Research Paper

The Effects of Music Intervention on Respiratory Comfort, Anxiety, and Depression During Noninvasive Mechanical Ventilation Among Patients With COVID-19

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ABSTRACT

Background: Hospitalized patients with COVID-19 may experience emotional problems and respiratory discomfort during mechanical ventilation. This study aimed to evaluate the effects of music therapy on respiratory comfort, anxiety, and depression among patients with COVID-19 under noninvasive mechanical ventilation.

Methods: It was a randomized clinical trial. The study subjects were 64 patients requiring noninvasive mechanical ventilation (NIV) who were selected from the COVID-19 intensive care unit (ICU) of Ali ibn Abi Talib Hospital, Rafsanjan City, Iran. They were randomly allocated to the intervention (n=32) and control (n=32) groups. The intervention group received 30 minutes of daily light music by an MP3 player and a JBL headphone for 4 consecutive days, and the control group only used headphones. The data were collected by the hospital anxiety and depression scale and a visual analog scale before and 4 days after the intervention. The SPSS software, version 16 was employed for data analysis through the chi-square, independent sample, and paired-samples t-tests at a significance level P<0.05.

Results: The groups did not significantly differ regarding the pre-test mean scores of respiratory comfort, anxiety, and depression before intervention (P>0.05). The mean scores of respiratory comfort, anxiety, and depression significantly changed in the intervention group (P<0.05), but no significant changes were seen in the control group (P>0.05). Between-group differences respecting the post-test mean scores of these variables were also significant (P<0.05).

Conclusion: Thirty minutes of daily music therapy for 4 days is effective in reducing anxiety and depression and improving respiratory comfort among patients with COVID-19 under noninvasive mechanical ventilation.

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Highlights

• In recent decades, a growing interest has been seen in the therapeutic use of music, mainly because of its safe, low-cost, and effective nature.

• This study shows the effect of music therapy in improving respiratory comfort and reducing anxiety and depression among COVID-19 patients under noninvasive ventilation.

• Given music therapy's safety, simplicity, inexpensiveness, and easy applicability, nurses can use it to improve mechanical ventilation tolerance, care outcomes, and recovery among patients under mechanical ventilation.

• As there is no consensus over the best mechanical ventilation techniques, more studies are suggested to compare the effects of different mechanical ventilation interventions.

Plain Language Summary

Hospitalized patients with COVID-19 experience respiratory discomfort, anxiety, and depression, particularly during mechanical ventilation. Music therapy is a non-pharmacologic intervention that can be used as a complementary adjunct in the nursing care of patients supported by noninvasive ventilation. This study aimed to measure the effects of music therapy on respiratory comfort, anxiety, and depression among COVID-19 patients under noninvasive mechanical ventilation. The findings revealed that 30 minutes of daily music therapy for 4 days is effective in reducing anxiety and depression and improving respiratory comfort among patients with COVID-19 under noninvasive mechanical ventilation.

1. Introduction

The novel coronavirus disease 2019 (COVID-19) is a great healthcare challenge worldwide. It appeared in December 2019 and rapidly became a pandemic and serious international healthcare concern in January 2020 (Lai et al., 2020). The prevalence of COVID-19 was 526 million confirmed cases, and over 6 million deaths have been reported globally by May 2022 (Kim & Yeniova, 2022). Despite great efforts to manage the disease through worldwide vaccination, the prevalence and mortality rates are still high (Lai et al., 2020). The most prevalent symptoms of COVID-19 are high fever, cough, exhaustion, myalgia, and dyspnea (Guo et al., 2020). In severe cases, COVID-19 can progress to respiratory distress and cause acute respiratory distress syndrome (ARDS) (Guo et al., 2020). This syndrome is associated with severe respiratory shunt and hypoxia which are not manageable through simple oxygen therapy; thus, mechanical ventilation (MV) will be required (Yang et al., 2020).

