetic resonance imaging (MRI), stated that GI utilizes verbal suggestions in order to create a flow of thoughts, thus, focusing an individual's attention on imagined visual, auditory, tactile, or olfactory sensations. They suggested that GI deactivates the sympathetic nervous system and engages the parasympathetic nervous system, leading to decreased stress and physiological arousal and that hypnosis and GI are similar processes that include helping patients refocus their attention from environmental stimuli and personal stress to imagined stimuli, thus, activating the parasympathetic nervous system, reducing arousal, and increasing relaxation. Yijing et al. [25] revealed the enhancing effects of GI on the indices of heart rate variability (HRV). HRV is the change in the time interval between heartbeats, beat to beat, controlled by the autonomic nervous system (sympathetic and parasympathetic nervous system). Moreover, HRV reflects the capacity of the central autonomic network, including the prefrontal cortex, central nucleus of the amygdala, hypothalamus, and brainstem, to meet and adapt to environmental demands. It also reinforces an individual's capacity to regulate their emotions and may be critical to psychological flexibility [25].

In addition, other studies have [26–28] suggested that the utilization of GI to reduce pain is based on the biopsychosocial theory of chronic pain. According to the theory, multiple factors affect sensation, transmission, and perception of pain. GI may affect higher brain centers by blocking the transmission of nociceptive stimuli. Another mechanism suggested by Banks et al. [29] is the possible interaction of the amygdala with the frontal cortex that may change pain perception with GI use. Some researchers suggest that GIR may reduce autonomic nervous system responses, thus, resulting in the relaxation of skeletal muscle tension near the affected joint [30, 31]. Menzies et al. hypothesized that GIR might initiate cognitive processes such as distraction and refocus attention from pain to pleasant imagery [32]. According to Baston et al.'s psychoneuromuscular theory, GI stimulates the mental rehearsal of desired movements [33]. Electroencephalogram, MRI, and positron emission tomography studies have demonstrated that imagery rehearsal creates activity in the brain, thus, duplicating the actual motor movement being rehearsed [34]. Repeated practice with GIR may lead to the expectation that moving with less pain and difficulty will lead to post imagery use of rehearsed bodily actions.

Conclusions

After examining the reviewed studies, we conclude that GI may be a helpful tool in managing pain, depression, stress, fatigue, anxiety, reducing medication use, improving general well-being, wellness, and quality of life [9, 16, 20, 21] in patients with musculoskeletal disorders. Characteristics of GI significantly varied between studies. The majority of studies employed the following components: relaxation, positive guidance, abstract guidance, and guidance for performing functional tasks. Although the components of GI were common, their execution differed, i.e., relaxation, instruction to observe or concentrate on his/her breathing or to concentrate on different organs of the body with instruction to release each one slowly, incorporating suggestive phrases or just listening to the music. Great variability in practicing GI was found in the following areas: (1) combining other techniques while using GI; (2) the length of time the GI is performed; (3) frequency: per day, weeks, or months. The studies showed a variability both in the duration of the GI training and in its frequency of use; therefore, it is challenging to ascertain the recommended duration for GI therapy/training—20 min or maybe a few minutes? Should GI training be performed once or several times a day? Does the training vary from subject to subject? Although a positive effect of GI training was observed, many unresolved issues remain.

One feature that characterizes all the GI techniques was repetitiveness. Moreover, all types of GI therapy require training. Despite the differences in the studies, GI is a safe, non-invasive technique that assists in dealing with musculoskeletal pain. Therefore, we recommend continuing to investigate the mechanism and efficacy of GI in various musculoskeletal disorders.

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References

1. George RJ, Sam ST. Guided imagery: + child guided imagery = reduced pain, stress, and anxiety. Let your child get healed without pain and expenses. Asian J Nur Educ Res. 2017;7(1):79–85. https://doi.org/10.5958/2349-2996.2017.00017.9.

