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ORIGINAL ARTICLE

The Effect of Music on Procedural Analgesia and Anxiety of Patients Undergoing Diagnostic Facet Block for Low Back Pain

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ABSTRACT

Aim: Chronic back pain is a common health problem which deteriorates quality of life which may be managed by medical therapy, interventions and surgery. Interventional therapies, including facet blocks and facet denervations are used regularly. Music therapy may be used before or during the painful interventional procedures with or without sedation. The study was designed to assess the effects of listening to music on procedural analgesia and anxiety during diagnostic facet block procedure.

Method: Volunteering 52 patients that were involved in the study were randomly allocated into intervention and control groups of 26 patients each. The intervention group listened to music of their choice, if they demanded or classical music with headphones during the procedure. The control group did not listen to music. A combination of midazolam, morphine and fentanyl were used for sedation and analgesia in both groups.

Results: The majority of the patients were women (77%) and the mean age was 55. We used Numeric Rating Scale (NRS) to assess pain, Spielberger State Trait Anxiety Inventory-6 (STAI-6) to assess anxiety and Ramsay Sedation Scale to determine the clinical level of sedation. No clinical or statistical significant differences in pain scores between control and intervention groups were found, when sedation effect was corrected (p=0.68). Ramsey Sedation Scores and NRS Scores were similar. Mean STAI-6 Score s were 9.5 ± 0.611 in the intervention group and 12.5 ± 0.726 in the control group (mean ± SE). The reduction in anxiety scores was significant both clinically and statistically, when sedation effect was corrected (p=0.006).

Conclusion: Listening to music is an easy to use method that may be effective to reduce anxiety in patients with chronic low back pain during facet block procedure.

Keywords: low back pain, music therapy, anxiety, anxiolytic agents, analgesia.

INTRODUCTION

Chronic low back pain is common in adults and has distressing effects on quality of life of the patients, labor force and health expenditures. It has been reported that 25% to 45% of chronic low back pain originates from the facet joints. Interventional procedures such as nerve branch blocks, intra-articular injections, denervations are useful in patients when satisfactory relief cannot be achieved with analgesic drug treatment. Short and long-term efficacy of named interventions has been established [1]. Interventional treatment methods for low back pain are used commonly. The procedures are usually performed in operating room conditions and adequate analgesia and sedation are provided since the procedures are moderately painful.

Music has become a non-pharmacological tool that is increasingly used in clinics to increase patient comfort and reduce pain and anxiety [2]. One of the known physiological effects of music is the feeling of relaxation, and simultaneous clinically measurable blood pressure and heart rate changes have been demonstrated [3]. It is suggested that listening to music during post-surgical care, painful processes such as labor and some minor interventional procedures increases patient satisfaction and reduces pain. Music therapy can be used effectively either solitarly or concurrently with analgesic and sedative agents [4].

Music therapy is defined by the American Music Therapy Association as the use of music to achieve set goals during a course of therapy by a trained music therapist. Music therapists direct therapy according to their patients' needs, goals and perceptions of music. Live music is often present in these therapies, and patients often go beyond passive listening; this can be in the form of singing, keeping rhythm, playing an instrument or dancing [5].

Medical music, on the other hand, was described as the presentation of recorded music by the medical personnel and passive listening by the patient. Headphones are often utilized. The patient may or may not be involved in the choice of music [6].

The most distinguished and well studied effect of music therapy is anxiolysis. This effect has been observed in several studies in different settings [7-10]. Bringman's study demonstrated that music alone, was more effective than midazolam sedation in reducing anxiety in pre-operative patients, and had similar effects on pulse rate and blood pressure [11]. Considering the possible side effects of sedative drugs such as midazolam, music therapy can be recommended as an effective anxiolytic therapy in patients waiting for surgery.

It is demonstrated that music has physiological effects. The pulse rate decreases slightly, blood pressure and respiratory rate decreases, with music [6, 10]. However, there are some inconsistencies in the data of the publications reviewed, the mentioned effects are not prominent and may not have clinical significance.

There is marked variability in results of studies on music medicine. It is essential to be considerate in interpreting the results [12]. Music was found to be superior to standard care and placebo in reducing pain during needle interventions in children [13]. There is evidence about the efficacy of music in the pediatric population, in controlling prick, procedural, and postoperative pain [14]. Another use of music in medicine is the reduction of pain during medical interventions. Various studies report a decrease in pain scores, however, the discrepancy in results of different studies, manifest methodological weaknesses of some studies may lead to limitation of the evidence obtained.

