v1: 26 February 2025

Research Article

Music Therapy for Alleviating Pain and Enhancing Quality of Life During Endodontic Treatment in Lagos, Nigeria

Peer-approved: 26 February 2025

Qeios, Vol. 7 (2025)
ISSN: 2632-3834

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Background: The oral health-related quality of life (OHRQOL) in patients undergoing endodontic procedures is closely linked to their emotional and psychological well-being, which is influenced by factors such as pain management, anxiety, and overall satisfaction with the dental experience. This study aims to investigate the impact of music therapy on endodontic patients' quality of life, with a particular focus on its role in reducing anxiety and managing pain.

Methods: This study employed a quasi-experimental design among 35 patients over 18 years of age who visited the LASUTH dental clinic for endodontic treatment. The study was utilized to determine the effect of slow, classical music on pain perception, anxiety, and oral health-related quality of life of patients receiving endodontic therapy. The Modified Dental Anxiety Scale (MDAS), the Numerical Graphic Pain Rating Scale (NPRS), and the Oral Health Impact Profile-14 (OHIP-14) were utilized for baseline and pot-intervention data collection. Comparative analysis for continuous variables was done using an independent sample T-test and Repeated measures Analysis of variance (ANOVA). Statistical significance was set at P-values <0.05.

Results: Psychological discomfort showed significant reductions in both groups, with a mean difference of 1.507 in the test group (p=0.006) and 1.441 in the control group (p=0.015). Psychological disability also decreased significantly in both groups, with mean differences of 1.168 (p=0.010) and 0.987 (p=0.041) in the test and control groups, respectively. NPRS scores decreased significantly in both groups, with a larger mean difference in the test group (2.660 ± 0.691, p<0.001) compared to the control group (1.920 ± 0.753, p=0.016). OHIP-14 scores also showed significant reductions, with a mean difference of 5.543 ± 1.990 in the test group (p=0.009) and 5.291 ± 2.169 in the control group (p=0.020). There was however no significant difference in pain perception reduction and OHRQOL between the intervention and control groups, despite higher reductions observed in the test group.

doi.org/10.32388/SQBC5K.2

Conclusion: The study demonstrated significant within-group reductions in psychological discomfort and psychological disability domains of OHIP-14, MDAS, and NPRS scores, with the test group showing more pronounced improvements. However, the lack of statistically significant differences in key outcomes such as pain perception and oral health-related quality of life between the intervention and control groups limits the generalizability and applicability of these findings. While both interventions appear effective in alleviating psychological and physical distress, further research—particularly randomized controlled trials with larger sample sizes—is necessary to determine whether music therapy provides measurable benefits beyond standard care.

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Introduction

Endodontic treatment or root canal therapy, is perceived as one of the anxiety-inducing dental procedures. For many patients, the anticipation of pain, discomfort, and potential complications creates heightened levels of dental anxiety. This anxiety not only affects patients' willingness to seek care but also significantly impacts their quality of life (QOL) before, during, and after treatment[1][2]. Dental anxiety is a widespread phenomenon, with studies showing that a significant proportion of individuals experience varying degrees of fear related to dental visits. This anxiety often leads to the avoidance of necessary care, delays in treatment, and increased stress, ultimately compromising oral and general health. [2] [3]. Furthermore, the clinical environment, coupled with the use of intimidating instruments and prolonged periods of discomfort, exacerbates these fears, making endodontic procedures particularly daunting. [4]

The quality of life (QOL) in patients undergoing endodontic procedures is closely linked to their emotional and psychological well-being, which is influenced by factors such as pain management, anxiety, and overall satisfaction with the dental experience. As a result, many patients report diminished oral health-related quality of life (OHRQOL) as they avoid timely dental care, leading to long-term health risks[3][4]. To manage dental anxiety, traditional approaches often rely on pharmacological interventions such as sedatives, anxiolytics, and nitrous oxide. While effective, these methods are not without drawbacks, including potential side effects and patients' preferences for less invasive alternatives[5]. Consequently, non-pharmacological interventions like music therapy (MT) have gained increasing attention due to their ability to address anxiety in a holistic and patient-friendly manner. [6][7][8][9]

Music therapy, as a non-invasive technique, leverages the power of music to reduce stress and promote relaxation. The introduction of distraction techniques, such as music therapy and audiovisual aids, is transforming how dental anxiety is managed. Unlike pharmacological interventions, music therapy provides an accessible and non-invasive means to ease anxiety, lower physiological stress markers, and improve patients' overall comfort during dental procedures[4]. Relaxing music has been shown to mitigate negative emotional states such as fear and anxiety, thus contributing to an enhanced sense of well-being and improved quality of life(QOL[10]. By fostering a sense of calm and reducing emotional distress, music therapy can enhance patient compliance and satisfaction, leading to better treatment outcomes and improved QOL[8]. By stimulating the auditory system, music influences both psychological and physiological responses, helping to distract patients from negative stimuli and creating a calming environment during medical and dental procedures[4][7]. Importantly, for endodontic patients—who are often predisposed to heightened anxiety—music therapy offers a promising alternative to traditional anxiety management approaches[4].

