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# The impact of music on patient tolerance during office-based laryngeal surgery

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## Abstract

**Objective:** To investigate the impact of music on patient tolerance during office-based laryngeal surgery (OBLS).

**Methods:** All patients undergoing OBLS between February 2024 to June 2024 were invited to participate in this study. They were divided into two subgroups, those with music in the background during surgery and those without. Following surgery, all patients were asked to fill IOWA tolerance score and the VAS for discomfort ranging from 0 to 10, with 0 indicating no discomfort and 10 indicating maximum discomfort.

**Results:** A total of 87 patients undergoing 95 office-based laryngeal surgeries (OBLS) were included, with a mean age of 54.7 years and a male-to-female ratio of 1.5. The most common procedure was blue laser therapy (45.3%), followed by vocal fold injection (29.5%). The mean IOWA tolerance score was 2.02. Patients who listened to music during OBLS showed a significantly higher mean IOWA tolerance score compared to those without music (2.48 vs. 1.55; $p < .001$). Significant differences persisted when stratified by procedure type. Additionally, the mean VAS score for discomfort was lower with music (2.27 vs. 4.21; $p = .001$), with a significant difference noted for laser therapy ($p = .004$).

**Conclusion:** The results of this investigation indicate that music has a positive effect on procedural tolerance in OBLS. Participants who underwent OBLS with music in the background had significantly higher tolerance score and less discomfort than those who had no music in the background. Music can be used as a safe nonpharmacologic modality to reduce stress and improve patient tolerance in awake OBLS.

**Level of Evidence:** 2.

KEYWORDS
biopsy, laser therapy, music, office-based laryngeal surgery, patient tolerance, vocal fold injections

## 1 | INTRODUCTION

Office-based laryngeal surgery (OBLS) is gaining popularity as a safe and effective alternative to microlaryngeal surgery for the treatment of benign and premalignant lesions of the larynx. The success of these surgeries is contingent on many factors, and most important of which is patient tolerance. Based on numerous studies, the estimated tolerance rate of OBLS exceeds 90% (1–6). *Zeiltels* et al showed successful completion of office-based laser therapy for glottal respiratory papilloma and dysplasia in 70 out of 72 procedures.[1] Similarly, in a review of 443 cases, *Koufman* et al noted the completion of all their office laryngeal surgery except in four cases due to adverse events.[2] In rare instances, OBLS needs to be aborted as a result of poor patient compliance, vasovagal reflex, or other factors such as limited angle of vision and pooling of mucus.[3–6]

Several means have been advocated to improve patient tolerance. These include preoperative patient counseling, adequate application of local anesthetic to the upper airway, and patient engagement during surgery such as maintaining quiet breathing.[7,8] The role of music in improving patient tolerance in OBLS has not been discussed in the literature, although music is increasingly being recognized as a valuable tool to reduce stress and anxiety in other medical settings. By providing both physical and emotional relief, music is considered by many as a universal language that transcends cultural and linguistic boundaries. Its positive effects are extensive, encompassing the emotional, psychological, and physical well-being of the listener.[9–13]

The purpose of this study is to investigate the impact of music on patient tolerance in a large cohort of patients undergoing OBLS in an awake setting. The hypothesis set forth by the authors is that music can increase patient tolerance, meaning to say that those who undergo OBLS with music in the background will have better tolerance than those who have no background music. Subgroup analysis in relation to the type of procedure was also performed.

