Available online at www.sciencedirect.com

ScienceDirect

Journal of the Chinese Medical Association 80 (2017) 154–160

www.jcma-online.com

Original Article

Effect of music on level of anxiety in patients undergoing colonoscopy without sedation

Chia-Hui Ko [a], Yi-Yu Chen [b], Kuan-Ta Wu [b], Shu-Chi Wang [c], Jeng-Fu Yang [b], Yu-Yin Lin [b,d], Chia-I. Lin [b,d], Hsiang-Ju Kuo [b], Chia-Yen Dai [b,c,d,e], Meng-Hsuan Hsieh [b,d,e,*]

[a] *Department of Music, College of Liberal Arts, National Sun Yat-sen University, Kaohsiung, Taiwan, ROC*
[b] *Health Management Center, Kaohsiung Medical University Chung-Ho Memorial Hospital, Kaohsiung, Taiwan, ROC*
[c] *Hepatitis Center and Hepatobiliary Division, Department of Internal Medicine, Kaohsiung Medical University Chung-Ho Memorial Hospital, Kaohsiung, Taiwan, ROC*
[d] *Department of Occupational and Environmental Medicine, Kaohsiung Medical University Chung-Ho Memorial Hospital, Kaohsiung, Taiwan, ROC*
[e] *Faculty of Internal Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan, ROC*

Received June 28, 2016; accepted August 11, 2016

Abstract

Background: Listening to music can be a noninvasive method for reducing the anxiety level without any adverse effects. The aim of this study was to explore whether music can reduce anxiety and to compare two different styles of music, informal classical music and light music, to ascertain the more effective style of music in reducing anxiety in patients undergoing colonoscopy without sedation.
Methods: This study enrolled 138 patients who underwent colonoscopy without sedation during a general health examination from February 2009 to January 2015. The patients were randomly assigned to a group that did not listen to music, a group that listened to music by David Tolley, or a group that listened to music by Kevin Kern. The State-Trait Anxiety Inventory was used to evaluate the status of anxiety.
Results: A trend test for mild anxiety was performed on the patients in the three groups, and a significant trend was noted ($p = 0.017$ for all patients; $p = 0.014$ for analysis by sex). Multivariate analysis for mild anxiety on the patients in each group was also performed in this study, and music by Kevin Kern was found to have the lowest odds ratio (Odds ratio = 0.34, $p = 0.045$).
Conclusion: Listening to music, especially music by Kevin Kern, reduced the level of anxiety in patients undergoing colonoscopy examination without sedation.

Keywords: anxiety; colonoscopy; Kevin Kern; light music

1. Introduction

Colonoscopy is an endoscopic examination of the large bowel and the distal part of the small bowel that is used to diagnose pathological lesions, such as ulceration, polyps, inflammation, and even cancer, via gross inspection or biopsy and as a therapeutic approach to remove suspected malignant lesions. In recent years, colonoscopy has been considered the gold standard for colon cancer screening and surveillance.[1]

However, the colonoscopy procedure carries risks of perforation[2] and bleeding.[3] Discomfort related to colonoscopy, such as abdominal pain and a sensation of fullness, is frequently experienced by patients during this procedure. Anxiety arising from this discomfort is inevitable for most patients, which may even prevent completion of the procedure in some cases. Under these circumstances, adequate patient physiological and

Conflicts of interest: The authors declare that they have conflicts of interest related to the subject matter or materials discussed in this article.

* Corresponding author. Dr. Meng-Hsuan Hsieh, Department of Preventive Medicine, Kaohsiung Medical University Hospital, 100, Tzyou 1st Road, Kaohsiung 807, Taiwan, ROC.
E-mail address: hsmonyan@gmail.com (M.-H. Hsieh).

http://dx.doi.org/10.1016/j.jcma.2016.08.010

psychological preparation is essential for a safe and successful examination and to maintain compliance during subsequent follow-up procedures. Colonoscopy under sedation is one alternative to ensure smooth performance of the procedure and is now widely applied in clinical practice.[4] However, potential risks of cardiopulmonary complications exist, such as oversedation, hypoxemia, hypoventilation,[5−7] aspiration pneumonia, pulmonary embolism, and myocardial infarction,[8,9] which patients and clinicians should be aware of prior to sedation. Therefore, although colonoscopy with sedation is performed to reduce anxiety and discomfort in patients during the examination, the risk of undergoing the procedure under sedation is not lower than that of colonoscopy without sedation.