In the light of this information, music therapy can be used to reduce anxiety and pain in patients who will undergo interventional procedures with or without sedation, before and after surgery. The main advantages of the treatment are that it is simple in application, non-invasive and inexpensive, does not contain any pharmacological interaction and has no known adverse effects.

In this study, it was aimed to evaluate the effect of listening to music during the procedure on patient comfort and pain in patients with chronic low back pain caused by facet joint degeneration and undergoing diagnostic facet block.

MATERIALS AND METHODS

This study was planned as a prospective, randomized, controlled study and was conducted

in a university hospital. Volunteer patients between the ages of 40 and 85 who was planned to undergo diagnostic facet block procedure for low back pain were enrolled to the study. The patients who had severe hearing loss, difficulty in verbal communication due to mental or physical reasons, an altered state of consciousness that hinders answering questions to be used in assessing pain and anxiety were excluded from the study. A total of patients 52 were included in the study. Written informed consent was obtained from all participating patients. The patients were randomly allocated to one of the two groups; intervention and control groups. During the procedure, the patients in the intervention group listened to the kind of music they would like with headphones. The music was initiated before sedation and analgesia were administered to patients in the intervention group, soon after they were brought in to the operating room. The patients in the control group did not listen to music and no earphones were used. For the patients in both groups, sedation and analgesia were administered by the anesthesiologist in charge, regardless of the group, according to the clinical condition and needs of the patient. Clinical decisions, such as the technique of the procedure and the decision to discharge the patients were up entirely to the anesthesiologist in charge of the unit.

The anxiety level was measured with the short version of the Spielberger State–Trait Anxiety Inventory (STAI-6). The original inventory included forty questions [15]; however, short forms were developed, and reliabilities were established eventually [16,17]. The inventory was translated to Turkish and found use in some medical studies [18,19].

Sedation levels of all patients included in the study were evaluated during the procedure. After the procedure was complete and the patient fully recovered from sedation, their perception of pain and comfort during the procedure were assessed, demographic data such as age, weight, gender, and the total doses sedative and analgesic administered were obtained from the patient file. Ramsay sedation score was used to evaluate sedation level, verbal numerical rating scale (NRS) was used for pain assessment, and STAI-6 scale was used for comfort-anxiety assessment. In addition, the age, gender, weight information of the patients and the drugs they took were also noted. No information was collected regarding the identity of the patients.

Ramsay sedation score was used to evaluate the sedation levels of the patients [20] to evaluate patients under sedation in the intensive care unit and has been widely used for many years. Ramsay sedation score provides an assessment that can be converted into objective data for the level of sedation, that does not vary according to the population and individuals, and that it is easy to apply. A total of six levels were established, three with the patient awake and three with the patient asleep (Figure 1).

1	Patient is anxious and agitated or restless, or both
2	Patient is co-operative, oriented, and tranquil
3	Patient responds to commands only
4	Patient exhibits brisk response to light glabellar tap or loud auditory stimulus
5	Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus
6	Patient exhibits no response to light glabellar tap or loud auditory stimulus

Figure 1. Ramsay Sedation Score

The numerical pain scale (NRS) was used to evaluate the level of pain, which, is a one-dimensional scale similar to the visual analogue scale (VAS), with the two extremes "no pain" and "unbearable pain". The intensity of pain is scored by the patient verbally, between 0-10 [21].

It is important to evaluate and follow the anxiety levels of patients in the clinic. Spielberger State-Trait Anxiety Inventory (STAI) is a widely used scale all over the world, consisting of 40 positive and negative statements about how the subject feels. Occasionally its length causes functional complexity, so it has been endeavored to develop shorter and uncomplicated but equally reliable version of the scael. STAI-6, which contains three positive and three negative statements, has been derived from STAI [16]. On the STAI-6 scale, the patient scores each of the six statements about his mood as "Not at all", "Somewhat", "Moderately so", "Very much so" (Figure 2).