## 2 | METHOD

After having obtained the approval of the institution review board (IRB BIO ID: 2023–0266), all patients undergoing OBLS using the flexible endoscope during the period extending from February 2024 to June 2024 were invited to participate in this study and verbal consent was obtained before their enrolment. Demographic data pertaining to age, gender, type of comorbidities, and voice diagnosis. Voice diagnosis was classified into benign lesions such as Reinke's edema, polyps, nodules, cysts, and fibrovascular masses, premalignant lesions such as leukoplakia, recurrent respiratory papilloma, neurogenic causes such as vocal fold paralysis, spasmodic dysphonia, and paradoxical vocal fold dysfunction, and others such as nonspecific inflammatory changes. The type and duration of OBLS (including anesthesia time) were recorded. Office-based laryngeal surgery was stratified into three categories: Laser therapy, laryngeal biopsy, and vocal fold injection (VFI) of various pharmaceutical agents. All OBLS were performed using the trans-nasal approach in an office setting. After having applied topical anesthesia to the nose using cotton pledges soaked with 2% lidocaine, and to the pharynx and larynx using laryngeal gargle and anesthetic spray, a flexible endoscope with a working channel was introduced into the nose and guided to the laryngeal inlet for visualization of the vocal folds. For the office-based vocal fold injections, a 25-mm flexible needle (Olympus America, Center Valley, Pennsylvania) was introduced into the working channel of the flexible endoscope and used for the injection of pharmaceutical agents (Figure 1). For the laryngeal biopsies, a 3-mm cup forceps was introduced through the working channel similar to the flexible needle and was used to biopsy the suspected lesion. More than one biopsy was often performed (Figure 2). All office-based laser surgeries were performed using one type of laser, namely the blue laser with a wavelength of 445 nm. The laser was delivered using a 400-micrometer glass fiber that was threaded through the working channel of the flexible endoscope. The laser was used in contact and non-contact mode (Figure 3).

During surgery, Gnosnienne N° 1 by Erik Satie was alternated, in a way that stratified patients into those who listened to music and those who did not. This piece of music was chosen because of its simplistic structure and its popularity in the community where the study is being conducted.

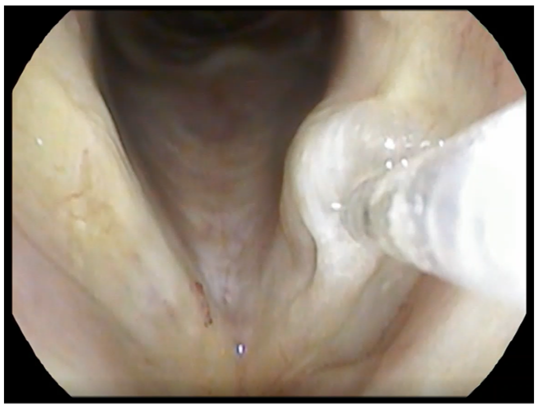

**FIGURE 1** An endoscopic view of the larynx showing right vocal fold scar injection with o.2 cc of dexamethasone (8 mg/2 mL). Note the bleb formation following the injection.

**FIGURE 2** An endoscopic view of the larynx showing a 3-mm cup forceps used to biopsy a left vocal fold lesion.

FIGURE 3 An endoscopic view of the larynx showing the blue laser in directed toward a right vocal fold polyp. Note that it is used in a non-contact mode.

Immediately after surgery, all patients were asked to fill out the IOWA satisfaction with anesthesia scale, which is a self-administered assessment tool composed of 11 items to measure patient tolerance.[14] The statements alternate between negative and positive with a total of six negative statements and five positive statements. The patient is provided with a set of response choices from "disagree very much", scored as −3, to "agree very much", scored as +3, to determine his or her level of agreement with the scale's statements. The score of positive statements remains the same while that of the negative statements is reversed. The sum of the scores is then divided by 11 to determine the mean tolerance score for each patient which can range from −3 (totally unsatisfied patient) to +3 (totally satisfied patient). The patients were also asked to fill out the visual analogue scale (VAS) for a level of discomfort. The score ranged from 0 to 10 with 0 indicating no discomfort and 10 indicating maximum discomfort.

### 2.1 | Statistical methods

Categorical and continuous variables were described using frequencies and means (± standard deviation), respectively. Mann–Whitney U test was used to measure the strength of association between categorical and continuous variables. Kruskal–Wallis H test was performed to identify thr significance between continuous nonparametric and categorical variables. All variables were tested for normality prior to the analysis using the Kolmogorov–Smirnov and Shapiro–Wilk tests.