Research into the benefits of music therapy across various healthcare settings has yielded promising results. Studies have demonstrated its anxiolytic properties, with music shown to reduce physiological stress markers such as heart rate and blood pressure while fostering positive emotional states[4]. Specific genres, including traditional music and Western

classical compositions like Mozart's works, have been highlighted for their calming effects[4]. Despite these successes in broader medical contexts, the application of music therapy in dentistry, particularly in endodontics, remains relatively underexplored, especially in Nigeria. However, its potential to enhance OHRQOL and improve treatment experiences makes it a valuable area for further investigation[4][9].

This study aims to investigate the impact of music therapy on endodontic patients' quality of life, with a particular focus on its role in reducing anxiety and managing pain. By exploring how exposure to relaxing music during root canal therapy influences psychological and physical states, this research seeks to establish music therapy as a practical and effective intervention for enhancing OHRQOL in dental practice[4].

Materials and Methods

Description of The Study Area

The study was done at the Lagos State University Teaching Hospital dental clinic in Ikeja, Lagos state. The Lagos State University Teaching Hospital (LASUTH), as it is now called, was initially a cottage hospital that was established on June 25th 1955 by the old Western Regional Government to provide health care service for the people of Ikeja and its environs. In July 2001 it became a teaching hospital, providing specialist training and services. The LASUTH Dental Clinic is a tertiary oral healthcare facility in Lagos, Nigeria, providing comprehensive dental services, education, and research. Equipped with modern diagnostic and treatment technologies, it offers preventive, restorative, prosthetic, orthodontic, and surgical dental care. The clinic serves a diverse patient population, contributing to public health through specialized interventions and outreach programs. It trains dental students, residents, and healthcare professionals as a teaching facility, fostering clinical excellence and innovation. Research activities focus on oral diseases, epidemiology, and advanced treatment modalities. The clinic collaborates with national and international institutions to enhance service delivery. Patient-centered care and ethical practice are fundamental to its operations. LASUTH Dental Clinic supports government efforts to improve oral health awareness and policy development. Its multidisciplinary team includes experienced specialists, resident doctors, and allied health professionals. The clinic is vital in bridging the gap between dental education, clinical practice, and public health initiatives and has clinical departments including Restorative dentistry, Oral and maxillofacial surgery, Preventive dentistry, Child dental health and Oral medicine/Oral pathology. The dental clinic attends to approximately 18,000 patients annually with an estimated average of about 40 new patients daily.[11]

Study Design and Study Population

This study employed a quasi-experimental design among patients over 18 who visited the LASUTH dental clinic for treatment. The study was utilized to determine the effect of slow, jazz music on pain perception, anxiety, and oral health-related quality of life of patients receiving endodontic therapy.

Inclusion Criteria

Patients above the age of 18 years who were willing to participate, mentally fit, who had no hearing impairment, who were adjudged to require a single visit endodontic therapy, with teeth that are restorable and periodontally sound, and who were fully conscious were included in this study.

Exclusion Criteria

Patients below the age of 18, those who refused to consent, those with impaired hearing, participants using anxiolytics, and analgesic medications, and those who were not mentally fit were excluded from the study.

Sampling Technique

A simple random sampling technique was used to recruit participants for the study. Patients who visited the LASUTH dental clinic and were adjudged to require endodontic therapy were sampled, using the balloting method, and the attendance register in the endodontic clinic served as the sampling frame. The participants were then randomly assigned into two groups, via a table of random numbers: a test group that would undergo endodontic treatment with soft jazz music and a control group that would undergo endodontic treatment without music.

