Effect of Music Therapy in Anxiety Reduction for Local Anesthesia Injection by Dental Students

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Abstract

The objective of this research is to reduce dental anxiety of the patients during local anesthesia injection by dental students. In this pilot study, 60 patients who came into Oral Surgery Department, College of Dental Medicine, Rangsit University during the period between June 2019 to October 2019 were evaluated. Patient data including vital signs (systolic blood pressure, diastolic blood pressure and a heart rate), the anxiety score (MDAS), the pain score (VAS) and the satisfaction score were evaluated by statistical tests. There was no statistically significant difference of vital signs between music and non-music groups ($p>0.05$). No statistically significant difference of anxiety score between music and non-music groups ($p>0.05$). The mean of anxiety score preoperatively in music group was 10.66 and decreased to 9.06 postoperatively while the mean of anxiety score preoperatively in non-music group was 10.34 and decreased to 9.58 postoperatively. There was a statistically significant difference of preoperative anxiety score and postoperative anxiety score in music group ($p<0.05$) while there was no difference in non-music group ($p>0.05$). The use of music therapy is a simple, safe, inexpensive and non-pharmacological intervention that can effectively reduce dental anxiety of the patients during local anesthesia injection.

Keywords: *Music therapy, Dental student, Anxiety, Local anesthesia injection, MDAS, Vital signs*

1. Introduction

Anxiety is an emotional state that one feels endangered, insecure or in an unpredictable situation that has a physiology effect on body and mind (Aartman, de Jongh, Makkes, & Hoogstraten, 2000). In the dental clinic, many factors can cause anxiety, whether the surrounding environment, the sound of drilling, the white coat of dentists, local anesthesia injection, and dental treatment procedures can cause high anxiety for the patients (Acharya, Joshi, & Pradhan, 2018). Likewise, experience of the operator also affects patient's emotion. Dental anxiety contributes threatening to avoidance and it may cause complication in dental treatment (Stabholz & Peretz, 1999). The American Dental Association (ADA) estimated that 35 to 50 million adults have so much anxiety about dental visits that they worry, postpone, or avoid seeing their dentist (Ogle & Hertz, 2012). This behavior results in a bad oral health, patients with dental fear or anxiety usually show up for dental treatment only when pain occurs or in need for emergency treatment (Quteish, 2002). This kind of treatment is time consuming and often require complicated and traumatic treatment procedures, which further reinforces their fear, leading to complete avoidance in the future (Armfield, Stewart, & Spencer, 2007). Treating patients with dental fear and anxiety combined with complicated treatment procedures can also inflict stress to the dentists (Skaret, Raadal, Kvale, & Berg, 2000). Therefore, it is essential to reduce the anxiety level for the benefit of the treatment and patients. There are various methods to be used in order to decrease the anxiety caused by stress in a dental appointment.

The available methods of conscious sedation in dentistry include inhalation sedation (nitrous oxide), conscious intravenous sedation and oral sedation, which may lead to a range of undesirable side effects and risks, including increases the cost of treatment. Therefore, other alternative methods such as hypnosis, relaxation, distraction, guided imagery technique, and music therapy are preferred due to low side effect and low cost. The music therapy was effective in decreasing surgical stress, which sedatives were needed less often in patients who were treated with music during surgery (Lepage, Drolet, Girard, Grenier, & DeGagne, 2001). Moreover, in terms of saliva cortisol, it was found that there were significant differences between the experimental group and the control group in a study of physiologic parameter in

patients with dental anxiety (Mejia-Rubalcava, Alanis-Tavira, Mendieta-Zeron, & Sanchez-Perez, 2015), which clearly indicates that music therapy can help reduce dental anxiety. Our scope of interest is to use music therapy to decrease anxiety of the patients during local anesthesia injection by dental students.

2. Objectives

The objective of this research is to reduce dental anxiety of the patient during local anesthesia injection by dental students included comparing preoperative and postoperative evaluation of the anxiety score and vital signs.

3. Materials and Methods

3.1 Subject

60 patients who came into Oral Surgery Department, College of Dental Medicine, Rangsit University during the period between June 2019 to October 2019.

Inclusion criteria are male or female patients who are older than 18 years old with ASA I and ASA II (The American Society of Anesthesiologist, ASA classification 2014), have no history of allergy to local anesthesia used in the study, are not under antipsychotic drugs, can fully understand Thai language and have experienced of tooth extraction at least 1 tooth.