All analyses were conducted using Statistical Package for the Social Sciences (SPSS) version 29 software package. A two-tailed *p*-value <0.05 was considered statistically significant.

## 3 | RESULTS

### 3.1 | Demographic data

A total of 87 patients who underwent 95 OBLS were included in this study. The mean age of the study group was 54.7 ± 13.7 years with a male to female ratio of 1.5. Almost two-thirds of the patients had medical comorbidities with the most common being hypertension (32.1%). The most common pathologies were benign lesions of the vocal fold (48.4%) followed by premalignant lesions of the vocal fold (29.5%; Table 1).

TABLE 1 Demographic characteristics of the study population.

| Demographic data | *N* = 87 |
|---|---|
| Gender (Male: Female ratio) | 1.5 |
| Age in years (mean ± SD) | 54.7 ± 13.7 |
| Comorbidities (*n* (%)) | 57 (65.5) |
| Voice diagnosis (*n* (%)) | |
| Benign lesions | 46 (48.4) |
| Pre-malignant lesions | 28 (29.5) |
| Neurogenic disorders | 15 (15.8) |
| Other | 6 (6.3) |

Abbreviations: RE, Reinke's edema; RRP, Recurrent respiratory papillomatosis; SD, Spasmodic dysphonia; SD, Standard Deviation; VF, Vocal fold.

### 3.2 | Type and duration of procedures performed

The most commonly performed procedure was office-based laser therapy (45.3%), followed by VFI (29.5%). A total of 48 office-based procedures were performed with background music, and 47 procedures were performed with no background music. The duration of surgery was recorded in 73 patients. The mean duration of surgery was 17.07 ± 6.88 minutes. Patients who underwent laser therapy had the longest duration vs. those who had vocal fold injection of pharmaceutical agents had the shortest duration. The difference between the subgroups was statistically significant ($p < .001$; Table 2).

TABLE 2 Mean duration across different types of procedures.

| Types of procedure (*N* = 95) | *n* (%) | Duration in minutes (Mean ± SD) |
|---|---|---|
| Blue laser | 43 (45.3) | 21.2 ± 6.70 |
| Vocal fold injection | 28 (29.5) | 13.38 ± 3.39 |
| Biopsy | 24 (25.2) | 14.95 ± 6.84 |
| *p* value = <.001* | | |

Abbreviation: SD: Standard deviation.
*Statistically significant.

### 3.3 | The IOWA satisfaction with anesthesia scale in patients undergoing OBLS with or without music

The mean IOWA satisfaction score of the whole study group was 2.02 ± 1.1. There was a statistically significant difference in the mean tolerance score across the three types of OBLS ($p = .038$) with the highest tolerance score being noted in VFI and the lowest in laryngeal biopsy, 2.27 ± 1.28 vs. 1.85 ± 1. When looking at the impact of music, there was a significant difference in the mean IOWA satisfaction score between patients who had their OBLS performed with background music vs. those who had their OBLS performed with no background music (2.48 ± 0.71 vs. 1.55 ± 1.23; $p < .001$).

When stratified by type of procedure, the statistically significant difference in the mean IOWA score between those who had music in the background vs. those who did not was still present in the subgroup who underwent office-based laser therapy and in those who underwent office-based laryngeal injection, but not in those who underwent office-based laryngeal surgery (Table 3).

### 3.4 | VAS discomfort score in patients undergoing OBLS with or without music

The mean VAS score for patient discomfort in the whole study group was 3.23 ± 2.92. There was no significant difference in the mean VAS score across the three types of OBLS ($p = .07$). Patients who had music in the background during surgery had a significantly lower VAS score of discomfort than those who had no music in the background (VAS score of 2.27 ± 2.4 vs. 4.21 ± 3.1, $p = .001$).

When stratified by type of procedure, there was still a significant difference in the mean VAS score of discomfort in only those who underwent office-based laser therapy (Table 4).

