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Investigating the Effect of Meditation on the Level of Anxiety And Pain in Patients Undergoing Implant Surgery Along With Bone Grafting



Abstract: - Background and Purpose: Anxiety is one of the primary reasons for people's avoidance of visiting the dentist. It reduces oral and dental hygiene and the quality of life in the long term. Also, anxiety in clients and its repetition in examining patients affects the efficiency of dentists. Several studies have been conducted on the effect of music on the level of pain and anxiety of patients undergoing implant surgery. This study investigates the effects of meditation and music therapy on the mentioned criteria.

Materials and Methods: 28 patients who needed tooth replacement with implants using bone grafting with guided bone regeneration (GBR) were randomly divided into two groups. The first group was exposed to meditation techniques and listening to alpha music for half an hour before and during surgery. The second group was the control group which did not receive any of the mentioned techniques. Pain level was measured by the VAS scale after surgery and anxiety was measured by the Spielberger questionnaire before and after surgery. Systolic blood pressure, diastolic blood pressure, heart rate, and blood oxygen level were also measured before and after surgery. U-Man-Whitney analysis was used to compare the level of pain between the two groups. ANOVA analysis of covariance was used to compare the level of anxiety between the two groups (P value < 0.005).

Results: Comparing the pain level between the groups indicated that the perception of pain significantly decreases after meditation (P value < 0.005). Also, systolic blood pressure, diastolic blood pressure, and heart rate were significantly lower in the intervention group than in the control group (P value < 0.005). However, there was no significant difference between the two groups in the blood oxygen level (P value = 0.193).

Conclusion: Meditation before performing complex implant surgery and listening to alpha music during surgery help to reduce the level of anxiety and pain perception. Also, systolic blood pressure, diastolic blood pressure, and heart rate decrease following meditation.

Keywords: Implant, Dental anxiety, Bone grafting, Meditation

I. INTRODUCTION

Investigating the psychological processes in the rate and trend of patients referring to dental clinics for annual visits and subsequent treatments has indicated that anxiety and stress from dental procedures are some of the crucial reasons for people's avoidance of referring to medical centers (1). This affects the oral and dental health and the quality of life of people. The study by Veerobonia et al. on the relationship between the level of anxiety in dental sessions and oral health revealed a strong relationship between anxiety and the number of decayed teeth, or DMFT index (2). Also, the high level of anxiety of the client negatively affects the dentist's concentration and efficiency. The patient's non-cooperation due to anxiety disrupts the dentist's concentration and ability to diagnose and increases the time required for treatment (3).

Studies have indicated that the patient's anxiety level in surgical interventions is higher than in other dental treatments (4). Implant placement along with bone grafting is one of the common dental surgeries. The level of pain and anxiety of the patient during and after the surgery are two of the most crucial factors in the success and patient satisfaction of implant surgery (5). Studies have revealed a direct relationship between the patient's anxiety level before surgery and the patient's pain level during and after the implant surgery process (6).

High anxiety level also increases the recovery time. Some of the factors that trigger the perception of pain are fear, anxiety, high expectations of the treatment result, and the feeling of being surrounded and under the control of another person (dentist) (7). A study by Weisensee et al. on 121 dental implant candidate patients reported a strong correlation between pain perception and preoperative anxiety. Additionally, the pain perception duration is associated with the level of anxiety and fear (4).

Meditation and introspection are the skills of working with the mind. Meditation is a practice in which a person uses a method such as mindfulness or focusing the mind on a specific object, thought, or activity to develop attention and awareness and achieve a mental relaxation, calm, and mentally stable state. Clinical studies have reported that

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meditation reduces stress, anxiety, depression, improves sleep, and fatigue, and reduces heart rate. Some studies have indicated that using meditation in your daily routine can be beneficial for pain control (8).

Various studies have also indicated the impact of meditation on reducing the anxiety and pain of dental treatment processes such as third molar surgery or endodontic treatments (9). Listening to Alpha music is one of the meditation methods. Alpha music has several benefits for the body and mind. Stress reduction is one of the most important benefits of being in an alpha state. The alpha state of the brain also strengthens the immune system, reduces depression, and improves sleep.