Anxiety levels were evaluated using the STAI-6 scale, as it is reliable and straightforward. In STAI-6, statements 2, 3 and 6 are positive for anxiety; statements 1, 4 and 5 are negative statements that point to reduced level of anxiety. The scores of positive statements are added and the scores of

	Not at all	Somewhat	Moderately so	Very much so
1. I feel calm	(1)	(2)	(3)	(4)
2. I feel tense	(1)	(2)	(3)	(4)
3. I feel upset	(1)	(2)	(3)	(4)
4. I feel relaxed	(1)	(2)	(3)	(4)
5. I feel content	(1)	(2)	(3)	(4)
6. I feel worried	(1)	(2)	(3)	(4)

Figure 2. Spielberger State-Trait Anxiety Inventory (STAI-6)

negative statements are subtracted from the total and an anxiety score of 6-24 is obtained. Higher scores indicate elevated levels of anxiety. There is no threshold or range [17].

The data of the study was analyzed using IBM-SPSS Statistics program (version 23.0 IBM International Business Machines Inc. Armonk, NY, USA). Descriptive analyzes were performed for demographic data and drug use. Numerical variables are presented as Mean±Standard deviation ($\bar{X}$±SD), minimum and maximum values. Qualitative categorical data are presented as numbers (S) and/or percentages (%).

Linear regression analysis was performed for the statistical assessment of the effect of listening to music on pain and anxiety levels.

Sedation and analgesia was used for all patients in our study, which, may be an independent factor on both pain and anxiety scores; therefore, the sedation levels of the patients (Ramsay Sedation Score) were included in the statistical model. Two separate regression analyzes were performed in which pain scores and anxiety scores of the patients were dependent variables, and listening to music and sedation scores were studied as independent variables. [22].

There were no predetermined standard doses or combinations of sedative and analgesic drugs administered during the intervention procedures of the patients included in the study. The drug type and doses were determined by the anesthesiologist managing the procedure, according to the clinical requirements of the patient. Since it is difficult to calculate the efficacy and potency of drugs in different combinations and their independent and cumulative contribution to sedation and pain levels as a standard data, and an assessment using drug doses directly may not reflect the clinical situation, drug doses were not included in the statistical analysis. Instead, the Ramsay Sedation Score, which gives clinical information of the achieved sedation level, was used in the analysis.

Written permission was obtaied from university non–interventional clinical research ethics committee. Informed consent was obtained from volunteering patients. The study was carried out in accordance with the principles of the Declaration of Helsinki.

RESULTS

A total of 52 patients were involved in the study, of which 40 were female (76.9%) and 12 were male (23.1%). Body weight and age distributions were statisticallty indifferent in theintervention and control groups. There were no statistically significant differences between the intervention and control groups in terms of demographic data. Demographic data are given in Table 1.

Double or triple combinations of midazolam, fentanyl, and morphine were used for sedation and analgesia in patients participating in the study. Midazolam – fentanyl, and this combination was preferred in 22 patients. Fentanyl - morphine combination was used in 11 patients, midazolam -

Table 1. Demographic Data

	N (%)	Gender (M:F)	Age (Years) (Mean±SD)	Weight (Kg) (Mean ± SD)
Intervention Group	26 (%50)	4:22	53.3 ± 13.4	76.7 ± 10.2
Control Group	26 (%50)	8:18	57.8 ± 14.1	75.1 ± 12.7
Total	52 (%100)	12:40	55.6 ± 13.8	75.9 ± 11.4
			p=0.703	*p=0.504*

morphine in 6 patients, and three drugs were used in combination for 9 patients.

Drug useage for midazolam and opioids were studied separately. Equivalent opioid dose was calculated by converting each 10 micrograms of fentanyl to 1 milligram of morphine, intended for analysis of opioid utilization. The dose of midazolam and equivalent opioid dose was calculated per kilogram of patients and analyzed.

Midazolam was used at an average dose of 0.021 mg/kg in the intervention group listening to music, and 0.016 mg/kg in the control group. There was no statistically significant difference in midazolam doses (p=0.876).

The total equivalent opioid dose was 0.0827 mg/kg in the group listening to music and 0.0831 mg/kg in the control group (Table 2). There was no statistically significant difference between these doses (p=0.718).

All patients were evaluated for pain intensity during the procedure using the numerical pain scale (Table 3). All patients were evaluated for their anxiety levels during the procedure using the Spielberger State Trait Anxiety Inventory – 6 (STAI-6). It is seen that the anxiety scores obtained with the scale consisted of values between 6 and 24, with an average anxiety score of 11.25, the maximum anxiety score of 20, and minimum anxiety score of 6 (Table 3).