### 3.5 | Music-induced change in tolerance score and VAS score in relation to type of procedure

When looking at subgroups of OBLS who underwent different types of procedures, the difference in tolerance score among those who had music in the background vs. those who did not was found to be the highest in the subgroup who had laser therapy (1.228 ± 0.45), and the lowest in the subgroup who had laryngeal biopsy (0.144 ± 0.07).

Similarly, the difference in VAS score for discomfort among those who had music in the background vs. those who did not was highest in the subgroup who had VFI (2.57 ± 2.08) and lowest in the subgroup who had biopsy (0.37 ± 0.51; Table 5).

## 4 | DISCUSSION

The belief that music can influence pain experience in humans dates back to the ancient Greeks as the healing properties of music have been valued by indigenous cultures worldwide.[15] Music has been proven to be effective in reducing procedural anxiety and pain perception during various types of awake procedures. Its benefits have been demonstrated in office-based transrectal ultrasound-guided prostate biopsy, in-office hysteroscopy, and shockwave lithotripsy.[16–21] *Palakanis* et al. showed that patients who listened to music during flexible sigmoidoscopy had significantly lower anxiety scores as well as peaks in heart rate and blood pressure readings in comparison with those who had no music in the background.[16] Similarly, multiple studies showed that music therapy significantly decreases pain and anxiety associated with flexible cystoscopy, therefore increasing procedural satisfaction and willingness to undergo the procedure again.[22–25] *Hamidi* et al. demonstrated that listening to music during office-based percutaneous nephrostomy tube placement decreased anxiety and increased the success rate of the procedure in a cohort of 100 patients.[26] Music has also been shown to reduce anxiety in women undergoing thyroid fine-needle aspiration biopsy and to decrease pain perception in women undergoing ultrasound-guided breast biopsy.[27,28]

There are no studies in the literature on the effect of music on patient tolerance in laryngology practice. The results of this

**TABLE 3** Tolerance scores in relation to music.

| | Laser ($n = 43$) | | VFI ($n = 28$) | | Biopsy ($n = 24$) | | Total ($N = 95$) | |
|---|---|---|---|---|---|---|---|---|
| Type of procedure | With music | Without music | With music | Without music | With music | Without music | With music | Without music |
| Tolerance score | 2.49 ± 0.65 | 1.26 ± 1.00 | 2.78 ± 0.41 | 1.67 ± 1.67 | 1.94 ± 0.97 | 1.80 ± 1.04 | 2.48 ± 0.71 | 1.55 ± 1.23 |
| *p*-value | <.001* | | .03* | | .742 | | <.001* | |

AbbreviationVFI: Vocal fold injection;
*Statistically significant $p < .05$.

**TABLE 4** Discomfort score in relation to music.

| | Laser ($n = 43$) | | VFI ($n = 28$) | | Biopsy ($n = 24$) | | Total ($N = 95$) | |
|---|---|---|---|---|---|---|---|---|
| Type of procedure | With music | Without music | With music | Without music | With music | Without music | With music | Without music |
| VAS score for discomfort | 2.46 ± 2.43 | 4.74 ± 2.51 | 1.20 ± 1.82 | 3.77 ± 3.89 | 3.56 ± 2.65 | 3.93 ± 3.15 | 2.27 ± 2.40 | 4.21 ± 3.11 |
| *p*-value | .004* | | .08 | | .786 | | .001* | |

Abbreviation: VAS: Visual analogue scale; VFI: Vocal fold injection.
*Statistically significant $p < .05$.