2. Bonadies V. Guided imagery as a therapeutic recreation modality to reduce pain and anxiety. Ther Recreation J. 2009;43(2):43–55.
3. Merriam-Webster. Medical Dictionary, guided imagery, 2015. Available at http://www.merriamwebster.com/medical/guided%20imagery. Accessed 8 Jan 2019.
4. Kosslyn SM, Ganis G, Thompson WL. Neural foundations of imagery. Nat Rev Neurosci. 2001;2(9):635–42.
5. National Center for Complementary Integrative Health. Relaxation techniques for health. https://nccih.nih.gov/health/stress/relaxation.htm. Accessed 13 Dec 2017.
6. Trakhtenberg EC. The effects of guided imagery on the immune system: a critical review. Int J Neurosci. 2008;118(6):839–55. https://doi.org/10.1080/00207450701792705.
7. Kaplan U, Epstein GN, Smith AS. Microdevelopment of daily well-being through mental imagery practice. Imagin Cogn Pers. 2014;34:73–96. https://doi.org/10.2190/IC.34.1.f.
8. Taylor SL, Herman PM, Marshall NJ, et al. Use of complementary and integrated health: a retrospective analysis of US veterans with chronic musculoskeletal pain nationally. Med Complement Altern J. 2018;25(1):32–9. https://doi.org/10.1089/acm.2018.0276.
9. Menzies V, Lyon DE, Elswick RK, et al. Effects of guided imagery on biobehavioral factors in women with fibromyalgia. J Behav Med. 2014;37(1):70–80. https://doi.org/10.1007/s10865-012-9464-7.
10. Verkaik R, Busch M, Koeneman T, et al. Guided imagery in people with fibromyalgia: a randomized controlled trial of effects on pain, functional status and self-efficacy. J Health Psychol. 2014;19(5):678–88. https://doi.org/10.1177/1359105313477673.
11. Jacobson AF, Lewandowski W, Palmieri PA, et al. Feasibility trial of guided imagery and control interventions in mock subjects. Appl Nurs Res. 2011;24(1):45–52. https://doi.org/10.1016/j.apnr.2009.01.002.
12. Jacobson AF, Umberger WA, Palmieri PA, et al. Guided imagery for total knee replacement: a randomized, placebo-controlled pilot study. J Altern Complement Med. 2016;22(7):563–75. https://doi.org/10.1089/acm.2016.0038.
13. Torres E, Pedersen IN, Pérez-Fernández JI. Randomized trial of a Group Music and Imagery Method (GrpMI) for women with fibromyalgia. J Music Therapy. 2018;55(2):186–220. https://doi.org/10.1093/jmt/thy005.
14. Onieva-Zafra MD, García LH, Del Valle MG. Effectiveness of guided imagery relaxation on levels of pain and depression in patients diagnosed with fibromyalgia. Holist Nurs Pract. 2015;29(1):13–21. https://doi.org/10.1097/HNP.0000000000000062.
15. Butcher HK, Parker NI. Guided imagery within Rogers' science of unitary human beings: an experimental study. Nurs Sci Q. 1988;1(3):103–10. https://doi.org/10.1177/089431848800100305.
16. Baird CL, Murawski MM, Wu J. Efficacy of guided imagery with relaxation for osteoarthritis symptoms and medication intake. Pain Manag Nurs. 2010;11(1):56–65. https://doi.org/10.1016/j.pmn.2009.04.002.
17. Lewandowski WA. Patterning of pain and power with guided imagery. Nurs Sci Q. 2004;17(3):233–41. https://doi.org/10.1177/0894318404266322.
18. Kaplun A, Roitman P, Rosenbloom T. Effects of brief guided imagery on female patients diagnosed with fibromyalgia: an exploratory controlled trial. Med Health Ther Altern. 2020;20.
19. Case LK, Jackson P, Kinkel R, et al. Guided imagery improves mood, fatigue, and quality of life in individuals with multiple sclerosis: an exploratory efficacy trial of Healing Light Guided Imagery. J Evid Based Integr Med. 2018;23:2515690X17748744. https://doi.org/10.1177/2515690X17748744.
20. Chen YL, Francis AJ. Relaxation and imagery for chronic, nonmalignant pain: effects on pain symptoms, quality of life, and mental health. Pain Manag Nurs. 2010;11(3):159–68. https://doi.org/10.1016/j.pmn.2009.05.005.
21. Lewandowski W, Jacobson A, et al. Biological mechanisms related to the effectiveness of guided imagery for chronic pain. Biol Res Nurs. 2011;13(4):364–75. https://doi.org/10.1177/1099800410.
22. Menzies V, Kim S. Relaxation and guided imagery in Hispanic persons diagnosed with fibromyalgia: a pilot study. Fam Community Health. 2008;31(3):204–12. https://doi.org/10.1097/01.FCH.0000324477.48083.08.
23. Epstein G. Healing visualizations. New York: Bantan Books; 1989.
24. Chadderdon AL, Carns DR, Pudalov LR, et al. Underlying mechanisms of psychological interventions in magnetic resonance imaging and image-guided radiology procedures. Top Magn Reson Imaging. 2020;29(3):157–63. https://doi.org/10.1097/RMR.0000000000000239.
25. Yijing Z, Xiaoping D, Fang L, et al. The effects of guided imagery on heart rate variability in simulated spaceflight emergency tasks performers. Biomed Res Int. 2015;2015: 687020. https://doi.org/10.1155/2015/687020.
26. Meeus M, Nijs J. Central sensitization: a biopsychosocial explanation for chronic widespread pain in patients with fibromyalgia and chronic fatigue syndrome. Clin Rheum. 2007;26(4):465–73. https://doi.org/10.1007/s10067-006-0433-9.
27. Melzack R. From the gate to the neuromatrix. Pain. 1999;6:S121–6. https://doi.org/10.1016/S0304-3959(99)00145-1.
28. Melzack R. Pain and the neuromatrix in the brain. J Dent Educ. 2001;65(12):1378–82.
29. Banks Sarah J, Eddy KT, Angstadt M, Nathan PJ, et al. Amygdala–frontal connectivity during emotion regulation. Soc Cogn Affect Neurosci. 2007;2(4):303–12. https://doi.org/10.1093/scan/nsm029.
30. Benson H. The relaxation response. New York: William Morrow; 1975.
31. McCaffery M, Pasero C. Pain: clinical manual. 2nd ed. St. Louis, MO: Mosby; 1999.
32. Menzies V, Taylor AG, Bourguignon C. Effects of guided imagery on outcomes of pain, functional status, and self-efficacy in persons diagnosed with fibromyalgia. J Altern Complement Med. 2006;12(1):23–30. https://doi.org/10.1089/acm.2006.12.23.
33. Batson G, Feltman R, McBride C, et al. Effect of mental practice combined with physical practice on balance in the community-dwelling elderly. Act Adapt Aging. 2006;31(2):1–18. https://doi.org/10.1300/J016v31n02_01.
34. Stephenson NL, Herman J. Research brief. Pain measurement: a comparison using horizontal and vertical visual analogue scales. Appl Nurs Res. 2000;13(3):157–8. https://doi.org/10.1053/apnr.2000.7658.