Noninvasive ventilation (NIV) is a technique for ARDS management. NIV creates a continuous or intermittent positive pressure in the airways to keep alveoli open during inspiration and prevent their collapse during expiration (Grieco et al., 2021). MV reduces the workload of the respiratory muscles, improves gas exchange, and reduces respiratory effort. During NIV, patients should be conscious of expelling secretions. However, consciousness during NIV may reduce the patient's ability to cope with MV and lead to MV intolerance. The symptoms of MV intolerance are respiratory discomfort and anxiety, which may increase the need for endotracheal intubation and invasive MV (Okba et al., 2020).

There are different pharmacological and non-pharmacological techniques to reduce MV intolerance among conscious patients. Pharmacological techniques include the use of mild sedative agents. However, these techniques are usually associated with respiratory depression and impaired patient collaboration (Carron et al., 2013). Non-pharmacological techniques such as distraction, heat or cold therapy, and music therapy are mostly noninvasive, safer, and less expensive than pharmacological methods (Hashemy & Zakerimoghadam, 2013). They do not alter patients' consciousness and collaboration. These techniques can effectively reduce anxiety, fear, pain, and discomfort and improve MV parameters and MV tolerance (Zakeri-Moghadam et al., 2016).

Music therapy (MT) is one of the non-pharmacological techniques with potentially positive effects on anxiety, fever, and calmness (Head et al., 2022). MT is an accessible and applicable noninvasive technique widely used worldwide for anxiety management (Thoma et al., 2013). It reduces the level of stress hormones by affecting the amygdala but increases the level of endorphins (Messika et al., 2016), thereby decreasing heart rate and improving general health, well-being, and respiratory rhythm and depth (Barber, 2021). Previous studies reported that MT positively affects mood, emotions, and cardiovascular, endocrine, and respiratory systems and, thereby, reduces anxiety (Hole et al., 2015), depression (Burrai et al., 2020), blood pressure, respiratory rate, heart rate, and MV-associated discomfort and problems (Barber, 2021).

Despite the known positive effects of MT on different health-related outcomes, limited information is available about its applicability to MV tolerance in patients with COVID-19. Therefore, this study aimed to evaluate the effects of MT on respiratory comfort, anxiety, and depression among patients with COVID-19 under NIV.

2. Materials and Methods

This randomized control trial was conducted in 2021. The research has a pre-test & post-test design with a control group. The subjects were 66 patients selected from the COVID-19 intensive care unit (ICU) of Ali Ibn Abi Talib Hospital, Rafsanjan City, Iran. The inclusion criteria were as follows: Age of 20–65 years, NIV for the first time, full consciousness, informed consent for participation, no problem hearing or listening to music, previous history of psychological problems, no record of taking psychiatric medications, and no history of acute emotional stress in the last 6 months. The exclusion criteria were discontinuing participation in the study, early discharge from ICU, any problem interfering with the qualification to receive the study intervention, and death during the study.

The sample size was calculated by the Equation 1:

$$1.\ n=\frac{2\sigma^2(Z_{1-\alpha/2}+Z_{1-\beta})^2}{d^2}$$

as 32 subjects per group, considering a standard deviation of 3.6, a confidence level of 0.95, a power of 0.85, and a d of 2.4 (Figure 1) (Mohammadi et al., 2014). Thus, 66 patients were recruited and divided into two groups of 33 people.

The subjects were assigned to either intervention or control study arms through the minimization method (a biased coin). Minimization has been suggested as the manner of choice for smaller trials to achieve equivalency in several prognostic factors (Anderson et al., 2008).

In this way, there was no significant difference between the studied arms regarding sociodemographic variables such as gender and age.

Data collection instruments

Data collection instruments were a demographic questionnaire, the hospital anxiety and depression scale (Zigmond & Snaith, 1983), and a visual analog scale (VAS).

The hospital anxiety and depression scale is a valid and reliable self-report 14-item scale for evaluating a patient's anxiety and depression during the last week. It has a 7-item anxiety subscale and a 7-item depression subscale. Its items are scored on a 0–3 rating scale, and thereby, possible subscale scores are 0–21, which are interpreted as follows: Scores 0–7: Normal condition; 8–10: Mild problem; 11–14: Moderate problem; and 15–21: Severe problem. The response time of this scale is 5 minutes. A previous study in Iran reported this scale's acceptable validity and reliability with a Cronbach α of 0.87 (Montazeri et al., 2003).