**TABLE 5** Difference in tolerance score and VAS score for discomfort between those who had music vs. no music background across subgroups.

| Type of procedure | Laser ($n = 43$) | VFI ($n = 28$) | Biopsy ($n = 24$) |
|---|---|---|---|
| Δ Tolerance score | 1.228 ± 0.45 | 1.11 ± 1.26 | 0.144 ± 0.07 |
| ΔVAS score | 2.28 ± 0.082 | 2.57 ± 2.08 | 0.37 ± 0.51 |

Abbreviations: VAS, Visual analogue scale; VFI, Vocal fold injection; Δ, delta.

investigation support the premise that music can be used as a safe nonpharmacologic tool to improve patient tolerance and reduce the perception of discomfort during OBLS. The mean tolerance IOWA score was significantly higher, and the VAS score for discomfort was significantly lower in patients who underwent OBLS with music in the background in comparison with those who had no music in the background. These findings are in accord with the results of *Casale* et al in their study on the effect of music on patient discomfort during in-office video-assisted endoscopic radiofrequency inferior turbinate volume reduction. The authors reported a significant decrease in the mean VAS scores for pain and discomfort, a significant decrease in systolic blood pressure, and a nonsignificant decrease in heart rate during surgery. They concluded that music may be used as adjunct therapy to reduce anxiety and pain perception.[13]

The results of this investigation also showed that the impact of music on patient tolerance differed with the type of procedure performed. The impact of music was more pronounced in patients who underwent laser therapy and vocal fold injection of pharmaceutical agents in comparison to those who underwent laryngeal biopsy. The disparity in the impact of music on patient tolerance across the different types of procedures can be ascribed to many factors among which is the duration of surgery. This latter was significant with a p-value <0.001. Those who underwent office-based laser therapy and injections had significantly longer procedure time in comparison to vocal injection and biopsy.

How can music improve paint tolerance is still a topic of active deliberation. Tolerance is a complex experience shaped by personal attributes and inherent elements that vary widely between individuals. Despite this intersubject variability, music has been consistently reported to improve tolerance, relief pain, and decrease stress in different settings.[29] The mechanisms behind the impact of music on pain and tolerance are diverse, involving neurochemical, physiological, and psychological factors that operate in an intertwined fashion. Music is well-known as an effective distracter, focusing the patient's attention away from negative stimuli to something pleasant and encouraging. As such music occupies the listener's mind with something familiar and soothing, which allows the patient to escape into his or her "own world".[9] The rhythmic and melodic elements of music have also been shown to regulate autonomic nervous system responses, slowing the heart rate and respiratory rate, and also reducing blood pressure, which further contributes to a sense of calmness and relaxation. Neuroimaging studies have shown that various cortical and subcortical regions involved in pain processing are also activated by music-related stimuli, via a complex interplay of neuro-modulators such as endorphin, oxytocin, dopamine, and serotonin.[29] These neuromodulators, along with others like noradrenaline, glutamate, GABA, nitric oxide, cannabinoids, histamine, prostaglandins, and pro-inflammatory agents, have been implicated in modifying ascending nociceptive transmission at levels starting from peripheral dorsal root ganglia to cerebral cortex.[30] Most of these neuromodulators interact together at synaptic and receptor levels, affecting numerous intracellular signaling pathways and influencing pain perception.[31–33] When individuals listen to music, the brain's reward system is activated and there is release of dopamine, the neurotransmitter associated with pleasure and motivation. Together with other body's natural painkillers, including β-endorphin, enkephalins, and dynorphin, they bind to various opioid receptors in the brain to reduce pain sensation.[34] They can also influence many other psychophysiological and cognitive functions via peripheral and central actions on oxytocin receptors further reducing stress and anxiety.[35–38]

This study is the first to report the impact of music on OBLS. Nevertheless, it has its limitations, One is the heterogeneity in the OBLS performed and the second is the variation in individual preference to type of music. Knowing the cultural differences among participants, having one type of background music may bias the results of this investigation. Future studies are needed to further understand the multifaceted impact of music on patient tolerance.

## 5 | CONCLUSION

The results of this investigation indicate that music has a positive effect on procedural tolerance to OBLS. Participants who underwent OBLS with music in the background had significantly higher tolerance scores and less discomfort than those who had no music in the background. Music can be used as a safe nonpharmacologic adjunctive therapy.

