

Effect of music therapy on anxiety levels on patient undergoing dental extractions

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ABSTRACT

Background and Aims: Dental anxiety has been found to be a significant problem faced by patients undergoing extractions. Anxious patients tend to avoid dental care ultimately leading to complications. Treatment of anxious patients can be very challenging to the dentists, prolonging the treatment duration. There has been various methods to reduce anxiety of which non pharmacological ways include music and aroma therapy. Music has been known to reduce fear, stress and is a form of meditation and relaxation. Hence effect of music on the reduction of anxiety levels for patients undergoing extractions were assessed. The aim of this study is to assess the effect of music therapy on dental anxiety levels of patients undergoing extractions. **Methods:** 50 patients visiting the outpatient department of Saveetha Dental College for dental extractions were randomly selected and allocated to Test group and Control group. The test group (N = 25) were subjected to music during extractions and Control (N = 25) were not exposed. Dental anxiety levels and hemodynamic changes namely systolic pressure, diastolic pressure and heart rate were assessed before and after extraction. The data was collected and analyzed using SPSS software with Paired t Test. **Results:** The study showed that the control population had elevated hemodynamic changes with regard to systolic, diastolic blood pressure and heart rate, of which the diastolic pressure rise was significant. In the test population, there was fall in the hemodynamic changes with respect to systolic diastolic blood pressure and heart rate, all of which were statistically significant. This was evident in the modified dental anxiety scale as well. **Conclusion:** Music seems to be a psychological and spiritual way to calm oneself down. Hence music therapy can be used as an anxiolytic agent for stressful dental procedures.

Keywords: Dental anxiety, dental extractions, music therapy

Introduction

Dental anxiety can be defined as a state of worry, nervousness, or unease about something with an uncertain outcome, with regard to a dental procedure.^[1] Waiting for a medical procedure can exert significant increase in anxiety levels.^[2] Factors that mainly trigger the anxiety are pain, bleeding, injections, rotary

noise, smell of the medicines, commotion in the waiting room or patient's past dental experience. Patients with dental anxiety will show some refusal symptoms during treatment. These refusal symptoms of anxiety, can be classified into physiological symptoms, behavioral symptoms, cognitive symptoms, and emotional symptoms.^[3] Among these symptoms, the physiological symptoms, such as dyspnea, hyperventilation, tachycardia, hypertension, increased respiration rate, nausea, and vomiting, are the most potential symptoms that might attribute to the failure of the treatment.^[3] This is commonly encountered dental problem by most practitioners, where patients avoid visiting the dentist, leading to deterioration of oral health. It can also compromise the standard of treatment as dentist is also stressed

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by the patient's anxiety levels. Studies have shown that one-sixth of the patients suffer with dental anxiety.^[4] Even in the context of minor medical interventions or medical routine check-ups such as a dental hygiene treatment, levels of anxiety can be markedly elevated.^[5] There are a few treatment options to effectively reduce anxiety, they include pharmacological techniques like the use of benzodiazepines and antidepressants, which may have side effects and drawbacks,^[6] such as drowsiness, haemodynamic instability, agitation and hyperactivity.^[7] Hence to avoid the side effects of the various drugs, patients opt for conservative approaches like music therapy which is an effective, non-invasive and cost-effective intervention, which decreases anxiety and therefore optimizes the outcome of a medical intervention. Listening to music has been shown to alleviate anxiety and the associated stress response in human trials in laboratory settings quite effectively.^[8] Due to its calming and soothing cadence, classical music has been well known for its efficacy in reducing anxiety.^[9,10] Listening to music has also been found to decrease intervention-associated anxiety/stress of hospital patients in clinical settings.^[11,12]

Dynamics behind Stress response

Anxiety leads to the activation of various stress systems, such as the hypothalamus-pituitary adrenal (HPA) axis or the sympathetic nervous system,^[13,14] which in turn control the immune system.^[15] High levels of pre-treatment anxiety and the associated stress response may lead to increased pain sensation,^[16] or complicate treatment, inhibit or delay an optimal recovery or increase post-treatment pain.^[17] These symptoms are the manifestations of the secretion of stress hormones such as cortisol, and catecholamine (noradrenaline and adrenaline.^[18] Whilst cortisol is known as the stress hormone that is released as a response to long term anxiety, catecholamines are the stress hormones that are released during short term anxiety.^[19]