Exclusion criteria are patients who have the MDAS score between 0 to 5(non-anxiety), patients who cannot tolerate dental extraction under local anesthesia, patients who are unable to give informed consent, patients who are allergic to local anesthesia used in the study, patients who are on medications that interact with mepivacaine, presence of uncontrolled cardiovascular disease condition and hearing impairment.

This study was approved by Ethics Review Board of Rangsit University (Certificate of Approval number RSUERB2019-040).

3.2 Materials and instruments

1. MDAS (Modified Dental Anxiety Scale) questionnaire
2. Satisfaction scale
3. VAS (Visual Analog Scale)
4. Smartphone
5. Two earphones (earbud type)
6. Two ear plugs
7. A digital blood pressure monitor (Citizen CH-432, Japan)

3.3 Method

When the patients presented to Oral Surgery Department, College of Dental Medicine, Rangsit University, the patients were informed about the objective of this research and the whole procedure at the beginning. If they agreed to participate, written informed consent had to be signed (the samples were divided systematically into control group and experimental group). Next, data collection was performed and each patient chose one favorite song from the list provided by the researcher (the list included varieties of genres and eras of slow beat songs). After the preparation was completed, history taking was done by the operator. MDAS questionnaire was given to each patient to fill up. Thereafter the patients were escorted to the operating room, allowed to rest for 5 minutes then measured the preoperative vital signs (blood pressure and heart rate) with a digital blood pressure monitor (Citizen CH-432, Japan). The patients were given the chosen song to listen repeatedly by two earbud earphones (loudness 60-90 decibel controlled by Sound meter; mobile application) operated with a smartphone throughout the injection. After 15 minutes, the operator (dental students with minimum one time of injection experience) applied topical anesthesia, injected with 2% mepivacaine with epinephrine 1: 100,000 in inferior alveolar nerve block or local infiltration (within 2 cartridges, and aspiration before every injection). After injection and mouth rinsing, the patients were set in upright position and rested for 5 minutes, the postoperative vital signs were

measured. VAS and satisfaction scale were given to fill up after returning the earphone to the researcher and continue normal treatment procedure without a song.

3.4 Data collection and analysis

All patient data was recorded in Microsoft Excel. All statistical analysis was performed by using SPSS 24. Descriptive and inferential statistics were used to analyze differences in anxiety scores between participants who listened to music preoperatively and those who did not. Using the Kolmogorov-Simonov test and Shapiro-Wilk test to assess the normality of the data. The independent t-test was used for calculating to compare the changes in anxiety scores between music and non-music groups in normally distributed data. If the data are not normally distributed, the Mann-Whitney test was used. The paired t-test was used to test the presence of an interaction effect between pre-operation and post-operation within each group in normally distributed data. If the data are not normally distributed, the Wilcoxon Signed Rank test was used.

4. Results and Discussion

4.1 Demographic data and characteristics of subjects

The participants of this study consisted of 60 patients, 27 men (45%) and 33 women (55%). The mean age of the patients was 35.02 (rank 19 to 71). The demographic data and characteristics that consisted of age, gender, education and MDAS of the patients as listed in table 1.

Table 1 Patients' demographic distribution

Variable	values	music group (n=30)	non-music group (n=30)
Age		36.67	34.27
Gender	men	11 (18.33%)	17 (28.33%)
	women	19 (31.67%)	13 (21.67%)
Education	elementary	5	3
	high school	5	2
	university	18	22
	master degree	1	-
	other	3	3
MDAS	6-10	17	18
	11-15	11	11
	16-20	1	1
	21-25	1	-
Teeth	upper teeth	15 (25%)	15 (25%)
	lower teeth	15 (25%)	15 (25%)

Abbreviation: MDAS, Modified-Dental Anxiety Scale

As presented in table 2, the Kolmogorov-Smirnov test showed the data of preoperative and postoperative anxiety score was not normally distributed, therefore the non-parametric test was used accordingly.

Table 2 Normality test

Variable	music group	non-music group
Preoperative anxiety score	not normal	not normal
Postoperative anxiety score	not normal	not normal

As listed in table 3, the mean of SBP, DBP, and HR values were showed. There was no statistically significant difference of vital signs between music and non-music groups ($p>0.05$) measured by the independent paired t-test.