Sample Size Determination

This was done with a formula for the comparison of means[12]:

$$n = 2\left[\frac{(Z_\alpha + Z_\beta)\,\sigma}{\Delta}\right]^2$$

Where:

n	=	Sample size per group
$Z\alpha$	=	Standard normal deviate corresponding to α value of 0.05=1.96
Z_β	=	Standard normal deviate corresponding to β value of 0.20 (when the power of the study is 80.0%) =0.84
σ	=	The standard deviation of Post-op RCT from a previous study (38) (5.16+3.61) = 8.77
μ_1	=	Mean VAS score among participants who had RCT with music from a previous study[13] =32.80
μ_2	=	Mean VAS score among participants who had RCT without music from a previous study[13]=39.55
Δ	=	The difference between the two average values 39.55-32.80= 6.75

For α= 0.05 and β= 0.20, $z\beta$ = 0.8416 and $z\,\alpha/2$ = 1.96

$$\left[\frac{(1.96+0.84)8.77}{6.75}\right]^2$$

$$\left[\frac{(2.8)8.77}{6.75}\right]^2$$

$$[3.64]^2 = 13.24$$

Addition of 10% attrition= 13.64+1.32= 14.56 approximately 15. The total calculated sample size is hence 15x 2 =30.

Nineteen (19) participants recruited for the cases kept their appointment while 16 of the 19 recruited for the control did. A total of 35 participants thus participated in the study.

Survey Instrument

The study was done utilizing a structured interviewer-administered questionnaire. The purpose of the study was explained to the patients and their consent was taken, while their names and addresses were excluded to maintain confidentiality and ensure accurate responses. The questionnaire had 5 sections; section A obtained the socio-demographic characteristics of the patients; Age, gender, nationality, marital status, occupation, level of education. Section B obtained information on the level of anxiety of the participants, using the Modified Dental Anxiety Scale (MDAS). [14] Section C collected data on dental parameters like DMFT and teeth scheduled for treatment; Section D collected data on pain perception using the Numerical Graphic Pain rating scale (NPRS). [15] while Section E collected data on oral health-related quality of life using OHIP-14. [16] NPRS and OHIP-4 data were taken before and one hour after the endodontic therapy for each group. The NPRS is a segmented numeric version of the visual analogue scale (VAS). It is typically a bar or a line from which a respondent selects a whole number (0-10 integers) that best reflects the intensity of the participants' pain, bounded at the left-most end with "no pain" and at the right-most end with "worst pain imaginable".

The Modified Dental Anxiety Scale (MDAS)[14] was utilized as the primary instrument to measure dental anxiety levels among participants. The MDAS is a validated and widely used tool specifically designed to assess anxiety related to dental experiences. It consists of five questions that evaluate anxiety in response to various dental scenarios, including: thinking about visiting the dentist, waiting in the dentist's office, preparing to have a tooth drilled, preparing for teeth scaling and polishing, and receiving a local anaesthetic injection. Each question is scored on a Likert scale ranging from 1 to 5, where 1 represents "not anxious" and 5 represents "extremely anxious." The total score, calculated by summing the responses, ranges from 5 to 25. A higher score indicates greater levels of dental anxiety, with scores of 19 or above signifying severe anxiety. The Oral Health Impact Profile-14 (OHIP-14) is a questionnaire that measures people's perception of the social impact of oral disorders on their well-being. OHIP-14 comprises 14 questions divided into seven dimensions; functional limitation, physical discomfort, psychological discomfort, physical disability, psychological disability, social disability, and handicaps. The NPRS, MDAS, and OHIP-14 have been extensively validated instruments and have been validated in Nigeria.

Study Procedure

The participants were instructed to arrive at the dental clinic one hour before their scheduled

appointment. On arrival, before beginning the root canal procedure, the participants were comfortably seated, and the research questionnaire was administered to them. Subsequently, the dental nurse prepared a portable CD player by inserting a designated CD and providing headphones to the participants. The headphones were carefully placed and the volume was adjusted to ensure optimal comfort. Once the participant reclined in the dental chair, the clinical environment was maintained at a consistent room temperature of 26°C to enhance comfort during the intervention. After the participant fully settled, the classical music was played continuously throughout the root canal procedure. For those in the control group, an identical procedure was followed, except for the music. The music therapy group recieved pre-procedural reassurance and local anesthesia, and also passively listened to a pre-selected playlist of slow classical pieces at a volume of approximately 50–60 dB, using noise-cancelling headphones, for 20 minutes before and during the procedure. This playlist was curated based on previous research indicating its effectiveness in reducing anxiety. The control group received standard care, which included routine pre-procedural reassurance and local anesthesia. Participants in the music therapy group were instructed to focus on the rhythm and melody of the music. The intervention was primarily intended as a relaxation technique, leveraging the calming effects of slow-tempo music to reduce physiological and psychological stress responses. Throughout the study, none of the participants in either group requested the removal of their headphones and all adhered fully to the instructions provided. The postoperative questionnaire was administered to them 30 min after the procedure.