Firstly, music reduces anxiety through its effect on the autonomic nervous responses which regulates bodily functions such as the heart rate, digestion, respiratory rate and pupillary response.^[20,21] Secondly, the anxiolytic effect of music is achieved through its suppressive action on the sympathetic nervous system, leading to lowered adrenergic activity and fall in neuromuscular arousal.^[22] Thirdly, several studies have demonstrated reduction in cortisol and other hypothalamic-pituitary-adrenal axis neuropeptides following music listening. This triggers the limbic system releasing endorphins which minimizes discomfort and pain and maximise pleasure.^[23,24]

Another interesting mechanism has been revealed by neuro imaging studies which demonstrates that music stimulates the ventral segmental area and the Nucleus accumbens (NAc).^[25] The NAc is the most important pleasure centre of the brain and its activation leads to the release of dopamine, which regulates perception of pleasure and mood.^[26] Dopamine brings about central analgesia due to its interactions with endogenous opioids.^[27] Studies have revealed that music has also been shown to reduce activity in the amygdala, a key area

for the development and activation of a conditioned fear response.^[25]

Other theories claim music distracts patients from the anxiety-provoking stimulus.^[28] It may also activate imagery. This can play an important role in anxiety management as it offers a temporary escape from the stressful reality.^[29] Music may also make the environment less threatening. Psychosocially music provides the patient with an aesthetic experience that can offer comfort and peace while awaiting and during dental treatment. This effect was observed by Brad *et al.*, in a study among patients with coronary heart disease, where the patient experienced a supporting and validating experience from the therapy.^[29]

In this research, we aimed to study the role of music therapy on reducing dental anxiety in patients undergoing extractions, so that various pharmacological methods for reducing anxiety can be avoided. The hemodynamic changes were analyzed by monitoring the systolic and diastolic blood pressure along with the heart rate. The anxiety was measured using the modified dental anxiety scale. We played classical instrumental music in this study.

Methods

This was a randomised controlled trial conducted in the Department of Oral and Maxillofacial surgery at Saveetha Dental College, Chennai, India. The sample size was set as 50 patients. Prior to the start of the study, ethical clearance was obtained from the Ethical Committee of Saveetha Dental College and the ethical clearance number is SRB/SDBDS/FINAL/18-19/0075. All the patients in the outpatient of the Department was screened from the period of 20th October 2018 to 30 January 2019, of which 50 patients were randomly selected by Simple Random Sampling method. Informed consent was obtained from the patients.

Patients who required extraction were selected from the age group of 17-64 years of age and divided into test group and control group. This randomization was done by computer generated randomization with a block size of 5. The inclusion criteria comprised of participants that are systemically healthy and fit for extraction. The exclusion criteria comprised participants with systemic diseases, pregnant women and deaf patients.

Allocation was concealed into the test and control group on the basis of the SNOSE method (Sequentially numbered, opaque, sealed envelopes). This was a single blinded study where the investigator was blinded. All the participants wore headphones [Refer Figure 1]. The tray setup was done [Refer Figure 2]. The test group was exposed to the classical music for 5 minutes prior and during extraction. The control group wasn't subjected to any music intervention (only noise cancellation headphones were worn without any input).

All the extractions were performed by a single practitioner, who was not aware of which group the participants belonged to standardize the bias associated with the skill of the operator. The data was



Figure 1: Patient with Ear phones



Figure 2: Armamentarium

collected by a third person. The anxiety levels were assessed and after music therapy with a help of a questionnaire [refer Figure 3]. The parameters used to analyse anxiety were blood pressure, heart rate and modified dental anxiety scale. The data collected was analysed using SPSS software. The association between the various parameters were verified using paired *t*-test. Microsoft Excel was used to graphically represent data.

