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Article

Patients' Perception of Sound and Noise dimensions in the Dental Clinic Environment

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Abstract: In the area of dental healthcare services, where patients and professionals deal with multiple auditory stimuli, this cross-sectional study reports on the intricate dynamics of sound preferences, noise obstacles, and the profound impact of music on anxiety reduction within dental office settings. The sample comprises of 134 dental patients, primarily females (56.7%), with varying age groups, education levels, and therapy durations in the university clinics of the department of Dentistry, National and Kapodistrian University of Athens and four private dental offices at the metropolitan area of Athens, Greece. Notably, 92.5% of the participants report no hearing loss, and 56.7% exhibit some level of noise sensitivity. The study reveals a moderate to good perceived health status (M=3.84, SD=0.95) among participants, with low perceived noise disturbance in university dental clinics. Preferences for instrumental music, foreign pop, and classical music are prominent during waiting times. Potential irritations include impersonal treatment (44%) and staff behavior (41.8%). Music player usage within the settings of the dental clinic involves radios (49.3%) and headphones (41.0%). Correlations and predictors indicate associations between health status, music preferences, and noise disturbances. More specifically, visiting the university dental clinics ($\beta = .300$, $p = .005$) as well as younger age ($\beta = .300$, $p = .034$) were significant predictors of better perceived health status. Clearer perception of external sounds while using the music player ($\beta = .190$, $p = .039$) was a significant predictor of better perceived health status, while poorer health was predicted by the preference of Greek folk songs ($\beta = -.200$, $p = .030$). Also, the use of smartphones for playing music was related to poorer health ($\beta = -.370$, $p < .001$). Following, younger age ($\beta = -.270$, $p = .015$), lower education ($\beta = -.210$, $p = .035$), higher noise sensitivity ($\beta = .190$, $p = .027$), as well as feelings of anxiety and nervousness due to ambient noise from people and machines ($\beta = .510$, $p = .027$) were significant predictors of noise disturbance from machines. Also, visiting private clinics ($\beta = .240$, $p = .018$), preferences of specific playlist ($\beta = .310$, $p = .012$), no music ($\beta = .280$, $p = .016$) and use of smartphones to play music ($\beta = .230$, $p = .029$) were significant predictors of noise disturbance from patients or staff. Finally, the preference of listening to a specific playlist was related to better health status ($r = .190$, $p < .05$). Findings aim to optimize eco-soundscapes in dental offices, contributing to enhanced patient well-being. The research underscores the potential of music interventions to alleviate dental anxiety and improve the overall dental experience and quality care.

Keywords: Dental healthcare; soundscape in the dental office; sound preferences; noise obstacles; music interventions; anxiety reduction; patient experiences; healthcare environment; eco soundscape; patient well-being

1. Introduction

Dental professionals and patients within the dental clinic often encounter a variety of auditory stimuli [1]. These sounds can yield either unfavorable effects [2,3], perceived as disruptive noise, or positive outcomes, such as the enjoyment of soothing music [4]. Sound in the dental office originates

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from both dental and non-dental sources. The first group includes noises generated by dental equipment [5], which can be reduced by taking appropriate measures. The second group incorporates sounds from within the dental clinic, including interactions between staff and patients, the operation of computers and printers, background music, and television, as well as external sources like traffic and ongoing roadwork sounds [6,7]. According to the National Research and Safety Institute, new dental equipment typically generates noise levels that remain below 85 dBA [8], while sound emitted overall within a dental facility, falls overall below 80 dB(A), thus falling within the acceptable thresholds established by the World Health Organization [5,8]. If these limits are exceeded, or the noise is present for a long time during a patient's stay in the dental office, then the sound has a negative effect on the patient's psychology [6].

Noise, as described in the literature, refers to undesirable and bothersome sounds [9]. Among dental patients, the most extensively researched consequence of noise is heightened anxiety. In fact, noise-induced fear or anxiety ranks as the third most common reason for avoiding dental appointments [2]. Patients frequently perceive the dental clinic as an inhospitable and anxiety-inducing place, primarily due to the presence of disruptive and loud noises [10]. On the other hand, dental healthcare facilities frequently accommodate individuals with dental anxiety and phobias, who exhibit heightened sensitivity to both sound and tactile sensations [11,12]. Such anxious patients may become uncooperative and pose increased challenges in management of dental therapies [2,11].

Music on the other hand, offers not only well-being benefits but also numerous advantages in healthcare settings, from community environments to waiting rooms and surgical settings, where it can serve as background music [6]. Its impact includes mood enhancement, pain and anxiety reduction, improved cardiovascular fitness, mindfulness, and increased social engagement [13]. Patients can use music as a self-management technique to reduce or control discomfort in these environments [14]. Also, listening to music provides an effective, nonpharmacologic option for reducing pre-procedural dental anxiety among dental patients [15]. Music therapy, as a non-invasive and cost-effective intervention, effectively diminishes dental anxiety, thus enhancing the outcomes of medical or dental procedures [6]. Also, music contributes significantly to relaxation, facilitating concentration and it proves valuable in (a) reducing anxiety and pain levels [6], (b) aiding recovery [4,16], and (c) promoting commitment to essential preventive care [17]. Understanding the above-mentioned positive effects of music on patients' anxiety is then essential for improving the overall patient experience, their well-being, and the well-being of dental professionals working in the area [18]. It also influences the sustainability of the setting in strategic management and marketing issues [19]. Thus, several studies have already investigated the potential of music as a non-pharmacological intervention to reduce anxiety levels in patients undergoing dental procedures [6,20,21] by affecting subjective anxiety scales and objective physiological parameters, such as heart rate, blood pressure, and cortisol hormones in patients with moderate dental anxiety during dental procedures [22]. To add more, a study assessing the effect of music therapy on dental anxiety levels of patients undergoing extractions found that music reduced fear, stress, and anxiety, and was a form of meditation and relaxation [20].

Furthermore, the choice of music genre significantly affects anxiety and pain reduction, as studies indicate these effects aren't exclusive to any specific music type [4]. Interestingly, in a specific study, 58% of respondents favored classical music in the healthcare setting [23]. Ideally, music in dental settings should align with patients' personal musical preferences, which are deeply rooted and influential [6]. Patient preferences and past musical experiences are then crucial factors in the success of any health intervention [24] including dental procedures. To be effective, though music should resonate with listeners in terms of culture, genre, mood, and era [25]. Dental professionals should also be mindful not to elicit excessive emotions or irritation, as music's evocative nature can impact relaxation for them too [19]. In a relevant study, it was reported that music is most effective when the musical program is selected by the patient [26]. In another study, it was found that music chosen by the patient offers the best results in healthcare settings [27]. But of course, there is a difference between passive music listening, often administered by medical professionals, and active music therapy, where trained music therapists use music creatively to promote and sustain health and well-

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being [28]. Finally, it is reported that music therapy programs can benefit people of all ages and abilities, irrespective of their musical background or skill [6,29].