A review study (2017) revealed that using yoga, music therapy, meditation, and massage helps the healing process of breast cancer patients. It also reduces the symptoms of pain and anxiety in these people and improves changes in mental states (10). A systematic review by Moola et al. showed that playing relaxing music during routine dental treatments reduces anxiety levels in adults (11). Several studies have evaluated the effect of relaxation with music on the level of dental anxiety in different treatment processes. They have indicated its significant positive impact on the reduction of patients' anxiety after surgery (12, 13-17). A growing number of people seek more comprehensive health improvement treatments and meditation, which is a mental training that can establish a connection between the mind and body. It helps people achieve balance, relaxation, and self-control. This study investigated the effect of this technique and music therapy with alpha music on reducing the level of pain, stress, and bleeding in patients undergoing implant surgery and bone grafting. It can directly and indirectly increase patients' satisfaction with the treatment and provide positive outcomes.

II. METHODS AND MATERIALS

The study was approved by the ethics committee of Tabriz University of Medical Sciences under the ethics code IR.TBZMED.VCR.REC. The study was conducted as a randomized clinical trial on patients who were referred to the implant department of the Faculty of Dentistry in Tabriz. Written informed consent was obtained from all patients before entering the study. To determine the sample size, using the results of the study by Pedro Christian et al., the mean and standard deviation in the intervention and control groups were 0.6 (4.8) and 5.9 (3.79), respectively (30). Given the first type error of 0.05 and a power of 80%, the sample size of 12 people in each group was obtained. The sample size was increased by 20% to increase the study's validity. As a result, 14 patients in each group who needed tooth replacement using implant surgery and bone grafting were selected.

Inclusion criteria:

- 1-People who needed implants and bone grafting of mild and medium levels (three- and four-walled lesions)
- 2-Patients whose surgery takes less than an hour.
- 3- The surface of the area requiring surgery should be small and about one to three teeth.
- 4- Patients with good health status and plaque index of less than 30%
- 5- Patients over 50 years old

Exclusion criteria:

- 1-Taking blood thinners such as NSAIDs and anticoagulants
- 2-History of hypertension, leukemia, diabetes, and other diseases that affect the normal physiology of blood, vessels, and heart.
- 3-Statement of dental phobia
- 4-Requires a large bone graft and surgery longer than an hour
- 5- Patients with mental problems such as depression and anxiety disorders and people who take psychiatric drugs.
- 6- Patients who need bone grafting
- 7- Smoking patients
- 8- Patients with hearing problems (18)

Study groups

People over 50 years old and the same number of patients from both sexes, male and female, were selected to match the two intervention and control groups. In the first group, 14 people underwent meditation half an hour before surgery and during surgery with a pre-learned meditation technique called mindful meditation. In this method, the person sits for 30 minutes in a resting position with closed eyes. This method requires focusing on the flow of air at the nose tip or the movements of the abdomen during natural inhalation and exhalation without applying any force or manipulating the natural rhythm of breathing, which does not cause a loss of concentration on breathing and distraction. In case of distraction, the patient should focus on his breathing again. Then, during surgery, the patients listened to alpha music.

In the second group, 14 people (the control group) did not undergo any meditation.

All surgeries were performed by one person

Investigating the effect of meditation and music on the level of pain

To evaluate the pain level after removal of anesthesia after surgery, a 10 cm VAS (Visual analog scale) scale was used (19).

Investigating the effect of meditation and music on the anxiety level

Patients of the intervention group were exposed to meditation practice and listening to alpha music half an hour before surgery. Then, both groups were asked to complete the Spielberger questionnaire (y-1 form from STAI) before surgery (20). Also, systolic and diastolic blood pressure, heart rate, and oxygen saturation were measured in both groups using pulse oximetry before and after surgery (21).