Results

Table 1 shows the hemodynamic changes in systolic, diastolic and heart rate in the control group before and after the intervention. The average value of the systolic blood pressure, diastolic pressure and heart rate at the beginning, in the control population was seen to be 135.5 mm/hg, 84.8 mm/hg and 81 beats/min. The average value of the systolic blood pressure, diastolic pressure and heart rate measured just before the extraction, in the control population was 139.6 mm/hg, 86 mm/hg and 113 beats/min. This clearly shows the raise in anxiety as expressed by the haemodynamic changes. The systolic pressure was increased by 4.04 mm/hg, the diastolic by 1.16 mm/hg and the heart rate was raised by 31 beats/min, of which only the raise in the systolic blood pressure was statically significant when analysed using the paired *t*-test (*P* value < 0.05).

Table 2 shows the results of the modified dental anxiety scale of the control group of the study before and after the intervention. The modified dental anxiety scale was modified for fear factors associated with extraction and a few questions pertaining to the procedure were added. It included 8 questions in total. The analysis showed that the anxiety score increased with regard to questions 2,3,4,5,6 and 7, of which only the fall with regard to the score in question 3 was of statistical significance when analysed using the paired *t*-test (*P* value < 0.05). There was a fall in anxiety score with respect to questions 1 and 8 alone in the control population which was not statistically significant.

Table 3 shows the haemodynamic changes in systolic, diastolic and heart rate in the test group before and after the intervention.

Table 1: Paired Samples test of Haemodynamic changes

	Before	After	Mean difference	<i>P</i>
Systolic	135.5 mm/hg	139.6 mm/hg	-4.04000	0.011*
Diastolic	84.84 mm/hg	86.00 mm/hg	-1.16000	0.292
Heart Rate	81 beats/min	113 beats/min	-31.48000	0.284

*5% Level of Significance

In the test population, the systolic pressure was 134.4 mm/hg, the diastolic was 88.4 and the heart rate was 78 beats/min, before the group was given the music intervention. The systolic, diastolic and heart rate measured after the music therapy was 126.6 mm/hg, 81.84 and 73 beats respectively. A fall in the haemodynamic changes was seen in the systolic pressure by 7.84 mm/hg, in the diastolic by 6.5 mm/hg and by 5 beats/min in the heart rate, all of which were statically significant when analysed using the paired *t*-test (*P* value < 0.05).

Table 4 shows the results of the modified dental anxiety scale of the test group of the study before and after the intervention. The results of the modified dental anxiety scale in the test population showed that the there was a fall in the anxiety score with regard to the all the 8 questions, all of which was of statistical significance when analysed using the paired *t*-test (*P* value < 0.05).

Discussion

The effect of music on health has been known since ancient history. Pythagoras, Plato, Aristotle and Hippocrates applied music in medicine.^[30] Shamans and indigenous healers have used music, drumming, singing, and dancing to heal people,^[31] In the 19th century, music was considered for healing purposes as addressed by Nightingale's concerns regarding the effect of noise and music in the care of patients.^[31] In the late 19th century, the first recorded music was used in the hospitals as an intervention to diminish anxieties associated with surgery and it has been a growing field of development and research since the end of World War II, especially in the USA and in Germany.^[32] Dubar *et al.*,^[33] proved its role in increasing the pain threshold.

Please tick the following boxes:

- If you went to your dentist for treatment tomorrow, how would you feel?
 Not Anxious Slightly Anxious Fairly Anxious Very Anxious Extremely Anxious
- If you were sitting in the waiting room(waiting for the treatment), how would you feel?
 Not Anxious Slightly Anxious Fairly Anxious Very Anxious Extremely Anxious
- If you were about to have a tooth drilled, how would you feel?
 Not Anxious Slightly Anxious Fairly Anxious Very Anxious Extremely Anxious
- If you were about to have your teeth scaled and polished, how would you feel?
 Not Anxious Slightly Anxious Fairly Anxious Very Anxious Extremely Anxious
- If you were about to have a local anaesthetic injection in your gum, how would you feel?
 Not Anxious Slightly Anxious Fairly Anxious Very Anxious Extremely Anxious
- If you were to get a tooth extracted, how would you feel about the procedure?
 Not Anxious Slightly Anxious Fairly Anxious Very Anxious Extremely Anxious
- If you were to see the instruments for extraction , how would you feel?
 Not Anxious Slightly Anxious Fairly Anxious Very Anxious Extremely Anxious
- How would you feel if you saw blood or blood stained instruments and cotton, during the process?
 Not Anxious Slightly Anxious Fairly Anxious Very Anxious Extremely Anxious