Sedation may be an independent factor influencing pain and anxiety scores. Since sedation was used for all patients in both groups during the procedure, linear regression analysis, a statistical model that evaluates the effect of both music listening and sedation on NRS and STAI-6 scores has been utilized (Tables 4 and 5).

When the sedation effect is corrected; a statistically significant effect of listening to music on anxiety scores was observed (p= 0.006). The mean STAI-6 scores were found to be 2.74 points lower in the intervention group (9.88±3.115) compared to the control group (12.62 ±3.699). No statistically significant effect of listening to music on pain scores was identified.

DISCUSSION

Low back pain is a complex clinical condition, which is common all over the world, frequently leading to admission to hospitals, and affecting daily life, social and psychological conditions of the patients. It also deteriorates active labor force and public health expenditures significantly [23]. Although low back pain is mostly interpreted as mechanical or idiopathic and considered as benign, the presence of many potential rare but grave etiologies may be neglected making diagnosis and treatment of these patients challenging for numerous physicians. Therefore, it is very important to make a complete and accurate assessment that includes physical and psycho-social aspects [24]. Facet joints are the source of at least 16-41% of low back pain [25]. Facet joint pain is caused by degeneration and arthritis in joint structures. Disc degeneration in the spine and facet joint degeneration are almost always observed together and at equal levels [26].

Guidelines including algorithms for diagnosis and treatment for low back pain have been published by the American College of Physicians and American

Table 2. Opioid and Midazolam Doses

	Intervention Group	Control Group	*p*
Midazolam Dose mg/kg	0.021±0.015	0.016±0.015	0.268
Equivalent Opioid Dose mcg/kg	82.7±30.7	83.1±32.4	0.718

Mean ± SD

Table 3. Sedation Pain and Anxiety scores

	Intervention Group	Control Group	Total	p
Ramsey Sedation Score	3 ± 0.133 (2-4)	3 ± 0.133 (2-4)	3 ± 0.093 (2-4)	1.000
NRS Score	5 ± 0.361 (2-8)	5 ± 0.441 (1-9)	5 ± 0.283 (1-9)	0.687
STAI-6 Score	9.5 ± 0.611 (6-19)	12.5 ± 0.726 (6-20)	10 ± 0.507 (6-20)	0.006

Median ± SE (Min-Max)

Table 4. Effect of music and sedation on pain scores (NRS), Linear Regression Analysis

	β (± SE)	p	%95 CI
Constant	6.499 (±1.193)	-	4.101 – 8.896
Listening to Music	-0.231 (±0.557)	0.681	-1.351 – 0.889
Ramsay Sedation Score	-0.757 (±0.418)	0.077	-1.597 – 0.084
Dependent Variable:	***NRS Score***	***n = 52,***	***R^2 = 0.66***

SE: Standard Error, CI: Confidence Interval

There is no statistically significant difference in pain scores between the study group and the control group as the sedation effect is corrected (p=0.681).

Table 5. Effect of music and sedation on Anxiety Scores (STAI-6), Linear Regression Analysis

	β (± SE)	p	%95 CI
Constant	13.665 (±2.045)	-	9.556 – 17.775
Listening to Music	-2.731 (±0.995)	* 0.006	-4.650 – -0.811
Ramsay Sedation Score	-0.390 (±0.717)	0.589	-1.831 – 1.051
Dependent Variable:	***STAI-6 Score***	***n = 52,***	***R^2 = 0.147***

SE: Standard Error, CI: Confidence Interval

There is a statistically significant difference in anxiety scores between the study group and the control group, as the sedation effect is correct (p=0.006).

Pain Society. The pain management in these guidelines may be classified mainly as patient's self-care and physical exercise, pharmacological treatments, interventional treatments and surgical treatments [27].

Pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" [28] Pain may be related to the subjective, primitive protective experiences of the person in the past [29]. The way the pain is perceived and its severity differs between individuals; however, it is quite common for the same person to perceive inconsistency in pain at different instances and to demonstrate variations in response to it [30]. Chronic pain may be nociceptive, neuropathic, or a combination of both. Psychological and environmental factors play a significant role in chronic pain compared to acute pain [29].