Endodontic Procedure

After subjects had been adjudged to require endodontic therapy via a comprehensive diagnosis which would include history, examinations, and investigations such as radiographs and pulp sensibility testing. It was ensured that the participants were not premedicated with analgesics, antibiotics nor anxiolytics to avoid bias. The participant's tooth was anaesthetized by using 2% lidocaine hydrochloride with adrenaline (1:100,000) in a 2 ml 26-gauge needle or 30-gauge needle as the case may be depending on the site of the tooth intended for the endodontic treatment. After waiting for 10 minutes, the tooth for root canal treatment was tested to check for the success of anaesthesia both subjectively and objectively. The participants then underwent the endodontic procedure in a standardized manner, from working length determination to obturation and access cavity restoration. The procedures lasted between 40 and 60 minutes, depending on case complexity. All treatments followed a standardized protocol involving local anesthesia, rubber dam isolation, and rotary instrumentation. No intraoperative complications were recorded The treatment was performed by a single operator who was adequately calibrated. The participants completed the endodontic therapy in a single visit.

Data Analysis

Data entry, analysis and validation was done with IBM SPSS 26 software (Statistical package for social sciences). The data was presented using frequency tables and percentages, chi-square testing was used for sociodemographic comparisons and to define the relationship between the categorical variables and the dependent variables. Comparative analysis for continuous variables was done by using independent sample T-test and one-way ANOVA with Bonferroni correction was used for multiple comparisons. Statistical significance was set at P-values <0.05.

Ethical Consideration

Approval was obtained from the Health Research Ethics Committee of LASUTH. All participants were properly briefed on the nature, purpose, benefit, and duration of the study. Informed consent was obtained from each participant, and the confidentiality of their responses was assured. The confidentiality of the information collected was secured by restricting access to the data collected by investigators and research assistants. Anonymity of the respondents was ensured by excluding the personal details of the respondents in the questionnaire. Respondents were informed of their right to decline participation without undue influence on the care they will receive in the facility.

Results

Table 1 presents the comparison of sociodemographic characteristics between the case group (n=19) and the control group (n=16). The mean age was higher in the case group (38.79 ± 15.86 years) compared to the control group (31.63 ± 9.80 years), but this difference was not statistically significant (p=0.113). Gender distribution showed a higher percentage of females in both groups, with 78.9% in the case group and 68.8%

in the control group (p=0.700). Educational level revealed that all participants in the control group had tertiary education, while 26.4% of the case group had either no formal education or only secondary education (p=0.071). Religious affiliation was the only significantly different category, with Christianity accounting for 100% in the control group compared to 73.7% in the case group (p=0.049). Ethnic group distributions were predominantly Yoruba, but the case group had more participants identifying as "Others," while the control group had a higher proportion of Igbo (p=0.073). The mean DMFT index was slightly higher in the control group (3.39 ± 1.38) than in the case group (2.32 ± 1.765), but not significant (p= 0.057).

doi.org/10.32388/SQBC5K.2

	Cases (n=19) N (%)	Control (n=16) N (%)	p-value*
Mean age	38.79±15.863	31.63±9.804	0.113
Gender			
Male	4 (21.1)	5 (31.3)	0.700
Female	15 (78.9)	11 (68.8)	
Marital status			
Single	7 (36.8)	8 (50.0)	
Married	10 (52.6)	8 (50.0)	0.923
Separated	1 (5.3)	0 (0.0)	
Widow/widower	1 (5.3)	0 (0.0)	
Educational level			
None	1 (5.3)	0 (0.0)	
Secondary	4 (21.1)	0 (0.0)	0.071
Tertiary	14 (73.7)	16 (100.0)	
Religion			
Christianity	14 (73.7)	16 (100.0)	0.049*
Islam	5 (26.3)	0 (0.0)	
Ethnic group			
Yoruba	17 (89.5)	10 (62.5)	0.073
Igbo	1 (5.3))	5 (31.3)	
Others	1 (6.3)	1 (6.3)	
Occupation			
Artisan	2 (10.5)	3 (18.8)	
Civil servant	3 (15.8)	1 (6.3)	0.585
Professional	8 (42.1)	10 (62.5)	
Student	4 (21.1)	1 (6.3)	
Unemployed	2 (10.5)	1 (6.3)	
Mean DMFT	2.32±1.765	3.39±1.384	0.057