The selection of music types in diverse healthcare settings, including dental offices, is moreover contingent upon several factors, notably personal preferences, age, emotional associations, familiarity, and the overall dental office atmosphere and culture. Individuals exhibit unique musical tastes shaped by personal experiences, emotions, and cultural backgrounds, with certain types eliciting positive emotions or inducing relaxation [30]. Age plays also a pivotal role, as music preferences often vary among different generations; younger patients may gravitate towards contemporary genres, while older patients may lean towards classical or folk music [31,32]. Music's ability to evoke emotions and establish a specific atmosphere is crucial in dental settings, where choosing music that promotes relaxation and reduces anxiety contributes to a more comfortable environment for patients [6]. The element of familiarity is significant, with patients often preferring music they know well, fostering a sense of comfort and security rooted in personal experiences or cultural backgrounds [33]. Moreover, the dental office atmosphere itself can influence preferences, with instrumental or soothing-tempo music being preferable, contributing to a calm and focused ambiance during appointments [6]. It seems that recognizing and accommodating these diverse music preferences based on various factors can significantly enhance the overall comfort and relaxation of dental patients.

The principal objective of this study is to investigate the current sound preferences of dental patients before and during dental treatment, encompassing ambient sounds like background music, staff-patient interactions, operation of dental equipment, and other environmental noises. Additionally, the research aims to identify and understand noise obstacles within dental offices, considering both dental and non-dental sources, while also evaluating the psychological impact of varying noise levels on patients during their dental appointment. Additionally, the investigation seeks to assess the impact of music on anxiety reduction and analyze the influence of music therapy on patient outcomes, encompassing anxiety levels, pain reduction, and overall satisfaction. The study also aims to compare the effectiveness of patient-selected music versus music administered by dental professionals in reducing anxiety and examine the potential benefits of incorporating active music therapy, led by trained music therapists, in dental healthcare settings. Overall, we aim to offer valuable insights into optimizing eco-soundscapes in dental offices, ultimately contributing to the improvement of the overall experience and well-being of dental patients.

2. Methodology

2.1. Study Design

A cross-sectional study design was employed to collect data at a single point in time, capturing patients' current perceptions and preferences regarding sound environments in dental clinics. Participants were recruited from diverse dental healthcare facilities including the undergraduate and postgraduate clinics of the department of dentistry of the National and Kapodistrian University of Athens, Greece. Inclusion criteria encompassed adult patients (18 years and above) who have recently undergone dental treatment or were scheduled for upcoming treatments. The participants were met at the reception halls of the clinics of the department of dentistry and four private dental clinics in the metropolitan area of Athens located in different parts of the town. Two private settings had up to two staff members and the other two had three or more staff members. Otherwise, the characteristics of the private dental settings were similar concerning the number of personnel in each subgroup, the number of units and dimensions of waiting rooms and secondary visiting areas), the mean time of waiting period between appointments and setting of the reception area.

Further, in conducting the research on human participants to explore their preferences regarding sound and noise factors in the dental office, the study took No 569/2-2-2023 approval from the ethics committee of the Department of Dentistry as part of a bigger protocol studying sound issues in the university clinics [8]. Then we selected informed consent from all participants, ensuring a comprehensive understanding of the study's objectives and potential implications. Consent was

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obtained either in a written form or through a secure digital platform, allowing participants to make an informed decision about their involvement in the study. Moreover, the research prioritized the privacy and confidentiality of participant information throughout the entire research process. Stringent measures were implemented to safeguard the sensitive data collected through the questionnaires, ensuring that participants' identities and responses remained confidential as described in Appendix A.

2.2. Questionnaire of the Study

In this study, we used the questionnaire study technique, which is a systematic method for data collection. Furthermore, it has previously been used to investigate people's sensation on the presence of different sound stimuli in a dental environment [7]. So, a structured questionnaire was designed to address the objectives of this study. The questionnaire included an introductory message describing the aim of the study. It was further noted that participation was voluntary, and confidentiality was guaranteed. Participants had the right to refuse to participate.

The questionnaire included the following sections: a) Part I: demographic information (age, gender, gender, educational level, clinic of attendance, duration of treatment) (Q1-Q5), b) Part II: consisted of two questions (Q6-Q7) about patients' acoustic health, c) Part III: consisted of a question with five subquestions and a question with one subquestion concerning anxiety and potential irritations in the dental clinic (Q8-Q9), d) Part IV: consisted of two questions about sound preferences in the waiting area (Q10-Q11), e) Part V: consisted of eight questions regarding patients' hobbies and habits (Q12-Q19), f) Part VI: consisted of two questions about patients' general health and their interest in the effect of sound on health (Q20-Q21) and g) Part VII: consisted of two questions about patients' dental experience with noise (Q22-Q23).

More specifically, the questionnaire investigated demographic characteristics of the sample including gender, age and educational level of the participants (as seen in questions Q1-Q3), which have also been described elsewhere as possible correlating factors to dental anxiety [34]. Questions Q4 and Q5 inquired about the patients' clinic of attendance and the duration of their treatment there, as background information. Questions Q6 and Q7 related to possible diagnosis of hearing loss and patients' sensitivity to noise respectively [35]. These questions had multiple choice answers. Questions Q8.1-Q8.5 addressed patients' potential discomfort regarding the crowded environment in the clinic as well as concerns about noise generated by various dental equipment such as suction devices, dental handpieces, and the ultrasonic scaler [2,36]. This question required answers in terms of a 5-point Likert scale, where 1 = "never (does not apply)", 2 = "Rarely (applies to a small extent)", 3 = "Sometimes (applies and does not apply)", 4 = "Often (applies to a large extent)", and 5 = "Always (always applies)". Q9 addressed aspects that may lead to dissatisfaction, encompassing patient and staff behavior, but also the environment of the dental clinic [36,37]. Q10-Q11 referred to patients' preferences regarding audiovisual content in the waiting room [2,23] and their music preferences [23]. In Q12, a question that is based on the 'Health Assessment of Noise Exposure Update Questionnaire'[35], conducted by the University of California, but also on a study by Jokitulppo et al. [38], patients filled in their hobbies. Moreover, questions Q13-Q19 were based on the equipment patients use when listening to music and their listening habits [39]. Questions Q20-Q21 were about the general health of the participants and their interest in the effect of sound on their health. Q9-Q11.1 and Q13-Q21 were also multiple-choice questions. Finally, open-ended questions Q22-23, gathered patients' perspectives on enhancing their clinic experience specifically regarding sound and any concerns they may have regarding noise within the dental practice.

Before the full-scale implementation, the questionnaire has undergone pilot testing with a small group of individuals to ensure clarity, relevance, and appropriateness of the questions. Adjustments were made based on feedback received during this phase. The structure of the final questionnaire is seen in Table 1.

Table 1. Summary of the questions in the self-administrated questionnaire.

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Questionnaire Parts	Questions	Number of Questions	Scales
Part I: Demographic information	Gender; age; educational level; clinic of attendance; duration of treatment	5	Nominal, Multiple choice
Part II: Acoustic health	Diagnosis of hearing loss; sensitivity to noise	2	Multiple choice data
Part III: Discomfort in dental clinic	Irritation by crowded environment, irritation by noise generated by suction devices, handpieces, ultrasonic scaler data	2 including 6 subquestions in total	5-point Likert scale, multiple choice
Part IV: Patient's preferences	Preferences regarding audiovisual content and music in the waiting room, People's behavior in the office data	2 including 2 subquestions in total	Multiple choice
Part V: Hobbies and habits	Hobbies, music devices, listening habits	8 including 1 subquestion	Nominal, Multiple choice
Part VI: General health	General health, interest in the effect of sound on health	2	Multiple choice
Part VII: Dental experience	Enhancement of dental experience, concerns regarding noise within the dental practice	2	Open-ended

The questionnaire was available in written form but was also assigned a specific QR-code so that participants were digitally introduced to the purpose of the study while waiting for their appointment in the reception areas. They were then asked to fill it (in written form) or through their smartphones, just after the end of their appointment. The questionnaire was self-administrated, and all data collected was treated with maximum confidentiality, adhering to ethical guidelines and privacy regulations mentioned before. Participation was completely voluntary, and participants had the right not to participate without penalties, ensuring that their relationship with the university (and the private dental setting) remained unaffected. By submitting the study questionnaire, participants consent to their participation and contribution to the promotion of knowledge on soundscapes in the dental settings. A max amount of twelve minutes was needed to complete the questionnaire.