Respiratory comfort was assessed using a VAS (Messika et al., 2019; Price et al., 1983) developed this scale. The scale has been used to measure patients' comfort in recent years. It is a 10-cm horizontal or vertical line with two ends representing the minimum and maximum scores for comfort (0-10 cm line) (Gift, 1989). In this scale, comfort has been defined as the lake of physical discomfort. Comfort scores of patients are documented by the researcher. The Iranian version of VAS has already been validated with good internal consistency.

Study intervention

The study intervention was 30 minutes of daily MT for 4 consecutive days implemented using the peace in dreamwork of Dr Arnd Stein (Messika et al., 2016). This work has a monotonous light theme without rhythmic and melodic stimuli (Zakeri-Moghadam et al., 2016). The first researcher implemented the MT intervention for each participant in the morning working shifts using an MP3 player and a JBL headphone (MBR-XB100VT). This headphone effectively reduces environmental noises. Participants in the control group received the same intervention while the MP3 player was turned off and head-

phones were in to reduce ambient noise. The headphone was disinfected after each use to reduce the risk of infection transmission. The levels of participants' respiratory comfort, anxiety, and depression were assessed on the first day of NIV before and 4 days after the intervention. It is worth mentioning that the statistical analyst was unaware of the data of the intervention and control groups.

Data analysis

The SPSS software, version 16 was used for data analysis. The data were described using descriptive statistics, i.e. Mean±SD and frequency. The Kolmogorov-Smirnov test revealed the normal distribution of the study variables. Between-group comparisons were performed through the chi-square and independent samples t-tests, and within-group comparisons were performed using the paired-samples t-test. The level of significance was set at $P<0.05$.

3. Results

A total of 66 patients were recruited for the study. One participant from the control group was excluded due to developing critical conditions, and one from the intervention group due to early discharge from the ICU. Finally, the study was completed with 32 participants in each group (Figure 1).

The mean age of the subjects was 58.21±6.12 years in the control group and 57.02±6.41 years in the intervention group, and most participants were female in both