Table 1. Sociodemographic characteristics

*Chi square

Table 2 displays the responses of cases and controls to the Modified Dental Anxiety Scale (MDAS) questions at baseline. Those in the control group reported higher mean scores compared to cases, for the questions. In response to receiving a local anesthetic injection, cases reported a mean score of 2.21±1.182, while controls reported 2.94±1.124. Similarly, for drilling, the mean score for cases was 2.16±1.344, compared to 2.88±1.204 for controls. However, none of these differences was statistically significant. The overall MDAS score was also higher in controls

(11.38±4.241) than in cases (9.42±4.260), but this difference was not statistically significant (p = 0.185).

doi.org/10.32388/SQBC5K.2

MDAS Questions	Group	Mean±SD	t	Mean difference	95% Confidence interval		P-value
					Lower	Upper	
If you were to visit your dentist for treatment tomorrow, how will you feel?	Cases	1.68±0.820	-0.370	-0.128	-0.835	0.578	**0.714**
	Control	1.81±1.223					
If you were sitting in the reception area waiting for treatment, how will you feel?	Cases	1.89±1.049	-0.111	-0.043	-0.828	0.743	**0.912**
	Control	1.94±1.237					
If you were about to have a tooth drilled, how would you feel?	Cases	2.16±1.344	-1.648	-0.717	-1.602	0.168	**0.109**
	Control	2.88±1.204					
If you were about to have your teeth scaled and polished, how would you feel?	Cases	1.47±0.612	-1.192	-0.339	-0.917	0.240	**0.242**
	Control	1.81±1.047					
If you were about to receive an injection of local anaesthesia in your gum above an upper back tooth, how would you feel?	Cases	2.21±1.182	-1.853	-0.727	-1.525	0.71	**0.073**
	Control	2.94±1.124					
Total MDAS score	Cases Control	9.42±4.260 11.38±4.241	-1.954	t=-1.355	-4.889	0.981	0.185

Table 2. Baseline Dental Anxiety Levels among Cases and Controls using the Modified Dental Anxiety Scale (MDAS)

Table 3 reports the changes in Oral Health Impact Profile (OHIP) domain scores before and after the intervention for both test and control groups. Functional limitation improved significantly in the test group (p=0.004) and control group (p=0.001), with mean differences of 0.939 and 1.146, respectively. Psychological discomfort also showed significant reductions in both groups, with a mean difference of 1.507 in the test group (p=0.006) and 1.441 in the control group (p=0.015). Psychological disability decreased significantly in both groups, with mean differences of 1.168 (p=0.010) and 0.987 (p=0.041) in the test and control groups, respectively. Social disability improved significantly only in the control group (p=0.048) with a mean difference of 1.071, while the test group showed a smaller, non-significant improvement: 0.581 (p=0.233). Physical pain, physical disability, and handicap did not change significantly in either group (p>0.05),

doi.org/10.32388/SQBC5K.2

Variables			Mean	Mean difference	Confidence interval		p-value
					Lower level	Upper level	
Functional Limitation	Test group	Pre-Intervention	3.158±0.294	0.939±0.302	2.559	3.756	0.004*
		Post-intervention	4.096±0.364		3.355	4.838	
	Control group	Pre-Intervention	2.375±0.321	-1.146±0.329	1.723	3.027	0.001*
		Post-intervention	3.521±0.397		2.713	4.329	
Physical Pain	Test group	Pre-Intervention	5.474±0.484	-0.130±0.479	4.489	6.458	0.788
		Post-intervention	5.604±0.530		4.526	6.682	
	Control group	Pre-Intervention	5.500±0.527	0.901±0.522	4.427	6.573	0.094
		Post-intervention	4.599±0.577		3.424	5.773	
Psychological Discomfort	Test group	Pre-Intervention	5.842±0.619	1.507±0.515	4.582	7.102	0.006*
		Post-intervention	4.335±0.546		3.225	5.445	
	Control group	Pre-Intervention	5.563±0.675	1.441±0.561	4.190	6.935	0.015*
		Post-intervention	4.122±0.595		2.912	5.332	
Physical Disability	Test group	Pre-Intervention	5.474±0.559	0.968±0.539	4.336	6.612	0.082
		Post-intervention	4.505±0.566		3.353	5.657	
	Control group	Pre-Intervention	4.687±0.610	0.257±0.588	3.447	5.928	0.665
		Post-intervention	4.430±0.617		3.175	5.686	
Psychological Disability	Test group	Pre-Intervention	5.158±0.506	1.168±0.425	4.129	6.187	0.010*
		Post-intervention	3.989±0.481		3.010	4.969	