It is often difficult to evaluate patients' pain and anxiety level and transform it into objective data; therefore, various scales have been developed for the common use of clinicians. The most commonly used methods for the assessment of pain in adults are the visual analog scale (Visual Analog Scale for Pain VAS-Pain) and the numerical pain scale (Numeric Rating Scale - NRS). In Visual Analog Scale, the patient marks the pain on a visual scale and provides the clinician a numerical VAS score or the patient typically scores the pain verbally out of ten in Numeric Rating Scale (NRS) [21]. Patients undergoing interventional procedures for low back pain, usually experience intense pain during the procedure, so sedation and analgesia are regularly used. Listening to music before or during the procedure may influence the perception pain and anxiety.

Long questionnaire forms consisting of 20-50 questions are mostly used to evaluate the anxiety status of patients; however, shorter and practical versions of these forms have been designed and put into use when rapid assessment is required or for situations where it is aimed to measure anxiety for a certain event (examination, intervention, etc.). Among them, Spielberger State-Trait Anxiety Inventory-6 (STAI-6) is a scale that is widely used and has been translated into Turkish and validated in this language [16].

It should be noted that the majority (76.9%) of the 52 patients participating in the study were women. The situation is similar in the literature, since majority of patients who admit for examination to pain clinics with low back pain complaints are women. Also, female gender is predictive for more severe low back pain [31].

In our study, three drugs (midazolam, fentanyl, morphine) were used for sedation and analgesia, and they were frequently administered in combination. Similar drug combinations are widely used on interventional sedation and analgesia [32]. Frequently midazolam – fentanyl combination

was used in the study (42%).The use of drugs in combination is intended to benefit from their different effects. For instance, midazolam is a good sedative and anxiolytic but has no analgesic properties. When used reciprocally with fentanyl, which is a strong analgesic, smooth and superior sedation and analgesia is obtained. [33,34] The most recognized adverse effect in drug combinations is the increase in side effects such as respiratory depression [32].

The diagnostic facet block procedure carried out in the pain unit is not lengthy (10-20 minutes), and the patients are asked to arouse and communicate at certain moments during the procedure to answer questions about pain localization and spread. Therefore, patients should be at a level of sedation so as to be aroused by verbal or tactile stimuli. Considering the clinical condition of the patients, sedation and analgesia was administered by the anesthetist in charge of the unit and Ramsay sedation score was sustained within the range of 2-4.

The doses of drugs used in our study were evaluated separately as midazolam and opioid groups. The total equivalent morphine dose was calculated by converting the fentanyl dose to the equivalent morphine dose. There was no difference between the doses of midazolam and opioids used in the patient groups listening and not listening to music. In a study investigating the effects of music on labor pain and anxiety, it was found that the group listening to music had lower postpartum analgesic needs [3]. No such difference was observed in our study. Studies investigating the difference between analgesic needs are limited.The drugs used during the procedure have direct consequences on pain and anxiety. That outcome should be taken into account when assessing the effect of listening to music on pain and anxiety. The effect of drugs when used in combination differs from when they are used separately. The sedative and analgesic effects of mentioned drugs are diverse, so the dose needed to achieve the targeted effect varies in particular patients. Therefore, the sedative and analgesic potency of the drugs, and consequently, their effects on pain perception cannot be determined. Instead, the Ramsay sedation score, which provides a clinical classification of the final accomplished level of sedation and analgesia in each patient, was used to as a proper tool for assessing this perplexing effect.

The treatment of preoperative anxiety is essential since it is common and leads to unfavorable outcomes. Different pharmacological and non-pharmacological interventions may be used. Non-pharmacological treatments are becoming more popular, since anxiolytic drugs maycause serious side effects. These methods include cognitive-behavioral therapy, hypnosis, music therapy, relaxation therapy, aromatherapy, and massage [35]. Music has been used in many medical disciplines to provide psychological and spiritual assistance to patients. It is suggested that listening to music may have a beneficial effect on preoperative anxiety. In the last two decades, numerous studies have been carried out on clinical role of music medicine [6,36]. It is reported that music medicine reduces the need for morphine and decreases distress after minor surgery, but it has no further influence on postoperative care [38]. The physiological and behavioral responses of pain during and after blood sampling were reduced by music therapy in premature infants [38].