2.3. Sampling Procedure and Data Collection

A systematic random sampling method was employed to select participants. Dental clinics were randomly chosen, and every 3rd patient attending the clinics (private and public ones were asked to participate during the data collection period). A trained research assistant was distributing the questionnaires to eligible patients in the waiting areas of dental clinics. Participants were encouraged to complete the questionnaire immediately after their dental appointment to ensure accurate recollection of experiences.

2.4. Statistical Analysis

Descriptive statistics were employed to summarize demographic information and participant responses. Correlation analysis was conducted to explore relationships between sound preferences, anxiety levels, and demographic variables. Data collected from the survey was analyzed with the statistical package IBM SPSS v.28. Cronbach's alpha index was used to examine the reliability of the questionnaire. Absolute and relative frequencies were calculated to summarize demographic characteristics of the study sample. Quantitative variables were summarized with descriptive statistics (M, SD). Dummy variables were created for categorical variables, to calculate Spearman correlation coefficients between demographics, music preferences, health status, noise disturbance from machines, patients and staff, feelings of anxiety and nervousness because of the mobility in the clinic, people, and machines. Multiple linear regression analyses were used to detect significant

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predictors of health status and perceived noise disturbance from machines as well as noise disturbance from patients and staff [39].

3. Results

A total of 134 questionnaires were completed, 55 from the department of dentistry and 79 from the four private practices over a 3-month period, from September 2023 to November 2023. Table 2 presents the demographic and clinical profile of the study's sample (N=134). In terms of gender, there was a slightly higher representation of females (56.7%, n=76) compared to males (43.3%, n=58). Participants were segmented into five age groups, with the majority falling in the 20-30 years (24.6%, n=33) and 51-60 years (23.9%, n=32), while the least represented group is those over 60 years (12.7%, n=17). Educational background varies, with 42.5% (n=57) having secondary education, 17.9% (n=24) having post-secondary education, and 39.6% (n=53) holding university degrees. The distribution of participants across medical centers was fairly even, with the largest group attending private dental clinics with over 2 seats (32.1%, n=43), followed by those attending private dental clinics with up to 2 seats (26.9%, n=36). Therapy duration was categorized into four ranges, with an even distribution across 1-3 months (20.9%, n=28), 4-8 months (26.9%, n=36), 9-12 months (26.9%, n=36), and 12 months or more (25.4%, n=34). Only a small percentage of the participants report hearing loss (4.5%, n=6), while the majority do not (92.5%, n=124). Regarding noise sensitivity, 56.7% (n=76) were somewhat sensitive, 25.4% (n=34) were not sensitive at all, and 17.9% (n=24) were sensitive or very sensitive. The mean (M) and standard deviation (SD) for health status was reported as 3.84 (SD=0.95), indicating an overall moderate to good perceived health status of the sample. The noise disturbance from patients or staff (2.11, SD=1.62) and from machines (2.28, SD=0.92) were also reported, showcasing overall low perceived noise disturbance either from people or machines in the dental clinic.

Table 2. Demographic characteristics of the sample (N=134).

		N	%
Gender	Male	58	43.3%
	Female	76	56.7%
Age	20-30 y	33	24.6%
	31-40 y	30	22.4%
	41-50 y	22	16.4%
	51-60 y	32	23.9%
	>60 y	17	12.7%
Education	Secondary	57	42.5%
	Post-secondary	24	17.9%
	University	53	39.6%
Medical center	University undergraduate clinic	29	21.6%
	University postgraduate clinic	26	19.4%
	Private dental clinic up to 2 seats	36	26.9%
	Private dental clinic over 2 seats	43	32.1%
Duration of therapy	1-3 months	28	20.9%
	4-8 months	36	26.9%
	9-12 months	36	26.9%
	12 months or more	34	25.4%
Hearing loss	Yes	6	4.5%
	No	124	92.5%
	N/A	4	3.0%

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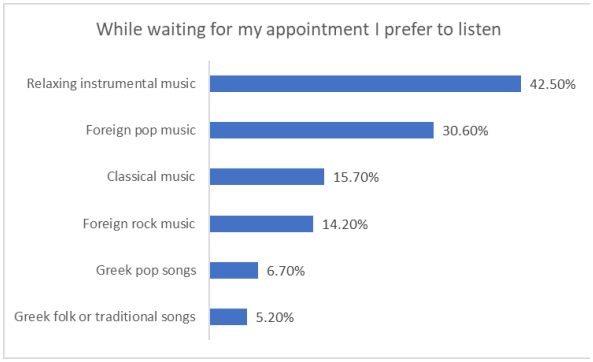
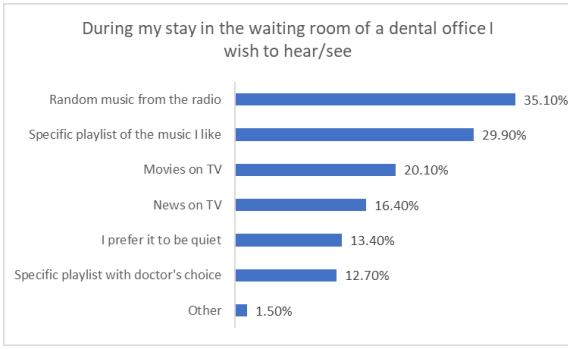
Noise sensitivity	Not at all	34	25.4%
	Somewhat	76	56.7%
	Sensitive/ Very sensitive	24	17.9%
Health status [M(SD)]		3.84(0.95)	
Noise disturbance from patients or staff [M(SD)]		2.11(1.62)	
Noise disturbance from machines [M(SD)]		2.28(0.92)	

Note. For health status and noise disturbance from machines, the min value was 1 and the maximum value was 5. For noise disturbance from patients or staff, the min value was 0 and the maximum value was 8. The variable of Noise disturbance from patients or staff was calculated from the aggregated responses to eight yes/no questions (Cronbach's α=0.533). The variable of Noise disturbance from machines was calculated from the aggregated responses to three questions of 5-point Likert scale (Cronbach's α=0.811).

While waiting for their dental appointment, participants preferred to listen mainly to relaxing instrumental music (42.5%), foreign pop music (30.6%) or classical music (15.7%), as depicted by Figure 1A. Also, during their stay in the waiting room of the dental office, they wished to hear random music from the radio (35.1%), playlist of the preferred music of the patient (29.9%), watch movies (20.1%) or the news (16.4%) on TV (Figure 1B). Participants reported that they would be irritated if the following happened: impersonal staff treatment (44%), disrespectful staff behavior (41.8%), hearing other patients in pain (41.8%), staffs' lack of communication (37.3%) and complaints from other patients (30.6%), while only 12.7% of participants reported that they would be irritated by the lack of music playing in the dental clinic.