doi.org/10.32388/SQBC5K.2

Variables			Mean	Mean difference	Confidence interval		p-value
					Lower level	Upper level	
	Control group	Pre-Intervention	4.562±0.551	0.987±0.463	3.441	5.684	0.041*
		Post-intervention	3.575±0.525		2.508	4.642	
Social Disability	Test group	Pre-Intervention	4.947±0.500	0.581±0.478	3.930	5.965	0.233
		Post-intervention	4.367±0.568		3.211	5.522	
	Control group	Pre-Intervention	4.562±0.545	1.071±0.521	3.453	5.672	0.048*
		Post-intervention	3.492±0.619		2.232	4.751	
Handicap	Test group	Pre-Intervention	5.105±0.526	0.842±0.442	4.034	6.176	0.065
		Post-intervention	4.263±0.583		3.076	5.450	
	Control group	Pre-Intervention	4.000±0.574	0.625±0.481	2.833	5.167	0.203
		Post-intervention	3.375±0.636		2.081	4.669	

Table 3. OHIP Domains-Pairwise comparisons

Table 4 evaluates pre- and post-intervention changes in the Numerical Pain Rating Scale (NPRS), OHIP-14, and MDAS scores within the test and control groups. NPRS scores decreased significantly in both groups, with a larger mean difference in the test group (2.660 ± 0.691, p<0.001) compared to the control group (1.920 ± 0.753, p=0.016). OHIP-14 scores also showed significant reductions, with a mean difference of 5.543 ± 1.990 in the test group (p=0.009) and 5.291 ± 2.169 in the control group (p=0.020). In the test group, the mean MDAS scores significantly decreased from 9.42±4.260 to 6.97±3.154, with a mean difference of 2.45±1.106 (p = 0.001), indicating a substantial reduction in anxiety. Similarly, the control group showed a significant decrease from 11.38±4.241 to 9.29±3.464, with a mean difference of 2.09±0.777 (p = 0.024).

doi.org/10.32388/SQBC5K.2

Variables			Mean	Mean difference	Confidence interval		p-value
					Lower level	Upper level	
NPRS	Test group	Pre-Intervention Post-intervention	5.526±0.579 2.867±0.530	2.660±0.691	4.348 1.789	6.704 3.945	<0.001*
	Control group	Pre-Intervention Post-intervention	4.687±0.631 2.768±0.577	1.920±0.753	3.404 1.593	5.971 3.943	0.016*
OHIP-14	Test group	Pre-Intervention Post-intervention	35.158±2.749 29.614±3.188	5.543±1.990	29.565 23.128	40.750 36.101	0.009*
	Control group	Pre-Intervention Post-intervention	31.250±2.995 25.959±3.474	5.291±2.169	25.156 18.891	37.344 33.028	0.020*
MDAS	Test group	Pre-Intervention Post-intervention	9.420±4.260 6.970±3.154	2.45±1.106	8.659 6.023	9.938 7.247	0.001*
	Control group	Pre-Intervention Post-intervention	11.383±4.241 9.293±3.464	2.09±0.777	10.982 8.824	11.893 10.016	0.024*

Table 4. Within/intra-group comparisons for mean NPRS, OHIP-14 and OHIP-14 scores.

Table 5 compares the Numeric Pain Rating Scale (NPRS), Oral Health Impact Profile-14 (OHIP-14), and Modified Dental Anxiety Scale (MDAS) scores of the test and control groups before and after the intervention. Before the intervention, the test group reported higher mean NPRS scores (5.526±0.579) than the control group (4.687±0.631). Post-intervention, both groups showed reductions, with the test and control groups scoring 2.867±0.530 and 2.768±0.577, respectively. There was a relatively greater reduction in the test group, though not significant. For OHIP-14, Pre-intervention, the test group also exhibited higher baseline scores (35.158±2.749) than the control group (31.250±2.995), reflecting greater initial oral health-related quality-of-life impacts. The post-intervention scores were 29.614±3.188 and 25.959 ± 3.474 in the test and control groups, respectively. Although both groups showed improvement, the test group achieved a larger non-significant absolute reduction. For MDAS, the baseline anxiety levels were lower in the test group (9.420±4.260) than in the control group (11.383±4.241). Post-intervention, the scores decreased to 6.970±3.154 in the test group and 9.293±3.464 in the control group., with a larger relative reduction in the test group.