There are also reports on the lack of positive outcomes of music therapy on pain and anxiety relief [39]. Vecchione et al. have not found a significant effect on pain threshold in patients listening to classical ambient music, and concluded that the positive effect of music may be attributed to a psychological effect [40]. Music was found to decrease anxiety, but not pain during ultrasound-guided core needle breast biopsy [41].

Music was found to be effective for pain related to needle insertion into a fistula in hemodialysis patients [42] Anxiety, pain, dissatisfaction was reduced in patients listening to music during colonoscopy as well as the dose of sedative medications used during the procedure [43]. As a result of a meta-analysis evaluating patients listening to music during colonoscopy, there was an improvement in patients' total satisfaction; it has been shown that there is no significant difference in pain, analgesic and anxiolytic drug doses, and the duration of the procedure [44].

There are various questions about the practice of music therapy such as the timing of music, choosing the genre of music, utilization of headphones and preselected music or the patient-selected music [8]. There is no study that gives a direct and clear

answer to these questions; however, there have been studies concerning different methods. For instance, in a study reported by Nyugen et al. [45], patients listened to music during lumbar puncture, and the patients chose the music they would listen to, not from a list or genre, but entirely on their own. Significant improvement in pain perception was observed in the patients. In another study in which music was chosen by a music therapist in the research team, pain relief was shown in the group listening to music [46].

Choosing the music by the patient or someone else may not make a significant difference in outcomes related to pain or anxiety [47]. Patients who to listen to their favorite music may have an advantage in entertaining, getting themselves lost in music, and relaxing.

The effects of listening to music during and after the procedure was compared in two studies by Nilsson U et al,. The pain was reduced in both groupsin the first report [48]. A significant reduction in pain and morphine requirement was observed in the group that listened to music only after the procedure in the latter study [49].

The mechanism by which music therapy causes these physiological and emotional alterations on patients has not been fully elucidated. The most common theory in terms of anxiety-reducing effects is that attention of the patients is directed to a relaxing issue rather than a stressful and painful incident [50]. While this may be a vital mechanism, it is not particularly apparent to explain the effect. For example, in music therapies, the therapist guides the therapy according to the patient's immediate requirements, tendencies, changes the choice of music, so that the patient participates in a more holistic process emotionally and the positive effects of the therapy are reinforced.

Neurophysiological mechanisms probably play a role in the anxiolytic and analgesic effects of music. In a study by Gillen; it has been reported that music slightly suppresses sympathetic activity by affecting the autonomic nervous system and reduces adrenergic activity [51]. In another study, it was pointed out that music triggers the limbic system and increases the release of endorphins, thus making patients feel better particularly [52]. In a study by Miluk-Kolasa et al. [53] in the preoperative period, blood sugar decreased in patients who listened to music, in contrest to an increase in blood sugar patients who did not listen to music. This effect may be attributed to the stress response of the patients.

In a report discussing the mechanisms of action, it is stated that music activates dopaminergic centers in the central nervous system, especially the nucleus accumbens, and that these reward centers may contribute to the modulation of pain by triggering opioidergic systems through many pathways [54]. Meanwhile, quite good analgesic results were obtained in patients who were conditioned to believe that music had a pain-relieving effect. This can be evaluated in a similar framework to the placebo effect; personal emotional factors, the bond established with the chosen song, and the expectation of benefit from music will affect the patient's anxiety level and pain perception [55].

When more detailed assessments are made about the patients who selected the song they want to listen to in music therapy, it may be suggested that these patient are more likely to achieve psychological benefit. The patients stated that they have a special bond with the song they chose, that it helped them in a hard moment in time formerly, and that they felt relieved and remote when they wrapped themselves up in the music. This mechanism may be similar to the reward method in cognitive-behavioral therapies [56].

In our study, no statistically or clinically significant difference between the intervention and the control group was observed on pain during the procedure as the effect of listening to music was considered ($p>0.05$).However, a clinically and statistically significant difference between the anxiety scores of the intervention and control groups was recognized during the procedure. When the sedation effect was corrected; it was observed that the group listening to music had 2.73 lower mean anxiety score than the control group ($p=0.006$). Although sedation was used for all patients; it is a considerable result that those who listen to music had lower anxiety scores.