The American Pain Society suggested that apart from medication, pain control can be achieved by alternative nonmedication methods, which may result in improved efficacy in pain control. One nonmedication method for pain control is listening to music,[10] which is a noninvasive method to reduce pain and anxiety without causing any adverse effects.[11] Currently, music is employed in many medical procedures and therapies, such as in the treatment of patients suffering from malignancy,[12] patients undergoing imaging-guided core-needle breast biopsy,[13] burn injury patients,[14] and women in labor,[15] to reduce pain and anxiety. In a colonoscopy examination, music is viewed as an effective method for reducing procedure-related anxiety.[16−18]

The aim of this study was to explore whether music can reduce procedure-related anxiety and also to compare two styles of music, informal classical music and light music, in order to ascertain the more effective music style for reducing anxiety in patients undergoing colonoscopy without sedation in Taiwan.

2. Methods

2.1. Patients

We enrolled patients who underwent a colonoscopy during a general health examination without sedation from February 2009 to January 2015 in the Health Management Center, Kaohsiung Medical University Chung-ho Memorial Hospital. Patients who suffered from medical conditions, such as myocardial infarction, pulmonary embolism, cerebral vascular infarction, unstable and severe cardiac disease, or severe gastroenteritis disease, were excluded from colonoscopy examination. In addition, the data for some patients were incomplete, and these patients were also excluded from this study. In total, 138 patients were enrolled in this study. The study was approved by the ethics committee and Institutional Review Board of Kaohsiung Medical University Chung-ho Memorial Hospital, and signed informed consent was obtained and agreed from all the patients who were enrolled in this study.

2.2. Body mass index, blood pressure, and past history

In this study, prior to colonoscopy examination, basic data of the patients, including height, weight, blood pressure, and past history, were recorded. Body mass index [BMI, (kg/m^2)] was calculated as weight/height^2. Blood pressure was measured in a sitting position, and the patients took no drugs during the fasting period. The cutoff values used in this study were systolic blood pressure and diastolic blood pressure of 120/80 mmHg, according to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure criteria).[19] A BMI equal to or greater than 23 kg/m^2 was defined as overweight, according to the Steering Committee of the Regional Office for the Western Pacific Region of the World Health Organization.[20] Histories of hypertension, smoking, and drinking alcohol were also recorded. If patients had smoked or imbibed alcohol in the past 5 years, they were categorized as having a history of smoking or alcohol consumption.

2.3. Music and equipment

Patients were randomly classified into groups that did or did not listen to music during the colonoscopy examination. Those who were randomly classified into the group that listened to music were also randomly assigned to either a group that listened to “Canon in D” from the album “Pachelbel by The Sea” by David Tolley, which belongs to the genre of informal classical music, or a group that listened to “Blossom on the Wind” from the album “Embracing The Wind” by Kevin Kern, which belongs to the genre of light music. The music was played via an iPad with an amplifier at an adequate volume from the start of the colonoscopy examination and was stopped when the examination ended. No sedation was applied during the procedure. The music was played in the room where the procedure was performed in order to ensure that the outside noise was isolated. Finally, 81 patients were randomized into groups that listened to music, including 45 and 36 patients who listened to music by David Tolley and Kevin Kern, respectively, after exclusion of patients with incomplete data.

2.4. The State-Trait Anxiety Inventory

In this study, the State-Trait Anxiety Inventory (STAI) was used to evaluate the status of anxiety. Every patient completed the form following colonoscopy examination. The STAI Form Y is a brief, self-rating scale for the assessment of state and trait anxiety in adults. The concepts of state and trait anxiety were first introduced by Cattell and Scheier[21−23] and have been further elaborated by Spielberger.[24−27] Each STAI item is given a weighted score of 1 to 4 for each question (e.g., select item 1 scoring 1 for this question). For questions 1, 2, 5, 8, 10, 11, 15, 16, 19, 20, 21, 23, 24, 26, 27, 30, 33, 34, 36, and 39, the score was calculated as the reverse score (i.e., 5 minus the selected item score); scores of the other questions were simply the score of the selected item. The calculated scores for all questions were then summed up to give a total anxiety score. The lower the total score, the less anxious was the patient. A total final score of 41−80 represented mild anxiety, 81−120 represented moderate anxiety, and 121−160 represented severe anxiety.

2.5. Statistical analysis

The statistical tests employed in this study were the Student *t* test, Chi-square test, and one-way analysis of variance. In addition, multivariate analysis was used to estimate odds ratios and 95% confidence intervals. A trend test was also performed to analyze trends. All tests were two sided, and the significance level was set at $\alpha = 0.05$. The statistical analyses were performed using SPSS version 22 (SPSS Inc., Chicago, IL, USA).