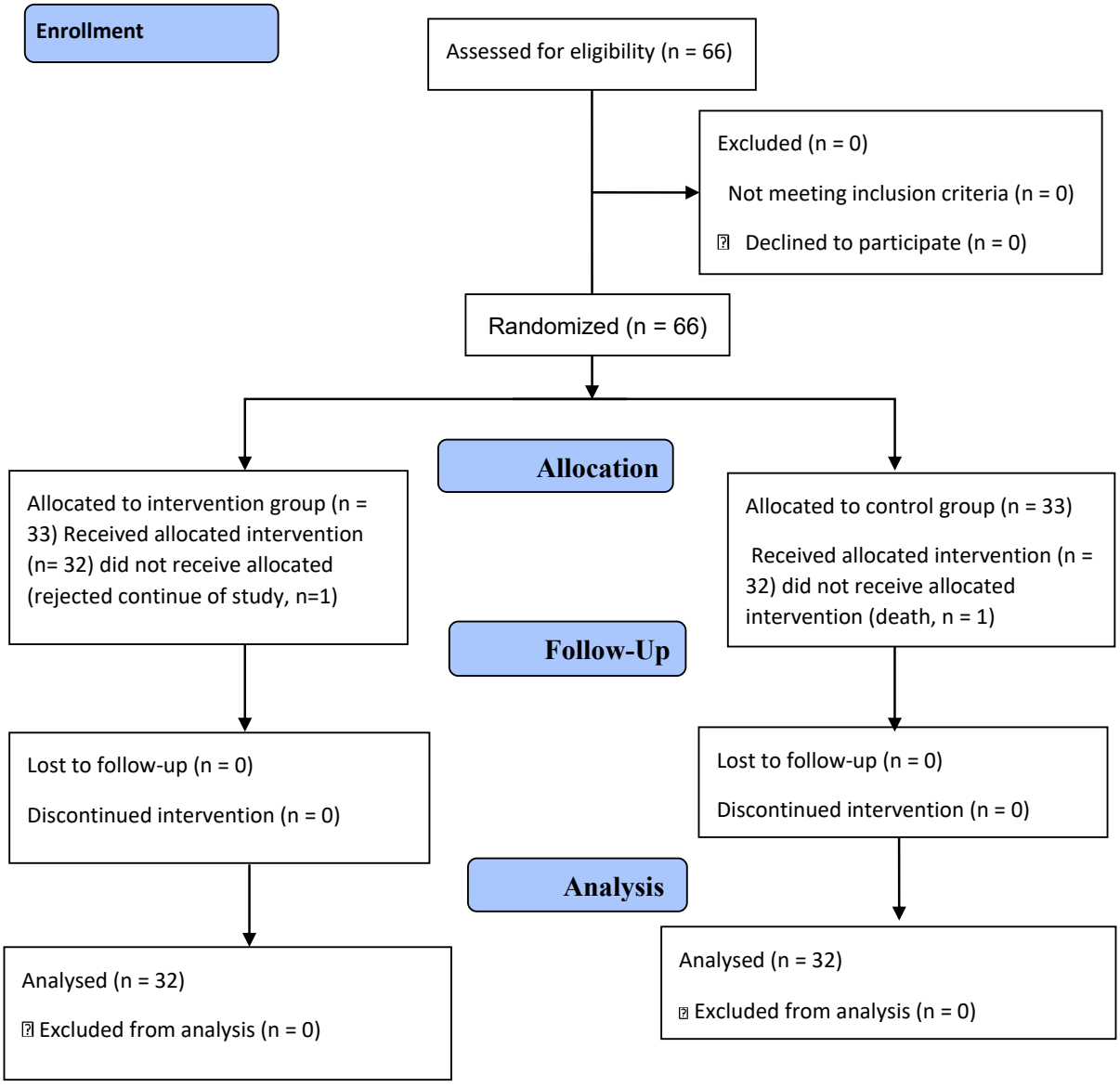

Figure 1. The flow diagram of the study

Table 1. Between-group comparisons regarding participants' demographic and clinical characteristics

Group / Characteristics		Mean±SD/No. (%)		P
		Intervention	Control	
Age (y)		57.02±6.41	58.21±6.12	0.439*
Weight (kg)		75.01±11.23	76.02±12.62	0.647*
Height (cm)		165.24±6.45	165.63±7.04	0.833*
Body mass index (kg/m²)		27.48±3.88	27.52±3.40	0.964*
Gender	Male	14(43.8)	14(43.8)	0.87**
	Female	18(56.3)	18(56.3)	
Educational level	Illiterate or primary	22(69.7)	26(76.5)	0.72**
	Secondary and higher	10(30.3)	8 (23.5)	0.54**
History of COVID-19	Yes	0	2(6.2)	0.54**
	No	32(100)	30(93.8)	
History of drug abuse	Yes	4(12.5)	3(9.4)	1
	No	28(87.5)	29(90.6)	
History of other diseases	Yes	28(87.5)	29(50.1)	0.08**
	No	4(12.5)	3(9.4)	
PCR test	Positive	30(93.8)	32(100)	1
	Negative	2(6.3)	0	

*The results of the independent samples t-test, **The results of the chi-square test.

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groups (56.3%). There were no significant differences between the groups in terms of participants' age, gender, level of education, occupation, history of COVID-19 affliction, history of other diseases, body mass index, history of drug abuse, and the results of COVID-19 PCR test (P>0.05, Table 1).

The study groups did not significantly differ from each other regarding the pre-test mean scores of respiratory comfort (P=0.309), anxiety (P=0.090), and depression (P=0.142). After the intervention, the level of anxiety (P=0.001) and depression (P=0.004) in the experimental group was significantly lower than in the control group. Moreover, the results of the paired-samples t-test revealed that, compared with baseline readings, the level of anxiety (P=0.006) and depression (P=0.0001) in the experimental group significantly decreased after the intervention. However, the level of anxiety (P=0.108) and depression (P=0.897) did not reduce significantly at the end of the study in the control group (Table 2). The independent t-test showed a significant difference (P=0.001) between the scores of the two groups after the intervention. Moreover, compared with the control group, the post-test mean scores of respiratory comfort were higher in the intervention group. But, the level of respiratory comfort in the control group did not decrease significantly at the end of the study (P=0.108). After the intervention, the average score of respiratory comfort increased (8.28±1.46).