(A)



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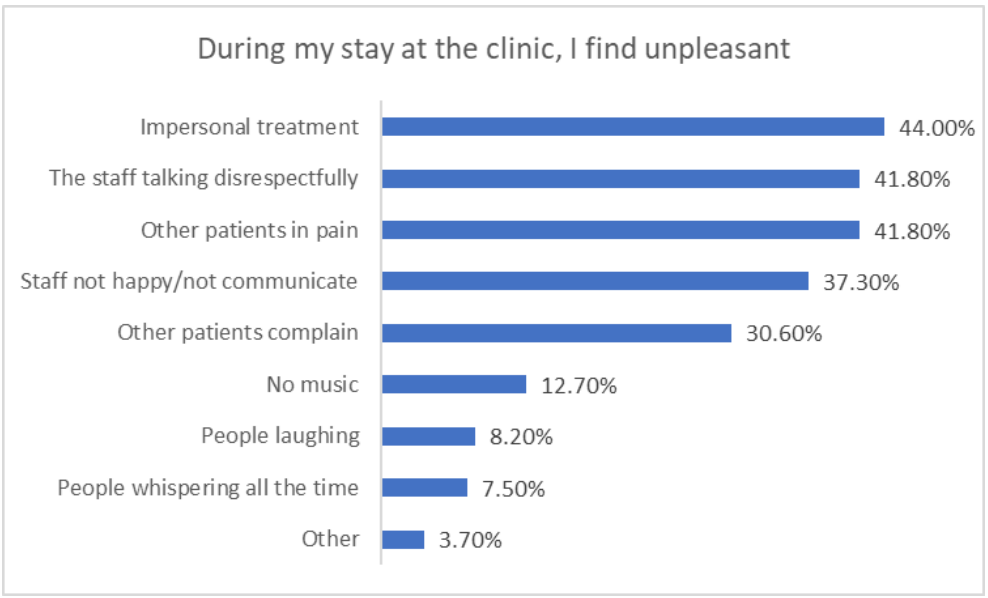

(C)

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Figure 1. Preferences relative to noise and music playing in the dental clinic A) type of music while waiting for the appointment, B)source of music in the waiting room of the dental office and C) types of noise that are perceived as unpleasant in the dental clinic.

Table 3 presents data on the use of music players and related behaviors. The participants used a range of devices to play music, with radios being the most common (49.3%, n=66), followed by headphones (41.0%, n=55), smartphones (35.1%, n=47), TVs (21.6%, n=29), and other devices (9.0%, n=12). Most of the respondents prefer a volume that is neither low nor high (44.0%, n=59). However, significant portions also prefer high (29.9%, n=40) or the opposite, low volumes (15.7%, n=21). A small number listen at very high volumes (8.2%, n=11) or very low volumes (1.5%, n=2), and only one participant had others annoyed by how loud they listen to music (0.7%, n=1). Most participants report speaking at a volume that is neither low nor high (36.6%, n=49) or high (35.1%, n=47) in noisy environments. Fewer participants speak at low (14.2%, n=19) or very high volumes (9.0%, n=12), and a small percentage have others annoyed by the volume of their voice (3.7%, n=5). Participants have varied perceptions of external sounds while using their music player, ranging from bad (5.2%, n=7) to excellent (2.2%, n=3), with the most common responses being moderate (25.4%, n=34) and good (26.1%, n=35). Music players' usage patterns vary, with the most common being 1-2 hours per day (28.4%, n=38), followed by 0-30 minutes (22.4%, n=30) and 30-60 minutes (21.6%, n=29). Regarding continuous music players' usage, most participants use music players for 0-30 minutes (32.8%, n=44) or 30-60 minutes (28.4%, n=38) continuously per day. Longer continuous usage decreases progressively. Attendance at live concerts varies, with most attending 1-2 times per year (46.3%, n=62). A significant portion never attended concerts (32.1%, n=43), and a smaller percentage attended more frequently.

Table 3. General preferences relative to music playing and music listening.

		N	%
Types of devices used to play music	Headphones	55	41.0%
	TV	29	21.6%
	Radio	66	49.3%
	Smartphones	47	35.1%
	Other	12	9.0%
Volume on audio/video player	Very low	2	1.5%
	Low	21	15.7%
	Neither low nor high	59	44.0%
	High	40	29.9%
	Very high	11	8.2%
	Others get annoyed at how loud I listen to music	1	0.7%
Peak volume of voice in noisy environment	Very low	2	1.5%
	Low	19	14.2%
	Neither low nor high	49	36.6%
	High	47	35.1%
	Very high	12	9.0%
	Others are annoyed by the volume of my voice	5	3.7%
	Bad	7	5.2%

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Perception of external sounds while using the music player	Moderate	34	25.4%
	Neutral	31	23.1%
	Good	35	26.1%
	Very good	24	17.9%
	Excellent	3	2.2%
Total time spent using music players per day	0-30 min	30	22.4%
	30-60 min	29	21.6%
	1-2 h	38	28.4%
	2-3 h	18	13.4%
	3-4 h	12	9.0%
	over 4 hours	7	5.2%
Hours of continuous use of music player per day	0-30 min	44	32.8%
	30-60 min	38	28.4%
	1-2 h	36	26.9%
	2-3 h	7	5.2%
	3-4 h	5	3.7%
	over 4 hours	4	3.0%
Attend live concerts	Never	43	32.1%
	1-2 times/year	62	46.3%
	3-4 times/year	15	11.2%
	4-5 times/year	6	4.5%
	5 times/year or more	8	6.0%

Following Table 4, female gender was associated with noise sensitivity (r = .220, p < .05) and poorer health status (r = -.176, p < .05). Visiting private clinics versus university clinics was associated with younger age (r = -.355, p < .01), higher education level (r = .374, p < .01), and poorer health status (r = -.237, p < .01). Private clinic patients reported higher noise disturbance from patients and staff (r = .235, p < .01), lesser feelings of anxiety and nervousness because of the mobility in the clinic (r = -.215, p < .05) and ambient noise from people and machines (r = -.174, p < .05). Older age was associated with higher noise sensitivity (r = .194, p < .05) and lower education levels was associated with higher noise disturbance from machines (r = -.185, p < .05). Moreover, noise sensitivity was positively related to noise disturbance from machines (r = .438, p < .01), as well as feelings of anxiety and nervousness because of the mobility in the clinic (r = .427, p < .01) and ambient noise from people and machines (r = .399, p < .01).

Table 4. Spearmann correlation coefficients between demographic variables, health status, noise disturbance from machines, patients and staff, feelings of anxiety and nervousness because of the mobility in the clinic, people and machines.

		1	2	3	4	5	6	7	8	9	10	11
1	Gender (Female vs Male)	--										
2	Clinic type (Private vs	0.067	--									

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	University clinic)										
3	Age	0.061	-.355**	--							
4	Education	0.019	.374**	-.690**	--						
5	Duration of therapy	0.111	-0.01	-0.087	0.055	--					
6	Noise sensitivity	**.220***	-0.051	**.194***	-0.082	0.025	--				
7	Health status	**-.176***	**-.237****	-0.139	0.082	-0.093	0.025	--			
8	Noise disturbance from machines	0.097	-0.133	0.078	**-.185***	-0.067	**.438****	0.097	--		
9	Noise disturbance from patients or staff	-0.09	**.235****	-0.068	0.096	-0.099	0.135	-0.089	**.249****	--	
10	Feeling irritated, anxious or nervous because of the mobility in the clinic	0.035	**-.215***	0.162	-0.093	-0.093	**.427****	0.058	**.542****	**.208***	--
11	Feeling anxious due to ambient noise from people and machines	-0.024	**-.174***	0.147	-0.131	-0.066	**.399****	0.104	**.662****	**.254****	**.680****	--

Note. *p < .05, **p < .01. Gender and clinic type were recoded as dummy variables.