3. Results

Table 1 shows the basic characteristics of the 138 patients enrolled in this study. Male patients were dominant (54.3%), and the average age of the patients was 48.0 ± 11.9 years. The percentages of patients with histories of hypertension, smoking, and alcohol consumption were 8.7%, 11.6%, and 22.5%, respectively. No significant differences in any of the basic characteristics were noted between the patients who did and those who did not listen to music during colonoscopy.

Table 2 shows the results of analysis of anxiety status in patients who did and those who did not listen to music, and the anxiety score was determined to be lower among the patients who listened to music during colonoscopy without sedation (85.3 ± 18.6 vs. 79.9 ± 16.8, $p = 0.074$). However, this difference was not significant. Additionally, the differences according to sub analyses of the male and female patients were not significant. Furthermore, a moderate status of anxiety was most prevalent among all the patients. Similarly, from the results shown in Table 3, analysis of anxiety status in patients who did not listen to music, those who listened to music by David Tolley, and those who listened to music by Kevin Kern showed no significant differences between the three groups although the anxiety score was the lowest in the patients who listened to music by Kevin Kern. Due to the gradually increasing tendency toward development of a mild status of anxiety in the order of not listening to music, listening to music by David Tolley, and listening to music by Kevin Kern, as shown in Table 2, we also performed a trend test for mild anxiety among patients in all the three groups, and a significant trend was noted (Fig.1A and 1B; $p = 0.017$ for all patients, $p = 0.014$ for analysis by sex).

Multivariate analysis of a mild status of anxiety among patients in all three groups was also performed in this study, and patients who listened to music by Kevin Kern were found to have the lowest odds ratio (OR = 0.34, 95% confidence interval = 0.14–0.81, $p = 0.045$; Table 4).

Finally, we also analyzed the relationships between blood pressure before colonoscopy examination, BMI, history of hypertension, smoking, alcohol consumption and status of anxiety; however, no significant differences between any item and status of anxiety were noted (data not shown in table).

Table 1
Basic characteristics of the patients undergoing colonoscopy without sedation.

Characteristics	All patients	Did not listen to music	Listened to music	*p*
Sex				
Male	75 (54.3)	31 (54.4)	44 (54.3)	0.99
Female	63 (45.7)	26 (45.6)	37 (31.9)	
Age (y)	48.0 ± 11.9	45.7 ± 12.6	49.5 ± 11.1	0.06
Mean blood pressure				
Systolic blood pressure	126.1 ± 17.2	123.8 ± 16.8	127.7 ± 17.4	0.19
Diastolic blood pressure	77.6 ± 10.7	76.4 ± 11.1	78.4 ± 10.4	0.27
Systolic/diastolic blood pressure				
< 120/80 mmHg	46 (33.3)	21 (36.8)	25 (30.9)	0.46
≥ 120/80 mmHg	92 (66.7)	36 (63.2)	56 (69.1)	
Hypertension history	12 (8.7)	6 (10.5)	6 (7.4)	0.52
BMI	24.6 ± 4.4	24.5 ± 4.9	24.7 ± 3.9	0.76
BMI < 23 kg/m^2	45 (32.6)	19 (33.3)	26 (32.1)	0.88
BMI ≥ 23 kg/m^2	93 (67.4)	38 (66.7)	55 (67.9)	
Smoking history	16 (11.6)	6 (10.5)	10 (12.3)	0.74
Alcohol consumption history	31 (22.5)	12 (21.1)	19 (23.5)	0.74

Data are presented as *n* (%) or mean ± SD.
BMI = body mass index.

Table 2
Analysis and comparison of status of anxiety in patients who did not listen to music and those who listened to music.

	Did not listen to music	Listened to music	*p*
Sex	57 (41.3)	81 (58.7)	
Male	31 (54.4)	44 (54.3)	0.99
Female	26 (45.6)	37 (45.7)	
Age (y)	45.7 ± 12.6	49.5 ± 11.1	0.06
Depression score[a]	85.3 ± 18.6	79.9 ± 16.8	0.074
mild anxiety (41–80) (*n* = 54)	17 (29.8)	37 (45.7)	0.054
moderate anxiety (81–120) (*n* = 82)	38 (66.7)	44 (54.3)	
severe anxiety (121–160) (*n* = 2)	2 (3.5)	0 (0)	
Depression score for male patients	87.5 ± 19.8	80.7 ± 15.6	0.10
mild anxiety (41–80) (*n* = 28)	9 (29.0)	19 (43.2)	0.14
moderate anxiety (81–120) (*n* = 45)	20 (64.5)	25 (56.8)	
severe anxiety (121–160) (*n* = 2)	2 (6.5)	0 (0.0)	
Depression score for female patients	82.8 ± 17.0	78.9 ± 18.3	0.40
mild anxiety (41–80) (*n* = 26)	8 (30.8)	18 (48.6)	0.16
moderate anxiety (81–120) (*n* = 27)	18 (69.2)	19 (51.4)	
severe anxiety (121–160) (*n* = 0)	0 (0.0)	0 (0.0)	