Figure 3: Patient Questionnaire

Table 2: Paired Samples test of modified dental anxiety scale

Question	Before	After	SD	SER	t	df	Mean difference	P
1	3.8800	3.8000	0.86217	0.17243	0.464	24	0.08000	0.647
2	3.4400	3.7600	0.85245	0.17049	-1.877	24	-0.32000	0.073
3	3.4400	3.9600	0.71414	0.14283	-3.641	24	-0.52000	0.001*
4	3.8000	3.9200	1.05357	0.21071	-0.569	24	-0.12000	0.574
5	4.0400	4.2000	0.89815	0.17963	-0.891	24	-0.16000	0.382
6	4.2000	4.3200	1.01325	0.20265	-0.592	24	-0.12000	0.559
7	4.4000	4.5600	0.80000	0.16000	-1.000	24	-0.16000	0.327
8	4.6000	4.5200	0.70238	0.14048	0.569	24	0.08000	0.574

*5% Level of Significance

Our study used haemodynamic changes and modified dental anxiety scale to evaluate the state of anxiety in a patient. The haemodynamic parameters used were systolic, diastolic blood pressure and heart rate. Another study used the measurement of

noradrenaline in plasma as dental anxiety indicator. A study by Bradt *et al.*, had revealed the effectiveness of music in reducing anxiety.^[29] However, contrary results were found in a study by Lai *et al.*^[34]

In our study, the systolic pressure was increased by 4.04 mm/hg, the diastolic by 1.16 mm/hg and the heart rate was raised by 31 beats/min, of which only the raise in the systolic blood pressure was statically significant when analysed using the paired *t*-test (*P* value < 0.05). An increased activity of the sympathetic nerves is followed by an increase in noradrenaline secretion, hormonal influence, vasoconstriction, peripheral resistance etc., therefore causing an increase in blood pressure, heart rate, and muscle contractility.^[35] The results obtained in the control group was in accordance to the above. As for the increase of the diastolic blood pressure, it might be due to the fact that the increase of the NAP plasma level during anxiety will cause vasoconstriction of blood vessels in general, which will cause total peripheral resistance.^[36] An increase in total peripheral resistance will increase the diastolic blood pressure.^[37]

The present study revealed an increase in anxiety score with regard to questions 2,3,4,5,6 and 7, of which only the raise in anxiety score with regard to question 3(If you were about to have a tooth drilled, how would you feel?) was of statistical significance when analysed using the paired *t*-test (*P* value < 0.05). There was a fall in anxiety score with respect to questions 1 and 8 alone in the control population which was not statistically significant. This could be due to the relationship between the doctor and the patient that was established during the treatment which could have instilled confidence in the patient and reduced the anxiety about the extraction as they would be better informed about the procedure.

A fall in the haemodynamic changes was seen in the systolic pressure by 7.84 mm/hg, in the diastolic by 6.5 mm/hg and by 5 beats/min in the heart rate, all of which were statically significant when analysed using the paired *t*-test (*P* value < 0.05). This clearly shows the effectiveness of music therapy on dental anxiety in patients undergoing extractions. However, in the accordance to another study, participants who listened to classical music tend to show an increase in the NAP level, the systolic blood pressure, as well as the diastolic blood pressure.^[38]

Table 3: Paired Samples test of Haemodynamic changes

	Before	After	Mean difference	P
Systolic	134.4 mm/hg	126.64 mm/hg	7.84000	0.000*
Diastolic	88.4 mm/hg	81.84 mm/hg	6.56000	0.000*
Heart Rate	78 beats/min	73 beats/min	5.04000	0.000*

*5% Level of Significance

The results of the modified dental anxiety scale in the test population showed that there was a fall in the anxiety score with regard to all the 8 questions, all of which was of statistical significance when analysed using the paired *t*-test (*P* value < 0.05). This shows that patients who had the music intervention were relatively composed and distraction from the pain was evident.