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### CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare that are relevant to the content of this article.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon request. Abdul-Latif Hamdan confirms that he has full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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## REFERENCES

1. Zeitels SM, Akst LM, Burns JA, Hillman RE, Broadhurst MS, Anderson RR. Office-based 532-nm pulsed KTP laser treatment of glottal papillomatosis and dysplasia. *Ann Otol Rhinol Laryngol*. 2006;115(9):679-685.
2. Koufman JA, Rees CJ, Frazier WD, et al. Office-based laryngeal laser surgery: a review of 443 cases using three wavelengths. *Otolaryngol Head Neck Surg*. 2007;137(1):146-151.
3. Rees CJ, Halum SL, Wijewickrama RC, Koufman JA, Postma GN. Patient tolerance of in-office pulsed dye laser treatments to the upper aerodigestive tract. *Otolaryngol Head Neck Surg*. 2006;134(6):1023-1027.
4. Hamdan AL, Jabbour C, Khalifee E, Ghanem A, Hage AE. Tolerance of patients using different approaches in laryngeal office-based procedures. *J Voice*. 2023;37(2):263-267.
5. Hamdan AL, Hosri J, Abou Raji Feghali P, Ghanem A, Fadel C, Jabbour C. Patient tolerance in office-based blue laser therapy for lesions of the vocal folds: correlation with patients' characteristics, disease type and procedure-related factors. *Laryngoscope Investig Otolaryngol*. 2023;8(4):934-938.
6. Rosen CA, Amin MR, Sulica L, et al. Advances in office-based diagnosis and treatment in laryngology. *Laryngoscope*. 2009;119(S2):S185-S212.
7. Hamdan AL, Sataloff RT, Hawkshaw MJ. Topical anesthesia in office-based laryngeal surgery. In: Hamdan AL, Sataloff RT, Hawkshaw MJ, eds. *Office-Based Laryngeal Surgery*. Springer Nature; 2022:123-135.
8. Woo P. Office-based laryngeal procedures. *Otolaryngol Clin North Am*. 2006;39(1):111-133.
9. Nilsson U. The anxiety- and pain-reducing effects of music interventions: a systematic review. *AORN J*. 2008;87(4):780-807.
10. Byers JF, Smyth KA. Effect of a music intervention on noise annoyance, heart rate, and blood pressure in cardiac surgery patients. *Am J Crit Care*. 1997;6(3):183-191.
11. White JM. Music as intervention: a notable endeavor to improve patient outcomes. *Nurs Clin North Am*. 2001;36(1):83-92.
12. Magill-Levreault L. Music therapy in pain and symptom management. *J Palliat Care*. 1993;9(4):42-48.
13. Casale M, Sabatino L, Moffa A, et al. Could music minimize discomfort and pain during office-based ENT surgery? *Int J Otolaryngol*. 2018;2018:6480346.
14. Dexter F, Aker J, Wright WA. Development of a measure of patient satisfaction with monitored anesthesia care: the Iowa satisfaction with anesthesia scale. *Anesthesiology*. 1997;87(4):865-873.
15. Thaut MH. Music as therapy in early history. *Prog Brain Res*. 2015;217:143-158.
16. 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(5):478-481.
17. Tsivian M, Qi P, Kimura M, et al. The effect of noise-cancelling headphones or music on pain perception and anxiety in men undergoing transrectal prostate biopsy. *Urology*. 2012;79(1):32-36.
18. Dell'Atti L. Impact of music on anxiety and pain perception among men undergoing prostate biopsy: synthesis of qualitative literature. *Complement Ther Clin Pract*. 2021;43:101330.
19. Angioli R, De Cicco NC, Plotti F, et al. Use of music to reduce anxiety during office hysteroscopy: prospective randomized trial. *J Minim Invasive Gynecol*. 2014;21(3):454-459.