Statistical analysis method

All statistical analyses and reporting results were done using SPSS-22 software. Data were reported as mean ± standard deviation. Statistical analysis to compare the results of the study including systolic blood pressure, diastolic, heart rate, and oxygen saturation was evaluated by covariance analysis and pain level was evaluated by U-Man-Whitney analysis. The significance level of the test was considered to be 0.005.

III. RESULTS

Descriptive results

In this study, 28 candidates for implant surgical treatment with bone grafting were studied in two intervention and control groups. Table 1 shows the basic characteristics of patients in two control and intervention groups.

Table 1. Basic characteristics of patients in both control and intervention groups

	N	Control	Experiment	p-value
Age	14	34.93 + 10.37	51.14 + 14.8	0.002
Systolic Before	14	113.86 + 7.67	130.21 + 7.81	<0.001
Diastolic Before	14	72.36 + 8.23	80.14 + 8/66	0.022
Pulse Rate Before	14	83.36 + 17.06	84.79 + 15/86	0.82
O2 Before	14	96.71 + 8.06	91.29 + 5/09	0.043
Stress Level	High	10(76.92)	3(23.08)	0.023
	Low	4(30.77)	9(69.23)	
	Very Low	0(0)	2(100)	
	Low			

The independent t-test indicated a statistically significant difference between the control and intervention groups in the age of the patients (P = 0.002). A statistically significant difference was also reported between the control and intervention groups in the mean systolic blood pressure at the beginning of the study based on the independent t-test (P < 0.001). There was a statistically significant difference between the two groups in the diastolic blood pressure, oxygen level, and initial stress level (P < 0.05). No significant difference was found between the control and intervention groups in the mean (standard deviation) of Pulse Rate at the beginning of the study (P = 0.82).

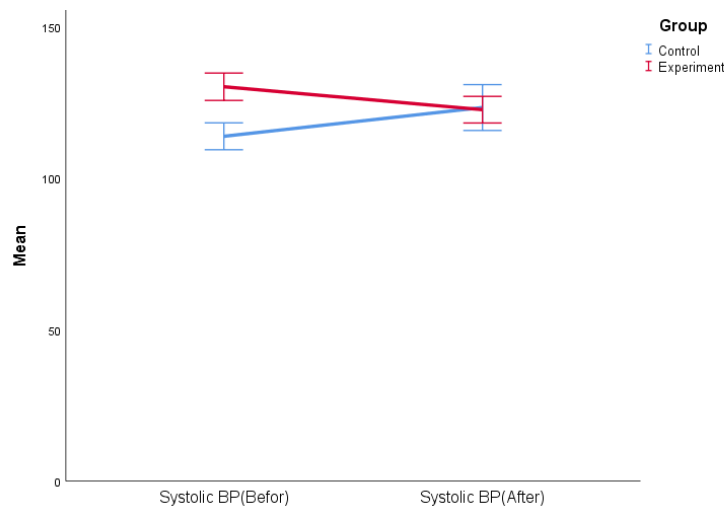
Comparison of the studied outcomes

To compare the results of the two groups, analysis of covariance was used considering the initial values. Table 2 shows the results of covariance analysis to compare the results between the control and intervention groups.

Table 2. Results of covariance analysis to compare outcomes between control and intervention groups