Data are presented as *n* (%) or mean ± SD.
[a] For questions 1, 2, 5, 8, 10, 11, 15, 16, 19, 20, 21, 23, 24, 26, 27, 30, 33, 34, 36, and 39, the score was calculated as the reverse score (i.e., 5 minus the score of the selected item); the scores of the remaining questions were simply calculated as the score of the selected item. The calculated scores for all questions were then summed up to obtain the total score. The lower the total score, the less anxious was the patient. A total score of 41–80 indicated mild anxiety, 81–120 indicated moderate anxiety, and 121–160 indicated severe anxiety.

4. Discussion

Previous study has shown that one of the most important characteristics of music is that of reducing anxiety.[28] The mechanism of music therapy is thought to arise from multiple nervous stimuli that are conducted into the brain, which are antagonists to each other, and under certain conditions, receiving the stimulus of hearing music can reduce pain or discomfort. Music can change the reaction of the autonomic nervous system in the thalamus, such as relaxing the tensive

Table 3
Analysis and comparison of anxiety status in patients who did not listen to music, those who listened to music by David Tolley, and those who listened to music by Kevin Kern.

	Did not listen to music	Listened to music by David Tolley	Listened to music by Kevin Kern	*p*
Sex	57	45	36	
Male	31 (54.4)	22 (48.9)	22 (61.1)	0.55
Female	26 (45.6)	23 (51.1)	14 (38.9)	
Age (y)	45.7 ± 12.6	49.0 ± 12.0	50.3 ± 10.1	0.155
Depression score[a]	85.3 ± 18.6	82.6 ± 16.5	76.4 ± 16.8	0.057
mild anxiety (41−80) ($n = 54$)	17 (29.8)	17 (37.8)	20 (55.6)	0.074
moderate anxiety (81−120) ($n = 82$)	38 (66.7)	28 (62.2)	16 (44.4)	
severe anxiety (121−160) ($n = 2$)	2 (3.5)	0 (0.0)	0 (0.0)	
Depression score for male patients	87.5 ± 19.8	84.0 ± 12.0	77.3 ± 18.3	0.12
mild anxiety (41−80) ($n = 28$)	9 (29.0)	8 (36.4)	11 (50.0)	0.30
moderate anxiety (81−120) ($n = 45$)	20 (64.5)	14 (63.6)	11 (50.0)	
severe anxiety (121−160) ($n = 2$)	2 (6.5)	0 (0.0)	0 (0.0)	
Depression score for female patients	82.8 ± 17.0	81.4 ± 20.1	74.9 ± 14.6	0.40
mild anxiety (41−80) ($n = 26$)	8 (30.8)	9 (39.1)	9 (64.3)	0.12
moderate anxiety (81−120) ($n = 27$)	18 (69.2)	14 (60.9)	5 (35.7)	
severe anxiety (121−160) ($n = 0$)	0 (0.0)	0 (0.0)	0 (0.0)	

Data are presented as *n* (%) or mean ± SD.

[a] For question 1, 2, 5, 8, 10, 11, 15, 16, 19, 20, 21, 23, 24, 26, 27, 30, 33, 34, 36, and 39, the score was calculated as the reverse score (i.e., 5 minus the score of the selected item); the scores of the remaining questions were simply calculated as the score of the selected item. The calculated scores for all questions were then summed to obtain the total score. The lower the total score, the less anxious was the patient. A total score of 41−80 indicated mild anxiety, 81−120 indicated moderate anxiety, and 121−160 indicated severe anxiety.

muscle, decreasing the release of adrenocorticotropic hormone, and changing the activity of the sympathetic nervous system. In addition, music influences the limbic system to evoke joyful sensations and decrease anxiety.[29−31] Music can also stimulate the pituitary gland to release more endorphins, which reduce pain and, therefore, can decrease the level of anxiety.[30]