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According to Table 5, preferring higher volume on audio/video player was positively associated with higher noise disturbance from patients and staff (r = .171, p < .05). Better health status was related to clearer perception of external sounds while using the music player (r = .194, p < .05) and time spent using music players per day (r = .185, p < .05) and higher education level (r = .374, p < .01), with poorer health status (r = -.237, p < .01). Hours of continuous use of music player per day was associated with higher noise disturbance from dental equipment (r = .198, p < .05) and feelings of anxiety and nervousness from people and dental equipment (r = .192, p < .05). The preference of Greek folk songs in the dental clinic was linked to poorer health status (r = -.176, p < .05). Preference of seeing movies on TV was positively related to noise disturbance from dental equipment (r = .181, p < .05), while news on TV was positively related to noise disturbance from patients or staff (r = .186, p < .05). The preference of listening to a specific playlist was related to better health status (r = .190, p < .05).

Table 5. Spearmann correlation coefficients between music preferences, health status, noise disturbance from machines, patients and staff, feelings of anxiety and nervousness because of the mobility in the clinic, people and machines.

	Health Status	**Noise Disturbance from Machines**	**Noise Disturbance from Patients or Staff**	**Feeling Irritated, Anxious or Nervous Because of the Mobility in the Clinic**	**Feeling Anxious due to Ambient Noise from People and Machines**
Volume on audio/video player	0.039	-0.066	**.171***	-0.117	-0.137
Peak volume of voice in noisy environment	-0.077	-0.158	0.066	-0.107	-0.164
Perception of external sounds while using the music player	**.194***	-0.005	-0.155	0.035	0.079
Total time spent using music players per day	**.185***	0.119	-0.011	0.049	0.069
Hours of continuous use of music player per day	0.106	**.198***	-0.06	0.16	**.192***
Attend live concerts	0.061	0.033	0.059	-0.045	-0.054
Relaxing instrumental music	-0.061	0.092	0.096	0.134	0.149
Foreign pop music	0.073	-0.1	-0.009	-0.086	-0.155
Foreign rock music	0.119	0.061	0.063	-0.031	0.04

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Greek pop songs	0.052	-0.16	-0.067	-0.138	-0.087
Greek folk songs	**-.176***	-0.008	-0.083	0.032	-0.01
Traditional songs	0.002	-0.032	-0.067	0.002	0.005
Classical music	0.008	0.028	0.15	0.102	0.095
Opera	0.002	-0.128	-0.144	-0.103	-0.1
Movies on TV	0.073	**.181***	0.161	0.121	0.117
News on TV	-0.158	-0.032	**.186***	-0.107	-0.14
Random music from the radio	0.048	0.067	-0.124	0.118	0.115
Specific playlist of the music I like	**.190***	0.048	0.158	0.025	0.11
Specific playlist with doctor's choice	0.044	0.08	-0.023	0.154	0.16
I prefer it to be quiet	-0.159	-0.019	0.049	0.018	0.049

Note. *p < .05, **p < .01.

As presented in Table 6, visiting the university dental clinics (β = .300, p = .005) as well as younger age (β = .300, p = .034) were significant predictors of better perceived health status. Clearer perception of external sounds while using the music player (β = .190, p = .039) was a significant predictor of better perceived health status, while poorer health was predicted by the preference of Greek folk songs (β = -.200, p = .030). Finally, the use of smartphones for playing music was related to poorer health (β = -.370, p < .001). Following, younger age (β = -.270, p = .015), lower education (β = -.210, p = .035), higher noise sensitivity (β = .190, p = .027), as well as feelings of anxiety and nervousness due to ambient noise from people and machines (β = .510, p = .027) were significant predictors of noise disturbance from machines. Also, visiting private clinics (β = .240, p = .018), preferences of specific playlist (β = .310, p = .012), no music (β = .280, p = .016) and use of smartphones to play music (β = .230, p = .029) were significant predictors of noise disturbance from patients or staff.

Table 6. Regression coefficients of demographics, volume preferences, music preferences and device preferences for predicting health status, as well as noise disturbance from machines and noise disturbance from patients or staff.

	Health Status[1]				**Noise Disturbance from Machines[2]**				**Noise Disturbance from Patients or Staff[3]**			
	B	**SE**	**β**	**p**	**B**	**SE**	**B**	**p**	**B**	**SE**	**β**	**p**

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(Constant)	3.57	0.74		<.001	1.99	0.67		0.004	-0.41	1.31		0.758
Female vs Male	-0.33	0.17	-0.18	0.055	0.24	0.15	0.12	0.120	-0.50	0.30	-0.15	0.102
Private vs University clinic	-0.54	0.19	-0.30	0.005	-0.07	0.17	-0.03	0.684	0.80	0.33	0.24	0.018
Age	-0.19	0.09	-0.30	0.034	-0.20	0.08	-0.27	0.015	0.19	0.16	0.16	0.227
Education	0.11	0.12	0.11	0.372	-0.23	0.11	-0.21	0.035	0.10	0.21	0.06	0.636
Noise sensitivity	0.17	0.14	0.13	0.226	0.29	0.13	0.19	0.027	0.07	0.25	0.03	0.789
Perception of external sounds while using the music player	0.14	0.07	0.19	0.039	-0.02	0.06	-0.03	0.696	-0.22	0.12	-0.17	0.055
Total time spent using music players per day	0.02	0.06	0.03	0.734	0.09	0.06	0.12	0.128	-0.15	0.11	-0.13	0.187
Relaxing instrumental music	0.11	0.21	0.06	0.603	-0.11	0.19	-0.05	0.580	0.06	0.37	0.02	0.880
Foreign pop music	0.20	0.24	0.10	0.412	-0.03	0.22	-0.02	0.878	0.02	0.42	0.01	0.964
Foreign rock music	0.00	0.28	0.00	0.997	-0.05	0.25	-0.02	0.842	-0.12	0.50	-0.03	0.813
Greek pop songs	0.65	0.35	0.19	0.064	-0.18	0.32	-0.05	0.572	-0.45	0.62	-0.07	0.464
Greek folk songs	-0.86	0.39	-0.20	0.030	-0.24	0.36	-0.05	0.496	-0.91	0.70	-0.12	0.193
Traditional songs	-0.95	0.91	-0.09	0.301	0.01	0.83	0.00	0.992	0.50	1.62	0.03	0.759
Classical music	-0.08	0.25	-0.03	0.762	-0.12	0.23	-0.04	0.600	0.28	0.44	0.06	0.535
Opera	0.54	0.88	0.05	0.546	-0.74	0.80	-0.06	0.359	-1.25	1.57	-0.07	0.429
Movies on TV	0.35	0.24	0.16	0.142	0.16	0.22	0.07	0.454	0.80	0.42	0.20	0.061