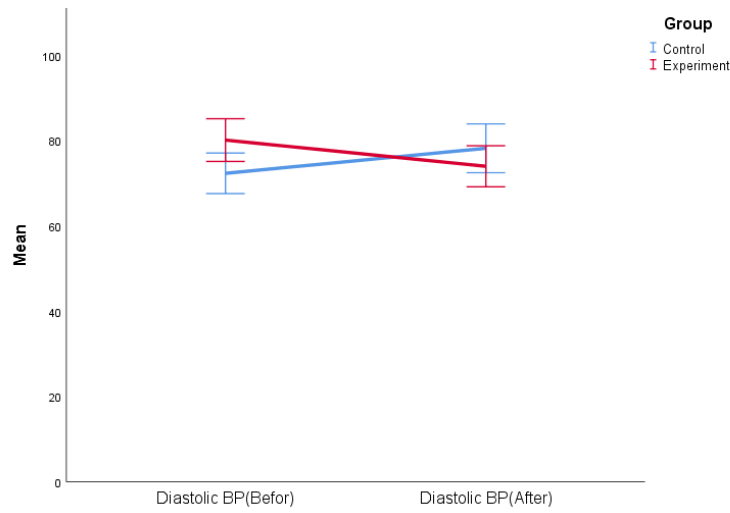
	Group	N	Mean + SD	Mean Diff (After – Before) + SD	p-value
Systolic After	Control	14	123.36 ± 13.13	9.5 ± 9.34	<0.001
	Experiment	14	122.64 ± 7.62	-7.57 ± 3.34	
Diastolic After	Control	14	78.21 ± 9/92	5.86 ± 4.88	<0.001
	Experiment	14	74 ± 8.35	-6.14 ± 2.66	
Pulse Rate After	Control	14	87.71 ± 17.39	4.36 ± 1.08	<0.001
	Experiment	14	78.43 ± 13.51	-6.36 ± 7.77	
O ₂ After	Control	14	99.57 ± 7.78	2.86 ± 2.03	0.193
	Experiment	14	96.14 ± 3.35	4.86 ± 2.51	

According to Table (2), there was a significant difference between the intervention and the control groups in systolic blood pressure after meditation based on covariance analysis ($P < 0.001$). Figure (1) shows the changes in systolic blood pressure between the two groups before and after meditation.



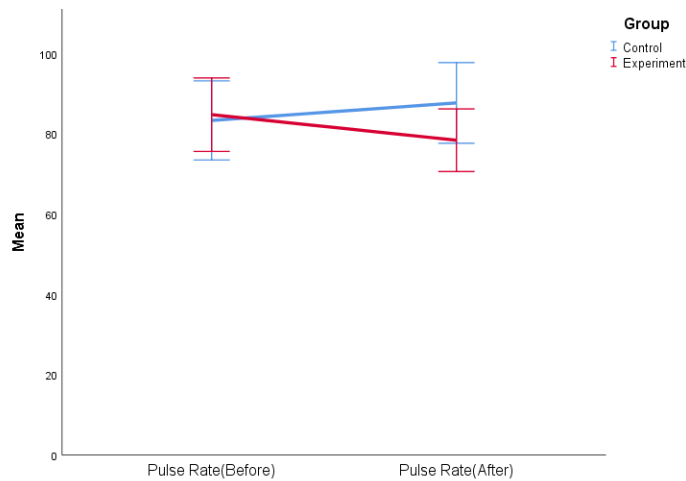
Graph 1. Changes in systolic blood pressure between the two groups

According to covariance analysis, there was a statistically significant difference between the intervention and the control groups in the mean ± standard deviation of diastolic blood pressure after meditation ($P < 0.001$). Figure (2) shows the diastolic blood pressure changes between the two groups before and after meditation.



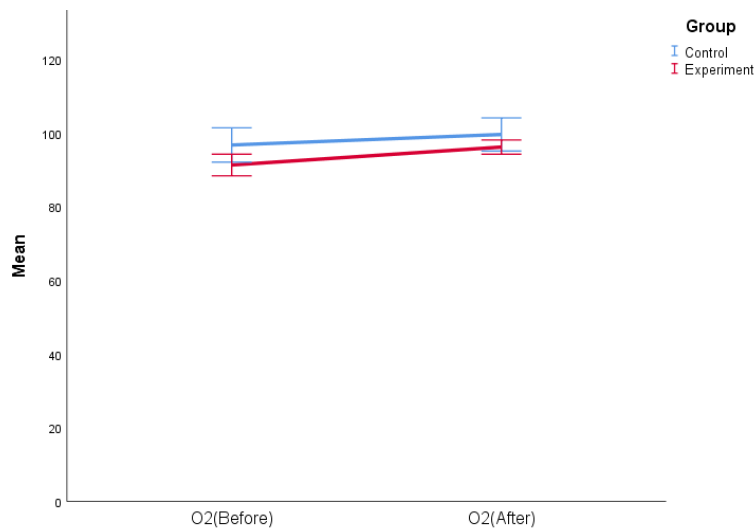
Graph 2. The changes in diastolic blood pressure between two groups

According to the covariance analysis, there was a statistically significant difference in the intervention group regarding the mean \pm standard deviation of Pulse Rate after meditation ($P < 0.001$). Figure (3) shows the mean pulse rate changes between the two groups before and after meditation.