Previous studies have not determined which style of music (such as easy listening, jazz, rock, and country) has the best efficacy in terms of reducing anxiety.[18,32−37] A study reported that anxiety was reduced in patients undergoing a transrectal ultrasound-guided prostate biopsy under local anesthesia by listening to "Twilight's Embrace" by Kevin Kern from the album "Summer Daydreams".[38] In this study, music by Kevin Kern had the best efficacy in reducing anxiety. This may be because "Canon in D" from the album "Pachelbel by The Sea" by David Tolley is of the canon style of informal classical music. Pachelbel's canon is a variation form, which has a solid repetition formation throughout the piece. However, "Blossom on the Wind" from the album "Embracing The Wind" by Kevin Kern has a simple light musical style, which is a less serious form. Therefore, we believe that listening to light music is less stressful than listening to music of the canon style, and it is more effective in terms of reducing anxiety than the other formal musical styles.

Listening to music has been shown to reduce anxiety during cardiac vascular procedures,[39,40] transrectal ultrasound-guided prostate biopsies,[41] shockwave lithotripsy,[42] and gastrointestinal procedures.[18] One meta-analysis study analyzed the effect of listening to music on patients undergoing colonoscopy from eight randomized controlled trials published from 2002 to 2006.[43] The meta-analysis concluded that music can significantly improve the patient's experience during colonoscopy, but does not shorten the duration of the procedure, decrease pain levels, or reduce the amount of sedative medications required. However, two studies did report that listening music decreased the doses of sedative medications needed.[44,45] Listening to music during a colonoscopy has been shown to reduce the STAI score,[16,18] and for patients undergoing esophagogastroduodenoscopy and colonoscopy, relaxing music has been shown to improve tolerance, attitude, and overall feelings about the procedure.[46] Therefore, listening to music is thought to be one method by which anxiety can be reduced during the colonoscopy procedure.[47] In this study, patients who listened to music had a lower STAI score, regardless of the style of music. Therefore, we believe that listening to music can reduce the status of anxiety in patients undergoing colonoscopy without sedation.

Finally, neither physiological factors, such as BMI, nor a history of hypertension, smoking, or alcohol consumption were associated with the status of anxiety. Music played during flexible sigmoidoscopy was reported to have decreased the mean arterial blood pressure and heart rate,[48,49] but one study had converse results.[18] In this study, blood pressure prior to colonoscopy was not related to listening to music; therefore, we believe that physiological factors have no influence on the status of anxiety during colonoscopy without sedation.

A limitation of this study was that the sample size was small, and a larger sample size might be necessary to demonstrate significant differences in statistical analysis. In addition, as the patients who underwent colonoscopy only did so as part of a general health examination, we could collect only limited data. For example, the number of patients who underwent successful colonoscopy completion and the total duration of each colonoscopy procedure were not recorded; therefore, we were unable to analyze these variables. In addition, blood pressure was not recorded after the colonoscopy examination, and therefore, we were unable to assess whether a change in blood pressure before and after