Variables			Mean	Mean difference	Confidence interval		p-value
					Lower level	Upper level	
NPRS	Pre-intervention	Test group Control group	5.526±0.579 4.687±0.631	0.839±.856	4.348 3.404	6.704 5.971	0.334
	Post intervention	Test group Control group	2.867±0.530 2.768±0.577	0.099±0.784	1.789 1.593	3.945 3.943	0.901
OHIP-14	Pre-intervention	Test group Control group	35.158±2.749 31.250±2.995	3.908±4.066	29.565 25.156	40.750 37.344	0.343
	Post intervention	Test group Control group	29.614±3.188 25.959±3.474	3.655±4.715	23.128 18.891	36.101 33.028	0.444
MDAS	Pre-intervention	Test group Control group	9.420±4.260 11.383±4.241	-1.986±0.019	8.659 0.982	9.938 11.893	0.096
	Post intervention	Test group Control group	6.970±3.154 9.293±3.464	-2.333±0.310	6.023 8.824	7.247 10.016	0.073

Table 5. Between-group comparisons for mean NPRS, OHIP-14, and OHIP-14 scores.

Discussion

Endodontic treatment can elicit dental anxiety due to its invasive nature and association with discomfort and pain. This anxiety profoundly affects patients' quality of life and treatment outcomes. Sociodemographic characteristics of the participants revealed that the mean age was higher in the case group compared to the control group, and the case group also had higher mean baseline NPRL and QoL scores, reflecting that older individuals may perceive endodontic procedures differently. This observation aligns with existing research suggesting that older adults often report distinct anxiety triggers related to health and dental care, including fears of pain and complications[17]. Gender distribution showed a predominance of females in both groups, which corresponds to studies indicating that women are generally more likely to report higher levels of dental pain. This may be attributed to increased awareness and emotional sensitivity towards dental health among females[18].

Educational level appeared to play a role, with all control group participants possessing tertiary education compared to the 26.4% of the case group with lower educational attainment. Although not statistically significant, this could have had an effect in the results of the study, since higher education levels might correlate with better health literacy, improved understanding of dental procedures, and reduced anxiety[19]. Conversely, the slightly higher DMFT index in the same control group, nearing statistical significance, could indicate a trend toward poorer oral health in this group, which has been strongly associated with increased anxiety due to fears of pain, and the perception of worsening dental conditions[20].

The changes in MDAS and OHIP-14 domain scores pre- and post-intervention underscore the impact that endodontic therapy itself had on the self-rated quality of life of the respondents. There was a

significant reduction in the MDAS scores, pre- and post-intervention in both groups. Similarly, for the OHIP-14 domain scores, functional limitation improved significantly in both groups, but more in the control group, while social disability improved significantly only in the control group, reflecting that the music intervention had no impact in these domains. Psychological discomfort and psychological disability were however significantly reduced in both groups, but the cases group had higher mean reductions, highlighting the role of music therapy in alleviating emotional distress. The observed improvements in psychological and functional domains suggest that music therapy could foster a sense of control and positive association with dental care. This is particularly significant given that avoidance behaviors linked to dental anxiety can lead to delayed treatment and worsening oral health outcomes. By addressing both immediate and long-term psychological needs, music therapy can reshape patients' attitudes toward dental care, encouraging more proactive health-seeking behaviors[18]. In dental settings, findings have emerged. A study by Kühlmann et al.[21] found that patients who listened to relaxing music during dental procedures reported lower anxiety and a more positive experience than those without music 29. Additionally, Bringman et al. [22] research indicated that classical music, specifically pieces like Mozart's compositions, could reduce subjective and physiological stress markers. However, the specific use of music therapy in endodontics and its effects on the quality-of-life metrics, such as satisfaction, compliance, and reduced pain perception, requires further investigation[22].

Daokar et al.[23] found that using audio and audiovisual aids significantly reduced patients' vital signs (blood pressure and heart rate) throughout the treatment process, with female patients, in particular, showing higher initial anxiety levels but benefiting more from the intervention. Additionally, Bringman et al. found that classical music, such as compositions by Mozart, could decrease both subjective and physiological stress markers, potentially making it a valuable tool for anxiety reduction in dental settings[22] These findings also align with evidence suggesting that music can modulate the brain's response to stress, creating a calming effect that diminishes negative emotions and promotes relaxation[24] Music therapy's ability to serve as a distraction and modulate emotional states could explain these trends.