In a study by Liu and Petrini in which they investigated the effect of music on pain, anxiety and vital signs [57], a total of 112 postoperative thoracic surgery patients were evaluated and it was noted that the pain and anxiety scores of the intervention group listening to music were reduced. It was also

found that the heart rate of the intervention group was lower than the control group. In contrast to our study, the patients listened to music not once but for three postoperative days in thirty-minute sessions. Throughout the music sessions, the patients stayed in quiet rooms without any discomforting interventions.

Hsieh et al. [2] tested the effects of music, non-musical sound, and positive conditioning on pain perception by setting up a randomized controlled trial in which calibrated noxious stimuli were given to participants with a medical temperature probe. The participants were conditioned according to the group they belonged to; informing them that music or non-musical sound is effective in the treatment of pain. As a result of the evaluation of the participants who listened to music or non-music sound during the experiment, it was observed that listening to music resulted in a decrease in pain scores, even over enhanced conditioning. It has also been noted that non-musical sound gives better results than silence.

Akbas et al. [4] investigated the effect of listening to music on pain perception in patients who underwent ESWL (Extracorporeal Shockwave Lithotripsy) and a significant decrease in pain scores in patients who listened to music was demonstrated. In their study, although no analgesic and anxiolytic drugs were used, a substantial difference in pain scores was observed between the patients that listened to music and those who did not, decreasing from 6.4 to 2.8.

In our study, there was a significant improvement in anxiety scores, similar to these studies, but no similar change was observed for pain.

In a Cochrane review published in 2013 [6], 20 studies on the issue were reviewed and it was concluded that listening to music in patients awaiting operation was as effective as sedatives on anxiety. The authors recommend the use of such a music therapy. In our study, patients listened to music during the procedure, not before the procedure, but before onset of sedation and analgesia, and the anxiety they felt during the procedure was reduced. Music therapy can be used during the procedure, as well as in patients waiting before surgery, to reduce patients' anxiety.

There are studies evaluating the effects of music on physiological values such as heart rate, respiratory rate, and blood pressure reporting that music reduces blood pressure and heart rate to some extent, despite their inconsistencies [11,53,57,58]. In a study investigating the effect of music on labor pain, it was demonstrated that both pain and anxiety of patients who listened to music was reduced, and their heart rate, blood pressure and respiratory rate decreased [3].

The genre of listened music in music therapy and the question whether the patient or the practitioner should choose the playlist has not been elucidated [45,49]. It is acclaimed that patients who form a bond with music and certain songs can achieve further constructive results if they choose the playlist themselves; however, there is also evidence that the choices made by a trained music therapist may be superior [46]. In our study, when asked about the music they want to listen, about half of the patients in the music-listening group either did not state any preference or they used very broad expressions such as "joyful songs" or "folk songs". Only a few patients had a completely definitely clear selection of artists or songs. For patients who do not declare specific musical preference, it may be useful for the practitioner to play selected songs, rather than making random choices.

CONCLUSION

The therapeutic effects of listening to music on emotional state, anxiety and pain are known. There is increasing evidence suggesting music therapy may reduce both pain and anxiety during painful procedures.

In this study, we investigated the effects of music on the pain and anxiety associated with the procedure in patients who received interventional treatment for low back pain. We found no statistically significant change in the pain scores of patients who listened to music, but a significant reduction in their anxiety scores. Even though all patients in our study were sedated, the decrease in anxiety scores in the group listening to music is noteworthy.

Music is an easily accessible and inexpensive method that may be individually adapted to the patient and conducted without negative effects. It

may be used as an effective anxiolytic in patients awaiting preceding surgery, during the procedure or in the early postoperative period in patients undergoing interventional procedures with or without sedation. Further studies with higher number of patients may be planned and the type of music may also be integrated in the study setting in order to achieve comprehensive results.

Author contribution

Study conception and design: CÇ, ÇY, NÇ, AŞ and MAS; data collection: CÇ, ÇY, NÇ and AŞ; analysis and interpretation of results: CÇ and MAS; draft manuscript preparation: CÇ and MAS. All authors reviewed the results and approved the final version of the manuscript.

Ethical approval

The study was approved by Hacettepe University Non-interventional Clinical Research Ethical Committee (Project registration number GO-16/99 and decision number 16969557-337).

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Conflict of interest

The authors declare that there is no conflict of interest.

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