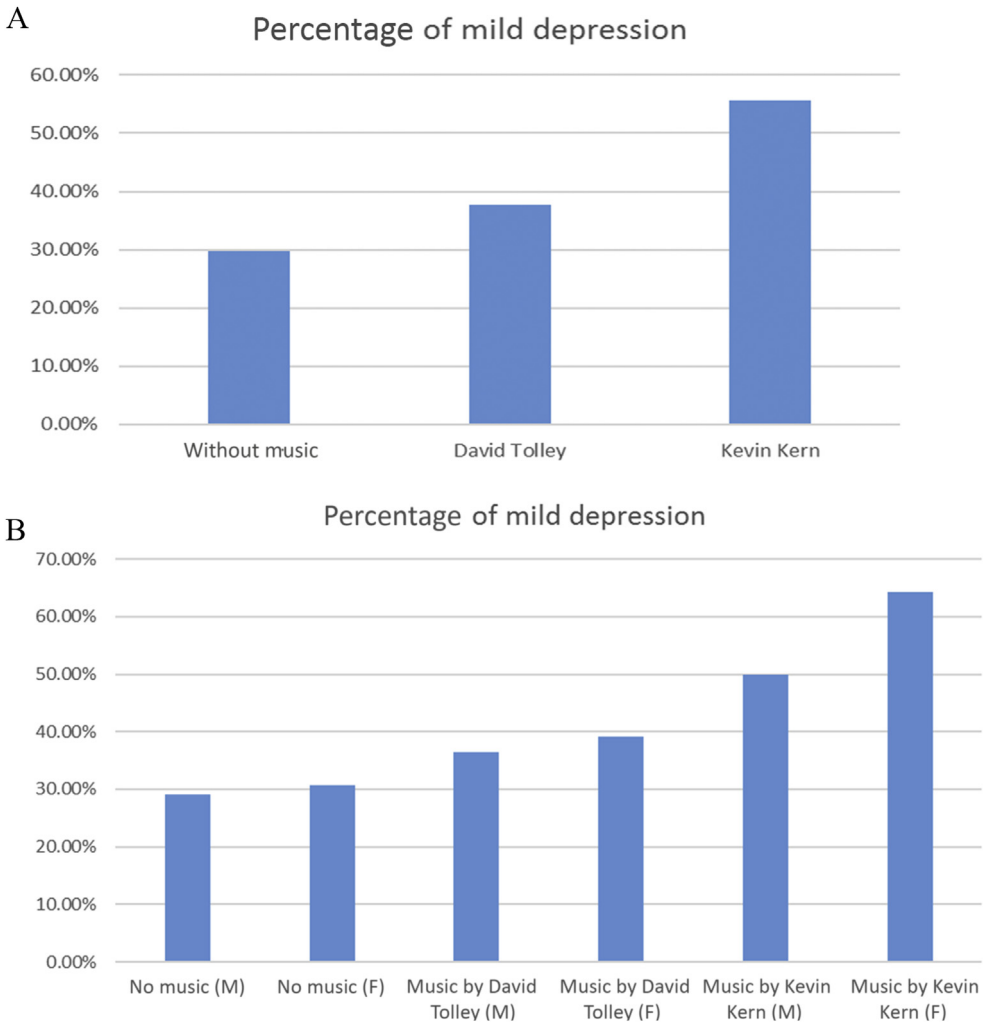

Fig. 1. (A) Results of trend test for mild anxiety in patients who did not listen to music, those who listened to music by David Tolley, and those who listened to music by Kevin Kern. (B) Results of trend test in patients analyzed by sex. F = female patients; M = male patients. All p values for trend are < 0.05. Detailed data for Figures 1A and 1B are listed below the charts.

	Total n	Mild anxiety status, n	Percentage of subjects with mild anxiety	P for trend
Male subjects who did not listen to music	31	9	29.03%	**0.014**
Female subjects who did not listen to music	26	8	30.77%	
Male subjects who listened to music by David Tolley	22	8	36.36%	
Female subjects who listened to music by David Tolley	23	9	39.13%	
Male subjects who listened to music by Kevin Kern	22	11	50.00%	
Female subjects who listened to music by Kevin Kern	14	9	64.29%	

Table 4
Multivariate analysis of anxiety status in patients who did not listen to music, those who listened to music by David Tolley, and those who listened to music by Kevin Kern.

	Comparison	Odds ratio	95% confidential interval	p
Did not listen to music	Reference	1		**0.045**
Listened to music by David Tolley		0.70	0.31–1.60	
Listened to music by Kevin Kern		0.34	0.14–0.81	

colonoscopy examination was related to the status of anxiety. However, these issues will be addressed in the future.

In conclusion, listening to music can decrease a patient's STAI score and reduce their status of anxiety during colonoscopy examination without sedation, especially listening to music by Kevin Kern, which is of a light musical style. Neither physiological factors nor a history of hypertension, smoking, or alcohol consumption were associated with the status of anxiety. We believe that for patients undergoing colonoscopy examination without sedation, listening to light music, such as music by Kevin Kern, is a safe, convenient, and effective method to reduce anxiety.