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News on TV	0.39	0.29	0.16	0.178	0.27	0.26	0.10	0.295	0.74	0.51	0.17	0.151
Random music from the radio	-0.03	0.26	-0.02	0.903	0.05	0.23	0.02	0.831	0.76	0.45	0.23	0.095
Specific playlist of the music I like	0.23	0.24	0.12	0.326	0.09	0.22	0.04	0.694	1.08	0.42	0.31	0.012
Specific playlist with doctor's choice	0.28	0.26	0.11	0.277	-0.10	0.23	-0.03	0.666	0.52	0.46	0.11	0.258
I prefer him to be quiet	0.09	0.31	0.03	0.775	0.12	0.28	0.04	0.678	1.34	0.55	0.28	0.016
Headphones	0.04	0.19	0.02	0.818	-0.22	0.17	-0.11	0.206	0.50	0.34	0.15	0.139
TV	-0.11	0.19	-0.05	0.580	-0.12	0.18	-0.05	0.502	0.34	0.34	0.09	0.327
Radio	0.21	0.18	0.12	0.229	0.21	0.16	0.11	0.188	0.00	0.31	0.00	0.998
Smartphones	-0.69	0.20	-0.37	<.001	-0.17	0.18	-0.08	0.333	0.77	0.35	0.23	0.029
Feeling irritated, anxious or nervous because of the mobility in the clinic	0.03	0.10	0.04	0.741	0.10	0.09	0.11	0.251	0.06	0.18	0.04	0.724
Feeling anxious due to ambient noise from people and machines	-0.07	0.10	-0.09	0.449	0.46	0.09	0.51	<.001	0.24	0.17	0.17	0.156

Notes. 1. $F(27, 104)= 2.057$, $p=.005$, $R^2= .348$, 2. $F(27, 104)= 5.377$, $p<.001$, $R^2= .583$, 3. $F(27, 104)= 2.391$, $p<.001$, $R^2= .383$.

4. Discussion

The present study provides a comprehensive overview of dental patients' estimation on noise levels and sound disturbances in private and public dental clinics. The importance of controlling noise in healthcare settings, particularly within dental clinics, is already discussed in relevant studies [1,5,8,40–42] and addressed from our findings too. The insights gathered on the issue from this study align with and extend upon previous research [2,8], offering an examination of the interplay between

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soundscapes in different dental environments (public and private ones), patient experiences, and healthcare outcomes. Overall, in our study, participants reported low perceived noise disturbance, both from people and dental equipment, aligning with studies emphasizing the importance of a calm clinical environment [6]. However, specific potential irritants were identified, such as staff behavior, other patients' expressed pain, and communication gaps, emphasizing the need for personalized approaches to enhance the patient experience as mentioned elsewhere too [9,10].

More specifically, as demonstrated by McGeoch and Rouw in 2020 [3], who explored the emotional dimensions of everyday sounds, the multifaceted effects of sound extend beyond audiological considerations and other factors are influencing the phenomena. Results in our study show that listening habits, meaning how many hours people spend on listening to music everyday, on what volume and how loud, personal experiences, age, and individual preferences all play crucial roles in shaping how we perceive and feel about different sounds in dental settings. For example, a sound that might be soothing to one person could be irritating to another based on their unique background and associations as also reported elsewhere [43]. Additionally, the timing and setting in which a noise occurs within the dental office can significantly impact its emotional effect [44]. According to our results, preferring higher volume on audio/video players was positively associated with higher noise disturbance from patients and staff. This correlation suggests that even though individuals may typically listen to audio/video content at high volumes, when they are in a dental office setting and where they may already feel anxious, the emotional impact of noise disturbance prompts a desire for reduced volume levels. This complexity highlights the rich interplay of psychological and situational factors in shaping our emotional responses to the sounds around us, as mentioned by other studies [45]. Moreover, our finding that 29.9% of respondents listen to music at high volumes underscores the need to consider not only individual preferences but also the situational context in which sound is experienced. Just as the timing and setting within a dental office can significantly impact the emotional effect of a noise, such as the sound of a dental drill for example, individuals' choices to listen to music at high volumes may reflect their attempts to modulate their emotional state in various environments as discussed in the study of Aletta et al in 2019 [46]. This finding also highlights the intricate interplay of psychological and situational factors in shaping our emotional responses to the sounds around us, as provided by phenomena such as ASMR (Autonomous Sensory Meridian Response) and misophonia, discussed elsewhere too [3,47,48]. For example, ASMR, a sensory phenomenon characterized by a tingling sensation that typically begins on the scalp and moves down the neck and spine in response to specific auditory or visual stimuli has as common triggers some soft whispers, tapping sounds, gentle hand movements, and personal attention as we, dentists, usually use on our patients to calm them down. It is then reported that individuals who experience ASMR often report feelings of relaxation, calmness, and euphoria and was the case in our study too [3]. Misophonia, on the other hand, the condition characterized by strong negative emotional reactions to specific sounds [47,48] was also addressed in our findings caused by mechanical handpieces sounds. It is mentioned elsewhere that people with misophonia experience intense anger, anxiety, or disgust in response to certain trigger sounds, such as chewing, slurping, pen clicking, throat clearing or dental drill [8,47,48]. These reactions can significantly impact daily functioning and quality of life for dental patients highlighting the intricate relationship between sound, emotions, and overall well-being as derived from our data. This means that the well-being of dental patients is derived from a combination of factors, including their general sensitivity in noises, the ambient soundscape within the dental environment, individual preferences for audiovisual content and their listening habits, and the consideration of potential discomfort-inducing situations. This is also suggested in other studies too [49–51].

Considering the psychological and physiological repercussions of noise exposure, it becomes evident that maintaining a controlled acoustic environment in dental clinics is paramount. Our participants comment on the sounds from other patients and impersonal personnel and communication as lack of quality in their dental journey [52,53]. Specifically, the majority of respondents (44%) agreed that they would feel dissatisfaction if the staff of a dental clinic treated them impersonally and failed to explain the treatment plan. Significant concerns also revolve around

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the manner in which staff addresses patients, particularly when perceived as impolite, and when overhearing others in pain (41.8%). These situations not only contribute to dissatisfaction but are also linked to increased stress levels and a reduced sense of relaxation as mentioned also by Grissinger in 2017 [54]. Thus, it becomes evident from our data that dental patients place considerable emphasis on the conduct, communication and noise level they receive in the dental office, as well as the responses of other patients regarding the treatment process, recognizing the impact that these factors have on their overall emotional well-being and comfort during dental visits as mentioned elsewhere too [6,8,11].