4. Discussion

This study aimed to evaluate the effects of MT on respiratory comfort, anxiety, and depression among COVID-19 patients under NIV. The findings revealed the significant positive impact of MT on respiratory comfort, anxiety, and depression among these patients.

We found that MT significantly improved respiratory comfort. In agreement with this finding, a previous study showed that MT significantly has improved respiratory comfort and adherence to continuous positive airway pressure treatment among adult individuals with sleep

Table 2. Between-and within-group comparisons regarding the mean scores of respiratory comfort, anxiety, and depression

Outcomes	Time / Group	Before	After	P**
Anxiety	Control	11.90±2.08	11.25±2.01	0.801
	Intervention	12.03±1.85	9.90±1.76	0.006
	P*	0.090	0.001	—
Depression	Control	12.09±2.03	12.12±2.21	0.897
	Intervention	12.78±1.64	0.71±11.48	0.0001
	P*	0.142	0.004	—
Respiratory comfort	Control	7.42±1.56	7.06±1.38	0.108
	Intervention	7.09±1.35	8.28±1.46	0.001
	P*	0.309	0.001	—

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*The results of the independent samples t-test related to between-group comparisons, **The results of the paired-samples t-test related to within-group comparisons.

apnea (Barber, 2021). Another study showed that MT improved respiratory comfort among children in pediatric ICU (Liu et al., 2019). Moreover, a survey of the effect of music on the difficulty of dyspnea, anxiety, and hemodynamic parameters in patients with dyspnea found that MT has significantly reduced the patients' dyspnea severity and improved their hemodynamic parameters (Ergin et al., 2018). However, a study reported the inconsiderable effect of MT on respiratory comfort (Mateu-Capell et al., 2019).

This contradiction may be due to the differences between the studies regarding their intervention goal to assess the effect of sound isolation versus music on the comfort of mechanically ventilated patients admitted. The mean of the subjects' ages was 69 years in the above study.

The effects of MT depend on the type and characteristics of music and participants' interest in listening to music (Yung et al., 2001).

We also found that MT has significantly reduced anxiety and depression among patients with COVID-19 under NIV. This finding is in line with the result of many previous studies reporting the significant positive effects of MT on anxiety (Dai et al., 2020; Nilsson, 2009; Pakniam et al., 2018) and depression (Dai et al., 2020; Nilsson, 2009). Music probably reduces anxiety and depression and improves calmness by reducing negative emotions, regulating internal bodily processes, stimulating a neurovegetative response, and reducing stress (Rabiee et al., 2007). Contrary to our findings, a study showed that MT had no significant effects on anxiety and sedative exposure during weaning from MV (Hetland et al., 2017). An explanation for this contradiction is that our study was conducted on patients with COVID-19 under NIV, while that study was conducted during weaning from invasive MV. Many factors affect successful weaning, and it is a complex process. Moreover, patients under invasive MV receive sedatives that alter their consciousness and affect MT outcomes.

It is worth mentioning that the patient's characteristics, the music therapist's white uniform, and the patient's focus and interest in the music might have affected the results.

5. Conclusion

This study shows the effectiveness of MT in improving respiratory comfort and reducing anxiety and depression among patients with COVID-19 under NIV. Given MT's safety, simplicity, affordability, and easy applicability, nurses can use it to improve MV tolerance, care outcomes, and recovery among patients under MV. As there is no consensus over the best MT techniques, more studies are recommended to compare the effects of various MT interventions.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Rafsanjan University of Medical Sciences (Code: IR.RUMS.REC.1400.076). Besides, the study was registered as a clinical trial in the Iranian Registry of Clinical Trials (Code: IRCT20171002036498N5).

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Authors' contributions

Conceptualization, study design and administration: Ali Akbari; Data collection: Reyhana Hassan Shahi; Data analysis: Fatemeh Hosseini; Data analysis: Ahmad Reza Sayadi; Writing the initial draft: Maryam Shahabi Nedjad; Reviewed the results and final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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