References

1. American Cancer Society. *Colorectal Cancer Prevention and Early Detection*. Atlanta, GA: American Cancer Society; 2015.
2. Stock C, Ihle P, Sieg A, Schubert I, Hoffmeister M, Brenner H. Adverse events requiring hospitalization within 30 days after outpatient screening and nonscreening colonoscopies. *Gastrointest Endosc* 2013;**77**:419−29.
3. Fruhmorgen P, Demling L. Complications of diagnostic and therapeutic colonoscopy in the Federal Republic of Germany. Results of an inquiry. *Endoscopy* 1979;**11**:146−50.
4. Baudet JS, Aguirre-Jaime A. The sedation increases the acceptance of repeat colonoscopies. *Eur J Gastroenterol Hepatol* 2012;**24**:775−80.
5. Fleischer D. Monitoring for conscious sedation: perspective of the gastrointestinal endoscopist. *Gastrointest Endosc* 1990;**36**:S19−22.
6. O'Connor KW, Jones S. Oxygen desaturation is common and clinically underappreciated during elective endoscopic procedures. *Gastrointest Endosc* 1990;**36**:S2−4.
7. Sharma VK, Nguyen CC, Crowell MD, Lieberman DA, de Garmo P, Fleischer DE. A national study of cardiopulmonary unplanned events after GI endoscopy. *Gastrointest Endosc* 2007;**66**:27−34.
8. Arrowsmith JB, Gerstman BB, Fleischer DE, Benjamin SB. Results from the American Society for Gastrointestinal Endoscopy/U.S. Food and Drug Administration collaborative study on complication rates and drug use during gastrointestinal endoscopy. *Gastrointest Endosc* 1991;**37**:421−7.
9. Quine MA, Bell GD, McCloy RF, Charlton JE, Devlin HB, Hopkins A. Prospective audit of upper gastrointestinal endoscopy in two regions of England: safety, staffing, and sedation methods. *Gut* 1995;**36**:462−7.
10. Gordon DB, Dahl JL, Miaskowski C, McCarberg B, Todd KH, Paice JA, et al. American pain society recommendations for improving the quality of acute and cancer pain management: American Pain Society Quality of Care Task Force. *Arch Intern Med* 2005;**165**:1574−80.
11. Good M, Anderson GC, Stanton-Hicks M, Grass JA, Makii M. Relaxation and music reduce pain after gynecologic surgery. *Pain Manag Nurs* 2002;**3**:61−70.
12. Horne-Thompson A, Grocke D. The effect of music therapy on anxiety in patients who are terminally ill. *J Palliat Med* 2008;**11**:582−90.
13. Soo MS, Jarosz JA, Wren AA, Soo AE, Mowery YM, Johnson KS, et al. Imaging-guided core-needle breast biopsy: impact of meditation and music interventions on patient anxiety, pain, and fatigue. *J Am Coll Radiol* 2016;**13**:526−34.
14. Fratianne RB, Prensner JD, Huston MJ, Super DM, Yowler CJ, Standley JM. The effect of music-based imagery and musical alternate engagement on the burn debridement process. *J Burn Care Rehabil* 2001;**22**:47−53.
15. Phumdoung S, Good M. Music reduces sensation and distress of labor pain. *Pain Manag Nurs* 2003;**4**:54−61.
16. Andrada JM, Vidal AA, Aguilar-Tablada TC, Reina IG, Silva L, Guinaldo AR, et al. Anxiety during the performance of colonoscopies: modification using music therapy. *Eur J Gastroenterol Hepatol* 2004;**16**:1381−6.
17. Bechtold ML, Perez RA, Puli SR, Marshall JB. Effect of music on patients undergoing outpatient colonoscopy. *World J Gastroenterol* 2006;**12**:7309−12.
18. Hayes A, Buffum M, Lanier E, Rodahl E, Sasso C. A music intervention to reduce anxiety prior to gastrointestinal procedures. *Gastroenterol Nurs* 2003;**26**:145−9.
19. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo Jr JL, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003;**289**:2560−72.
20. Chang CJ, Wu CH, Chang CS, Yao WJ, Yang YC, Wu JS, et al. Low body mass index but high percent body fat in Taiwanese subjects: implications of obesity cutoffs. *Int J Obes Relat Metab Disord* 2003;**27**:253−9.
21. Cattell RB. *Handbook of Multivariate Experimental Psychology*. Chicago: Rand McNally; 1966.
22. Cattell RB, Scheier IH. *The meaning and measurement of neuroticism and anxiety*. New York: Romald Press; 1961.
23. Cattell RB, Scheier IH. *Handbook for the IPAT Anxiety Scale*. 2nd ed. Champaign, IL: Institute for Personality and Ability Testing; 1963.
24. Spielberger CD. Theory and research on anxiety. In: Spielberger CD, editor. *Anxiety and behavior*. New York: Academic Press; 1966. p. 3−20.
25. Spielberger CD. Anxiety as an emotional state. In: Spielberger CD, editor. *Anxiety: Current trends in theory and research*vol. 1. New York: Academic Press; 1972. p. 23−49.