A study assessing the dental anxiety prior to surgical tooth extraction which involving 164 oral surgical patients in Pacific Dental College, India, showed that 35.5% of these patients experienced fear of injection.^[39] Dental anxiety that might arise during dental extraction procedure can complicate the procedure and the patients are most likely to avoid dental procedures.^[40] Avoiding seeking of primary dental care can have a drastic impact on the family, especially in the case of paediatric patients. This can also have a tremendous influence in changing the overall dental attitude of the individual and the family as a whole. Music intervention is a non-pharmacological psychological intervention techniques which is cost effective and easily accepted by patients. Moreover, it was found that music decreases anxiety levels equally effective,^[41] or even to a greater extent,^[42] than the administration of benzodiazepines.

Karou *et al.* assessed the effect of music listening during extraction of impacted third molars and suggested that it decreasing the dental anxiety by suppressing the sympathetic nervous system. The patients in their study was assessed for salivary cortisol, stimulate salivary flow, blood pressure, heart rate, oxygen saturation and body temperature.^[43] Miyata *et al.* also found similar results where they assessed the effect of music on preoperative dental anxiety by using the heart rate variability analysis. They found that music reduces the sympathetic nervous activity without involving the parasympathetic activity.^[44] Cynthia *et al.* assessed the effect of music therapy on dental anxiety levels and correlated it to physiological parameters like salivary cortisol, stimulated salivary flow, blood pressure, heart rate, oxygen saturation and body temperature. They registered significant difference in the salivary cortisol concentration, systolic and diastolic pressure, heart rate, body temperature and stimulated salivary flow for music therapy treated group.^[45] Choon Yoong Wong *et al.* assessed a combination of non-pharmaceutical psychological interventions like muscular relaxation, psycho-education and music distraction to reduce dental anxiety and found reduction in anxiety levels in the experimental group.^[46] Sung *et al.*, suggested

Table 4: Paired Samples test of modified dental anxiety scale

Question	Before	After	SD	SER	t	df	Mean difference	P
1	4.0800	2.0400	0.93452	0.18690	10.915	24	2.04000	0.000*
2	4.2800	1.9600	0.80208	0.16042	14.462	24	2.32000	0.000*
3	4.2000	2.2800	0.90921	0.18184	10.559	24	1.92000	0.000*
4	4.1200	2.4400	0.74833	0.14967	11.225	24	1.68000	0.000*
5	4.3600	2.6400	0.79162	0.15832	10.864	24	1.72000	0.000*
6	4.1200	2.7600	0.99499	0.19900	6.834	24	1.36000	0.000*
7	4.1200	3.0000	0.78102	0.15620	7.170	24	1.12000	0.000*
8	4.1200	3.4400	0.94516	0.18903	3.597	24	0.68000	0.000*

*5% Level of Significance

that the familiarity of the music might recall certain pleasant memories associated with the music and that it might elicit the patient's positive feeling, and therefore is responsible for the reduced anxiety.^[47]

Chafin *et al.* stated that different type of music might have different effect on blood pressure.^[48] Mok and Wong in 2003 evaluated the effect of music on patient's anxiety showed that participants who listened to the music they preferred will show more significant decrease in dental anxiety.^[49] Since the Indian population is surrounded by tradition and culture and a majority of the population included were South Indians, the music chosen for this study was classical instrumental Veena, which is an important part of the culture. A study by Tantry *et al.* showed that unlike the participants of the classical music group, the participants who listened to religious Islamic music showed a decrease in systolic blood pressure, diastolic blood pressure, as well as NAP level.^[38] Another study by Bradshaw *et al.* on the effect of religious music on anxiety experienced by the elderly showed that religious music was proven to be effective in reducing anxiety.^[50]

On the contrary, Aitken *et al.*^[51] studied the efficacy of music therapy on 45 children aged 4-6 years old who were about to undergo dental treatment and they showed no significant differences statistically between those who listened to upbeat music group, relaxing group, and no music group.

The limitations of our study are that it should be conducted on a larger sample size, and include other physiological parameters to assess anxiety.

Conclusion

Knowing the anxiety level of the patient helps assess the patient better. Music seems to be a psychological and spiritual way to calm oneself down as the patients showed an overwhelming response towards this therapy being practiced in dentistry. The effect of playing music significantly lowered the diastolic blood pressure and heart rate. This was also reflected in the dental anxiety questionnaire.

Therefore we recommend earphones be made available for patients to listen to music while waiting for their appointments, in an effort to decrease any anxiety felt prior to dental treatments.

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Conflicts of interest

There are no conflicts of interest.

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