Significant reductions in NPRS scores in both groups, with a larger mean difference in the case group, underscore the efficacy of music therapy in alleviating perceived pain. This supports the Gate Control Theory of Pain, which posits that non-painful stimuli can interfere with pain transmission and perception. Music, as an auditory stimulus, effectively competes with nociceptive signals, reducing the intensity of pain experienced during dental procedures[25]. Music's ability to alter physiological responses is particularly relevant for patients undergoing stressful procedures like endodontics. Studies have consistently shown that listening to music can lower blood pressure, heart rate, and levels of cortisol, a stress hormone, which can mitigate the body's natural fight-or-flight response during dental treatment[10]. These changes in physiological markers are indicative of a more relaxed state, which is beneficial not only for patient comfort but also for the success of the procedure itself. The significant decrease in OHIP-14 scores further reinforces the role of music therapy in enhancing overall QOL by addressing both emotional and physical stressors associated with endodontic treatments[26].

No statistically significant differences were found between the NPRS and OHIP-14 scores of the intervention and control groups, suggesting that while music listening may provide relief, its effects were not significantly greater than standard care. Possible reasons for this, including the potential ceiling effects of standard care and the small sample size. While between-group comparisons of NPRS and OHIP-14 scores did not yield statistically significant differences, the within-group improvements highlight the relevance of individualized interventions. Music therapy's capacity to promote relaxation and mitigate stress likely contributed to these positive outcomes. These findings suggest that music therapy is a valuable adjunct to traditional anxiety management strategies, particularly for patients undergoing anxiety-provoking procedures such as root canal therapy. The findings of this study align with an extensive body of literature demonstrating music therapy's effectiveness in medical and dental settings. By reducing anxiety and physiological stress markers such as heart rate and cortisol levels, music therapy fosters a calming environment conducive to better treatment experiences. This aligns with prior research indicating that music therapy reduces procedural stress and enhances patient satisfaction and compliance[24]. Patients often feel more empowered

and satisfied with their care when interventions like music therapy are integrated into the treatment process. These findings suggest that music therapy could play a critical role in holistic dental care models, enhancing clinical outcomes and patient well-being[21]. However, possibility of placebo effects cannot be ruled out, as patient expectations may have influenced outcomes. Additionally, factors such as clinician-patient interactions may have affected anxiety levels independently of the music intervention.

This study had some limitations that warrant consideration. First, the relatively small sample size, and subjects recruited from a single centre, may limit the generalizability of the findings to a broader population. Second, the study relied on self-reported measures, which are inherently subject to response bias and may not fully capture participants' experiences. Similarly, while pre- and post-procedure measurements were chosen to minimize participant burden, we recognize the value of more frequent assessments. Third, the absence of long-term follow-up precludes an understanding of the sustained effects of the intervention on psychological outcomes and oral health-related quality of life. Finally, the study did not account for potential confounding factors such as individual variations in baseline anxiety levels or prior experiences with dental procedures, which may have influenced the outcomes. The absence of structured psychological support could also have influenced anxiety levels. Future research could compare music therapy to another active anxiety-reduction method (e.g., guided relaxation or deep breathing) to improve control group validity. Despite its limitations, this study represents the first of its kind conducted in this environment; thus, establishing foundational understanding provides a crucial starting point for future research. The insights gained can inform subsequent randomized controlled trials, which can address the gaps identified.

Conclusion

The study demonstrated significant within-group reductions in psychological discomfort and psychological disability domains of OHIP-14, MDAS, and NPRS scores, with the test group showing more pronounced improvements. However, the lack of statistically significant differences in key outcomes such as pain perception and oral health-related quality of life between the intervention and control groups limits the generalizability and applicability of these findings. While both interventions appear effective in alleviating psychological and physical distress, further research—particularly randomized controlled trials with larger sample sizes—is necessary to determine whether music therapy provides measurable benefits beyond standard care. Future research should explore larger, multi-center trials, incorporate biometric measures, assess intra-procedural pain for a more detailed tomporal analysis, and compare different music genres to better understand the role of patient preferences in therapeutic music interventions.

Statements and Declarations

Conflicts of Interest

There are no conflicts of interest.

Funding

None.

Authors' Contributions

All authors: Conceptualization, Data Curation, Formal Analysis, Writing - Review and Editing and Project Administration.

All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

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Declarations

Funding: No specific funding was received for this work.
Potential competing interests: No potential competing interests to declare.