26. Spielberger CD. The nature and measurement of anxiety. In: Spielberger CD, editor. *Cross-cultural anxiety*. Washington D.C.: Hemisphere/Wiley; 1976. p. 3−12.
27. Spielberger CD. *Preliminary manual for the State-Trait Personality Inventory (STPI)*. University of South Florida; 1979.
28. Standley JM. Music research in medical/dental treatment: meta-analysis and clinical applications. *J Music Ther* 1986;**23**:56−122.
29. Beck SL. The therapeutic use of music for cancer-related pain. *Oncol Nurs Forum* 1991;**18**:1327−37.
30. Cook JD. Music as an intervention in the oncology setting. *Cancer Nurs* 1986;**9**:23−8.
31. Daniel E. Music used as anti-anxiety intervention for patients during outpatient procedures: a review of the literature. *Complement Ther Clin Pract* 2016;**22**:21−3.
32. Cooke M, Chaboyer W, Schluter P, Hiratos M. The effect of music on preoperative anxiety in day surgery. *J Adv Nurs* 2005;**52**:47−55.
33. Leardi S, Pietroletti R, Angeloni G, Necozione S, Ranalletta G, Del Gusto B. Randomized clinical trial examining the effect of music therapy in stress response to day surgery. *Br J Surg* 2007;**94**:943−7.
34. Nilsson U, Rawal N, Enqvist B, Unosson M. Analgesia following music and therapeutic suggestions in the PACU in ambulatory surgery; a randomized controlled trial. *Acta Anaesthesiol Scand* 2003;**47**:278−83.
35. Nilsson U, Rawal N, Unosson M. A comparison of intra-operative or postoperative exposure to music−a controlled trial of the effects on postoperative pain. *Anaesthesia* 2003;**58**:699−703.
36. Wang SM, Kulkarni L, Dolev J, Kain ZN. Music and preoperative anxiety: a randomized, controlled study. *Anesth Analg* 2002;**94**:1489−94.
37. Yung PM, Chui-Kam S, French P, Chan TM. A controlled trial of music and pre-operative anxiety in Chinese men undergoing transurethral resection of the prostate. *J Adv Nurs* 2002;**39**:352−9.
38. Chiu LP, Tung HH, Lin KC, Lai YW, Chiu YC, Chen SS, et al. Effectiveness of stress management in patients undergoing transrectal ultrasound-guided biopsy of the prostate. *Patient Prefer Adherence* 2016;**10**:147−52.
39. Buffum MD, Sasso C, Sands LP, Lanier E, Yellen M, Hayes A. A music intervention to reduce anxiety before vascular angiography procedures. *J Vasc Nurs* 2006;**24**:68−73.
40. Forooghy M, Mottahedian Tabrizi E, Hajizadeh E, Pishgoo B. Effect of Music Therapy on Patients' Anxiety and Hemodynamic Parameters During Coronary Angioplasty: A Randomized Controlled Trial. *Nurs Midwifery Stud* 2015;**4**:e25800.
41. Cho SW, Choi HJ. Effect of Music on Reducing Anxiety for Patients Undergoing Transrectal Ultrasound-Guided Prostate Biopsies: Randomized Prospective Trial. *Urol J* 2016;**13**:2612−4.
42. Akbas A, Gulpinar MT, Sancak EB, Karakan T, Demirbas A, Utangac MM, et al. The effect of music therapy during shockwave lithotripsy on patient relaxation, anxiety, and pain perception. *Ren Fail* 2016;**38**:46−9.
43. Bechtold ML, Puli SR, Othman MO, Bartalos CR, Marshall JB, Roy PK. Effect of music on patients undergoing colonoscopy: a meta-analysis of randomized controlled trials. *Dig Dis Sci* 2009;**54**:19−24.
44. Schiemann U, Gross M, Reuter R, Kellner H. Improved procedure of colonoscopy under accompanying music therapy. *Eur J Med Res* 2002;**7**:131−4.
45. Lee DW, Chan KW, Poon CM, Ko CW, Chan KH, Sin KS, et al. Relaxation music decreases the dose of patient-controlled sedation during colonoscopy: a prospective randomized controlled trial. *Gastrointest Endosc* 2002;**55**:33−6.
46. Bampton P, Draper B. Effect of relaxation music on patient tolerance of gastrointestinal endoscopic procedures. *J Clin Gastroenterol* 1997;**25**:343−5.

47. Leung FW. Methods of reducing discomfort during colonoscopy. *Dig Dis Sci* 2008;**53**:1462−7.
48. Palakanis KC, DeNobile JW, Sweeney WB, Blankenship CL. Effect of music therapy on state anxiety in patients undergoing flexible sigmoidoscopy. *Dis Colon Rectum* 1994;**37**:478−81.
49. Chlan L, Evans D, Greenleaf M, Walker J. Effects of a single music therapy intervention on anxiety, discomfort, satisfaction, and compliance with screening guidelines in outpatients undergoing flexible sigmoidoscopy. *Gastroenterol Nurs* 2000;**23**:148−56.