20. Çift A, Benlioglu C. Effect of different musical types on Patient's relaxation, anxiety and pain perception during shock wave lithotripsy: a randomized controlled study. *Urol J*. 2020;17(1):19-23.
21. Akbas A, Gulpinar MT, Sancak EB, et al. The effect of music therapy during shockwave lithotripsy on patient relaxation, anxiety, and pain perception. *Ren Fail*. 2016;38(1):46-49.
22. Raheem OA, Mirheydar HS, Lee HJ, Patel ND, Godebu E, Sakamoto K. Does listening to music during office-based flexible cystoscopy decrease anxiety in patients: a prospective randomized trial. *J Endourol*. 2015;29(7):791-796.
23. Wang DS. Re: does listening to music during office-based flexible cystoscopy decrease anxiety in patients: a prospective randomized trial. *J Urol*. 2016;195(2):448-449.
24. Gauba A, Ramachandra MN, Saraogi M, et al. Music reduces patient-reported pain and anxiety and should be routinely offered during flexible cystoscopy: outcomes of a systematic review. *Arab J Urol*. 2021;19(4):480-487.
25. Chen G, Tang C, Liu Y, Liu Y, Dai Y, Yang L. Does listening to music improve pain perception and anxiety in patients undergoing cystoscopy: a meta-analysis. *Front Surg*. 2021;8:689782.
26. Hamidi N, Ozturk E. The effect of listening to music during percutaneous nephrostomy tube placement on pain, anxiety, and success rate of procedure: a randomized prospective study. *J Endourol*. 2017;31(5):457-460.
27. Barlas T, Sodan HN, Avci S, Cerit ET, Yalcin MM. The impact of classical music on anxiety and pain perception during a thyroid fine needle aspiration biopsy. *Hormones (Athens)*. 2023;22(4):581-585.
28. Öztürk FU, Turnaoğlu H, Uslu N. Preferred music lowers anxiety levels and pain perception while promoting patient satisfaction in women undergoing ultrasound-guided breast biopsy: randomized controlled study. *Acta Radiol*. 2023;64(3):993-998.
29. Arnold CA, Bagg MK, Harvey AR. The psychophysiology of music-based interventions and the experience of pain. *Front Psychol*. 2024;15:1361857.
30. Yam MF, Loh YC, Tan CS, Khadijah Adam S, Abdul Manan N, Basir R. General pathways of pain sensation and the major neurotransmitters involved in pain regulation. *Int J Mol Sci*. 2018;19(8):2164.
31. Cahill CM, Holdridge SV, Morinville A. Trafficking of delta-opioid receptors and other G-protein-coupled receptors: implications for pain and analgesia. *Trends Pharmacol Sci*. 2007;28(1):23-31.
32. Hao S, Shi W, Liu W, Chen QY, Zhuo M. Multiple modulatory roles of serotonin in chronic pain and injury-related anxiety. *Front Synaptic Neurosci*. 2023;15:1122381.
33. Li C, Liu S, Lu X, Tao F. Role of descending dopaminergic pathways in pain modulation. *Curr Neuropharmacol*. 2019;17(12):1176-1182.
34. Neugebauer V, Presto P, Yakhnitsa V, Antenucci N, Mendoza B, Ji G. Pain-related cortico-limbic plasticity and opioid signaling. *Neuropharmacology*. 2023;231:109510.
35. Pilozzi A, Carro C, Huang X. Roles of β-endorphin in stress, behavior, Neuroinflammation, and brain energy metabolism. *Int J Mol Sci*. 2020;22(1):338.
36. Yang LN, Chen K, Yin XP, Liu D, Zhu LQ. The comprehensive neural mechanism of oxytocin in analgesia. *Curr Neuropharmacol*. 2022;20(1):147-157.
37. Herpertz SC, Schmitgen MM, Fuchs C, et al. Oxytocin effects on pain perception and pain anticipation. *J Pain*. 2019;20(10):1187-1198.
38. Lorek M, Bąk D, Kwiecień-Jaguś K, Mędrzycka-Dąbrowska W. The effect of music as a non-pharmacological intervention on the physiological, psychological, and social response of patients in an intensive care unit. *Healthcare (Basel)*. 2023;11(12):1687.

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