Table 3 Vital signs of the subject

Category		Music		non-music		p-value
		mean	S.D.	mean	S.D.	
SBP (mmHg)	pre-operation	123.03	16.97	126.03	19.32	0.525
	post-operation	125.60	18.62	128.60	19.30	0.543
DBP (mmHg)	pre-operation	76.67	10.01	79.00	10.48	0.381
	post-operation	77.20	9.31	78.20	11.89	0.718
HR (beat/min)	pre-operation	82.07	10.68	81.07	13.83	0.755
	post-operation	79.97	9.32	77.03	13.16	0.323

Abbreviation: SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate
* $p < 0.05$, p value using independent paired t-test of baseline value between groups.

As presented in table 4, the mean of preoperative anxiety score in music group was 10.66 and 10.23 in non-music group while the mean of postoperative anxiety score in music group was 9.06 and 9.50 in non-music group.

The Mann-Whitney U test showed no statistically significant difference between music and non-music groups ($p>0.05$).

Table 4 Difference of anxiety score between music and non-music group

Variable	music		non-music		p-value
	mean	S.D.	mean	S.D.	
Preoperative anxiety	10.66	3.976	10.23	3.901	0.796
Postoperative anxiety	9.06	4.033	9.50	3.776	0.458

* $p < 0.05$
p-value of preoperative and postoperative anxiety score using Mann-Whitney U Test.

As presented in table 5. The mean of satisfaction scores were 9.26 and 8.96 in music and non-music group respectively. The mean of pain scores were 2.90 and 2.95 in music and non-music group respectively. The Mann-Whitney U test showed no statistically significant difference between music and non-music in both satisfaction and pain score ($p>0.05$).

Table 5 Satisfaction score and pain score of the music and non-music groups

Variable	music		non-music		p-value
	mean	S.D.	mean	S.D.	
SAT score	9.26	1.112	8.96	1.43	0.290
Pain Score	2.90	2.87	2.95	2.57	0.592

Abbreviation: SAT, satisfaction
* $p < 0.05$
p-value of SAT and pain score using Mann-Whitney U test.

As listed in table 6. The paired t-test showed there was statistically significant difference in heart rate of non-music group between preoperative and postoperative vital signs. All of the mean values of SBP and DBP in both music and non-music group slightly increased from preoperative evaluation to postoperative one except DBP in non-music group that slightly decreased. While the mean value of heart rate decreased from preoperative to postoperative in both groups.

Table 6 Preoperative and postoperative vital signs of the music and non-music groups

Variable		Preoperative vital signs		Postoperative vital signs		p-value
		mean	S.D.	mean	S.D.	
Systolic	music	123.48	16.868	125.71	18.320	0.135
	non-music	125.66	19.545	128.59	19.644	0.089
Diastolic	music	77.03	10.051	77.45	9.255	0.646
	non-music	78.69	10.522	77.97	12.025	0.621
Heart rate	music	81.74	10.652	79.71	9.274	0.093
	non-music	81.38	13.968	77.21	13.359	0.037*

* $p < 0.05$
p-value of preoperative and postoperative vital signs using paired t-test.

As presented in table 7, in music group, the mean of anxiety score preoperatively was 10.66 and decreased to 9.06 postoperatively, whereas in non-music group, the mean of anxiety score preoperatively was 10.34 and decreased to 9.58 postoperatively.

The Wilcoxon Signed Rank test showed there was a statistically significant difference between preoperative and postoperative anxiety scores in music group ($p<0.05$), while no difference in non-music group ($p>0.05$).

Table 7 Preoperative and postoperative anxiety scores of the music and non-music groups

Variable	Preoperative anxiety		Postoperative anxiety		p-value
	mean	**S.D.**	**mean**	**S.D.**	
Music	10.66	3.976	9.06	4.033	0.001*
Non-music	10.34	3.921	9.58	3.812	0.102

* $p < 0.05$
p-value of preoperative and postoperative anxiety scores using Wilcoxon Signed Rank test.

We divided our samples into two categories as upper tooth and lower tooth injection. As results listed in table 8.

1. Upper tooth injection

The mean of anxiety score preoperatively was 10.80 and decreased to 9.07 postoperatively in music group. While the mean of anxiety score preoperatively was 10.93 and decreased to 10.20 postoperatively in non-music group.

2. Lower tooth injection

The mean of anxiety score preoperatively was 10.47 and decreased to 9.07 postoperatively in music group. While the mean of anxiety score preoperatively was 9.40 and decreased to 8.80 postoperatively in non-music group.