Graph 3. Mean pulse rate changes between the two groups

According to the covariance analysis, there was no statistically significant difference between the intervention and the control groups in the mean \pm standard deviation of oxygen level after meditation ($P = 0.193$). Figure (4) shows the mean oxygen level changes between the two groups before and after meditation.



Graph 4. Changes in the mean oxygen level between the two groups

Comparison of pain levels in two groups

Table (3) shows the descriptive statistics of the pain level between the intervention and control groups.

Group	N	Mean + SD	Minimum	Maximum	Median(Q1-Q3)	p-value
Control	14	(5.14 ± 1.17)	4	7	5(4 – 6.25)	0.024
Experiment	14	(3.36 ± 2.62)	0	8	3(1.75 – 6.25)	

Table 3. Descriptive statistical indices of pain between two intervention and control groups

Based on the Mann-Whitney test, there was a statistically significant difference between the intervention and the control groups in the median (first quartile - third quartile) of pain (P = 0.024).

IV. DISCUSSION

Based on the World Health Organization, anxiety problems appear at a younger age than most mental problems (22). Dental anxiety is one of the crucial factors in reducing the visits of patients to medical centers and increasing the prevalence of caries in these people. This also disrupts the dentist's work process and affects his efficiency. The prevalence of dental anxiety has not changed much despite the increase in patient information in recent decades. It could be due to the multifactorial nature of this problem. Studies have indicated the prevalence of dental anxiety or what is mostly called "dental phobia" to be 4-30% (23).

Since no previous study has examined dental anxiety during complex implant surgery, this study evaluated this treatment process. The present study investigated the effect of mindful meditation before surgery and listening to alpha music during surgery on the pain and anxiety levels of patients and their satisfaction with the treatment process. Past studies have often investigated the effect of one of these two methods, while the present study investigated the effect of a combination of them. Meditation before surgery by the patient seems to remove negative thoughts and listening to music during surgery provides more relaxation, and distracts the patient from the surgery process. Some past studies, such as the study by Gurrum et al. showed that preoperative meditation alone cannot reduce the anxiety level of patients undergoing third molar surgery (20).

Additionally, playing music reduces the sounds related to dental devices, which can cause dental anxiety (24). In this regard, Wazzan et al. reported that it is better to listen to music from entering the clinic/office since it prevents feeling anxiety (14). Thus, by adding meditation to the beginning of the dental treatment process, this study tried to prevent the onset of stress in patients and to continue the relaxing process by playing alpha music during the surgery. In the study by Wazzan et al., listening to music started before closing the rubberdam. The results showed that the level of patient satisfaction with endodontic treatment in the group that was treated while playing music was higher than in the control group (14).

In the present study, meditation and listening to alpha music reduced patients' anxiety and subsequently increased their satisfaction with the treatment process. The study by Gonzales et al. revealed that patients with higher preoperative anxiety showed a lower level of satisfaction (25). The Spielberger questionnaire was used in this study to assess anxiety. It has been used in many studies to assess anxiety (12, 26). This questionnaire is valid and it was translated into the Persian language for better understanding of the patients. In the present study, at the beginning of the study, the stress level of 13 patients (46.4%) was at a high level, the stress level of 13 patients (46.4%) was at a low level, and the stress level of 2 patients (7.1%) was at a very low level.