Furthermore, our data uncover significant associations between demographic/psychographic variables and noise sensitivity/disturbance. These findings contribute to the growing body of literature on the complex interrelations between age, gender, education, health, and perceptual experiences in healthcare settings [1,5]. To begin with, the predominance of females in our sample aligns with existing literature highlighting gender-specific associations with noise sensitivity and health status [1,3]. Moreover, in our study, we identified an association between the female gender and noise sensitivity. This aligns with existing studies that suggests women may be more sensitive to noise than men, although the evidence remains somewhat unclear [55]. Another study found that higher noise-sensitive males tended to exhibit more agreeable and conscientious traits, while being less extroverted. Conversely, in females, noise sensitivity correlated with anxiety, nervous complaints, and stress as mentioned elsewhere too [56]. Then, the age distribution across different brackets in our study suggests potential generational variations in preferences and perceptions, which may impact the design of patient-centric interventions as discussed also by Kühlmann et al., in 2019 [4]. In our study, it is shown that older age is correlated with heightened noise sensitivity influenced by various health factors associated with aging such as sensory changes [76]. Conversely, younger age is associated with being bothered by noise disturbance from machines and this suggests a unique sensitivity to mechanical sounds [56]. It could be allocated to the fact that young dental patients are working a lot with smartphones [58]. Being most of the time online while waiting in the dental office, they need silence to focus thus noise from machines can be extremely annoying, highlighting the concern regarding the potential impact of technology on our sensory experiences and reactions to environmental stimuli [58]. Furthermore, we report that choosing to visit private clinics instead of university clinics is linked to a younger age demographic possibly attributed to the needs of younger people of the generation Z (who expect to have exclusivity and quality service without considering expenses [59]. Also, this preference of younger individuals for private clinics over university clinics may be linked to the brevity of their treatment plans, requiring shorter appointments and a more expedited service. In addition, the educational background emerged as a significant factor in our study, linking higher education levels to private clinic visits, echoing findings by Wide and Hakeberg in 2023 [12]. In our study, the majority of participants possessed a secondary education (42.5%) while it was observed that lower levels of education were correlated with increased noise disturbance from machines. Exploring more how people's educational background affects their sensitivity to environmental stimuli could help us understand if those with lower education levels are more reactive to machine-generated noise [60]. This could be due to various factors, including differences in cognitive processing abilities, environmental exposure, and coping mechanisms [60]. Moreover, people with lower education levels might be more likely to live in noisier environments due to economic reasons, and this could affect how they feel about noise [61]. This point needs further investigation to comprehend better the relationships between educational background, socio-economic factors, and noise sensitivity. Further research in this area could help clarify the complex relationship between education, environmental stimuli, and individual sensitivity to noise, thereby informing interventions to mitigate the potential negative effects of noise exposure, especially among vulnerable populations [60].

This study also reports on participants' music preferences and behaviors, revealing a spectrum of choices for alleviating anxiety. Preferences for relaxing instrumental music, foreign pop, and classical music resonate with literature advocating for these types of music's anxiolytic effects in healthcare settings [14,21]. However, the relatively low irritation reported due to the absence of music

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in the dental clinic suggests that while music is appreciated, it might not be a universal expectation. In our study, it is noteworthy that a significant majority of participants indicated a preference for listening to relaxing instrumental music while waiting in the waiting room as suggested by other studies too [27,62,63] that aimed to establish a healthy acoustic environment [45]. But remains unclear what elements should be considered when we want to build a healthy dental acoustic environment and what people care about most when mentioning a healthy dental acoustic environment [44]. Additionally, a notable number of participants expressed a desire to hear random music from the radio during their stay in the waiting room. This aligns with the notion that diverse musical selections, such as those found on radio stations, can cater to a wide range of tastes and contribute to a more pleasant waiting room experience. Moreover, it underscores the potential value of offering varied music options to accommodate diverse preferences in healthcare settings [27].

Additionally, our findings underscore the importance of tailoring sound interventions to individual preferences, thereby contributing to a more personalized and positive patient experience in the dental office. According to our results, 29.90% of respondents indicated a preference for a specific playlist of music they enjoy listening to while waiting for appointments. This finding resonates with another study, which emphasizes the importance of considering individuals' music preferences and usage habits to reduce stress. Both studies underscore the significance of tailoring music interventions to individual preferences and circumstances for effective stress management [64]. Studies have documented that patients, when surveyed, often express a desire to choose their own music and adjust its volume [65]. This insight has prompted the recommendation to provide music through headphones, enabling patients to control the selection of music played [27]. Moreover, our data provided valuable insights into participants' use of music players and related behaviors. The prevalence of radio usage aligns with the accessibility and ambient nature of this medium, catering to a diverse audience as described elsewhere too [16]. We also found associations between volume preferences, health status, and noise disturbance which highlight the intricate interplay between individual characteristics and environmental factors as already reported from previous studies [31,66]. There were also predictive insights into perceived health status and noise disturbance. Visiting university clinics and younger age emerged as predictors of better health, emphasizing the potential influence of the clinical environment on patients' well-being [37]. Preferences for Greek folk songs and smartphone use for music were associated with poorer health, underlining the need for tailored interventions considering individual preferences [29]. On the other hand, another finding from a separate study suggests a contrasting perspective. Ning in 2023 [67] examined the effects of engaging with Tibetan Guozhuang folk music on mental health among college students. The research revealed that participation in this folk art form was associated with significant benefits, including emotional regulation, stress relief, and overall mental well-being. A substantial majority of students reported feeling happier and more excited when participating in the dance, highlighting the potential positive impact of folk music engagement on mental health. These findings suggest that while preferences for certain types of folk music may have varying effects on health outcomes, tailored interventions and educational initiatives aimed at promoting folk music participation could offer valuable benefits for mental health during healthcare or more specifically, dental appointments. Overall, folk music has been reported to have a positive effect on the human body, returning people to their historical roots and promoting a sense of security and calmness [68].

Despite the valuable insights gained, this study has several limitations that need consideration in future similar research approaches. The cross-sectional design utilized in this investigation provides a static snapshot of the participants' experiences, hindering the establishment of causal relationships between variables. To express the dynamics of patient experiences over time, future studies employing longitudinal designs could be more useful. Moreover, the reliance on self-report measures introduces the potential for response bias, particularly concerning variables such as health status and noise sensitivity [19]. Participants may provide responses influenced by social desirability or subjective interpretations, underscoring the importance of incorporating objective measures and observational data in future research. The generalizability of the study might also be influenced by the homogeneity of the sample and the relatively low number of participants, representing specific

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demographic and clinical profiles. This constraint impedes the extension of findings to a more diverse population, emphasizing the need for future research with broader participant recruitment. Further, the exclusive emphasis on quantitative data may overlook the qualitative factors included in patient experiences. Qualitative methodologies, then, such as interviews or focus groups, could offer a more profound understanding of the emotional and subjective dimensions of patients' encounters in dental clinics. So future investigations should aim for a different representation of diverse dental care settings to provide a wider understanding of patient experiences across various dental contexts. We could even search deeper into developing tailored interventions, presenting insights from music therapy for anxiety control or/and exploring innovative architectural designs that mitigate noise disturbances in dental settings as is the current trend [18,20,21,29].

Despite limitations, the study suggests an interesting research model for future studies to track changes in dental patients' noise experiences and preferences during dental appointments. Building on the insights gained from this study, researchers should design and implement interventions based on personal patient preferences for sound in dental settings. Investigating the efficacy of interventions, such as personalized music playlists or ambient noise modifications, would provide evidence-based strategies to enhance the overall patient experience and provision of quality dental services. Overall, understanding how dental soundscapes impact patients' well-being across different dental settings or procedures would contribute to broader and better-quality dental healthcare practices.

5. Conclusions

There is a need for conscientious noise management strategies in dental clinics. Beyond the audiological considerations, recognizing the impact of sound on emotional states and dental patients' experiences necessitates a holistic approach to optimize the healthcare environment for all stakeholders. The findings underscore the importance of tailoring acoustic environments to individual needs, considering factors such as gender, age, education, and health status. Correlations and predictors indicate associations between health status, music preferences, and noise disturbances. The implementation of patient-centric sound interventions, such as music preferences, has the potential to enhance the overall dental experience and create patient-friendly environments.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the department of Dentistry, School of health sciences, National and Kapodistrian University of Athens for studies involving humans.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Upon request.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. Study Questionnaire.