The Wilcoxon Signed Rank test showed there was a statistically significant difference of anxiety score in both upper and lower tooth injections of music group ($p<0.05$) while there was no difference in non-music group ($p>0.05$) when compared between pre-operation and post-operation.

Table 8 Preoperative and postoperative anxiety scores of upper and lower tooth injection

Category	operation	preoperative anxiety		postoperative anxiety		p-value
		mean	**S.D.**	**mean**	**S.D.**	
Upper tooth injection	music	10.80	3.342	9.07	4.043	0.018*
	non-music	10.93	4.166	10.20	4.195	0.082
Lower tooth injection	music	10.47	4.719	9.07	4.166	0.040*
	non-music	9.40	3.776	8.80	3.299	0.470

* $p < 0.05$
p-value of preoperative and postoperative anxiety using Wilcoxon Signed Rank test.

4.2 Discussion

There were several evidences confirmed that music therapy can reduce anxiety. Mok and Wong (2013) (Kim, Kim, & Myoung, 2011), and Thompson, Moe, and Lewis (2014) showed music therapy was a positive complementary therapy to help patients to relax and reduce anxiety. There was no difference found in an initial anxiety level between music group and non-music group but the patients who listened to music had a small significant decrease of anxiety when compared between preoperative and postoperative one. These results were consistent with our study although the positive impact on anxiety probably became less because our study was performed only by injection procedure, unlike other studies that included more invasive operations such as extractions or surgical removal procedures. A study by Bradt, Dileo, and Shim (2013) included 26 trials in their systemic review. All studies with music listening prior to operative treatment had resulted in an anxiety reduction on the experimental group measured by the Stait-Trait Anxiety Interventory (STAI-S).

For the vital signs, our study also showed slightly increasing in blood pressure (SBP and DBP), whereas decreasing in heart rate but there was no statistically significant difference, which was consistent to the study of Kim et al., (2011). One interesting study by Bringman, Giesecke, Thorne, and Bringman (2009) showed that music listening can result in a similar reduction in blood pressure (SBP and DBP) compared with the administration of midazolam.

The patients in this study chose their own favorite song from our music playlist. Numerous researchers had recommended that clinicians should consider patient's music preferences and familiarity with selected music to maximize the anxiolytic effects of music therapy. Leardi et al., (2007) and Smolen, Topp, and Singer (2002) who recommended the importance of the choice of music styles. The music may have helped the patients to gain control of an unpleasant situation and gave them a feeling of being in a familiar environment when they chose well-known music of their own. In the present study, patient's musical preferences were easily surveyed using a list of musical genres during a preoperative meeting. Snyder and Lindquist (2006) also recommended that it is necessary for patients to select the appropriate music volume to prevent discomfort and fatigue during the intervention.

From the previous studies, there was none of any studies that performed with an injection procedure. Caltabiano et al., (2018) showed the higher levels of anxiety in the treatment of local anesthesia injection. Our study excluded the patient with no anxiety (MDAS score 0-5) and used the equal samples for each group to achieve an accurate and reliable comparison. The music playlist was created with all types of music for all patients preferences.

However, there were several concerns of our study. Firstly, our study was performed with an injection procedure only which required a short operating time. The music therapy may required a longer period of time to show more significant anxiolytic effect as shown in other studies with longer operating procedures. Secondly, the study cannot control the exact duration between pre-operation and post-operation due to the procedures such as history taking, intraoral examination, radiographic examination, and the reporting time to their supervisors. Thirdly, even though our study created the playlist with all music types but the patient allowed to choose only one song to listen repeatedly throughout the study. Fourthly, due to the small sample, the result of this study cannot represent the general population. A larger sample size are recommended to further study of the anxiolytic of music therapy to confirm these results. Lastly, the operation was done by a random operator that was in charge of the cases. To reduce bias and minimize errors in future study, a control operator should be assigned for the study.

5. Conclusion

Our study supported the objective of this research that is to reduce dental anxiety of the patients during local anesthesia injection by dental students. The study found that anxiety score decreased gradually from preoperative to postoperative one in music group. So the use of music therapy is recommended for every surgical procedures since it is a simple, safe, inexpensive and non-pharmacological intervention that can effectively reduce dental anxiety of the patients during local anesthesia injection.

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