Brain evaluation by EEG has shown that listening to alpha music with a frequency of 7-12 Hz increases the production of alpha and beta brain waves and reduces people's anxiety and stress (27). Several clinical studies have indicated that listening to music reduces anxiety in hospitalized patients, cancer patients, and patients undergoing surgery (28, 29). A few studies have evaluated the effect of music on dental anxiety despite extensive studies on its effect on anxiety. Also, no study has evaluated the relaxing effect of music on dental anxiety during implant and bone grafting procedures.

Consistent with the results of the present study, a study by Arevana showed that listening to music with a frequency of 432 Hz for 15 minutes during tooth extraction reduces anxiety and stress. In this study, the CORAH scale was used to evaluate the dental anxiety level (15). Music experts have reported that the frequency of 432 Hz is the closest to the frequencies produced by the body. It has also been reported that music affects the human psyche since some music causes adverse emotional changes by evoking emotions or recalling memories (30). The study by Chafin et al. reported that different types of music have different impacts on changes in the blood pressure of people (31). This indicates that in the studies where the music type and its frequency were selected by the researchers, the results were more reliable than the studies where the patients listened to their favorite music. Thus, the music selected before by the researcher was used in the present study. The blood oxygen level is changed by pain and other individual factors such as age, gender, hypertension, previous dental experiences, and the psychological response of each patient. In the present study, the oxygen saturation was stable in both groups and had no effect when using music therapy.

In the study by Di Nasso et al, similar to the present study, music with a frequency of 432 Hz, which is similar to the body's frequency, was used to reduce dental anxiety during endodontic treatment. This study used the Corah dental anxiety scale to assess the initial stress level. Consistent with the present study, the results emphasized that relaxation from meditation or music is not the reason for reducing or eliminating local anesthesia and can only be replaced with drug therapy and anesthesia methods (17). These results were inconsistent with the results of the study by Wazzan et al. In the study by Wazzan et al., the reduction in blood pressure, heart rate, and salivary cortisol after music therapy in patients with dental anxiety was not statistically significant (14). The temperature of the clinic setting is one of the factors affecting the level of anxiety of patients in the dental setting. This study reported that the ambient temperature of the dental clinic was colder than the usual conditions. This is effective in not reducing patients' anxiety and their lack of concentration on music and can be the reason for the difference in the results with the present study. The temperature of the clinic was set at 25°C in the present study and it was ensured that the patients did not feel cold or hot.

The present study indicated that the pain level of patients in the group who did meditation and played music during the implant surgery was significantly lower than in the control group. Past studies have extensively investigated the effect of meditation and music therapy on the patient's perception of pain during various medical and surgical procedures. Studies have reported that listening to relaxing music reduces patient anxiety and reduces patient pain during chronic and acute diseases (32). A review of 51 studies (a total of 3500 patients) that evaluated the effect of music on reducing pain perception indicated that more than 70% of patients reported a pain reduction of at least 50%. The consumption of all kinds of narcotic painkillers was also reduced (33).

Some neurological studies have indicated that listening to music stimulates parts of the brain related to feelings of happiness and pleasure, such as the limbic system, orbitofrontal cortex, and cerebellum (34, 35). Listening to music also releases endorphins, which reduce pain stimuli and suppress spinal responses to pain (36). As stated, dental anxiety is a common problem in developed and developing societies. This prevents patients from referring to medical centers and endangers the oral and dental health of people. Finding a non-pharmacological way to reduce dental anxiety will significantly help the oral and dental health of society since the anxiety of patients receiving dental implants and bone grafting is greater than other dental treatments. The present study reported that meditation combined with playing music reduces the anxiety and pain perception levels of patients.

V. CONCLUSION

1-Meditation before implant surgery and playing relaxing music during the procedure reduces the anxiety level of patients.

2-Meditation before implant surgery and playing relaxing music during the procedure reduces patients' pain perception.

3-Meditation before implant surgery and playing relaxing music during the procedure reduces systolic and diastolic blood pressure and heart rate.

4-Meditation before implant surgery and playing relaxing music during the procedure does not affect the blood oxygen level.

VI. RESOURCES

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