INTRODUCTORY MESSAGE

This questionnaire is about recording your preferences regarding the noise and acoustic stimuli you receive while in the clinic. It also aims to investigate factors that influence your acoustic preferences in the dental clinic, as well as the intensity/frequency/quality of your acoustic stimuli during the day. It is self-administered. It is anonymous and no personal information is collected.

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Participation in this survey is voluntary. The questionnaire must be completed only once by each participant.

In this study, all collected data will be handled with the utmost confidentiality, adhering to ethical guidelines and personal data protection regulations. Identifiable information will be kept separately, and access to it will be restricted to members of the research team. Any elements (if any) that could potentially reveal the identity of participants will be anonymized. Participation is entirely voluntary, and participants have the right not to participate without consequences, ensuring that their relationship with the university remains unaffected.

Every possible effort will be made to minimize potential discomfort or inconvenience for participants, and the study does not involve any risks. All research data will be securely stored digitally, with limited access granted only to the researchers. Data retention will adhere to relevant ethical guidelines, and their secure disposal will occur after a specified period.

By submitting the study questionnaire, participants consent to their involvement and contribution to advancing knowledge regarding sound in dental clinics. The research team is committed to maintaining the highest ethical standards throughout the entire process. Responding to the questionnaire takes approximately 10 minutes.

The questionnaire consists of six parts:

PART ONE: Contains questions related to demographic characteristics.

PART TWO: Includes a total of 2 questions (Q6-Q7) about hearing loss diagnosis among participants and their sensitivity to noise.

PART THREE: Includes a total of 2 questions with sub-questions (Q8-Q9) addressing situations that create discomfort in the dental office.

PART FOUR: Contains a total of 2 questions with sub-questions (Q10-Q11) about patients' preferences regarding audiovisual content and music in the waiting room.

PART FIVE: Consists of eight questions (Q12-Q19) related to patients' hobbies and listening habits.

PART SIX: Consists of two questions about patients' general health (physical and mental) and their interest in the effect of sound on health (Q20-Q21).

PART SEVEN: Finally, the last part includes two open-ended questions (Q22-Q23), allowing participants to express concerns about noise in the dental office and suggest ways to improve their experience.

We appreciate your cooperation and we thank you in advance.

For any questions or concerns, participants are encouraged to contact the principal investigator or the Ethics Committee of the Dental School at the National and Kapodistrian University of Athens.

Study Questionnaire

Q1. What is your gender? Male_Female_Other

Q2. What is your age? 20-30_31-40_41-50_51-60_61-70_71+

Q3. What is your educational level? Primary school_High school_Private University_ Public University

Q4. In what dental clinic do you proceed for your dental treatment? Private clinic with one dental chair_ Private dental clinic with two or more dental chairs_ Undergraduate university clinic_Postgraduate university clinic

Q5. How often do you come to the clinic for your dental care (indicate the consecutive time period)? 1-3 months_4-8 months_9-12 months_ 12 or more months

Q6. Have you been diagnosed with hearing loss? Yes_No_I am not sure/I would like not to answer

Q7. Are you generally sensitive to noise? Not at all_Sensitive_Very sensitive

Q8. Which of the following applies to you at the moment?

Q8.1. Do you feel restless, anxious, or nervous because of the mobility in the clinic (people come and go all the time): 1=Never (does not apply) 2=Rarely (applies to a small extent) 3=Sometimes (applies and does not apply) 4=Often (applies to a large extent) 5=Always (always applies)

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Q8.2. Do you feel anxious during your stay in the clinic because of the ambient noise from people and machinery? 1=Never (does not apply) 2=Rarely (applies to a small extent) 3=Sometimes (applies and does not apply) 4=Often (applies to a large extent) 5=Always (always applies)

Q8.3 Does the suction noise bother you? 1=Never (does not apply) 2=Rarely (applies to a small extent) 3=Sometimes (applies and does not apply) 4=Often (applies to a large extent) 5=Always (always applies)

Q8.4 Does the airotor/micromotor noise bother you? 1=Never (does not apply) 2=Rarely (applies to a small extent) 3=Sometimes (applies and does not apply) 4=Often (applies to a large extent) 5=Always (always applies)

Q8.5 Does the scaling noise bother you? 1=Never (does not apply) 2=Rarely (applies to a small extent) 3=Sometimes (applies and does not apply) 4=Often (applies to a large extent) 5=Always (always applies)

Q9. During my stay at the clinic, I feel uncomfortable when: I hear other patients being in pain_I hear other patients complaining_I hear the staff talking disrespectfully_I hear people whispering_I hear people laughing_People treat me impersonally and don't explain the treatment_Staff are not happy and do not address me_I don't listen to music_Other

Q9.1 If you answered "other" to the previous question, please fill in (briefly) what else you find unpleasant during your stay at the clinic.

Q10. While waiting for my appointment I prefer to listen: Relaxing instrumental music_Pop music_Rock music of foreign repertoire_Greek pop_Greek folk songs_Traditional songs_Classical music_Opera_Other

Q10.1. If you marked "Other" in the previous question, please summarise here what else you like to listen to.

Q11. During my stay in the waiting room of a dental clinic I wish to hear/watch: (you can tick more than one option): Film on TV_News on TV_Random music selections from the radio station_Playlist of music I like_Playlist with the doctor's choice_I prefer it to be quiet_Other

Q11.1. If you answered "other" to the previous question, please fill in (briefly) what you would like to hear/watch in the waiting room.

Q12. Note the hobbies you participate in at least 1-2 times a month: Reading_Horseriding_All-terrain motoring_Running_Golf_Walking_Swimming_Hiking_Motorcycling_Barcade_Concerts_Hunting_Shooting_Firearms shooting_Scuba fishing_Cinema_Cycling_Attending webinars_Attending scientific workshops/conferences_Sports_Camping_Horticulture_Carpentry/woodcutting_Other activity not listed (please tick).

Q13. What types of devices do you use to play music? Headphones_Television_Radio_Smartphone_Other

Q13.1 If you answered "other" to the previous question, please indicate which other music player you use.

Q14. What is usually the volume of the audio/video player you use? Very low_Low_Neither loud nor low_Loud_Very loud_Others are disturbed by the volume I listen to music

Q15. What is the top volume of your voice in a noisy environment? Very low_Low_Neither loud nor low_Loud_Very loud_Others are annoyed by the volume of my voice

Q16. What is your perception of external sounds while using the music player? Poor_Average_Neutral_Good_Very good_Excellent

Q17. What is the total amount of time you use music players per day? 0-30 minutes_30-60 minutes_1-2 hours_2-3 hours_3-4 hours_Over 4 hours

Q18. How many hours of continuous use of your music player do you do per day? 0-30 minutes_30-60 minutes_1-2 hours_2-3 hours_3-4 hours_Over 4 hours

Q19. Do you attend live concerts? Never_1-2 times a year_3-4 times a year_4-5 times a year_5 times or more

Q20. What do you consider to be your state of health (physical and mental) at the moment? Bad_Fair_Neither bad nor good_Good_Very good

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Q21. Would you like to know more about the effect of sound/noise on your health? Yes_No_I am not interested in the subject

Q22. What would you like to see improved in the acoustics of the clinic to make you feel better during your stay? (fill in)

Q23. Thank you for your participation. Please add here anything else that concerns you about noise in the dental office (optional).

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